DOBSON Engineering Ltd.

Project: 20998

October 19, 2020

Barnett Construction Ltd.
2885 Arawana Road
Naramata, BC V0H 1N1

Attention: Kevin Barnett
sent by email to Barnett Construction <v4-6-30f233f-71f78-dd310@reply.coconstruct.com>

Re: Flood Hazard Assessment for Reconstruction of Dwelling at 1905 Jennens Road, West Kelowna, BC

This letter has been prepared to address proposed reconstruction of the dwelling at 1905 Jennens Road, West Kelowna, BC with regards to the requirements set out in the City of West Kelowna Bylaw 0154, section 3.24 Floodplain Regulations.

The Floodplain Regulations require that:

3.24.1 The underside of any floor system, and the top of any pad supporting any space or room that is used for dwelling purposes, business, or the storage of goods which are susceptible to damage by floodwater, shall be above the following levels:
(a) 343.66m (1,127.5ft) above the Geodetic Survey of Canada datum for a parcel abutting Okanagan Lake, and
(b) 1.5m (4.9ft) above the natural boundary of any stream.

3.24.3 Any landfill placed to elevate a floor system or pad to achieve the levels specified in Section 3.24.1 shall be sited at least:
(a) 15.0m (49.2 ft) from the natural boundary of Okanagan Lake;
(c) 15.0m (49.2 ft) from the natural boundary of any stream.

1. **Background**
   There is an existing dwelling situated on the lot at 1905 Jennens Road, [legal description: Lot C, Plan EPP 5742, DL 434, ODYD] (Figure 1). This flood hazard assessment has been prepared to address the proposal to rebuild the dwelling using the existing foundation that presently does not meet the 15m setback stated in the bylaw and may require a relaxation in the setback if it is deemed safe to do so.

2. **Current Dwelling Setting with Regards to Bylaw 0154 Requirements**
   McDougal Creek Setback
   The foundation is situated approximately 12.3m away from the left bank natural boundary of McDougall Creek (when looking downstream). The top of the concrete footing of the foundation is at ~343.5m. The setback is less than the 15m specified in the Bylaw and the existing concrete floor elevation is less than the required 1.5m above the natural boundary for McDougall Creek (Figure 2).

   Okanagan Lake Setback
   The existing foundation is situated >30m back from the natural boundary of Okanagan Lake. The top of the concrete footing of the foundation is at ~343.5m. The setback exceeds the required 15m setback from the

natural boundary of Okanagan Lake, but the concrete floor elevation is less than the required 343.66m (Figure 2).

3. Proposed Reconstruction

It is proposed to utilize the existing foundation for the reconstructed dwelling with the underside of the lowest floor system used for dwelling or storage of goods to be set at the required flood construction elevation. As stated previously, the setback of the existing foundation is ~12.3m from the natural boundary of McDougall Creek.

4. Flood Hazard Assessment

There are two flood hazards on this property. The first is related to McDougall Creek and the second is related to Okanagan Lake. A field inspection of the property was completed on August 19, 2020.

The flood risks to the foundation and reconstructed dwelling from McDougall Creek is considered to be low. McDougall Creek flows across Jennens Road through a bridge just upstream of the subject property then flows along the west boundary of the property to Okanagan Lake. Throughout the reach adjacent to the dwelling the stream is well contained within its channel. The risk of McDougall Creek overtopping its banks and flooding the dwelling is low since the top of the bank adjacent to the dwelling ranges in elevation from 345.3m upstream of the dwelling to 344.5m adjacent, and 344.8m downstream. These elevations range from 2.4m to 2.1m above the natural boundary. In addition, the left bank has been armoured with riprap (0.3-0.6m diameter) and has well established vegetation protecting the bank (Photo 1). The date of installation is not known but appears to be likely several decades ago based on the weathered appearance of the rock (Photo 1). Inspection of the channel and the bank line adjacent and upstream of the dwelling noted that the channel was generally straight, stable and did not identify any recent erosion (Photo 2). There could be elevated groundwater levels around the foundation during extended periods of high flows in the creek and there for the FCL for the underside of the lowest floor system of the reconstructed building should meet or exceed the required 1.5m above the natural boundary of the creek.

