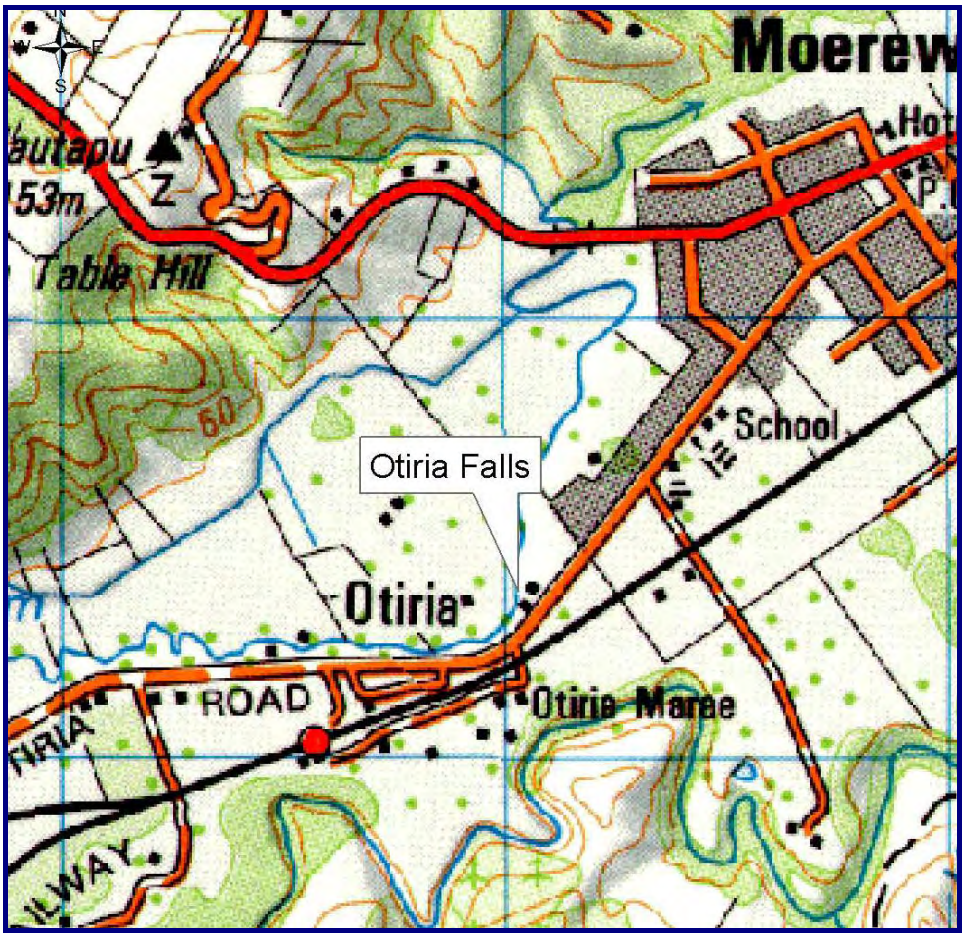
Review of water quality information for Otiria Stream, Moerewa



August 2008
Northland Regional Council
Private Bag 9021
Whangarei
Ph: 0800 002 004

NORTHLAND REGIONAL COUNCIL

Executive summary

The Otiria Stream Catchment flows north-east from Ngapipito, through Moerewa, joining several other rivers (including Waiharakeke Stream). It then becomes the Kawakawa River, which flows into the Bay of Islands. The Otiria catchment is dominated by exotic forestry and pastoral farming. The river is relatively slow flowing with soft bottomed geology.

There is substantial information available for the Otiria catchment to make some predictions on the likely sources of bacterial contamination, including water quality data collected for state of the environment (recreational bathing programme) and resource consent monitoring, land use data, catchment observations and findings from the faecal source tracking investigation.

Based on all the information available for the Otiria Catchment the potential sources of bacterial contamination are likely to be:

- Diffuse surface runoff from agricultural land of animal waste from sheep and cattle and direct stock access to waterways
- Microbial activity in catchment wetlands
- Diffuse surface runoff from indigenous or exotic forest land cover of animal waste from wild animals such as pigs, deer, possums, goats, mustelids and rats
- Faecal contamination from water fowl in wetland and stream areas

Based on these findings the greatest improvements in bacterial water quality in the Otiria catchment are likely to be achieved by:

- Reducing diffuse surface runoff of faecal pollution from agricultural land use through riparian fencing and planting
- Stock exclusion from waterways
- Wetland enhancement or rehabilitation (needs further investigation)
- Pest control in both exotic and native forests
- Continuing to maintain and improve farm dairy effluent discharges and onsite wastewater treatment systems in the catchment

From the background information and water quality data the areas in the catchment with the most impacted bacterial water quality are:

- The outflow from Lake Kaiwai
- The lower catchment (from NRC site 105323 or FNDC site 4 downstream)

To assist with prioritising areas for management or enhancement work at least one year of water quality sampling in the catchment is recommended, concentrating the sampling in the lower end of the catchment. Monthly sampling at six sites for a range of parameters will be carried out by Northland Regional Council commencing in August 2008. As part of this process it is also recommended that the Far North District Council, Northland District Health Board and the community including landowners, schools, marae and iwi groups are aware of this monitoring and are involved as much as possible.

Contents

Introduction

The Otiria Stream Catchment flows north-east from Ngapipito, through Moerewa, joining several other rivers (including Waiharakeke Stream), as shown in figure 1 (below). It then becomes the Kawakawa River, which flows into the Bay of Islands. The Otiria catchment is dominated by exotic forestry and pastoral farming. The river is relatively slow flowing with soft bottomed geology. There is a popular swimming spot on the Otiria Stream below the waterfall, shown in the photograph (below).

The Regional Council has been sampling the Otiria Stream in the swimming hole below the waterfall (site 105376, refer to figure 1) since December 1999 as part of the recreational bathing water quality programme. This sampling has highlighted issues with the water quality in Otiria Stream. To date there has been irregular follow-up sampling carried out by Far North District Council, Northland Regional Council and Northland Health, as well as investigative sampling to identify the source of the contamination. However there has not been any routine monitoring in the catchment, which could then been used to prioritise areas for management and restoration.

