



MEMORANDUM

TO Adrian Meredith

DATE 30 May 2008

CC

FROM Greg Burrell

PROJECT No. VALAS-CAN-001

Agreed Statement of Ecological Facts for the Valetta-Ashburton River Groundwater Zone Hearing

1.0 INTRODUCTION

- 1.1 This memorandum provides an agreed statement of facts regarding aquatic ecological values in the Valetta (VA) and Ashburton River (AR) Groundwater Allocation Zones. The purpose of this memorandum is to inform the Commissioners hearing multiple groundwater consent applications of what aquatic values are present and relevant to the hearing, and to establish agreed facts between the applicants and Environment Canterbury (ECan) officers prior to the hearing.
- 1.2 This memorandum was compiled by Dr Greg Burrell, an expert witness representing the applicants at the VA hearing. Dr Adrian Meredith (ECan expert witness and freshwater scientist) has reviewed this memorandum and the result is an agreed statement of facts. . There were no significant areas of disagreement between the author and Dr Meredith and therefore there are no intentional omissions from this document.
- 1.3 The relationship between groundwater abstraction, stream flow and ecology is a contentious issue that is not discussed in this memorandum, due to a lack of agreement between ECan and applicant groundwater scientists at the time of writing. However, groundwater and stream flow data will be presented as evidence at the consent hearing by the applicant and ECan, and this will be discussed in relation to stream ecology by Drs Burrell and Meredith.
- 1.4 The focus of this statement is on the Ashburton River and lowland streams in the VA groundwater zones. As such, it does not discuss foothills-fed streams of the upper plains such as Taylors Stream or Bowyers Stream. Similarly, for the Ashburton River this statement primarily focuses on its lower reaches, below the confluence of the north and south branches. Figures 1 and 2 attached show the location of waterways in the area.
- 1.5 Recreational and amenity values are included, as there is a close relationship between ecology and recreation, particularly fishing and game bird hunting.

2.0 INFORMATION SOURCES

- 2.1 The following significant information sources have been used in compiling this statement of facts:
 - ECan water quality and stream invertebrate data.
 - Ecology reports for the areas by Meredith et al. (2004, 2006).
 - A published history of the Longbeach area by Small & Blee (1999).
 - A published history of the drainage schemes by Mitchell (1980)
 - Discussions with Fish and Game New Zealand (Ms Bridget Pringle).
 - New Zealand Freshwater Fish Database (NZFFD) records.
 - Fieldwork undertaken by Golder Associates during late summer 2007.
 - Canterbury mudfish survey data from ECan.



3.0 GROUNDWATER ZONE OVERVIEW

- 3.1 The Ashburton River groundwater zone includes the North and South Branches of the Ashburton River, and their tributaries, and the mainstem of the Ashburton River, from the confluence of the north and south branches to the sea. The seaward end of the zone also includes Wakanui, Riverside and Wheatstone Creeks and several other smaller waterways. The Valetta groundwater zone extends south from the Ashburton River groundwater zone to the southern banks of the Hinds River. Figures 1 and 2 attached show the locations of waterways in the VA area.

4.0 ASHBURTON RIVER

Water Quality

- 4.1 The Ashburton River is a moderate sized braided river arising from both foot-hill and alpine (glacial) zones. As such it has good water quality in its upper reaches but water quality declines downstream. Declining water quality is associated with groundwater recharge, wildlife inputs, agricultural runoff, and several treated wastewater discharges (including urban stormwater and gravel wash discharges), and the discharge from the Ashburton District Council (ADC) oxidation ponds (soon to be decommissioned). Large populations of riverbed nesting birds are also implicated in declines in water quality, due to faecal contamination (Main 1999).
- 4.2 Concentrations of dissolved nutrients (nitrogen and phosphorus) in the Ashburton River tend to increase with distance downstream. Nitrogen concentrations typically exceed all ecological guideline values for aquatic plant growths, and are related to inflows of nitrogen enriched shallow groundwater, irrigation bywash discharges, and the ADC treated sewage discharge.
- 4.3 Phosphorus concentrations are low but can also exceed recommendations for the protection of biodiversity and aesthetic/recreational values (Biggs 2000) at times. Upstream of the ADC sewage discharge, the Ashburton River is largely phosphorus limited (i.e., low phosphorus concentrations limit plant and algal growth) and seldom exhibits effects of high nutrient concentrations (e.g., nuisance growths of algae).

