Associated Environmental

REPORT

Down's Enterprises Ltd.

BX Creek Watershed
Water Supply Study for Wallace Road, Vernon
PID: 013-569-368

MAY 2022

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1 INTRODUCTION

1.1 Background

Associated Environmental Consultants Inc. (Associated) was retained by Down's Enterprises Ltd. (the client) to carry out a groundwater supply study for a land parcel located on Wallace Road in the Regional District of North Okanagan (the Site, PID 013-569-368). The assessment is intended to support the rezoning application for the Site from non-urban to country residential (RDNO 2019). Figure 1-1 shows the project location. The Site currently comprises one lot of approximately 16 ha. We understand that if the rezoning application is successful, the Site will be subdivided into 7-8 lots, each greater than 2 ha.

1.2 Regulatory Consideration

In the Planning Department Information Report dated August 23, 2019 (RDNO 2019) (Appendix A), the RDNO requested a water supply study be completed "which takes into consideration the potential to service the full build-out potential of the subject property (7-8 lots) in accordance with the RDNO Subdivision Servicing Bylaw No. 2600, 2013 (RDNO 2013) and the impact the use of groundwater supplies could have on existing wells in the neighbourhood and local aquifer." RDNO will withhold the Second Reading of the rezoning application until the water study is completed.

For the purposes of this study, we used Section 406-2 of the Subdivision Servicing Bylaw No. 2600, 2013 as a benchmark to calculate groundwater availability, which requires that groundwater wells be capable of supplying 4.6 litres/minute (1.2 US gallons per minute [USgpm]) or at least 6.55 m^3/day on a year-round basis and that the use of the well will not negatively impact the use of neighbouring wells (RDNO 2013). According to Bylaw Section 407-3, subdivision parcels 2 ha or greater may be approved without the provision of a potable water supply if a written report is obtained from a Qualified Professional and a covenant registered on the proposed lots until a potable water supply is drilled.

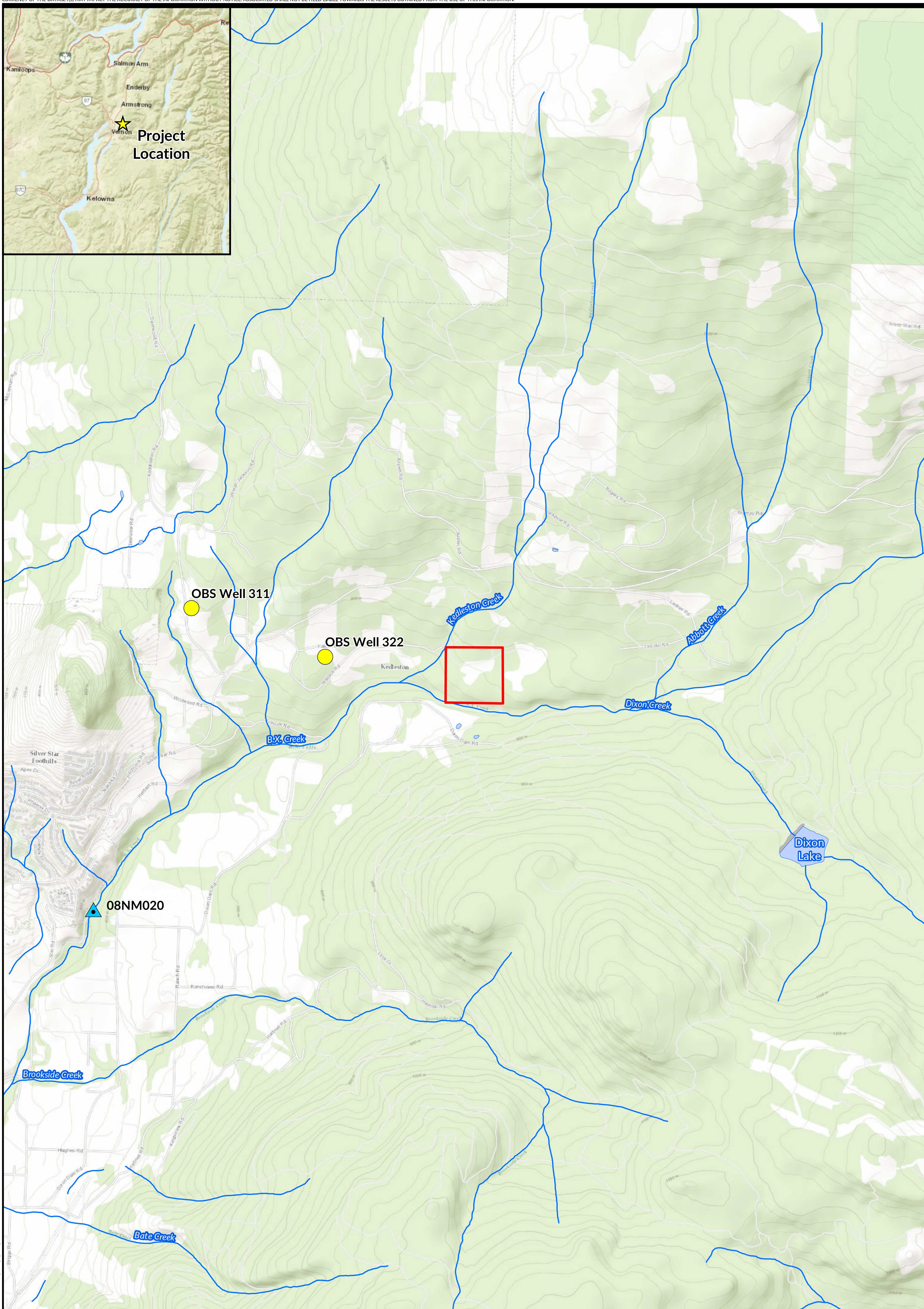
1.3 Objective and Scope of Work

The objective of this study is to satisfy the requirements of the RDNO Planning Department by providing information to support the rezoning application.

To meet these requirements, Associated carried out a desktop study to assess if there is likely sufficient groundwater supply to meet the Bylaw required quantity for each lot, considering interference effects on nearby wells and seasonal fluctuations. Based on a proposed eight lot subdivision that would require water supply sources, the expected total water supply required will be 19,126 m^3/yr (6.55 m^3/day x 8 lots x 365 days).

The desktop study involved the following scope of work:

- Review and interpretation of available climate, hydrology, geology, well, and aquifer data.
- Assessment of the availability of groundwater based on the findings of the information review.
- Analysis of well yields, and comparison of proposed well density versus existing well density to provide an indication of the potential for well interference.
- Report the findings of the study (this document). This report summarises the adequacy of the water supply for the proposed subdivision and how the use would impact existing wells in the area.



LEGEND

HYDROMETRIC STATION
OBSERVATION WELL
PROPERTY BOUNDARY

BASE DATA
WATERCOURSE
WATERBODY

0 150 300 450 600 m

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AE PROJECT NO.	2021-8860
DATE	2022-04-14
SCALE	1:25000
COORD. SYSTEM	NAD 1983 UTM ZONE 11N
REV	00
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FIGURE 1-1
SITE LOCATION

DOWN'S ENTERPRISES LTD.

BX CREEK WATERSHED STUDY

\\AE.CA\DATA\WORKING\VER\2021-8063-00\GIS\ARCMAP\AE20218063_FIG1_1_LOC_220413.MXD

2 DESKTOP REVIEW

2.1 Site Description

The Site encompasses a 15.7 ha area of sloping land within the BX Creek drainage basin (Figure 1-1). Aerial images of the area indicate that vegetation on the Site predominantly consists of trees. The Site elevation ranges from approximately 735 metres above sea level (m asl) at the southwest corner of the Site to 815 m asl along the north boundary of the Site. The Site is accessed along an unmetalled gravel road that is a continuation east of Wallace Road.

2.2 Climate

The nearest climate station with long-term climate data is the Vernon North climate station (Climate ID 1128583), located 7.6 km to the northwest at 50° 20' 39" N and -119° 16' 17" W, with an elevation of 538 m above mean sea level (m asl). Data are available for the climate normal period 1981-2010 (Government of Canada 2022a). Daily average temperatures range from −2.8°C in January to 21.0°C in July, with an average annual temperature of 8.8°C. The average annual precipitation from this station is 487 mm, with the majority occurring during winter. Based on the difference in elevation between the Site and this station, the precipitation rates at the Site are likely higher than this average. The Pacific Climate Impacts Consortium (PCIC) High-Resolution Parameter-elevation Regressions on Independent Slopes Model (PRISM) Climatology page provides access to gridded, 30 arc-second (roughly 800 metre grids) precipitation climatology for the 1981–2010 climate normal periods for land-surface areas of British Columbia (PCIC 2022). This model indicates that precipitation at the Site is more likely in the range of 600–700 mm/year (PCIC 2022). In the higher reaches (i.e., at Silver Star Mountain) of the watershed in which the Site is located, precipitation is estimated to be 1,100 mm/yr, with much of this occurring as snow during winter.

2.3 Hydrology and Surface Water Licences

A search of iMapBC (Government of BC 2022a) indicates that two mapped creeks border the Site: BX Creek to the south and Kedleston Creek to the north and west (Figure 1-1):

- **BX Creek** is the larger of the two creeks and acts as surficial drainage originating in the highlands of Silver Star Mountain. The BX Creek watershed is approximately 70.5 km^2 and extends from east to west (Government of BC 2022a). The headwaters of BX Creek are sourced from the surrounding hillside predominantly from the north toward Silver Star Mountain. BX Creek is predominantly to the south of the Site and flows from east to west. A Water Survey Canada Hydrometric station (08NM020) is located on BX Creek approximately 2.8 km downstream of the Site. Streamflow data are available between 1921 and 1999. Reported Mean Annual Discharge (MAD) for BX Creek at this location is 0.298 m^3/sec, ranging from 0.108 to 0.544 m^3/sec (Government of Canada 2022b), which amounts to an average runoff of 0.169 m/year for the 55.7 km^2 watershed captured by this hydrometric station.
- **Kedleston Creek** is a small creek, which acts as surficial drainage for the valley side to the north. Kedleston Creek flows in a southwest direction crossing the very northwest corner of the Site before its confluence with BX Creek approximately 500 m to the southwest of the northeast corner of the Site. There are no available streamflow data for this creek.

The iMapBC web mapping application shows no surface or groundwater licences within the Site boundary (Government of BC 2022a). The closest surface water licence (Licence No. C038201) is for a surface water source known as Harold Spring, located on the adjacent lot, 80 m west of the Site. The licence permits a diversion of 4.55 m^3/d for domestic use. Two other licences are located within 500 m of the Site boundary, which are both associated

with Kirby Spring, located 430 m west of the Site. Licence No. F039837 permits a diversion of 2.27 m^3/d for domestic use, and Licence No. F040393 permits a diversion of 4.55 m^3/d for domestic use.

2.4 Geology

2.4.1 Bedrock Geology

Bedrock geology underlying the Site is shown on the MapPlace2 web application (Government of BC 2022b) and consists of the Shuswap group on the north flank of the BX Creek valley bottom and the Nicola group on the south side of the valley. The boundary between the two groups has been mapped approximately following the line of BX Creek. To the northeast of the Site, this boundary is shown as a faulted boundary, but near the Site, no fault has been mapped.

The Shuswap group comprises metamorphic rocks consisting of quartzfeldspathic gneiss, biotite-quartz schist (commonly with sillimanite, kyanite, garnet or staurolite), amphibolite, quartzite, marble, calc-silicate rock and skarn; abundant and locally dominant pegmatite, muscovite granite (Government of BC 2022a).

The Nicola group mainly consists of mudstone, siltstone and fine clastic sedimentary rock consisting of sedimentary facies: shale, argillite, siltstone, sandstone, phyllite, tuff; local polymict conglomerate, limestone, greenstone and chloritic phyllite (Nasmith 1962).

Bedrock mapping shows the Site predominantly overlying bedrock of the Nicola Group (Government of BC 2022b); however, a review of the drillers' logs for wells drilled in the area suggests that the Site actually overlies metamorphic rocks of the Shuswap group, and the boundary between the Shuswap group and the Nicola group should actually be further southeast. Further details on nearby wells and the lithology they are drilled through are provided in Section 2.5.2.

