Chapter 39: Are Are Creek And Kaituna Valley

Introduction

The Okaramio, Kaituna and Tuamarina Rivers as well as Are Are Creek are sometimes classified as being part of the Marlborough Sounds on the basis of their location, geology and rainfall. However, with the exception of the Kaituna River, they are tributaries of the Wairau River.

The Kaituna Valley links the Wairau Plain with Havelock. It is drained by Are Are Creek flowing to the south and the Kaituna River flowing in a northwards direction. The Wairau River and Onamalutu Rivers also play an important part in the local hydrogeology at Kaituna.

Are Are Creek rises near Leslies Road and flows south to join the Wairau River downstream of the SH6 bridge (Fig. 39.1). The Kaituna River flows north in the opposite direction from near Kenningtons Road into Pelorus Sound at Havelock. The catchment boundary dividing the Kaituna River and Are Are Creek catchments is barely discernible at the valley floor.

The valley that contains Are Are Creek and the Kaituna River is oversized for the current catchment flows (Fig. 39.2). This is because the valley once carried the ancient Pelorus River, which originally flowed south to join the Wairau River.

The basement geology of the area is dominated by schist rock which forms the local hills while the valley floor is infilled by a sedimentary sequence of alluvium 20 to 100 metres thick, depending on location (Fig. 39.3). These sediments are a mixture of alluvium and colluvium deposits and consist of clays, gravels and sand.

Figure 39.2: Are Are catchment looking sorth to the Wairau Plain.

Groundwater demand has increased since the 1980s in the north-bank areas of Kaituna, Okaramio and the Kaituna River Valley due to landuse intensification and rural residential settlement.

Geology

The Pelorus River once flowed through the Kaituna River Valley with the first direct evidence of such found in 1995. Wells 2918 and 2919, drilled as part of a mineral exploration programme in the Okaramio area, discovered an assemblage of minerals unique to the Pelorus area (Fig. 39.4) (Mortimer & Wopereis - 1997). Water bearing Pelorus Gravels were encountered at depths of 39 metres and 44 metres respectively. The existence of the Pelorus Gravels and the depth of the alluvium confirmed that they must have been deposited by the Pelorus River.