Therefore the aim of this report is to review all existing data and information for Otiria Stream. The objectives of this report are to:

- Collate all existing data and information for the Otiria Stream catchment
- Use this to identify potential sources and problem areas within the catchment likely to cause contamination of the Otiria Stream
- Provide recommendations for a catchment study that will further isolate the problem areas and sources of contamination, so that areas in the catchment can be prioritised for management, restoration and rehabilitation.

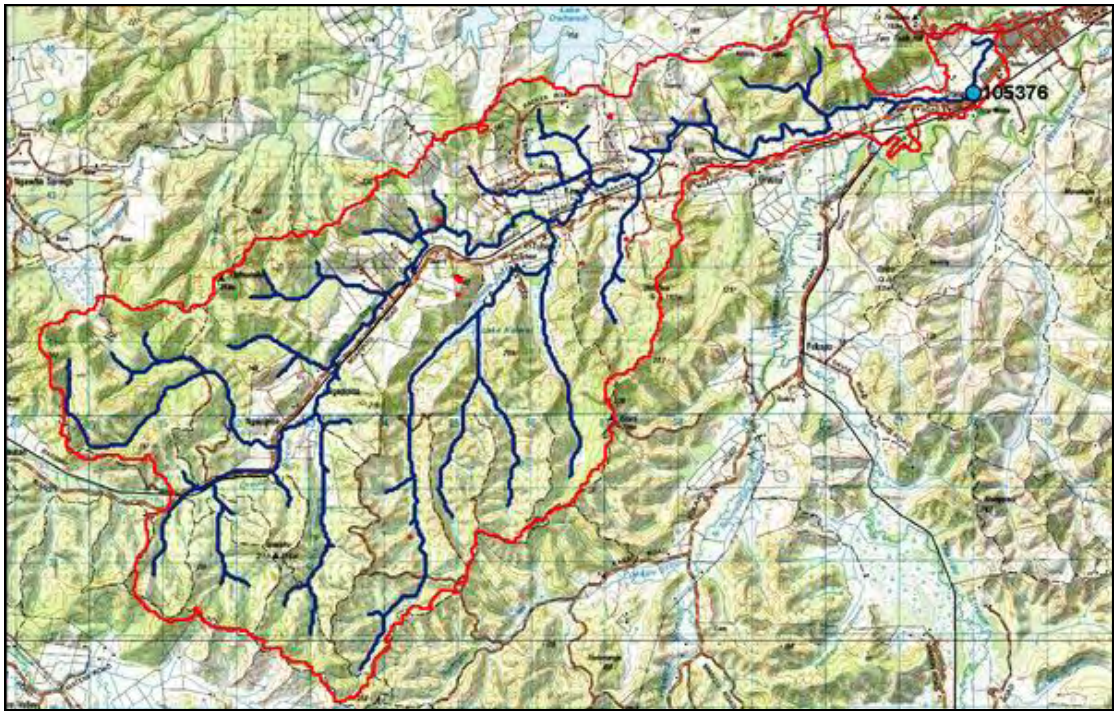


Figure 1: Map showing Otiria Stream (blue), the catchment boundary (red) and the recreational bathing water quality sampling site 105376.

Background information

Community concern

In 2003, Mataitai Mahinga O Ngati Hine Incorporated Society, as part of a joint sanitary survey project with Northland Health, produced a brief report on the key findings of observations and research into the sewerage issues affecting waterways of Moerewa (refer to Appendix A). A summary of their concerns for Otiria Stream included:

- Pollution associated with households and livestock activities
- Effluent runoff straight into the river and cattle crossings
- Water takes and no water planning
- Lack of stock exclusion from the river and alternative water supply (i.e. troughs) for stock
- Illegal dumping of rubbish on riverbanks
- Lack of awareness of need for remediation
- Community action and empowerment

There have been many enquiries to the Regional and District Council and concerns raised about the water quality since the swimming spot in the Otiria Stream has had warning signs erected, including a letter from the Moerewa School in November 2007 (refer to Appendix B) and phone calls from individuals within the community wanting to improve the water quality of the Otiria Stream.

Land use

The catchment is dominated by pine forestry, at approximately 45% of the catchment in 2002, as shown in table 1 and figure 2 (below). A large proportion of the pine forestry is managed by Hancock Forest Management Limited. This includes two pine forests in the catchment, Rakautao established in the early 1980s and Ngatihine established in the late 1970s (Urshula Albrecht, Hancock Forest Management Limited, *pers. comm.*). There has been no pest control in either of these forests, other than recreational hunting.

There are some small areas of indigenous forest remaining, mostly in the headwaters. The indigenous forest land cover is mostly on land owned by Hancock Forest Management Limited, and again there is no pest control carried out.

Table 1: Area (hectares) of different land covers in the Otiria Catchment. Data source: Land Cover Database II (LCDB2) based on satellite imagery from 2001/2002 (MFE 2002).

Land cover type (LCDB2)	Area (hectares)	Percentage of catchment area
Indigenous forest	984.1	21.2
Pine forestry	2083.9	44.9
Manuka/kanuka	212.9	4.6
Other exotics	128.5	2.8
Grassland	1143.5	24.6
Freshwater vegetation	80.1	1.7
Urban areas	13.2	0.3
Total catchment area	**4646.8**	

Approximately 25% of the catchment was grassland in 2002, most of which was high producing grassland (1070 hectares). This grassland cover is typically in the mid to lower catchment and surrounds the river. It can be assumed that the land use on grassland is predominately pastoral farming including dairy, drystock, sheep and pigs. There are currently five supplying dairy farms in the catchment, shown on figure 2 (below). There is information on the performance of these farms in relation to their farm dairy effluent discharges under resource consents.

Other land use in the catchment includes small areas of artificial surfaces and three small wetlands. The artificial surfaces had a total land area of less than 15 hectares in 2002 and includes residential areas, roading and transport infrastructure (including a railway line) and two quarries. The three wetlands (Lake Kaiwai and two unnamed) are relatively small, totalling about 80 ha in area in 2002 and are dominated by herbaceous freshwater vegetation.

