Summary report for Ruamāhanga Whaitua Committee

Hydrological systems of the Ruamāhanga catchment

River system and channel form

The Ruamāhanga River originates in the Tararua Range near Mt Dundas and emerges into the Wairarapa valley west of Mauriceville. The river flows along the eastern margin of the valley to Lake Onoke, which discharges to the sea (Figure 1). The river has a total length of 162 km and a catchment area of 3,430 km^2. In its upper reaches the river has a wide, semi-braided channel, although it places it is confined by terraces and assumes a single-thread form. In its lower reaches, the Ruamāhanga River has a meandering, single channel contained within stopbanks.

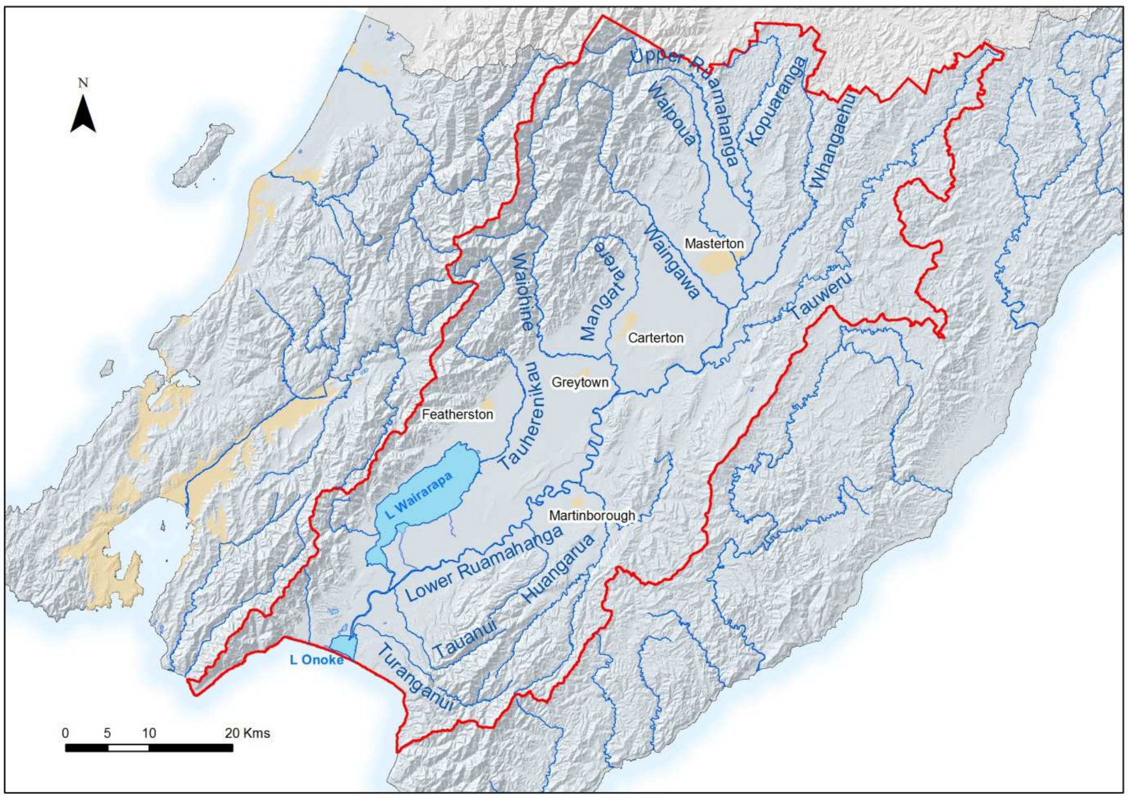

Figure 1: The Ruamāhanga catchment showing the main rivers and whaitua boundary (red)

The main tributaries entering the Ruamāhanga River from the Tararua Range and its foothills are the Waipoua River, Waingawa River, Waiohine River and Tauherenikau River (which flows into Lake Wairarapa). These western tributaries are subject to the cool, wet to extremely wet climatic conditions that occur in the Tararua Range, and have catchments clad with indigenous forest, with some alpine shrublands and tussock land in the highest reaches (Chrystall 2007). In the upper reaches, these rivers have steep gradients and incise into the hard greywacke bedrock before traversing the younger alluvial gravels that dominate on the valley floor. The exception is the Waipoua River, which originates in the foothills of the Tararua Range. The Waipoua, Waingawa, Waiohine and Tauherenikau rivers vary along their length between single-thread and semi-braided channel form, and carry high loads of gravel.