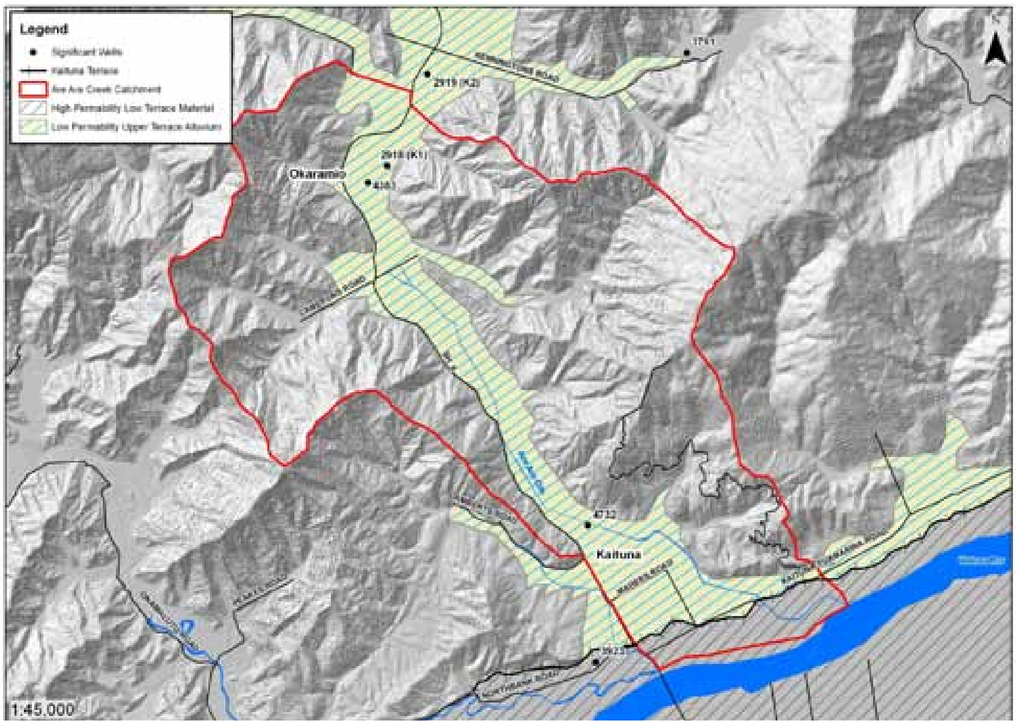

Figure 39.1: Are Are Creek catchment boundary

Dating of sediments in the Okaramio-Kaituna divide indicates that the Pelorus River stopped flowing through the area sometime between 130,000 and 70,000 years ago. The reversal in the direction of flow was caused by the sinking of the Marlborough Sounds.

Groundwater systems

Because most wells are relatively shallow and concentrated in the southern area near the Wairau River at Kaituna, a complete understanding of local aquifer systems does not yet exist.

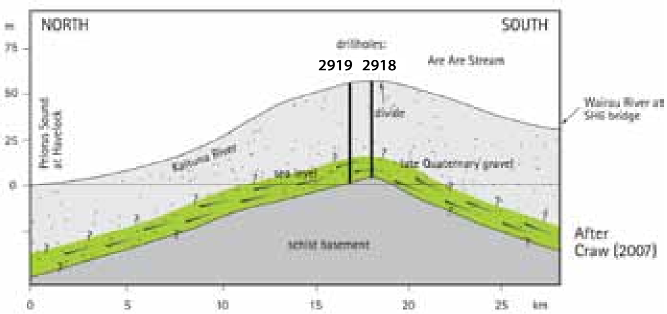

Figure 39.3: Kaituna/Are Are catchment divide at Okaramio


Figure 39.5: Kaituna alluvial terrace

The knowledge that we do have has come about as a result of well drilling associated with landuse intensification and exploration. The MDC have also carried out measurements of stream flows and water chemistry surveys.

Kaituna groundwater resources can be split into two groups depending on their location in relation to the Wairau River terrace running parallel to the Kaituna-Tuamarina Track. The terrace represents the boundary separating the more permeable Wairau River derived gravels to the south, from the clay-bound material derived from the lower energy Are Are Creek or its predecessors to the north (Fig. 39.5). The terrace varies in height from one to three metres depending on location.

On the upper terrace most wells tap the shallower Are Are Creek Gravels with very few currently intercepting the Pelorus Gravels (Fig. 39.6). This is a reflection of low irrigation demand and there being sufficient groundwater in the shallower layer to meet current rural residential or stock supply needs.

On the lower terrace the existence of more permeable gravels and the appearance of new sources of recharge such as the Onamalutu River, and to a lesser extent the Wairau River, makes the aquifer more productive. The resource associated with these more productive gravels is referred to as lower terrace groundwater. Wells tend to be higher yielding and historically groundwater has been piped from this area northwards.

Up until quite recently it was thought that Wairau River flow dominated groundwater in the alluvial gravels as far north as the terrace, but new information gained in 2004 shows the influence of the Wairau River is relatively limited under most conditions.