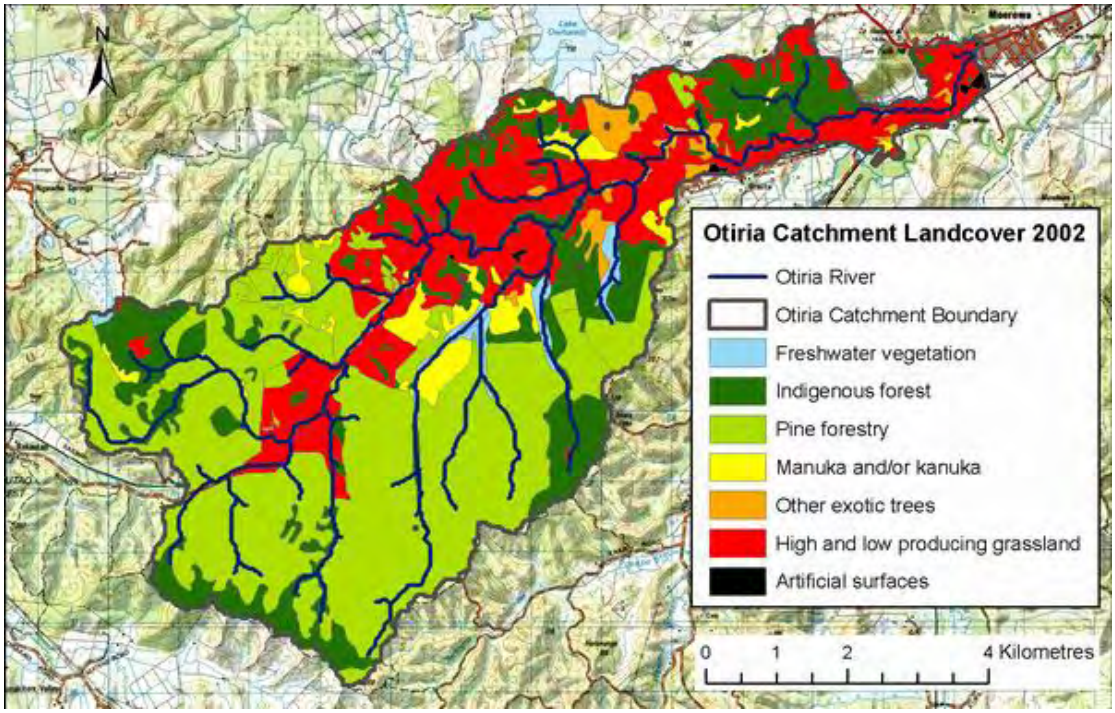


Figure 2: Map showing land cover in Otiria Catchment. Source: LCDB2 (MFE 2002).

Resource consents

At 30 June 2008 there were only seven NRC resource consents within the Otiria catchment. Five of these were for farm dairy effluent discharges, four of which are treated discharges to water and one is a treated discharge to land. The other two resource consents are for the discharge of stormwater from a log sawmilling and timber dressing yard to land and the discharge of treated animal waste from livestock farming (not dairy) also to land.

See below for more information on the compliance of these consents with their respective consent conditions.

Environmental incidents

There have been 33 environmental incidents in the Otiria catchment that have been reported to the Regional Council between November 1993 and June 2008. These are shown in figure 3 (below) and table 5 (in appendix E).

Only ten of these occurred in the last five years (July 2003 to June 2008), of which four were dust nuisance incidents and therefore not likely to affect water quality. Two were illegal dumpings of refuse, one was a dead cow in the stream and one was an alleged discharge causing discolouration of the stream (not confirmed). The last two incidents were herbicide spraydrift into a wetland and alleged illegal earthworks associated with forestry operations.

Seven of the ten most recent incidents were recorded as having minor or no impact on the environment, meaning that contaminant volumes were small and the incident was short lived and/or very localised. The impact of two incidents is unknown and the impact of one of the illegal refuse dumping incidents was recorded as significant. Note none were recorded as having a large impact.

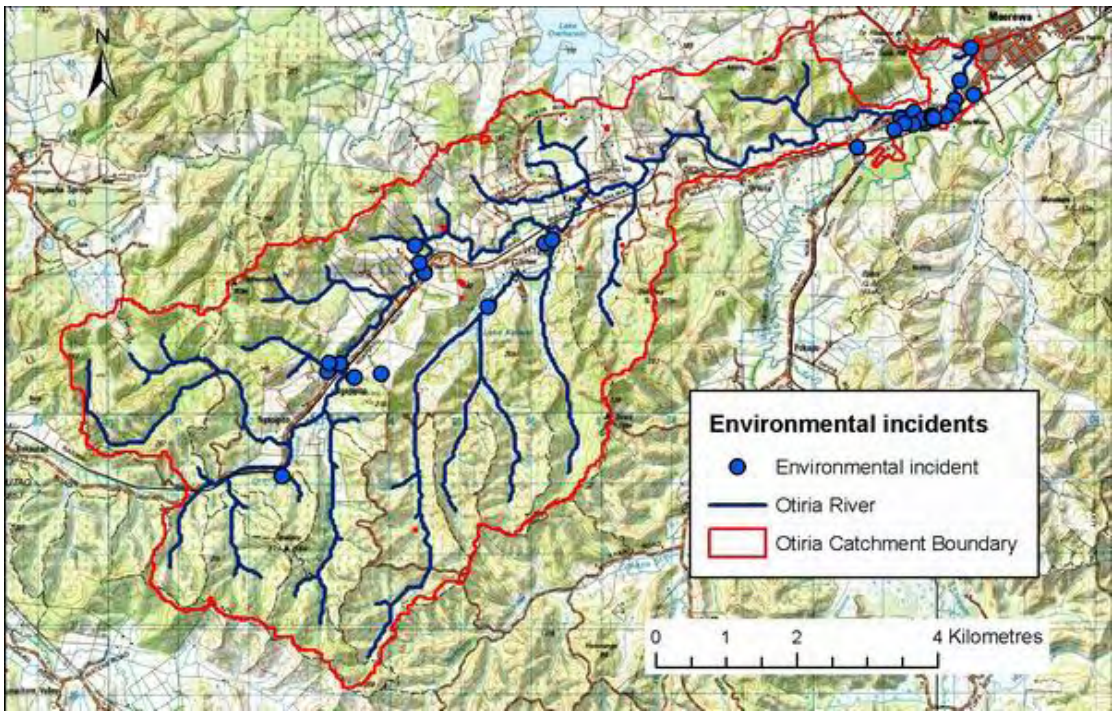


Figure 3: Environmental incidents in the Otiria Catchment reported to the Council from November 1993 to June 2008.

