Fitzpatrick Aquifer
Delineation and Allocation

September 2017

Otago Regional Council

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Subject: Fitzpatrick Aquifer - Delineation and Allocation

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1. Introduction

A groundwater take consent has been applied for in the Late Pleistocene gravels that are outside of the mapped aquifers within the Wakatipu Basin. A maximum allocation limit (MAL) is required for the area that is being targeted by applicants taking water outside of the mapped aquifer (Figure 2.1). The area is located relatively close to the Speargrass-Hawthorne aquifer boundary and within sediments that comprise this aquifer boundary. RSU-groundwater began investigating if the Speargrass-Hawthorn boundary was suitable, if it could be extended or if another aquifer boundary would need to be created to include the targeted area. The findings are presented below.

2. Could the Speargrass-Hawthorne aquifer boundary be refined?

The geological map suggests that the mapped Speargrass-Hawthorne Aquifer is mainly comprised of recent Holocene sediments. The south-western edge of the aquifer boundary extends into late Pleisticene sediments (Figure 2.1). There was no documention found on how this boundary was defined.

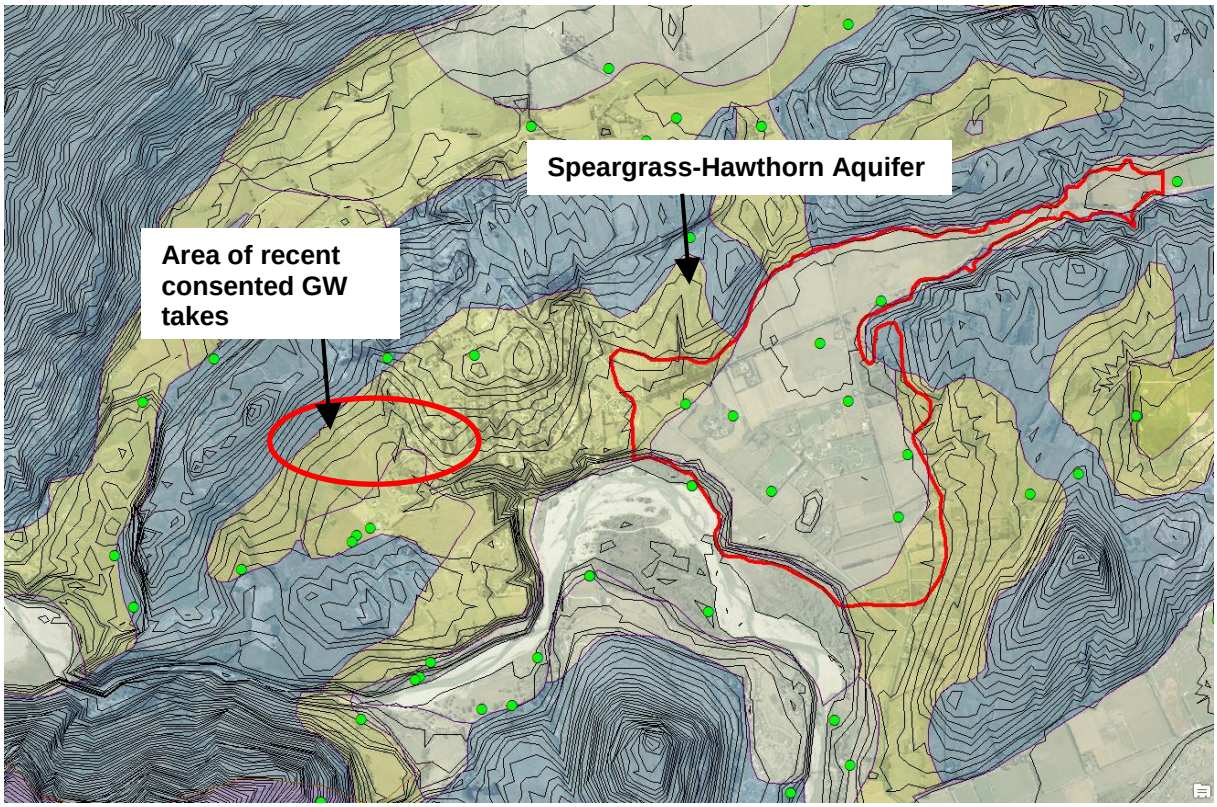

Figure 2.1: Location plan (Geological Legend: White – recent Holocene sediments. Yellow – late Pleistocene sediments. Blue – Schist rock. Green dots – boreholes)

To determine if the Speargrass-Hawthorne aquifer boundary could be extended to include the unmapped area with recent consented GW takes, google maps street view was used to look at the terrain along Speargrass Flat Road (starred location below). You can see that elevation of the land steepens quite substantially (Figure 2.2 and 2.3).