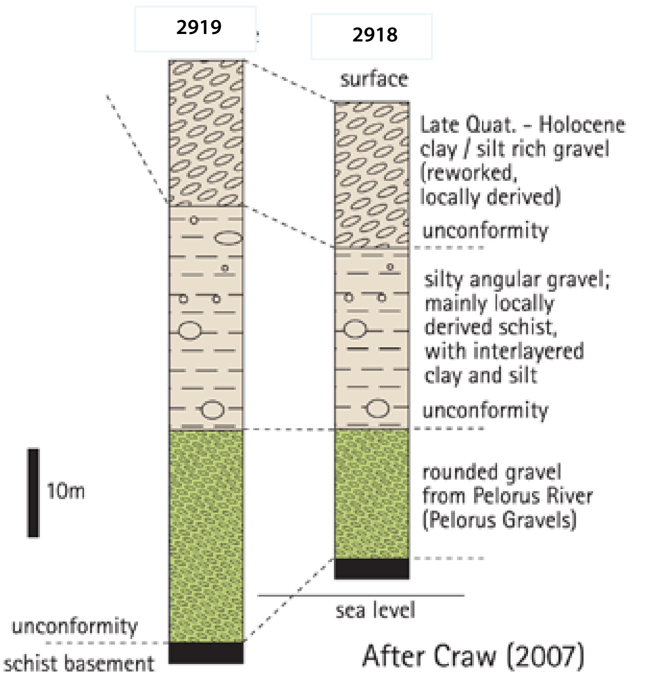

Figure 39.4: Wells 2919 and 2918 drilling sequence

Groundwater flow and recharge

Lower terrace groundwaters

Current understanding of the relationship between terrace gravels and streams is based on a combined approach using hydrogeological, hydrochemical and isotopic tools. This information has been used to supplement conventional drilling information and flow or aquifer test measurements.

As part of an MDC study looking at the interaction between the Wairau River and riparian aquifers, IGNS analysed groundwater chemistry and stable isotope

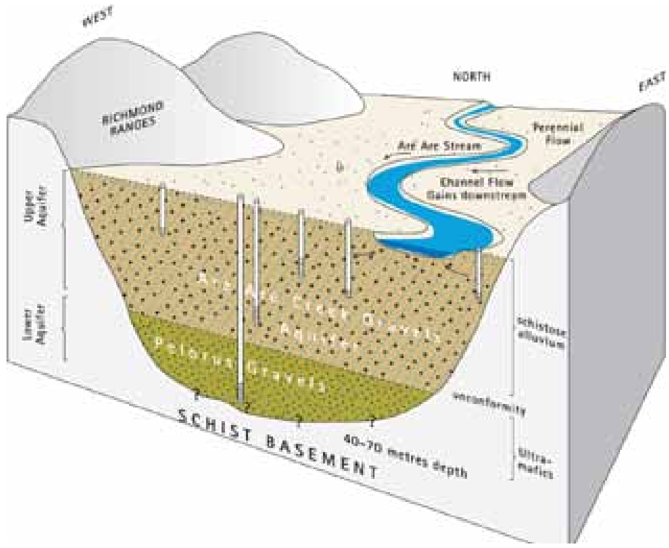

Figure 39.6: Are Are Creek Gravels Aquifer conceptual model

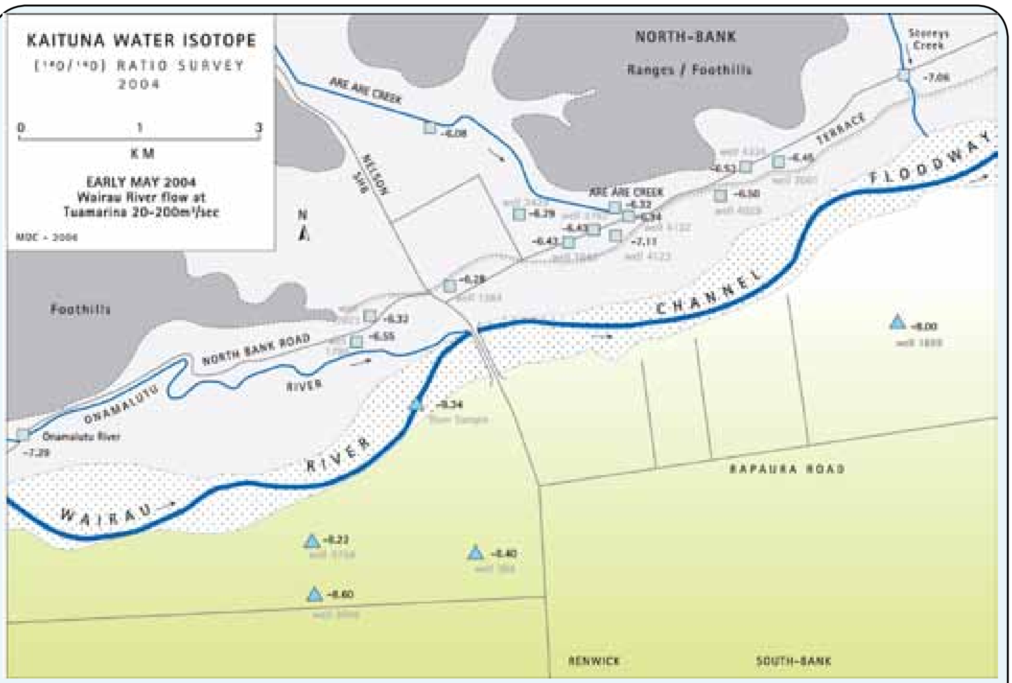

Figure 39.7: May 2004 Kaituna isotope survey. Square boxes represent wells accessing water from the upper and lower terraces. The triangles represent water recharged predominantly from the Wairau River.

