Webster Engineering Design Brief

VILLAGE OF PEMBERTON, B.C.

Preliminary Engineering Design Brief

Lot C

7362 Pemberton Farm Road East

Prepared for:

Rivertown Properties

Prepared by:

STEEP ROCKY TERRAIN SPECIALISTS
WEBSTER ENGINEERING LTD

EGBC PERMIT No. 1001444

July 7, 2022

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APPENDICES

1.0 Introduction & Site Context

Rivertown Properties (the Developer) has retained Webster Engineering Ltd. (WEL) for Civil Engineering services and preparation of site servicing drawings and an engineering design brief in support of the Subdivision Application for Lot C at 7632 Pemberton Farm Road East located within the Village of Pemberton (VoP). A Master Servicing Plan drawing is enclosed in **Appendix A** for general site layout and servicing.

The subject site is located adjacent to Pemberton Farm Road East, approximately 150m south of Sunstone Way and approximately 250m south of the existing mountainside. It borders the Pemberton Plateau neighborhood to the south, and the future Pemberton & District Recreation Site to the north. Further north of Lot C sits the existing Ridge Development and the Sunstone Development area. Currently, the Lot C is accessed via. a gravel access road that branches off Pemberton Farm Road East and extends slightly in the property.

Topographically, Lot C is characterized by a well-defined bedrock plateau that was altered as part of previous quarrying works. The crest of the plateau sits immediately east of Pemberton Farm Road East, approximately 9m above the roadway, and extends along the south and west edges of the subject property. From the plateau, the terrain slopes gradually to the east before meandering back towards the west.

Figure 1: Aerial Photo facing South-East (January 2022)

Lot C has a total area of 2.3 hectares and its subdivision will include thirty-four (34) single family lots and one (1) commercial lot. Of the thirty-four (34) single family lots, twenty-six (26) are proposed to be zoned to permit secondary suites. A new road network will be established that connects Lot C to Pemberton Farm Road East and provides access to all lots. It is anticipated that the entire subdivision site servicing and access will be built in a single construction phase.

Figure 2: Aerial Photo facing South-West (January 2022)

At the time of this report, it is understood that the neighboring Recreation Site is in the early stages of planning/design. It is also understood that the adjacent Pemberton Farm Road East corridor will be upgraded soon as part of VoP's capital works. As such, the servicing and access concepts presented in this report include provisions for future developments.

2.0 Report Resource Materials

In preparation of this report, the following design guidelines and reports have been reviewed and referenced, including:

- Village of Pemberton Subdivision and Development Control Bylaw No. 677 (2011) – Village of Pemberton
- Master Municipal Construction Document (MMCD) Design Guidelines (2014)
- Village of Pemberton Sanitary Sewer Forcemain Analysis (Nov 6, 2012) – ISL Engineering and Land Services
- Sunstone Ridge (SRD) Water and Water Design Brief and Submission Reviews (Apr 30, 2018) – Memorandum – ISL Engineering and Land Services
- The Ridge at Pemberton Sanitary Forcemain Design Brief (Jul 21, 2016) – Parsons
- Sunstone Preliminary Design Report (Dec 2017) – Parsons
- Sunstone Pump Station Calculations (Feb 2018) – Parsons
- Sunstone Ridge Developments – Subdivision Environmental Assessment (Jun 2013) – Dayesi Services Ltd.
- Electoral Area D Subdivision and Development Servicing (Planned Communities) Bylaw No. 741 (Oct 28, 2002) – Squamish-Lillooet Regional District
- Transportation Association of Canada Geometric Design Guide for Canadian Roads (1999)
- Stormwater Source Controls Design Guidelines – GVRD (2005)
- Stormwater Planning: A Guidebook for British Columbia (2002)
- Urban Stormwater Guidelines and Best Management Practices for the Protection of Fish and Fish Habitat – DFO
- Geotechnical Review – Residential Subdivision – 7362 Pemberton Meadows Road, Pemberton, BC (Jan 2022)
- Village of Pemberton Water System Performance Assessment - VoP (2020)
- Environmental Assessment – 7362 Pemberton Farm Road East, Lot C, Pemberton, BC – Cascade Environmental (Feb 2022)

3.0 Roadworks

The proposed road network layout for Lot C is based on preferred land use concepts discussed with the Developer. The road network includes two (2) new roads, which will be referred to as Sabre Way and Road B for the purposes of this report.

Sabre Way will branch perpendicularly off Pemberton Farm Road East and run parallel to the northern PL of Lot C for approximately 90m, where it will intersect with Road B at a tee intersection. It will be graded relatively flat in order to match the surrounding area while maintaining positive drainage towards Pemberton Farm Road. Sabre Way will be paved just beyond the intersection for future extension to developments north and/or east of Lot C.

Road B will branch perpendicularly off the south side of Sabre Way and generally follow the existing gravel at the start with full embankment cut and fill before terminating on the plateau located at the SW corner of the property. In general, the road will be graded to best fit the existing bedrock slope and will maintain positive drainage towards Sabre Way for its entire length. A cul-de-sac will be included at the end of Road B to facilitate turnaround of passenger and emergency vehicles.

Designated snow storage zones will be included adjacent to the intersection of Sabre Way and Road B, within the Road ROW.

3.1 Road Design Standards & Criteria

Roadworks design criteria is as per the VoP Subdivision and Development Control Bylaw No. 677 (2011) and the Transportation Association of Canada Geometric Design Guide for Canadian Roads (1999).

