geoteknik
consulting ltd
324 clifton road north
kelowna. b.c.
canada. v1v 1n4
tel&fax: 250.763.1079
cell: 250.212.8711
email: geoteknik@telus.net

April 5, 2010 Our Ref.: 210-131

Mr. M. Richardson
1-360 Spedding Court
Kelowna, BC
V1X 7K9

RE: GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENCE, POOL | ACCESSORY BUILDING
SHEERWATER LOT 5,
KELOWNA, BRITISH COLUMBIA

Dear Sir:

As requested, Geoteknik Consulting Ltd. has completed a geotechnical investigation of the above referenced residential lot. The purpose of the investigation was to provide a general overview of the subsurface soil, bedrock and groundwater conditions as well as to identify areas that could pose a potential risk to the proposed development when considering the stability of the adjacent slopes. Based on these observations, our comments and recommendations pertaining to the geotechnical aspects of development of the property are provided herein.

The review was conducted by examining aerial photographs of the site as well as available topographic and soil/bedrock information. Subsequent to the above review, a ground reconnaissance and excavation of test pits were undertaken on March 30, 2010. The ground reconnaissance included logging the surficial soil/bedrock conditions as well as areas exhibiting potential geotechnical hazards such as slope instability.

1.0 SITE CONDITIONS AND PROPOSED DEVELOPMENTS

The site, which is presently undeveloped, is located along the east of Okanagan Lake about 7 km north of Kelowna. It is understood that it is proposed to construct a three-storey residence. Observations and topographic information are shown in detail on Figures 1 and 2. These indicate that the property located along the west side of a local easement road rises up from Okanagan Lake to a gently sloping terrace, which is about 30 m wide from the crest of the slope along the edge of the easement road. The lakeside slopes consist of bedrock and stand at angles ranging from 27 to 45 degrees. A typical section illustrating the ground surface profile is shown on Figure 2.

Observations indicate the property supports a growth of wild grasses, underbrush and a few trees. Examination of the aerial photographs together with the results of the ground reconnaissance did not indicate any evidence of past or recent slope instability as well as groundwater seepage discharge.

2.0 SOIL/BEDROCK CONDITIONS

The results of the test pit excavations indicate that the ground surface in the area of the proposed foundations is covered by silty sand and gravel deposits varying in thickness between 1 m to 1.5 m overlying weathered bedrock. Numerous bedrock outcops were encountered in the area of the proposed residence especially in the area to the west of the proposed foundations.

3.0 DISCUSSION

3.1 General

In general, it is our opinion that the overall slopes are stable. It is recommended that all construction not be permitted within the no-disturbance zone downhill and adjacent to the crest of the slopes. Details of our recommendations and design are discussed below.

3.2 Slope Stability

It is recommended that the proposed foundations be constructed at the proposed location adjacent to the road as shown in Figures 1, 2 and 3. The area to the west towards Okanagan Lake is considered to be a no-disturbance zone. The proposed building area including the pool was established based on a line projected at a slope of 1.8 horizontal to 1 vertical drawn from the toe of the slope as shown in detail on Figure 2. The proposed accessory building area was established based on a line projected at a slope of 1.6 horizontal to 1 vertical drawn from the toe of the slope as shown in detail on Figure 3. The results of the investigation have indicated that bedrock is encountered at or near the surface along the entire slope sections. The angle of 28 degrees or 1.8 horizontal to 1 vertical is considered to be safe for

habitable structures. The angle of 32 degrees or 1.6 horizontal to 1 vertical is considered to be safe for the proposed accessory structures. The safe line or slope angle of the accessory building is steeper as the building does not include living space or bedrooms. In both cases the slopes are comprised of bedrock at or very close to the ground surface. When considering the risk of a slope failure of a development near a hazard zone, we have used the standard geotechnical guidelines which state that the level of risk is acceptable when the potential hazards are less than 10 percent chance in 50 years or a return period in the order of 1 in 475 years. It is recommended that irrigation not be allowed adjacent to the slope. Any roof and surface drainage water should be taken to the west of the proposed residence.

No terrain or drainage features were observed uphill or to either side of the property that could pose a natural hazard to the site, nor were any conditions observed on the property which could pose a natural hazard to adjacent or downslope area. No signs of any slope instability were observed on the site.