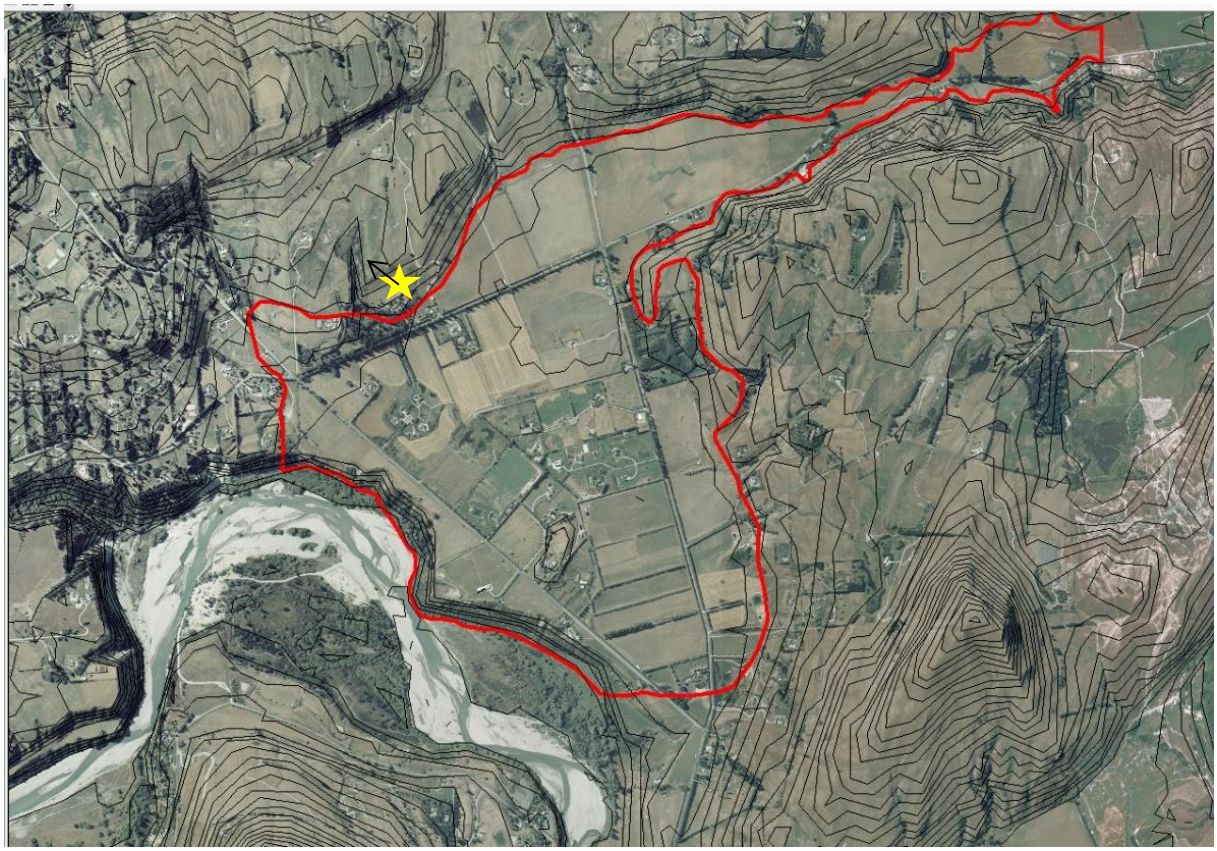

Figure 1.2: Location of google maps street view at 69 Speargrass Flat Road.

