

Ayrburn Farm Developments Limited  
Cruickshank Pryde  
Unit 23 Gorge Rd Retail Centre  
159 Gorge Rd  
Queenstown 9300

C/- Andrew Cavill, Winton partners

Attention: Andrew Cavill

Dear Andrew

### **Water supply modelling results for Ayrburn Farm development, Lake Hayes.**

Following our recent discussions with Chris Hansen on 21 October 2015, and in accordance with his request on Ayrburn Farm Developments Limited behalf, we are pleased to confirm the basis on which we will provide water supply modelling services for Ayrburn Farm Developments Limited as our client.

We understand based on discussions with Chris Hansen of Clark Fortune McDonald and Associates (CMFA) that you require a water supply modelling report to assist in the scoping of the proposed 150 lot residential Ayrburn Farm development, and support your submission to the district plan for this development.

### **Development setting**

We have undertaken initial discussions with Queenstown Lakes District Council (QLDC)<sup>1</sup> to identify which water supply network the proposed development should connect to (i.e. Arrowtown or Lake Hayes), and the Lake Hayes water supply network has been specified. Modelling proceeded on the basis of connection to the existing Lake Hayes water supply network at Speargrass Flat Rd/ Arrowtown-Lake Hayes Road (connection to the existing 225 mm diameter main). Specific details of the connection location should be discussed and agreed with QLDC.

The Lake Hayes water supply network is understood to be constrained by the capacity of the intake and reservoir system, such that historically during peak demand periods the total daily demand volume exceeded the intake capacity, causing the reservoir to drawdown into the fire fighting and emergency storage volumes. The recently proposed network reconfiguration to supply the entirety of the Lake Hayes Estate area (including the 159 lots currently supplied from Lake Hayes Estate scheme) from the new Shotover Country network are expected to alleviate this demand such that additional capacity may exist in the Lake Hayes scheme (following this reconfiguration).

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<sup>1</sup> Pers. Comm., Rob Darby (QLDC) and Dominic Fletcher (T+T) phone conversation and email 4:58 pm 21 October 2015.

## Modelling methodology

The purpose of this modelling was to identify for the proposed development demands and indicative reticulation layout:

- i Whether available fire flows meet fire fighting requirements<sup>2</sup>,
- ii Whether the minimum residual pressures at each connection are  $\geq 300$  kPa<sup>3</sup> during the design peak hour demand scenario, and
- iii The potential effects of connecting the proposed development on levels of service in the Lake Hayes water supply network.

The modelled demand scenarios used to determine levels of service for the proposed Ayrburn Farm development connecting to the Lake Hayes water supply network were:

- **Peak day demand** - To determine whether available fire flows meet fire fighting requirements, and
- **Peak hour demand** - To determine whether minimum residual pressures at each connection are  $\geq 300$  kPa.

Fire fighting flows were determined including an allowance for hydrant losses.

## Network layout

Modelling proceeded on the basis of the indicative subdivision layout presented on the supplied draft concept plan<sup>4</sup>, connection via a new main down Arrowtown-Lake Hayes Rd, and the minimum reticulation requirements as per the QLDC "*Land Development and Subdivision Code of Practice*" (2015). Minimum reticulation sizes within the proposed development for residential areas are 100 mm diameter primary mains (for fire hydrants to connect to) with 50 mm diameter rider mains (on the other side of the road for connections to).

We have assumed FW2 fire fighting only is required for the subdivision and have undertaken indicative reticulation sizing on this basis. We note that a small retail centre is proposed and that the equivalent of FW3 fire fighting may be required for this lot (i.e. on site tanks or network supplied fire fighting). Supply of FW3 fire fighting to this lot from the network has been assessed and is commented on below.

The indicative reticulation layout as modelled is presented in Figure 1 attached.

## Design demands

The development design demands were calculated on the basis of 150 residential lots (or equivalent) in accordance with QLDC requirements, with an average day demand of 700 l/person/day and 3 persons per lot.