3.2 Foundations

Where structures are founded on strong intact rock, free of soil and loose rock fragments, an allowable bearing pressure of 300 KPa can be used in design. In the area of the foundations where the rock surface is sloping at more than 5 degrees, the footing should be anchored to the rock with 25 mm diameter of reinforcing steel grouted into holes in the rock with a length of 0.6 m below the base of the footings. The anchors should be installed at a distance of 6 ft

Grade fills required beneath proposed buildings should consist of 75 mm minus pit run sand and gravel. The excavation spoil material consisting of the mixed and interlayered deposits and/or blasted rock will be suitable for use as general road/parking embankment fills. Fills consisting of the rock fill material may be considered if it is well graded and selectively excavated to ensure that the largest particle size is not exceeding 300 mm. It is also preferable that this material be mixed with a soil component to minimize the presence of voids in the fill section.

It is recommended that grade supported floor slabs be founded on an under slab base course consisting of at least 100 mm of 19 mm minus crushed gravel. All fill materials used on the site should be compacted to 100 percent of Standard Proctor maximum dry density. (ASTM D698).

For design of walls that are restrained against movement, it is recommended that a coefficient of earth pressure at rest, of 0.45 be used. If the walls are permitted to tilt freely 25 mm or move in 3.0 m of wall height, a coefficient of active pressure of 0.3 may be used in design. A soil unit weight for backfill behind the walls of 2000 kg per m^3 may be used in the design calculations.

Backfill behind walls should consist of free draining pitrun sand and gravel. A positive drainage system should also be provided behind the walls to eliminate the potential buildup of hydrostatic pressures as well as to prevent water ponding at the base of the wall.

The utilities may pass through the bedrock zones. In these areas, it is recommended that an imported layer of bedding sand, a minimum of 100 mm thick, be provided over the base of the bedrock trench.

Backfill placed at the base of the trench or adjacent to the pipes where compaction can only be carried out using light weight equipment should be placed in horizontal lifts not exceeding 150 mm. Where compaction can be carried out using heavy compaction equipment, the backfill should be placed in lifts not exceeding 300 mm in horizontal thickness. Backfill in trenches should be compacted to 95 percent of Standard Proctor maximum dry density (ASTM D698).

3.3 Drainage and Erosion Control

It is recommended to construct a trench as a septic disposal trench for the disposal of the roof drainage water. The total length of trench should be 20 m or two lines of 10 m and located at a distance greater than 5 m from the house. The trench should be 0.6 m wide and 1 m deep with a 100 mm white plastic perforated pipe located 0.3 m from the bottom. The trench should be backfilled with 0.7 m of 25 mm minus drain rock and covered with tar paper or the like before placing 0.3 m of fill materials on top. The roof drain pipes may be connected to both ends of the drain trench. The water should be taken to a road catch basin prior to disposal in the trenches to ensure relatively clean water enters the trenches.

Few, if any surface drainage and erosion difficulties are anticipated. In general all the excavation material will consist of waste rock with a minor amount of silty sand and gravel. No evidence of surface water drainage channels or paths of concentrated flow leading onto or off of the property were observed at the site. No signs of significant runoff flows crossing onto or off of the property were observed. It is considered that these conditions reflect the generally shallow and dense to very dense silty sand and gravel soils at the site which overlie bedrock and thus limiting surface runoff and ground water seepage flows. It is recognized that all run-off from the adjacent road is being collected and taken to the storm sewer system. During construction it is recommended that a silt fence be installed on the downhill side of the open excavation and stockpile area. House gutter downspouts may discharge rock pits which is located a minimum of 5 m away from the house. It was recommended that site grading after completion of construction be such that surface water is not ponded on site near the house. The ground surface should be graded to produce a slope of not less than 2 percent away from the structure.

4.0 SUMMARY

Based on the results of the investigation, the land may be developed safely without influence to down slope or adjacent properties, provided that the work is undertaken in accordance with the recommendations provided. Beyond the specific recommendations provided herein, the work should adhere to the requirements of the British Columbia Building Code.