Figure 2.3: Street view of terrain at 69 Speargrass Flat road (starred location in Figure 2.2)

Whilst bore logs are not available in this exact location, one bore log is available from a bore on top of the hill (F41/0405) and is circled in red below (Figure 2.4). This bore is constructed in the schist rock. Only 3 m of gravel is present before weathered schist is encountered. Bore F41/0160 (circled in yellow below), also has a borelog with 5 m of gravel with groundwater recorded at 1.5 m below ground level (bgl). However, this bore is located in close proximity to a stream. It is likely this bore is drilled within the alluvial ribbon of the stream and the groundwater level is recording the stream level.

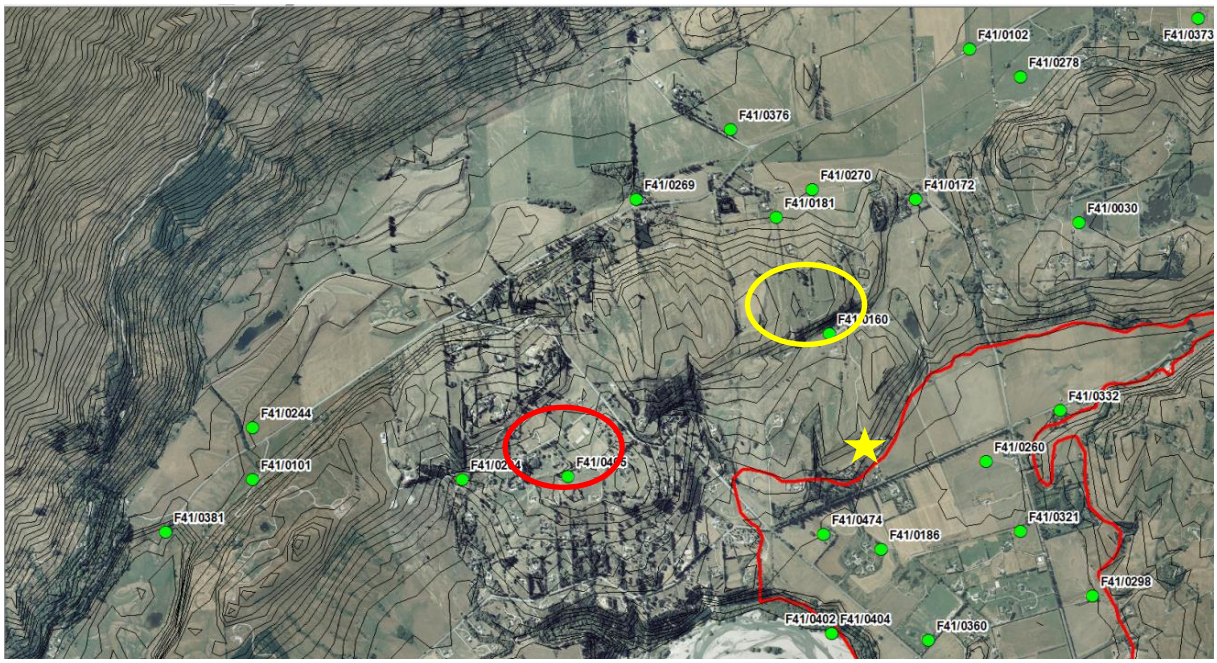

Figure 2.4: Location of bores where lithology data was available

Since some of the late Pleistocene sediments were included, RSU-groundwater was curious to know if the western boundary could be extended further into the late Pleistocene sediments. Google maps was again utilised and street view was used at the intersection of Domain Road and Speargrass Flat Road (starred location below, Figure 2.5).