The flood risks to the dwelling from Okanagan Lake are also considered to be low. The dwelling is setback ~40m from the natural boundary of Okanagan Lake. The foundation footing is set at ~343.5m but the recommended FCL for the lowest floor system of the reconstructed dwelling would exceed 343.66m since it would be set relative to the natural boundary of McDougall Creek. There is also a flood risk associated with wave action on the lake during high water levels. This hazard is also considered to be low at the dwelling site due to the significant setback distance of ~40+m combined with the naturally rising ground elevation.

For the two flood hazards, the greater risk is considered to be from McDougall Creek but associated with an elevated water table during periods of high flow. There can be elevated groundwater levels associated with prolonged periods of high lake levels as well but since the recommended FCL is greater than that required from the lake, the flood risks related to an elevated groundwater level from the lake is low.

The recommended FCL is the greater of either 343.66m or the average natural boundary elevation for McDougall Creek + 1.5m. A recent survey of the natural boundary of McDougall Creek adjacent to the dwelling indicated that the average elevation is ~342.7m (Figure 3). The FCL for the creek would be 344.2m (342.7+1.5). Since this the greater elevation, it is the recommended FCL.

5. Access for Emergency Equipment

During flood events it is important that heavy equipment such as excavators and dump trucks can safely access the creek channel and lakeshore beyond the dwelling. The reconstructed dwelling would not change the access past the dwelling which is adequate for the passage of emergency equipment.

6. Recommendations

The following recommendations are provided for the proposed reconstructed dwelling:

Flood Hazard - McDougall Creek

- Flood Construction Level - The recommended flood construction level of the lowest floor system used for dwelling purposes, business, or the storage of goods which are susceptible to damage by floodwater, should meet or exceed 344.2m.
- Setback – The existing foundation wall is ~12.3m back from the natural boundary of the creek. This setback is less than the 15m stated in the bylaw however, as stated in Section 4, the channel is generally straight, stable with the bank armoured with riprap and well vegetated with mature plants and shrubs. There was no evidence of flooding nor any channel or bank erosion from the recent high stream flows in 2017 and 2018. Since the risk from bank erosion is low, it is recommended that the reduced setback distance of ~12.3m be approved.

Flood Hazard - Okanagan Lake

- Flood Construction Level - The recommended flood construction level of the lowest floor system used for dwelling purposes, business, or the storage of goods which are susceptible to damage by floodwater, should be the FCL for MacDougall Creek. That FCL is 344.2m which exceeds the bylaw requirement of 343.66m.
- Setback – The existing foundation wall is >40m from the natural boundary of the lake and exceeds the bylaw requirement of 15m.
- Waves – Although not stated in the bylaw, the risks from wave damage during highwater on the lake was also considered and is rated as low due to the distance the existing foundation is from the natural boundary of the lake (>40m), and the ground elevation at the foundation that is ~343.5m and rising.

Climate change

- The potential impacts of climate change on flows in McDougall Creek were considered. It is likely that peak flows may increase over time. The recommended FCL that is 1.5m above the present natural boundary is considered to be adequate since the crest of the bank adjacent to the dwelling is ~2m higher than the natural boundary, providing an additional factor of safety.
- The OBWB has released a recent report by Northwest Hydraulic Consultants regarding future water levels for Okanagan Lake and recommendations for revised FCLs. The results of this study are under review by local governments at this time. The recommended FCL of 344.2m exceeds the present FCL for Okanagan Lake by ~0.5m.

7. Summary

- The reconstructed dwelling should have an FCL of 344.2m, that is consistent with the bylaw requirement of 1.5m above the natural boundary of McDougall Creek.
- The existing foundation is ~12.3m from the natural boundary of the creek that is less than the 15m in the bylaw but the flood risks due to the armoured, vegetated bank line that has a crest elevation ~2m above the natural boundary are low and the reduced setback is considered to be safe.
- The reconstructed dwelling exceeds the 15m setback requirements from the natural boundary of Okanagan Lake and the recommended FCL of 344.2m exceeds the bylaw requirement for the lake of 343.66m.
- These reconstructed dwelling would not obstruct the access for equipment past the dwelling during a flood event, should that be required.