Catchment observation

In 2003, Mataitai Mahinga O Ngati Hine Incorporated Society made observations at 20 sites along the Otiria Stream (refer to Appendix A). Some of the common activities observed that are potential sources of microbial pollution to the Otiria Stream were:

- Stock have access to the river at 12 of the 20 sites observed. Many of these sites were cattle crossings and there was evidence of pugging or cattle effluent on the river banks (sometimes in the river).
- Four sites had illegal dumpings of refuse, including household rubbish.
- Suspected seepage from septic tanks.

Recreational bathing programme

Otiria Stream below the falls (site 105764) is one of the many sites in Northland sampled weekly in summer as part of the recreational bathing programme. This site has been sampled for 6 – 14 weeks every summer from 1999/2000 to 2006/2007.

As part of the programme the Regional Council is responsible for the routine surveillance monitoring. The samples are tested for the bacteria *Escherichia coli*, which is used as an indicator for the presence of disease causing micro-organisms. The results are compared to the freshwater recreational bathing guidelines (MFE 2002). The results are sent to the District Councils and Northland Health, who then carry out follow-up sampling as required and warn the public of any swimming sites that may have water quality that is unsafe.

Following a review of all recreational bathing sites in 2007, the Otiria Stream site was temporarily removed from the sampling programme because of the consistently poor water quality at this site. Permanent warning signs were erected at this site and further investigative sampling was initiated including faecal source tracking (see below for more information) and a recommendation for a catchment study. There have been issues with warning signs being removed and/or destroyed over the last nine years. Therefore the Otiria site was not sampled in 2007/2008, other than on three occasions, which were in conjunction with the faecal source tracking investigation.

More information on the recreational bathing programme is available on the Regional Councils website at the following link:

http://www.nrc.govt.nz/Living-in-Northland/At-the-beach/Swimming-water-quality/

Routine sampling

The results from the nine years of routine sampling by the Regional Council for Otiria Stream have been consistently poor each summer, as shown in table 2 (below), noting that it was only sampled on three occasions in 2007/2008. The median for each summer is above the action mode of 560 E. coli/100mL. In six of the nine years no samples comply with the alert mode guideline of 260 E. coli/100mL.

Table 2: *Escherichia coli* results from the recreational bathing water quality sampling programme for the Otiria Stream at swimming hole site (NRC site 105376) for nine summers from 1999/2000 to 2007/2008.

Summer	n	median	% comply with alert (260/100ml)	% comply with action (550/100ml)
1999/2000	6	700	16.7%	50.0%
2000/2001	7	1162	14.3%	14.3%
2001/2002	7	906	0.0%	14.3%
2002/2003	7	579	0.0%	42.9%
2003/2004	11	1014	0.0%	0.0%
2004/2005	10	1581	0.0%	10.0%
2005/2006	12	1475	0.0%	8.3%
2006/2007	14	1105.5	7.1%	7.1%
2007/2008	3*	1336	0.0%	33.3%

Note: There were only three samples collected in the 2007/2008 summer as this site has been temporarily removed from the sampling programme.

Follow up sampling

This includes follow up sampling carried out by Northland Health and Far North District Council, as well as Northland Regional Council.

In April 2002 the Regional Council did a longitudinal survey of bacterial water quality down the Otiria catchment. Seven sites on the Otiria catchment were sampled for Escherichia coli, as shown in figure 4 (below).

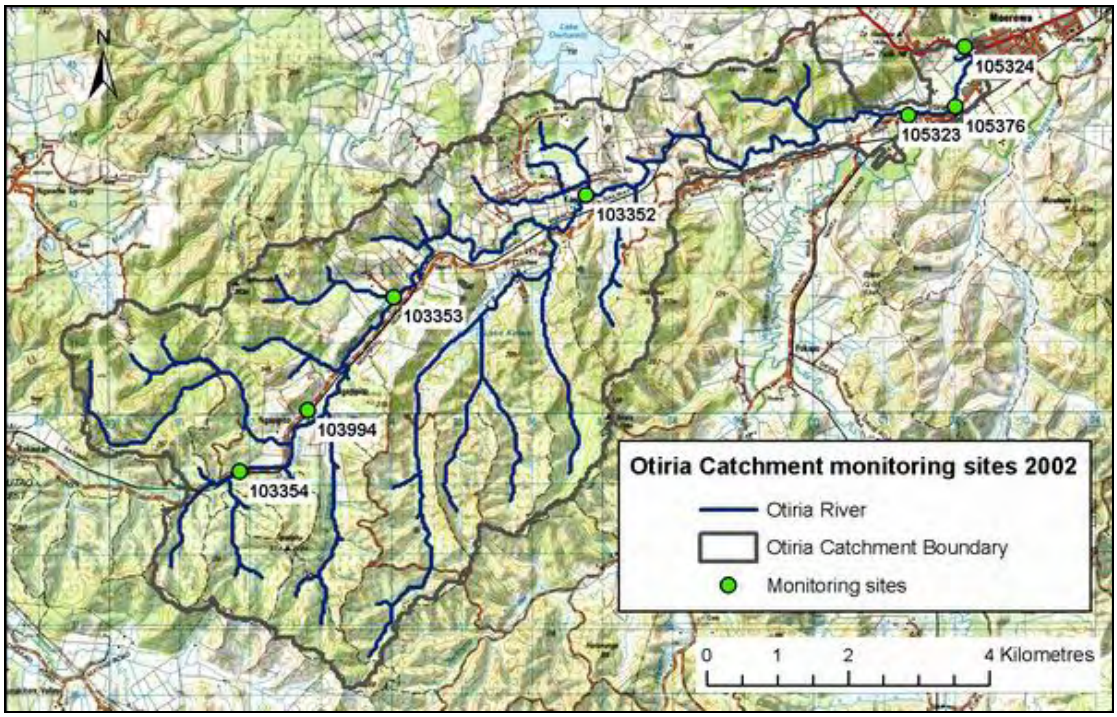


Figure 4: Map showing sites sampled in Otiria catchment by NRC in April 2002.