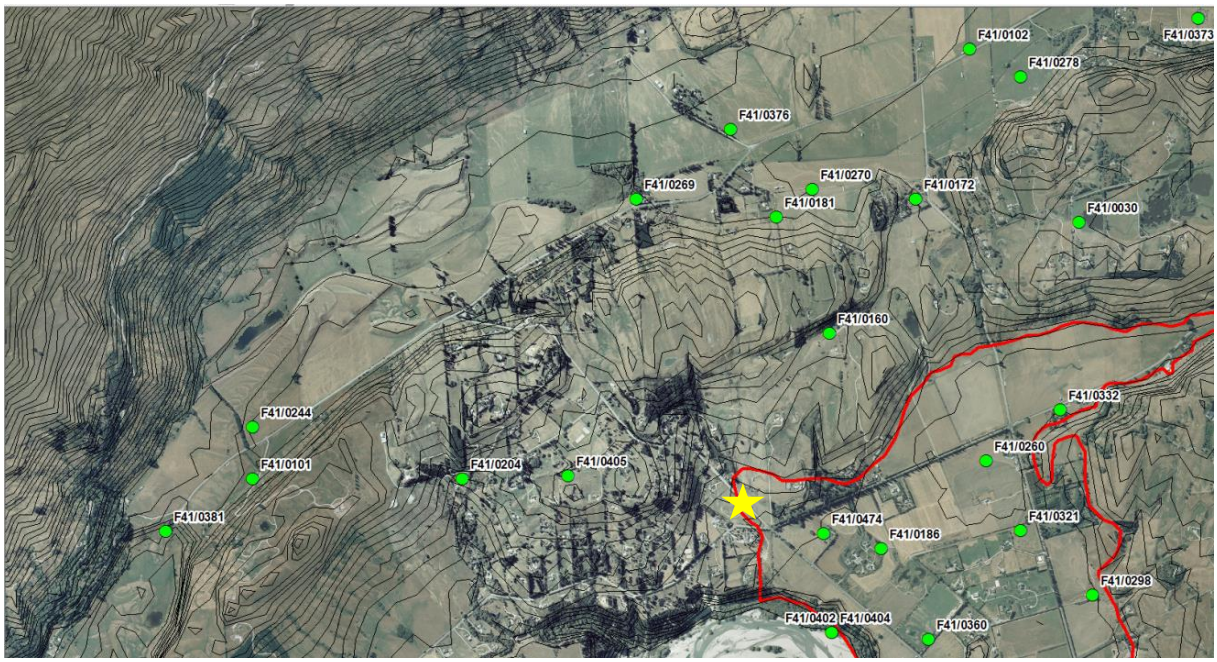

Figure 2.5: Location of google maps street view on western boundary of the Aquifer at the intersection of Speargrass Flat Road and Domain Road.

When looking west towards Littles Road, you can see that the spurs are encountered where the boundary is drawn (Figure 2.6). There is no need to refine this boundary.

Figure 2.6: View towards Littles Road noting the spurs

It was decided that whilst the mapped aquifer shows late plesitocene sediments

adjancent to the mapped aquifer boundary, due to the topography and the thin layer of Pleistocene sediments it is not recommended to extend the Speargrass-Hawthorne aquifer. A new aquifer would need to be delinated for the management of the groundwater takes near Dalefield.

3. Fitzpatrick Aquifer

A combination of geological bore logs, 1:250,000 geological map, 10 m DTM maps, Landcare S-maps, natural boundaries and google earth were used to draw this aquifer boundary.

Using google maps you can see that the terrain is steep until around the 430 m contour line (Figure 3.1 and 3.2).

Figure 3.1: Google earth street view showing where the terrain starts to flatten out