The design demands from the proposed development during the peak day and peak hour demand scenarios were calculated as follows:

- Average daily flow (ADF) = 3.65 l/sec (315 m<sup>3</sup>/day)
- Peak day flow (PDF) = 3.3 x ADF = 12.0 l/sec (1040 m<sup>3</sup>/day)
- Peak hour flow (PHF) = 6.6 x ADF = 24.1 l/sec (87 m<sup>3</sup>/hr)

<sup>2</sup> Fire flow requirements are in accordance with SNZ PAS 4509:2008, "New Zealand Fire Service Fire Fighting Water Supplies Code of Practice".

<sup>3</sup> The minimum residual pressure requirement is as set out in Queenstown Lakes District Council "Land Development and Subdivision Code of Practice" 2015.

<sup>4</sup> Baxter Design Group (BDG) Plan titled "Ayrburn – Draft Concept", BDG Ref: 2514-SK16 dated 01 May 2015.

These design demands were added to Mike Urban partially calibrated dynamic network analysis model for Lake Hayes, last updated September 2012. The design demands were evenly distributed throughout the proposed development pipe network for modelling.

The background demand from the Lake Hayes water supply network was taken as the design network peak day (12.9 l/sec, 1111 m<sup>3</sup>/day) which is based on previously recorded flow volumes from bulk flow meters only, and noting diurnal flow records have not yet been collected for Lake Hayes as reported previously to QLDC. Standard peak day residential demand patterns were adopted for this modelling to give the peak day flow and peak hour flows on the peak day, and assess the potential effects on intake and reservoir operation.

## Modelling results

Modelling determined that the minimum size of the new main down Arrowtown-Lake Hayes Rd (connecting the development to the existing 225 mm diameter trunk main at the intersection of Speargrass Flat and Arrowtown-Lake Hayes Rd) to enable QLDC level of service requirements to be met is a 150 mm internal diameter main. This pipe extends into the development as shown on Figure 1 attached to enable FW2 fire fighting requirements to be met.

The adopted pipe sizes in the modelled network reticulation (refer Figure 1 attached) give an indication of necessary sizing to achieve FW2 fire flow throughout the development. The exact reticulation layout and sizes are subject to detailed design.

In order to supply FW3 (or flow equivalent) to the retail area from the network, extending the length of the 150 mm main by approximately 175 m (to the south of retail area) would be required at minimum.

The modelling results associated with the adopted reticulation layout are presented in Table 1 below. Note that these results relate to the Ayrburn Farm development with a background design peak day network demand of 12.9 l/sec, and do not include demands from other proposed developments.

**Table 1 Minimum pressures and fire flow availability**

Nodes assessed	Residual pressure (kPa) <sup>(1)</sup>	Fire flow available (l/sec) <sup>(2) (3)</sup>
585	820 ≥ 300 <b>OK</b>	57 ≥ 25 <b>OK</b>
589	730 ≥ 300 <b>OK</b>	39 ≥ 25 <b>OK</b>
593	700 ≥ 300 <b>OK</b>	30 ≥ 25 <b>OK</b>
596	690 ≥ 300 <b>OK</b>	27 ≥ 25 <b>OK</b>
597	690 ≥ 300 <b>OK</b>	32 ≥ 25 <b>OK</b>
600	580 ≥ 300 <b>OK</b>	27 ≥ 25 <b>OK</b>
601	570 ≥ 300 <b>OK</b>	26 ≥ 25 <b>OK</b>
606	600 ≥ 300 <b>OK</b>	26 ≥ 25 <b>OK</b>
609	630 ≥ 300 <b>OK</b>	28 ≥ 25 <b>OK</b>
626	690 ≥ 300 <b>OK</b>	28 ≥ 25 <b>OK</b>

(1) A minimum residual peak hour pressure of 300 kPa is required as per the QLDC Land Development and Subdivision Code of Practice 2015.

(2) A total of 25 l/sec is required from within 270 m of each non-sprinklered, residential dwelling for Class FW2 fire fighting as per SNZ PAS 4509:2008.