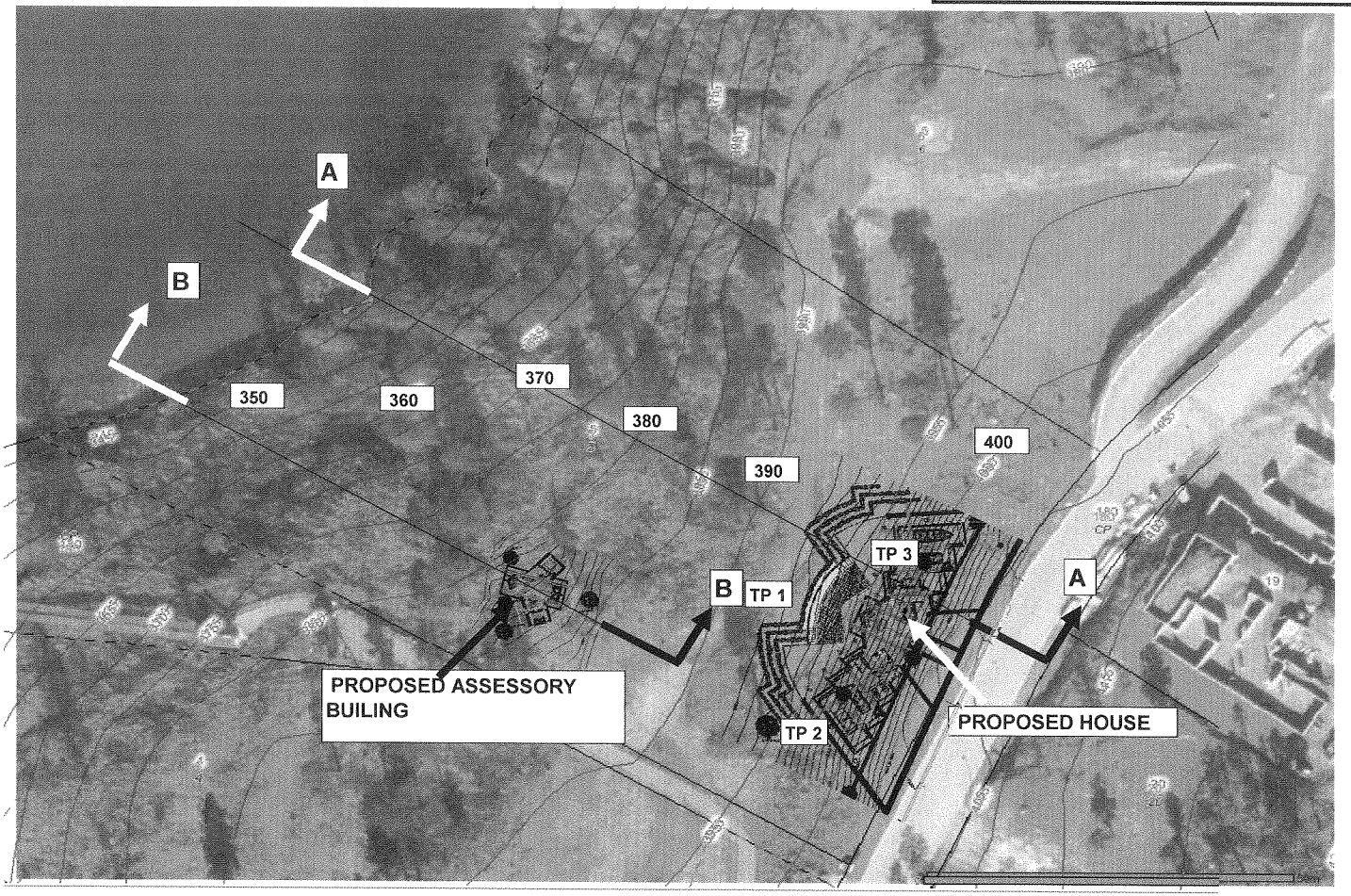
We trust that the foregoing meets with your current requirements. However, should you have any questions or require additional information please contact this office at your convenience.

Yours very truly,

GEOTEKNIK CONSULTING LTD.