The main tributaries entering from the eastern hills are the Kopuaranga River, Whangaehu River, Tauweru River, Huangarua River, Tauanui River and Turanganui River. The first of these three differ greatly from the western tributaries. Their catchments are subject to drier climatic conditions, are of lower elevation and slope, and are predominantly pastoral in land use with an underlying geology of soft, sedimentary rock. In their lower reaches the Kopuaranga, Whangaehu, and Tauweru rivers are generally sluggish and have meandering, silty channels. These rivers tend to have poorer water quality – in particular, higher nutrient concentrations and suspended sediment loads – than the western tributaries.

The Huangarua River (with its major tributary, Ruakokoputuna River) is sourced in the Aorangi Range, but flows through sedimentary hill country before entering the Ruamāhanga River. The other small rivers flowing off Aorangi Range, Tauanui and Turanganui rivers, enter the Ruamāhanga River in its lower reach. The rivers carry high gravel loads and tend to flow below bed level during dry periods.

The major lowland streams, which commonly emerge from springs within the valley, include Makoura Stream, Parkvale Stream, Papawai Stream, Otukura Stream and various streams around the south Featherston area. The lowland streams are often interconnected with the Wairarapa water race systems, which are artificial waterways fed from the Ruamāhanga River and its major western tributaries.

River flow characteristics

Due to the different catchment characteristics of climate, geology and elevation, the western and eastern tributaries tend to have quite different flow regimes. The western tributaries have higher base flows, are less prone to extreme low flows, than the eastern tributary rivers. As an indication of the relative flows of the different rivers and streams, mean annual low flow estimates for the major tributaries, and the Ruamāhanga River itself, are shown in Table 1. The most significant tributaries, in terms of average flows, are the Waiohine and Waingawa rivers.

Table 1: Estimated 7-day mean annual low flow (MALF) statistics for main Ruamāhanga River tributaries, at the point they enter the Ruamāhanga, and at three locations on the Ruamāhanga River. Source: adapated from Keenan(2009)

Category	River	MALF (L/s)
Western tributaries	Waipoua River	490
	Waingawa River	1,720
	Waiohine River	3,550
	Tauherenikau River	310
Eastern tributaries	Kopuaranga River	605
	Whangaehu River	100
	Tauweru River	500
	Huangarua River	310
Lowland streams	Makoura Stream	150
	Parkvale Stream (including Booths Creek)	210
	Tilsons Creek	150
	Papawai Stream (including Tilsons Creek)	360
	Otukura Stream (including Stonestead Creek)	600
Ruamāhanga	Ruamāhanga River at Wardells (near Masterton)	3,836

River main stream	Ruamāhanga River at Waihenga (near Martinborough)	12,875
	Ruamāhanga River at Lake Onoke	14,800

The highest flows in the Ruamāhanga River and its major tributaries tend to occur during winter, although rivers with headwaters in the Tararua Range tend to have sustained high monthly average flows through spring, when frequent westerly frontal systems bring rainfall to the range. The lowest flows tend to occur between January and March. The eastern tributaries tend to have a larger variation in flow between the seasons, as illustrated in Figure 2.

