



STAFF REPORT

TO: Environment & Planning Committee

FROM: Glenn Stevens – Resource Scientist (Water & Land)

REFERENCE: W324

SUBJECT: **GROUNDWATER QUALITY OF COASTAL SETTLEMENTS, GOLDEN BAY– REPORT EP07/06/02** – Report prepared for 20 June 2007 Meeting

1. INTRODUCTION AND BACKGROUND

To date the Tasman District Council has collected limited information on the water quality of residential water supplies in the coastal settlements of Golden Bay. Current information is essentially derived from a survey undertaken by a Canterbury University engineering student (on behalf of the Council) during the summer of 2004/2005. The results of this were reported to Council in June 2005 (EP05/06/10).

The 2004/2005 survey sampled 18 residential groundwater supplies from the settlements of Patons Rock, Parapara and Pakawau. Four rainwater supplies were sampled, one from each of these three settlements as well as Milnthorpe. Two samples were also collected from each of the Parapara and Totara Ave community supply schemes.

During the 2004/2005 survey coliform bacteria and iron were found to be the only contaminants tested that did not meet the New Zealand Drinking Water Standards (2000)¹. Only seven of 22 samples met the coliform bacteria standard and 15 of 22 samples were below the guideline value for iron.

A recommendation of report EP05/06/10 was for a repeat survey of the tested water supplies to be undertaken over the summer of 2006/2007 to provide greater certainty of the results and to identify any potential trends in water quality. This second survey was undertaken during January / February 2007 and is the basis of this report.

2. 2007 SURVEY

Sixteen of the 18 individual groundwater supplies that were sampled over summer 2004/2005 were re-sampled during January / February 2007. An additional groundwater supply was also sampled as well as the Parapara and Totara Ave community supplies (i.e. a total of 19 groundwater samples). The collected samples were analysed for *Escherichia coli* bacteria (*E. coli*), *faecal coliform bacteria*,

¹ This was the relevant standard at the time of sampling. It has now been superseded by the New Zealand Drinking Water Standards (2005). The MAV for coliform bacteria and the guideline value for iron remain unchanged.

biochemical oxygen demand, iron, nitrate-nitrogen, dissolved reactive phosphorous, and total suspended solids.

In addition to the groundwater sampling, a total of nine water samples were collected from rainwater supplies at Pakawau (two), Milnthorpe (two), Parapara (three) and Patons Rock (two) and analysed for *E. coli* and faecal coliform bacteria.

All analyses were undertaken by the Cawthron Institute's analytical laboratory.

Electrical conductivity, pH, temperature and where possible groundwater level, were measured in the field during the collection of all groundwater samples.

3. RESULTS

3.1 2007 Survey

The results of both the summer 2004/2005 and summer 2006/2007 sampling are presented in Tables 1a, 1b and 2. Of the 19 groundwater samples collected, eight did not meet the New Zealand drinking water standards (DWSNZ 2005)² for bacteriological contamination. Nine groundwater samples did not meet the New Zealand drinking water (aesthetic) guideline for iron. For the remaining parameters tested for there was either no maximum limit specified in the drinking water standards or, as in the case of nitrate concentrations, all samples complied with the maximum acceptable value.

Whilst only seven of the 19 groundwater supplies can be considered suitable for a potable drinking water supply without some form of treatment (based on the parameters tested) it needs to be emphasised that not all of the groundwater supplies tested are used for drinking water supplies. Rather many are either unused or used for non-potable uses such as garden watering, boat washing, etc.

Bacteriological

The presence of disease causing bacteria in drinking water can present a significant health risk. *Escherichia coli* (*E. coli*) is an indicator bacteria used to test for the presence of bacteriological contamination, primarily from animal faeces (including human). The New Zealand drinking water standards contain a maximum acceptable value (MAV) for *E. coli* of less than one colony forming unit per 100 mL of sample (1 cfu/100mL).

Of the tested water sources eight showed some degree of contamination with coliform bacteria, with one site in particular having a very high count of bacteria (1700 cfu/100mL). In general the water supplies that showed some form of bacteriological degradation when sampled during the summer of 2004/2005 also showed some form of degradation during the recent round of sampling. However, there is much variability in the data with some increasing and some decreasing. One site showed no evidence of bacteriological contamination in 2004/2005 but showed the presence of coliform bacteria in this recent round of sampling.

² *Drinking-water Standards for New Zealand 2005*, Ministry of Health.