Periphyton and Invertebrates

- 4.4 Periphyton is the slime and algae found on the bed of streams and rivers. Periphyton is the predominant form of plant life in the Ashburton River system with larger aquatic plants (macrophytes) only present in the stable, spring fed backwaters, braids, and tributary streams (Mosley 2001). Regular flood disturbance means that periphyton communities tend to be dominated by thin algal films. However, periphyton biomass generally increases with distance downstream and nuisance growths of filamentous algae do occur during long periods of stable low flow, and downstream of the ADC sewage discharge.
- 4.5 Benthic invertebrates are an important component of river ecosystems that integrate the influences (amongst other factors) of water quality, water abstractions, flow variability and periphyton community characteristics. They are also important food for many native and introduced fish and wading birds. Macroinvertebrate communities in the Ashburton River are generally dominated by clean-water taxa such as mayflies and caddisflies, although long periods of low flow are associated with a greater abundance of chironomid midge larvae.

Fish and Birds

- 4.6 Upland bullies are the most commonly recorded native fish species from the Ashburton River, followed by Canterbury galaxias and longfin eels (NZFFD records). Introduced brown trout are the



second most frequently recorded fish species in the Ashburton River. The majority of other freshwater fish species have few records in the Ashburton River.

- 4.7 A number of riverine bird species have been recorded on or near the gravel bed of the Ashburton River, and it has been described as one of the most important rivers in Canterbury for bird life (O'Donnell & Moore 1983). The river includes nationally significant populations of black-fronted terns, black-billed gulls, banded dotterels, and black-fronted dotterel, and regionally significant populations of wrybill, South Island pied oystercatcher, pied stilt, and black-backed gull (Mosely 2001). Several of these species are threatened, with black-fronted tern and wrybill, both braided river specialists, the most acutely threatened. The large sizes of gull colonies (particularly black-backed gulls) has been implicated in water quality problems (Main 1999) and has resulted in control operations on gull numbers on occasions. Vegetation encroachment, particularly willows, is perhaps the single greatest threat to threatened birds in Ashburton River (Mosley 2001). Channel-forming floods are therefore critical for maintaining weed free foraging and breeding habitat.

Recreation

- 4.8 The North and South branches of the Ashburton River above SH72 are rated as having low frequency and intensity of use for trout and salmon angling (Sutherland-Downing et al. 2004) although headwater lakes and streams are highly used. This increases to moderate frequency use and intensity from SH72 to the mouth (Sutherland-Downing et al. 2004). The Ashburton River has in the past supported a healthy salmon fishery, but brown trout are now the main species fished for. It has been suggested that the decline in the salmon fishery is due to reduced flows caused by water abstraction; however, other factors such as vegetation encroachment (making it more difficult to catch fish) may also be responsible for the decline (Mosley 2001). The Ashburton River provides a regionally significant sport fishery, with 4,170 angler days recorded in the 2002 National Angler Survey (Unwin & Image 2003). By comparison, the nearby (and over 10 times larger) Rakaia and Rangitata Rivers recorded a total of 34,650 and 35,960 angler days in the same survey (Unwin & Image 2003).

5.0 HINDS RIVER AND LOWLAND STREAMS

Introduction

- 5.1 Based on historical observations and survey maps from the mid 1800s, the Ashburton River is the only waterway in the VA area that has maintained a near natural course to the sea over time (Small & Blee 1999). While a number of defined watercourses existed to the west of where SH1 is today, their channels became ill-defined upon entering the Longbeach swamp. There were a number of well defined outlet channels to the coast (associated with deeply eroded gullies commonly called "dongas"). It is uncertain how many watercourses historically had perennial flow to the coast. Waterways that did appear to have both perennial flow and a perennial opening to the sea were the wetlands now called Hinds River, Parakanoi Drain¹ and Blee's Drain. Others exited at ponds and wetlands behind the beach.
- 5.2 The Hinds River historically had an ill-defined channel downstream of the present location of SH1 and it discharged directly into Longbeach swamp. This contributed to an extensive swamp which was unable to be productively farmed. Thus, in the late 1800s works were undertaken to artificially

¹ With a few exceptions, nearly all lowland waterways in the Valetta-Ashburton River area are named as drains, as all of the waterways have been artificially modified to some extent to assist the draining of the land. However, the term "drain" often has negative connotations, implying that the only value a waterway provides is drainage, when in fact a wide variety of instream values may be provided. For this reason, the term "drain" is used when referring specifically to waterway names (e.g., Deals Drain), but the term "stream" is used when referring to flowing waterways in a generic sense.



