CLEARING THE WATER

The saving of Taranaki's most precious asset

By Jim Tucker

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THE WAITARA

Chapter 7

Long steps to recovery

Few rivers in Taranaki are as controversial as the Waitara.

The debates that have swirled around the biggest waterway in the province have little to do with the river itself, though, and everything to do with those who (mis) used it.

For decades until the end of the 1970s, it was a drain for the Waitara freezing works, the wool scouring plant and the town sewage tanks, which added their combined wastes to farming and dairy factory pollution and rubbish dump leachate swept down from a hinterland that unloaded soil and mudstone laid bare by early unsuccessful attempts to farm it.

In those days, the river's opaque surface hid nasty surprises. Rowing there as a young man, Kinsley Sampson, later chief executive of New Plymouth District Council, thought he'd snagged something with his oar one day. He had - when he hoisted the blade out it was entangled in a sheep's guts.[1]

The river flushed such detritus away into the sea, but sometimes too vigorously. As farmers cleared bush and drained swamps, the land lost its ability to absorb deluging rainfall and the Waitara developed a habit of flooding rapidly and massively, endangering the township in 1965, 1967, 1971 and 1990.

The river belches a dirty plume into the Tasman Sea, and scientists testing seawater and marine life have found evidence of the footprint on coastal reefs.

Westerly winds and currents sometimes push a layer of river water east for kilometres, making the consumption of shellfish taken from reefs at nearby Motunui a hazardous business.

Even in 1978, when the town and its industries got around to piping their wastes a few hundred metres out to sea off the river mouth, the problems were merely shifted

offshore and closer to one of the main kai moana reefs.

After community consensus was reached, repairs to the outfall and massive dosing with disinfecting lime eventually rendered the effluent more or less harmless in 1991, at least in a scientific context.[2]

The outfall owner, New Plymouth District Council, and local industries and farmers have spent millions on remedies and continue to do so, but that has not assuaged the offence felt by Māori at having human sewage - treated though it is - discharged into the sea near one of their sources of food.

As Taranaki Catchment Commission scientist Mike Patrick noted in his 2001 report on kai moana resources on the north Taranaki coast, the Waitangi Tribunal in 1982 heard of the impact of "cultural" pollution as distinct from scientifically-measurable pollution of reefs – that is, "human wastes are not supposed to be discharged into our food basket".[3]

Debates about the Waitara River include the origin of its name, which remains unsettled, at least among Pākehā historians.

Te Ara, the Encyclopedia of New Zealand, refers to the writings of A. H. McLintock, who in 1966 said the commonly accepted meaning of the name was "mountain stream".[4]

Since it is not a mountain stream and gains much of its flow from the inland hill country (although a major tributary, the Manganui River, does originate on Mount Taranaki), McLintock's take seems awry.

The *Reed Dictionary of New Zealand Place Names* says that as one word, *Waitara* means "hail", and as two it could mean "river" and "peak" (perhaps explaining McLintock's view).[5] It also says *tara* is a term for any sharp-pointed object, such as a spear.

However, the Reed dictionary prefers a literal translation of *Wai*: "river", and *taranga,* which it says is the long version of *tara,* and means "long steps". It links the name to Turi, captain of the waka, Aotea, who is said to have needed "long strides" to cross the river.

Ngāti Mutunga, a north Taranaki iwi that has many kilometres of the river as its south-eastern boundary, has its interest recorded in the Taranaki Regional

Council's 2010 *Regional Policy Statement*. That says the river takes its name from Te Whaitara-nui-ā-Wharematangi-i-te-kimi-i-tana-matua-i-ā-Ngārue.[6]

The main *Te Ara* reference to Waitara says the name of Waitara town is said to be derived from the story of Whare Matangi, the estranged son of Ngārue.[7] He was given a magic dart (tara) that would lead him to his father. After a number of throws, the tara struck Ngārue's house at the mouth of the river, thereafter known as Te Whaitara nui a Ngārue (follow the dart of Ngārue). This story was illustrated on the Ōwae marae entrance gate carver John Bevan Ford in 1973.

Despite the abuse and the controversy, the river is cherished by many. It has significant cultural importance for Māori, particularly those iwi on its banks, Ngāti Maru in the upper reaches, Ngāti Mutunga to the north and Te Ātiawa at Waitara.

During the 1982 Waitangi Tribunal hearings into the Motunui project, the river's status as a taonga and source of food was frequently raised. Giving evidence, Hikaia Amohia of Te Ātiawa said: "My people personify the river as an entity allied to our ancestor Maruwaranui, with the spirit or taniwha of the river a personification of the spirit of the river."[8]

A survey conducted by the Taranaki Catchment Commission found it was the most popular in the province for recreation ranging from jet-boating, rowing, kayaking, water skiing, sailing, fishing, and white-baiting, to tramping and visiting historical, scientific and educational features.[9]

This chapter continues the theme of the previous two and explores the lengthy strides taken by the many guardians of the Waitara River to restore and modify it in a way that is acceptable to those who hold it in great stead.

For people who don't see it every day, the enduring image of the Waitara River is...well, brown. Naturally, it's more intricate than that.

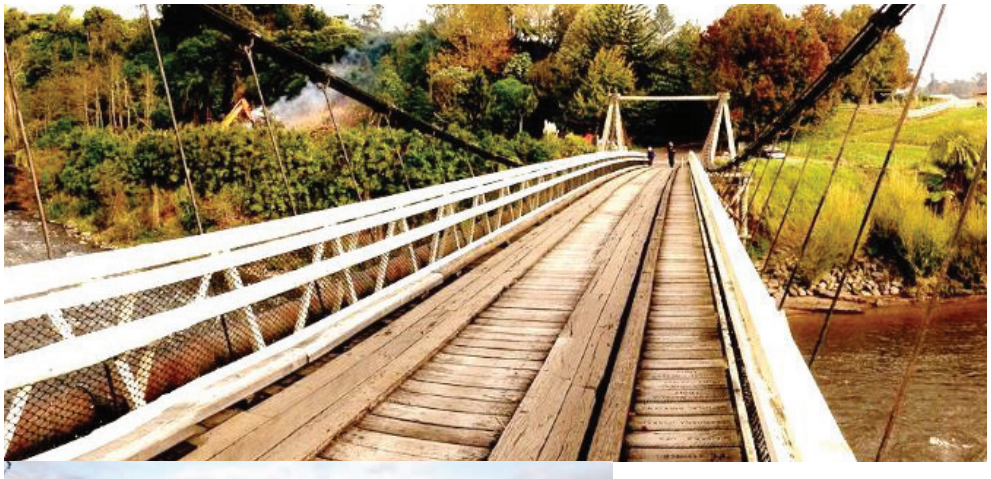
Down near the mouth, if the tide is coming in and the light's just right on a fine autumn morning and there hasn't been any rain for a day or two, the water is the deep, dark green of pounamu as it slides past the town.

Upstream at the graceful Bertrand Road swing-bridge, it has the hues of a weak flat white coffee, and in Tarata country at Pūrangi Bridge, it's army camouflage.

In the high hill country, north of the "republic" of Whangamomona and past Tāhora Saddle, if you look from one of the bridges on the Mangapapa Road (off the Forgotten World Highway, SH43), you're surprised to see it's as clear (and small) as a Mount Taranaki Ring Plain stream.

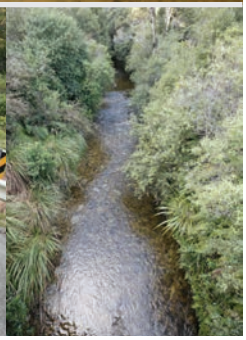
There's a reddish tinge to the papa riverbed, something to do with tannin from the bush.

Those colour variations speak volumes about the complexity of the river, especially the state of its waters. These have been the subject of more reports by the Taranaki Regional Council than probably any other river.



Multiple Shades
Waitara River shows its many colours.