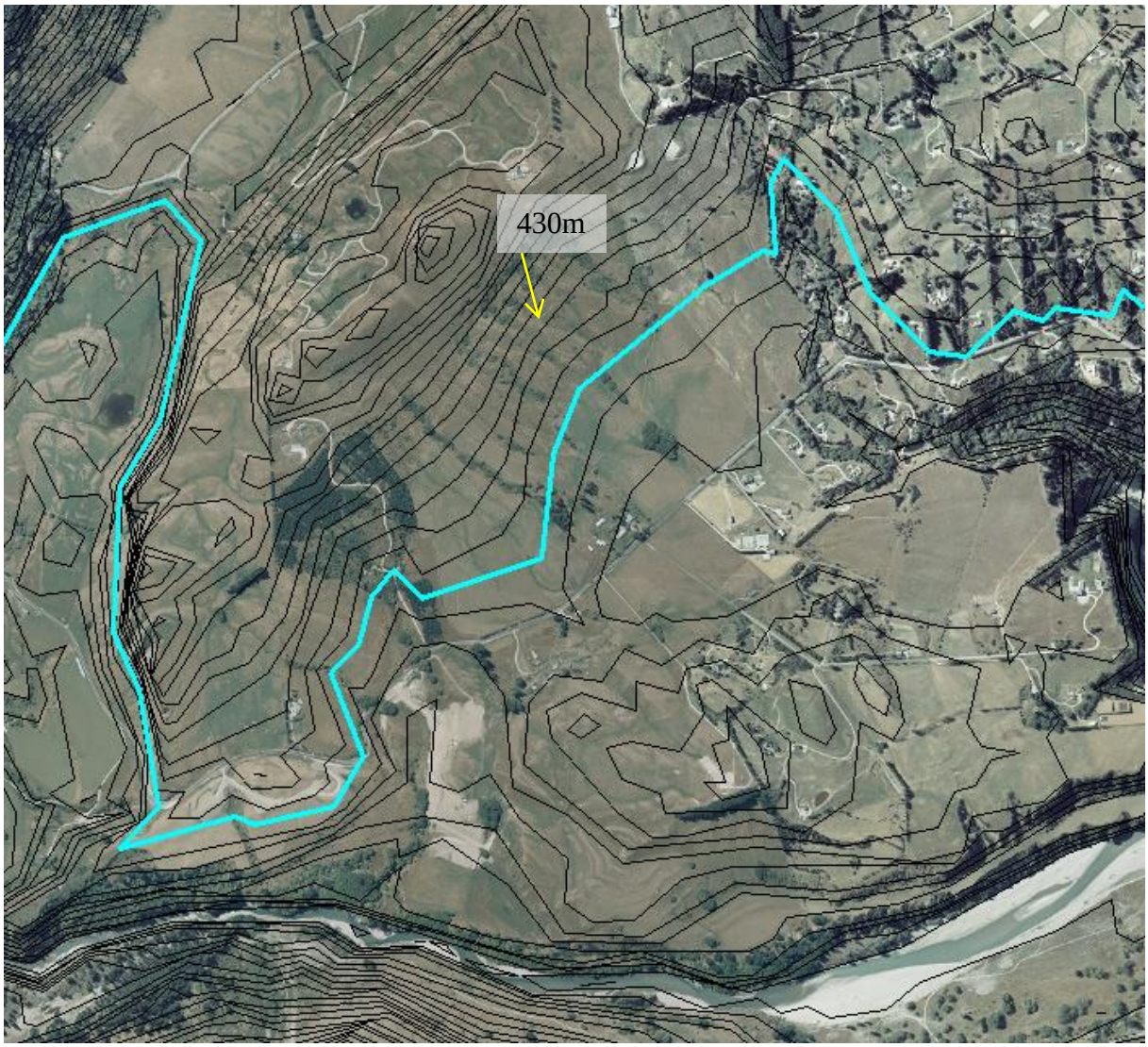

Figure 3.2: 430 m contour line where the google earth street view showed terrain flattening out

The geological maps, 10 m DTM, S-maps and topographic map were all used to assist with drawing the Aquifer Boundary. The Fitzpatrick aquifer is 1.14 km^2 and is comprised of late Pleistocene sediments. The final boundary is presented below in Figure 3.3.