2.4.2 Surficial Geology

The surficial deposits that overly the bedrock in the BX Creek valley floor and on the valley sides consist of glacial morainal deposits (clay and till) underlain by sand and gravel deposits and silty sand, interpreted to be pre- to early glacial alluvium and colluvium derived from a limited upslope catchment (Stewart and Allard 2017). More recent fluvial deposits related to BX Creek are found in the valley bottom.

2.5 Hydrogeology and Groundwater Wells

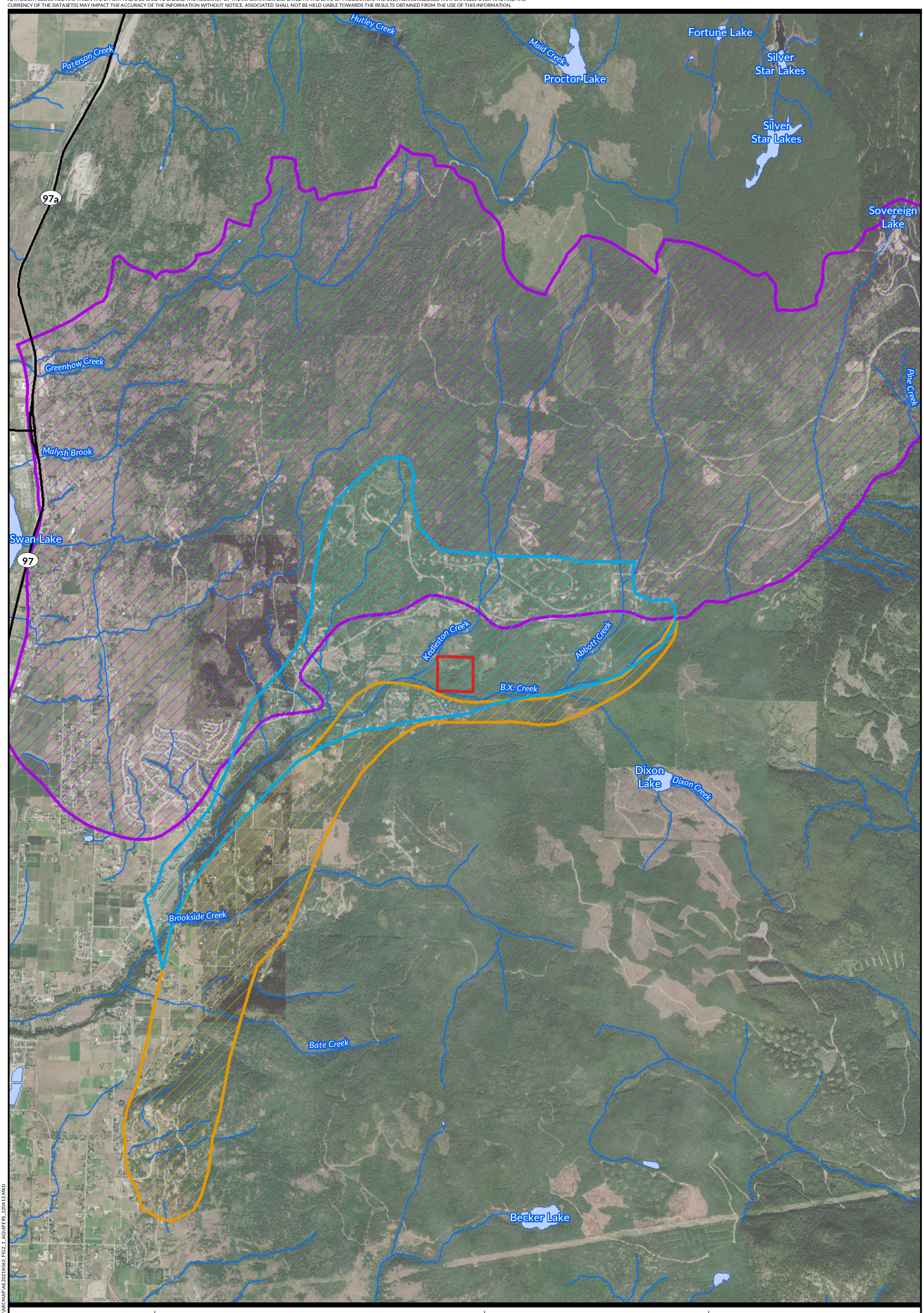
2.5.1 Aquifers

The Ministry of Environment and Climate Change Strategy (the Ministry) aquifer classification system supports groundwater management in BC. Aquifer mapping for the subject area indicates that there is one mapped aquifer underlying the boundary of the Site, one mapped aquifer to the south, and one mapped aquifer to the north. The mapped aquifer underlying the Site is surficial Aquifer 349, and the two mapped aquifers to the south and north of the Site are bedrock Aquifer 350 and bedrock Aquifer 351, respectively (Figure 2-1).

Groundwater Objectives 2 and 3 Basin Study of the Phase 2 Okanagan Water Supply and Demand Project (Golder and Summit 2009) identifies three aquifers underlying the Site, referred to as Aquifers OBWB-270, OBWB-270C and

OBWB-270F[1]. In this report, OBWB-270 is described as an unconsolidated aquifer that sits in the valley bottom and is fed in part by bedrock Aquifers OBWB-270C and OBWB-270F (Golder and Summit 2009)

[1] The Okanagan Basin Water Board (OBWB) has developed an Okanagan watershed-specific aquifer numbering convention. The difference between the two aquifer mapping conventions is that the OBWB has assigned the entire watershed to an aquifer, and aquifers are not just limited to areas where well logs are available as is the case with the provincial aquifer mapping system.



LEGEND

- AQUIFER 349
- AQUIFER 350
- AQUIFER 351
- PROPERTY BOUNDARY

BASE DATA

- HIGHWAY
- WATERCOURSE
- WATERBODY

0 250 500 750 1,000 m

IMAGERY: ESRI, DIGITALGLOBE, GEOEYE, I-CUBED, USDA FSA, USGS, AEX, GETMAPPING, ROAD: STATISTICS CANADA, 2019; HYDROGRAPHY: NATURAL RESOURCES CANADA, 2017; AQUIFER: GEOBC 2020.

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FIGURE 2-1
AQUIFER MAP

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BX CREEK WATERSHED STUDY

\\AE.CA\DATA\WORKING\VER\2021-8063-00\GIS\ARCMAP\AE20218063_FIG2_1_AQUIFERS_220413.MXD

There are many registered wells within the vicinity of the Site providing water predominantly for domestic use. These wells are constructed in both the surficial deposits and in bedrock. The location and well tag number[2] (WTN) for each well are shown on Figure 2-2. There are likely additional domestic wells in the area that have not been registered, as registration was voluntary until February 29, 2016; after which, it became mandatory for drillers to register water supply wells under the provincial *Water Sustainability Act* (SBC 2014, c. 15).

2.5.2 Surficial Aquifer 349 / OBWB-270

Aquifer 349 is a 26 km^2 confined sand and gravel aquifer that is oriented along the valley bottom. It is classified in GWELLS[3] (Government of BC 2022c) as having moderate demand, moderate productivity, and low vulnerability to contamination. Aquifer recharge is predominately through infiltration of precipitation on the valley sides, groundwater-surface water interaction with BX Creek, and contributions from mapped adjacent bedrock aquifers surrounding it. Ministry records indicate there are 257 wells correlated to this aquifer, 9 of which are within 500 m of the Site (Table 2-1). Based on the well logs, the water-bearing deposits are generally described as sand and gravel seams deposited within poorly sorted glacial till deposits. Average reported yield for the wells within 500 m of the Site boundary is 99.7 m^3/day (18.3 USgpm) with a range of 2.7-327 m^3/d (0.5-60 USgpm). The geometric mean yield is 55.6 m^3/d (10.2 USgpm). The average yield is more than 15 times what each proposed lot requires, and the geometric mean is more than 8 times what each proposed lot requires (6.55 m^3/d as per the Bylaw) (Table 2-2).

Table 2-1
Well Details for Wells Constructed in Aquifer 349 within 500 m of the Site Boundary (details from GWELLS)

Well Tag No.	Distance from Site (m)	Well Depth (m)	Well Yield [(1)] (USgpm)	Well Yield (m^3/d)	Well Class and Use
25655 [(2)]	210	61.9	0.5	2.7	Unknown
34391	415	22.9	25	136.3	Water supply – unknown
34392	415	25.3	18	98.1	Monitoring – n/a
59586	470	67.1	60	327.0	Water supply – commercial
82371	225	85.3	2	10.9	Water supply -unknown
82465	255	33.5	15	81.8	Water supply – domestic
90094	210	47.9	25	136.3	Water supply – domestic
90110	250	18.3	12	65.4	Water supply – domestic
90112	340	28.7	5	27.3	Water supply – domestic
120298 [(3)]	440	36.6	20	109.0	Water supply – domestic

Notes:
(1) Well yield information is taken from drillers' well logs.
(2) The well log for WTN 25655 indicates it is screened in both surficial deposits and the underlying bedrock.
(3) Well WTN 120298 is uncorrelated to any aquifer on GWELLS, but a review of the lithology suggests it is screened in Aquifer 349 so has been included here.

[2] The WTN is the file number assigned in the government's records to the records in relation to a particular well.
[3] The Groundwater Wells and Aquifers (GWELLS) database can be accessed at: https://apps.nrs.gov.bc.ca/gwells/

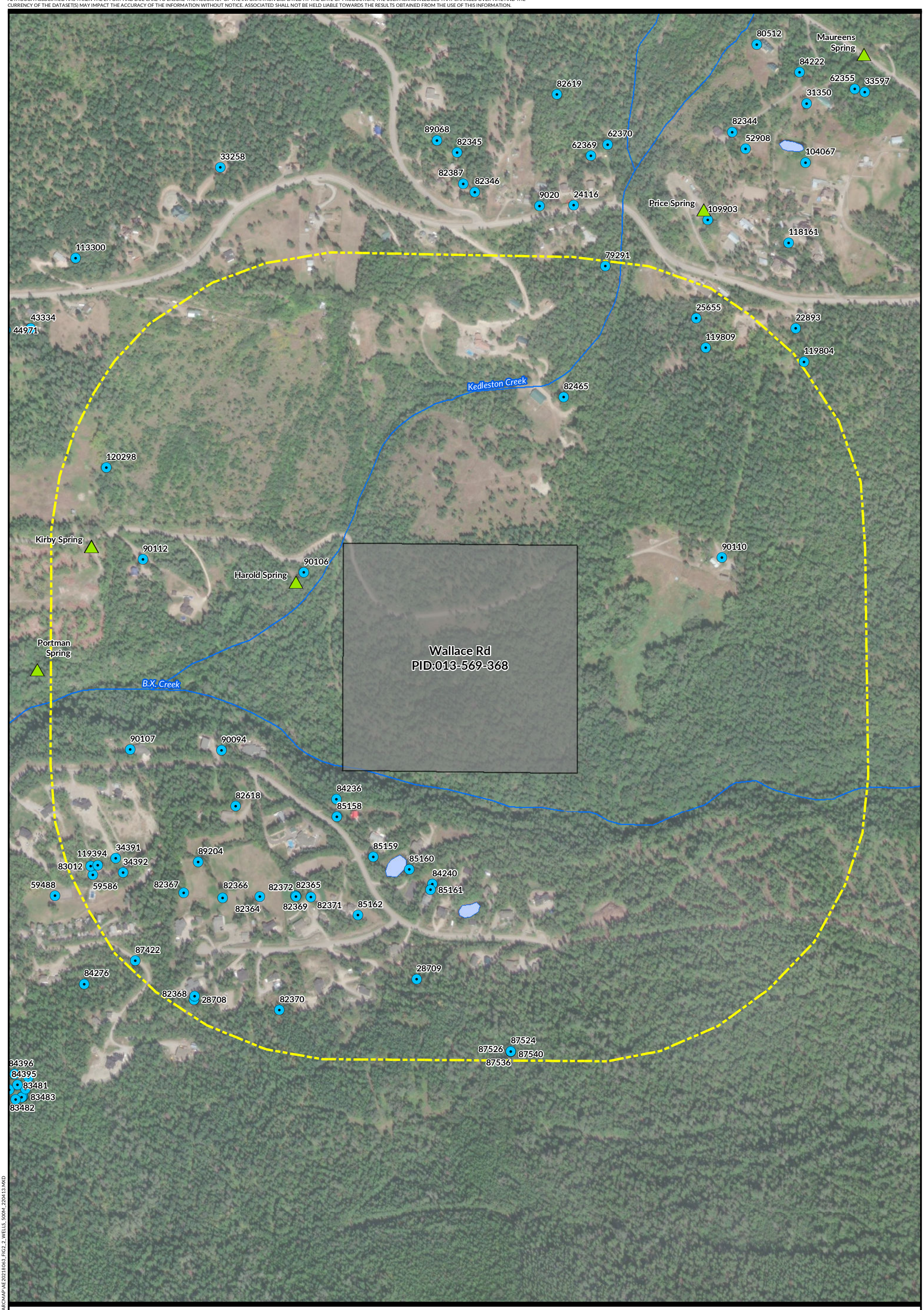
Table 2-2
Well Characteristics in Aquifer 349 within 500 m of the Site Boundary, Compared to the Water Demand of the Potential Development