B. Carlsen, M.ASc., P.Eng.

SITE PLAN	FIGURE 1



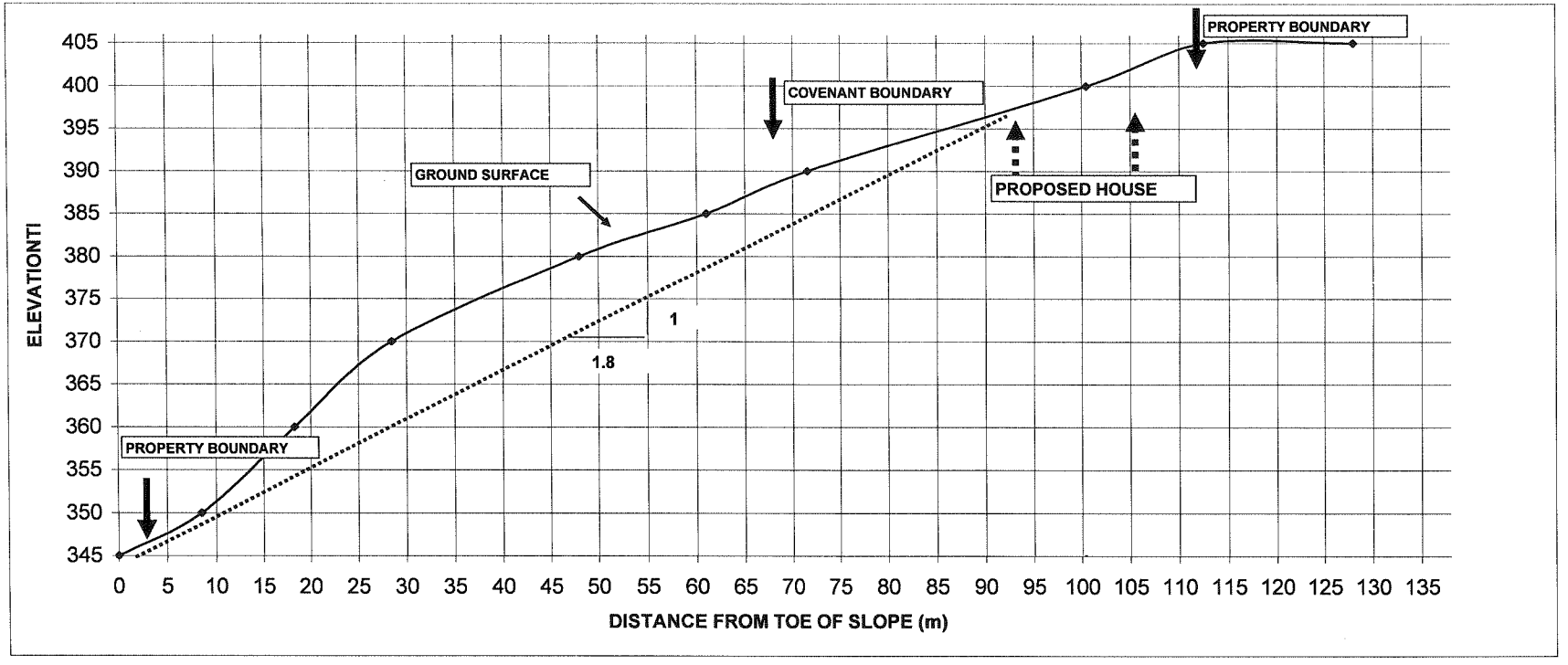
LEGEND

350	ELEVATION (m)