Above: Bertrand Rd Bridge. Left: Hocken farm at Tarata. Below: Pūrangi. Lower left: Above Pūrangi. Lower right: Upper Waitara; and bottom: A bridge on Mangapapa Rd, reached via Forgotten Highway



The water's opaqueness is what makes the Waitara different from Taranaki's typical rivers. It's the result of the hinterland, hill country known for its erosion-prone mudstone, papa, a hard clay the colour of the underside of a rain cloud.

Grey, relentless grey, as shown in this photograph **(above)** taken on Moki Road. When 19th and 20th century pioneers struck out into the hinterland in hope of farming the hill country inland from Taranaki and Whanganui, their failures left more than the Bridge to Nowhere.[10]

Stripping the land of its bush left it open to the ravages of the weather, which to this day tears at the soft earth and fills the river and its tributaries with sediment. It can be difficult to understand why country that these days looks less scarred under a cloak of pasture and regenerating bush can still colour up the Waitara at the drop of a downpour.

But locals have their theories.

One-time Whangamomona publican Geoff Taylor **(pictured below)** stamping the passports of tourists who have found their way to the republic says the paddocks may look as green as a village sward, but anyone foolish enough to kneel down on the grass will find the papa stain never comes out of their jeans. He knows – it happened to him.

Tarata farmer Bryan Hocken (**above**), who has more than eight kilometres of the river as a boundary, says a century and more of removing bush and piping swamps means the land is no longer able to slow the drainage of rainwater, causing the Waitara to rise rapidly to flood levels.

In its reports on various qualities of the river, TRC confirms what everyone can see – the river often carries a heavy burden of suspended matter that reduces clarity to less than half a metre (0.8m is desirable for river ecology, 1.6m for swimming).[11] The particle loading is high, getting to 8.5 NTUs on the scale, the preferred limit being 5.6.[12]

"Lower Waitara River median clarity and particularly turbidity were the worst of all thirteen sites monitored in the region, reflecting the significant impact of the eastern hill country component of this large river's catchment," the council reported in 2012.[13]

The council's 2001 regional soil plan offers land-users advice on how to manage the effects of erosion in the eastern hill country.[14] Its last review in 2009 showed that 293 hill country farms covering 178,580 hectares (58% of privately owned land) had soil management plans that involved retiring erosion-prone areas from grazing and/or replanting with trees.[15]

By June 2013 the numbers looked even better, with 329 plans in place covering 180,665 hectares of land, 59% of it privately owned. The council says the objective is to increase productivity as well as stem erosion.

One recent example of the success of this approach was recorded in May 2013 in a story by *Taranaki Daily News* farming reporter Sue O'Dowd about tree planting on one of the big stations in the area, 713ha Motu Maniapoto.

Tarata landowner and New Plymouth insurance consultant Lyall Bunn has used funds from the Taranaki Regional Council (TRC) South Taranaki Regional Erosion Support Scheme to help him withdraw 25ha from pasture.

He has planted pine at 100 stems per hectare. The trees are on south-facing slopes where they grow more slowly in the ash soil to retain wood quality.

Bunn said forestry offered the potential to diversify farm income in future. Thirty-four hectares planted in forestry on Motu Maniapoto in the early 1990s should be ready for harvest within 10 years.

The scheme funding covered half the cost of fencing the new forest block. Bunn financed the remainder and carried out earthworks with his own earthmoving equipment.

The Waitara starts in a cave in steep regenerating bush country a few hours' tramp from the nearest of the precarious loose-metal roads that venture over the ridgelines.

Well before such tenuous links opened up the area, south Taranaki Māori warrior Riwha Tītokowaru, of Ngā Ruahine and Ngāti Ruanui, used its inaccessibility in the early 1870s as a refuge from pursuing colonial troops, at times, legend has it, living in a cave that could be reached only via the waters of the Waitara.

There are several waterfalls in the upper reaches. In fine weather in the upper catchment, the river runs as clear as the Stony, but as it emerges onto farmland near the Moki Road it begins to pick up colour. By the time it has coiled its way down to Pūrangi, the midpoint of its journey, the water can be brackish and brown.

However, Ian and Laurel Aitken (**above**), who grow walnuts and fruit in an idyllic, sheltered part of the valley just up from the road bridge, agree with Bryan Hocken that even this far down, the river runs clear at times when there has been no rain for a while.

For the Aitkens, the water temperature provides a micro-climate effect in winter, but the river's potential to flood is never quite forgotten. In their 32 years, they count the big one in 1990 as the worst, although by chance they weren't at home when it struck. They were at a family wedding in Waitara, enjoying the wedding breakfast at the Masonic Hotel, when police arrived to order them out. The town was evacuated as floodwaters crept close to the top of the stop-banks, which held by barely a foot.

Ian and Laurel couldn't get back home for a day or so, and when they did there was ample evidence of the river's rampage over the lower part of their property.

Further downstream at the Hocken farm, the river is broad, slow, lazy, papa-brown. The day we visit, the Hockens are hosting the Taranaki Hunt Club. About 30 riders and a dozen or so hounds taking a gentle gallop over steep paddocks in search of hares.

The river features when Jane, a two-year-old hound, gets down a steep, papa bluff and can't get out without a perilous swim for half a kilometre downstream (**above**).

She is urged to safety by the calls of the pack and worried hunters, some of them stripping off jackets in expectation of an unscheduled autumn swim.

Were Jane's masters (and mistresses) at risk of catching something in water that appears, from its mere colour, to be polluted? That far upstream, unless they drank some, it's unlikely.

While the only permanent water monitor in these parts, a metering station at Pūrangi Bridge, doesn't test for bacteria – it records flows and warns of river level rises – there are comparatively few dairy farms operating in this steeper part of the catchment.

The agriculture is sheep and beef, which produce some paddock runoff, but nothing like the problematic contribution of big dairy herds being grazed close to river banks further downstream.

The greater bacteriological dangers, such as they are, begin to accumulate below Tarata, as the landscape eases.

Here, the Waitara gains its main tributary, the Manganui, a Mount Taranaki stream that flows 44 kilometres across the dairying Ring Plain before joining the main river well east of Inglewood.

By the lower Waitara Valley, the river is big by Taranaki standards, and it was the sheer volume of its flow that attracted Think Big petrochemical project planners to the neighbourhood back in the late 1970s.

So how much water is there and how much could it supply? One of the earliest to know for sure was current Taranaki Regional Council chief executive Basil Chamberlain. One of his first jobs for the Taranaki Catchment Commission after he arrived in 1980 was to write a Waitara River management plan, in which he described the hydrology of the 1470 square kilometre catchment,[16] the largest within the water board's jurisdiction.[17]

He described the Waitara as rising about 450 metres above sea level and flowing some 150 kilometres through well-dissected hill country, whose soft, easily eroded tertiary deposits give it a very high sediment load.

In contrast, the Manganui starts 1700 metres above sea level and drains the eastern slopes of Mount Taranaki, before joining the Waitara about eight kilometres above the Bertrand Road bridge.

Its main tributaries include Te Popo, Waipuku, Mangawhete, Maketawa, Piakau and Ngātoro streams all beginning on the mountain and carrying clear, snow-fed water on boulder beds.

He said the waters of the two actually mix before their natural confluence, as flow from the upper Manganui is diverted just below Tāriki Road through a canal to Lake Ratapiko, from where it passes through the Motukawa power station before joining the Waitara about three kilometres upstream from Tarata.

At Bertrand Road, the mean daily flow of the Waitara is about 60,000 litres per second, dropping to an estimated 10-year low of 3400 to 3800. More recent figures show the highest flow ever recorded was 2.45 million litres per second.[18]

Looking ahead to potential future uses such as the Think Big projects, water supplies and horticultural irrigation, Chamberlain reckoned demand by 2013 would not go above 1800 litres per second, which was insignificant given the river's flows for 99% of the time.

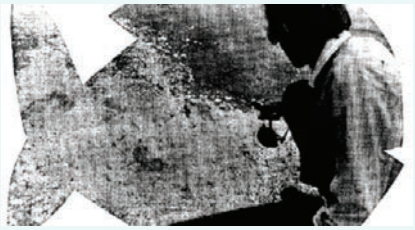
However, there could be serious problems during the other one per cent. So he used complex and at that time relatively new methods to calculate what he termed was a residual low flow – the lowest the river could go before irreparable harm was done to its ecology.