Lot C will seek similar variances as granted by VoP Staff and Council for the neighboring Sunstone Ridge development, which help suit the steep slope terrain. These variances are summarized in **Figure 3** on the next page and are incorporated into the proposed roadworks design.

Figure 3: Road Standard Variance Summary

Road	**Standard**	**Driving Lanes** (m)	**Drainage**	**Shoulder** (m)	**Sidewalk** (m)	**On-Street Parking**
Sabre Way	Local Hillside	6.6	Curb & Gutter	1.45 (N) / 0.5 (S)	1.0 (S)	No
Road B	Local Hillside	6.6	Curb & Gutter	1.45 / 0.5	1.0	No

We note that **Figure 3** above present minimum values. Shoulder widths are increased in locations to suit appropriate design for utility structures, hydrants, vehicle barriers, and other structures.

3.2 Geotechnical Considerations

Kontur Geotechnical Consultants have prepared a Preliminary Geotechnical Assessment (dated January 24, 2022), which includes a site investigation of the existing soil conditions as well as recommendations for subgrade preparation and pavement structure. These recommendations have been incorporated into the roadworks design by WEL.

4.0 Water Distribution System

The water distribution system supplies domestic and fire flow demands. A Master Servicing Plan is included in **Appendix A** which illustrates the proposed waterworks system.

The proposed Lot C water distribution system will connect to the existing 250mm watermain that runs along Pemberton Farm Road East. This watermain is supplied by both the existing Ridge Reservoir and the Benchlands Reservoir, with flow capable of travelling in either direction depending on system conditions.

As part of previous development works, a tee and stub for Lot C's water connection was installed at the entry point to Sabre Way off Pemberton Farm Road East. From the existing stub, the proposed 250mm watermain follow Sabre Way and subbed off beyond the tee intersection of Sabre Way and Road B for future extension. At the intersection, the main will branch off to a 250mm line that follows the Road B alignment before terminating at the proposed cul-de-sac.

Service connections complete with curb stops will be provided off the Road B watermain for each of the single-family lots and mixed-use lot per VoP standard drawing VOP-W11. Sizing of these connections will be determined at detailed design and will depend on sprinkler requirements for the proposed buildings.

Hydrants will be located at standard intervals along Road B with the preferred locations at common property boundaries.

4.1 Water System Design Parameters

Relevant design criteria for the proposed water distribution system are provided in review of Section 2.0 in the MMCD Design Guideline Manual, 2014, the VoP Subdivision and Development Control Bylaw No. 677 (2011), and the Squamish-Lillooet Regional District (SLRD) Subdivision and Development Servicing Bylaw No. 741 (Oct 2002). Criteria from the VoP generally takes precedence over criteria outlined in MMCD and SLRD Bylaw. Design criteria applied are summarized in the section below.

4.1.1 Watermain Design Criteria

Sizing the proposed watermain distribution system for Lot C is based on the following design criteria:

- Minimum 200mm pipe diameter;
- Minimum 100mm pipe diameter where no extension in future and does not service hydrant;
- Hydrants to be serviced by minimum 150mm diameter watermain.

4.1.2 Domestic Water Demand

VoP has provided the domestic demand rates, while SLRD has provided the residential population factors, and MMCD has provided the commercial population factors to be used for the mixed-use lot. **Figure 4** shows population factors based on land use type and unit flow rates per capita.

Figure 4: Population Factor and Domestic Water Demand

Land Use Type	**Population Factor**	**Max Daily Demand Unit Rate** (L/cap/day)	**Peak Hour Demand Unit Rate** (L/cap/day)
Single Family (Conventional)	4 cap/lot	910	1,820
Single Family (with Secondary Suite)	7 cap/lot	910	1,820
Commercial (Lot 35)	90 cap/ha	910	1,820

4.1.3 Fire Flow Demand Criteria

Fire flows requirements for the site are governed by the commercial building on Lot 35. Based on preliminary architectural plans, the commercial building will have a total floor area of 8,397 ft^2 (780 m^2). Building materials and fire suppression measures will be selected based on the available fire flow supply and anticipated construction timelines. A range of fire flow demands is provided in **Figure 5** below based on various build out conditions. Demands have been calculated in accordance with the Fire Underwriters Survey "Water Supply for Public Fire Protection, 1999", which is the required method under MMCD specifications. Detailed calculations are provided in **Appendix D**.

Figure 5: Fire Flow Demand Summary

Material Type	**Sprinklers?** (Y/N)	**Fire Wall?** (Y/N)	**Fire Flow** (L/s)
Wood Frame	N	N	133
Wood Frame	N	Y	100
Ordinary	N	N	83
Wood Frame	Y	N	67
Ordinary	Y	N	50

The VoP water distribution system governs the available fire flow supply. Currently, the supply capacity is limited to 115.4 L/s; however, this is anticipated to increase upon construction of the future reservoir at Sunstone Ridge - Phase 4.

A hydrant test will be conducted prior to detailed design and hydraulically modelled to confirm the available fire flow to site.

Based on the hydraulic modelling results, recommendations will be provided relating to building construction (e.g. fire suppression sprinkler requirements, construction materials, fire wall requirements). Service connection sizing for the proposed subdivision will be governed by fire suppression sprinkler requirements.