Given the un-serviced nature of these locations, a likely source of such contamination is poorly performing on-site domestic wastewater treatment systems. It is unknown to what extent these results indicate either a wide spread cumulative effect from many wastewater treatment systems or a localised contamination in close vicinity to the groundwater sampling point. However, the variable distribution of sites where bacteriological contamination was detected would suggest the latter.

It should be noted that a single transgression of the E.coli MAV does not necessarily indicate that the water is non-potable. The DWSNZ (2005) requires a regime of follow up testing to confirm the transgression. Such follow up sampling was beyond the scope of this investigation.

Total Suspended Solids (TSS)

Total suspended solids is a measure of small colloidal material present in the water sample. This can include inorganic (fine sediment particles) and organic matter. Typically undisturbed groundwater has low concentrations of suspended material. In the context of this survey the measuring of TSS was to characterise any potential contamination of organic material that may be derived from domestic wastewater disposal systems.

A significant number of sites had elevated TSS concentrations. Often, but not always, these correlated to sites where elevated coliform bacteria were detected.

Biological Oxygen Demand (BOD)

The biological oxygen demand is a measure of the oxygen demand derived from the biological breakdown of organic material present in the sampled water. A higher BOD is indicative of higher levels of organic material. All but one of the sampled groundwaters had a BOD of 1 g/m³ or less and are not of concern. One sample had a BOD of 10 g/m³. This sample also had elevated coliform bacteria counts. In the context of the coastal communities that are the subject of this survey, domestic wastewater discharges are the most likely cause of the observed elevated BOD.

Nitrate

The New Zealand drinking water standard for nitrate-nitrogen is 11.3 g/m³-N. All of the sampled groundwaters had concentrations below this with the maximum encountered being 3.7 g/m³-N. Naturally occurring nitrate concentrations in New Zealand groundwaters are typically low. Close *et al*³ comments that concentrations rarely exceed 1.0 g/m³-N as a result of natural inputs and that in the United States of America nitrate concentrations over 3.0 g/m³ are considered to be from anthropogenic sources.

Potential sources of nitrates include discharges from domestic wastewater treatment systems, inappropriate fertiliser use and animal/stock effluent. In the context of the sites sampled in this survey, the most probable source is poorly performing domestic wastewater treatment systems.

³ Close M. E., Rosen M. R. and Smith V. R. 2001. In *Groundwaters of New Zealand*, Rosen M. R. and White P. A. (eds). Chapter 8 – Fate and Transport of Nitrates and Pesticides in New Zealand's Aquifers. New Zealand Hydrological Society Inc.

The results can be further placed in context by comparison against the ANZECC (2000)⁴ guidelines for protection of aquatic ecosystems. These guidelines have a trigger value of 3.8 g/m³-N (for the protection of 80% of species). Other impacts to surface water bodies can occur at lower nitrate concentrations such as excessive algal growth. With respect to this study this is only of concern where groundwater discharge is a significant contributor to nearby surface water bodies.

Dissolved Reactive Phosphorus DRP

The sampled groundwaters encountered low dissolved reactive phosphorus concentrations with all samples below 0.092 g/m³ and eleven of the 19 sampled below 0.009 g/m³.

Potential sources of phosphorus include animal wastes (including humans) and fertiliser use. Again the likely source of phosphorus in the context of the sample locations is poorly performing domestic wastewater treatment systems.

Iron

Elevated iron concentrations were encountered in many of the tested groundwaters (nearly half being above the New Zealand drinking water aesthetic guideline value of 0.2 g/m³). One sampled groundwater supply, WWD5031 at Pakawau, had extremely high iron concentrations (35 g/m³). However, this bore intercepts a deeper and more confined aquifer than the other coastal groundwater supplies (which are shallow and unconfined). This particular bore has an extensive treatment system in place to remove the iron so that the resultant groundwater is suitable for domestic use.

Elevated iron concentrations are not necessarily indicative of contamination from non-natural sources. Rather, the encountered iron concentrations are considered to be naturally occurring and present a nuisance issue rather than a health issue. Nevertheless, such iron concentrations can be problematic if the groundwater is to be used as a water supply.

4. CONCLUSIONS

Groundwater

Whilst only limited data was collected from a relatively small number of sites, the comparison with the previous round of sampling does show reasonably consistent results. That is, in general the water supplies that showed some form of degradation (principally bacteriological contamination) when sampled during the summer of 2004/0205 showed similar degradation during the recent round of sampling.