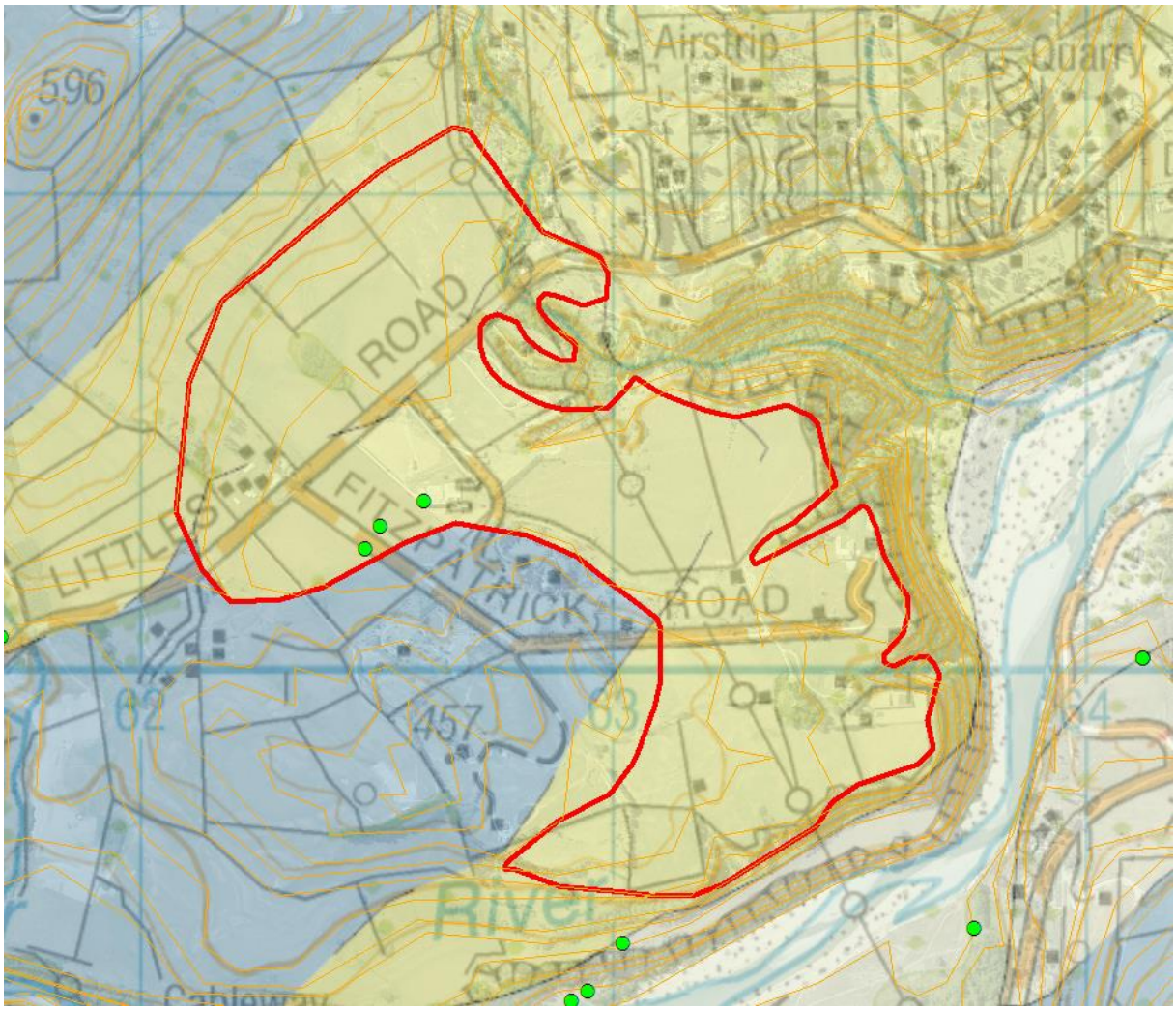

Figure 3.3: Fitzpatrick Aquifer Boundary

4. Rainfall recharge modelling

An in-depth study was not undertaken for this aquifer. Rainfall was the only input calculated for this aquifer using a rainfall recharge model as per the 2014 report. Details of the rainfall recharge modelling carried out during the 2014 investigation are set out in section 4.1 of the Wakatipu Basin Aquifer report (ORC, 2014). In summary, 10 soil hydrogeological classes were used for the recharge modelling which were provided by Landcare Research. Rainfall from three Arrowtown sites were used for aquifers located in the northern part of the basin. Rainfall from the Queenstown Aero Automatic Weather Station was used for aquifers in the southern portion of the basin (Figure 4.1). For the Fitzpatrick aquifer rainfall from the three Arrowtown sites were used.