4.2 Domestic Water Demands

Maximum Daily Demands (MDD) and Peak Hour Demands (PHD) were calculated using the unit flow rate values outlined in Section *4.1.2 Domestic Water Demand* above. Using the unit flow rate values as per **Figure 4**, populations and total domestic water demands were determined and are summarized in **Figure 6**.

Detailed calculations are provided in **Appendix B**.

Figure 6: Anticipated Population and Total Domestic Water Demand

Development Area	**Single Family Lots**	**Commercial Area** (ha)	**Equivalent Population** (cap)	**Max. Daily Demand** (L/s)	**Peak Hour Demand** (L/s)
Single Family Lots (Conventional)	8	0	32	0.3	0.7
Single Family Lots (with Secondary Suite)	26	0	182	1.9	3.8
Commercial (Lot 35)	0	0.17	15	0.2	0.3
Total	34	0.17	229	2.4	4.8

4.3 Watermain Hydraulic Design

Sizing of the proposed watermains will accommodate on-site domestic water demands and fire flows. Hydrostatic conditions for the proposed on-site watermain are based on values presented in the VoP's Water System Performance Assessment (2020).

Lot C falls within the Valley Floor pressure zone, which has a Hydraulic Grade Line (HGL) set to 265m controlled by the Ridge, Fernwood Drive, and Eagle Drive PRV stations. At this HGL, the high point on Lot C (216m el.) has a static servicing pressure of approximately 70psi, while the low point (207m) has a static servicing pressure of approximately 82psi. As such, the servicing pressure for Lot C under normal operating conditions is within the acceptable range per VoP bylaw.

5.0 Sanitary Conveyance System

The Lot C sanitary sewer will be entirely gravity-fed. Each of the proposed lots will include a standard service connection that connects to a piped sanitary sewer routed below Road B. The proposed sewer will then convey sanitary flows west along Sabre Way and north along Pemberton Farm Road before tying-in to an existing stub at the Sunstone Way intersection. From there, flows will then feed into the existing wet well / lift station, which pump flows to the Pemberton Sewage Treatment Plant via. an existing force main.

Trenching and restoration works will be required along Pemberton Farm Road East to facilitate the sewer connection. A stub will also be provided at the edge of paving for Sabre Way for future extension.

5.1 Sanitary Flow Calculations

Sanitary demands are based on information provided in the VoP Subdivision and Development Control Bylaw No. 677 (2011), Squamish-Lillooet Regional District (SLRD) Subdivision and Development Servicing Bylaw No. 741 (Oct 2002) and calculated based on the MMCD methodology.

5.1.1 Sanitary Demand

Population Factor and Unit Average Dry Weather Flow (ADWF) rates are as per SLRD Bylaw No. 741 and VoP Bylaw No. 677 respectively and are summarized below in **Figure 7**.

Figure 7: Population Factor and Unit ADWF

Land Use Type	**Population Factor**	**Unit ADWF** (L/cap/day)
Single Family (Conventional)	4 cap/lot	410
Multi Family	3 cap/lot	410
Single Family (with Secondary Unit)	7 cap/lot	410
Commercial (Lot 35)	90 cap/ha	410

Using the unit flow rate values as per **Figure 7** populations and unit flow demands, the sanitary flow demands were determined and are summarized in **Figure 8**. Detailed calculations are provided in **Appendix B**.

Figure 8: Anticipated Population and Sanitary Demand

Development Area	**Single Family Units**	**Commercial Area** (ha)	**Equivalent Population** (cap)	**ADWF** (L/s)	**PDWF** (L/s)	**PWWF** (L/s)
Single Family Lots (Conventional)	8	0	32	0.15	0.49	0.64
Single Family Lots (with Secondary Suite)	26	0	182	0.86	2.76	2.92
Commercial (Lot 35)	0	0.17	15	0.07	0.23	0.24
Total	34	0.17	229	1.09	3.48	3.63

5.2 Sanitary Conveyance – Gravity Sewer Mains

Gravity sanitary sewer mains are designed as per MMCD Design Guidelines 2014 and are as follows:

- Minimum pipe diameter of 200mm will be used for gravity sewers;
- Pipe Capacity Calculations: Manning's (n=0.013);
- Infiltration allowance = 0.1 l/s/ha;

5.3 Service Connections

All proposed lots will be provided a 100mm sanitary service connection capped at property line. Service connections will be constructed as per MMCD standard drawing S7 and complete with an inspection chamber near PL. Inverts for the individual connections will be provided at detailed design.

5.4 Downstream Sanitary Pump Station

All sanitary flows from Lot C will be directed to the existing pump station located at the intersection of Pemberton Farm Road East and Sunstone Way. The pump station was constructed as part of the neighboring Ridge development and includes a pair of Flygt NP 3153 SH 3-274 pumps, providing a design pump rate of 12.1 L/s at 51.7m Total Dynamic Head (TDH).

Currently, the pump station receives flows from The Ridge (44 Lots), which has a calculated PWWF of 5.0 L/s. With the addition of Lot C, the PWWF load will increase by 3.63 L/s for a total post-development PWWF of 8.67 L/s. A summary of sanitary loads to the existing pump station is shown in **Figure 9** below.

Figure 9: Sanitary Pump Station Loads

Development	**No. of Lots**	**PWWF** (L/s)
The Ridge	44	5.04
Lot C	35	3.63
Total	79	**8.67**

It is understood that this load will increase further in the future as the neighboring lots are developed. The head in the downstream forcemain will also increase as the lands are developed and more flows are directed to the forcemain. Operation and performance of the pumps will need to be reviewed as the surrounding area is developed; however, no upgrades are necessary to facilitate Lot C's sanitary flows at this time.

