



Agua Consulting Inc.

“Engineered Water Solutions”

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October 25, 2016

District of Summerland
9215 Cedar Avenue
Box 159
Summerland, BC
V0H 1Z0

Attention: Mr. Devon van der Meulen, Manager of Utilities

Dear Devon:

**RE: Banks Crescent – Proposed 302 Unit Multi-Family Development
Preliminary Engineering Review – Water Supply Requirements**

1.0 INTRODUCTION

This letter sets out our initial review of the water supply servicing requirements for the 302 multi-family unit proposed at 13610 Banks Crescent. This engineering review comes as per your request in the e-mail dated October 13, 2016. The following information was reviewed and utilized in the preparation of this letter report:

- Summerland Subdivision Servicing Bylaw No. 99-004 and amendments;
- Summerland water plate maps and water base mapping;
- Summerland Arable Lands Assessment Roll;
- The most current version of the District of Summerland water distribution model;
- Development Servicing Report dated Sept 26, 2016 prepared by CTQ Consultants Ltd.;
- Architectural Drawings dated August 2, 2016 prepared by Derek Crawford Architects;
- Aerial images (Google Earth);
- District of Summerland 2008 Water Master Plan, System Separation Plan Layout;

This report is comprised of the following five sections:

1. Introduction
2. Engineering Criteria
3. Proposed Development
4. Water Service Assessment
5. Summary

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- Phone: 250.212.3266

Figure 1.1 - Existing Land Use



The multi-family development is proposed on Lot A, District Lot 455, Plan 2091, at the south limits of Latimer Avenue, at 13610 Banks Crescent. The land proposed for development is approximately 14.43 acres in size of which only 6.72 acres will be used for the development.

Existing land use is primarily as orchard as illustrated in Figure 1.1. The property has 4.75 acres of arable land registered with the District of Summerland for irrigation. The farmed area appears to be slightly larger at 5.0 acres. One single family residence exists on the site with access off of Latimer and Lynx Avenue.

2.0 ENGINEERING CRITERIA

Criterion for the engineering review is generally consistent with District of Summerland Subdivision and Servicing Design Bylaw No. 99-004 and amendments. Specific criteria used are as follows:

Roughness Coefficient “C” for new PVC (exception to bylaw)	130
Maximum Allowable Velocity under fire flow (FF) condition	4.0 m/s
Maximum Allowable Velocity under Peak Hour Demand (PHD) condition	2.0 m/s
Minimum Pipe Size	150 mm dia.
Minimum Fire Flow (FF)	As per FUS
Maximum flow from a single hydrant	90 L/s
Minimum Residual Pressure under Max Day Demand (MDD) plus FF	14.1m (20 psi)
Maximum Water main length (not interconnected)	200 metres
Fire Flow duration (as per FUS guidelines for flow rate)	see table below
Maximum hydrant spacing for flow for residential (as per FUS guidelines)	see table below

Table 2.1 – FUS Guideline Table

Flow (L/s)	Flow (L/min)	Std Hydrant Coverage (m ²)	Req'd Hydrant Radius (m)	Hydrant Diameter	Duration (hr)	FF Storage Vol + 25% emerg. (m ³)	Flow	No. of Hydrants
60	3600	15200	69.6	139.1	1.400	378		1 hydrant
75	4500	14750	68.5	137.0	1.670	564		1 hydrant
90	5400	14300	67.5	134.9	1.870	757	90 L/s	1 hydrant
125	7500	13250	64.9	129.9	2.000	1125		2 hydrants
150	9000	12500	63.1	126.2	2.000	1350	150 L/s	2 hydrants
175	10500	11750	61.2	122.3	2.130	1677		3 hydrants
200	12000	11000	59.2	118.3	2.500	2250		3 hydrants
225	13500	10375	57.5	114.9	2.875	2911	225 L/s	3 hydrants
250	15000	9750	55.7	111.4	3.250	3656		4 hydrants
275	16500	9375	54.6	109.3	3.625	4486	280 L/s	4 hydrants
300	18000	9000	53.5	107.0	4.000	5400		> 4 hydrants
325	19500	8625	52.4	104.8	4.375	6398		> 4 hydrants
350	21000	8250	51.2	102.5	4.750	7481		> 4 hydrants

Table 2.1 is derived from the tables on page 16 in the FUS Guideline document (1999). Once building types and siting are confirmed, the developer’s engineer is required to submit a FUS calculation to show the fire demand for the proposed housing type, density, building materials and exposures proposed for this development.