TP 1	TEST PIT

geoteknik

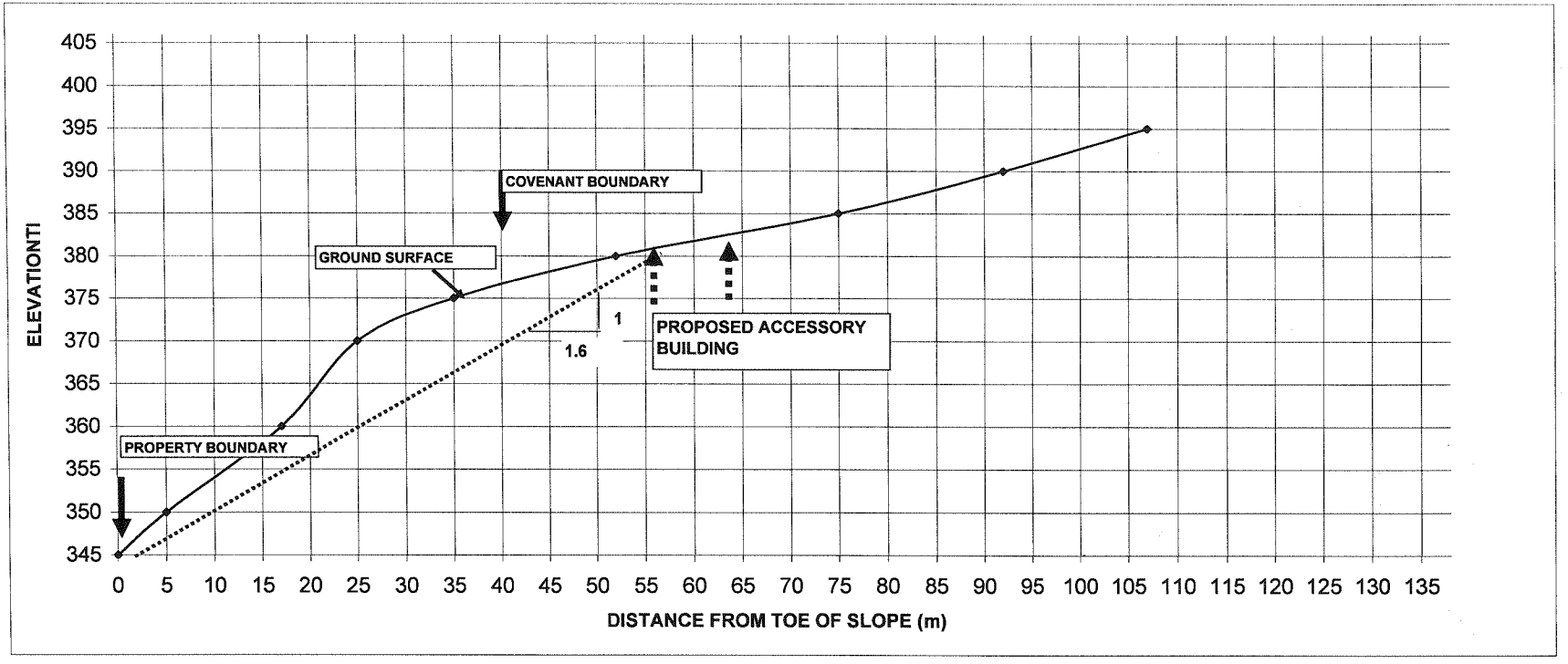
PROJECT NO 210-131 DRAWN pjc REVIEWED bc DATE March 29, 2010