These results showed an increase in bacterial levels as you move down the catchment, as shown in figure 5 (below). Refer to Appendix C for more information on this sampling.

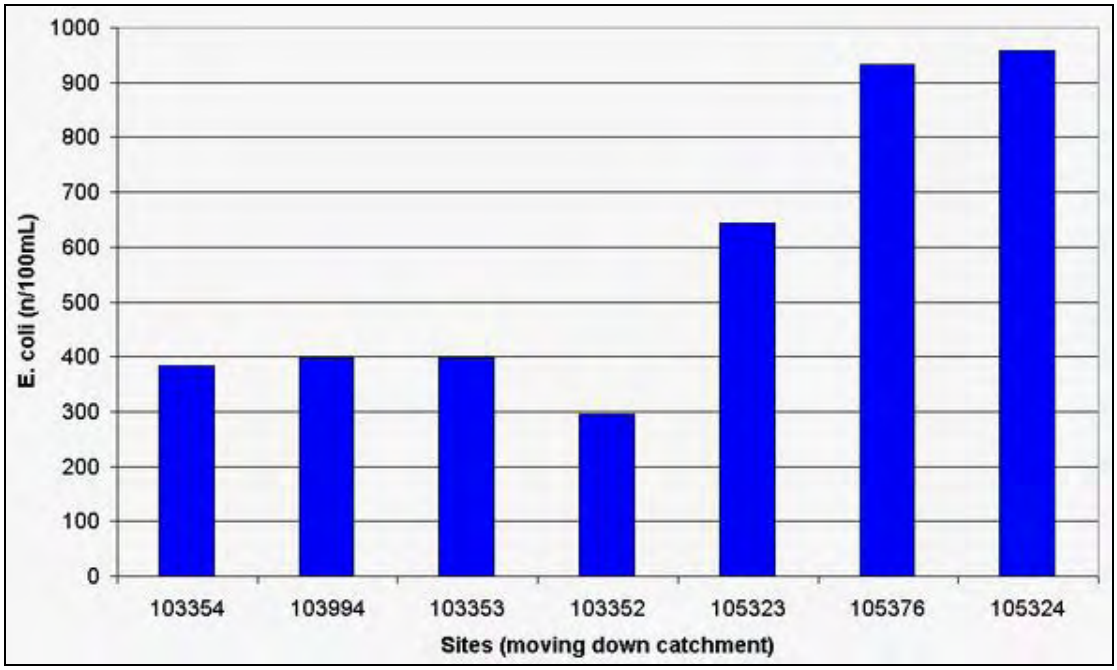


Figure 5: Escherichia coli results for Otiria catchment sites sampled in April 2002 by NRC. Note: The left of the graph is the headwater sites and the right is the bottom of the catchment.

Northland Health completed a sanitary survey of Moerewa streams, including Otiria Stream, in December 2002. The results are presented in the next section of this report.

In summer 2004-2005 FNDC did a longitudinal survey of bacterial water quality in the Otiria catchment. The results from samples collected on 7 March 2005 are presented in table 3 (below). The bacterial levels were elevated at the swimming hole (NRC site 105376 and FNDC site 2). The results did not show the expected increase in bacterial levels moving down through the catchment. However they did show that there are several potential sources of bacterial contamination. For example, at FNDC site 4 (near NRC site 105323), the Terewatoa stream, which flows from Lake Kaiwai wetland system (FNDC site 8) and the upper catchment near the forestry block (FNDC site 10 and NRC site 103354).

Table 3: Escherichia coli (MPN/100ml) results for Far North District Council sites sampled on 7 March 2005, with the location and vicinity to the Regional Council sampling sites.

FNDC site	NRC site	Location	E. coli (n/100ml)	Comments
1	105324	At SH1 bridge	565	Cattle access
2	105376	Swimming hole	933	Cattle access
3	NA	Opposite 175 Otiria Road	907	
4	105323	Opposite 211 Otiria Road	1483	Cattle access
5	NA	At approx. 1899 Ngapipito Road	563	Cattle access
6	NA	Behind quarry near Davies Road	556	Cattle access
7	103352	Ngawhitu Road bridge	437	Cattle access
8	NA	Terewatoa Strm at Ngapipito Rd	6131	Outflow from wetlands
9	Downstream of 103353	Opposite Ngapipito Schol	404	Cattle access
10	Downstream of 103354	1km downstream from forestry boundary	959	

Sanitary survey

Northland Health carried out a sanitary survey in December 2002 (Morton 2003). Refer to the report attached in appendix D for more information.

The sample results from this survey show that a health risk exists to humans who bathe in the Orauta/Otiria Stream downstream of Te Rito marae. Morton (2003) reported that cattle access to the river, farming activities and septic tanks are the likely sources of contamination to the Otiria Stream.

Faecal source tracking investigation

Water samples have been collected from the Otiria Stream swimming hole (NRC site 105376) and sent to the Institute of Environmental Science and Research (ESR) for analysis on five occasions. These samples were tested using a range of scientific techniques to assist in identifying the source of bacterial contamination, including faecal sterols, fluorescent whitening agents and polymerase chain reaction (PCR) markers.

Faecal sterols

Sterols are lipids that relate to both plants and animals such as cholesterol or the plant sterol, stigmasterol. The sterol profile in faeces depends on the animal's diet, internally produced sterols and the bacteria in the animal's gut. Consequently analysis of the sterol composition of animal faeces can generate distinctive faecal sterol fingerprints. Therefore, the ratio of different sterols in a water sample can be used to narrow down the potential source(s) of bacterial contamination to either humans, herbivores (animals whose main diet consists of vegetation – members of the ruminant group are a subset of herbivores and include cattle, sheep, deer and goats) and plant decay and/or runoff from vegetation.