Average Well Characteristic	Wells Within Aquifer 349 (N = 10)	Proposed Development Area
Average well depth (m)	42.7	No Wells
Average well yield (m^3/day)	99.7	
Geometric mean well yield (m^3/day)	55.6	
Water demand of proposed development (m^3/day), assuming 8 Lots		52.4
Water demand per proposed Lot as per RDNO Bylaw 406 (m^3/day)		6.55
Average well yield in percent of water demand per proposed Lot (Equal to 6.55 m^3/day per Lot, as per Bylaw)	1,522%	
Geometric mean well yield in percent of water demand per proposed Lot (Equal to 6.55 m^3/day per Lot, as per Bylaw)	849%	

Aquifer OBWB-270 is 11.91 km^2 and 2,912 m wide, with an average thickness of 4 m giving it a cross sectional area of 11,648 m^2. Using this information together with the estimated hydraulic conductivity of 1 x 10^{-4} m/s and a hydraulic gradient of 0.03, the calculated Darcy's Flux[4] is 1.16 x 10^6 m^3/yr (Golder and Summit 2009). The annual usage of the proposed development (19,126 m^3/yr) would account for approximately 1.6% of the total annual discharge of Aquifer OBWB-270.

There are no documented water quality concerns for Aquifer 349 (Government of BC 2022c).

[4] Darcy's Flux is a measure of groundwater flow through a cross-sectional area of an aquifer. It is calculated using the following equation Q = KiA, where Q is groundwater flow, K is the hydraulic conductivity, i is the hydraulic gradient, and A is the cross-sectional area through which flow occurs.



LEGEND

- NATURAL SPRING
- REGISTERED WELL
- PROPERTY BOUNDARY
- 500M RADIUS FROM PROPERTY BOUNDARY

BASE DATA

- WATERCOURSE
- WATERBODY

0 50 100 150 200 m

IMAGERY: ESRI, DIGITALGLOBE, GEOEYE, I-CUBED, USDA FSA, USGS, AEX, GETMAPPING, ROAD: STATISTICS CANADA, 2019; HYDROGRAPHY: NATURAL RESOURCES CANADA, 2017; AQUIFER: GEOBC 2020, REGISTERED WELLS: GEOBC 2022.

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COORD. SYSTEM	NAD 1983 UTM ZONE 11N
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DRAWN BY	KP
CHECKED BY	SC

FIGURE 2-2
REGISTERED WELLS PLAN

DOWN'S ENTERPRISES LTD.

BX CREEK WATERSHED STUDY

\\AE.CA\DATA\WORKING\VER\2021-8063-00\GIS\ARCMAP\AE20218063_FIG2_2_WELLS_500M_220413.MXD

2.5.3 Bedrock Aquifers 350 and 351 / OBWB-270C and OBWB-270F

In addition to the surficial aquifer, bedrock aquifers near the Site provide many properties with their domestic water supply. These aquifers may provide some recharge (known as mountain block recharge) to adjacent surficial aquifers.

2.5.3.1 Aquifer 350 / OBWB-270C

Aquifer 350 is a 7 km^2 fractured sedimentary bedrock aquifer mapped on the south side of the BX Creek watershed with portions of it underlying surficial Aquifer 349. The Ministry classifies this aquifer as having low demand, low productivity, and low vulnerability (Government of BC 2022c). Recharge to this bedrock aquifer is likely a result of infiltration of precipitation in the spring and fall, as well as snowmelt during freshet. Further recharge may be from streamflow losses (leakage) from BX Creek and smaller tributaries. Ministry well records indicate that there are 19 wells correlated to this aquifer, with 2 drilled within 500 m of the Site (WTN 82618 located 195 m southwest of the Site boundary, and WTN 83012 located 465 m southwest of the Site boundary). These two bedrock wells have reported yields of 82 m^3/d (15 USgpm) and 13.1 m^3/d (2.4 USgpm), both above the required 6.55 m^3/d (1.2 USgpm). Well WTN 82618 is licensed (Licence No. 501184) and permitted to extract 5 m^3/d for use on a camp site.

The mean annual discharge of aquifer OBWB-270C delineated by Golder and Summit (2009) is estimated to be 1.041 x 10^6 m^3/yr. The annual usage of the proposed development (19,126 m^3/yr) accounts for approximately 1.8% of the total annual discharge of OBWB Aquifer 270-C.

There are no documented water quality concerns for Aquifer 350 (Government of BC 2022c).

2.5.3.2 Aquifer 351 / OBWB-270F

Aquifer 351 is a 54 km^2 fractured crystalline bedrock aquifer mapped on the north side of the BX Creek watershed with portions of it underlying Aquifer 349. It is mapped outside of the Site boundary; the closest part being 440 m northeast. The Ministry classifies this aquifer as having low demand, low productivity, and low vulnerability (Government of BC 2022c). Recharge to this bedrock aquifer is likely a result of infiltration of precipitation in the spring and fall, as well as snowmelt during freshet. Ministry well records indicate that there are 148 wells correlated to this aquifer, although none of these are located within 500 m of the Site boundary. However, while this aquifer is not mapped below the Site boundary and no wells within 500 m have been correlated with this aquifer, a review of the well log for the majority of wells drilled into bedrock within 500 m of the Site boundary suggests that they are drilled into crystalline bedrock with lithology descriptions including gneiss, schist, quartzite and granite. These descriptions suggest that the wells are drilled into the same rock formation as Aquifer 351, and the mapped boundary of this aquifer (and Aquifer 350) is incorrect. The boundary for Aquifer 351 should likely extend further south beyond BX Creek to the south of the Site. It is also probable that the two bedrock wells in the area that are correlated to Aquifer 350 (Section 2.5.3.1) should be correlated to Aquifer 351 (the well log descriptions for these two aquifers only describe “bedrock” with no additional detail on lithology provided).

The mean annual discharge of aquifer OBWB-270F delineated by Golder and Summit (2009) is estimated to be 1.615 x 10^6 m^3/yr. The annual usage of the proposed development (19,126 m^3/yr) accounts for approximately 1.2% of the total annual discharge of OBWB-270F.

There are no documented water quality concerns for Aquifer 351 (Government of BC 2022c).

As many of the registered bedrock wells located within the area are not correlated to Aquifers 350 or 351, Table 2-3 provides details of all the bedrock wells registered in GWELLS that are located within 500 m of the Site boundary (30 wells in total). Table 2-4summarises the average well characteristics. Based on these data, a typical bedrock well drilled within 500 m of the Site boundary yields more than the quantity of water required by the Bylaw. Based on the available well logs, only one well was dry and that well did not extend very far into the bedrock (only 7 m). All other wells had estimated or tested yields of 10.9 to 327 m^3/d (2 to 60 USgpm). The average yield of 116.3 m^3/d (21.3 USgpm) is nearly 18 times what each proposed lot requires, and the geometric mean yield of 80.2 m^3/d (14.7 USgpm) is more than 12 times what each lot requires (6.55 m^3/day as per the Bylaw). This provides confidence that wells drilled into bedrock beneath the Site have a high likelihood of being able to supply the required quantity of water for domestic purpose, provided water-bearing fractures are encountered.

Based on the presence of significantly more bedrock wells than surficial wells in proximity to the Site, the majority of the wells that will be drilled on the Site will likely be drilled into bedrock.

Table 2-3
Well Details for Wells Constructed in Bedrock within 500 m of the Site Boundary (details from GWELLS)

Well Tag No.	Distance from Site (m)	Well Depth (m)	Well Yield [1] (USgpm)	Well Yield (m^3/d)	Well Class and Use
28709	365	42.7	0	0.0	No water encountered
79291 [2]	485	74.7	5.8	31.6	Unknown
82364	260	73.2	15	81.8	Water supply – domestic
82365	225	67.1	60	327.0	Water supply – domestic
82366	300	86	30	163.5	Water supply – domestic
82367	345	92	10	54.5	Water supply – domestic
82368	465	49.4	30	163.5	Water supply – domestic
82369	225	97.5	2	10.9	Water supply – domestic
82370	425	85.6	4	21.8	Water supply – domestic
82371	225	85.3	2	10.9	Water supply – domestic
82372	225	76.2	60	327.0	Water supply – domestic
82618	195	73.2	15	81.8	Water supply – camp facilities
83012	465	33.5	2.4 [3]	13.1	Water supply – domestic
84236	50	85.3	15	81.8	Water supply – domestic
84240	190	79.2	50	272.5	Water supply – domestic
85158	80	85	12	65.4	Water supply – domestic
85159	145	79.2	7	38.2	Water supply – domestic
85160	170	79.2	4	21.8	Water supply – domestic
85161	200	85.3	10	54.5	Water supply -unknown
85162	250	54.9	10	54.5	Water supply – domestic

Well Tag No.	Distance from Site (m)	Well Depth (m)	Well Yield [1] (USgpm)	Well Yield (m^3/d)	Well Class and Use
87422	485	49.4	30	163.5	Water supply – domestic
87524	480	67.4	40	218.0	Water supply – domestic
87526	480	79.9	40	218.0	Water supply – domestic
87536	480	67.1	18	98.1	Water supply – domestic
87540	480	92	12	65.4	Water supply – domestic
89204	295	79.9	12	65.4	Water supply – domestic
90106	70	75.1	30	163.5	Water supply – domestic
90107	360	68.3	50	272.5	Water supply – domestic
119394	450	50.6	24	130.8	Water supply – domestic
119809	400	133.2	40	218.0	Water supply – domestic

Notes:
[1] Well yield information from drillers' well logs.
[2] Lithology unknown, assume bedrock based on well depth at this location.
[3] Artesian flow.

Table 2-4
Bedrock Well Characteristics for Wells within 500 m of the Site Boundary, Compared to the Water Demand of the Proposed Development

Average Well Characteristic	Wells Within Bedrock (N = 30)	Proposed Development Area
Average well depth (m)	75.0	No Wells
Average well yield (m^3/day)	116.3	
Geometric mean well yield (m^3/day)	80.2	
Water demand of proposed development (m^3/day), assuming 8 Lots		52.4
Water demand per proposed Lot as per RDNO Bylaw 406 (m^3/Day)		6.55
Average well yield in percent of water demand per proposed Lot (Equal to 6.55 m^3/day per Lot, as per Bylaw)	1,776%	
Geometric mean well yield in percent of water demand per proposed Lot (Equal to 6.55 m^3/day per Lot, as per Bylaw)	1,224%	

2.5.4 Groundwater Level Variations Over Time

Two provincial groundwater observation wells (Observation Well 322 [OBS Well 322] and Observation Well 311 [OBS Well 311]) are located relatively close to the Site (Government of BC 2022d) and provide time-series datasets of

aquifer water levels. Review of observation well groundwater levels can provide information on seasonal variations and long-term trends related to the sustainable use of groundwater resources.

