



**CITY OF WEST KELOWNA
FLOODPLAIN EXEMPTION PERMIT
FEX 22-01**

To: John Stremel
s22(1)

1. This **Floodplain Exemption Permit** is issued subject to compliance with all the Bylaws of the City of West Kelowna applicable thereto, except as specifically varied or supplemented by this Permit.
2. This Permit applies to and only to those lands within the City of West Kelowna described below, and any and all buildings, structures, and other developments thereon:

LOT 1, DISTRICT LOT 3190 ODYD PLAN KAP61491
(3320 Turnbull Road)

3. **This Permit allows for the construction of a single-family dwelling on the subject property 3320 Turnbull Road. Specifically, this Floodplain Exemption Permit exempts the following:**
 - Floodplain Regulation Section 3.28.2 (a) ii. of the Zoning Bylaw No.0265.

Requirements in Relation to Floodplain

- a) Any Structure or construction on 3320 Turnbull Road shall meet or exceed all Floodplain Regulations outlined in Zoning Bylaw No.0265 other than Section 3.28.2 (a) ii.
- b) The foundation of the structures shall not be modified from the placement outlined on the BC Land Surveyors Certificate of Location of Foundations prepared by AllTerra Land Surveying Ltd. On December 20th, 2022.
4. The land described herein shall be developed strictly in accordance with the terms and conditions of this Permit and any plans and specifications attached to this Permit, which shall form a part hereof. Should any changes be required to this permit, please ensure that you obtain written approval from City of West Kelowna prior to making any changes.
5. If this Floodplain Exemption Permit has not been issued within one year from approval, Floodplain Exemption Permit, shall be deemed to have been refused and the file will be closed.
6. **This Permit is not a Building Permit.**
7. **This Permit is not a Highways Permit.**

8. Subject to the terms of the permit, where the holder of a permit issued under the *Local Government Act* does not substantially commence any construction with respect to which the permit was issued within one year after the date it is issued, the permit lapses.

AUTHORIZING RESOLUTION NO (XXXXXXX) PASSED BY THE MUNICIPAL COUNCIL ON April 18, 2023.

Signed on _____

Corporate Officer

I hereby confirm that I have read and concur with the conditions of Development Permit FEX 22-01 and will ensure that copies of FEX 22-01 will be provided to onsite personnel at time of construction.

Signed on _____

Property Owner or Agent

ISSUED on _____

Schedules:

Schedule A: Flood Hazard Assessment prepared by Water's Edge Engineering Ltd., dated March 16th, 2023.

Schedule A

March 16, 2023

Rev. 1

WEEL FILE #: 1635

Sent Via Email: legend04@yahoo.com

John Stremel

s22(1)

Attention: Mr. John Stremel, Owner
Subject: Flood Hazard Assessment – 3320 Turnbull Road

I.0 INTRODUCTION

Waters Edge Engineering Ltd. (Waters Edge) was retained by John Stremel to complete a Flood Hazard Assessment of 3320 Turnbull Road (subject property), within which there is an unnamed tributary to Powers Creek, located within the City of West Kelowna, BC, in the upper Glenrosa area. The site location is shown in Figure 1. The subject property is legally described as: PLAN KAP61491, LOT 1, DISTRICT LOT 3190, OSOYOOS DIV OF YALE DISTRICT

The subject property is approximately 2.9 ha and is bounded by Glenrosa Road to the north, Turnbull Road to the east and existing residential and agricultural properties to the south and west. An unnamed ephemeral tributary to Powers Creeks transects the property. A more detailed site plan is shown in Figure 2.



Figure 1 – Location Plan of 3320 Turnbull Road

I.1 BACKGROUND

The subject property was originally severed in June 1997, upon which time Covenant #KM029183 (the covenant) was placed on the lot. This covenant required any habitable structure on the property to be constructed 15 m away and 1.5m above from the Natural Boundary of the unnamed stream. On this property the owner considers it unduly restrictive to construct 1.5 m above the natural boundary and wishes to complete the necessary assessment to vary this requirement of the covenant. The Ministry of Transportation and Infrastructure (MOTI) request for covenant is attached in the appendix (property title was not provided).

At the time of the assessment a driveway and foundation had been constructed on the property, see attached photos. The foundation is located greater than 15m from the Natural Boundary of the stream. It is understood that the owner has installed crushed stone under the footings to mitigate groundwater impacts. The owner also installed a culverted stream crossing (300 mm PVC) as part of the driveway. No engineering input was given for the driveway or foundation as part of this assessment, and the aforementioned driveway and foundation were constructed prior to the completion of this assessment.

A survey was conducted by AllTerra (2022), attached, to confirm the footing elevations, and found that the footings are below the 1.5 m vertical separation from the Natural Boundary. As the prefabricated home was nearing delivery, the owner opted to increase the foundation wall height rather than raise the footing to complete the house construction this year. This has left the owner with a basement that is below the 1.5 m vertical setback.

The purpose of this assessment is to determine the flooding risks from the unnamed stream and to demonstrate that the 1 in 200 year flood elevation lies within the 15 m setback distance. This Flood Hazard Assessment may then be used to remove the 1.5 m vertical setback requirement. There is currently no intention, nor desire, to vary the 15 m horizontal setback from the Natural Boundary of the stream.

It is also noted that for future development on the project, the City of West Kelowna will require an exemption to the Floodplain bylaw (Zoning Bylaw No. 0154, Section 3.24).

I.2 SCOPE OF WORK

Waters Edge conducted a field investigation and completed engineering calculations to determine the local flood risks.. This scope included the following:

- On site field stream measurement and watershed investigation
- Time to concentration estimation (multiple methods)
- 1:200 year return period peak discharge estimation (multiple methods)
- Determining the 1:200 year return period flow depth as the FCL (Manning's Equation)
- Show that the 1.5m vertical setback requirement may be removed, with no negative impact to the property.

2.0 FIELD INVESTIGATION

A site visit was conducted on July 12, 2022, by Joe Vandenberg, P.Eng., and Josh Holland, EIT, of Waters Edge Engineering Ltd. Following are the observations gathered from the background information review and site investigation.

2.1 SUBJECT PROPERTY CHARACTERISTICS

The subject property is a 2.9 ha rural residential lot, with a foundation for a single-family residence. The subject property generally consists of long grasses and existing pastureland, with gentle slope (13%) from west to east. Runoff from more than half of the subject property drains to the unnamed stream which consists of a central swale-like depression which crosses in a 750 mm culvert under Turnbull Road at Glenrosa Road. The remainder of the property drains north towards the ditch line along Glenrosa Road. The swale is overgrown with long grasses with minimal evidence of consistent flow. The intermittent nature of the flows through this catchment is evidence of a system governed by snow melt and large rain events. Site conditions are shown in the attached photo summary.