MEMORANDUM

straighten and constrain the Hinds River downstream of the Surveyors Road area down to an opening to the sea. The lower reaches of the river have been maintained for flood protection (e.g., addition of stopbanks and willow removal) since then. At the same time, Taylors Drain was cut, following an existing line of drainage to the Hinds River, to further drain swampland, and alleviate flooding in the area

Riparian and Instream Habitat

- 5.3 Prior to European settlement, the main plant species in the Longbeach swamp were raupo, flax, toe toe, manuka and various other shrubs and native grasses (Small & Blee 1999). Now, very few waterways have any indigenous vegetation, and the most common riparian species are introduced grasses, willows, poplars, gorse and other weedy exotics. Willows line both the Hinds and Ashburton Rivers, but provide little shading due to their wide gravel beds. A notable exception is the Wakanui Creek lagoon, which has a reasonable stand of raupo and sedges. Several waterways such as the upper reaches of Parakanoi Drain and Kenougs Drain also have sparse flax and *Carex*. Overall, very few waterways have any significant shading other than where they follow shelterbelts, or through scrub and willows in the lower reaches of some streams.
- 5.4 Although most of the waterways are artificially straight and steep-sided, there are a number that, at least in some reaches, have retained a sinuous channel form that adds to their natural character. The Hinds River, with its broad gravel bed and mix of riffles and pools and winding channel, has the greatest natural character. However, Wakanui Creek also largely retains a natural meandering channel form, and other waterways with meandering sections include Wheatstone Creek, Andersons Drain, Flemington Drain, Parakanoi Drain, and Deals Drain.
- 5.5 Most of the streams are narrow, around 1 to 3 m wide, and shallow, with average water depths of around 25 to 30 cm during summer. The Hinds River is the obvious exception; it has similar water depths to the other waterways but the wetted channel is over 6 m wide.
- 5.6 Streambed sediments are highly variable, but there is a general trend towards finer, more silt-dominated sediments as streams lose gradient closer to the coast prior to descending down towards the beaches. In contrast to many spring-fed lowland streams in Canterbury, several of the VA lowland streams have relatively silt-free gravel beds. Streams that are predominantly gravel-bedded, have some flow variability, and are mostly silt-free, include the Hinds River and Boundary Drain, and reaches of the Parakanoi, Windermere, Flemington, Taylors, Kenougs, and Home Paddock Drains.
- 5.7 In many waterways the combination of generally steep and often undercut banks, and stony stream beds, offers good instream habitat for stream invertebrates and instream cover for fish. Therefore, despite the general lack of riparian vegetation, many of the VA area streams have very good instream habitat compared to other small, lowland streams in Canterbury.

Water Quality

- 5.8 Most of the waterways have high clarity and reasonably cool temperatures, which is typical for lowland, spring-fed streams that have not been degraded by stock access issues. While most streams have reasonably high dissolved oxygen (DO) concentrations in their upper reaches, some become sluggish and choked with macrophytes in their lower reaches in summer or during low flow periods, resulting in low DO (e.g., lower reaches of Kenougs and Blee's Drains).
- 5.9 Counts of faecal indicator bacteria are elevated in many waterways, and this is common in lowland streams with poor riparian protection in agricultural landscapes. The faecal indicator concentrations render the water sources unsuitable for potable, stockwater, or bathing use.
- 5.10 Nitrate concentrations are very high in all waterways, with concentrations of nitrate plus nitrite-N (NO_x-N) of between 3 to 7 g/m³ in most streams (including the Hinds River). Elevated nitrogen concentrations reflect the history of intensive agriculture and irrigation in the catchments, giving



MEMORANDUM

rise to nitrogen enriched groundwater. Concentrations of the other primary plant nutrient, phosphorus, are comparatively low.

- 5.11 National guidelines for managing nutrients in streams recommend a limit of $<0.02 \text{ g/m}^3$ of $\text{NO}_x\text{-N}$ to avoid nuisance algal growths (Biggs 2002). As a rule of thumb, ratios of dissolved reactive phosphorus (DRP) to dissolved inorganic nitrogen (DIN) greater than 30 suggest that phosphorus, rather than nitrogen is likely to be the limiting nutrient. DIN:DRP ratios for all of the VA lowland streams are well in excess of 30, with many over 100, therefore these waterways are expected to be phosphorus, rather than nitrogen-limited.
- 5.12 Overall, water quality of the streams render the water sources unsuitable for human uses (potable, stockwater, or bathing use), but they are of good enough quality for supporting ecological communities and values.