SECTION A - A	FIGURE 2

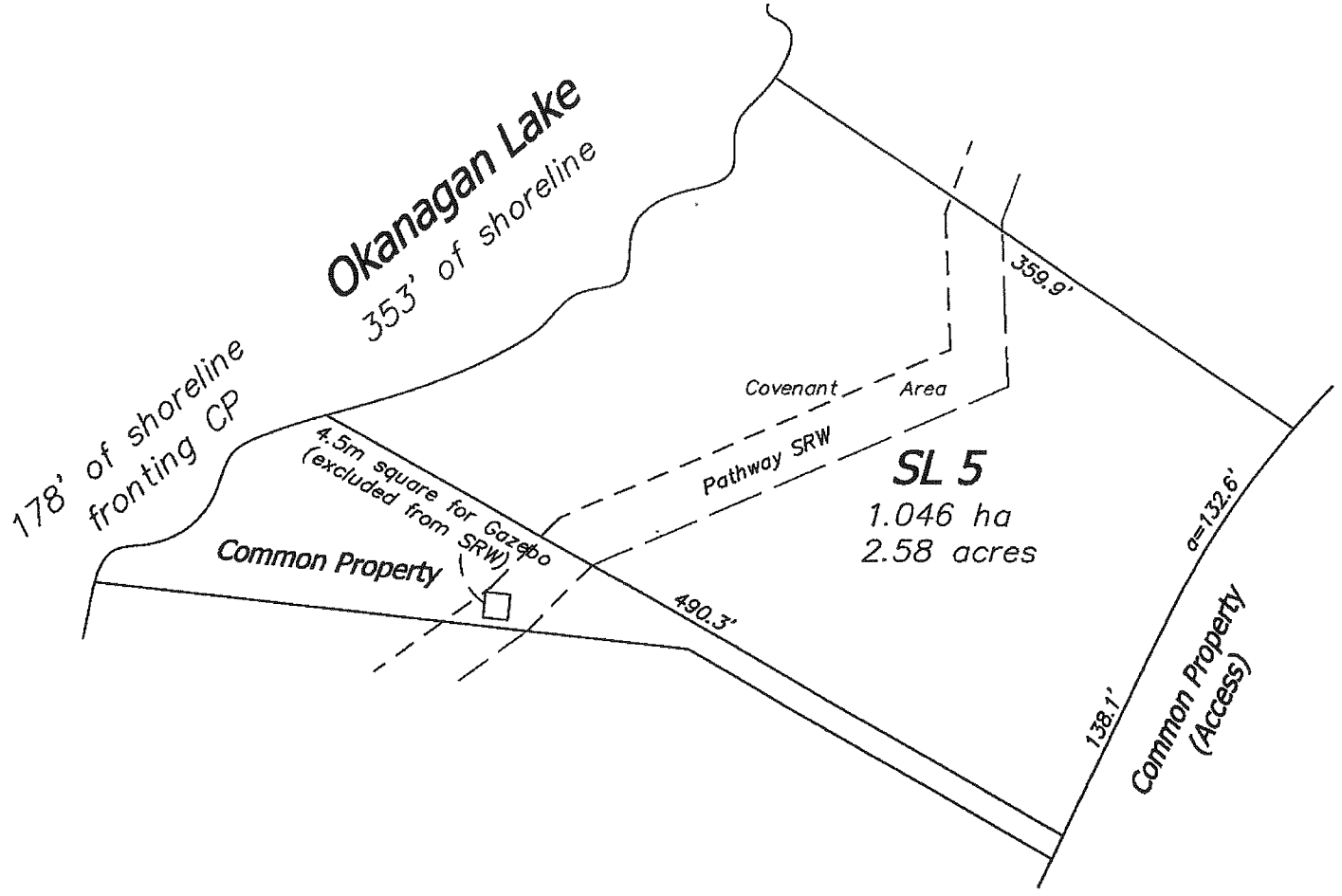


PROJECT NO 210-107 DRAWN pjc REVIEWED bc DATE March 30, 2010

SECTION B - B	FIGURE 3



PROJECT NO 210-107 DRAWN pjc REVIEWED bc DATE March 30, 2010



Scale: 1" = 100'

Fritsch Land Surveying Inc.

FILED KAKAS3129 RCVD:2006-11-27 RQST:2010-02-22-14.59.53.444

Sheet One Of One Sheet

BARELAND STRATA PLAN OF LOT 1, SECTION 6, TOWNSHIP 23, ODYD, PLAN KAP82511.

BCGS 82E.093

City of Kelowna

0 20 50 100 150m

Scale 1:1500 Metric

PLAN KAS 3129

Deposited and Registered in the Land Title Office at Kamloops, B.C. this 27 day of NOV 2006

CRAIG JOHNSTON
REGISTRAR

LA163357

LEGEND:

- ⊗ Standard Capped Post Set
- ● Standard Iron Post Found
- ○ Standard Iron Post Set
- ■ Standard Lead Plug Found

Distances shown are in metres and decimals thereof.

Integrated Survey Area No.4 – City of Kelowna. NAD83(CSRS)

Grid Bearings are derived from observations between geodetic control monuments 98H2217 & 98H2218 as shown on Plan KAP82511.

This plan shows horizontal ground-level distances except where otherwise noted. To compute grid distances, multiply ground-level distances by combined factor 0.9999144.

This Plan Lies Within the Regional District of Central Okanagan.