8. Flood Assurance Statement

The professional practice guidelines *Legislated Flood Assessments in a Changing Climate in BC*, prepared by the Engineers and Geoscientists of BC, requires that a Flood Assurance Statement be completed as part of this assessment. A copy of the signed statement is provided in Appendix A.

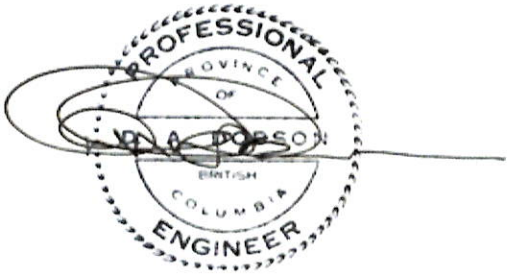
9. Closure and Limitations

This report has been prepared exclusively for use by Barnett Construction Ltd., the registered property owner, and the City of West Kelowna. The assessments were carried out in accordance with generally accepted practice. Professional judgment has been applied in the interpretations provided in this report. No other warranty is made, either expressed or implied. Please note that the flood hazard assessment is based on the conditions at the subject property at the time of the assessments. If conditions change, or if observed features are found to be different, please contact the undersigned for a follow up review.

10. Reference Documents

- Barnett Construction Ltd. CAD drawing detailing recent survey results
- City of West Kelowna, Zoning Bylaw No. 0154; and
- Dobson Engineering Ltd. 2018 report *La Prairie Lake House - 1905 Jennens Road, West Kelowna, BC – Floodplain Setback Assessment Recommendations as per West Kelowna Bylaw 0154.*