Of the parameters tested only bacteriological contamination is of health based concern and only at some of the tested sites. Whilst many sites had elevated iron concentrations this is only a nuisance factor and not a health concern, nevertheless high iron concentrations can limit the usefulness of the water as a potable supply.

⁴ ANZECC. 2000. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000*, Australian and New Zealand Environment and Conservation Council and Agriculture and Resource management Council of Australia and New Zealand.

It is the responsibility of the bore/well owner to ensure that if they are to use it as a drinking water supply that it is fit for purpose and meets the relevant drinking water standards. The results of this sampling have been forwarded to the property owners as well as to Council's Co-ordinator Regulatory Services (David Lewis). Not all of the groundwater wells in these coastal communities are used as a drinking water supply. Many are used for non-potable purposes such as garden watering and boat/car washing etc. In general, these water supplies are suitable for such purposes.

A primary driver of this investigation was to characterise the general groundwater quality and where possible to gauge the extent, if at all, that these water sources are affected by the continued presence of on-site domestic wastewater systems within the coastal communities. Whilst the sampling undertaken to date cannot completely exclude other potential sources of contamination, it is likely that some wastewater treatment systems (at the very least) are contributing to the degradation of localised groundwater quality. However, at this stage it is unknown if these are localised "hotspots" or representative of wider spread groundwater contamination.

At present, under the Tasman Resource Management Plan (TRMP), domestic wastewater can be discharged to land in these coastal communities as a permitted activity under Rule 36.1.5, subject to meeting a number of performance criteria (i.e. conditions of the rule). Existing discharges that commenced prior to 19 September 1998 are assessed against the less stringent requirements of Rule 36.1.4.

Whilst in recent years greater scrutiny is afforded to the type and standard of onsite domestic wastewater treatment systems installed to ensure that they are capable of meeting the permitted activity requirements. However, very little, if at all, subsequent monitoring is undertaken to ensure that such systems continue to be operated and maintained in a manner that results in the discharge meeting the TRMP requirements. Complicating this, many wastewater treatment systems in these areas are subject to significantly increased loadings during the summer holiday period where typically more people are residing at these localities. It is unknown how well these systems are able to cope with such additional loadings and whether the resultant discharge of treated effluent continues to meet the requirements of the TRMP discharge rules.

Council undertakes regular bathing water quality surveys over the summer months at popular beaches. Of the beaches surveyed (for bacteriological contamination) throughout the District, the bathing water sampling sites located at Parapara, Pakawau and Tukurua have all experienced some undesirable levels of indicator bacteria. Whilst there are several potential sources that could be contributing to degraded bathing water quality, cumulative discharges from poorly performing domestic wastewater systems can be significant, particularly during the summer holiday period where the number of people residing in these beach side communities increases dramatically.

Rainwater Collection

Of the nine rainwater collection systems tested for bacteriological contamination only two had elevated *E.coli* bacteria present and hence did not comply with the New Zealand drinking water standards for potable water. It is not unexpected that some would not comply with the standard as a recent Ministry of Health survey found that nationally of the 400,000 or so people who rely on roof-collected rainwater for their

drinking water supplies, an estimated 16% do not have adequate supplies in terms of water quality.

The results of this testing has been forwarded to the respective property owners as well as to Council's Co-ordinator Regulatory Services (David Lewis).

5. RECOMMENDATIONS

- a) That the Committee receive this report.
- b) That Council staff continue to offer advice and information about domestic water quality, well and bore protection and the maintenance of on-site domestic wastewater systems, to residents when opportunities arise and/or in response to queries.
- c) That Council staff regularly monitor the actual on going performance of domestic wastewater systems to ensure that all systems (i.e. those authorised as permitted activities and by resource consent) continue to comply with the relevant performance standards required by Part VI of the TRMP or the conditions of consent.
- d) That Council staff continue monitor bathing water quality at the respective beaches fronting these communities during the summer months.
- e) That the Committee supports repeating this survey in five years time (e.g. summer of 2011/2012). This would enable trend assessment on the underlying groundwater quality and the adequacy or otherwise of the on going functioning of domestic wastewater systems in these areas.

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Figure 1: Location of groundwater sampling sites.