Fluorescent whitening agents

Fluorescent whitening agents (FWAs) are common ingredients of washing powders, and only one is used in New Zealand. In most households the effluent from toilets is mixed with grey water from washing machines and therefore FWAs are usually linked to human faecal contamination in both septic tanks and community wastewater systems.

PCR markers

Polymerase chain reaction (PCR) markers basically show the difference between closely related bacteria using DNA sequencing. In some cases this bacteria is highly host specific (i.e. only associated with the faecal material of one animal or animal group). Therefore the type of animal that the bacteria are from can sometimes be identified using PCR markers. PCR markers for the following host groups were used in the study by Devane at al. (2008): human, ducks (wildfowl), ruminants (includes sheep, cattle, deer and goats), possums and pigs, as well as a general indicator for faecal contamination.

Initial faecal sterol sampling

The samples from the first two occasions (8 December 2005 and 16 January 2007) were only analysed for faecal sterols. The results showed that there was no evidence of human faecal pollution on both sampling occasions but there was some evidence of faecal contamination from herbivores.

Faecal source tracking investigation

An investigation was carried out at several recreational bathing sites in Northland that have consistently high bacterial levels with the support of ESR and Envirolink (Devane et al. 2008). As part of this investigation samples were collected from Otiria Stream on three fortnightly occasions in the 2008 summer. These samples were analysed for faecal sterols, FWAs and PCR markers.

Again the results showed there was no evidence of human faecal pollution. There was strong evidence for faecal contamination from herbivores, in particular ruminants and wildfowl. There is also a possibility of faecal contamination from pigs and/or possums but this is preliminary research and therefore these results should be interpreted with caution.

Although this investigation has found no evidence of faecal contamination from humans on the five sampling occasions, it should be highlighted that this does not mean that there is no risk of human faecal pollution reaching the Otiria Stream. Nor does it mean that there is no human health risks associated with the elevated bacterial levels in Otiria Stream. If the source of faecal contamination is mainly herbivores and wildfowl, the faecal material from these animals can still contain pathogens that can cause illness in humans such as *Campylobacter* sp. and *Salmonella* sp.

For more information on this investigation refer to the detailed report available on the Council website at the following link:

http://www.nrc.govt.nz/Resource-Library-Summary/Research-and-reports/Rivers-and-streams/Faecal-Source-Tracking-at-Recreational-Bathing-Locations-in-Northland/

Other monitoring information

Consent monitoring

Four of the resource consents for farm dairy effluent discharges have been monitored annually for at least five years. The results from this sampling suggest that these discharges have complied with their respective consent conditions for faecal coliform levels (bacteria) for the last three to four years and that these discharges are not likely to be the source of faecal contamination from stock (herbivores/ruminants) within the catchment.

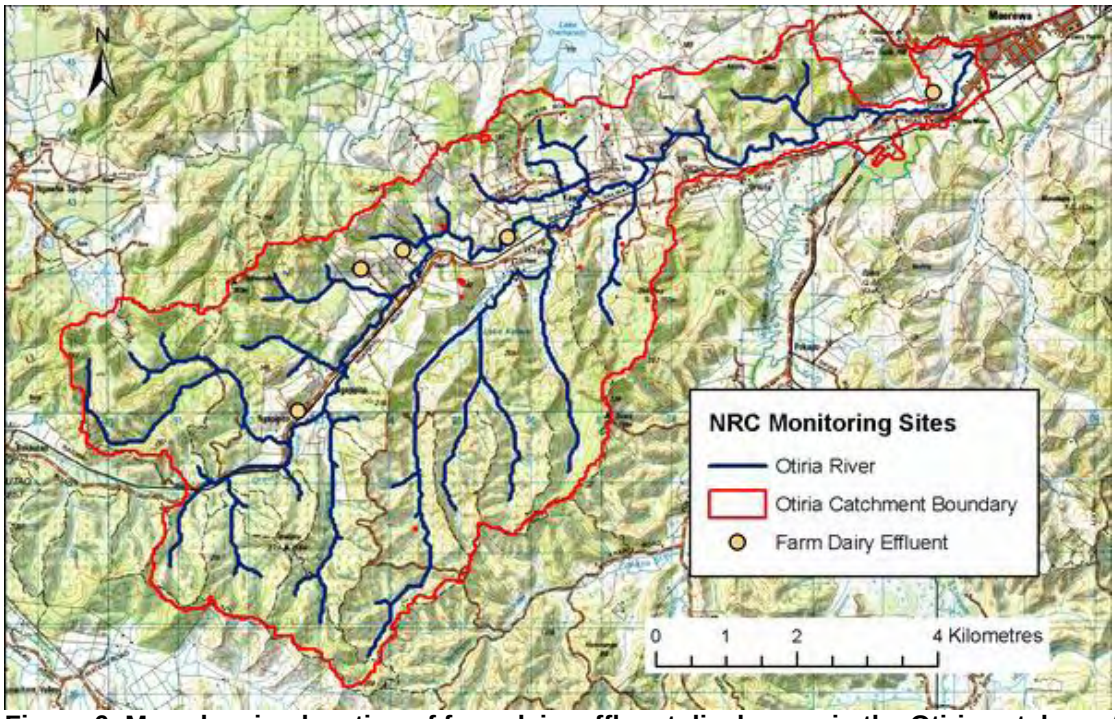


Figure 6: Map showing location of farm dairy effluent discharges in the Otiria catchment.

Summary and conclusions

There is substantial information available for Otiria catchment to make some predictions on the likely sources of bacterial contamination, including water quality data collected for state of the environment (recreational bathing programme) and resource consent monitoring, land use data, catchment observations and findings from the faecal source tracking investigation.