2.2 WATERSHED CHARACTERISTICS

GIS watershed generation yielded a total watershed area of 74 ha. Further observation in the field confirmed the location of two culverts (300 mm and 600mm, see photos) under Gill Road near McKeller Road. The catchment area of these culverts results in an additional 6.0 ha of contributing area for a revised total of 80 ha. The watershed is shown in Figure 3.

The land cover types over the catchment were conservatively assumed based on aerial imagery, and soil types were estimated from the publicly available soil data shown in Figure 4. The types of land cover and soil types ultimately determine the runoff coefficient for the catchment. The determination of the runoff coefficient is summarized below in Table 1.

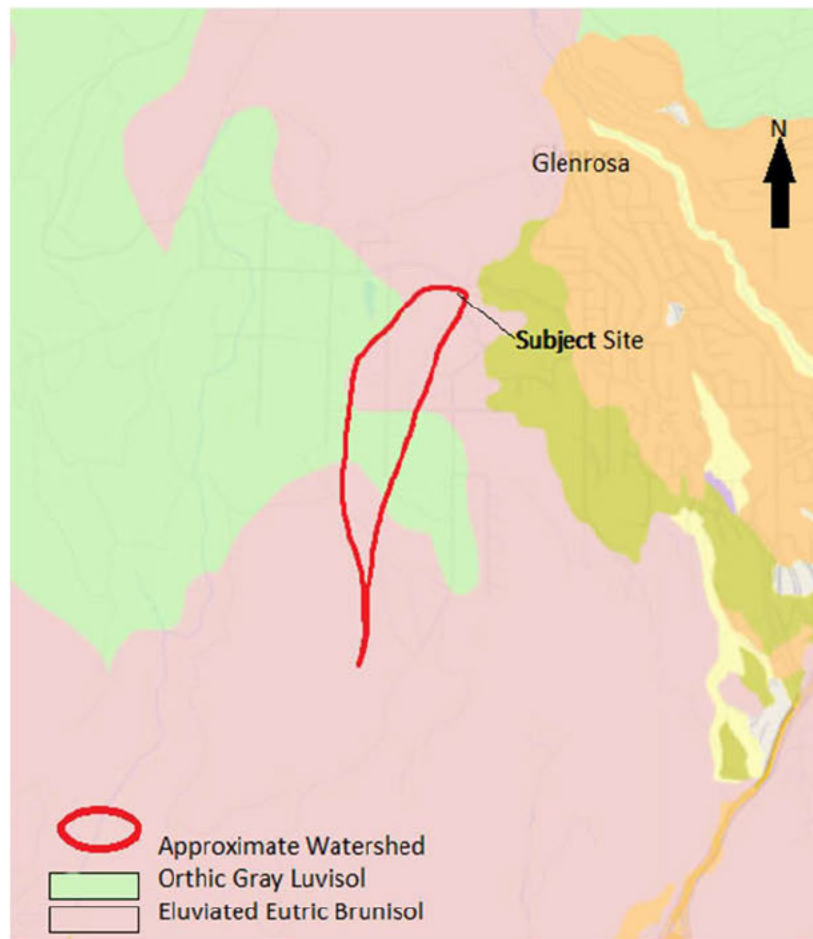


Figure 4 - Soil Types, iMapBC

The predominate soils within the watershed are classified as Orthic Gray Luvisol and Eluviated Eutric Brunisol. Both these soils are described as well drained but not rapidly drained. In both cases the soil texture is considered moderately coarse and subsurface flow may occur for short durations, but additions are equaled by losses. As such, the soils onsite will be classified as Hydrologic Soil Group AB. The runoff coefficients presented for the respective land cover types are selected based on soil type and combined to a weighted average. This single runoff coefficient will represent the entire catchment and be used in the Rational Method.

Table 1: Land Cover and Runoff Coefficient

Land Cover Type	Slope	Soil Type	Percentage of total Area	Runoff Coefficient
Pastureland	10-30%	AB	35%	0.22
Woodlot	10-30%	AB	60%	0.18
Impervious	n/a	n/a	5%	1.00
Weighted Average				0.24

2.3 STREAM CHARACTERISTICS

The stream was measured on site using a tape measure and clinometer. The observed characteristics are summarized below in Table 2.

It is noted that bankfull width and depth characteristics listed in Table 2 are based on observed changes in streamside vegetation and the presence of alluvial materials. The bankfull channel condition approximately corresponds to a mean annual flow, which is roughly equivalent to a 1 in 2 to 5 year return period flow.

Table 2: Relevant Unnamed Stream Characteristics at 3320 Turnbull Road

Parameter		Measured/Observed Value, Comments
Channel Morphology		Likely riffle/pool, no observed flow
Debris Load		Low
Bed Load		Low
Substrate	D50	1 mm (coarse loamy)
	D90	30 mm
Vegetation		Long Grasses
Channel Slope		13%
Bank Slopes (H:V)	Left Bank	4:1
	Right Bank	4:1
Bankfull Width		1.0 m
Bankfull Depth		0.05 m

3.0 TIME TO CONCENTRATION

The time to concentration of a watershed describes the time it takes for water to flow from the furthest upstream point to the discharge point. This time is used to determine the design storm event and maximum peak instantaneous flow rate. Two methods were used to estimate the time to concentration. These methods rely upon the overall catchment length, area, slope and runoff coefficient. The methods are summarized below in Table 3.

Table 3: Time to Concentration Calculations

Bransby Williams Method	FAA (Airport) Method
$t_c = \frac{58L}{A^{0.1}S^{0.2}}$	$t_c = \frac{3.26(1.1 - C)L^{0.5}}{S^{0.33}}$
L = Total Channel Length = 2.5 km A = Catchment Area = 0.8 km ² S = Average Catchment Slope = 130 m/km	C = Runoff Coefficient = 0.24 L = Total Channel Length = 2500 m S = Average Catchment Slope = 13%
t _c = Time to Concentration = 56 min	t _c = Time to Concentration = 60 min

As shown above, the time to concentration for the subject catchment is approximately 60 min or 1 hour. This value will be used to select the design storm event.