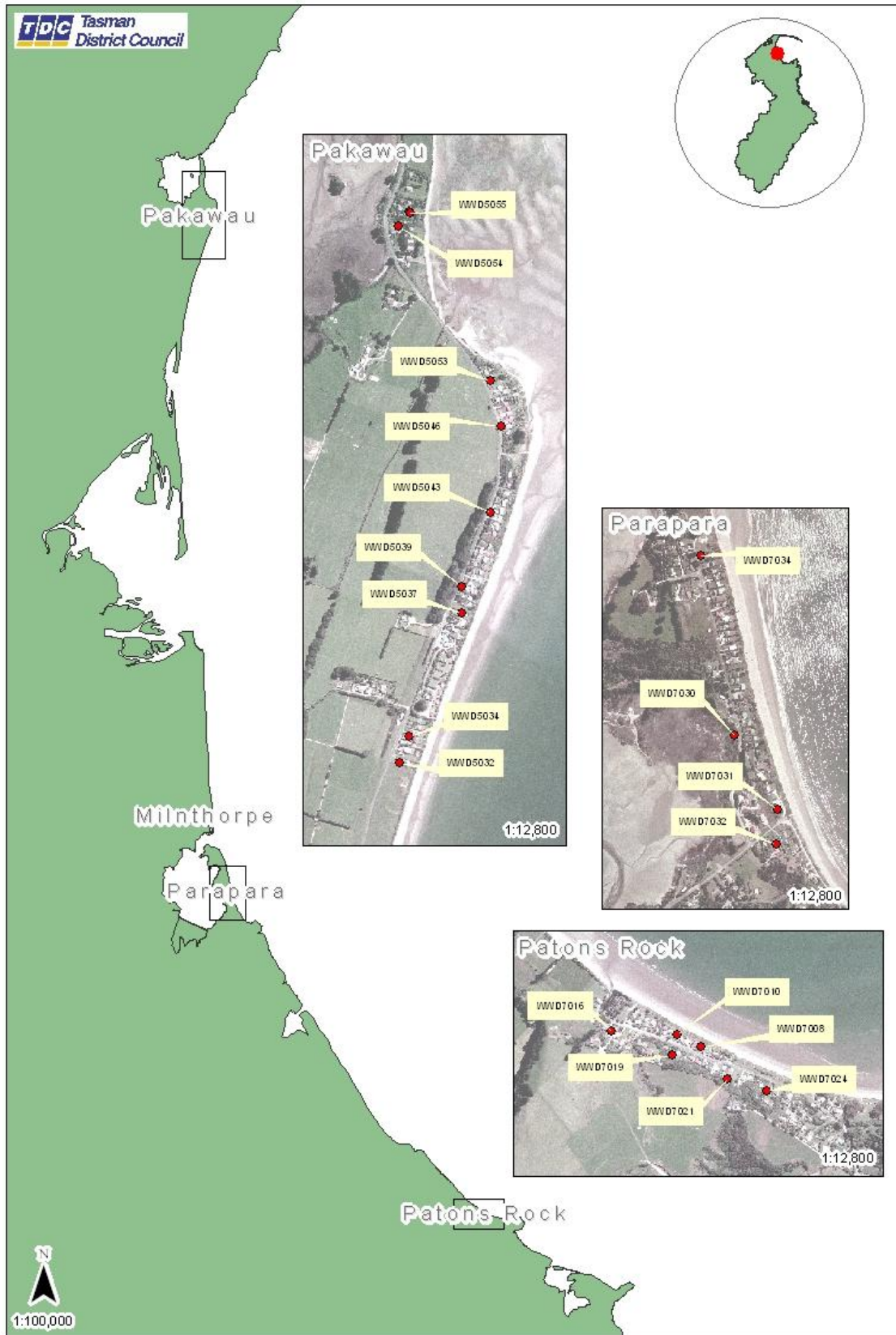


Table 1a: Groundwater Sampling Results

Community	Site	E.coli (cfu/100mL)	Faecal coliforms ⁵ (cfu/100mL)		Biological oxygen demand (g/m ³)		Iron ⁶ (g/m ³)	
		Summer 06/07	Summer 04/05	Summer 06/07	Summer 04/05	Summer 06/07	Summer 04/05	Summer 06/07
Patons Rock	WWD7008	<5	<1	<5	<1	<1	0.019	0.064
	WWD7010	<5	<1	<5	<1	<1	0.01	0.035
	WWD7016	<5	>100	<5	<1	<1	0.55	0.15
	WWD7019	-	8	-	<1	-	0.032	-
	WWD7021	60	<1	80	<1	10	0.068	0.25
	WWD7024	<5	17	<5	<1	<1	0.4	0.026
Parapara	WWD7031	<5	6	<5	<1	<1	0.083	2.4
	WWD7032	95	250	95	<1	<1	0.081	0.84
	WWD7034	40	270	40	<1	<1	0.012	0.92
Parapara community supply	WWD7030	<5	-	<5	-	<1	-	0.005
	Unknown property connected to scheme	-	<1	-	<1	-	0.005	-
	Unknown property connected to scheme	-	<1	-	<1	-	0.2	-
Totara Ave community supply	Unknown property connected to scheme	-	59	-	<1	-	0.011	-
	Unknown property connected to scheme	-	5	-	<1	-	0.014	-
	57 Totara Ave	12	-	12	-	<1	-	0.007
Pakawau	WWD5031	<5	-	<5	-	1	-	35
	WWD5032	<5	<1	<5	<1	<1	1.1	0.23
	WWD5034	<5	1	<5	<1	1	0.2	4.7
	WWD5037	49	9	49	<1	<1	0.15	2.2
	WWD5039	35	20	35	<1	<1	1.6	0.81
	WWD5043	<5	<1	<5	<1	<1	0.086	0.032
	WWD5046	-	16	-	<1	-	0.029	-
	WWD5053	<5	1	<5	<1	<1	0.012	0.14
	WWD5054	75	5	75	<1	<1	0.21	0.11
	WWD5055	1700	62	1700	<1	<1	0.037	0.015

⁵ New Zealand Drinking water Standard requires that

⁶ NZDW maximum guideline value of 0.2 g/m³ for aesthetic

Table 1b: Groundwater Sampling Results (continued)

Community	Site	Nitrate-N ⁷ (g/m ³ -N)		Dissolved reactive phosphorus (g/m ³)		Total suspended solids (g/m ³)	
		Summer 04/05	Summer 06/07	Summer 04/05	Summer 06/07	Summer 04/05	Summer 06/07