OBS Well 322 is an inactive monitoring well located 850 m west of the Site on Falcon Road (Figure 1-1). The well is 45 m deep and completed in surficial Aquifer 349, which underlies the Site. There are no current groundwater level data available from this well; however, data are available from 1993 to 2003, which provide some information for estimating seasonal fluctuations in groundwater levels and, to a lesser degree, the potential long-term trend. Figure 2-3 shows that between 1993 and 2003, groundwater levels increased approximately 2 m, with seasonal fluctuations ranging from 0.5 to 1.0 m (Government of BC 2022d). It is not known why aquifer water levels increased during these years. The period between 1993 and 2003 indicates a rise in groundwater level, the groundwater level eventually being above ground level from the year 2000 (indicated by the water level below ground becoming negative). The 'flat' high water levels observed in the summers of 2001-2003 may coincide with the top of the well casing and well cap above ground level. This is presumably the reason why monitoring at this well ceased in 2003.

The most recent mapping report for Aquifer 349 dated May 2017 suggests that this aquifer is overused. However, an assessment of the hydrostratigraphy of the northern Okanagan Basin completed in July 2017 (Stewart and Allard 2017), which includes the BX Creek watershed, noted that average yields in Aquifer 349 are 'low' at approximately 100 m^3/d (18 USgpm) and the density of wells is very high. However, it was also noted that while reliance on the aquifer appears to be high, the majority of groundwater use is for domestic purpose, and therefore the water demand from each well is likely to be low[5].

OBS Well 311 is an active observation well located approximately 1.8 km northwest of the Site. OBS Well 311 is 100 m deep and completed in bedrock Aquifer 351. Figure 2-4 shows that groundwater levels in OBS Well 311 increased from 1992 to 1998 followed by a decline in water levels in 2011 before increasing again in 2014 where it stabilized. Since 2020, the water level has increased sharply by approximately 1 m. The range of water level change during this entire period of monitoring is less than 2.5 m. The reason for the variation in water levels is not known. Seasonal fluctuations are typically in the order of 0.3 to 0.5 m from winter to early summer (Government of BC 2022d). Currently, water levels are at historic high levels for this well, indicating no concerns related to over-use of this aquifer.

[5] For example, 2 hectares irrigated with sprinklers for forage for a property in Vernon used 13,380 m^3/year (CAP 2022), compared to one residential lot with the RDNO Bylaw requirement of 6,550 L/day, which is equivalent to 2,428 m^3/year. The Okanagan average is 675 L/person (OBWB 2015). For a family of four, this equates to 986 m^3/year.

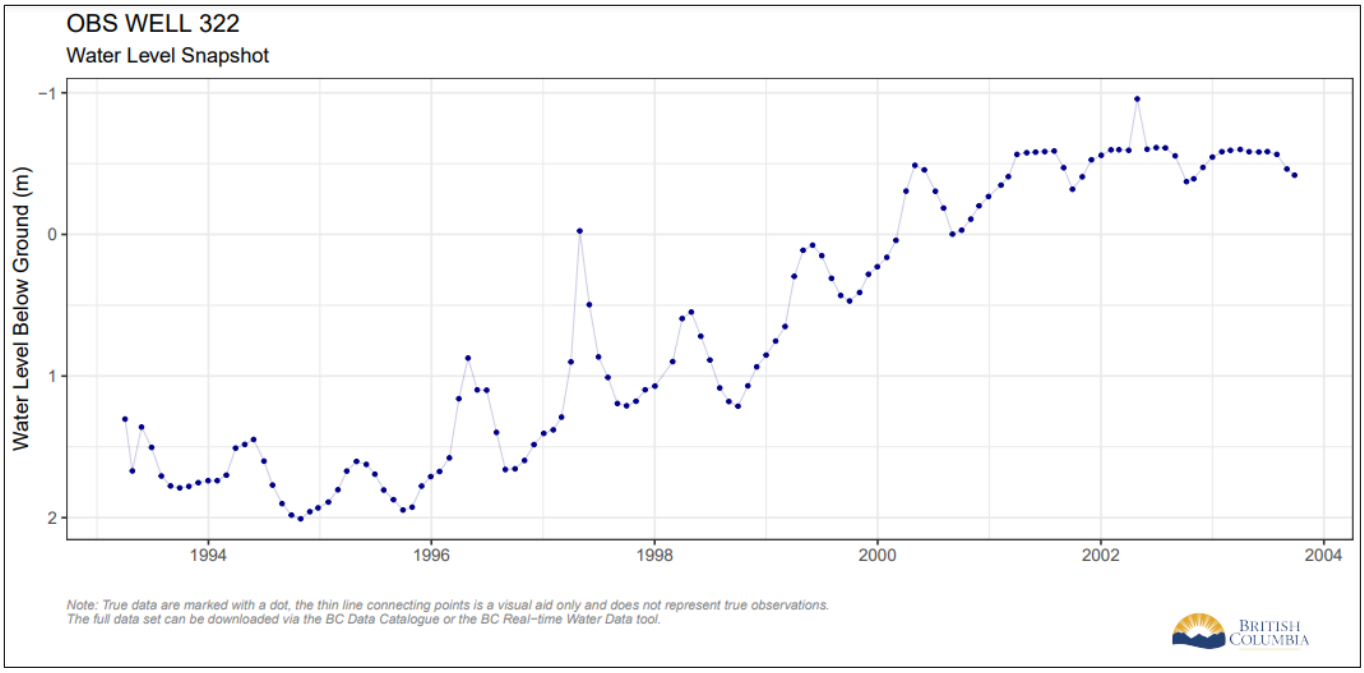

Figure 2-3
Groundwater Levels in OBS Well 322 [6]

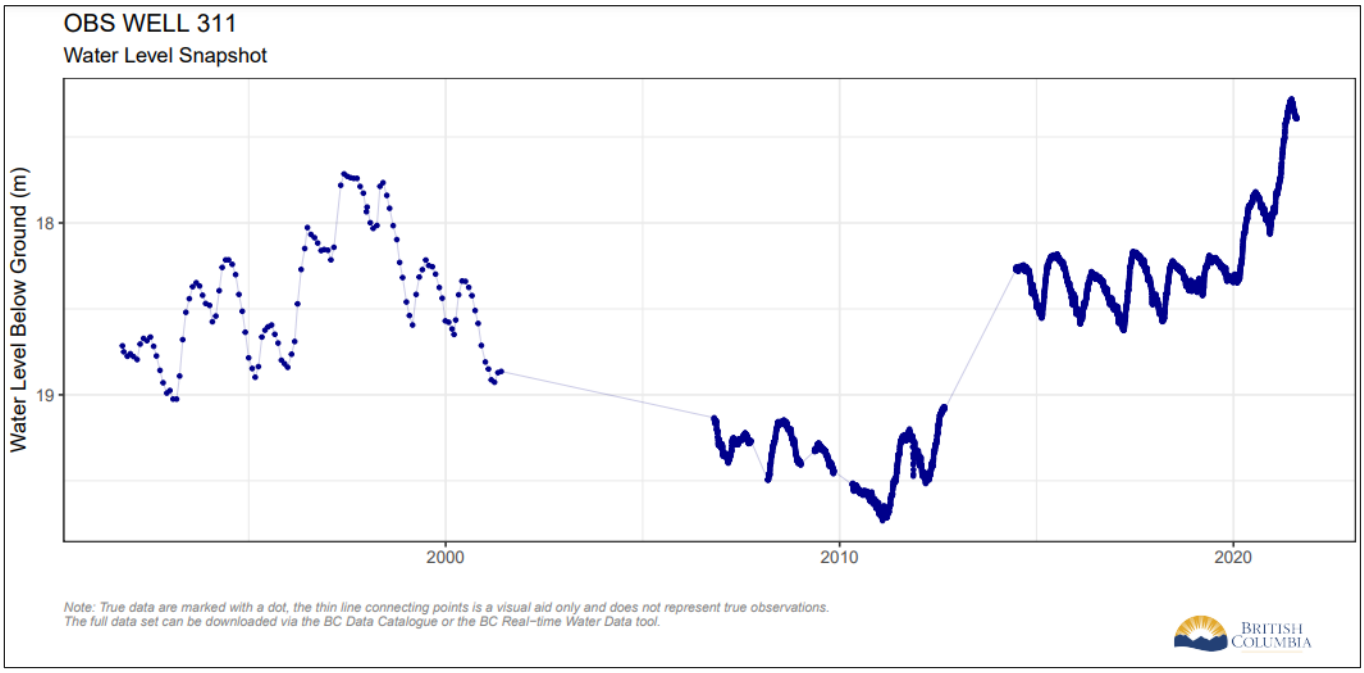

Figure 2-4
Groundwater Levels in OBS Well 311 [7]

[6] Water level chart obtained from: https://aqrt.nrs.gov.bc.ca/Report/Show/Groundwater.OW322.GWGraphAllData/
[7] Water level chart obtained from: https://aqrt.nrs.gov.bc.ca/Report/Show/Groundwater.OW311.GWGraphAllData/

2.5.5 Well Interference

In some cases when wells are drilled close together and within the same or a hydraulically connected aquifer, pumping in one well can lower the static water levels in other nearby wells, resulting in well interference. When well interference becomes great enough, it has the potential to decrease the overall yield of the effected wells (Driscoll 1987).

No pumping test or well interference data are available to assess the likelihood of well interference. Consequently a qualitative assessment has been made. The proposed development will have up to 8 wells over an area of approximately 16 ha (160,000 m^2). This equates to an average of one well for every 20,000 m^2. A review of the density of wells in other parts of the aquifers, such as those wells serving the properties along Dixon Dam Road and Deer Park Drive immediately to the south/southwest of the Site. Figure 2-5 shows there are 14 bedrock wells located in a similar sized area as the Site (i.e., one well for every 11,430 m^2). This indicates that the potential density of wells on the Site is not unusual for the area and from the underlying aquifers. To our knowledge, there have not been widespread complaints of well interference in the area, therefore it is reasonable to conclude that well interference will likely be minimal. In addition, based on the observation wells' data, in particular for the bedrock aquifer, water levels within the underlying aquifers, have increased over the period of record. This indicates that regional groundwater levels are not controlled by pumping but rather seasonal variations in recharge. Furthermore, it is possible that some of the potential future wells on Site could be constructed within the surficial aquifer while others could be constructed within the bedrock aquifer.

Associated Environmental

LEGEND

- REGISTERED WELL
- PROPERTY BOUNDARY
- AREA OF SIMILAR WELL DENSITY
- 500M RADIUS FROM PROPERTY BOUNDARY

BASE DATA

- WATERCOURSE
- WATERBODY

0 25 50 75 100 m

IMAGERY: ESRI, DIGITALGLOBE, GEOEYE, I-CUBED, USDA FSA, USGS, AEX, GETMAPPING; HYDROGRAPHY: NATURAL RESOURCES CANADA, 2017; REGISTERED WELLS: GEOBC 2022.

AE PROJECT NO.	2021-8860
DATE	2022-04-14
SCALE	1:4000
COORD. SYSTEM	NAD 1983 UTM ZONE 11N
REV	00
DESCRIPTION	ISSUED FOR REPORT
DRAWN BY	KP
CHECKED BY	SC

FIGURE 2-5
WELL DENSITY

DOWN'S ENTERPRISES LTD.

BX CREEK WATERSHED STUDY

\\AE.CA\DATA\WORKING\VER\2021-8063-00\GIS\ARCMAP\AE20218063_FIG2_5_WELL_DENSITY_220413.MXD

3 CLIMATE CHANGE CONSIDERATIONS

Future climate conditions were considered using the ClimateBC (Wang et al., 2016) 13 General Circulation Model (GCM) Representative Concentration Pathway 4.5 ensemble averaged future climate projections for the Site location. Projected mean monthly temperatures and mean total monthly precipitation were extracted for the climate normal periods of 1981-2010, 2011-2040, 2041-2070, and 2071-2100, hereafter referred to as the 1995, 2025, 2055, and 2085 climate periods, respectively (Table 3-1).

Mean monthly air temperatures are expected to increase in all months, with mean annual temperature projected to increase by 3.3°C (i.e., to 10.0°C) by 2085 climate period, compared to the 1995 climate period average (6.7°C). The increase in air temperatures is likely to result in higher evaporation and evapotranspiration in the region, which may impact surface and vadose zone water availability.