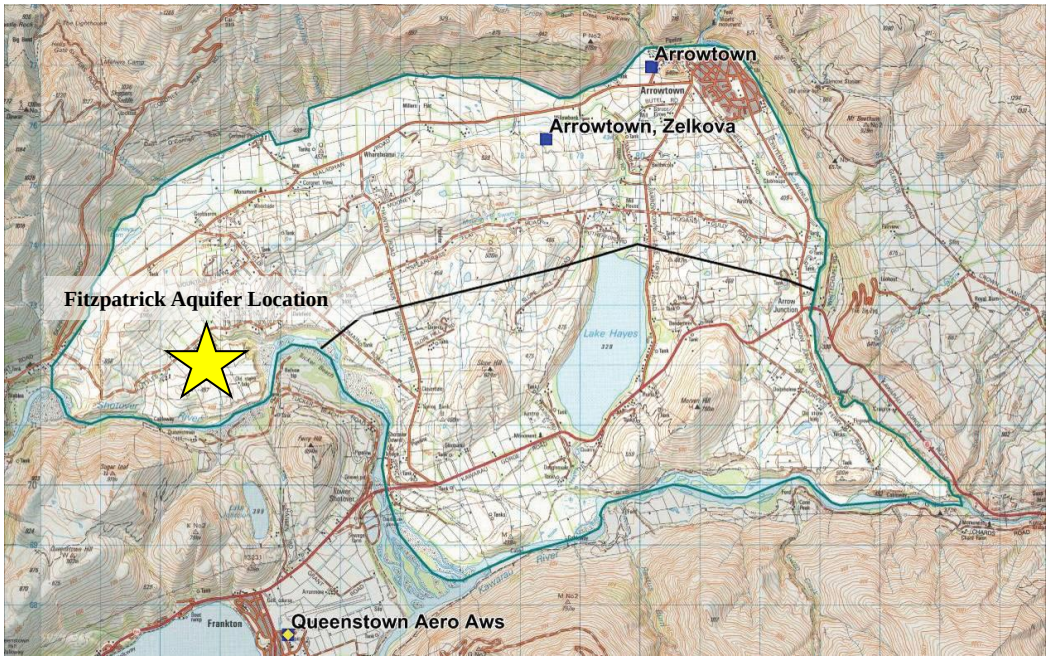

Figure 4.1: Climate stations used for modelling and dividing line for recharge zones

The area of each soil class was calculated and was then applied to the rainfall recharge model. The area of each soil class in the Fitzpatrick aquifer is presented below in Table 4.1. The aquifer boundaries and soil class extent is presented below in Figure 4.2. A soil class legend is located in Appendix A.

Table 4.1: Soil code, class, area and recharge of the Fitzpatrick aquifer

Soil Code	Assigned Soil Class	Area (km^2)	Recharge (m^3/y)
Ee2sU	1	0.39	35,967
Gd1sU	4	0.62	87,630
Wp2sR	7	0.13	84,744