Patons Rock	WWD7008	0.84	1.3	<0.10	0.002	<1	<1
	WWD7010	1.8	0.41	<0.10	0.003	<1	1
	WWD7016	4.3	3.7	<0.10	0.002	5	<1
	WWD7019	0.52	-	<0.10	-	<1	-
	WWD7021	0.11	<0.02	<0.10	0.059	<1	12
	WWD7024	0.42	0.71	<0.10	0.026	1	<1
Parapara	WWD7031	0.97	<0.02	<0.10	<0.002	<1	17
	WWD7032	0.79	<0.02	<0.10	0.007	2	13
	WWD7034	0.72	0.037	<0.10	0.067	7	4
Parapara community supply	WWD7030	-	0.051	-	0.007	-	<3
	Unknown property connected to scheme	0.058	-	<0.10	-	<1	-
	Unknown property connected to scheme	0.054	-	<0.10	-	6	-
Totara Ave community supply	Unknown property connected to scheme	0.29	-	<0.10	-	<1	-
	Unknown property connected to scheme	0.26	-	<0.10	-	<1	-
	57 Totara Ave	-	0.34	-	0.009	-	1
Pakawau	WWD5031	-	<0.02	-	<0.002	-	58
	WWD5032	0.06	0.12	<0.10	0.006	4	<3
	WWD5034	4.2	0.051	<0.10	0.004	<1	6
	WWD5037	0.46	<0.02	<0.10	0.005	1	<3
	WWD5039	<0.02	<0.02	<0.10	0.092	4	1
	WWD5043	1.5	2.6	<0.10	0.004	<1	<1
	WWD5046	0.057	-	<0.10	-	2	-
	WWD5053	0.72	2.1	<0.10	<0.002	<1	<1
	WWD5054	1.1	0.88	<0.10	0.003	<1	1
	WWD5055	0.17	1.7	<0.10	0.012	2	<3

⁷ NZDW Standard 11.3 g/m³-N

Table 2: Rainwater Collection Sampling Results

Community	Site	E.coli (cfu/100mL)		Faecal coliforms (cfu/100mL)	
		Summer 04/05	Summer 06/07	Summer 04/05	Summer 06/07
Patons Rock	245 Patons Rock Rd	-	920	-	920
	283 Patons Rock Rd	-	75	-	75
	Unknown property	-	-	7	-
Parapara	68 Bishop Rd	-	<5	-	<5
	76 Bishop Rd	-	<5	-	<5
	83 Bishop Rd	-	<5	-	<5
	Unknown property	-	-	<1	-
Milnthorpe	22 Nelson St	-	<5	-	<5
	28 Nelson St	-	<5	-	<5
	Unknown property	-	-	<1	-
Pakawau	1076 Main Rd	-	<5	-	<5
	1130 Main Rd	-	<5	-	<5
	Unknown property	-	-	14	-