From the background information e.g. land use and observations in the catchment the potential sources of bacterial contamination are:

- Human wastewater from septic tanks
- Point source discharges such as treated farm dairy effluent
- Diffuse surface runoff from agricultural land of animal waste from sheep and cattle and direct stock access to waterways
- Microbial activity in catchment wetlands
- Diffuse surface run off from indigenous or exotic forest land cover of animal waste i.e. wild animals such as pigs, deer, possums, goats, mustelids and rats
- Faecal contamination from water fowl in wetland and stream areas

However using the water quality, resource consent compliance and faecal source tracking information currently available it narrows these potential sources down to:

- Diffuse surface runoff from agricultural land of animal waste from sheep and cattle and direct stock access to waterways
- Microbial activity in catchment wetlands
- Diffuse surface runoff from indigenous or exotic forest land cover of animal waste from wild animals such as pigs, deer, possums, goats, mustelids and rats
- Faecal contamination from water fowl in wetland and stream areas

Based on these findings the greatest improvements in bacterial water quality in the Otiria catchment are likely to be achieved by:

- Reducing diffuse surface runoff of faecal pollution from agricultural land use through riparian fencing and planting
- Stock exclusion from waterways
- Wetland enhancement or rehabilitation (needs further investigation)
- Pest control in both exotic and native forests.
- Continuing to maintain and improve farm dairy effluent discharges and onsite wastewater treatment systems in the catchment

From the background information and water quality data the areas in the catchment with the most impacted bacterial water quality are:

- The outflow from Lake Kaiwai
- The lower catchment (from NRC site 105323 or FNDC site 4 downstream)

Recommendations

To assist with prioritising areas for management or enhancement work at least one year of water quality sampling in the catchment is recommended, concentrating the sampling in the lower end of the catchment. Monthly sampling at the six sites shown in table 4 (below) is recommended.

Table 4: Recommended sampling sites for monthly water quality sampling by NRC.

NRC site	Site description	X coordinate	Y coordinate
105324	Otiria Stream at SH1 Bridge	1691364	6083299
105376	Otiria Stream at swimming hole below falls	1691228	6082448
105323	Otiria Stream opposite entrance to Tranzrail	1690561	6082322
103352	Orauta Stream at Ngawhitu Road	1685991	6081186
103353	Orauta Stream at bridge off Ngapipito Road	1683256	6079736
103354	Orauta Stream at boundary to forestry	1681073	6077247

The following parameters should be tested for:

- Temperature
- Dissolved oxygen
- Conductivity
- Water clarity using the black disc method
- Turbidity
- Total coliforms and *Escherichia coli*
- Ammoniacal nitrogen
- Dissolved reactive phosphorus

This sampling will be carried out by Northland Regional Council commencing in August 2008, who will ensure that the results are passed on to key stakeholders including the community.

On the first sampling visit on 14 August 2008, an extra site was included behind Te Rito Marae (site 109425), as there was too greater distance between sites 105323 and 103352. However the data for all the sites will need to be reviewed after six months and one site dropped to keep to the budget for this sampling.

As part of this process it is also recommended that Far North District Council, Northland District Health Board and the community including landowners, schools, marae and iwi groups are aware of this monitoring and are involved as much as possible.

This data should be reviewed after a year of sampling to determine whether one year's data is sufficient on which to base prioritisation of management. The lower catchment, particularly directly upstream of the swimming hole should be a priority for improvements in land and catchment management.

Sampling during the summer for the recreational bathing programme should recommence either once significant change has occurred in the catchment or if improvements in water quality are detected. In the interim a permanent warning sign should remain erected at the swimming hole recommending people not to swim.

References

Devane, M., Gilpin, B., Nourozi, F., Robson, B. and Scholes, P. (2008). *Faecal Source tracking at Recreational Bathing locations in Northland.* Prepared for Northland Regional Council by the Institute of Environmental Science and Research Ltd with support from Envirolink. Christchurch. Available on Northland Regional Councils website at the following link:

http://www.nrc.govt.nz/Resource-Library-Summary/Research-and-reports/Rivers-and-streams/Faecal-Source-Tracking-at-Recreational-Bathing-Locations-in-Northland/

Mataitai Mahinga O Ngati Hine Incorporated Society. (2003). key findings and research regarding sewerage issues affecting the waterways and Moerewa. Refer to Appendix A.

Ministry for the Environment. (2002). *Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas.* Ministry for the Environment and Ministry of Health, Wellington, New Zealand. Available on the Ministry for the Environments website at the following link:

http://www.mfe.govt.nz/publications/water/microbiological-quality-jun03/

Morton, T. (2003). *Moerewa Streams Sanitary Survey: Interim report.* Northland Health, Whangarei. Refer to Appendix D.

NRC. (2002). Otiria/Orauta Stream Investigation. Summary prepared by Garrett Hall, Northland Regional Council. Refer to Appendix C.

Appendix A

Key findings and Research regarding sewerage issues affecting the waterways and Moerewa, 31st January 2003, Mataitai Mahinga O Ngati-hine Incorporated Society.

MATAITAI MAHINGA O NGATI-HINE INC SOCTY
with NORTHLAND HEALTH WHANGAREI
P O Box 73, Kawakawa

KEY FINDINGS & RESEARCH REGARDING SEWERAGE ISSUES AFFECTING THE WATERWAYS & MOEREWA 31st Jan 2003

We are a freshwater fisheries portfolio affiliated to Te Runanga O Ngati-Hine and Te Ropu Kaumatua Kuia O Ngati-Hine I Raro I Te Tiriti O Waitangi. We are a duly incorporated society registered in 2000.

Our Interests: Are to achieve clean safe sustainably maintained food, water and land resources for whanau Marae and Hapu; to achieve added value to water and land resources by means of Kaitiakitanga practices; to secure the guaranteed protection of Taonga Tuki Iho which includes land, sea and water resources (our constitution clauses).

In May 2002 **Northland Health Whangarei** joined with us on a plan to clean up the Bay of Islands waterways. This took place soon after the oyster scare, and two major reports.

Moerewa Streams Sanitary Survey: Survey results were compiled by T Morton, Northland Health Whangarei. In Dec 2002 a survey of eight (8) key sites was conducted 4 times over 5 kms of two rivers, Otiria and Waiharakeke, as they flow through Te-Rito, Otiria, Moerewa, and the northern edge of Kawakawa. These two main tributaries feed into the Kawakawa River then Taumarere Inlet at the Bay Of Islands.

This survey reveals major pollution originating along these rivers. The Otiria Marae pollution issue is a major concern amongst many. Tahi will speak to the survey detail and our approach to the survey. Benjamin Peihopa will speak about requests from the public to him, and how he has dealt with them.