Criteria utilized by not defined or within Subdivision Servicing Bylaw;

Domestic Water Demand – 2.35 persons / MF residence (Bylaw) 500 L/ca/day
 Irrigation Water Demand - maximum of irrigated land area equivalency to residential irrigation.

These criterions that are not within the Subdivision Bylaw must be confirmed to be acceptable by the District of Summerland.

3.0 PROPOSED DEVELOPMENT

The development is to consist of five buildings in relatively close proximity of each other, housing 302 multi-family units. Their preliminary layout is presented in Figure 3.1.

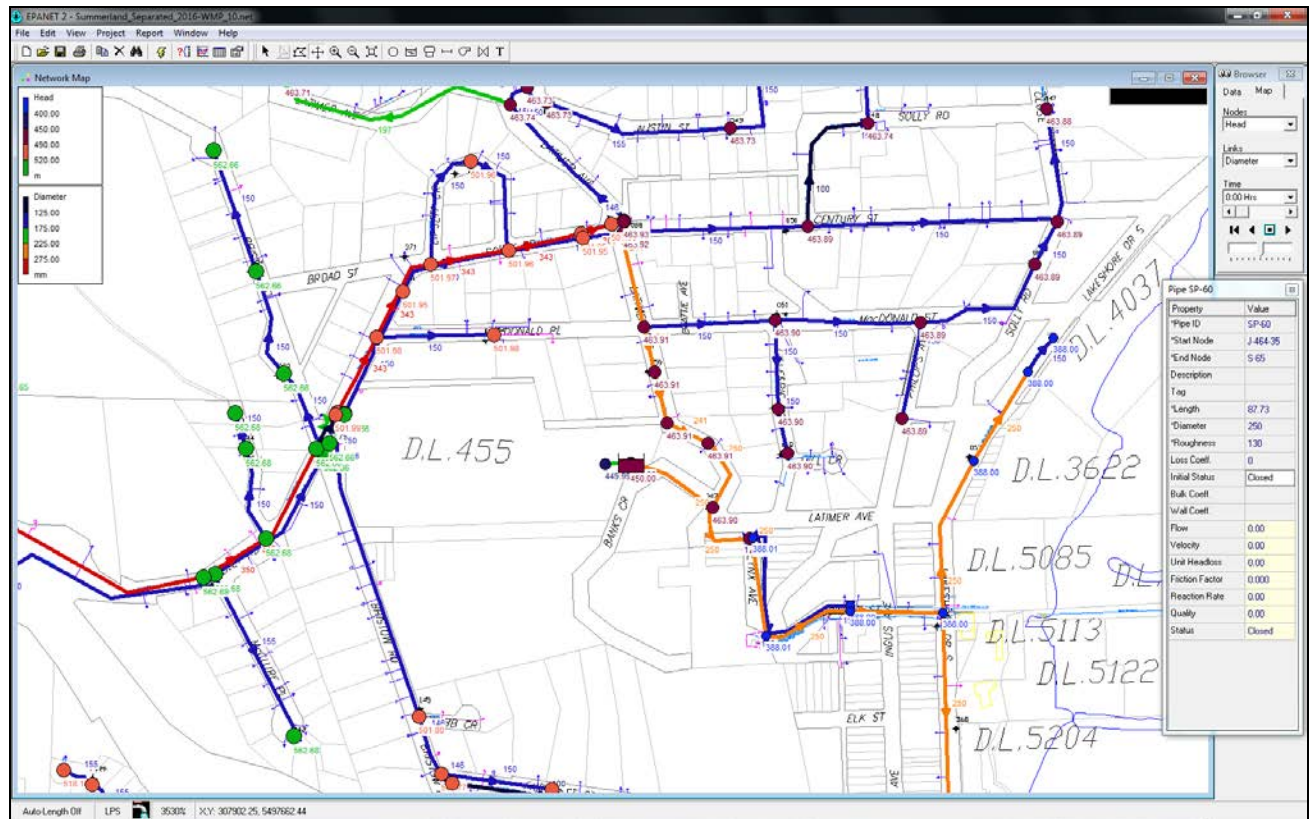
Figure 3.1 - Proposed Development Plan (Derek Crawford Architects Inc.)



