

Project Memorandum

6 May 2020

Landpro Reference: 18365

Council Reference: RM19.312

To: Ethan Glover

From: Will Nicolson

Subject: Revised Aqualinc water use efficiency calculations

Good afternoon Ethan,

As discussed, it has recently come to our attention that an error has been made with regards to the Aqualinc water use efficiency calculations provided in Section 6.6 and Appendix D of the AEE provided as part of the consent replacements application (RM19.312). While the Aqualinc table presented in Appendix D does present all of the irrigation areas and their individual water needs, we noticed that the monthly and annual totals did not include all of the irrigation areas (see original table below).

Site: Queensbury Ridges Ltd						Sub-region: Central and Lakes District							
Land use	Soil type	Area (ha)	MAR Zone	Smaps PAW	Aqualinc PAW	peak daily demand (mm/day)	peak daily demand (m ³)	maximum monthly demand (mm/month)	maximum monthly demand (m ³)	90%ile annual demand (mm/year)	90%ile annual demand (m ³)	100%ile annual demand (mm/year)	100%ile annual demand (m ³)
0 Pasture	CLUDEN - YELLOW	37.40	550	70	60	5.1	1907.4	158	59,092	769	287,606	877	327,998.00
0 Pasture	LINDIS - CYAN	117.90	550	56	60	5.1	6012.9	158	186,282	769	906,651	877	1033,983.00
0 Pasture	MAUNGAWERA_1 - JADE	12.16	550	69	60	5.1	620.2	158	19,213	769	93,510	877	106,643.20
0 Pasture	MOLYNEUX - LIGHT PURPLE	108.84	550	37	40	5.5	5986.2	171	186,116	785	854,394	875	952,350.00
0 Pasture	BARRHILL - ORANGE	85.19	550	121	120	4.2	3578.0	130	110,747	672	572,477	777	661,926.30
0 Pasture	PIBURN - PEACH	31.18	550	89	90	4.7	1465.5	146	45,523	729	227,302	818	255,052.40
0 Vineyard	PIBURN - PEACH	23.14	550	107	120	2.4	560.0	73	16,892	164	37,950	198	45,817.20
0 Pasture	GERMAN - LIGHT GREEN	10.55	550	75	90	4.7	495.9	146	15,403	729	76,910	818	86,299.00
0 Stonefruit	LUGGATE - LIGHT BLUE	17.10	550	54	60	5.5	940.5	171	29,241	702	120,042	809	1,383,339.00
0 Pasture	LUGGATE - LIGHT BLUE	31.88	550	41	40	5.5	1753.4	171	54,515	785	250,258	875	2,789,500.00
0 Pasture	TEMPLETON	15.05	550	104	90	4.7	707.4	146	21,973	729	109,715	818	923,109.00
Total		392.7					24,027		606,973		2,941,940		3,327,953

included in totals

not included in totals

As a result, approximately 100 ha of irrigable land was not included in the monthly and annual Aqualinc requirements presented in Table 5 of Section 6.6. This would create a significant water deficiency for the applicant, therefore a revised Table 5 is provided below, while an updated Appendix D is attached.

It is requested that ORC and notified parties please assess the application against these latest figures, rather than those provided in the original application. Note that while the monthly and annual volumes sought have been updated to reflect the additional irrigable areas, there is no proposed change to the instantaneous rates of take sought. A summary of changes to Table 5 is as follows:

1. Aqualinc irrigation requirements updated to include an additional ~100 ha that was missed out from the original monthly and annual totals.
2. An additional row has been added to Table 5 for clarity, showing the volume of water not required on those areas where frost fighting occurs (see Appendix D for further explanation).
3. Stock drinking requirements appear to have been over-calculated (511 m³/day was sought in the application), and have been revised to reflect the calculations in Appendix D.

Table 1: Aqualinc modelled application requirements for existing and future irrigated areas of Queensbury Ridges Ltd, compared to total existing paper allocation from the Albert Burn, Schoolhouse Creek and the Clutha River (Revised 6 May 2020 – amended values have been highlighted)

Volume	Daily (m ³)	Monthly (m ³)	Annual (m ³)
Required (per Aqualinc calcs)	24,027	744,997	4,010,467 (100% ile)
Current total paper allocation	48,929	N/A	N/A
Frost-fighting requirements	12,000	84,000	114,000
Irrigation water not needed on frost days	-1500	-10,500	-14,250
Stock drinking requirements	320	9,733	75,299
Baseflow required outside irrigation season	-	-	78,840
Volume sought	34,847	828,230	4,264,356

If you have any further questions about these revisions, please do not hesitate to reach out.

Kind Regards

A handwritten signature in blue ink, appearing to read 'W. Nicolson', with a long horizontal flourish extending to the right.