In addition, annual precipitation is projected to increase slightly from an average of 591 mm in the 1995 climate period to an average of 617 mm in 2085 climate period. The increase in precipitation is anticipated during spring, fall and winter months, with a decrease in summer. It is expected that an increasing proportion of winter precipitation will fall as rain rather than snow due to the increasing winter air temperatures. These climate projections may change the way groundwater recharge occurs (for example via direct infiltration or losing streams). However, there is insufficient information to conclude on whether these projections will result in a positive or negative impact to groundwater recharge (for example, quick snowmelt can result in rapid run-off [and less recharge] whereas periods of steady rain may allow for increased infiltration [and more recharge] into the ground).

Table 3-1
Averaged Mean Monthly Temperature and Precipitation Estimates for the Site, for Three Climate Periods

Climate Period	Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature														**Yearly Average**
1995	**Mean Monthly Temperature (°C)**	-3.6	-1.6	2.2	6.8	11.1	14.7	18	17.6	12.7	6.2	0.3	-4.1	6.7
2025		-3.8	-1.1	2.8	7.8	12.5	16.7	19.8	19.8	14.5	7.9	1.7	-3.5	7.9
2055		-2.6	0.2	3.8	8.9	13.8	17.7	21.1	21.1	15.8	9.2	2.8	-2.4	9.1
2085		-1.9	0.8	4.5	9.9	14.7	18.6	22.2	22.2	16.7	9.8	3.6	-1.3	10.0
Precipitation														**Yearly Total**
1995	**Total Monthly Precipitation (mm)**	53	42	37	34	54	73	42	38	45	47	64	62	591
2025		61	47	36	35	52	56	38	39	45	39	61	77	586
2055		64	48	37	39	56	58	36	39	46	43	64	81	611
2085		65	48	37	39	57	58	35	37	47	44	66	84	617

Note: climate normal periods: 1995 is from 1981-2010, 2025 is from 2011 to 2040, 2045 is from 2041 to 2070; and 2085 is from 2071 to 2100
Source: ClimateBC (https://www.climatewna.com/ClimateBC_Map.aspx)

4 SUMMARY AND CONCLUSIONS

Associated completed a desktop water supply study to assess groundwater availability at the Site, which is a land parcel located on Wallace Road in the Regional District of North Okanagan (the Site, PID 013-569-368). The objective of the study was to satisfy the request of the Planning Department "that second Reading of the Zoning Amendment Bylaw No. 2838, 2019 be withheld until the applicant has provided a "water supply study" which takes into consideration the potential to service the full build-out potential of the subject property (7-8 lots) in accordance with the provisions of the Regional District of North Okanagan Subdivision servicing Bylaw No. 2600, 2013 and the impact the use of groundwater supplies could have on existing wells in the neighbourhood and the local aquifer."

Groundwater availability was determined by assessing aquifer and geological mapping and reports, reviewing existing wells in the area to identify the aquifer they are constructed in and their typical well yields, and comparing the proposed well density versus existing well density to provide an indication of the potential for well interference. Results indicate the following:

- Wells in the area source water from either a surficial aquifer (Aquifer 349) or a fractured crystalline bedrock aquifer (Aquifer 351). These aquifers could provide a water supply for future wells drilled at the Site.
- The majority of wells in the area are used for domestic supply only and have a low demand compared to other uses, such as irrigation for forage crop (i.e., 2,428 m^3/year for one residential lot at 6,550 L/day per lot, compared to 13,380 m^3/year for 2 ha of irrigation using sprinklers for forage crop) (CAP 2022).
- Average and geometric mean well yield for wells constructed in surficial deposits within 500 m of the Site boundary are 99.7 m^3/d and 55.6 m^3/d, respectively, which are significantly higher than the 6.55 m^3/d required under RDNO Bylaw 406, Sub-section 406, thus indicating that required well yields would likely be achievable from wells drilled at the Site.
- Average and geometric mean well yield for wells constructed in bedrock within 500 m of the Site boundary are 116.3 m^3/d and 80.2 m^3/d, respectively, which are significantly higher than the 6.55 m^3/d required under RDNO Bylaw 2600, Sub-section 406, thus indicating that required well yields would likely be achievable from wells drilled at the Site.
- Based on a water demand of 6,550 L/day per lot, the proposed 7-8 lots' water demand would be approximately 1.2-1.8% of the estimated quantity of groundwater flow, as estimated using Darcy's flux calculations for the aquifers found beneath the Site. The percentage is even lower (less than 1%) if considering the average water use in the Okanagan of 675 L/day per person which would be 2,700 L/d for a family of four.
- The potential density of wells at the Site would be similar (or less dense) to the density of existing wells in the area, suggesting that well interference caused by new domestic wells on the Site is unlikely to be a problem.
- No drawdown of aquifer levels is indicated in the two observation wells (OBS Wells 311 and 322), suggesting that the use of groundwater at the existing well density is sustainable. However, only OBS Well 311 is active. Data from OBS Well 322 is only available up to 2003.
- According to the provincial aquifer reports there are no documented water quality concerns in either the surficial or bedrock aquifers.

Based on these results, it is reasonable to assume that there is sufficient groundwater available from either the surficial aquifer or the bedrock aquifer underlying the Site to provide domestic use water supplies for 7-8 lots at the Site. Based on the well log information for existing wells in the vicinity of the Site, the bedrock aquifer appears to be

the aquifer that is more likely to provide water supplies to any future properties on the Site, although within the Site there could be a combination of wells, some constructed in the surficial aquifer and some constructed in bedrock. It is also reasonable to assume, based on the findings of this assessment, that any impacts on neighbouring water supply sources from groundwater use from wells constructed at the Site would be negligible.

4.1 Limitations and Assumptions

The findings and conclusions of this report are based on the following limitations and assumptions:

- The information provided and conclusions made are based on a desktop study using publicly available information only.
- No site investigations (i.e., well drilling and/or pumping tests) have been undertaken.
- There may be additional unknown wells in the area that provide water supplies that have not been registered on the Ministry's GWELLS database.
- There may be additional wells which were drilled and abandoned due to no or low yields and have not been registered on the Ministry's GWELLS database.
- It is assumed that the majority of wells identified in the vicinity of the Site are used for domestic purposes only and therefore the quantity of water extracted from each well is small.
- The findings of this study indicate that there are likely aquifers located beneath the Site with sufficient capacity to provide the required water demand; however, there is no guarantee that well(s) drilled on the Site will provide the required yield. The quantity of water available will depend on the permeability of the geology beneath the site.
- No pumping test data with well interference information was available to assess the impact of pumping caused by wells located close to one another. We have assumed that as there are existing areas with a high density of wells with no know water availability issues, the density of wells proposed for the site will also be acceptable.
- The effect of climate change to aquifer recharge is unknown. Annual precipitation is anticipated to increase but temperatures are also expected to increase which could lead to greater evaporation and evapotranspiration and reduced winter snowpack. This could potentially affect the timing and extent of groundwater recharge.

CLOSURE

This report was prepared for Down's Enterprises Ltd. to assess groundwater availability for 7-8 lots located on the subject Site on Wallace Road in the Regional District of North Okanagan.

The services provided by Associated Environmental Consultants Inc. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,
Associated Environmental Consultants Inc.

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PERMIT TO PRACTICE
1001754

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APPENDIX A – RDNO PLANNING DEPARTMENT INFORMATION REPORT: REZONING APPLICATION, FILE NO. 19-0350-C-RZ

REGIONAL DISTRICT NORTH OKANAGAN

PLANNING DEPARTMENT INFORMATION REPORT

REZONING APPLICATION

DATE:	August 23, 2019
FILE NO.:	19-0350-C-RZ
OWNER/APPLICANT:	Down's Enterprises Ltd. c/o Monashee Surveying
LEGAL DESCRIPTION:	The NE ¼ of the SE ¼ of Sec 20, Twp 5, ODYD
P.I.D.#:	013-569-368
CIVIC ADDRESS:	Wallace Road
PROPERTY SIZE:	16.19 ha (40 ac)
SERVICING:	On-site wells and septic systems
PRESENT ZONING:	Non-Urban (N.U)
PROPOSED ZONING:	Country Residential (C.R)
O.C.P. DESIGNATION:	Country Residential
PROPOSAL:	Six (6) lot subdivision

PLANNING DEPARTMENT RECOMMENDATION:

That Zoning Amendment Bylaw No. 2838, 2019 which proposes to rezone the property legally described as The NE ¼ of the SE ¼ of Sec 20, Twp 5, ODYD and located at Wallace Road, Electoral Area "C" from the Non-Urban (N.U) zone to the Country Residential (C.R) zone be given First Reading; and further

That Second Reading of Zoning Amendment Bylaw No. 2838, 2019 be withheld until the applicant has provided a water study which takes into consideration the potential to service the full build-out potential of the subject property (7 – 8 lots) in accordance with the provisions of the Regional District of North Okanagan Subdivision Servicing Bylaw No. 2600, 2013 and the impact the use of groundwater supplies could have on existing wells in the neighbourhood and the local aquifer.

BACKGROUND:

This report relates to an application to rezone the property located at the east end of Wallace Road from the Non-Urban (N.U) Zone to the Country Residential (C.R) Zone. If successful in rezoning the property, the applicant is proposing a six (6) lot subdivision.

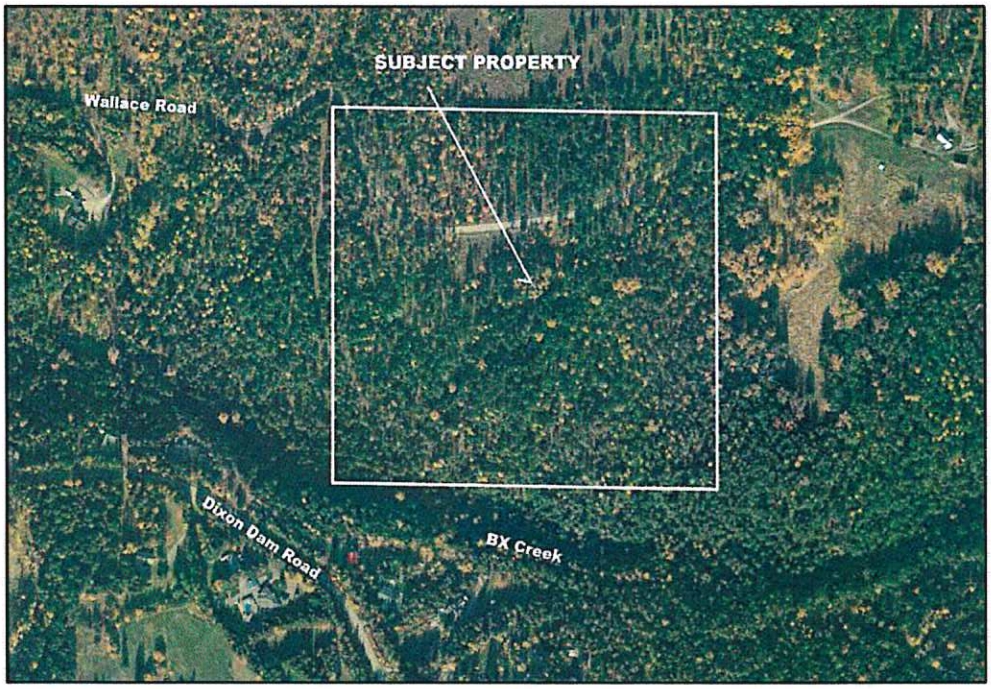
Site Context

The property is accessed from the east end of Wallace Road and is currently undeveloped and therefore has not been assigned a civic address. The Ministry of Transportation and Infrastructure's road inventory indicates that an undedicated portion of Wallace Road extends through the subject property to a point approximately 50 m east of the subject property within the neighbouring property to the east.

A 10 m (33 ft) wide strip of land abutting the north boundary of the lot situated immediately east of the subject property is visible on the attached Subject Property map and, while it may appear to be a portion of unconstructed road right-of- way, it is a privately owned lot.

The subject property is well treed and includes gentle to steep slopes which descend from north to south / southwest. BX Creek flows in a westerly direction to the south of the property. Topographic maps indicate a draw or gully passes through the property from northeast to southwest with increasingly steep side walls and descent as it approaches BX Creek. Steep slopes traverse the southwest portion of the property, in proximity to, and generally parallel to BX Creek. The Regional District's mapping indicates no streams or ponds within the property.

The following orthophoto of the subject and surrounding properties was taken in 2018.