The number he came up with was 2600 litres per second. He then divided the available water into category A – for users who needed guaranteed supply (farmers, horticulturalists, the towns of Inglewood and Midhirst, plus the two Think Big projects) - and category B.

In the latter case, a water right would insist on no or off-peak use if the river fell to the 10-year low.

Existing category A users already took 205 litres per second and the two Think Big plants would eventually need 600, making a total of 805, which added to the residual desirable flow of 2600 was still within the 10-year low of 3400 to 3800.

But only just, so he recommended restrictions be placed on the Think Big users.[19]



Fit for the cats…

An old woman and a youth fish for herring from the wharf. Thin, nut-brown fingers tug at lines. Rod and reel flick lazily. Plump fish wriggle in buckets.

The pair is oblivious to the sight below.

Down there, the surface of the river is thickly congealed with fat and foamy wastes. Around the wharf piles the water boils as herrings feed in frenzy, bobbing and biting at the clots of effluent whirling by.

The water for yards downstream is concealed by clouds of fatty matter which spread out from the bank and form themselves into patterns of cumulus-nimbus and stratus.

To the uninitiated, the spectacle is fascinating…and horrible. To the people of Waitara, it is part of life.

"Not for me, dear. The cats, for the cats," says the old woman. 'I wouldn't eat anything out of here. You need a bath after a day down here. I suppose they'll do something about it one day…"

The Bertrand Road gauge station (**left**) is where Chamberlain gathered some of his early data. It is the point where the river flows down into the flood plain of the lower Waitara Valley...and controversy.

In the box on the previous page is the somewhat overblown description I wrote in 1972 of a scene at Waitara Wharf as an introduction to a series on water pollution in the *Taranaki Herald*.

It was the worst sight I saw in a six-month investigation, something to which black and white photography of the day could not do justice.

At the time, the main problem was the Borthwicks meat works, which had been operating there for more than a century and employed about 1000 people.

Its buildings sprawled along the western bank of the river, into which it and an associated wool-scouring company poured a constant stream of foul wastes after minimal screening - blood, guts, processing water, fat, slime, and faecal matter.

Primary treatment of the works' discharge - equated to the outpourings of a city of 200,000 people - was not introduced until 1956.[20]

The town sewage was as bad. The Waitangi Tribunal's 1983 finding on Motunui quoted Department of Health reports from as early as 1937 - when Waitara's population was 1971 (by 1982 it had grown to 6012) – as saying in the first half of the 20th century there was no sewerage system for houses.[21]

"By 1947, it was reported that all stages of development in excreta disposal were evident at Waitara, ranging from homes with only the crudest form of disposal or with bucket latrines serviced by a night soil collection, to homes with individual septic tanks and homes linked to the borough water-borne sewerage installation, which discharged domestic sewage into the Waitara River via several septic tanks. By 1950 a sewerage installation scheme for the discharge of sewage from five septic tanks into the Waitara River was completed. A reminder of the health dangers came in 1967, when there were nine cases of typhoid, all in the Māori population, "with a strong possibility that polluted shellfish were implicated at Waitara...".

The Waitara Town Wharf

The river was already contaminated before it got to the town: hundreds of dairy farm cowsheds were washed into it twice a day; dairy factories from as far away as Inglewood contributed whey wastes from the manufacture of casein. Inglewood treated its sewage in ponds, but as the town grew these became overloaded and discharged contaminated water into the Manganui, and thence to the Waitara.

About the same time as publication of

the *Taranaki Herald* articles, the newly formed Taranaki Catchment Commission - one of whose founding members was Waitara Mayor Dick Wilson - began its long campaign to clean up the province's rivers.

Fixing the Waitara was a prime objective. Waitara Borough Council acknowledged it had to do something, so built a marine outfall to discharge the town and works effluent out beyond the breakers, through a pipe that would swap the river for the sea as a disposal solution.

The outfall project went wrong from the start. During construction, a storm swept part of it away, and when it was finally operating by 1978, it leaked and polluted the main shellfish source, Orapa (Airedale) Reef, to the east of the river mouth.

In a letter to the *Taranaki Daily News* in 2010, Basil Chamberlain described it: "The first outfall, which was short and leaked, discharged chopped-up raw sewage into the surf zone off the river mouth until 1991."[22]

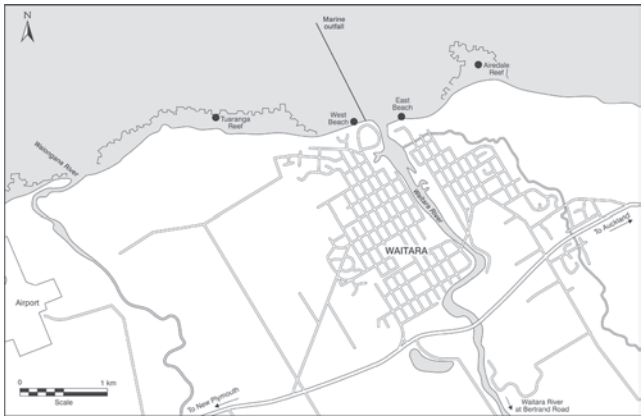
It was not until 1991 that things began to improve.

That year, the recently constituted New Plymouth District Council,[23] which inherited the problem when it took over Waitara Borough, and AFFCO, which had taken over the meatworks, installed a greatly improved treatment plant and outfall.

The sewage and works wastes were put through fine screens to remove solids; effluent was disinfected with a process called high-lime treatment; and the outfall pipe was re-lined with a leak-proof membrane,[24] fixed properly to the seabed, and extended 1.2 kilometres into marine currents beyond the reefs, where it discharges through a diffuser.

The meatworks company paid more than 70% of the cost of $1.8 million.

The outfall load shrank in 1997 when the meatworks closed because of high redevelopment costs faced by the meat industry to meet new hygiene regulations in the America and Europe.



That input has since been partly replaced by a smaller operation, Anzco Foods, which has the right to contribute up to 12,960 cubic metres of effluent a day (150 litres per second) to the system.

This is much the same flow as the Motunui methanol plant process water, which discharges directly to the sea via the Waitara outfall. It does not run through the Waitara treatment plant.

In another important development, Inglewood's sewage was routed away from the Waitara catchment through to the New Plymouth treatment plant in 1999, partly through a pipeline originally built to link Inglewood's Moa Dairy Company to Brixton.

The catchment commission, and now TRC, worked on getting dairy farmers to discharge their cowshed washings to treatment ponds and irrigation systems.

Chamberlain said by 2010 the Waitara catchment's 207 farms had spent an estimated $5 million to discharge wastes either to land or through treatment pond systems. TRC inspects them at least once a year. The council ran a rigorous dairy-

shed compliance programme, he said. “In the past decade, 147 abatement notices and 17 infringement notices have been issued in the Waitara catchment, and seven prosecutions taken to Court. One resulted in a fine of $62,000.”

The council is also encouraging farmers to fence and plant the riparian margins, with those in the Manganui catchment so far investing $2 million.

The Waitara’s fondness for sudden, high freshes and floods makes some of its flood plain margins unsuited to riparian planting, but some farmers like Bryan Hocken have fenced most of their river margins, which has helped keep cattle from trampling the banks and adding to the sediment load.

Fencing also reduces stock losses, making life more pleasant for Waitara residents long used to the sight of carcasses on their beaches.

Analytical Results for the Waitara River at the Town Wharf

DATE	Time	Conductivity @20°C	Bacteria			Temperature	Turbidity
	(NZST)	(ms/m)	*E.coll* (nos/100ml)	Enterococcl (nos/100ml)	Faecal califorms (nos/100ml)	(°C)	(NTU)
15.11.11	1145	352	120	13	120	17.0	5.6
28.11.11	1150	866	550	100	550	16.9	25
22.01.12	1005	567	100	42	100	18.8	2.9
26.01.12	0915	670	210	120	220	19.0	2.4
7.02.12	0940	110	100	52	100	18.8	1.5
10.02.12	1300	1310	79	42	87	20.8	1.5
13.02.12	1420	973	44	25	44	22.5	1.6
21.02.12	1010	466	230	110	230	20.9	1.4
27.02.12	1305	653	200	72	200	19.2	16
8.03.12	0940	900	260	79	260	15.9	9.6
28.03.12	1205	140	300	51	300	16.3	12
30.03.12	1430	253	150	40	160	17.2	4.4
10.04.12	1330	832	28	5	31	17.2	1.8

Meantime, the two Think Big projects have done no apparent harm with their contributions to the outfall discharge, close monitoring showing no discernible effects on marine life. More on that later.