Please contact me if you have any questions.
Sincerely,



D.A. Dobson, PEng

Reviewed by J. Clarke, PGeo

Figure 1 – Location Map for 1905 Jennens Road, West Kelowna, BC

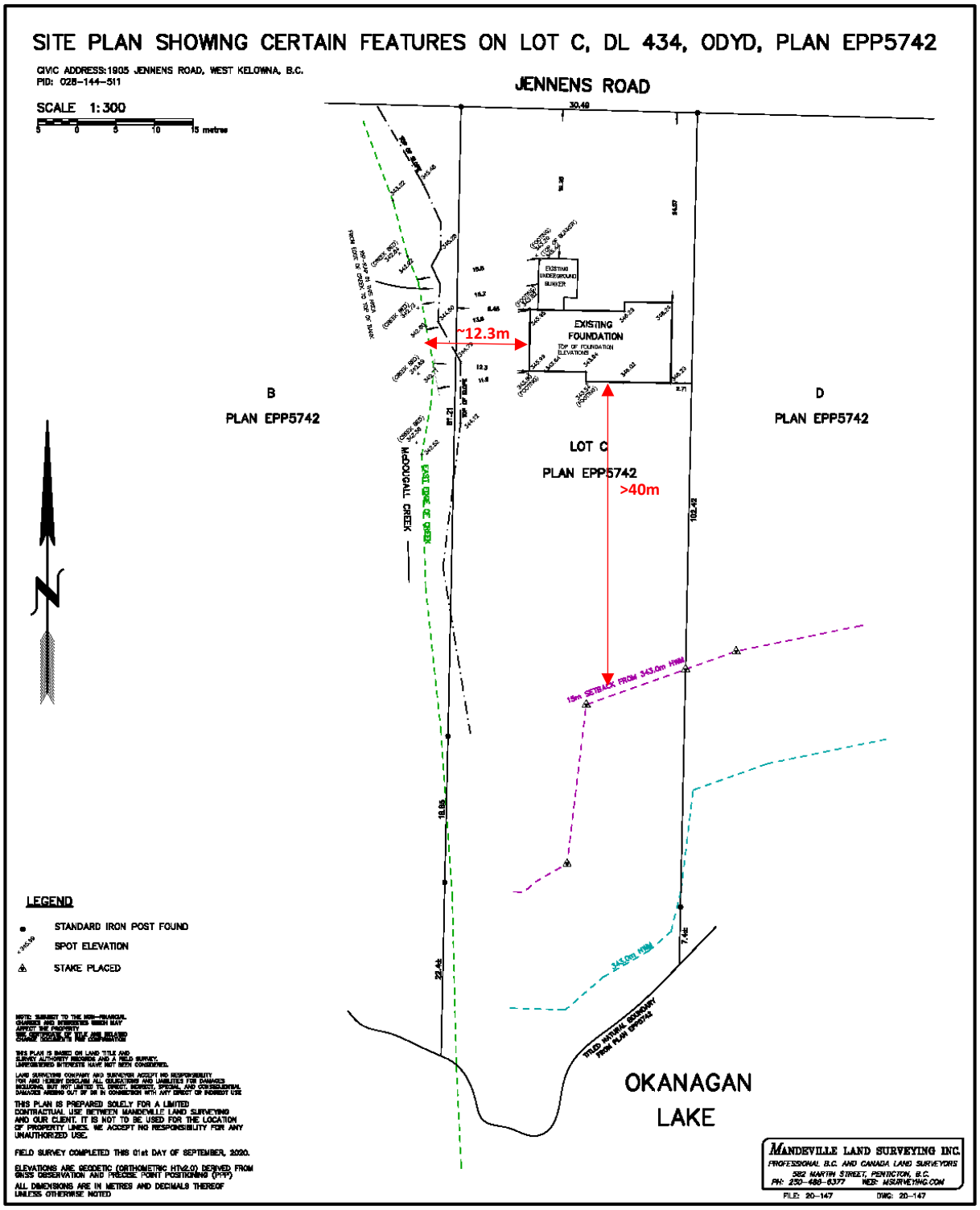


Figure 2 – Site Survey showing relevant elevations and setback distances

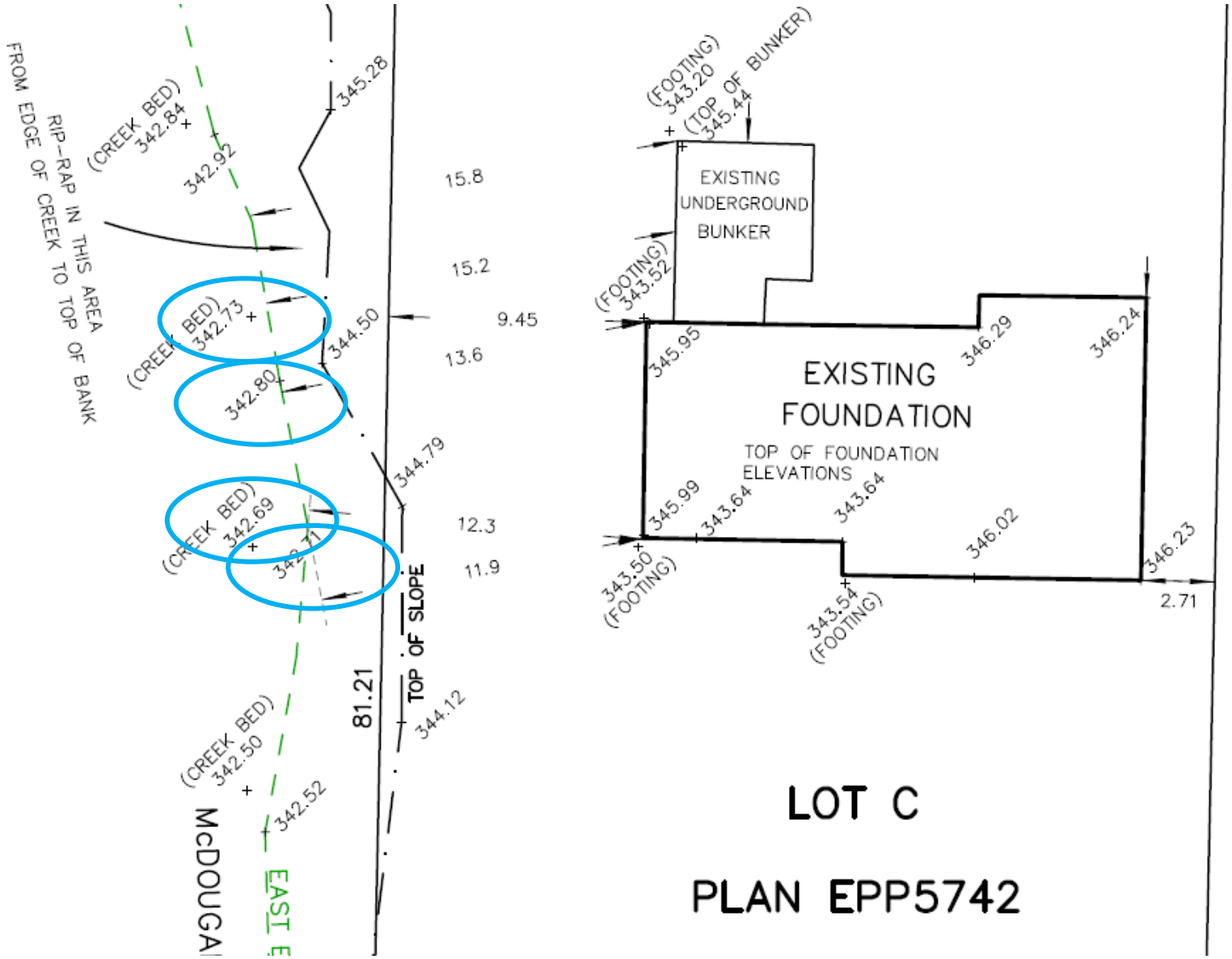


Figure 3 – McDougall Creek Natural Boundary Elevations – (average of 4 circled elevations = 342.7m)

Photo 1 – McDougall Creek looking downstream showing armoured and vegetated, stable banks. Subject property on left side.

Photo 2 – McDougall Creek looking downstream illustrating straight channel past subject property on left.

Appendix A

EGBC Flood Guidelines Flood Assurance Statement

FLOOD ASSURANCE STATEMENT

Note: This statement is to be read and completed in conjunction with the current Engineers and Geoscientists BC *Professional Practice Guidelines – Legislated Flood Assessments in a Changing Climate in BC* ("the guidelines") and is to be provided for flood assessments for the purposes of the *Land Title Act*, Community Charter, or the *Local Government Act*. Defined terms are capitalized; see the Defined Terms section of the guidelines for definitions.

To: The Approving Authority
City of West Kelowna
2760 Cameron Road, West Kelowna, BC V1Z 2T6
Jurisdiction and address

Date: October 10, 2020

With reference to (CHECK ONE):

- ☐ *Land Title Act* (Section 86) – Subdivision Approval
- ☐ *Local Government Act* (Part 14, Division 7) – Development Permit
- ☒ Community Charter (Section 56) – Building Permit
- ☐ *Local Government Act* (Section 524) – Flood Plain Bylaw Variance
- ☐ *Local Government Act* (Section 524) – Flood Plain Bylaw Exemption