Building site elevations across the proposed development site range from 407 metres at the main centre area for Buildings A, B and C to 397 metres main floor elevation for Building E at the east end. The highest floor to be serviced for the site is 427 metres.

A plan showing the existing water mains that feed the area is presented in Figure 1.2 on the next page. Water main sizes are listed in millimetres (inside diameter) and are colour-coded as per the bar graph in the image.

Figure 1.2 - Existing Local Water Mains



Existing Pressure Zones

Figure 1.2 presents the existing hydraulic grade lines (HGL) for off-site water mains near the development site. There are three pressure zones in the vicinity of the site, PZ 563 (green nodes), PZ 501 (orange nodes) and PZ 463 (brown nodes). All zone identifications are based on the hydraulic grade line of the water system under maximum day water demand. The pressure zones all feed down from the Summerland Water Treatment Plant which has an operating HGL of approximately 586 metres.

PRV 8, which is a 200mm valve with 75mm low flow valve, exists on Solly Road that connects PZ 563 to PZ 501. PRV 7, which is a 200 valve with 75mm low flow valve, exists on Solly Road at Latimer Avenue and connects PZ 501 to PZ 463.

3.0 WATER SERVICE ASSESSMENT

Section 3 provides a summary of our analysis of how water service can be provided to this development. With a large scale multi-family development, the critical water demand is for fire protection, considering both instantaneous flow and flow duration, which affects storage. The water distribution system must have the capacity to supply water for fire protection, indoor domestic use and outdoor domestic irrigation for lawn watering and incidental uses at the same critical time.

The District of Summerland EPANET model was utilized to estimate hydraulic capacity of the water distribution system. Computer model analysis was carried out to estimate the off-site water supply capacity. The storage capacity available from the Summerland Water Treatment Plant was reviewed to check the available fire storage capacity for the duration of fire flow.

Proposed Development Plan

The proposed preliminary plan by the developer is to connect to the 250mm diameter main on Latimer Avenue. This main has significant flow capacity, but also supplies water to the Old Town area below along Lakeshore Drive South. This main has limited hydraulic grade line capacity to feed back up the hillside.

Water Demand Assessment

The additional maximum daily domestic water demand created by the proposed development is estimated as follows:

$$302 \text{ MF units} \times 2.35 \text{ persons / residence} \times 500 \text{ L / ca / day} = \quad \mathbf{MDD = 4.11 \text{ L/s}}$$

The irrigation water demand required for the proposed development is to irrigate a land area of only 0.69 acres. The irrigation demand is estimated as follows :

$$0.69 \text{ acres} - \text{ equivalent to irrigation for 3 SF residences, maximum of 10 USgpm irrigation per residence} - = 30 \text{ USgpm flow or two irrigation zones of 15 USgpm/min. each} = \mathbf{MDD = 1.89 \text{ L/s}}$$

A variance would have to be applied for in the subdivision bylaw to permit the lower per capita design number of 500 L/ca/day. The property has significant irrigation capacity at the present time with 4.75 acres of arable land at 6.5 USgpm/acre.

Separated Irrigation and Domestic Water Distribution System

The 2008 Water Master Plan was reviewed. The subject property is within an irrigation pocket with very few nearby agricultural lands. Project 17 in the 2008 Water Master Plan covers the separation of lands in this part of Summerland. Project 17 focused on getting irrigation water to lands to the south around Giant's Head, but due to the lack of surrounding irrigation land at this site, a separate irrigation and domestic water system is not proposed for this area. Therefore all water to this site will originate from the domestic water distribution system.

Computer Model Analysis

There are several options for supplying water to the proposed development site:

1. Access PZ 463 and flow water down Latimer Avenue to the site (as per CTQ Servicing Report);
2. Access PZ 502 and obtain water from below PRV 8 by installing a main down the steep bank and reducing water pressure as required to service the lots;
3. Access PZ 563 and obtain water from above PRV 8 and service the site similar to Option 2;

The model was tested first from PZ 463 and then from PZ 502.

3.1 SERVICING FROM PZ 463 - LATIMER AVENUE

The computer model was tested to determine the available water from PZ 463. A criteria limiting water supply capacity is the 4.0 m/s maximum velocity under fire flow. For a 250mm diameter main this limits flow to 196 L/s. When subtracting the MDD for irrigation and domestic demands, this is further reduced by 6.0 L/s to 190 L/s available for fire flow.