So, after expenditure of more than $30 million between 1975 and 2011, according to TRC estimates, and with another $23 million being invested in refurbishing and expanding the New Plymouth treatment plant and piping the most problematic Waitara effluent there from 2014, are all the Waitara problems fixed?

In terms of bugs in the water, it's not easy to say.

That's because there are different ways of interpreting the results of all the sampling and testing that goes on in the river, and in the sea (in what's called the Waitara embayment).

If you go by the Ministry for the Environment's 2007 river "league tables" showing the condition of 77 of the nation's rivers, the Waitara is in big trouble.[25] On one table showing waterways' suitability for swimming, it rates as the worst in the country. It is more fouled, apparently, than the Manawatū, which in 2009 achieved the dubious distinction of being "among worst in the West", according to news headlines.[26] However, it depends on which figures you choose when it comes to drawing conclusions.

The Ministry tables are the result of sampling done by Niwa at Bertrand Road since 1989. It bases its rankings on the worst 5% of what turns up, using a calculation called the 95th percentile.

For a river like the Waitara, those "worst case" results are likely to be from when the flow is affected by heavy rain and flooding, which wash farming wastes off the land. There is supposedly a way around that: readings are delayed until three days after any significant rainfall and flood event.

But while that seems to work okay for smaller rivers, the size and makeup of the Waitara catchment mean it may take longer than expected (up to five days) for the effects of rain in the hinterland to drain away.

That's a theory expounded by the TRC, and it is backed up by the most recent report on the river's bacteriological condition.

Results of samples taken at the Waitara town wharf indicated negligible levels of E coli, the marker bacteria, throughout the summer of 2011-12, with the "alert" mark reached only twice in 13 samples, and the "action" level never. The report said those occasions coincided with "more turbid, brown river appearance indicative of the lag effects of rainfall run-off within this large catchment.

"The three-day post rainfall sampling protocols followed by the SEM programme for the other (Ring Plain) catchment sites are therefore not necessarily appropriate for baseline assessments of bacteriological water quality [at] this site near the mouth of this large predominantly eastern hill country catchment river."[27]

The TRC scientists confirmed that by sampling again two days later - E coli levels were back to an acceptable level. Acceptable? The national guidelines for E coli, which signal the presence of other, possibly harmful bacteria, say levels should be less than 260 per 100 millilitres of water.

They hit 300 and 550 on the occasions mentioned above, but the average for 11 of the 13 samples (dropping the highest, 550, and the lowest, 28) was a mere 163.

Averages are not usually applied to numbers like this, with scientists preferring to use the "median", the middle number in a range of numbers. For the 2011-12 tests, the median was just 150.

Let's compare that with the number used by the Ministry for the Environment for its league table. The Waitara's 95th percentile reading – its worst 5% - was 30 times bigger than the TRC's median: 4426.6 E coli per 100 millilitres, placing it 76th of 76

rivers. That was more than twice as high as the supposed world's worst river, the Manawatū, which placed 74th with 2041.7. The Whanganui was 75th with 3629.4.

The question is, should the worst-case scenario be used to make such a judgement, given that few people would be inclined to swim in the Waitara when it's still in flood?

Someone might fall in, of course, which is the Ministry's justification for publishing the numbers as it does. It is a matter of risk evaluation, versus what is actually happening in the river 95% of the time.

The Ministry does publish other numbers for each river, including the median reading for E coli and the one for the fifth percentile, the best-case.

It's an interesting exercise to re-rank the rivers using the medians, because then the Waitara (median a mere 65) leaps up the rankings to a much more respectable 49th, ahead of the Manganui, in fact. The latter is 57th (median 91), which is well down on its worst-case rating of 23rd (276).

On the basis of medians, there are far worse rivers than the Waitara. The most polluted is the Mataura in Southland (median 488), followed by Northland's Mangakahia (390) and Waitangi (326) Rivers.

The Waitara is better than the Waikato, the Waihou (at Te Aroha), the Waipa, the Waipoa (Gisborne) and the Whanganui. And the "world's worst" river? One of the Manawatū's two sample sites recorded median E coli of 61, which scored a ranking one better than the Waitara, 48th.

In fairness, the Ministry can claim that all rivers are treated the same. However, as the table's background information on each testing site shows, conditions vary greatly.

Rivers with similar sized catchments may get their water via countryside that has natural bush, planted forests, dairy farms, hill country farms, towns, cities and villages, all of which influence the results.

As the TRC notes drily in its 2011-12 report on physical and chemical monitoring done on the province's rivers: "The complex variations of those characteristics in the natural, and more especially the modified environment, makes it difficult to obtain accurate understandings…".[28]

Its concerns go further than the league table E coli ranking. Another system developed by the Ministry for the Environment and the Ministry of Health in 2003, called the Suitability For Recreation Grading (SFRG),[29] indicates that despite the TRC's low E coli counts, nobody should be swimming off the wharf, or anywhere else in the lower Waitara Valley.

If that method is used to compare the Waitara with 16 other key recreation sites around Taranaki, the river ranks fourth worst in the province, and gets a grading of "very poor", which means swimming is ill-advised.

But here's the context: in fact, none of the 17 recreation sites achieved a pass.[30] Seven ranked "poor" and the rest got the same "very poor" grading as the Waitara. The same happened in the summer of 2012-13 (see Chapter 10).

Although the Waitara's showing is linked to dairy farm runoff, most of the gradings are affected by birdlife. The three rated worse than Waitara – Te Hēnui river mouth, Lake Rotomanu in New Plymouth, and the Waiwhakaiho River near Lake Rotomanu

- all have big populations of wildfowl or seagulls, a factor identified by genetic testing. The next one down from Waitara, Lake Opunake, has the same issue.

Supposedly, then, none of Taranaki's favourite freshwater swimming places is safe. But the Regional Council disagrees, and rejects the Ministry's SFRG system as misleading.[31] It says gradings were determined by factors other than bacteriological results, such as the agricultural nature of the catchments in question.

The council's five-year microbiological data showed that all but one site (Te Hēnui Stream) would not have risen above the "action" guideline [more than 550 E coli per 100 millilitres] on more than 16% of all sampling occasions, with 11 sites below that on 90% or more of occasions.

"In general, these data indicate shortcomings in the grading system for these sites based upon land-use/perceived impacts and the use of extremes (95% confidence levels) in bacteriological quality data, rather than actual monitoring data measured throughout the bathing seasons."

The council says its contact recreational water quality programme results (E coli, etc, levels) confirmed that gradings did not reflect the water quality *actually* experienced by recreational users.[32] It believes SFRG gradings should not be used to make any statement about how safe water "actually" is for recreational purposes.[33]

The TRC has been on firmer ground to make this argument since it started bacteria testing from the town wharf in 2009, a strategy it adopted in conjunction with New Plymouth District Council and the Taranaki District Health Board.

Sampling over three summers at the wharf – a more popular swimming place since the district council refurbished the waterfront – found occasional low levels of faecal contamination, mostly from cattle, but also from human waste.

The TRC is not yet drawing any long-term trend conclusions from such a short period of testing (that will take at least 10 years), but these data seem to show the risks from bacteria are low, at least for water contact sports like swimming… except after a flood. Hence the warning signs.

Faecal bacteria are not the only measure of danger to health, a point acknowledged by the councils when in 2011 the New Plymouth District Council applied for a new resource consent to continue discharging treated sewage to the sea off the coast east of Waiwhakaiho.[34]

Another risk is from viruses, whose incidence may bear no relation to the number of bacteria found in a waterway.