For the following property ("the Property"):
Lot c, Plan EPP5742, DL 434, ODYD
Legal description and civic address of the Property

The undersigned hereby gives assurance that he/she is a Qualified Professional and is a Professional Engineer or Professional Geoscientist who fulfils the education, training, and experience requirements as outlined in the guidelines.

I have signed, sealed, and dated, and thereby certified, the attached Flood Assessment Report on the Property in accordance with the guidelines. That report and this statement must be read in conjunction with each other. In preparing that Flood Assessment Report I have:

[CHECK TO THE LEFT OF APPLICABLE ITEMS]

X 1. Consulted with representatives of the following government organizations:
City of West Kelowna Planning Staff

X 2. Collected and reviewed appropriate background information

X 3. Reviewed the Proposed Development on the Property

X 4. Investigated the presence of Covenants on the Property, and reported any relevant information

X 5. Conducted field work on and, if required, beyond the Property

X 6. Reported on the results of the field work on and, if required, beyond the Property

___ 7. Considered any changed conditions on and, if required, beyond the Property

8. For a Flood Hazard analysis I have:
   - X 8.1 Reviewed and characterized, if appropriate, Flood Hazard that may affect the Property
   - X 8.2 Estimated the Flood Hazard on the Property
   - X 8.3 Considered (if appropriate) the effects of climate change and land use change
   - ___ 8.4 Relied on a previous Flood Hazard Assessment (FHA) by others
   - X 8.5 Identified any potential hazards that are not addressed by the Flood Assessment Report