The existing wet well and forcemains are adequately sized and will not require any upgrades.

6.0 Stormwater Management & Conveyance System

The objective of the proposed stormwater management plan is to mitigate changes in quantity and quality of discharging water, and safely convey the minor and major storm events to existing ditches, channels, and watercourses. The following criteria are applied to the proposed stormwater management and conveyance system:

(a) A conventional underground storm sewer system to convey the post-development flow of the minor storm (10-year return period) event to the offsite storm sewer system without surcharge;

(b) A conventional underground storm sewer and/or overland flow drainage system to convey the post-development flow up to the major 100-year return period storm event to the offsite storm system;

(c) Provide an overland flow route;

(d) Provide stormwater detention to meet pre-development peak flows for the post-development 5-year, 10-year, and 100-year return periods; and,

(e) Provide stormwater cleansing where achievable to meet 80% removal of Total Suspended Solids (TSS) removal.

6.1 Storm Design Parameters

The Rational Method is used to calculate conveyance requirements including sizing of culverts and storm sewers.

6.1.1 Rational Method Design Parameters

Storm design parameters are based on information provided in the VoP Subdivision and Development Control Bylaw No. 677 (2011), Squamish-Lillooet Regional District (SLRD) Subdivision and Development Servicing Bylaw No. 741 (Oct 2002), and the MMCD.

- Rainfall Data: IDF Curve for Village of Pemberton
- Inlet Time: Airport Method; Single-Family Lot = 15 min
- Travel Time: Modified Manning's Formula (MMCD)
- Rational Method : Q= CiA

6.1.2 Storm Sewer Design Parameters

- Minimum pipe diameter of 250 mm
- Formula: Manning's assuming n=0.013 for all pipe, n=0.035 for all open channels.

6.2 Off-Lot Conveyance

Existing drainage characteristics sees water that sheds to the north, east, and west before generally migrating towards the existing swale that runs along the Pemberton Farm Road East. From the swale, flows are directed under the roadway via. an existing 450mm concrete culvert located at the intersection of Sunstone Way and Pemberton Farm Road East. The culvert discharges to a local creek that runs parallel to Pemberton Farm Road East, which ultimately leads to the Lillooet River.

It is understood that the existing swale system along Pemberton Farm Road East has poor conveyance capacity and will be re-instated or replaced as part of future roadworks upgrades.

In lieu of discharging to the existing swale system, a new storm outfall will be constructed as part of the Lot C subdivision, which will allow flows from the site to directly discharge to the local creek west of Pemberton Farm Road East. Detailed design of the storm outfall will be provided at Building Permit.

6.3 On-Lot Conveyance

Stormwater management criteria (a), (b), and (c) are satisfied with a conventional curb and gutter, and piped storm sewer system. In general, the 100-year flow in maintained within the storm sewer system below grade and generally within the pipe.

The on-lot storm sewer will be entirely gravity-based and follow the proposed road alignments. Stubs for future connection will be provided at the edge of Road A paving, with downstream pipes sized for future flows.

6.4 Peak Flow Detention

The existing undeveloped site is generally defined by exposed and shallow bedrock. Currently, rain that falls on Lot C runs off quickly to the surrounding areas with minimal flow retention and minimal infiltration.

It is anticipated that peak flows will decrease as a result of the proposed subdivision. Specifically, introduction of landscaped areas around the houses will provide storage volume on-site thereby reducing peak runoff rates. As such, the proposed subdivision will satisfy stormwater criterion (d) without the use of engineered detention systems.

6.5 Stormwater Treatment

To satisfy stormwater management criterion (f), a mechanical Oil-Grit Separator unit will be installed near the intersection of Sabre Way and Road B. All storm flows from the proposed lots and Road B will be pass through the treatment unit before discharging to the adjacent storm sewer and environment. Shop drawings and engineering design will be provided at detailed design to certify that the proposed infrastructure will satisfy the 80% TSS removal criterion.

7.0 Shallow Utilities / Street Lighting

Hydro and communication services will be provided by a traditional underground system. Hydro distribution and coordination with other shallow utilities is currently underway.

In discussion with VoP Staff, streetlighting design will be dark-sky friendly and will only be proposed at key locations.