But there is a problem: science is yet to settle on a reliable way to monitor their presence over the long term.

Notwithstanding that obstacle, the district council commissioned Niwa scientist Graham McBride to assess the risks from viruses, and the TRC got its marine biologist, Erin Zydervelt, to investigate the same topic.

Zydervelt's report said human viruses in the marine environment pose a potential

risk to humans through contact recreation such as swimming, but the greater danger comes from eating virus-contaminated shellfish, which can filter four to twenty litres of seawater an hour. [35]

Virus concentrations found within shellfish can be between 100-1000 times greater than in the water, and they can persist in the shellfish gut for several weeks or months. Contaminated shellfish can cause gastro-enteritis and hepatitis A, which can be transmitted from person to person, her report said.

Potential sources of human viruses include discharges to the Waitara River, such as improperly managed septic tanks, broken sewage reticulation pipes and illegal dumping of sewage, and discharges at sea by boats and the Waitara waste water treatment plant outfall.

How effective the plant was at killing viral cells was not known, she said, because it had never been specifically examined, and it would not be, given the sewage was soon to be piped to New Plymouth. The district council collected water samples from the Waitara River at four sites over a variety of flow and weather conditions and had these tested for microbial source tracking.

Bacterial markers likely to be from a human sewage source were found in four out of the five surveys, but could have come from any of the sources listed above: “It is not possible to pinpoint a specific source or sources at this time.”

While studies have shown people, especially children, can swallow up to 280 millilitres of water when swimming,[36] few people ever report coming down with virus-related illnesses like gastro-enteritis.

Nevertheless, in 2010 the district council contacted local medical offices in Waitara and the Taranaki Base Hospital to find out if any illnesses had been treated that were linked to contact recreation or shellfish consumption in the Waitara area. There were no known cases. But that didn’t help much, Zydervelt concluded, because the low reporting rate for illness meant it was not an appropriate method to analyse potential risks to human health.[37]

So how big is the risk? Zydervelt said virology results showed the Waitara shellfish contained mostly “low” levels of human noro-viruses,[38] but one sample had “moderate” levels. Guidelines developed by ESR (the Institute of Environmental Science and Research) say “low” levels are less than 80, and “moderate” levels are 80-320.[39]

But although the investigation indicated low virus levels, “even contact recreation may still pose a very low risk, and consumption of shellfish from the Waitara embayment may also pose some risk to human health”.

The infectious dose of noro-virus is low, believed to be 10-100 particles, and there are currently no guidelines for virus limits in New Zealand or internationally.

Will methods of monitoring and detection of viruses improve? It’s unlikely in the foreseeable future, it seems.

In a letter to the TRC in 2011, David de Jager, a Ministry of Health senior adviser, said ESR had done significant work on viruses in source and drinking water, but as there was no recognised methodology to identify infective and/or pathogenic viruses, “this work has reached a natural conclusion at this time.”[40]

Graham McBride’s report was an assessment of the risks from viruses – notably noro-virus[42] – that may come from the New Plymouth outfall during the plant upgrade and afterwards.

It is interesting to note he estimates virus risks to swimmers from marine-discharged effluent treated with high lime or chlorine as low - on average, less than 1% of bathers.

Risks are higher for raw shellfish consumption, “to the extent that, under present conditions, the only safe gathering sites lie some distance westward of the [New Plymouth] outfall,” a comment that undoubtedly applies to Waitara, as well.

Aside from the presence of microbes, what is the state of the river according to other measures, such as levels of nutrients like ammonia, nitrates and phosphorus, and the welfare of fish and macro-invertebrate life?

In its latest report on monitoring physico-chemical trends, the TRC says water quality has been relatively stable at the Waitara River (Bertrand Road) site compared with national trends and, “not surprisingly, water quality remains high at the upper/mid catchment Manganui River site.”

“There has been a reduction in ammonia levels at the Waitara River site (between 1989 and 2007) over the longer period.”[43] A read of various medians in long term trends reported by the Ministry for the Environment[44] shows there have been no significant changes to dissolved oxygen saturation (102.4%; MfE guideline 101%); clarity (0.380 metres; guideline 1.6m for swimming, 0.8m for ecology); total phosphorus[45] (0.033 milligrams per litre; guideline 0.03); and nitrate/nitrite (0.198 milligrams per litre: national median 0.108).[46]

Comparison of 1995 - 2012 SEM (TRC and NIWA) sites' water quality guideline values for various usage

Usage	Aesthetics		Contact recreation		Prevention of undesirable growths			Stock water		Aquatic ecosystems					Irrigation	Drinking water	
Parameter	Black disc	BOD[5]	E.coli	BOD[5]	DRP	TP	TN	Faecal coliforms	Faecal coliforms	Black disc	DO Saturation	NO_3	NH_4	Temp	TN	TP	NO_3
Guideline	>1.6 m	>3g/m^3	<550/100mls	<3g/m^3	<0.03 g/m^{3}P	<0.03 g/m^{3}P •	<0.6 g/m^{3}N •	<1000/100mls	Median <100/100 mls	>0.8m	>80%	<0.4 g/m^{3}N	<0.9 g/m^{3}N	<25° C	<25 g/m^{3}N	<0.8 g/m^{3}P	<11.3 g/m^{3}N
Waitara River at Bertrand Road	x	✓✓	✓	✓✓	✓	x	✓	✓	x	x	✓✓*	✓	✓✓	✓✓	✓✓	✓✓	✓✓
Summary of sites (13) in compliance	9	13	12	13	10	6	8	13	3	12	13	8	13	13	13	13	13

Key:
✓✓ = maximum (*minimum) value meets usage guideline
✓ = median value, meets usage guideline
x = median value, does not meet usage guideline
• = 80% of values to meet usage guidelines

References: 1 = ANZECC, 2000
2 = TRC, 2003 & TRC, 2009
3 = MfE, 2003

For two measures, the trends show a “meaningful increase”, which means a change greater than 1% a year. These were for dissolved reactive phosphate (0.005 milligrams per litre; national median 0.0041) and total nitrogen (0.498 milligrams per litre; national median 0.264).

Those numbers show the Waitara meets or is better than the national guidelines or medians for oxygen and total phosphorus, but fails to meet them for the other parameters.

However, as usual, it is more complicated than that. Here are the figures (some using different units of measure) in the latest TRC report, which breaks the numbers down into different water uses:

These indicate the river is doing okay in most indicators, but fails in the areas of clarity, total phosphorus (for algal growth), and faecal coliforms for stock water.

Confused? So let’s try another measure of water quality health – the ecology, or what lives in it.

It follows that river life will be influenced by the physical and chemical qualities of the water. In the case of the Waitara, lack of clarity and the heavy sediment load affect its life forms, as does the level of nutrients (nitrogen, phosphorus).

A useful indicator is the amount of "nuisance" periphyton that grows. Periphyton is algae found on the beds of streams and lakes, playing a key role by turning dissolved nutrients into nutritious food (ie, periphyton biomass) for invertebrates, which are themselves food for fish and birds, says a Ministry for the Environment report on periphyton in its river network, monitored by Niwa scientists since 1990.[47]

"However, there can be too much of a good thing. Periphyton blooms, as long filamentous growths or thick mats that cover much of the streambed, can make the stream unattractive for swimming and useless for angling, clog up water intakes, and reduce biodiversity by making the streambed habitat unsuitable for many sensitive invertebrate species."

The report said periphyton coverage is actually declining in the country's rivers, probably a result of point source pollution being eradicated over time.

The results for the Waitara showed no major problem, with average infestation less than 20% of the water surface. That is well within the MfE guidelines of 40%. The TRC monitors periphyton in a number of rivers, but not the Waitara main catchment, only the tributary Manganui.

Results for the period 2002-2010 show it never exceeded the MfE guideline for thick mats of growth, and went over the guideline for long, filamentous growth during only a couple of dry summers (2004 and 2006).[48]

One of the TRC's main measurements of river health is the macroinvertebrate community index score (MCI), which is calculated by sampling a waterway for the minute creatures that live in and on the water. Some are sensitive to pollution and others tolerate it, so the index rates a river based on how many of each kind are found.