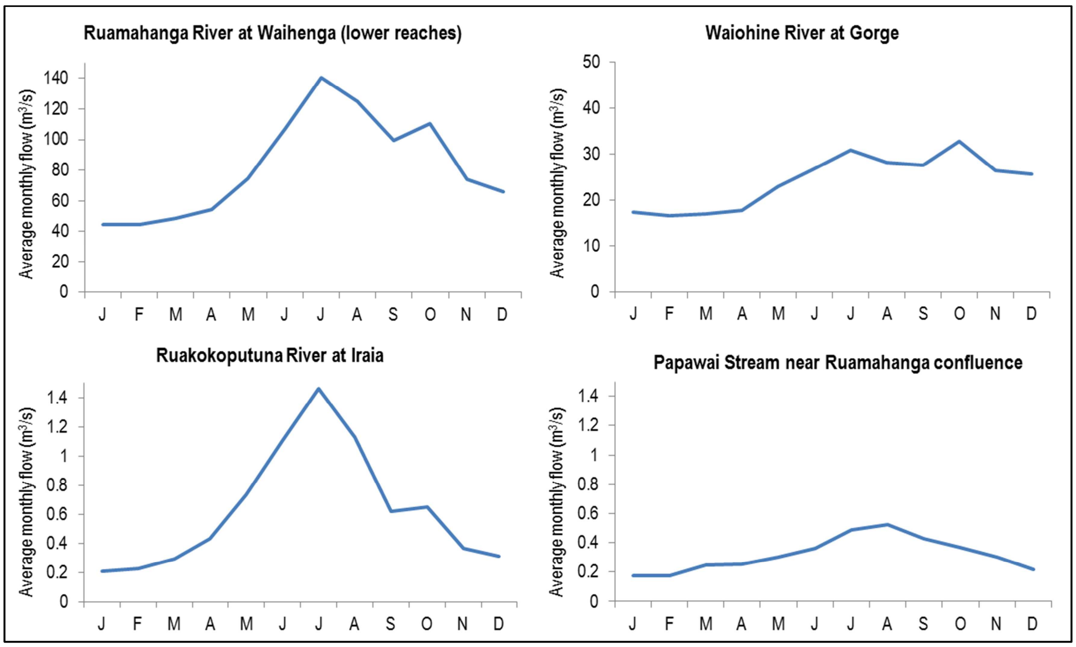

Figure 2: Monthly average flows in the Ruamāhanga River and some of its tributaries. The Waiohine River represents the western tributaries, and on average has a high baseflow during summer and sustained flows through spring. The Ruakokoputuna River represents the eastern tributaries and has large seasonal flow variation. Papawai Stream represents the lowland streams and has little seasonal variation in flow. Source: Greater Wellington Hilltop database, flow data for 1980 to 2013.

The flow characteristics of the lowland streams that enter the Ruamāhanga River are different to both the eastern and western tributaries. As shown in Figure 2, there is not a large seasonal variation in flow in these streams, due to their predominant source of flow being springs and seeps. However, some of the streams do experience severe low flows, due to abstraction and low groundwater levels affecting spring discharge rates during summer.

The severity of low flows in the Ruamāhanga River is strongly linked to rainfall in the Tararua Range and flows in the western tributary rivers, as these are the dominant flow contributors to Ruamāhanga River (Watts and Perrie 2007). The most severe low flows on record in the Ruamāhanga River and its western tributaries occurred in March 2013, following a period of unusually low rainfall in the Tararua Range (Keenan and Thompson 2014).

The Ruamāhanga River can experience large floods due to heavy rainfall in either the Tararua Range or the eastern hills, although historically the largest floods in the Ruamāhanga River have been due to heavy rainfall in the Tararua Range. However, extensive surface flooding in the central valley (including in the small lowland streams and the lower reaches of the eastern tributaries) can occur following south easterly (often ex-tropical cyclone) rainfall events.

The frequency of 'flushing flows' – i.e., small flood flows that allow accumulated algae to be flushed from the river system – is an important aspect of the hydrological regime. In general, the western tributaries tend to experience flushing flows more frequently than the eastern tributaries. On average, the Ruamāhanga River experiences a flushing flow, of equal to or greater than three times the median flow, every 20 days. However, the longest period on record between flushing flow events in the lower Ruamāhanga River is 4 months (Thompson and Gordon 2011).

Lakes and wetlands

Lake Wairarapa is located at the southern end of the catchment. It is the largest lake in the Wellington region (approximately 7,850 ha) and is very shallow, being only 2.5 metres at its deepest point. It receives its main inflow from the Tauherenikau River and other small streams, particularly around the northern and western lake margins. It has been significantly modified through flood protection and drainage activities carried out under the Lower Wairarapa Valley Development Scheme in the 1960s and 1970s. The most major modification was the diversion of the Ruamāhanga River from its natural course into Lake Wairarapa; the river now, during 'normal' flow conditions, bypasses Lake Wairarapa and flows directly down to Lake Onoke. However, during floods some flow enters Lake Wairarapa through the overland floodway system. Barrage gates at the outlet of Lake Wairarapa regulate flow into and out of the lake at its southern end, hence allowing control over the water levels in Lake Wairarapa.

Lake Onoke is approximately 622 ha and is the second largest lake in the Wellington region. It is located at the very bottom of the Ruamāhanga River catchment and drains to Palliser Bay through an opening in a sand spit. The main inflow to the lake is the Ruamāhanga River. The lake is typically tidal as long as the mouth remains open. However, under southerly conditions and low river flows the lake mouth regularly closes (on average nine times per year) and at such times water can backflow up the Ruamāhanga River into Lake Wairarapa.

The Lower Valley Development Scheme resulted in significant loss of wetlands associated with Lake Wairarapa and the lower Ruamāhanga River floodplain. However, a complex of wetlands around the margins of Lake Wairarapa still exists, and together with Lakes Wairarapa and Onoke the wetlands are known as Wairarapa Moana – the largest wetland network in the lower North Island (Wairarapa Moana Wetlands 2014).

The Wairarapa wetlands database contains records of 90 wetlands in the Ruamāhanga catchment. Other than the wetlands bordering Lake Wairarapa, many of the Ruamāhanga valley's wetlands are associated with springs and seeps emanating from fault lines (e.g., Waingawa Swamp, Foreman's Lagoon and Allen-Lowes wetland near Carterton), former river channels (e.g., Taumata Wetland), and recent floodplains of the major rivers (e.g., Carters Wetland) (Thompson 2012).