4.0 PEAK FLOW ESTIMATION AND DEPTH

4.1 DESIGN METHOD SELECTION

To calculate the 1 in 200-year instantaneous peak flow, the results using three different methods were examined. These include the Rational Method, the Index Flood Method, and Regional Flood Frequency Analysis. The Index Method involves large scale, regional peak flow data and is not suitable for small catchments. The Regional Flood Frequency Analysis relies upon gauged flow data for similar sized catchment in a similar area. Since the relative size of the subject catchment is small and there is a lack of local gauged watersheds, the Rational Method is used to determine the 1 in 200-year instantaneous peak flow.

4.2 DESIGN STORM SELECTION

The peak flow in a catchment is experienced when the peak of the rainfall event is able to travel through the entire catchment. The time of traveling through the catchment is equal to the time to concentration and will be used as the time to peak for the selected storm event. Assuming that the peak intensity of a storm event occurs at approximately 1/3 of its total duration, the total duration of the design storm will be 3 hrs (with peak intensity at 1 hr). Using the published IDF Curve for the Kelowna Airport, a 1 in 100-year, 3 hour storm, has a peak intensity of approximately 9.1 mm/hr.

4.3 DESIGN PEAK FLOW ESTIMATE RESULTS

The Rational Method peak flow calculation is summarized below in Table 4. Multiple adjustments are applied after the Rational Method is completed. These adjustments account for climate change effects, changes in watershed characteristics due to wildfires and snow pack, and an adjustment to scale up to a 1 in 200-year storm event.

The results indicate that the design flow for the unnamed stream at 3320 Turnbull Road is estimated to be 0.93 m³/s. The design flow accounts for upscaling from the 1 in 100 year storm event, climate change, and a Factor of Safety to account for uncertainty in the analysis.

Table 4: Rational Method Summary

Rational Method
$Q_{100} = 0.0028CiA$
C = Runoff Coefficient = 0.24 A = Catchment Area = 80 ha i = Peak Rainfall Intensity= 9.1 mm/hr
Q ₁₀₀ = 1 in 100-year Peak Instantaneous Flow = 0.49 m ³ /s
Post Calculation Adjustments
Conversion to Q ₂₀₀ = Q ₁₀₀ x 1.1
15% Climate Change Factor = Q ₁₀₀ x 1.15
Factor of Safety = Q ₁₀₀ x 1.5
Q₂₀₀ = 0.93 m³/s

4.4 DESIGN FLOW DEPTH ESTIMATION RESULTS

The depth of the 1 in 200-year design flow was determined using the Manning Equation. This formula relies on an empirically derived value known as the Manning’s n. This is determined based on the bank and stream bed materials observed on site. A Manning’s n value of 0.04 was selected based on the long grasses observed at the site. Using the peak flow determined in Section 4.3 and the stream characteristics shown in Table 2 the design flow depth was estimated by iterating the Manning’s Equation as shown below.

Table 5: Manning’s Equation Summary to Determine Design Flow Depth

Manning’s Equation
$Q = VA = \frac{1}{n} AR^{2/3} S^{1/2}$
n = Manning’s n = 0.04 A = Cross sectional Area (Iterated) R = Hydraulic Radius = $\frac{\text{Cross sectional Area}}{\text{Wetted Perimeter}}$ (Iterated) S = Channel Slope = 13% Q = Flow = 0.93 m ³ /s
Design Flow Depth = 0.13 m

Iterating Manning’s Equation yielded a 1 in 200-year flow depth of 0.13 m in the stream. This depth is drawn on the cross section as shown in Figure 5.

5.0 DISCUSSION AND RECOMMENDATIONS

The purpose of the current covenant that is in place for the subject property is to mitigate flooding risk to any proposed dwellings. The requirements set out by the covenant are standard values and were not based on a specific hydrology assessment of the stream. The watercourse running through the subject site is observed to be relatively small, only receiving intermittent flows. The estimated 1 in 200-year design flow depth is 0.13m.

The current vertical setback of 1.5 m is, therefore, not applicable. In addition to the hydrology assessment, other observed stream characteristics provide confirmation. First, there is no perennial flow in the stream. This watercourse is an ephemeral, snow melt and rainfall fed stream. Furthermore, the channel slope is significantly high such that no ponding would be expected along the channel bed through the property. This is evidenced by the lack of visible floodplain. As flows increase, the velocity will increase downstream allowing the increased volume to travel down the stream rather than ponding in a floodplain. A flow depth of 0.49 m would overtop the left bank, however a flowrate of 3.5 m³/s is required to achieve this depth. Since this flow rate is approximately 4 times the 1 in 200 year flow rate, it is statistically improbable for this to occur.

Based on this assessment, we recommend that the covenant be amended to remove the vertical setback requirement and only reference a 15m horizontal setback distance from the Natural Boundary of the unnamed stream located at 3320 Turnbull Road. This horizontal setback is sufficient to mitigate the flood hazard at the subject property. The foundation is greater than 15m away from the Natural boundary across a significant slope. This indicates that the single family dwelling not located within a floodplain system.

Glenrosa Lake Dam (Ficke's Pond) Flood Potential

The Glenrosa Lake Dam appears to be located upstream from the subject site. A desktop study showed that the dam was original created by grading a berm along Glenrosa Road (the north end of the pond). This berm has the lowest bank elevation indicating the natural drainage route from the dam would be the ditches along Glenrosa road and any watercourse they converge with. The watercourse on the subject property has a confluence with the Glenrosa Road Ditch downstream of the property and there are no locations where a flood flow would have access to the subject property. This shows that there is negligible flood risk from the Glenrosa Lake Dam.

6.0 CLOSURE

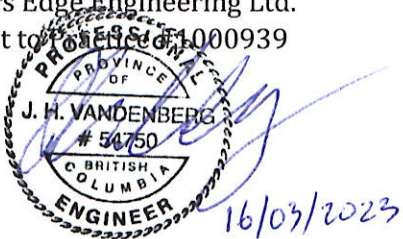
As with any natural system, the estimates presented in this report attempt to quantify something that is difficult to put values on and the specific numbers presented must be read with an understanding of a large margin of error that is inherent in these types of works.