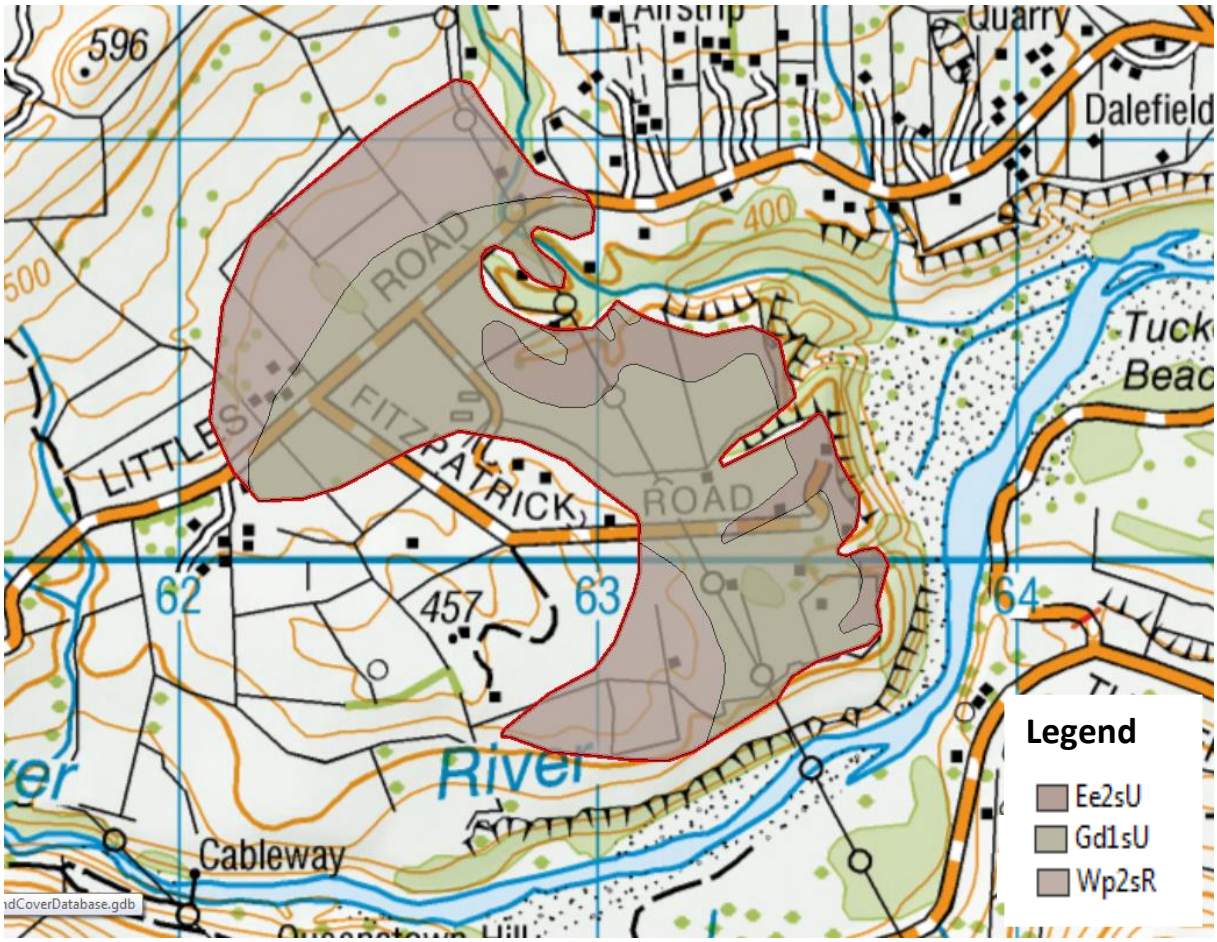

Figure 4.2: Fitzpatrick aquifer boundary and Landcare soil class map

5. Groundwater Allocation

Consent RM17.190.01 is the only consented groundwater take in the Fitzpatrick aquifer. It is consented to take 58,400 m^3/y.

Based on modelling from the rainfall recharge model it is estimated that a total of 208,342 m^3/y of rainfall recharges the Fitzpatrick aquifer. Section 6.4.10A2 of the Regional Plan Water for Otago; define the maximum allocation limit (MAL) for an aquifer as:

(a) That specified in Schedule 4A; or

(b) For aquifers not in Schedule 4A, 50% of the mean annual recharge (MAR) calculated under Schedule 4D.

The Fitzpatrick aquifer is not specified in Schedule 4A. It is proposed that the Fitzpatrick aquifer be allocated as 50% of MAR as defined below in Table 5.1.

Table 5.1: Allocation summary for the Fitzpatrick Aquifer

Item	Fitzpatrick Aquifer (Mm^3/y)
Mean annual recharge	0.21
50% of mean annual recharge	0.105
Consented allocation	0.06
Remaining allocation volume [in accordance with Policy 6.4.10A(a)(ii)(1)]	0.045

6. Conclusion

Groundwater consent applications have been applied for and granted in an un-named aquifer within the Wakatipu basin. To ensure that the groundwater resource is adequately protected, the Fitzpatrick aquifer has been defined. Using a rainfall recharge model a mean annual recharge volume of 0.21 Mm^3/y has been calculated for the Fitzpatrick aquifer. The MAL for the aquifer should be set at 50% of MAR at ***0.105 Mm^3/y***.

7. Appendix A

Soil Class Legend:

Soil Code	Interpretation	Assigned Soil Class
Ee2sU	Eely moderately deep sandy loam undulating	1
Gd1sU	Gladbrook moderately deep sandy loam undulating	4
Wp2sR	Wakatipu shallow sandy loam rolling	7

8. References

Institute of Geological and Nuclear Sciences (GNS). 2014. 1:250,000 Geological Map of New Zealand.

Otago Regional Council (ORC). 2012. Regional Plan: Water for Otago. Otago Regional Council, Dunedin.

Otago Regional Council (ORC). 2014: *Investigation into the Wakatipu Basin Aquifers*. Prepared by Jens Rekker for ORC Science Unit, Dunedin ISBN 978-0-478-37673-9.