Groundwater and its interaction with the surface water environment

The groundwater system of the Ruamāhanga valley is complex, due to the nature of its geological setting. The hydrogeological units of the valley and the geological features that impact groundwater flow are described in detail in the Geology summary. As an overview, the Ruamāhanga valley contains the following main types of aquifer[1] systems (Jones & Baker 2005):

- Highly permeable, unconfined[2] aquifers less than 20 metres deep associated with the recent gravels deposited by the major rivers; these aquifers are in direct connection with the rivers and are recharged by river flow.
- Low permeability and generally low yielding aquifers associated with older, alluvial gravel fans. These aquifers are predominantly recharged by rainfall. Aquifer depth varies considerably but generally appears to be in the range of 20 to 40 metres.
- Confined[3] and semi-confined moderate permeability aquifers within deep sub-basins. The aquifers are recharged by rainfall, river losses and throughflow from other aquifers. Aquifer depth exceeds 100 metres in places, although the average depth of wells is around 30 metres.

The Regional Freshwater Plan recognises 29 groundwater zones in the Ruamāhanga valley. However, more recent modelling of the groundwater system has resulted in the proposal of 17 zones, with different categorisation at depth depending on how well the aquifer is connected to the surface water environment (Figure 3).

[1] An aquifer is an underground formation of permeable rock or loose material which can produce useful quantities of water when tapped by a well.
[2] An unconfined aquifer does not have an upper layer of impermeable material (i.e., its upper boundary is the water table).
[3] A confined aquifer lies beneath a layer or layers of impermeable material.

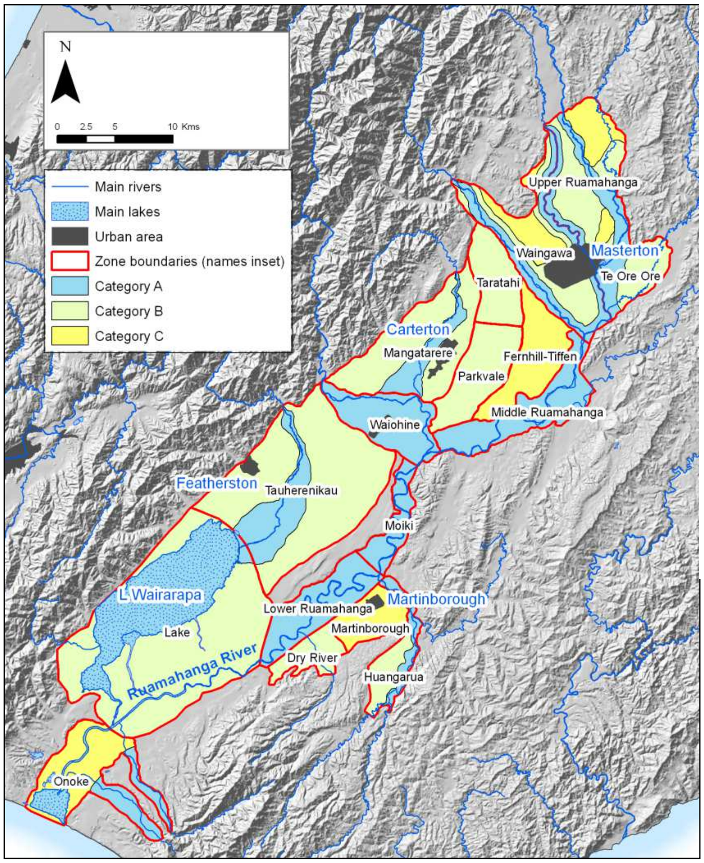

Figure 3: Proposed groundwater zones for the Ruamāhanga valley (red boundaries, with zone names in black text). The colours represent A, B and C categories which are based on the degree of connection with surface water environment, category A (blue) being in direct connection and category C (yellow) having no significant connection. Source: Hughes and Gyopari (2011)

The Ruamāhanga River and its tributaries (in particular, its western tributaries) display a complex pattern of flow losses and gains due to interaction with shallow groundwater systems. In places, the interactions with groundwater are controlled by fault traces, with the rivers gaining flow from groundwater systems above the faults and losing flow to groundwater downstream of the faults (Jones and Gyopari 2006). Water levels in the shallow groundwater systems, and the amount of abstraction from these systems, therefore have an influence on river flows during times of low flow.

More information

Greater Wellington Regional Council monitors river flow, water levels or groundwater levels at about 60 sites in the Ruamāhanga catchment. Annual hydrology monitoring reports can be found on Greater Wellington’s website (www.gw.govt.nz). Analysis of long-term trends in river flows and groundwater levels was carried out as part of the State of Environment technical reporting in 2012 (see Keenan et al. 2012, available on the website)

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