As modelled, there is 140 L/s, subtract the 6.00 L/s for irrigation and domestic demands, there is only 134 L/s fire flow capacity to the site with a residual HGL of 450m. A residual hydraulic grade line of 450 metres is insufficient to get sufficient water pressure to the upper building floor fire sprinklers.

With the highest floor at elevation 425 metres, a residual HGL of 472 metres is desired to get sufficient pressures to the sprinkler system. There are options for the developer to consider for the sprinkler system including an in-building fire pump system with emergency generator or connect to a higher pressure zone.

Results of pressure drawdown versus flow from the Summerland mains in PZ 463 is presented in Figure 3.1 and summarized in Table 3.1.

3.2 SERVICING FROM PZ 502 (SOLLY ROAD)

Supplying water to the site from Solly Road is viable as the main size and hydraulic grade line is sufficient to provide water to the highest floors of the proposed buildings, i.e. the fire protection sprinkler system. With a HGL at 502 meters elevation, a 180m length of 250mm diameter water main would be required to get the water from Solly Road, down the steep bank to the development site.

Based on a maximum pipe velocity of 4.0 m/s, if a 250mm diameter main is used, then a maximum flow of 196 L/s can be provided. If a 300 mm diameter main is used, then based on velocity, a theoretical maximum flow of 270 L/s can be provided to the site, however this is limited by fire storage to 225 L/s.

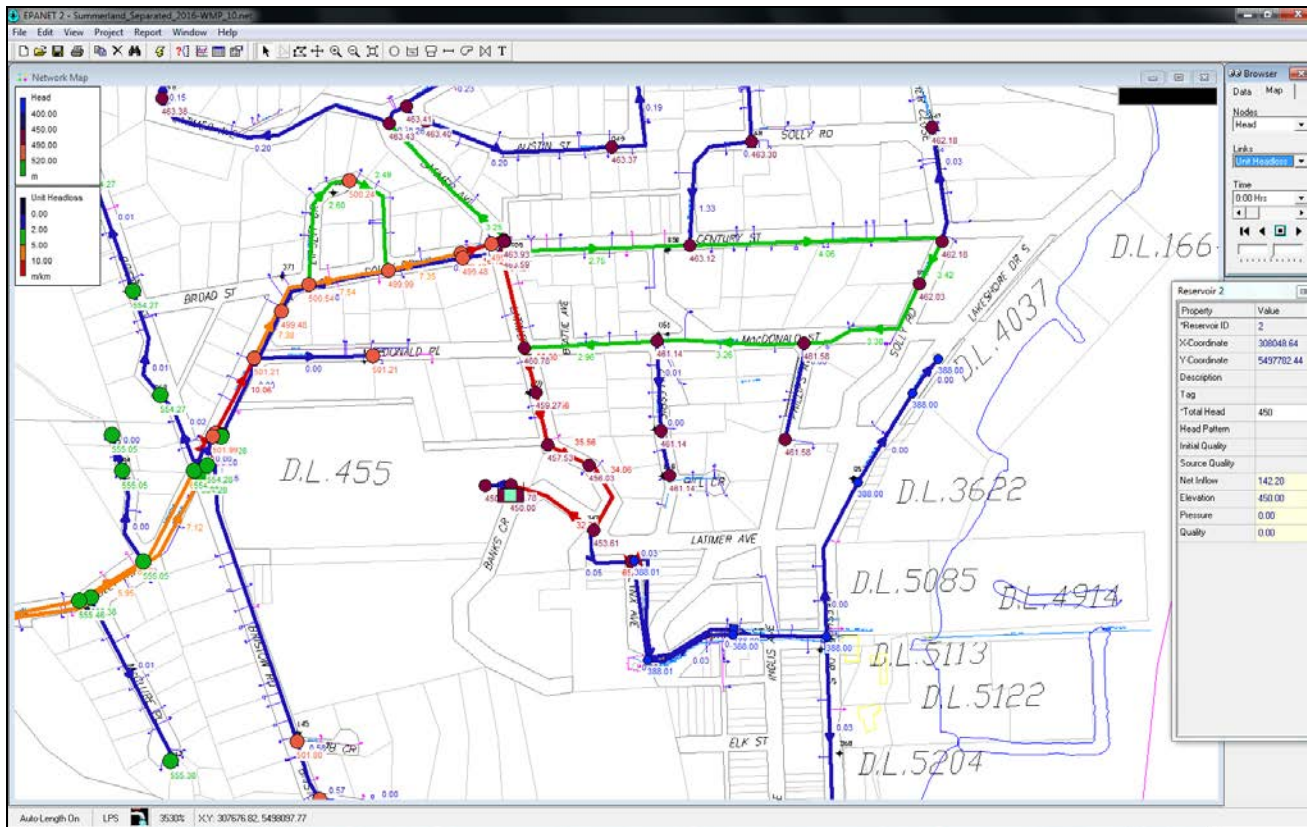
The service water main would have to be routed to a central location on-site, likely to a mechanical room in the parking garage where it could pass through a PRV station to drop the HGL so that pressures are not excessive at the lowest service elevations. It is likely that the pressure only has to be dropped by 20 m of head. From the central on-site location, the water could be routed through to the on-site hydrants.