It is noted that construction activities have been conducted on the subject property prior to this assessment. These activities include driveway, foundation, and stream crossing construction. This assessment has not evaluated the impact of these activities to the overall flood risk at the subject property. **Waters Edge has not provided, and does not provide any comment on the foundation, driveway, and stream crossing design and construction. The foundation of the home is greater than 15m from the natural boundary of the watercourse and the above analysis has shown that the 15m horizontal setback is sufficient to protect the single-family dwelling from flooding.**

This document has been prepared for John Stremel in support of their development at 3320 Turnbull Road. It is intended for the exclusive of both John Stremel and the City of West Kelowna in their pursuit to amend or discharge Floodplain Covenant KM 029182 and may not be relied upon by any other party or for any other project. Waters Edge provides opinions in this document based on the historical information available and provided by others and provides no warranty on this information. Climate change may impact the estimated return period events of storms and water levels as well as sediment trends. All project guidance, estimations and correspondence are bound by the terms in the Services Agreement

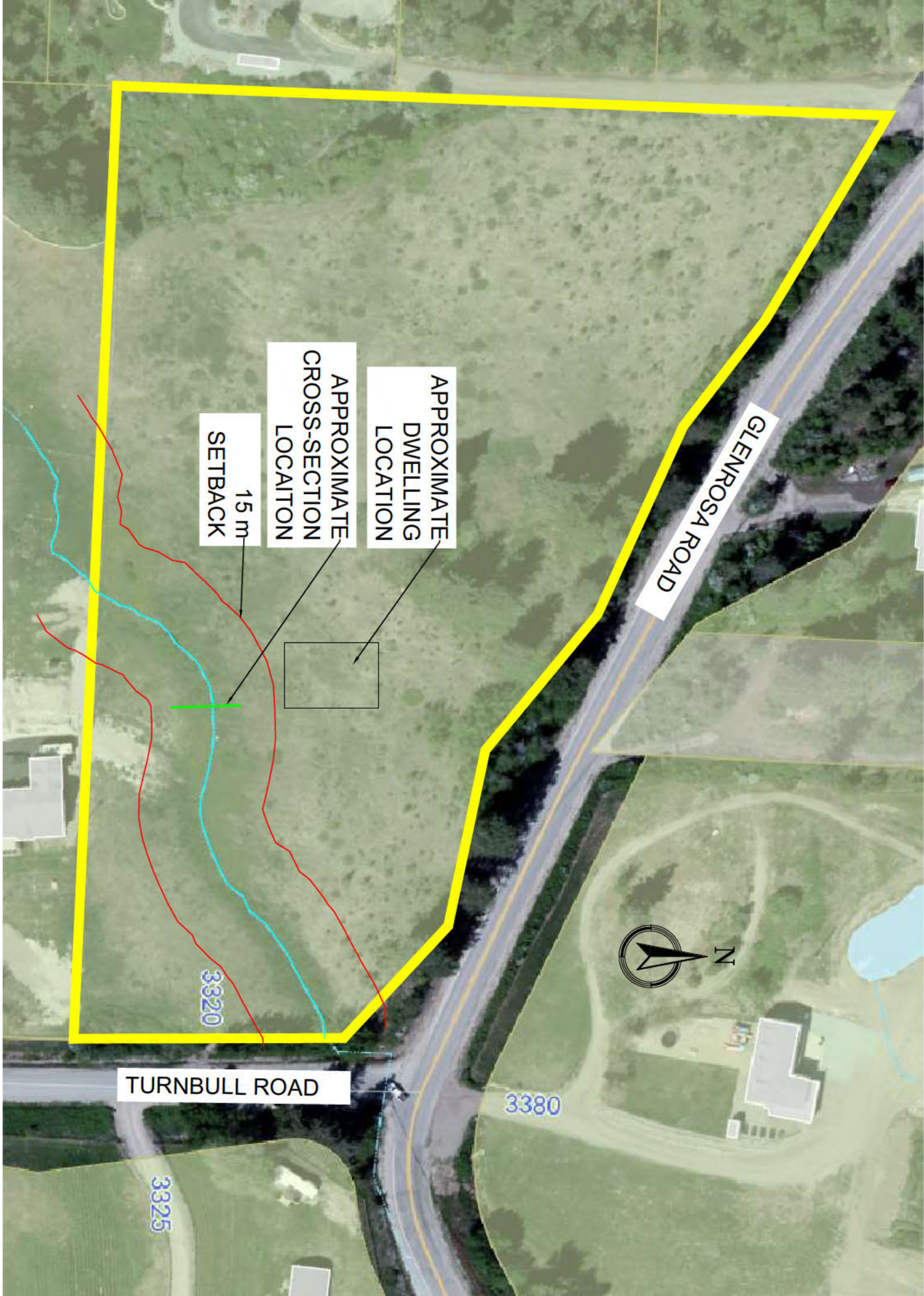
Waters Edge Engineering trusts this meets your present requirements. If you require additional information, please do not hesitate to contact us.

Sincerely,
Waters Edge Engineering Ltd.
Permit to Proceed #1000939



Joe Vandenberg, P.Eng.
Civil Engineer
Joe@WatersEdgeLTD.ca
(778) 760-3833

Encl.
Figure 2
Figure 3
Figure 5
MOTI Request for Covenant #KM029183
AllTerra Survey
Photo Summary