Upper terrace groundwaters

A hydraulic connection between groundwater and Are Are Creek is evident by a measured increase in channel flow in a downstream direction during dry conditions (Fig. 39.8). While some of this increase in channel flow will originate as runoff, Are Are Creek has few tributaries, and under low flow conditions baseflow comes from groundwater. This is a result of Are Are Creek being mechanically entrenched into the local gravels during the 1950s and is effectively an extension of groundwater. If groundwater levels rise, channel flow increases. Are Are Creek typically gains in the order of 100 l/s from its origins near Leslies Road, to the Wairau River confluence, under low flow conditions. The Are Are Creek Catchment can generate large flood flows due to rainfall runoff.

($\delta^{18}O$) ratios . The results show that the Wairau River is not a source of recharge to either wells on the upper Kaituna terrace, or those on the lower terrace nearer the channel of Are Are Creek (Fig. 39.7). Just one of the wells on the lower terrace showed a minor Wairau River contribution (Taylor - 2004). The measured $\delta^{18}O$ ratios, for a variety of Wairau River flow conditions varying between 20 and 1500 m^3/second at Tuamarina, show $\delta^{18}O$ values are insensitive to Wairau River flows.

Even under high flows the influence of Wairau River water appears limited to the floodway which is consistent with measurements on the southbank opposite Wairau Valley township. It is likely that the greatest influence on Northbank groundwater from Wairau River flow will occur under drier conditions when tributary flows are very low.

Leakage of Onamalutu River and Are Are Creek channel flow dominate the signature of groundwater north of the Wairau River.

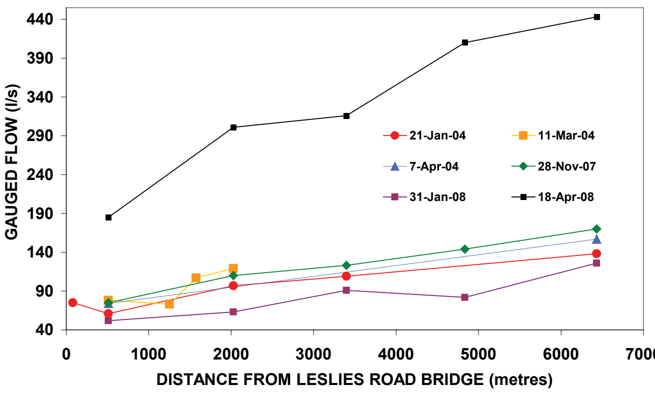

Figure 39.8: Are Are Creek longitudinal flow profile

A hydraulic gradient from the aquifer towards Are Are Creek is supported by MDC measurements in March 2008 showing groundwater levels were higher in well 4732 than the channel, 28 metres away. Well 4732 is 17 metres deep and the mean residence time of groundwater pumped from it was eight years in 2008 (GNS Science - 2008).

Hydraulic properties

A larger number of aquifer tests exist for wells in the Kaituna area near the Wairau River, however few tests are available from wells further inland. Higher transmissivity values confirm the presence of more permeable gravels on the lower terrace at Kaituna, although higher values are likely to be influenced by the presence of surface flows. For example, a series of wells close to the Onamalutu River, Are Are Creek or the Wairau River exhibited small drawdowns during testing due to a direct hydraulic connection with channel flow.

It is likely that a representative transmissivity for wells tapping the upper terrace aquifer and outside the direct influence of Are Are Creek recharge, is of the order of 100 to 700 m^2/day. This compares with values one to two orders of magnitude higher for wells influenced by stream flow during testing.

One of the few tests conducted on inland wells tapping the upper terrace aquifer was carried out in 2004 at the 45 metre deep well 4383. Well 4383 is likely to source water from the Pelorus Gravels Aquifer. The test returned a relatively high transmissivity value of around 3,500 m^2/day (PDP – 2004). This high transmissivity is a function of the permeable gravels deposited by the ancient Pelorus River and is higher than expected for the upper terrace area.