Results of pressure drop versus flow for this option is presented in Figure 3.2 and summarized in Table 3.2.

3.3 SERVICING FROM PZ 563 (SOLLY ROAD)

Supplying water to the site from the high side of PRV 8 on Solly Road was not modelled as there is sufficient water from below the PRV. The pressures generated by connection above PRV 8 would be too high and well above bylaw limits for maximum water pressure

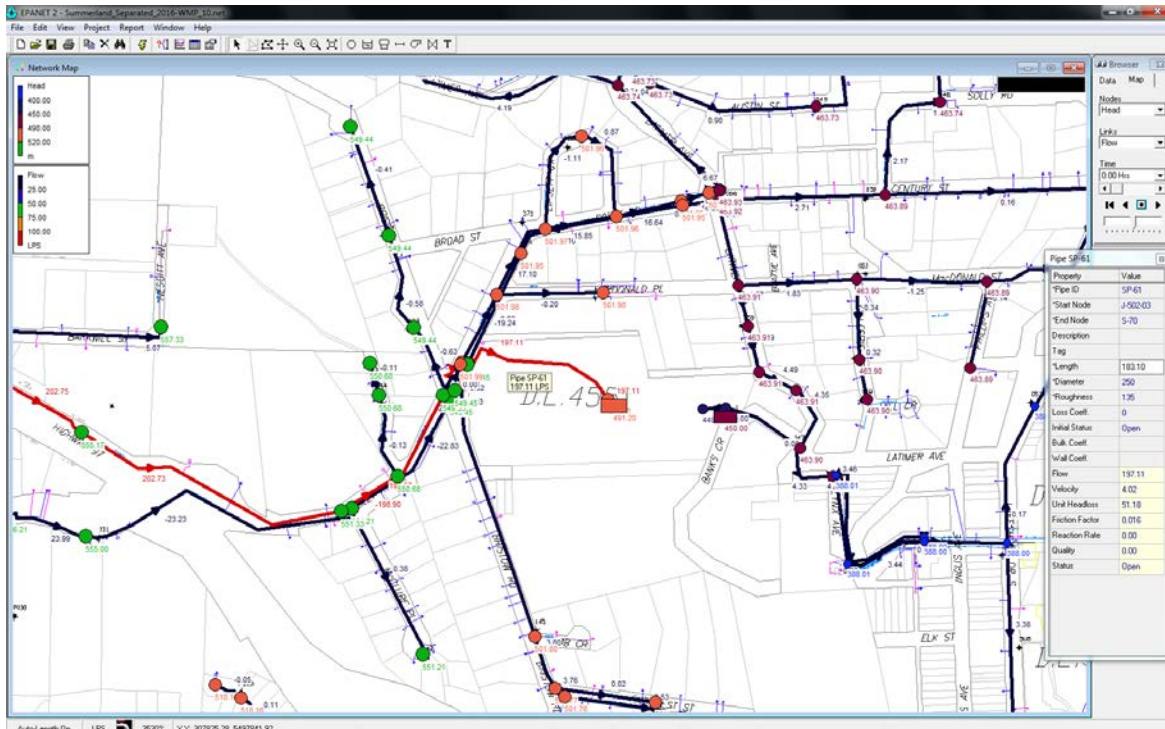
Figure 3.1 - Residual HGL and Unit Head loss