GLENROSA ROAD

TURNBULL ROAD

APPROXIMATE DWELLING LOCATION

APPROXIMATE CROSS-SECTION LOCATION

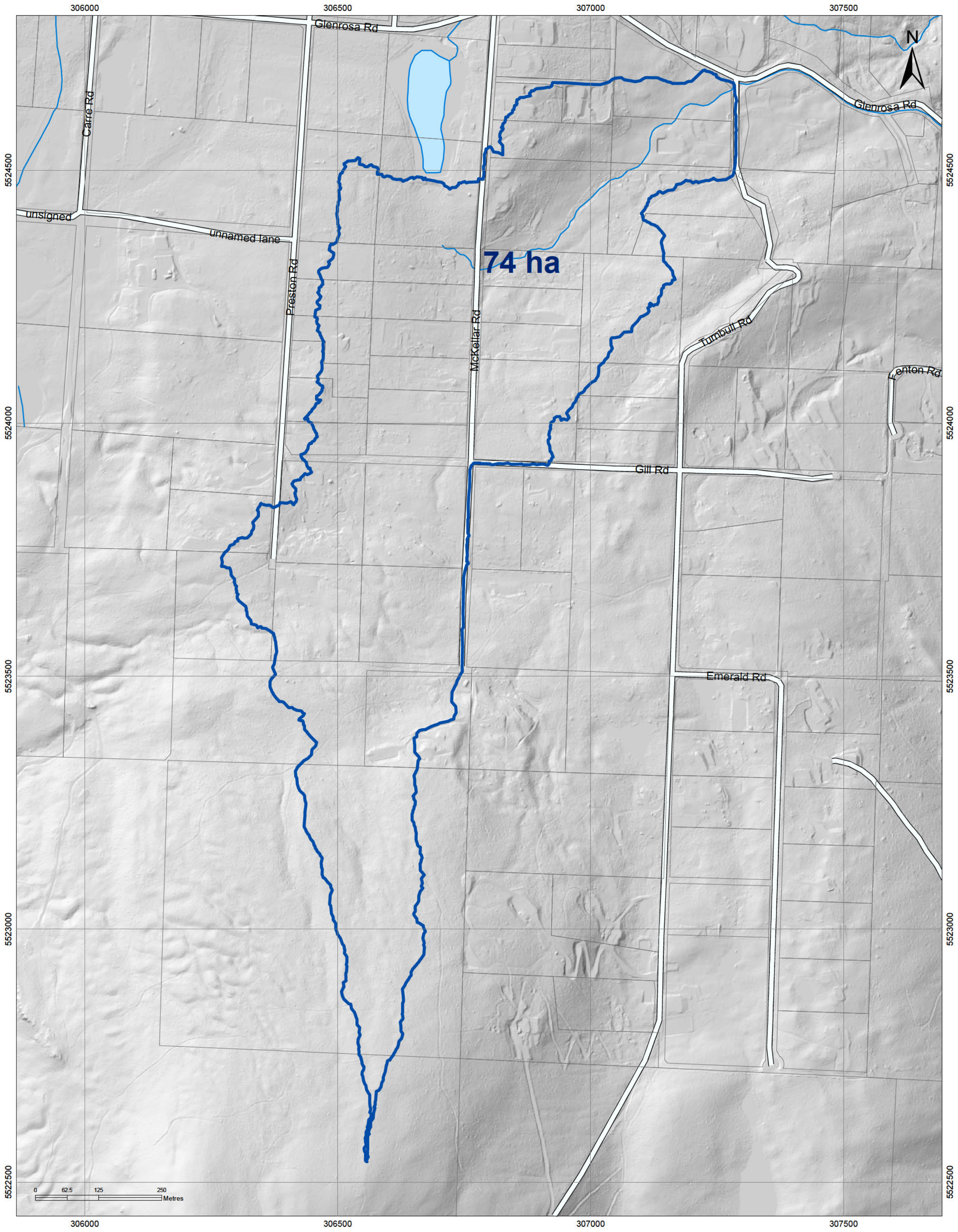
15 m SETBACK



3320

3325

3380



Glenrosa Rd

Carre Rd

unsigned

unnamed lane

Preston Rd

McKellar Rd

Gill Rd

Timbul Rd

Lenton Rd

Emerald Rd

Glenrosa Rd

74 ha

0 62.5 125 250 Metres

306000

306500

307000

307500

5524500

5524500

5524000

5524000

5523500

5523500

5523000

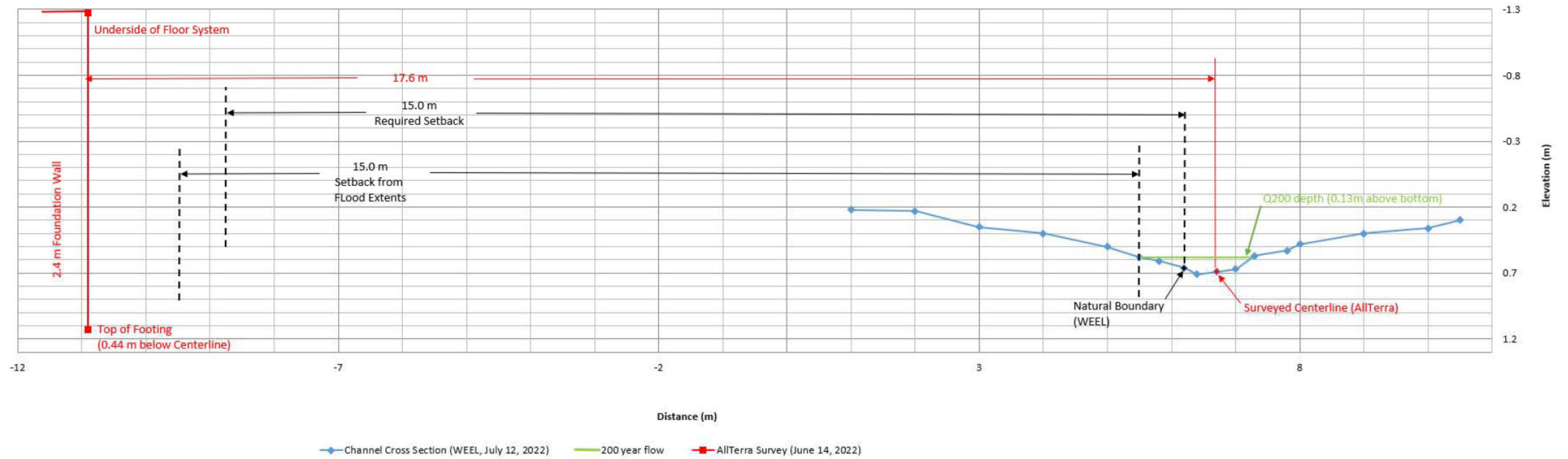
5523000

5522500

5522500



FIGURE 5 – SITE CROSS SECTION



Ministry of Transportation & Highways
#5 - 2484 Main Street
Westbank, BC
V4T 2G2

COVENANT # KMO29183

Dear Sir or Madam:

Re: Proposed Subdivision of Lot 93 Pl 777 DL 3190 ODYD

This letter is in reply to your correspondence of June 17, 1997. As the duly authorized designate of the Minister of Environment, Lands and Parks, consent is hereby given on his behalf, pursuant to Section 82 of the Land Title Act, for the approval of the above-mentioned plan of subdivision, subject to the subdivider entering into a covenant registrable under Section 219, which shall run with the land and shall effect the following conditions for each lot created including any remainder of the property:

- "1. Hereafter, no building, mobile home or unit, modular home or structure, shall be constructed, reconstructed, moved, extended or located within fifteen point zero (15.0) metres of the natural boundary of the unnamed watercourse crossing this property.
2. Hereafter, no area used for habitation, business or storage of goods damageable by floodwaters shall be located within any building at an elevation such that the underside of the floor system thereof is less than one point five (1.5) metres above the natural boundary of the unnamed watercourse crossing this property.

In the case of a mobile home or unit, modular home or structure, the ground level or top of concrete or asphalt pad on which it is located shall be no lower than the above described elevation.