Ecological Values

- 5.13 Streambed coverage with periphyton and macrophytes in the VA area mainly varies according to stream flow, water velocities and composition of streambed sediments. Thus, there is a gradient of streams from those that are swift, stony and mainly dominated by thin periphyton films, to sluggish waterways that are dominated by macrophytes. In general, the upper catchment stony streams have predominantly thin periphyton films. Some stream reaches have a high cover of filamentous algae during summer, and these are generally located along the downstream end of the catchment in streams with sluggish flow. Macrophyte cover can get quite high in summer in many of the streams, particularly those with softer bed sediments.
- 5.14 Most of the lowland waterways in the VA area (with the exception of the Hinds River) form part of the network of drains that is regularly managed by ECan as their drainage rating area manager, to maintain flood capacity, and control excessive macrophyte growth.
- 5.15 The invertebrate fauna of some of the streams are dominated by mayfly and caddisfly taxa. These taxa are relatively sensitive to pollution, prefer stony, silt-free sediments, and are favoured foods for fish and bird communities. These streams include the Hinds River, and Parakanoi, Boundary, Flemington, Windermere, Waterton, and Wheatstone Drains. The invertebrate fauna of many of the lower flowing lowland streams are dominated by snails, worms, crustaceans and dipteran larvae. This type of invertebrate community composition is more typical of degraded lowland streams in Canterbury, and the taxa are pollution-tolerant and also tolerant of fine sediments.
- 5.16 Upland bullies and eels are the most common and widespread freshwater fish in lowland streams of the VA area. Large longfin eels have been recorded from the Hinds River, and Windermere, Flemington, and Kenoughs, and Wheatstone Drains. Longfin eels are in gradual decline nationally, and large longfins are considerably less common than shortfins. Eels are an important lowland mahinga kai group for iwi.
- 5.17 The most notable native fish in the area is the Canterbury mudfish, which is nationally endangered but is known from a number of mostly sluggish, macrophyte-choked waterways in the Hinds-Ashburton area. Canterbury mudfish are known from various "dead end" water races and smaller drains (including Blee's Drain and Russells Drain). There are also mudfish records at various locations on private property, which appear to be associated with small springs. The Hinds area is one of the few remaining localities where Canterbury mudfish are reasonably widespread; loss of habitat through wetland drainage and reduction of groundwater levels have been the major agents of their decline.
- 5.18 Inanga are known from Wakanui Lagoon, and have also been recorded in Wheatstone Drain, which flows into the Ashburton River. Juvenile inanga are an important component of the whitebait catch, and are generally restricted to coastal waterways. The major threats to inanga are

² In the periphyton guidelines, nutrient limits vary according to flood disturbance frequency or inter-flood periphyton accrual period. The guideline $\text{NO}_x\text{-N}$ limit given of 0.02 g/m^3 corresponds to a 50 day accrual period (Biggs 2000).



MEMORANDUM

loss of habitat, particularly loss of spawning habitat in estuarine areas, and loss of access to and from the sea.

- 5.19 Bluegill bullies and torrentfish are present in the Hinds and Ashburton Rivers, and bluegill bullies have also been recorded from Parakanoi Drain. Both species are diadromous (they spend some of their time in freshwater and marine environments) and are typical of swift-flowing, stony streams. Although neither species is threatened, finding bluegill bullies in Parakanoi Drain is a rare find for a lowland Canterbury stream, and reflects the good instream habitat provided and open passage to the sea.
- 5.20 Brown trout are present at a number of the lowland streams. Large adult trout have been observed in the upper reaches of Windermere, Parakanoi, Flemington, and Home Paddock Drains, and based on habitat availability, they are also likely to be present in Taylors and Boundary Drains too. Although both trout and salmon are known from the Hinds and Ashburton Rivers and have historically supported reasonable fisheries (Lane 1964), the presence of large trout in several highly modified lowland streams is unusual in Canterbury. The presence of large trout in these streams reflects the combination of good water depths, moderate water velocities, perennial flow, and good instream cover in the form of overhangs, stony bed sediments and macrophytes. Smaller trout, either juveniles or stunted adults, are also found in the lower reaches of Parakanoi and Windermere Drains, and may exist in other drains.

Recreational Values

- 5.21 Because of its size and access to the public, the Hinds River probably provides the greatest recreational opportunities to the general public of the lowland streams in the VA area. The Hinds River recorded a total of 320 angler days in the 2001/2002 National Angler Survey, which is indicative of a locally valued fishery. Research undertaken in the early 1960s found that while trout densities were greatest in the lower reaches of Hinds, larger trout were mostly found in the upper reaches with perennial flow, close to the foothills (Lane 1964).
- 5.22 Until quite recently Fish and Game regularly harvested large numbers of trout from Windermere Drain for stocking high country lakes. This practise has temporarily ceased while biosecurity guidelines prevent the transfer of fish between waterways, to prevent spread of the invasive alga didymo (*Didymosphenia geminata*).

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MEMORANDUM

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