Grading	MCI
Excellent	>140
Very Good	120-140
Good	100-119
Fair	80-99
Poor	60-79
Very Poor	<60

The best results – more than 140 on the scale - are found near the headwaters of Taranaki's mountain streams before the influences of farming are felt. Scores decline slowly as streams flow down to the sea, where they can drop as low as the 1970s.

The Manganui is no exception, scoring as high as 143 at an upper catchment sampling site, but dropping as low as 77 at the second site downstream during summers when flows are low and periphyton expands its coverage.[49]

It scores exceptionally well on the MfE league table, coming in at number four of 66 rivers monitored between 2005 and 2007, with an average MCI of 130.6.[40] The Waitara does reasonably well there, too, ranking 36th with a score of 108.3.

However, the TRC has data dating back to 1985 and that shows a more modest result, with a range of MCI medians between 54 and 97. The river improved dramatically up until 2004, and then has stabilised around the 80 mark, which classes it as in "fair" condition.[51]

That doesn't make it much good for trout fishing, but as far as native fish species are concerned, the river has long been a popular fishery. In its 1983 report on Motunui, the Waitangi Tribunal said the Waitara River was of prime importance to the Māori people as a source of food.[52]

"We were given extensive photographic and other visual evidence of the large quantities of inanga [whitebait], tuna [eel], piharau [lamprey], kahawai, kaupapa, and yellow eyed mullet harvested from the Waitara River by the Te Atiawa people and used for both individual purposes and for feeding guests at tangi, hui and meetings."

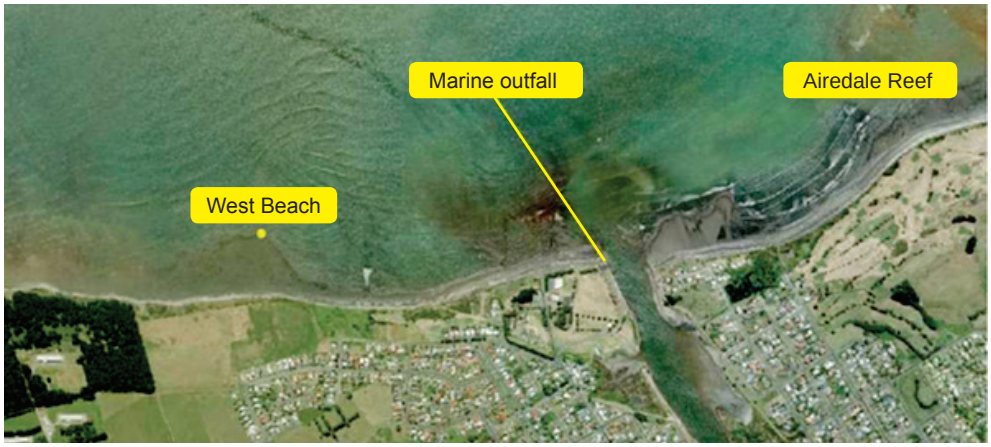
In 1986, when opposing an application from Synfuels to increase its water take from the river, Te Ātiawa's Aila Taylor lamented the deterioration of the Waitara and the gradual diminishing of food sources, particularly lamprey. In a report on Taranaki's whitebait fishing published in 1981, the Taranaki Catchment Commission said the Waitara was the province's most frequented fishery, with as many as 200 whitebaiters seen on the river banks at times.[53]

It also speculated, but could not confirm, that the banks of the river between the mouth and Bertrand Road were important spawning grounds during spring tides.

One of the biggest bones of contention in the Waitara saga has been the marine outfall, which, as discussed above, has been controversial since it was approved in 1973.

Even after it was improved considerably in 1991, there have been concerns over what it continues to do to the marine environment. The outfall has been monitored by the TRC since 1987 to assess whether any bacteria and heavy metals in the effluent from the Waitara treatment plant and the Think Big petrochemical plants are causing problems on the reefs and beaches.

The 1990 report - written prior to the plant and pipeline improvements - shows how bad the bacteria could be on what was once Te Ātiawa's prime shellfish source, Airedale (Orapa) Reef.



The levels of enterococcus, the marker used for marine environments, reached as high as 25,000 per 100 millilitres of water, although the average was much less, 2060.[54]

The readings were as bad on East Beach. The danger limit for swimming is 140 and for shellfish, just 14. There was much better news concerning the effects from process water being discharged directly through the outfall by the Motunui (Synfuels: synthetic petrol) and Waitara Valley (Petralgas: methanol) plants.

By 1992 - the sixth year the TRC monitored mussels on reefs along the coast for signs of heavy metals buildup - the signs were good, its report said that year.[55]

“While the results discussed in this report show significant increase in cadmium, these are less than 10% of the New Zealand permissible standards. Mercury levels are extremely low and this may in part be due to the storage time which elapsed before analysis took place. All other metals (chromium, copper, iron, lead, mercury, nickel and zinc) examined show a fairly constant tissue burden profile with fluctuations being within the likely natural perturbation levels.”

By 2010, the TRC was able to report there was “no obvious impact of the Waitara outfall discharge on the local intertidal community over the last 20 years in terms of species richness and diversity”.[56]

With bacteria, the results have been less reassuring, although by 2000 there seemed to be a definite improvement brought about by the 1991 plant and outfall refurbishing.

So far as swimming was concerned, the water was safe for most of the time, with median enterococcus levels well down. However, there were still occasions that year when they jumped comparatively high (East Beach to 520).[57] The scientists examined counts for the Waitara River on those occasions, but could detect no correlation.

A chart in this report comparing results for the summers from 1989 to 2000 showed prior to the refurbishing, enterococcus levels at Orapa Reef had a median of 76, and those on East Beach were 245; by 2000, the readings were 7 and 9, respectively. In 2011-12, they were much the same - 8 and 6.

The results may have been assisted by a decision to exclude wet weather conditions when testing. This was done to reduce the influence of the Waitara River on marine samples and allow more accurate testing of the effects of the outfall. The river is known to affect bacteriological levels for kilometres along the coastline when it floods, although testing is not done until some days afterwards.

The outfall monitoring reports do not mention shellfish gathering, concentrating instead on whether contamination levels meet swimming standards, which they invariably do. The measurement recommended by the Ministry for the Environment for shellfish is faecal coliforms, which denote the potential presence of pathogenic bacteria, viruses and protozoa.[58]

The MfE maximum safety level is a median of 14 per 100 millilitres of water and not more than 10% of samples should exceed a most-probable-number of 43.

The results are not so favourable here, with the 2011-12 TRC bacteriological monitoring report on the outfall’s performance recording a median of 30 on Orapa Reef. The shellfish source to the west of the outfall, Tauranga Reef, had a median of only 4, but if the risk factor is applied – as seems sensible when dealing with something as risk-prone as shellfish consumption - the highest readings give a more appropriate, and worrying, indication.

The maximum faecal coliform count on the Tauranga Reef was 54, while Orapa had one of 280. The year before, 2010-11, the former had one score of 200. The maximums since the waste water treatment plant work was done vary year by year,

with Orapa going as low as 24 in 2007-08 and as high as 290 the following year. Tauranga dropped to 17 in 2009-10, but was 600 in 2007-08.

So while the levels are most often within the guidelines for safety, now and again they are not. Hence the signs warning people not to take shellfish from the reefs. Will it be any better when Waitara's sewage is pumped off to New Plymouth? That question informs the last part of this chapter.

When former New Plymouth District Council assets manager Anthony Wilson took me on a tour of the city's sewage treatment facilities in 2012, it included a deviation down a backstreet in West Waitara that emerged on to the banks of the Waiongona Stream.

There, he pointed proudly to what looked like another bridge to nowhere. The concrete span (**above**) is in fact part of the project to pipe Waitara sewage several kilometres west along the coast to Waiwhakaiho so it can be handled in the upgraded treatment plant. Wilson's pride was in the fact the bridge not only carries the new sewer, but will also be used for the coastal walkway.