3. The required elevation may be achieved by structural elevation of the said habitable, business or storage area

or by adequately compacted landfill on which any building is to be constructed or mobile home or unit located, or by a combination of both structural elevation and landfill. No area below the required elevation shall be used for the installation of furnaces or other fixed equipment susceptible to damage by floodwater. Where landfill is used to raise the natural ground elevation, the toe of the landfill slope shall be no closer to the natural boundary than the setback requirement given in condition (1) above. The face of the landfill slope shall be adequately protected against erosion from flood flows (wave action, ice or other debris).

4. The owner acknowledges that the Province of British Columbia does not represent to the owner or any other person that any building constructed or mobile home located in accordance with conditions (1) and (2) herein will not be damaged by flooding or erosion, and the owner covenants and agrees not to claim damages from the Province or the Regional District of Central Okanagan or hold the Province or the Regional District of Central Okanagan responsible for damages caused by flooding or erosion to the land or to any building, improvement or other structure built, constructed or placed upon the said lands and to any contents thereof."

These covenant conditions are to be registered with priority over any financial charges registered against the property.

The following declaration is to be endorsed on the subdivision plan:

The registered owners designated hereon hereby acknowledge that the land affected by this plan may be subject to flooding and declare that they have entered into a covenant in favour of Her Majesty the Queen in right of the Province of British Columbia, as represented by the Ministry of Environment, Lands and Parks, under Section 219 of the Land Title Act.

(covenantor)

dated at _____, _____, ____.

The covenant must be tendered with the application to deposit the subdivision plan. The covenant must have the following

statement typed or stamped on it and signed by the Approving Officer:

This is the instrument creating the condition or Covenant pursuant to Section 219 of the Land Title Act by the Grantor referred to herein and shown on the Print and Plan annexed hereto as Schedule "A" and initialled by me.

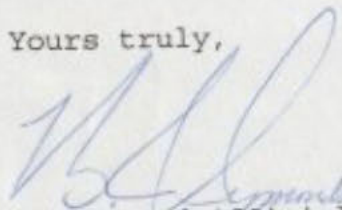
Approving Officer
(cite authority)

A sample restrictive covenant is available on request.

This consent to the approval of the proposed subdivision applies only to the requirements under Section 82 of the Land Title Act, and does not apply to any other approval which may be required. If you require any further information, please contact the Ministry of Environment, Lands and Parks, Water Management, Engineering Section, telephone 490-8200.

Upon receipt of the registered restrictive covenant for this subdivision, I would be grateful if a copy could be forwarded to this office.

Yours truly,



Designated Official
Ministry of Environment,
Lands and Parks

MICHAEL/dc

cc: s22(1) & John Stremel

s22(1)

Regional District of Central Okanagan

BC LAND SURVEYOR'S SITE PLAN SHOWING PROPOSED LOCATION OF A HOUSE ON LOT 1, DL 3190, ODYD, PLAN KAP61491.

PID: 024-110-159
CIVIC ADDRESS: TURNBULL ROAD
CLIENT: STREMEL

This document shows the relative location of proposed improvement(s) named above with respect to the boundaries of the described parcel.

This document was prepared for the exclusive use of the client named herein, for building permit purposes.
Lot dimensions shown are derived from Land Title Office records.
This document shall not be used to define property lines or corners.

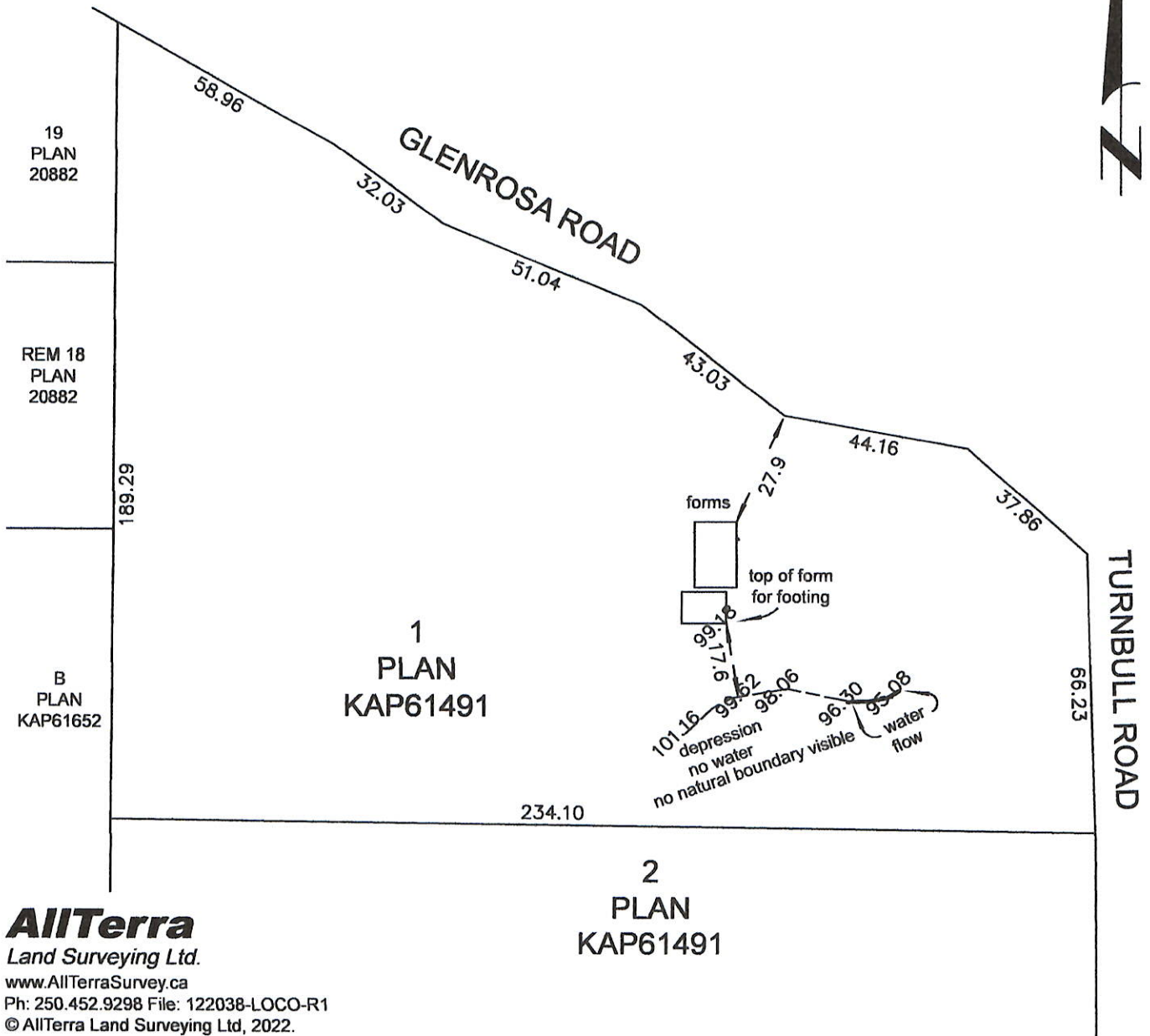
Scale 1:1500 Metric. Distances shown are in metres and decimals thereof.