MODELLING SUMMARY		Table 3.1				
Water System	District of Summerland					
EPANET Model version	Summerland_2016_WMP_10.net					
Analysis Date	October 24, 2016					
Demand Condition	Maximum Day Demand (0:00 hours)					
Special Condition Description	Simulated demand to provide maximum of 4.0 L/s through 250mm main from Solly Road to development site					
Node Analyzed, Description	Node at centre of development buildings					
Node Elevation	404 m (Estimated)					
Node Hydraulic Grade Line	Static condition 463m under static conditions (59 m head or 84 psi)					
Est. Residual HGL (metres)	463	500	495	491.2	485	480
psi	84	80	65	52	37*	23*
Est. Total Flow (L/s)	0 L/s	67	142	194	236*	272*

* Exceeds maximum velocity criteria of 4.0m/s in 250 mm diameter water main

Figure 3.2 – Available HGL at Development Site



MODELLING SUMMARY		Table 3.2				
Water System	District of Summerland					
EPANET Model version	Summerland_2016_WMP_10.net					
Analysis Date	October 24, 2016					
Demand Condition	Maximum Day Demand (0:00 hours)					
Special Condition Description	Simulated demand to provide maximum of 4.0 L/s through 250mm main from Solly Road to development site					
Node Analyzed, Description	Location at Centre of Buildings					
Node Elevation	404 m (Estimated)					
Node Hydraulic Grade Line	Static condition 502m under static conditions (98 m head or 139 psi)					
Est. Residual HGL (metres)	503	500	495	491.2	485	480
psi	141	136	129	124	115*	108*
Est. Total Flow (L/s)	0 L/s	79.2	156	197	327*	349*

** model run with 300mm diameter main due to max. velocity achieved at 197 L/s for 250 main*

If a 300 mm diameter main were utilized, the 4.0 m/s velocity criteria would not be exceeded until the flows were at 280 L/s.

To be consistent with the 2008 Water Master Plan, it was identified that the maximum fire flow available to the downtown core was 225 L/s for a duration of 2.875 hours. The fire flow to this site cannot exceed that rate and duration of flow. As a precaution, Summerland should check to see that there is 2911 m³ of water storage in the WTP clear well at all times of operation.

4.0 SUMMARY

Based on our initial review, the following points are provided to assist in directing water service development for this site:

- The maximum daily design demand for the 302 multi-family unit development, based on an indoor domestic demand of 500 L/ca/day, is estimated to be 4.11 L/s. This criteria is not clearly defined within the subdivision bylaw but is conservative for indoor water demand;
- The seasonal outdoor irrigation demand is for an area of approximately 0.69 acres. We are recommending a maximum design flow of 1.89 L/s (30 USgpm) be permitted as this allows the area to have two sprinkler zones running at any one time during the permitted irrigation times;
- The total maximum daily demand including domestic and irrigation is 6.00 L/s;
- Fire protection is the critical design factor for the water system. For the design fire demand, we would recommend that a maximum fire flow of 190 L/s be set if the source is originate from Solly Road. If the source is from Latimer Road, then we would recommend a maximum flow of 184 L/s be the design number as additional flow is required through the main on Latimer Avenue to service lower town;
- The maximum design fire flow from the Summerland Water Treatment Plant is 225 L/s for a duration of 2.875 hours. This is the design flow to the downtown core. Summerland should verify that the water storage volume at the WTP does not drop below 2911 m³ at any time;
- There are two options set out for providing water service to the development. The higher capacity option is to access the 350mm main on Solly Road directly west of the development site. A water main installation would be required off of Solly Road down the steep slope to the site with either a 250 or 300mm main being required. This option is presented in Figure 3.1 and Table 3.1;
- The lower capacity water supply option via Latimer Road is presented in Figure 3.2 and Table 3.2;
- It is foreseen that due to floor area size and building code requirements, all of the larger multi-family buildings will be sprinkler protected;
- To provide fire flow to the development, the design flow will include the sprinkler system demand and up to 3 hydrants. These would be privately owned and maintained. Provided there is adequate supply pressure and flow, the maximum flow from any one hydrant is 90 L/s;
- The developer must determine whether they wish to install on-site pressure boosting and a fire pump/emergency generator, or a PRV station to reduce operating pressures and provide fire suppression to the highest building floors of the development by gravity. The PRV is the less expensive and more reliable than an emergency generator and fire pump. The developer should review the options and come back to Summerland with their proposal.
- The recommendation of Agua is to develop a connection on Solly Road from just below PRV 8.

Please contact us if you any questions regarding this report.

Yours truly,

Agua Consulting Inc.



Robert Hrasko, P.Eng.
Principal