The early part of that 2012 tour included a visit to the New Plymouth carrousel sewage treatment plant, which was another source of pride for the council when it was commissioned in 1984. Most New Zealanders got their first childhood taste of mild vertigo on a carousel - but they probably knew it as a park roundabout or the merry-go-round in a travelling fairground. It's all about swirling around, which is probably why the Dutch borrowed the word to label their sewage treatment invention in the 1960s.

They used the French version of the spelling, however, and the double "r" has caused problems ever since. Even the plaque outside New Plymouth's carrousel plant at Waiwhakaiho drops an "r", something that probably hasn't gone unnoticed by surviving members of the Taranaki Clean Sea Action group in whose memory it was erected when the plant celebrated its 21st anniversary in 2005.

Not that a few errant spellings can detract from the success of a facility that set a new standard when it began as the only one of its kind in New Zealand and which

needs tweaking and enlarging only now as it approaches its 30th year. Wilson said the plant performed “like a dream” from day one and has always produced effluent of significantly high standard.

But one problem persisted for a while – processing the sludge that settled out in the bottom of the large circular concrete clarifiers. It was supposed to be easily dried and odourless, but proved difficult to de-water because of a problem with the centrifuges used to spin it dry. They produced a glutinous, stinking mess that was impossible to dispose of.

At first, they tried dumping it above the Colson Road tip, but eventually high moisture content and volume threatened the viability of the whole landfill. They trucked it out to a stockpile in sandy country at Bell Block with the intention of eventually mixing it with sand to produce a fertile cover for poorer land. But when they opened the pile the stench was so bad the council ended up in court.

The next, more successful, step was to mix it with sand straight away and spread it on council land around the airport and on a Bell Block coastal area now seen as the lush turf of Hickford Park. Then they began to run out of land, so various other ideas were generated as possible long-term solutions.

The eventual solution was to replace the centrifuges with a couple of gigantic belt presses bought second-hand from a failed Waitara enterprise to make an ingredient of the contraceptive pill.

The council reconfigured the presses to produce a workable sludge, which was then fed into gas-heated driers to produce sterile fertiliser for sale. Wilson said he believed they were actually over-treating the sewage. After a certain stage, the environmental costs of treatment begin to outweigh the benefits to the environment.

But he accepts cultural demands – and he emphasises he is not referring only to Māori here – dictate that finding a utopian balance in environmental cost is probably unrealistic.

What about ultra-violet (UV) disinfection, an alternative advocated by some environmental opponents to the extension of the existing plant?[59] This was an issue investigated later in 2012 by Niwa scientist Graham McBride.

His research showed the risk of contracting a virus from the outfall near the shore just east of the Waiwhakaiho treatment plant outfall would be reduced by UV from 0.33% to 0.06% per 100 swims or even less, depending on how much UV disinfection was used.[60]

New Plymouth District Council manager of water and wastes Mark Hall says UV disinfection was considered during the resource consent process.

However, commissioners hearing the application concluded the existing method of disinfection was appropriate and did not require a change to UV.

They did ask for further research to make sure – the McBride report - but that did not change the council’s view. A UV system would cost about $3.5 million, a significant expense when we have a suitable treatment system in place.”

That accords with Anthony Wilson’s opinion, given prior to the McBride report. He said one reason for not making a change related to what was found at Waitara.

“Viruses – probably of a human origin (and of unknown viability - infectiousness) – were detected in some shellfish gathered from one of the Waitara reefs.”

The origin of the viruses was never confirmed, but tests of both the influent into and effluent from the Waitara plant did show highly variable levels of viruses – several million times difference at times. The effluent results were several orders of

magnitude lower than influent results and of unknown viability.

“The levels vary, as viruses will only be found if there is an individual (or more) with the particular disease in the community and what stage the disease is at. So the Waitara plant does have some effect of viruses, but how much is not known.”

The viruses at the reefs may well have come from Waitara wastewater treatment effluent.

But they could equally have come from the un-sewered “Rahotū block” of housing on the eastern side of the river mouth, or down the river, or from a pump station overflow, or from a marine discharge from a boat or ship, or even a fisherman caught short.

There are no virus standards in the Drinking Water Standards for New Zealand, he said, and the standards’ notes say UV treatment is less effective at killing viruses than other disinfectants, of which the most common is chlorine (which is what the New Plymouth plant uses).

So back to our question: with another $23 million being laid out, taking the overall total spent on the river to more than $50 million, not counting millions for flood protection - are the people of Waitara going to be safer and better off?

It seems likely, given the town’s sewage – even though it was effectively treated - will no longer be going through the Waitara marine outfall. Eventually, other north Taranaki towns without modern systems, like Urenui and Ōnaero, will also benefit. All part of the bigger picture. It’s worth noting here that the outfall will still be used by the methanol plants, which will continue to discharge their process water there.

It was decided the extra capacity their flows would take at the New Plymouth plant was an unwarranted expense. They have on-site treatment plants and what goes to the outfall is not human sewage, is no threat to swimmers and shellfish gatherers, and is not causing any damage to the ecology.

The Waitara outfall will also still be available in case of emergencies, such as plant breakdowns and unexpected rainfall events causing sewerage system overloads.

However, when the Waitara plant is converted to a pumping station, holding tanks will be built that will minimise the risk of overflow, as will the ability to bypass the more finely screened Waitara effluent around the carrousel ditches (it still gets chlorine disinfection).

The district council is also testing the town’s sewer lines to remedy what it calls

“infiltration”, which is stormwater getting into the system. That problem has already been halved.

Will the reefs be restored for shellfish gathering? Only time will tell. But even if they are, that is not the end of the matter so far as Te Ātiawa are concerned. Their belief that human sewage should never be discharged to natural waters was affirmed by the Waitangi Tribunal in 1983, and they have not resiled from that position.

Moving the outfall a few kilometres west does not resolve anything for them, which is why they have opposed the latest scheme. During the resource consent hearing, they offered some of their land at Puketapu for their preferred option, land-based treatment (spray irrigation).

This was not accepted by the council, whose environmental effects report to the TRC said while such a scheme worked well in Rotorua (with a similar sized effluent load), that was because it could be sprayed in a forest where there was minimal chance of affecting nearby residents.

There was no such available land close to the New Plymouth plant.[61]

The environmental effects report went on to say the NPDC has already invested a significant amount of money in infrastructure and services ($240 million replacement value). The current upgrades to the system are estimated to cost up to $27 million, with new inlet works needing another $8.5 million in 2025. Alternative treatment options had been considered and would require “significant cost to the community in terms of rates increases”. For those who have lived with the Waitara for a long time, the outcome so far of more than 40 years of long strides to make it better will have been more than satisfactory.

For me, standing on the new wharf, looking down into the greenish depths, gruesome memories of scum and feeding fish are hard to reconcile with today’s placid scene. It looks good enough to swim in. And most days it’s certainly safe enough, if you’re sensible and give it a miss after a storm. The colour will tell you a lot.

NOTES *Chapter 7*

1 Such measures were written into conditions set by the Taranaki Catchment Commission in water rights granted to the synthetic petrol plant at Motunui and the methanol plant at Waitara Valley to take water for their processes (mainly cooling). According to TRC's *Methanex Motunui and Waitara Valley Combined Monitoring Programme Annual Report* for January – December 2009, Motunui still has the right to take up to 500 litres per second (amended from the original 370 in 1986) and Waitara Valley up to 100.

2 Waitangi Tribunal, 1983, *Report of the Waitangi Tribunal on the Motunui-Waitara Claim (Wai 0006)*, Section 7, "Pollution of the River and Reefs".

3 Ibid.

4 Chamberlain, Basil, 16 July 2010, Letter to the Editor, *Taranaki Daily News*, New Plymouth.

5 Created in the 1989 local government reforms by amalgamating New Plymouth City Council with Waitara and Inglewood Borough Councils, and Clifton, Inglewood and Taranaki County Councils.

6 Taranaki Regional Council, 2001, *Waitara Marine Outfall Bacteriological Monitoring Programme Annual Report 2000,* P1: The treatment involves screening of wastewater to 0.5 millimeters particle diameter (meatworks wastewater was screened at the works), followed by disinfection through elevation of pH with lime to pH 11 and holding for a minimum of four hours.