Notes:

- Unregistered interests have not been included or considered.
- This plan is based on a field survey conducted on June 14, 2022
- Elevations are based on an assumed datum.

Charges on Title:

- Covenants KM29179, KM29182, KM29183.



AllTerra
Land Surveying Ltd.

www.AllTerraSurvey.ca
Ph: 250.452.9298 File: 122038-LOCO-R1
© AllTerra Land Surveying Ltd, 2022.

2
PLAN
KAP61491

BC LAND SURVEYOR'S SITE PLAN SHOWING PROPOSED LOCATION OF A HOUSE ON LOT 1, DL 3190, ODYD, PLAN KAP61491.

PID: 024-110-159

CIVIC ADDRESS: TURNBULL ROAD

CLIENT: STREMEL

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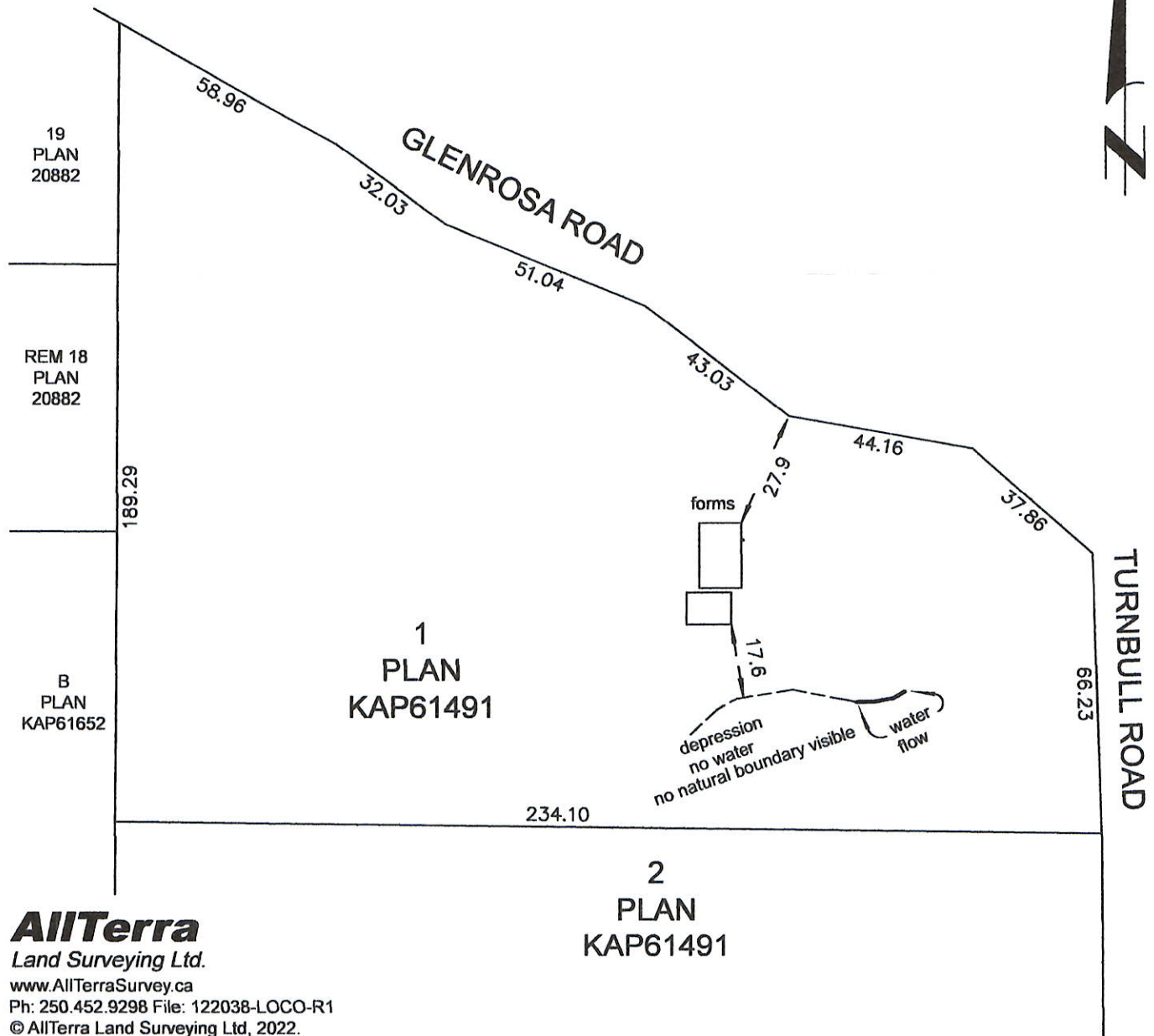
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AllTerra
Land Surveying Ltd.

www.AllTerraSurvey.ca

Ph: 250.452.9298 File: 122038-LOCO-R1

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Figure 2.6. Recommended design curves for the 100-year return period annual maximum instantaneous discharge – Zone 2: Northern Okanagan Basin.