(3) A minimum of 12.5 l/sec is required from each hydrant as per SNZ PAS 4509:2008.

Modelling shows that during the design peak hour demand scenario the residual pressures in the development will be at least 570 kPa. Hence, the Queenstown Lakes District Council (QLDC) requirement for minimum pressures being ≥ 300 kPa is met within the proposed development.

The static pressures within the development are >900 kPa due to the elevations (340 – 360 m RL) relative to the Lake Hayes Reservoir (435 m RL base level) as is consistent with the surrounding areas already serviced from the Lake Hayes water supply scheme. The modelled maximum pressures during the design peak day are 800 to 930 kPa.

Pressure reduction (i.e. a PRV) for the development would be necessary to maintain pressures below the 900 kPa maximum design pressure. Installation of a PRV is unlikely to affect the fire flow availability to the development provided the PRV setting is such that it would be fully open during fire fighting events.

Modelling has also shown that Class FW2 (25 l/sec) fire flow can be produced to all sections within the proposed development. The nearest hydrants can deliver at least 12.5 l/sec within 135 m of each proposed lot with the remaining 12.5 l/sec available from within 270 m (total of 25 l/sec as required for FW2 fire fighting).

The modelled effects due to connection of the proposed development on levels of service in the rest of the Lake Hayes are minimal. Overall peak hour pressures experience decreases of up to 5 kPa with the development when compared to the network without the development and Lake Hayes Estate. The effects on fire fighting flows are minimal.

The modelled effects on the Lake Hayes scheme headworks (intake and reservoir) (assuming Lake Hayes Estate is no longer ordinarily supplied from the Lake Hayes network) are:

- The operating level of Lake Hayes reservoir is drawn down by an additional 0.1 m (operating range 71% - 100%), and
- the intake operating time increases from approximately 16 hours (single pump only) to 19 hours/day, based on a single duty pump operating with assistance from the second intake pump for approximately 6 hours.

The reconfiguration of the network to supply Lake Hayes Estate from Shotover Country effectively increases the available capacity in the Lake Hayes scheme for additional flows greater than the design demands of the proposed development (i.e. design demands from the development of 150 lots and Lake Hayes Estate of approximately 600 lots).

## Applicability and closure

This technical water supply modelling report has been provided to aid further discussions with QLDC. The modelled network is in accordance with QLDC design requirements, however this does not constitute a reticulation design or accepted subdivision layout arrangements by QLDC. **Network design and subdivision arrangements should be discussed with QLDC to confirm their requirements.**

This modelling has been undertaken on the basis that Lake Hayes Estate is no longer usually supplied from the Lake Hayes water supply network, and therefore additional capacity is available in the Lake Hayes network for this proposed development. **As such these results are entirely contingent on the assumed network configuration** (with Lake Hayes Estate being supplied from Shotover Country).

The model is a numerical representation of the physical reality, and subsequently bears some uncertainty. The demands and peaking factors used are based on assumptions regarding the patterns of water use in the township, and are an approximation of the physical reality. Hence, actual demands within the network may differ from those modelled.

This report has been prepared for the benefit of Ayrburn Farm Developments Limited with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

In addition, the modelling results presented in this report show the available levels of service for the current Lake Hayes network, based on the design demands, and are not a guarantee of available levels of service in the future.

We trust this modelling report meets your requirements. Please contact Dominic Fletcher ([dfletcher@tonkintaylor.co.nz](mailto:dfletcher@tonkintaylor.co.nz)) on 03 363 2472 if you wish to discuss these results or any other aspect of this modelling report.

Yours sincerely,

TONKIN & TAYLOR LTD



Grant Lovell  
PROJECT DIRECTOR

Attached: Figure 1 – Aryburn Farms development - Modelled network reticulation layout

5-Nov-15

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51559.008 Ayrburn Farm Development  
Water supply network

Figure 1

**Tonkin+Taylor**



Drawn By:	MLAA
Date:	28/10/2015
Approved:	DAF
Scale:	1:3,500