7 Ministry for the Environment, 2007: Recreational river water quality league table: water clarity and *escherichia coli* bacteria levels state rankings for 2007 for median water clarity and 95th percentile *e. Coli* bacteria at 76 sites in the national river water quality network: http://www.mfe.govt.nz/environmental-reporting/freshwater/river/league-table/clarity-ecoli.html

8 Stuff.co.nz,11November 2009, "Manawatu River 'among worst in the West'": http://www.stuff.co.nz/environment/3097651/Manawatu-River-among-worst-in-the-West

9 Taranaki Regional Council, 2013, *Freshwater contact recreational water quality at selected Taranaki sites State of the Environment Monitoring Report, 2011-2012*, P63.

10Taranaki Regional Council, 2013, *Freshwater Physicochemical Programme State of the Environment Monitoring Annual Report 2011-2012,* P2.

11 Ibid, P3: "Components of these guidelines include sanitary surveys/inspections together with assessments of historical microbiological data which, when combined, provide an overall suitability for recreation grade, which describes the general condition of a site based on both risk and indicator bacteria counts. Changes to the E. coli freshwater recreational guideline values have been made for the purpose of regularly assessing single sample compliance with suitability for recreation. The new freshwater guidelines are now more reflective of New Zealand conditions. 'Alert' and 'Action' guideline levels are used for surveillance throughout the bathing season. They may be summarised as follows (with the marine levels included as some of the Taranaki sites monitored are in the lower, tidal reaches of rivers and streams)."

12 They include Pātea River at King Edward Park, Pātea River at boat ramp, Waingongoro River at Eltham camp, Waingongoro River at Ohawe Beach, the Kaupokonui River at beach domain, Lake Opunake adjacent to boat ramp, Timaru Stream at Lower Weld Road, Ōākura River downstream from SH45 bridge, Urenui River estuary, Manganui River at Everett Park, Lake Ratapiko boat ramp, Lake Rotokare adjacent to boat ramp, Te Hēnui Stream at mouth, and Waiwhakaiho River adjacent to Lake Rotomanu.

13 Ibid, PP3-4.

14 My emphasis.

15 The Ministry for the Environment has since (2013) backed off a little on bathing standards, telling TRC that the MfE's stance "reflects a precautionary approach to managing public health risks and does not represent an accurate picture of water quality in the catchment." See Chapter 10 for a detailed discussion of this important concession.

16 This was to cover its rebuild of the Waiwhakaiho treatment plant and the increase in load that would come from including Waitara, and eventually all the North Taranaki settlements north to Urenui.

17 Zydervelt, E, Scientific Officer (Marine Biology), Taranaki Regional Council, 26 April 2011, *New Plymouth District Council Waitara Waste Water Treatment Plant Monitoring Programme Annual Report 2011, Appendix IV: Viruses Present in the Waitara Embayment and the Risk to Human Health,* P2.

18 McBride, P12.

19 Zydervelt, P5.

20 *Wikipedia*, 16 May 2013: Noro-viruses are the most common cause of viral gastro-enteritis in humans: http://en.wikipedia.org/wiki/Norovirus

21 Ibid, P5: Based on genome copies of enteric viruses per gramme of shellfish gut tissue.

22 De Jager, David, Senior Advisor, Ministry of Health, Wellington, 11 June 2011 to Gary Bedford, Director – Environmental Quality, Taranaki Regional Council.

23 *Wikipedia*, 19 May 2013: Noro-viruses are a genetically diverse genus of single-stranded RNA, non-enveloped viruses in the Caliciviridae family. The known viruses in the genus are all considered to be the strains of a single species called Norwalk virus. The viruses are transmitted by faecally-contaminated food or water; by person-to-person contact; and via aero-solization of the virus and subsequent contamination of surfaces. Noroviruses are the most common cause of viral gastroenteritis in humans, and affect people of all ages: http://en.wikipedia.org/wiki/Norovirus

24 McBride, P5.

25 Taranaki Regional Council, 2013, *Freshwater Physicochemical Programme - State of the Environment Monitoring - Annual Report, 2011-2012*, P2.

26 Note that median figures are used here, because physicochemical parameters are not used for risk-to-humans calculations.

27 US Environmental Protection Agency website, 18 May 2013: The total phosphorus test measures all the forms of phosphorus in the sample (orthophosphate, condensed phosphate, and organic phosphate). The dissolved phosphorus test measures that fraction of the total phosphorus which is in solution in the water (as opposed to being attached to suspended particles): http://water.epa.gov/type/rsl/monitoring/vms56.cfm

28 Ministry for the Environment website, 18 May 2013: Taken from various water quality trends reports, 1989-2007: http://www.mfe.govt.nz/environmental-reporting/freshwater/river/network.html

29 Quinn, John M. and Ernst Raaphorst, June, 2009, *Trends in nuisance periphyton cover at New Zealand National River Water Quality Network sites 1990-2006*, National Institute of Water & Atmospheric Research Ltd, Hamilton, prepared for the Ministry for the Environment, P1.

30 Taranaki Regional Council, 2007, *Freshwater Nuisance Periphyton Monitoring Programme State of Environment Monitoring Report - 2002-2006*, P55.

31 Taranaki Regional Council, *Fresh Water Macroinvertebrate Fauna Biological Monitoring Programme Annual State of the Environment Monitoring Report 2007-2008*, P47.

32 Ministry for the Environment, 2009, *Biological river water quality league table: Macroinvertebrate Community Index (MCI), % of EPT taxa (mayflies, stoneflies and caddis flies), and periphyton*, League table of 66 rivers: http://www.mfe.govt.nz/environmental-reporting/freshwater/river/league-table/biological-state.html

33 Taranaki Regional Council, *Fresh Water Macroinvertebrate Fauna Biological Monitoring Programme Annual State of the Environment Monitoring Report 2007-2008*, P93.

34 Waitangi Tribunal, 1983, *Report of the Waitangi Tribunal on the Motunui-Waitara Claim (Wai 0006)*, Section 6, "The Waitara River".

35 Taranaki Catchment Commission, 1981, *The Recreational Whitebait Fishery in Taranaki*.

36 Enterococcus was adopted in 1989 as a more suitable measure than faecal coliforms in seawater.

37 Taranaki Regional Council, 1993, *Resource Consent Impact Monitoring Waitara Marine Outfall Trace Metals Monitoring Programme, Annual Report 1991/92*, "Executive Summary".

38 Taranaki Regional Council, 2011, *Waitara Marine Outfall Ecological Monitoring Programme Annual Report 2010*, "Executive Summary".

39 Taranaki Regional Council, *Waitara Marine Outfall Bacteriological Monitoring Programme Annual Report 2000*, P11,

40 Ministry for the Environment, 2003, *Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas*, Section F: "Microbiological Guidelines for Shellfish-Gathering Waters": http://www.mfe.govt.nz/publications/water/microbiological-quality-jun03/microbiological-quality-jun03.pdf

41 One such group is Friends of the Waitara River, whose Facebook page lists among its supporters: fishermen and other river users; environmental activists; hapū members; artists; kuia and koro. Māori and Non-Māori. "Our group has spent some time now, representing the community on the number of issues relevant to the River and all of its attributes. We have challenged the NPDC on their stance to dump industrial wastes through their 'privately owned' pipe-line; Requested information about

the number of ‘effluent spills’ on our coastline; Challenged local government through the consents process; dumping of fracking waste....etc etc etc to ensure that our River, the land and its coastline are protected for all of our mokopuna.” Accessed on 15 May 2013: https://www.facebook.com/groups/376026039143978/

42 McBride, P17. A table in his report shows that one version of UV would reduce the risk profile at a site inshore and to the east of the outfall from 0.328 cases of illness for every 100 people similarly exposed down to 0.057. Another version would cut it even further to 0.009%.

43 New Plymouth District Council, 31 May 2011, *Final Assessment of Environmental Effects and Consent Application for New Plymouth Wastewater Discharge*, P83.