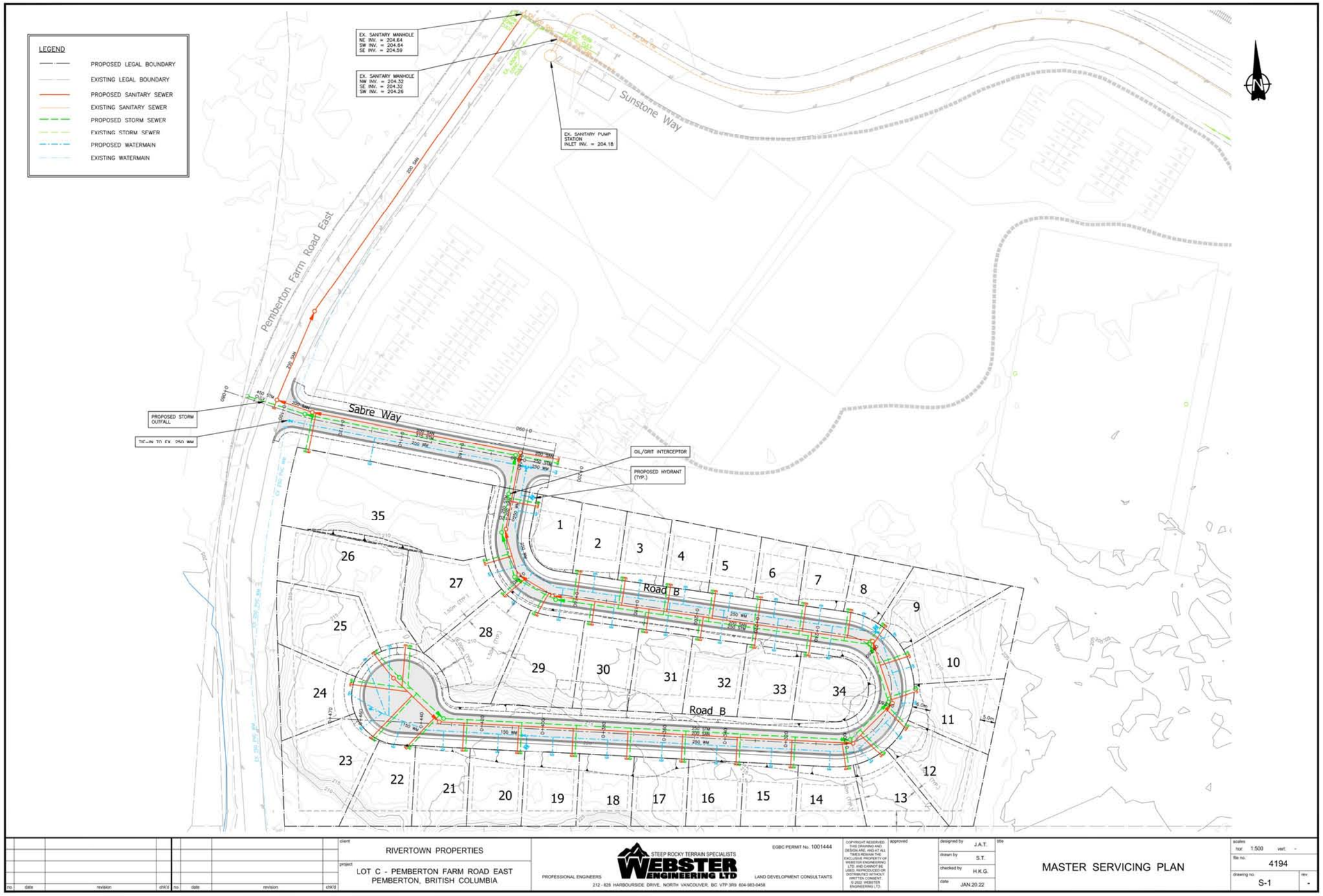
If you have any questions or comments in this regard, please call us at (604) 983-0458.

All of which is respectfully submitted by:

WEBSTER ENGINEERING LTD.

John Tynan, P.Eng.
Principal

Appendix A: Design Drawings



RIVERTOWN PROPERTIES

LOT C - PEMBERTON FARM ROAD EAST
PEMBERTON, BRITISH COLUMBIA

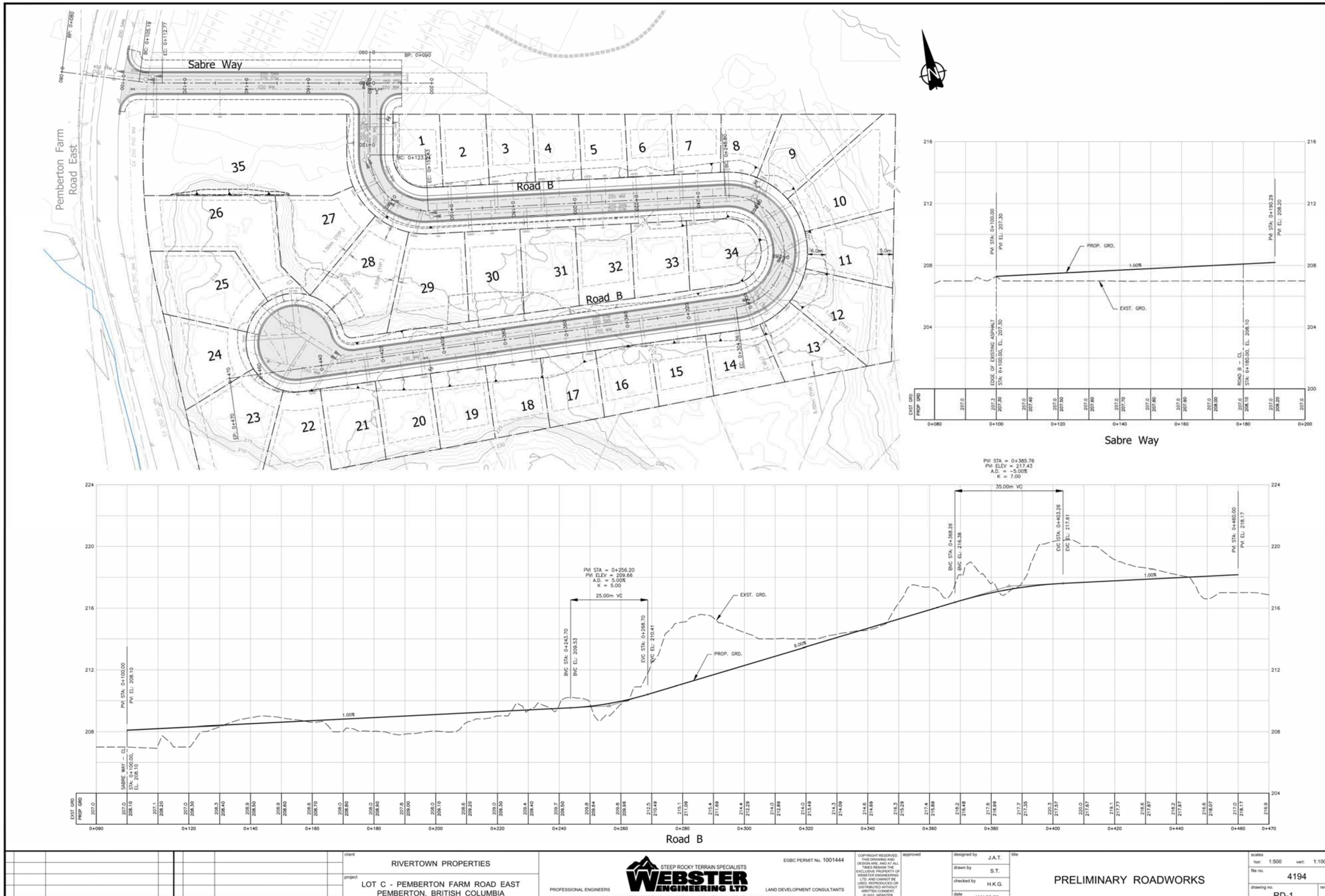
STEEP ROCKY TERRAIN SPECIALISTS
WEBSTER ENGINEERING LTD
PROFESSIONAL ENGINEERS
212 - 828 HARBOURSIDE DRIVE, NORTH VANCOUVER, BC V7P 3R9 604-983-0458
LAND DEVELOPMENT CONSULTANTS