The subject property is designated Country Residential in the Electoral Areas "B" and "C" Official Community Plan and is zoned Non-Urban (N.U). The subject and surrounding properties are not within the Agricultural Land Reserve. The attached maps show the OCP land use designation and the zoning of the subject and surrounding properties.

Surrounding properties to the north and east are designated Country Residential in the OCP and are zoned Non-Urban (N.U). Property to the west is designated Country Residential and zoned Country Residential (C.R). A 2.2 ha parcel of Crown land situated between the south boundary of the subject property and BX Creek is designated Park and is zoned Community Park and Public Use (S.3). On the south side of BX Creek, properties are designated Small Holding and are zoned Small Holding (S.H).

The Proposal

The applicant is proposing to rezone the subject property from the Non-Urban (N.U) zone to the Country Residential (C.R) zone. If successful, the property owner intends to apply to create a six (6) lot subdivision generally as shown on the attached site plan. The proposed lots would range in size from 2.1 ha to 2.8 ha. It is proposed that Wallace Road would be dedicated with a width of 20 m along the existing undedicated, travelled route of Wallace Road where it passes through the subject property in a curving, east/west alignment. Two of the proposed lots would have frontage on the north side of the proposed road while four lots would have frontage on the south side.

There are no existing wells on the subject property and the applicant proposes that water would be provided by individual drilled wells on each proposed lot. No additional information regarding the potential to use groundwater to service the proposed development has been provided at this time. The applicant is also proposing individual on-site sewage disposal systems for each lot.

ZONING BYLAW:

The subject property is proposed to be rezoned from the Non-Urban (N.U) zone to the Country Residential (C.R) zone. Uses permitted in the C.R zone include ancillary single family dwellings, bed and breakfast use, boarding house use, community care facilities, detached suites, home occupation use, limited agricultural use, limited resource use, manufactured homes, packing houses, public parks and playgrounds, single family dwellings, two family dwellings, veterinary clinics, wineries and cideries, work force housing units, and secondary suites.

The maximum number of dwellings permitted on 2.0 ha parcels in the C.R zone is one single family dwelling which may contain a secondary suite, or one manufactured home, or one two-family dwelling. One ancillary single family dwelling or one detached suite is also permitted provided it is ancillary to a single family dwelling which does not contain a secondary suite.

The minimum lot size standard of the C.R and N.U zones are 2.0 ha and 7.2 ha respectively.

Section 310 - Building Site and Driveways

All lots created within the Country Residential (C.R) zone must contain a contiguous area of land 2,000 m^2 or larger in size to serve as a suitable building site. Building sites must be less than 30% natural slope and be accessible from a highway in accordance with the following standards:

- Commencing at the edge of the finished road surface, private access driveways must be as close to right angles as practicable to the finished road surface for a minimum distance of 6 m, and have a minimum width of 5.5 m for the distance specified above and 4 m minimum width thereafter, and have a maximum slope of 2% from the ditch line for a minimum distance of 10 m and a maximum slope of 15% thereafter.

OFFICIAL COMMUNITY PLAN:

The Electoral Areas "B" and "C" Official Community Plan designates the land use of the subject property as Country Residential. The following OCP Policies are applicable to the application:

Rural Lands Policies

5.1.4 Developers on Rural Lands will be encouraged to consult with the Ministry of Forests Lands and Natural Resource Operations with regard to subdivision design, layout of roads, selection of building sites and the clearing of trees with regard to protection of the proposed development from wildfire hazard.

5.1.5 Because of the importance of water supplies for new development and the uncertainty about water supply for some Rural Lands, assurance about water supply should be provided with a rezoning application or an application to amend this Plan and as appropriate, hydrogeological studies should be undertaken to determine impacts, if any, on existing wells in the neighbourhood and the local aquifer.

5.1.6 Some lands in this Official Community Plan area are designated as *Country Residential*; however, this designation does not ensure that the land would be rezoned as *Country Residential* and the following information and considerations are necessary to guide a review of any rezoning application which may or may not be approved:

a. maps should be submitted showing how the rezoning area can developed into the *Country Residential* standard including the location of any new streets, environmental protection measures, lot layouts and any community amenities;

b. the area should not be subject to flooding, high water table or terrain instability;

c. the development of the area should not require excessive expenditures for community services such as roads, utility services and school busing;

d. the terrain should be suitable for development whereby each new lot would have a building site and driveway access in compliance with the *"Zoning Bylaw"*;

e. each new lot shall have an area that is adequate for on-site sewage disposal with a reserve site for on-site sewage;

f. information should be provided to show how development can be supplied with an adequate water supply as outlined in Policy 5.1.5 of this Plan;

g. sensitive environmental attributes should not be negatively impacted by a higher density of land use and in this regard, the Regional District may request that an environmental impact analysis be undertaken;

h. other submissions other than those cited herein may be necessary in order to adequately evaluate an application; and

i. notwithstanding these specific considerations, the Regional District will be guided by community goals and objectives cited in this Plan and other policies in this Plan as may be appropriate in the consideration of any application.

5.1.9 Pursuant to Section 482 of the "Local Government Act", the Regional District may apply a bonus density to a maximum of 20% for Country Residential developments. Where an application proposes to amend the "Zoning Bylaw" with no lots less than 1 ha in size with a minimum of 10% of land to be dedicated for community or site amenities as follows:

a. the dedication of parks or trails as outlined in this Plan;
b. the long-term security of a Natural Area as outlined in this Plan or other significant environmental or habitat feature;
c. the maintenance of substantial buffer zones adjacent to a Major Road as defined in this Plan; or
d. the conservation or provision of any other amenity as proposed by the property owner.

Natural Area Policies

11.2.1 Land within the Environmentally Sensitive Land, Development Permit Areas as designated on Schedule 'C' shall not be altered or developed, or subdivision approval granted, unless a Development Permit is issued in accordance with the guidelines in this plan.

11.2.3 All development within the Regional District shall be undertaken in compliance with the provincial *Riparian Areas Regulation*.

11.2.6 Encourage the voluntary protection of natural features.

11.2.7 Encourage the protection, preservation, enhancement and management of sensitive ecosystems or land contiguous to sensitive ecosystems of private lands through the following methods:

a. Donation of areas to the Regional District or provincial government;
b. Donation of areas to a Land Trust or conservation organization;
c. Creation of conservation covenants in favour of municipal, provincial government, private conservation organizations;
d. Establishment of statutory right of ways under the *Land Title Act* for affected areas;
e. Establishment of long-term leases for sensitive areas;
f. Land stewardship and participation in conservation initiatives by the private landowner;
g. Consideration of alternative development standards, such as clustering.

Steep Slope Policies

11.3.1 Development on slopes greater than 30% carry inherent geotechnical risks, access and safety concerns and therefore it is recommended that if possible development is accommodated elsewhere on the site and steep slopes are encouraged to be left as natural or open spaces.

11.3.2 The Regional District may require a geotechnical site evaluation for development on steep slopes. The assessment should take into consideration site design as it relates to substrates, natural contours, natural gradients and ensure site stability for the subject and neighbouring properties. The recommendations of this evaluation may be required to be incorporated into a Section 219 Restrictive Covenant.

Trails Policies

12.1.10 The Regional District supports the expansion of the BX Trail as outlined in Schedule 'E'.

12.1.12 The Regional District recognizes the need to develop local trails within Electoral Areas "B" & "C" to enhance the connectivity between Sub-Regional trails, any future Sub-Regional parks and local park space. Relevant trails are outlined in the Ribbons of Green Trails Plan 2013-2033 (Schedule G) with the exception of a trail linkage which should be considered between the Foothills Neighbourhood and Cools Pond.

12.1.13 The Regional District recognizes the need to develop priorities and an implementation strategy for the acquisition and development of new trails in the Electoral Areas; however, it is also recognized that when opportunities arise for the acquisition of a new trail segment as identified in the "Ribbons of Green Trail Plan 2013-2033" then prompt action is often necessary despite the priorities in the implementation strategy.

Community Safety, Police and Fire Protection Policies

14.1.21 Support and encourage the application of Fire Smart principles for existing and new development.

Transportation Policies

15.1.5 Where the Regional District is involved in planning for future roads and subdivisions or plans for improvements to existing roads, consideration will be given to the needs of public transit, school buses, pedestrian walkways and bicycle routes.

15.1.7 The Regional District requests the Ministry of Transportation and Infrastructure (MoTI) approving officer consider the needs of pedestrians and cyclists when approving subdivisions, the creation of new roads or upgrading existing roads. New road designs should accommodate for alternative transportation options with the addition of wider shoulders for pedestrian travel or a wider paved travel surface that can become a designated bicycle route.

Riparian and Swan Lake Development Permit Area

The Regional District considers that all streams, as defined under the Riparian Areas Regulation (RAR) are within the Riparian and Swan Lake Development Permit Area. Under RAR, a stream is defined as any of the following that provide fish habitat:

a) a watercourse whether it usually contains water or not;
b) a pond, lake, river, creek, or brook;
c) a ditch, spring or wetland that is connected by surface flow to something referred to above in section a) or b).

The primary objective of the Riparian and Swan Lake Development Permit designation is to regulate development activities in watercourses and their riparian areas in order to preserve natural features, functions and conditions that support natural processes. Given the proximity of the subject property to BX Creek, and a draw / gully that may serve as a seasonal drainage corridor through the central portion of the property, the proposed development will require a Riparian and Swan Lake Development Permit prior to subdivision approval unless an exemption applies.

Environmentally Sensitive Lands Development Permit Area

The Electoral Areas "B" and "C" Official Community Plan designates the subject property as a Development Permit Area for the protection of environmentally sensitive lands. The primary objective of the Environmentally Sensitive Lands Development Permit Area is to regulate development activities in areas of High and Very High conservation value to protect rare and fragile terrestrial ecosystems and habitat for endangered species, or native rare vegetation or wildlife.

The majority of the subject property is within an area of Moderate conservation value. A draw / gully descending from northeast to southwest through the property and the southerly portion of the property, adjacent to BX Creek, is identified as being within an area of High conservation value which transitions to an area of Very High conservation value closer to the creek itself. In this regard, unless an exemption applies, an Environmentally Sensitive Lands Development Permit would be required to be approved prior to subdivision approval.

Hazardous Conditions (Wildfire Interface) Development Permit Area

The subject property is designated as a Wildfire Interface Development Permit Area as the property is located within the interface area as identified on Schedule 'D' of the Official Community Plan. The primary objective of the Wildfire Interface Development Permit Area designation is to ensure that particular development and maintenance measures are implemented to protect persons and property from wildfire hazard, and to ensure that property owners are aware of the wildfire hazard. In this regard, unless an exemption applies, a Wildfire Interface Development Permit will be required to be approved prior to subdivision approval.

PLANNING ANALYSIS:

The Planning Department recommends that the proposal be given favourable consideration as it represents a rural residential land use that is consistent with the Electoral Areas "B" and "C" Official Community Plan land use designation of the subject property and complies with the previously noted OCP Policies as follows:

a) The applicant has submitted a site plan which shows how the property could be developed under the Country Residential (C.R) zone.

b) The proposed lots would contain building sites that would not be subject to flooding, high water table or terrain instability.

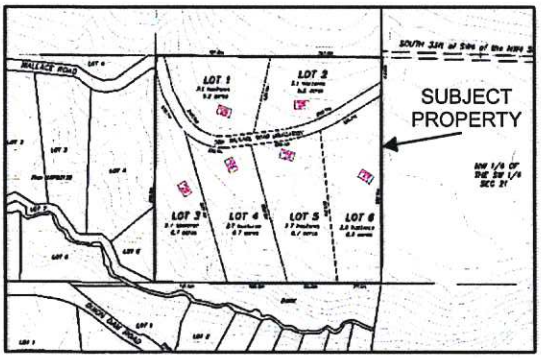
c) The proposed lots would not require excessive expenditures for community services such as roads, utility service and school busing, as such services already exist.