Ties to Present Natural Boundary

TH	to	BEARING	DISTANCE	TH	to	BEARING	DISTANCE
TH2427	1	81°38'32"	112.7	TH2426	56	46°53'17"	278.9
TH2427	2	77°25'42"	124.9	TH2426	57	47°19'53"	283.1
TH2427	3	71°32'32"	127.3	TH2426	58	47°16'39"	292.4
TH2427	4	68°44'21"	133.9	TH2426	59	46°54'49"	298.6
TH2427	5	64°43'36"	141.4	TH2426	60	46°07'32"	301.5
TH2427	6	60°19'21"	149.6	TH2426	61	45°30'07"	302.2
TH2427	7	59°04'25"	155.6	TH2426	62	44°54'16"	307.9
TH2427	8	58°47'55"	160.7	TH2426	63	44°20'26"	310.2
TH2427	9	56°08'35"	172.3	TH2426	64	43°05'06"	313.2
TH2427	10	53°58'23"	180.9	TH2426	65	41°15'20"	324.9
TH2427	11	52°45'55"	193.7	TH2426	66	40°38'58"	337.1
TH2427	12	53°41'42"	205.4	TH2426	67	40°43'03"	345.3
TH2427	13	55°30'27"	230.1	TH2426	68	40°10'40"	353.7
TH2427	14	53°07'34"	240.5	TH2426	69	39°16'02"	368.5
TH2427	15	53°02'44"	252.7	TH2426	70	36°53'40"	376.3
TH2427	16	50°33'56"	272.8	TH2426	72	38°10'58"	388.7
TH2427	17	49°46'44"	279.5	TH2426	73	37°44'53"	413.5
TH2427	18	48°50'02"	288.9	TH2426	74	37°10'59"	420.5
TH2427	19	46°33'38"	303.8	TH2426	75	37°29'09"	428.1
TH2427	20	45°53'21"	317.7	TH2426	76	36°54'41"	432.7
TH2427	21	44°14'19"	335.6	TH2513	77	219°05'57"	112.1
TH2427	22	42°05'54"	355.9	TH2513	78	218°58'16"	102.8
TH2427	23	40°39'07"	371.9	TH2513	79	215°16'48"	94.1
TH2427	24	40°12'36"	381.4	TH2513	80	216°13'27"	91.7
TH2427	25	40°45'26"	386.1	TH2513	81	214°22'44"	87.5
TH2426	26	77°48'52"	22.7	TH2513	82	209°35'59"	81.6
TH2426	27	64°37'03"	28.1	TH2513	83	203°48'50"	71.3
TH2426	28	63°46'40"	33.2	TH2513	84	197°10'25"	61.3
TH2426	29	65°03'36"	41.3	TH2513	85	199°45'09"	46.5
TH2426	30	67°55'22"	63.9	TH2513	86	195°15'36"	38.7
TH2426	31	67°57'59"	72.7	TH2513	87	190°27'29"	30.7
TH2426	32	67°23'29"	82.8	TH2513	88	191°14'51"	20.9
TH2426	33	66°50'16"	86.7	TH2513	89	209°51'02"	9.8
TH2426	34	65°04'31"	95.8	TH2513	90	242°05'11"	6.8
TH2426	35	65°38'48"	103.4	TH2513	91	323°53'17"	5.6
TH2426	36	62°07'52"	108.3	TH2513	92	12°26'55"	6.8
TH2426	37	60°58'59"	119.3	TH2513	93	49°48'14"	5.4
TH2426	38	61°22'02"	129.2	TH2513	94	54°10'57"	15.9
TH2426	39	58°51'43"	133.2	TH2513	95	52°45'23"	20.9
TH2426	40	57°19'22"	143.0	TH2513	96	41°19'32"	27.9
TH2426	41	54°22'00"	150.6	TH2513	97	40°57'50"	31.4
TH2426	42	53°20'29"	149.6	TH2513	98	40°51'41"	43.4
TH2426	43	52°01'21"	155.6	TH2513	99	38°43'34"	50.3
TH2426	44	50°14'55"	185.2	TH2537	100	238°05'41"	83.0
TH2426	45	50°17'28"	174.0	TH2537	101	238°15'45"	78.1
TH2426	46	49°10'01"	199.4	TH2537	102	236°39'36"	70.7
TH2426	47	48°40'03"	203.1	TH2537	103	236°08'24"	65.9
TH2426	48	48°11'20"	217.8	TH2537	104	234°57'27"	60.1
TH2426	49	47°25'47"	227.5	TH2537	105	235°33'02"	55.3
TH2426	50	47°18'32"	234.5	TH2537	106	236d44'24"	54.189
TH2426	51	47°10'03"	246.9	TH2537	107	235°55'46"	48.8
TH2426	52	46°50'40"	248.9	TH2537	108	230°20'30"	45.3
TH2426	53	46°47'28"	260.3	TH2537	109	229°33'07"	39.4
TH2426	54	46°57'58"	263.4	TH2537	110	221°47'24"	28.4
TH2426	55	47°00'36"	269.8	TH2537	111	211°01'53"	29.2

Civic Addess:

Owner:
Valendas Enterprises Ltd.

Authorized Signatory:

JONATHAN FRIESEN
Authorized Signatory:

Witness – Signature

Iris Work
Witness – NAME (Print)

620 - 1632 Dickson Ave
Address Kelowna BC

Executive Assistant
Occupation

Mortgage:
Canadian Western Bank

Authorized Signatory:
Pat Rennison

Authorized Signatory:
Mario Furlan

Witness – Signature

Dianne Popadivac
Witness – NAME (Print)

22nd Fl, 666 Burrard St.
Address Vancouver, BC.