EGBC PERMIT No. 1001444

designed by J.A.T.
drawn by S.T.
checked by H.K.G.
date JAN.20.22

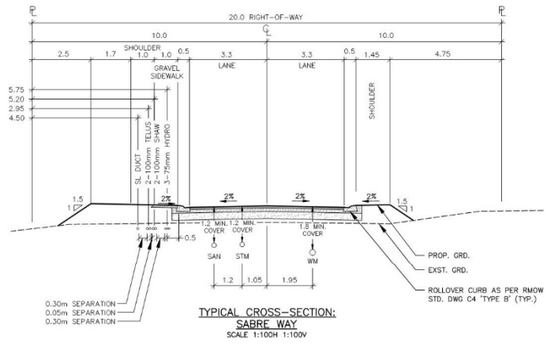
MASTER SERVICING PLAN

scales hor. 1:500 vert. -
file no. 4194
drawing no. S-1
rev -


Sabre Way
Road B
Road B
Pemberton Farm Road East
Sabre Way
Road B
PROP. GRD.
EXST. GRD.
25.00m VC
35.00m VC
client
RIVERTOWN PROPERTIES
project
LOT C - PEMBERTON FARM ROAD EAST
PEMBERTON, BRITISH COLUMBIA
STEEP ROCKY TERRAIN SPECIALISTS
WEBSTER ENGINEERING LTD
PROFESSIONAL ENGINEERS
LAND DEVELOPMENT CONSULTANTS
EGBC PERMIT No. 1001444
designed by J.A.T.
drawn by S.T.
checked by H.K.G.
date JAN.20.22
PRELIMINARY ROADWORKS
scales hor: 1:500 vert: 1:100
file no. 4194
drawing no. RD-1

ROAD STRUCTURE
40mm SURFACE LIFT ASPHALT PER MMCD (UPPER COURSE #2)
45mm BASE LIFT ASPHALT PER MMCD (LOWER COURSE #2)
100mm – 19mm MINUS CRUSHED GRANULAR BASE (CGB) COMPACTED TO 95% MMPDD
300mm – 75mm MINUS CRUSHED GRANULAR SUB-BASE (CGSB) COMPACTED TO 95% MMPDD
ROAD STRUCTURE PLACEMENT TO THE SATISFACTION OF THE GEOTECHNICAL ENGINEER

ALL DIMENSIONS ARE IN METRES



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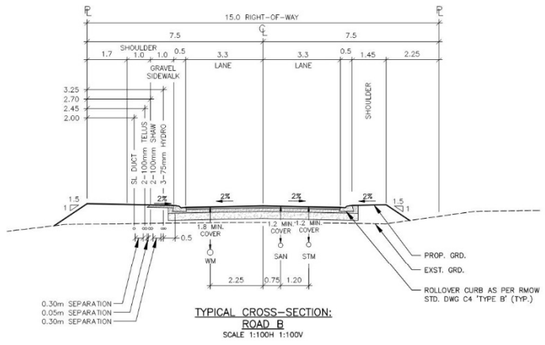
SABRE WAY
SCALE 1:100H 1:100V