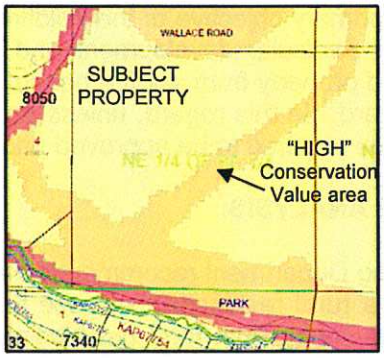
d) Subject to confirmation by a Registered On-Site Wastewater Practitioner prior to issuance of any Building Permit for the proposed lots, it is anticipated that the size and topography of the proposed lots should allow for on-site septic sewerage disposal.

e) Prior to final subdivision approval, unless an exemption applies, a Development Permit will be required which assesses the impact of development activities on riparian areas, terrestrial environmentally sensitive areas, and which includes measures to protect development from wildfire.

The proposal has been reviewed against OCP Policies that require a domestic water source for the proposed lots. In this regard, it is recommended that a hydrogeological assessment be provided to demonstrate that a water source would be available for the proposed development based on the Subdivision Servicing Bylaw No. 2600, 2013 standards for a private domestic well and to determine impacts, if any, of groundwater extraction to service the full build-out potential of the property, on existing wells in the neighbourhood and the local aquifer. Based on the 16.19 ha size of the property and the 2.0 ha minimum lot size provisions of the Country Residential (C.R) zone, full build-out potential would be 7 - 8 lots.

As noted previously in this report, an area identified as having High conservation value traverses the property from NE to SW. This area is shown in light orange on the figure to the right below. Development Permit guidelines suggest that subdivisions should be designed to protect environmentally sensitive areas and wildlife habitat and a report by a Qualified Environmental Professional may be required. The proposed site plan, shown on the figure to the left below, indicates that the road extension and proposed building sites would, largely, avoid the High ranked area however it is anticipated a driveway connecting the building site on proposed Lot 6 to the Wallace Road extension, would cross the High ranked area. The proposed dedication of Wallace Road through the subject property would follow the existing, undedicated travelled route which appears to cross the High ranked area within the adjacent property to the east.





The Official Community Plan includes policies which support the expansion of the BX Creek Trail and the need to develop local trails to enhance connectivity between existing and future parks and to other trails. With respect to this application, each proposed lot would be a minimum of 2 hectares in size, and in this regard a requirement to dedicate land, or to provide payment in lieu of land, for park purposes would not be triggered by Section 510 of the *Local Government Act*. In this regard, the applicant is encouraged to contact the RDNO Parks Manager directly to discuss the Parks Manager's referral response regarding park dedication.

SUMMARY:

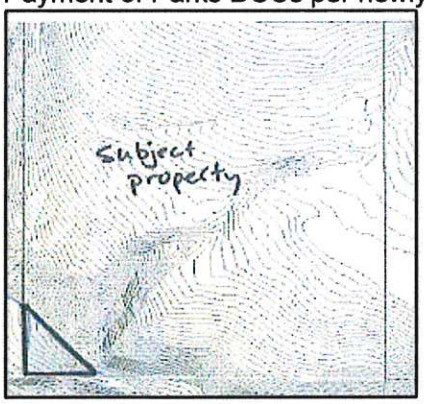
The subject application proposes to rezone the property located at the east end of Wallace Road from the Non-Urban (N.U) zone to the Country Residential (C.R) zone. If successful in rezoning the property, the applicant is proposing a six (6) lot subdivision. The Planning Department recommends that the proposal be given favourable consideration as the proposed subdivision is generally consistent with relevant Policies of the Electoral Areas "B" and "C" Official Community Plan. Recommendations have also been provided to facilitate informed decision-making with respect to water supply. In the event this rezoning application is successful, the Development

Permit process would address wildfire hazard, and protection of riparian and terrestrial environmentally sensitive areas.

REFERRAL COMMENTS:

The application was referred for comments to the following:

1. **Building Inspection Department**
2. **RDNO Community Services Department (Parks and Protective Services)**
   Parks requirements for the rezoning and future subdivision: Dedication of parkland as shown on attached map consistent with Sub-Regional Open Space and Trail Policy No. PRK001, Ribbons of Green Trails Plan 2013-2033, and Electoral Areas B and C OCP. Payment of Parks DCCs per newly created lot at the time of subdivision.



3. **BX – Swan Lake Fire Department**
4. **Interior Health Authority**
   An initial review has been completed and no health impacts associated with this proposal have been identified. As such, our interests are unaffected by this proposal.
5. **Ministry of Transportation and Infrastructure**
   Preliminary Approval is granted for the rezoning for one year pursuant to section 52(3)(a) of the *Transportation Act*. This approval does not imply approval of any future subdivision. A full review of the legislation, regulations and policies regarding subdivision will be carried out upon receipt of a subdivision application. Please forward a copy of the bylaw, to MoTI for endorsement, after third reading.
6. **Ministry of Environment / Ministry of Natural Resource Operations**
7. **Ministry of Forests, Lands, and Natural Resource Operations**
   The Ecosystems Section of Ministry provided the following comments:
   According to our records, the proposed development area contains the following sensitive values: high conservation ranking; riparian habitat adjacent to BX Creek; high potential for species at risk presence. As such, we have assessed this referral to be a known and potential risk to wildlife, fish or their habitats based on the information available.
   We recommend that the proponent retain a qualified professional (QP) to conduct an assessment of the site prior to development in order to evaluate the environmental values present, determine the potential for adverse effects to environmental values as a result of development, and develop value-specific mitigation measures to avoid or limit adverse effects.

Submitted by:

Marnie Skobalski, MCIP, RPP
Planner II

Endorsed by:

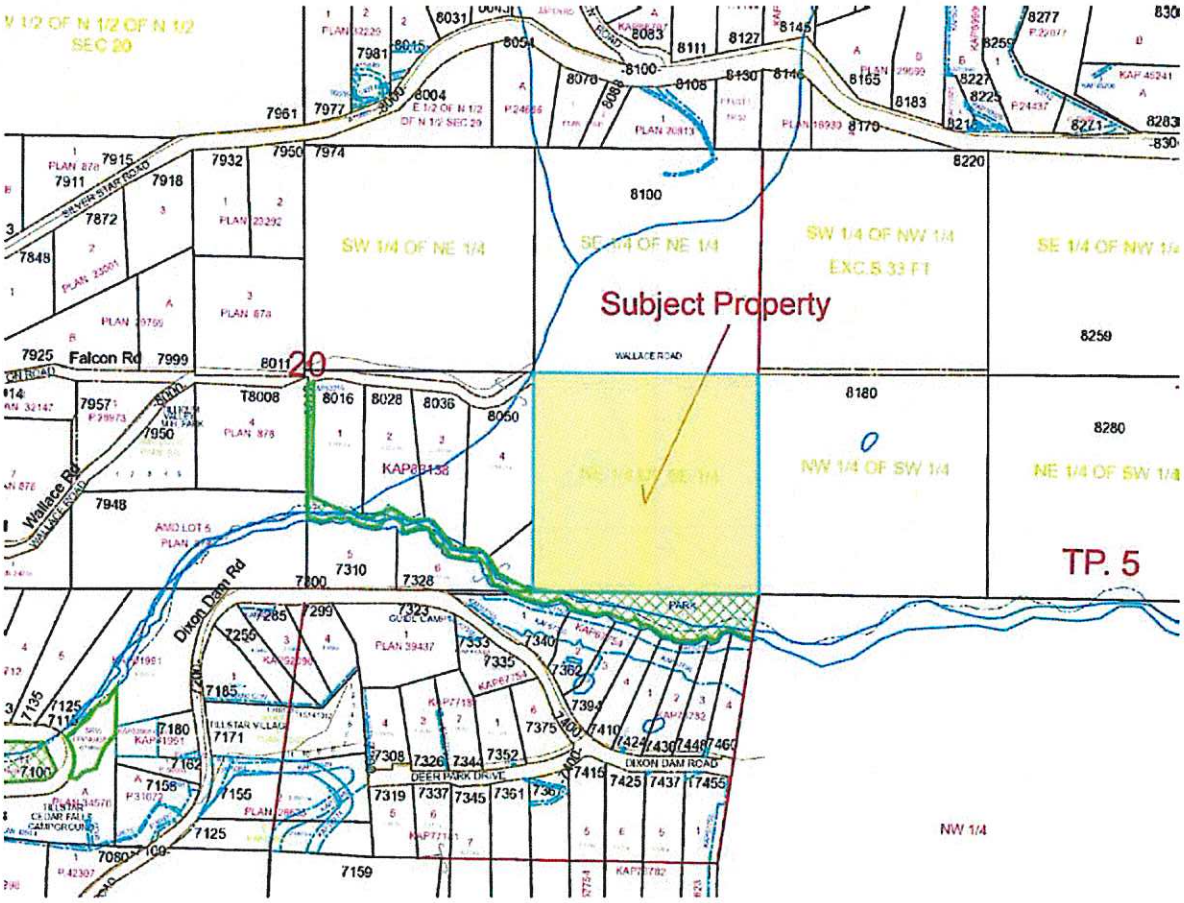
Rob Smailes, MCIP, RPP
General Manager, Planning and Building

Approved for Inclusion:

David Sewell
Chief Administrative Officer

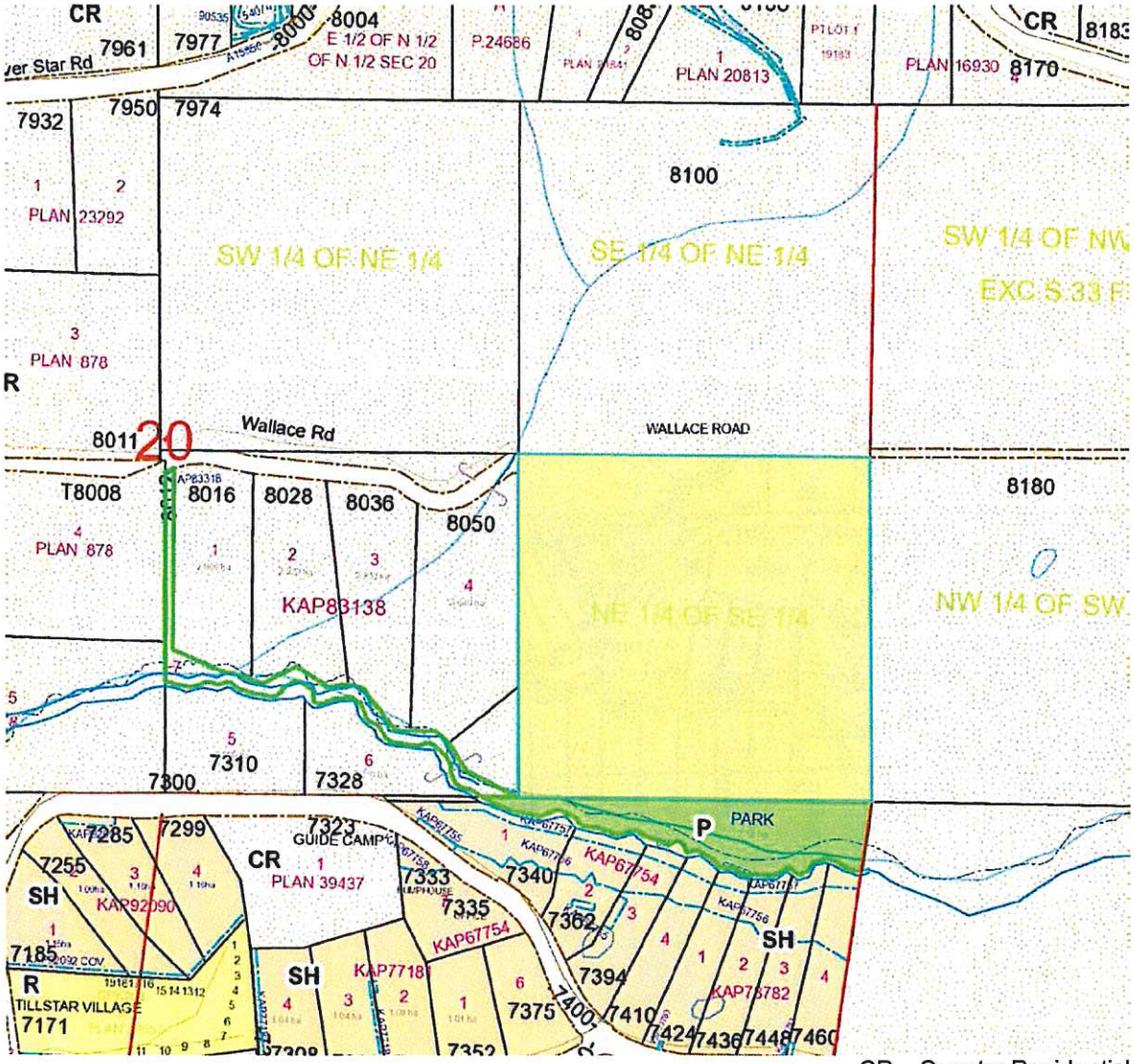
SUBJECT PROPERTY MAP

File: 19-0350-C-RZ
Owner/Applicant: Down's Enterprises c/o Monashee Surveying
Location: Wallace Road