9. For a Flood Risk analysis I have:
   - X 9.1 Estimated the Flood Risk on the Property
   - X 9.2 Identified existing and anticipated future Elements at Risk on and, if required, beyond the Property
   - X 9.3 Estimated the Consequences to those Elements at Risk

10. In order to mitigate the estimated Flood Hazard for the Property, the following approach is taken:
- X 10.1 A standard-based approach
- ___ 10.2 A Risk-based approach
- X 10.3 The approach outlined in the guidelines, Appendix F: Flood Assessment Considerations for Development Approvals
- ___ 10.4 No mitigation is required because the completed flood assessment determined that the site is not subject to a Flood Hazard

11. Where the Approving Authority has adopted a specific level of Flood Hazard or Flood Risk tolerance, I have:
- ___ 11.1 Made a finding on the level of Flood Hazard or Flood Risk on the Property
- ___ 11.2 Compared the level of Flood Hazard or Flood Risk tolerance adopted by the Approving Authority with my findings
- X 11.3 Made recommendations to reduce the Flood Hazard or Flood Risk on the Property

12. Where the Approving Authority has not adopted a level of Flood Hazard or Flood Risk tolerance, I have:
- ___ 12.1 Described the method of Flood Hazard analysis or Flood Risk analysis used
- ___ 12.2 Referred to an appropriate and identified provincial or national guideline for level of Flood Hazard or Flood Risk
- X 12.3 Made a finding on the level of Flood Hazard of Flood Risk tolerance on the Property
- X 12.4 Compared the guidelines with the findings of my flood assessment
- X 12.5 Made recommendations to reduce the Flood Hazard or Flood Risk

X 13. Considered the potential for transfer of Flood Risk and the potential impacts to adjacent properties

___ 14. Reported on the requirements for implementation of the mitigation recommendations, including the need for subsequent professional certifications and future inspections.

Based on my comparison between:

[CHECK ONE]

☐ The findings from the flood assessment and the adopted level of Flood Hazard or Flood Risk tolerance (item 11.2 above)

☒ The findings from the flood assessment and the appropriate and identified provincial or national guideline for level of Flood Hazard or Flood Risk tolerance (item 12.4 above)

I hereby give my assurance that, based on the conditions contained in the attached Flood Assessment Report:

[CHECK ONE]

☐ For subdivision approval, as required by the *Land Title Act* (Section 86), "that the land may be used safely for the use intended":

[CHECK ONE]

☒ With one or more recommended registered Covenants.

☐ Without any registered Covenant.

☒ For a development permit, as required by the *Local Government Act* (Part 14, Division 7), my Flood Assessment Report will "assist the local government in determining what conditions or requirements it will impose under subsection (2) of this section [Section 491 (4)]".

☒ For a building permit, as required by the Community Charter (Section 56), "the land may be used safely for the use intended":

[CHECK ONE]

☒ With one or more recommended registered Covenants.

☐ Without any registered Covenant.

☐ For flood plain bylaw variance, as required by the *Flood Hazard Area Land Use Management Guidelines* and the *Amendment Section 3.5 and 3.6* associated with the *Local Government Act* (Section 524), "the development may occur safely".

☐ For flood plain bylaw exemption, as required by the *Local Government Act* (Section 524), "the land may be used safely for the use intended".

I certify that I am a Qualified Professional as defined below.

October 10, 2020
Date

Dobson Engineering Ltd.
Prepared by

Don Dobson, PEng
Name (print)

Signature

5087 Seon Crescent
Address

Kelowna, BC V1W 5G8

250-878-4502
Telephone

ddobson@dobsoneng.com
Email

Clarke Geoscience Ltd.
Reviewed by

Jennifer Clarke, PGeo
Name (print)

Signature

PROFESSIONAL PROVINCE OF J.A. CLARKE 25319 BRITISH COLUMBIA GEOSCIENTIST

10/23/20

(Affix PROFESSIONAL SEAL here)

PROFESSIONAL PROVINCE OF D. A. DOBSON BRITISH COLUMBIA ENGINEER

If the Qualified Professional is a member of a firm, complete the following:

I am a member of the firm Dobson Engineering Lrtd.
and I sign this letter on behalf of the firm.

(Name of firm)