TYPICAL CROSS-SECTION:
ROAD B
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no.	date	revision	chk'd	no.	date	revision	chk'd

client: RIVERTOWN PROPERTIES

project: LOT C - PEMBERTON FARM ROAD EAST
PEMBERTON, BRITISH COLUMBIA

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EGBC PERMIT No. 1001444

approved

designed by J.A.T.
drawn by S.T.
checked by H.K.G.
date JAN.20.22

title: PRELIMINARY
TYPICAL CROSS - SECTIONS

scales hor: 1:100 vert: -
file no. 4194
drawing no. TYP-1
rev. -

Appendix B: Water Demand Calculations

Type: Domestic Water Demand - Lot C

Project:	Lot C - Pemberton Farm Road East	File:	4194
Location:	Pemberton, BC	Date	July 4, 2022 - V.1
Client:	Rivertown Properties	Prep'd By:	BJW / JAT

1) Bylaw Parameters

As per *Squamish Lillooet Regional District (SLRD) Subdivision and Development Servicing Bylaw No. 741, 2002*

Population Equivalents:		
Single Family (Conventional)	=	4 cap/lot
Multi Family	=	3 cap/unit
Single Family (with Secondary Suite)	=	7 cap/lot
Commercial	=	90 cap/ha

As per *Village of Pemberton Subdivision and Development Control Bylaw No. 677, 2011*

Per Capita Demands:		
Maximum Daily Demand (MDD) Unit Rate	=	910 L/cap/day
Peak Hour Demand (PHD) Unit Rate	=	1820 L/cap/day

2) Population

Single Family Lots (Conventional)		8 lots	
Population Equivalent	x	4 cap/lot	*(as above)*
Population	=	32 cap	
Single Family Lots (with Secondary Suite)		26 units	
Population Equivalent	x	7 cap/unit	*(as above)*
	=	182 cap	
Commercial Lot Area		0.17 ha	
Population Equivalent	x	90 cap/ha	*(as above)*
Population	=	15 cap	
Total Population	=	**229 cap**	

3) Maximum Daily Demand (MDD)

MDD Unit Rate		910 L/cap/day	*(as above)*
Population	x	229 cap	*(as above)*
MDD	=	208390 L/day	
MDD	=	**2.41 L/s**	

4) Peak Hour Demand (PHD)

PHD Unit Rate		1820 L/cap/day	*(as above)*
Population	x	229 cap	*(as above)*
PHD	=	416780 L/day	
PHD	=	**4.82 L/s**	

Appendix C: Sanitary Demand Calculations

SANITARY DESIGN FLOW

Lot C - Pemberton Farm Road East

Use MMCD Parameters

As per Village of Pemberton Subdivision and Development Bylaw No. 677, 2011 use MMCD methodology for design flow calculations. Use MMCD Design Guidelines 2014.

1) Population

Land Use:	Units	Pop. Equiv. (cap/unit)	
Single Family (Conventional)	8	4	(from SLRD Bylaw No. 741)
Multi Family	0	3	(from SLRD Bylaw No. 741)
Single Family (with Secondary Suite)	26	7	

	Area (ha)	Pop. Equiv. (cap/ha)	
Commercial	0.17	90	(per MMCD)

Population = **229 cap**

2) Average Dry Weather Flow (ADWF)

Average Daily Demand		410 L/cap/day	(VOP Bylaw No. 677)
Total Population	x	229 cap	(as above)
Average Dry Weather Flow		93890 L/day	
	=	**1.09 L/s**	

3) Peak Dry Weather Flow (PDWF)

PDWF = ADWF x Peaking Factor

Peaking Factor	=	3.2 / population in thousands$^{0.105}$	(MMCD)
	=	3.2 / $1^{0.105}$	
	=	3.20	
Average Dry Weather Flow		1.09 L/s	(as above)
Peaking Factor	x	3.20	(as above)
Peak Dry Weather Flow	=	**3.48 L/s**	

4) Design Flow = Peak Wet Weather Flow (PWWF)

PWWF = PDWF + Infiltration Allowance

Catchment Area		0.9 ha	
Unit Infiltration Rate	x	0.17 L/s/ha	
Infiltration Allowance	=	0.16 L/s	(VOP Bylaw No. 677, 2011)
Peak Dry Weather Flow		3.48 L/s	(as above)
Infiltration Allowance	+	0.16 L/s	(as above)
Peak Wet Weather Flow	=	**3.63 L/s**	

Appendix D: Fire Flow Calculations

1.) Parameters and Assumptions

- Material Type: Ordinary Construction
- Building considered to be Low Hazard Occupancy.
- Building is retrofitted with Fire Suppression Sprinklers.

2.) Calculation

- The following calculation is based on "Water Supply for Fire Protection" (1999) published by the Fire Underwriters Survey.

(a) Building Type and Size

C = 1.0 (Ordinary Construction)
A = 780 m²

(b) Initial Fire Flow

Finitial = 220CA^.5
= 6,144 L/min
= 6,000 L/min (Rounded to nearest 1000)

(c) Low content hazard, 25% credit

F(c) = 1,500 L/min $F_{revised}$ = 4,500 L/min

(d) Fire Suppression Sprinklers @ 50% credit

F(d) = 2,250 L/min

(e) Exposures

North	0.0%	
East	5.0%	
South	10.0%	
West	0.0%	
Total	15.0%	(Max 75%)

Maximum Charge:	
0 to 3m	*25%*
3 to 10m	*20%*
10 to 20m	*15%*
20 to 30m	*10%*
30 to 45m	*5%*

F(e) = 675 L/min

(f) Fire Demand

F = Frevised - F(d) + F(e) = 2,925 L/min for 1.25 hours
= 3,000 L/min (Rounded to nearest 1000)
= 50 L/s

FIRE FLOW = 50 L/s

1.) Parameters and Assumptions

- Material Type: Wood Frame Construction
- Building considered to be Low Hazard Occupancy.
- Building is retrofitted with Fire Suppression Sprinklers.