SUBJECT PROPERTY MAP
OCP BOUNDARIES

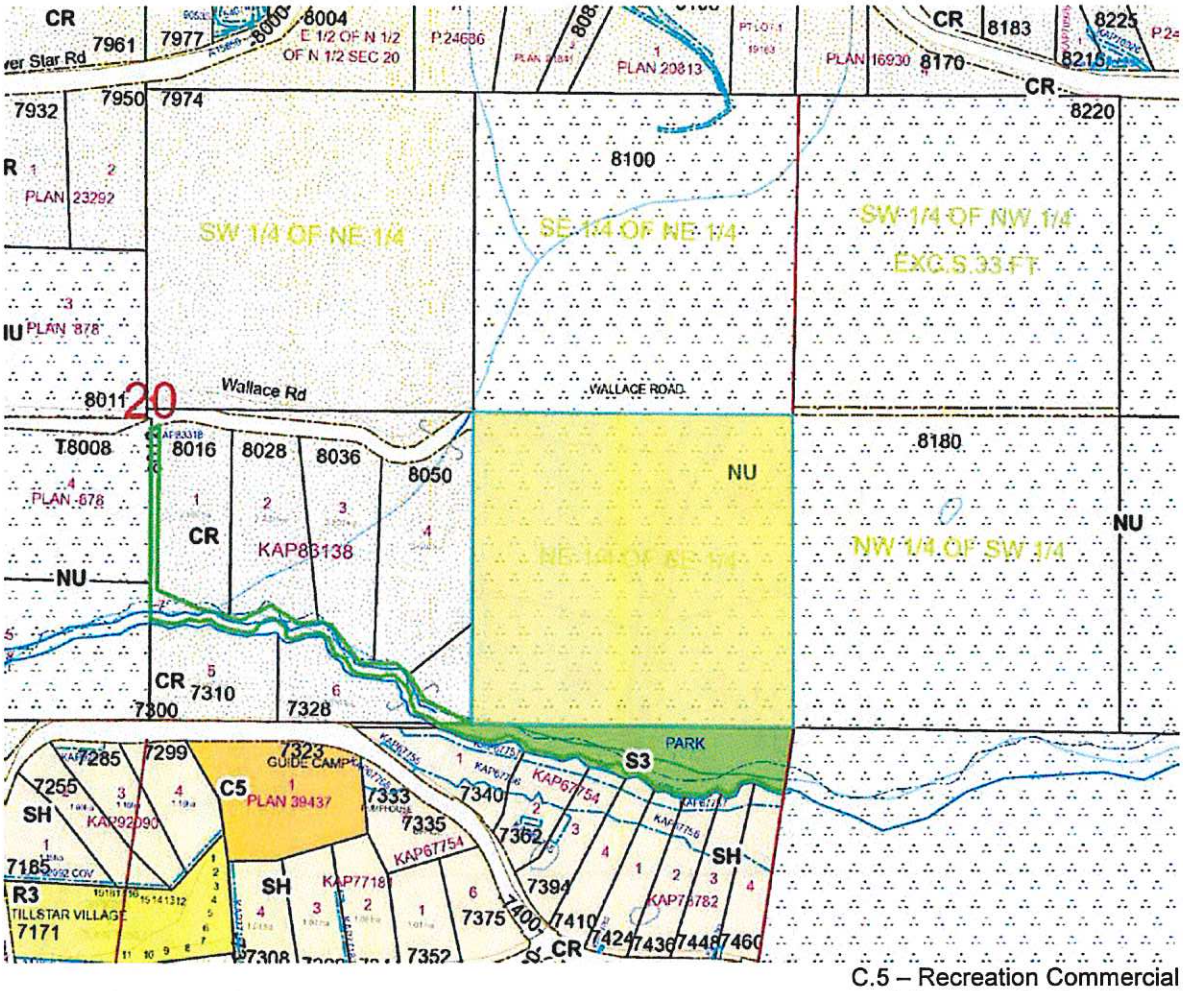
File: 19-0350-C-RZ
Owner/Applicant: Down's Enterprises c/o Monashee Surveying
Location: Wallace Road



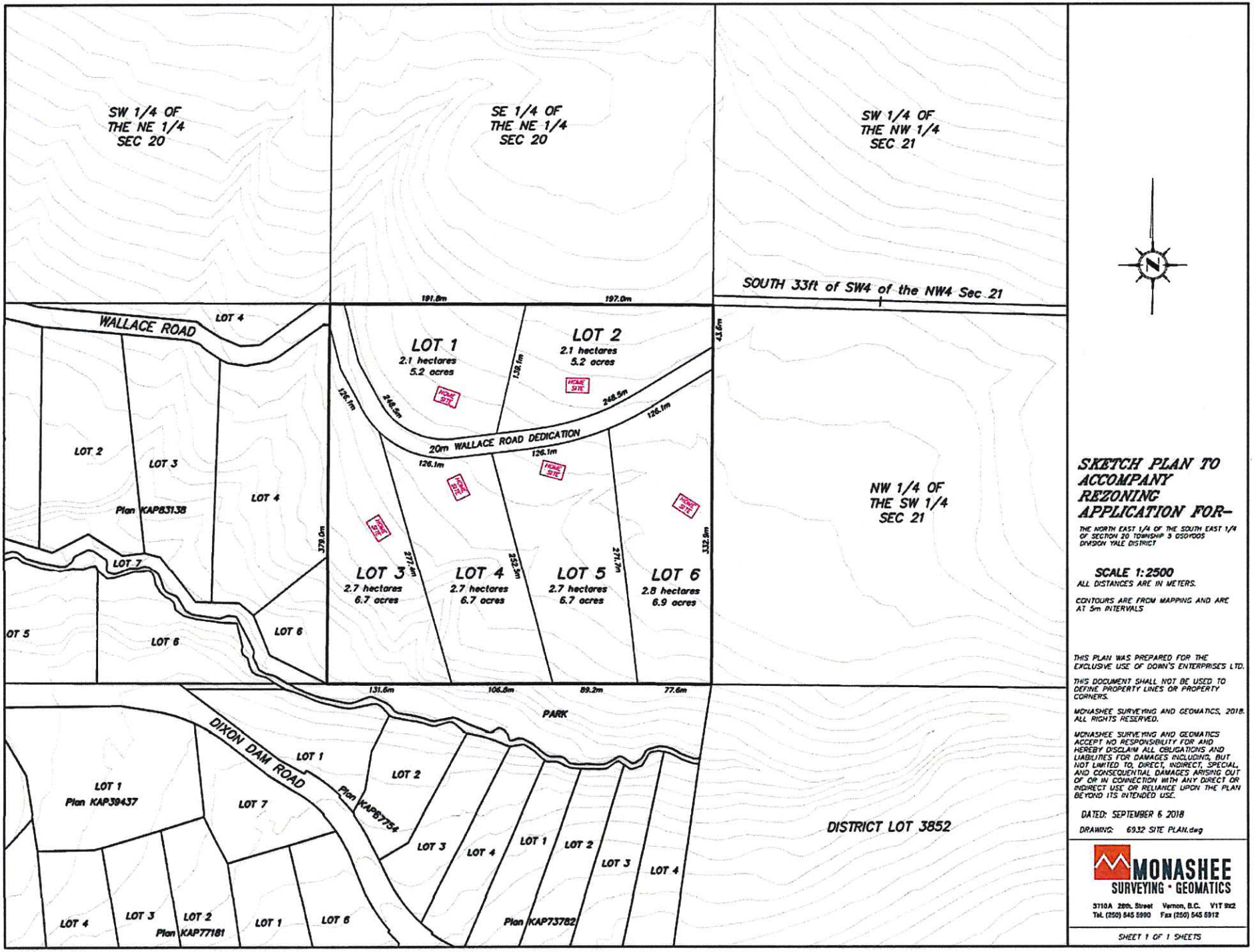
CR – Country Residential
P - Park
R – Residential
SH – Small Holding

SUBJECT PROPERTY MAP
ZONING BOUNDARIES

File: 19-0350-C-RZ
Owner/Applicant: Down's Enterprises c/o Monashee Surveying
Location: Wallace Road



C.5 – Recreation Commercial
C.R. – Country Residential
N.U – Non-Urban
R.3 – Residential Apartment and Multi-Family
S.3 – Community Park and Public Use
S.H – Small Holding



SKETCH PLAN TO ACCOMPANY REZONING APPLICATION FOR–

THE NORTH EAST 1/4 OF THE SOUTH EAST 1/4 OF SECTION 20 TOWNSHIP 3 OSOYOOS DIVISION YALE DISTRICT

SCALE 1:2500

ALL DISTANCES ARE IN METERS.

CONTOURS ARE FROM MAPPING AND ARE AT 5m INTERVALS

THIS PLAN WAS PREPARED FOR THE EXCLUSIVE USE OF DOWN'S ENTERPRISES LTD.

THIS DOCUMENT SHALL NOT BE USED TO DEFINE PROPERTY LINES OR PROPERTY CORNERS.

DATED: SEPTEMBER 6 2018

DRAWING: 6932 SITE PLAN.dwg

MONASHEE SURVEYING · GEOMATICS
3110A 28th. Street Vernon, B.C. V1T 9X2
Tel. (250) 545 5990 Fax (250) 545 5912

REGIONAL DISTRICT OF NORTH OKANAGAN

BYLAW No. 2838

A bylaw to rezone lands and amend the Zoning Map attached to the Regional District of North Okanagan Zoning Bylaw No. 1888, 2003 to change a zone designation

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WHEREAS pursuant to Section 479 [Zoning bylaws] of the *Local Government Act*, the Board of the Regional District of North Okanagan may, by Bylaw, divide the whole or part of the Regional District into zones, name each zone, establish boundaries for the zones and regulate uses within those zones;

AND WHEREAS the Board has created zones, named each zone, established boundaries for these zones and regulated uses within those zones by Bylaw No. 1888, being the *"Regional District of North Okanagan Zoning Bylaw No. 1888, 2003"* as amended;

AND WHEREAS, pursuant to Section 460 *[Development approval procedures]* of the *Local Government Act*, the Board must, by bylaw, define procedures under which an owner of land may apply for an amendment to a Zoning Bylaw and must consider every application for an amendment to the bylaw;

AND WHEREAS the Board has enacted the *"Regional District of North Okanagan Development Application Procedures and Administrative Fees Bylaw No. 2677, 2018"* as amended to establish procedures to amend an Official Community Plan, a Zoning Bylaw, or a Rural Land Use Bylaw, or to issue a Permit:

AND WHEREAS the Board has received an application to rezone property;

NOW THEREFORE, the Board of the Regional District of North Okanagan in open meeting assembled, hereby **ENACTS AS FOLLOWS**:

CITATION

1. This Bylaw may be cited as "***Zoning Amendment Bylaw No. 2838, 2019***".

AMENDMENTS

2. That the property legally described as The NE ¼ of the SE ¼ of Sec 20, Twp 5, ODYD and located at Wallace Road, Electoral Area "C" be rezoned from the ***Non-Urban [N.U] Zone*** to the ***Country Residential [C.R] Zone].***

3. That the Zoning Map, being Schedule "A" to *Zoning Bylaw No. 1888, 2003* be amended accordingly.

Read a First Time	this	day of	, 2019
Read a Second Time	this	day of	, 2019
Advertised on	this	day of	, 2019
	this	day of	, 2019
Public Hearing held	this	day of	, 2019

Read a Third Time	this	day of	, 2019
Approved by Minister of Transportation and Infrastructure *(Transportation Act s. 52(3))*	this	day of	, 2019
ADOPTED	this	day of	, 2019

Chair

Corporate Officer