The inland aquifer has a low storage value of 0.003 which is consistent with a semi-confined structure and is supported by a trend of increasing groundwater pressure in well 4383 corresponding with increasing depth.

Testing demonstrated a hydraulic link to a nearby shallow well and by implication, channel flow in Are Are Creek. This is an important finding as it shows the potential for pumping from deeper groundwater to affect flow in surface waterways.

While the fine grained clay material present in the profile tends to isolate the deeper aquifer from surface processes, the large aquitard leakage value of 0.13 $days^{-1}$ shows it does not represent a complete barrier to groundwater flow, which is consistent with the aquifer test observations.

Chemistry

Groundwaters sampled to date have generally been relatively dilute chemically and similar to rain or water in streams. This is because the water is young and groundwater is connected to surface flows.

Typical of the chemical composition of shallower groundwaters is a sample from well 4732 taken in November 2007 (Fig. 39.9). This well is located on the upper terrace near Are Are Creek.

Well 3923 located on the lower terrace near the intersection of the Northbank Road with SH6 is 18 metres deep. The chemical composition of water from well 3923 shows that it is similar to that of the upper terrace (Fig. 39.10). This supports the concept of an interconnected medium depth aquifer extending throughout the Kaituna area and recharged from a common source.

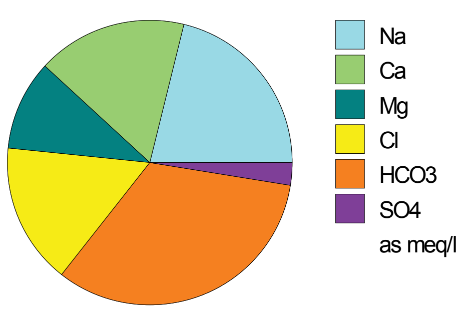

Figure 39.9: Well 4732 groundwater composition

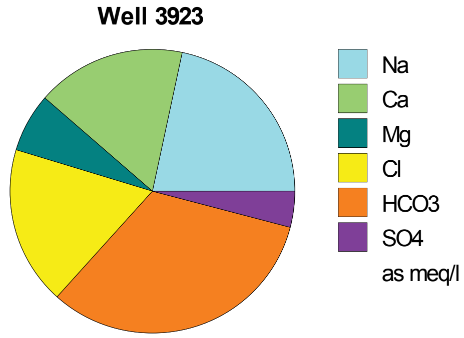

Figure 39.10: Well 3923 groundwater composition

The chemical composition of groundwater from the deeper aquifer layer known as the Pelorus Gravels is also similar and shows that despite a depth of over 40 metres, there is reasonable mixing with younger waters and limited evolution. This is based on a sample from well 4383 taken in June 2004 (PDP – 2004).

References

Begg, J.G. and Johnson, M.R., 2000. Geology of the Wellington Area, Institute of Geological and Nuclear Sciences Ltd, 1:250,000 geological map 10

Craw, D., Anderson, L., Rieser, U., and Waters, J., 2007. Drainage reorientation in Marlborough Sounds, New Zealand, during the Last Interglacial. New Zealand Journal of Geology and Geophysics 50: 13-20.

Mortimer, N, and Wopereis, P. 1997. Change in direction of the Pelorus River, Marlborough, New Zealand: evidence from composition of Quaternary gravels, New Zealand Journal of Geology and Geophysics, 1997, Vol. 40: 307-313

Pattle Delamore Partners Ltd, 2004. Aquifer Testing at Okaramio, Prepared for Palms

Pattle Delamore Partners Ltd. 2008. Are Are Creek Catchment Baseline Water Resource Report, prepared for the Marlborough District Council

GNS Science Ltd. 2008. Opawa Rivervines well at Kaituna P28w/4732 age interpretation & relationship between the well and Are Are Creek. Letter report No: 2008/125LR. Report prepared for the Marlborough District Council

Taylor, C.B. 2004. Groundwater in the Kaituna area. A report prepared for the Marlborough District Council, Dr Claude B. Taylor, groundwater consultant, 28 Wyndrum Ave. Lower Hutt