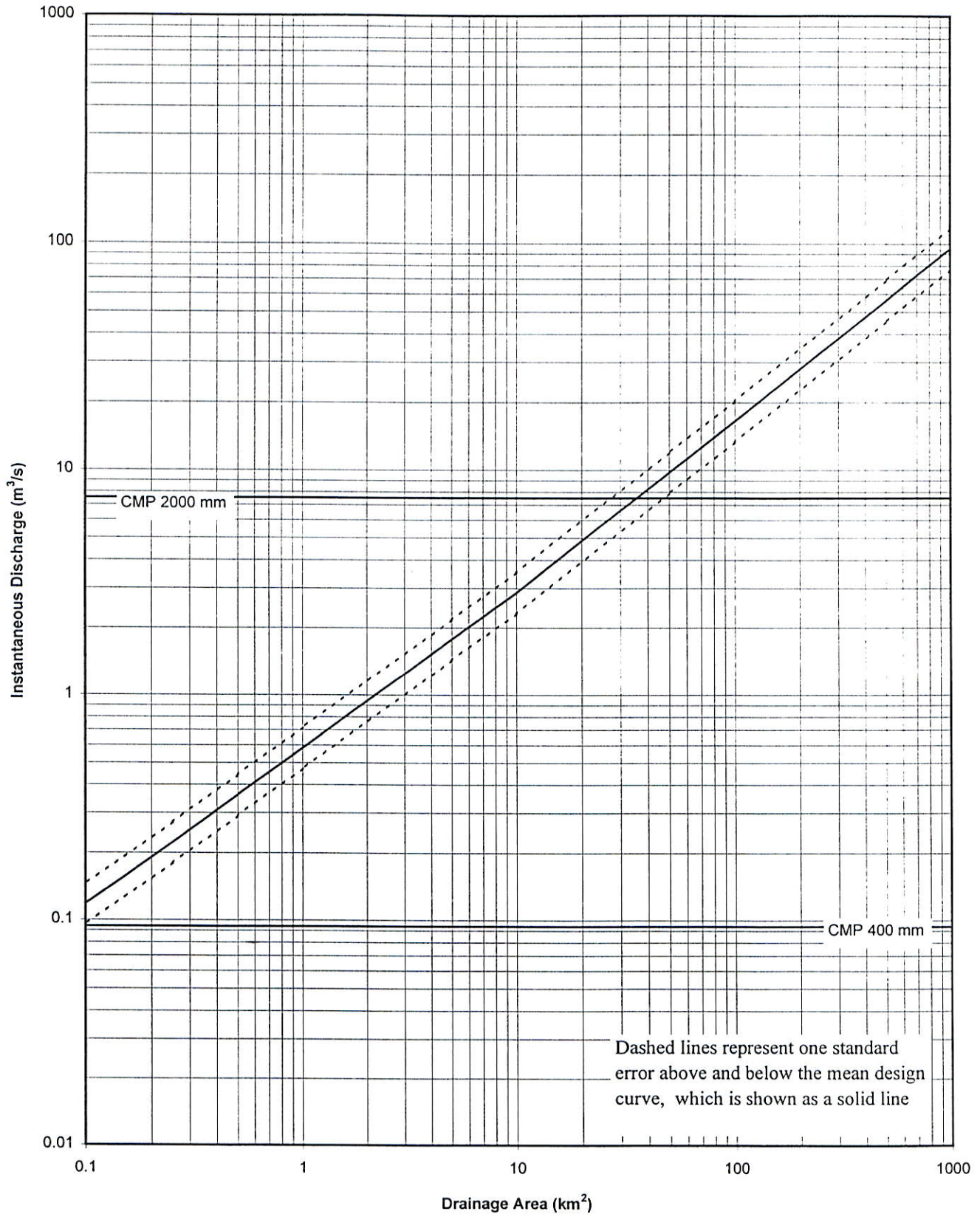




Photo 1: Unnamed stream – looking upstream from cross section



Photo 2: Unnamed stream – looking upstream from cross section



Photo 3: Unnamed stream – looking downstream from cross section

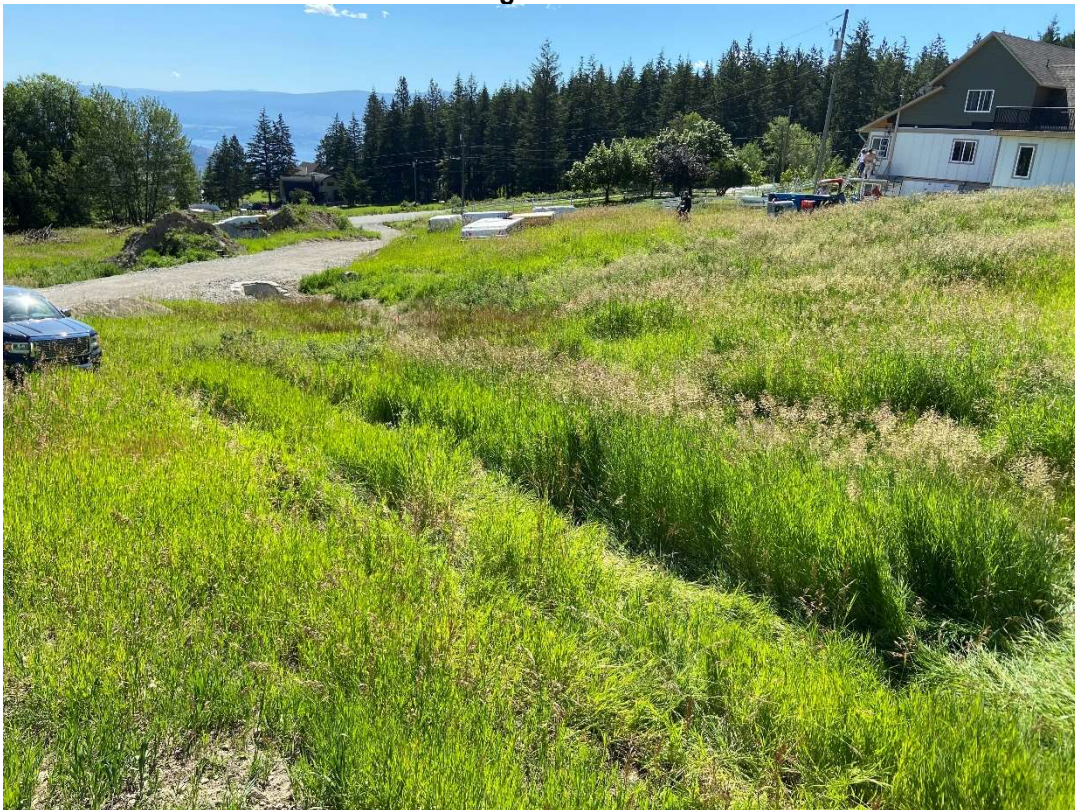


Photo 4: Unnamed stream – looking downstream from cross section



Photo 5: Small, intermittent, defined streambed



Photo 6: East culvert under Gill Road (~300mm CSP)



Photo 7: West culvert under Gill Road at McKeller Road (~600mm CSP)



Photo 8: Culvert under McKeller Road (~600mm CSP)



Photo 9: Culvert under Turnbull Road at Glenrosa Road



Photo 10: Footing forms on top of crushed stone



Photo 11: Constructed driveway



Photo 12: Looking downstream at driveway stream crossing (~300mm PVC)