Will Nicolson

Scientist/Resource Management Planner

Appendix D: Aqualinc calculations and associated explanations (Revised 6 May 2020 – revised text and/or values have been either underlined or highlighted)

Site: Queensbury Ridges Ltd						Sub-region: Central and Lakes District								
Land use	Soil type	Area (ha)	MAR Zone	Smaps PAW	Aqualinc PAW	peak daily demand (mm/day)	peak daily demand (m ³)	maximum monthly demand (mm/month)	maximum monthly demand (m ³)	90%ile annual demand (mm/year)	90%ile annual demand (m ³)	100%ile annual demand (mm/year)	100%ile annual demand (m ³)	
1 Pasture	CLUDEN - YELLOW	37.40	550	70	60	5.1	1907.4	158	59,092	769	287,606	877	327998.00	
2 Pasture	LINDIS - CYAN	117.90	550	56	60	5.1	6012.9	158	186,282	769	906,651	877	1033983.00	
3 Pasture	MAUNGAWERA_1 - JADE	12.16	550	69	60	5.1	620.2	158	19,213	769	93,510	877	106643.20	
4 Pasture	MOLYNEUX - LIGHT PURPLI	108.84	550	37	40	5.5	5986.2	171	186,116	785	854,394	875	952350.00	
5 Pasture	BARRHILL - ORANGE	85.19	550	121	120	4.2	3578.0	130	110,747	672	572,477	777	661926.30	
6 Pasture	PIBURN -PEACH	31.18	550	89	90	4.7	1465.5	146	45,523	729	227,302	818	255052.40	
7 Vineyard	PIBURN -PEACH	23.14	550	107	120	2.4	560.0	73	16,892	164	37,950	198	45817.20	
8 Pasture	GERMAN - LIGHT GREEN	10.55	550	75	90	4.7	495.9	146	15,403	729	76,910	818	86299.00	
9 Stonefruit	LUGGATE - LIGHT BLUE	17.10	550	54	60	5.5	940.5	171	29,241	702	120,042	809	138339.00	
10 Pasture	LUGGATE - LIGHT BLUE	31.88	550	41	40	5.5	1753.4	171	54,515	785	250,258	875	278950.00	
11 Pasture	TEMPLETON	15.05	550	104	90	4.7	707.4	146	21,973	729	109,715	818	123109.00	
Total		490.4					24,027		744,997		3,536,814		4,010,467	

Aqualinc calculations walkthrough

While the instantaneous rates applied for from each watercourse (Albert, Schoolhouse and Clutha) have been sought individually, Aqualinc reasonable irrigation demands have been calculated as a combined volume across the entire command area. The reason for this is in the adaptive nature of the irrigation system within the scheme: the tank farm captures and stores flows from the Albert Burn when sufficient water is present in the channel; typically during spring and early summer, and during rainfall events. When the Albert Burn abstractions begin to diminish, pumps on the Clutha River automatically ramp up and begin to pump water up to the tank farm to make up the Albert Burn water shortfall. Thus to break down Aqualinc volumes sought per watercourse would be impractical.

Aqualinc volumes were calculated using irrigated hectare summaries provided by the applicant, and include both existing irrigated areas and future areas intended for irrigation following the deemed permit replacement process. These land use breakdowns can be provided upon request, but it should be noted that less than half of the total command area is to be irrigated using surface water abstractions, with the remaining ~473 ha either serviced by groundwater takes, or left unirrigated.

Frost Fighting

With regards to frost fighting, ORC's resource consent application form 4 recommends a maximum of 3mm/hour (30 m³/ha) and a maximum frost fighting duration of 10 hours per event. As discussed in the main body of this report, climate data for Central Otago suggests a mean of 9.5 frost events between September and November (the start of the cherry and grape growing seasons), therefore frost fighting volumes have been calculated and integrated into the total volumes sought as follows:

- 23 ha vineyard and 17 ha cherries within the command area = 40 ha total frost fighting area.
- Daily frost fighting maximum: $30 \times 10 \times 40 = 12,000 \text{ m}^3$. Daily total volume sought: $24,027 \text{ m}^3$ (Aqualinc volume) + $12,000 \text{ m}^3$ (frost fighting volume) - 1500 m^3 (volume of water not needed for irrigation based on 40 ha of cherries and grapes) = $34,527$.
- Monthly and annual volumes sought were calculated similarly, but monthly volume was calculated assuming a maximum of 7 frost days (based on NIWA climate data) and annual volume was calculated assuming a maximum of 9.5 frost days.

As part of the calculations, it was assumed that no irrigation water is required on cherry or grape land during frost events.

Stock drinking requirements

Stock drinking requirements were calculated based on 2018 winter stock numbers, as outlined below:

Stock units/water use	ORC guidelines (per Form 4)	Water required (m ³ /day)
3980 mixed age ewes	5 L/head/day	19.9
1000 hoggets		5

Stock units/water use	ORC guidelines (per Form 4)	Water required (m ³ /day)
1500 ewe lambs		7.5
220 beef cows	40 L/head/day	8.8
287 steers and heifers		11.5
820 1 year old dairy heifers (winter only)	70 L/head/day (year-round)	57.4
700 2 year old dairy heifers (winter only)		49
2300 dairy cows (winter only)	70 L/head/day (May-August 15)	161
Total		320.1

Note that dairy cows are only present on the farm for the winter months (May through to mid-August), so water requirements for these stock have only been calculated for 107 days of the year.

Thus approximately 320 m³/day of water is needed for stock drinking within the command area.