2.) Calculation

- The following calculation is based on "Water Supply for Fire Protection" (1999) published by the Fire Underwriters Survey.

(a) Building Type and Size

C = 1.5 (Wood Frame Construction)
A = 780 m²

(b) Initial Fire Flow

Finitial = 220CA^.5
= 9,216 L/min
= 9,000 L/min (Rounded to nearest 1000)

(c) Low content hazard, 25% credit

F(c) = 2,250 L/min $F_{revised}$ = 6,750 L/min

(d) Fire Suppression Sprinklers @ 50% credit

F(d) = 3,375 L/min

(e) Exposures

North	0.0%	
East	5.0%	
South	10.0%	
West	0.0%	
Total	15.0%	(Max 75%)

Maximum Charge:	
0 to 3m	*25%*
3 to 10m	*20%*
10 to 20m	*15%*
20 to 30m	*10%*
30 to 45m	*5%*

F(e) = 1,013 L/min

(f) Fire Demand

F = Frevised - F(d) + F(e) = 4,388 L/min for 1.5 hours
= 4,000 L/min (Rounded to nearest 1000)
= 67 L/s

FIRE FLOW = 67 L/s

1.) Parameters and Assumptions

- Material Type: Ordinary Construction
- Building considered to be Low Hazard Occupancy
- No Fire Suppression Sprinklers

2.) Calculation

- The following calculation is based on "Water Supply for Fire Protection" (1999) published by the Fire Underwriters Survey.

(a) Building Type and Size

C = 1.0 (Ordinary Construction)
A = 780 m²

(b) Initial Fire Flow

Finitial = 220CA^.5
= 6,144 L/min
= 6,000 L/min (Rounded to nearest 1000)

(c) Low content hazard, 25% credit

F(c) = 1,500 L/min $F_{revised}$ = 4,500 L/min

(d) Fire Suppression Sprinklers @ 0% credit

F(d) = 0 L/min

(e) Exposures

North	0.0%	
East	5.0%	
South	10.0%	
West	0.0%	
Total	15.0%	(Max 75%)

Maximum Charge:	
0 to 3m	*25%*
3 to 10m	*20%*
10 to 20m	*15%*
20 to 30m	*10%*
30 to 45m	*5%*

F(e) = 675 L/min

(f) Fire Demand

F = Frevised - F(d) + F(e) = 5,175 L/min for 1.75 hours
= 5,000 L/min (Rounded to nearest 1000)
= 83 L/s

FIRE FLOW = 83 L/s

1.) Parameters and Assumptions

- Material Type: Wood Frame Construction
- Building considered to be Low Hazard Occupancy.
- No Fire Suppression Sprinklers
- Building is divided into two sections with Fire Wall.

2.) Calculation

- The following calculation is based on "Water Supply for Fire Protection" (1999) published by the Fire Underwriters Survey.

(a) Building Type and Size

C = 1.5 (Wood Frame Construction)
A = 390 m² (Divided Floor Area)

(b) Initial Fire Flow

$F_{initial}$ = 220CA^.5
= 6,517 L/min
= 7,000 L/min (Rounded to nearest 1000)

(c) Low content hazard, 25% credit

F(c) = 1,750 L/min $F_{revised}$ = 5,250 L/min

(d) Fire Suppression Sprinklers @ 0% credit

F(d) = 0 L/min

(e) Exposures

North	0.0%	
East	5.0%	
South	10.0%	
West	0.0%	
Total	15.0%	(Max 75%)

Maximum Charge:	
0 to 3m	*25%*
3 to 10m	*20%*
10 to 20m	*15%*
20 to 30m	*10%*
30 to 45m	*5%*

F(e) = 788 L/min

(f) Fire Demand

F = $F_{revised}$ - F(d) + F(e) = 6,038 L/min for 2.0 hours
= 6,000 L/min (Rounded to nearest 1000)
= 100 L/s

FIRE FLOW = 100 L/s

1.) Parameters and Assumptions

- Material Type: Wood Frame Construction
- Building considered to be Low Hazard Occupancy
- No Fire Suppression Sprinklers

2.) Calculation

- The following calculation is based on "Water Supply for Fire Protection" (1999) published by the Fire Underwriters Survey.

(a) Building Type and Size

C = 1.5 (Wood Frame Construction)
A = 780 m²

(b) Initial Fire Flow

Finitial = 220CA^.5
= 9,216 L/min
= 9,000 L/min (Rounded to nearest 1000)

(c) Low content hazard, 25% credit

F(c) = 2,250 L/min $F_{revised}$ = 6,750 L/min

(d) Fire Suppression Sprinklers @ 0% credit

F(d) = 0 L/min

(e) Exposures

North	0.0%	
East	5.0%	
South	10.0%	
West	0.0%	
Total	15.0%	(Max 75%)

Maximum Charge:	
0 to 3m	*25%*
3 to 10m	*20%*
10 to 20m	*15%*
20 to 30m	*10%*
30 to 45m	*5%*

F(e) = 1,013 L/min

(f) Fire Demand

F = Frevised - F(d) + F(e) = 7,763 L/min for 2.0 hours
= 8,000 L/min (Rounded to nearest 1000)
= 133 L/s

FIRE FLOW	**=**	**133 L/s**