Sr. Credit Officer
Occupation

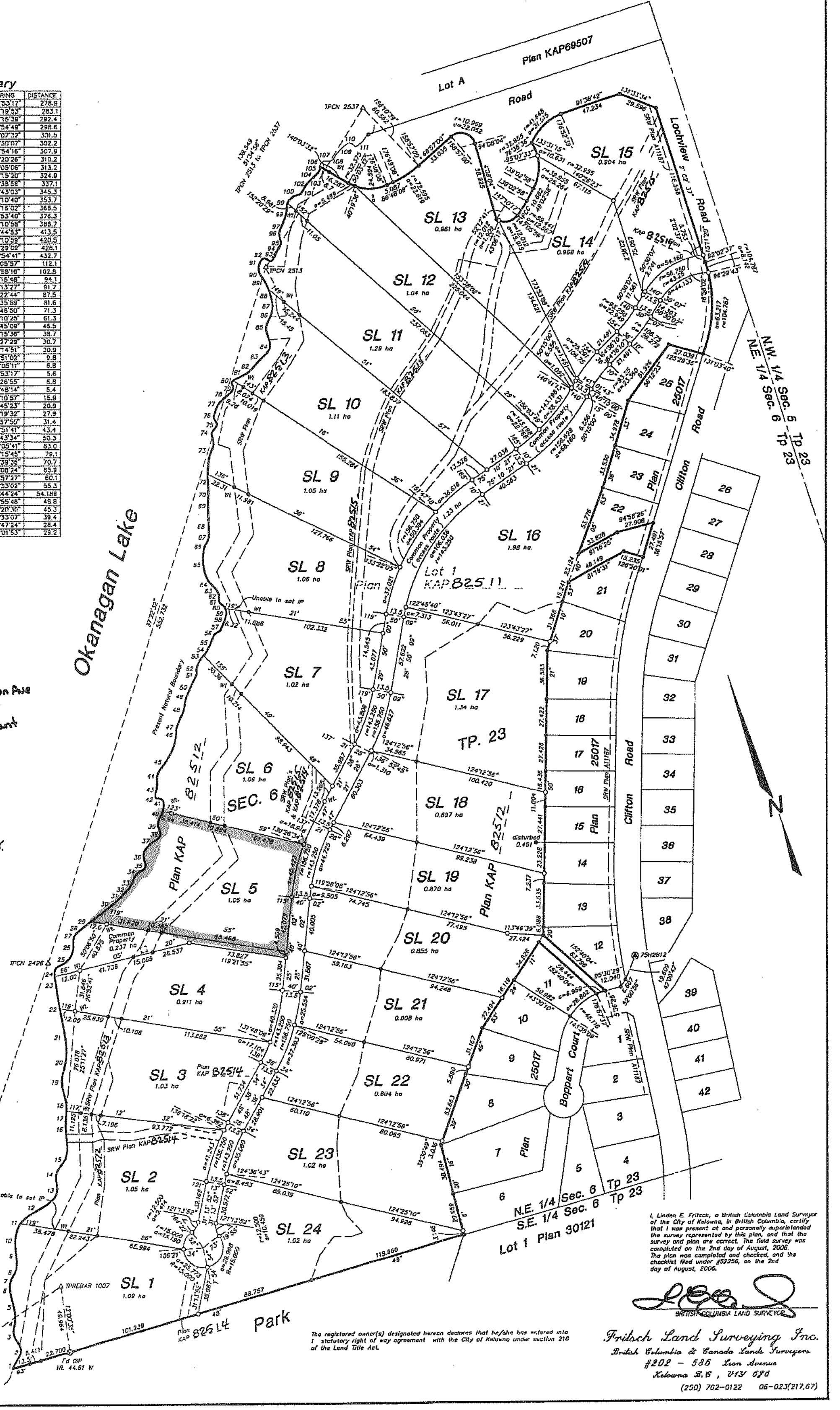
This plan need not comply with Section 8(1)(a) of the Strata Property Act, Bareland Strata Regulation."
Dated 2nd day of August 2006

for Minister of Transportation

Approved under the Land Title Act this 24TH day of OCT. 2006.

Approving Officer for The City of Kelowna

Civic Address is: 180 Shearwater Court
Kelowna, B.C.
V1V 2X1



I, Linden E. Fritsch, a British Columbia Land Surveyor of the City of Kelowna, in British Columbia, certify that I was present at and personally superintended the survey represented by this plan, and that the survey and plan are correct. The field survey was completed on the 2nd day of August, 2006. The plan was completed and checked, and the checklist filed under #52256, on the 2nd day of August, 2006.

BRITISH COLUMBIA LAND SURVEYOR

The registered owner(s) designated hereon declares that he/she has entered into a statutory right of way agreement with the City of Kelowna under section 218 of the Land Title Act.

Fritsch Land Surveying Inc.
British Columbia & Canada Lands Surveyors
#202 – 586 Leon Avenue
Kelowna B.C , V1Y 6J6
(250) 762-0122 06-023(217,67)

ORIGINAL