Latest Update: On 31st Jan 03 along the Otiria Stream from Te-Rito Marae to Otiria Marae, we encountered 20 households, most of which impacted on the river in some way. We include in our observations survey of today, some households on the other side of the road from the river, on the basis of them taking water from the river, or draining into culverts under the road and into the river. We made site observations which ask more questions, and answer some ! These are appended for your information.

Our Summary Concerns from 20 Site Observations made:

- There are high pollution conditions around households and livestock activities, ie. Where livestock are occasionally or regularly penned, there is no evidence of traps by which effluent runoff may be broken down by a stage or stages.
- Effluent runoff straight into the river is evident at two sites.
- There are no filtering accessories at water pumps or at river source. There were at least five water pumps from households and farm activities.
- There are no water troughs for livestock in paddocks, including fenced-off paddocks.

- There is no fencing off along river-banks, in some places. There is fencing off in some.
- Cattle crossings, cattle drinking access to the river, and effluent in the river are commonplace. Obviously these are major factors that contribute to the situation.
- There are farm implement dumps, and car bodies on riverbank and into the river at 3 sites.
- There is lack of awareness of need for remedy. It was easier to discuss Wahitapu than negligent farm practices.
- There is no water planning for Otiria/ Moerewa rural/urban communities.
- Community action and empowerment need to happen, so that:
- Householders obtain information and options to improve or remedy their household water reticulation and sewage services where deficient and contributing to pollution
- Householders be offered rating relief to improve the above, and their property equity
- We/they require local government (regional, territorial) to assist them to do the above.

Attachments:

Jan 2003, MMONHIS, Observations 31st Jan 2003

Further Relevant References:

Jan 2003, T Morton, Northland Health Moerewa Streams Sanitary Survey: Interim Report

Nov 2002, MMONHIS, Whakaorangia Nga Terenga Tuna: Terenga Tuna Schools Project

Aug 2002, MMONHIS, Freshwater Fisheries Strategic Direction

19 Jun 2002, MMONHIS, Resource Monitoring Unit Te Runanga O Ngati-Hine

May 2002, Northland Regional Council Working Group Guidelines for Iwi Management Plans

Aug 2001, MMONHIS, Water – Testing: A Practical Approach To Kaitiakitanga & Tamariki In Ngati – Hine Rohe

2000, MMONHIS Constitution

1988, Te Runanga O Ngati-Hine, An Introductory Perspective to Resource Management Planning

Observations made at 20 sites on 31st Jan 2003

Behind Te-Rito Marae:

Site 1: Small tributary into river

Site 2: Cattle crossing; cattle effluent in river

Site 3:	Cattle drinking access to river
Site 4:	Farmers rubbish dump into river
Site 5:	Cattle drinking access to river
Site 6:	Cattle crossing: cattle effluent in river

Otiria Straight Opposite Pokapu Road:

Site 7:	Cattle drinking access to river
	Dry man-made drain into river
	Pipe into river for water supply
	Car body, no sump
Site 8:	Logging yard dust hazard; dense
Site 9:	Large cattle crossing; cattle effluent in river
Site 10:	Calf tracks on river bank
	This site fenced, but livestock getting under fence
Site 11:	Cattle drinking access to river
	Pig – farm runoff trough straight into river
	Car wreck in river
	Cattle crossing; cattle effluent in river
	Rubbish & cartons in river
	Foot-bridge
	Pig effluent straight into river; scoria laid in old pen site
	More car bodies
Site 12:	Cattle cross; cattle effluent in river
	Water pipe from household
	Culvert from under the road
	Family in pink house; children got sick when using water from river
	Drinking water is accessed also from culvert as pipe enters river below culvert
	Presently appears to be using roof supply at house

Otiria Opposite Railyard:

Site 13:	Cattle crossing; cattle effluent in river
Site 14:	Farm not fenced off at river bank; both sides
Site 15:	Cattle crossing; cattle effluent in river
	Last sample taken from here, just above cattle crossing.
	High reading at Otiria Falls further down
Site 16:	Road culvert with rubbish in it into river
	Take a sample from here; evidence of runoff, grey water from houses across road

Site 17: Yellow house happens to have septic tank discharge.
During hot summer, looks dry; however grass is high beside river

Otiria Opposite Marae:

Site 18: Cattle crossing; cattle effluent in river

Site 19: At farm bridge, suckling in river; lot of silt

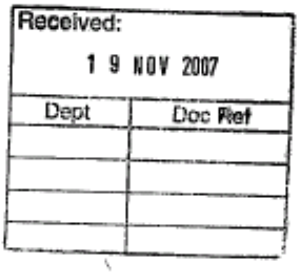
Site 20: Sue's house contributes to septic overflow
Evidence of seepage into river

Appendix B

Letter from Moerewa School

Far North District Council
Memorial avenue
Private bag 752
Kaikohe 0440

Moerewa School
Otiria rd
Moerewa



Dear sir/madam

I wish to draw your attention to the condition of Otiria Stream. In our view the stream is foul with lot of rubbish and dead cows and other stuff.

- We are unable to swim or drink from out of the river or go eeling from the stream. Could you help clean the river please ?

Your sincerely
Christopher Renata
Nellie Mane
Khalib Coates

Appendix C

Otiria/Orauta Stream investigation, 2002, G. Hall, Northland Regional Council.

Otiria/Orauta Stream Investigation

Purpose

To further investigate elevated concentrations of the bacteriological indicator 'E coli' within the wider Kawakawa River catchment with the aim of identifying possible areas/sources of contamination.

Monitoring Database

A new scheme has been created in the monitoring database to record all results from the investigation (SOE, Otiria/Orauta Stream Investigation).

Sites

Eleven sites have been selected within the Kawakawa River catchment. Sites are located on most major tributaries, with a particular focus on the Otiria/Orauta Stream. If possible, sampling should be timed to occur alongside the Kawakawa oxidation ponds monitoring. One site is also located downstream of the discharge from the Affco Freezing Works on the Waiharakeke River.

Site	Location
631	Kawakawa River – Lemon's Hill Rd Bridge
11	Kawakawa River - Footbridge
3351	Waiomio Stream – Old Whangae Rd
10	Waiharakeke River – 100m below Affco discharge
5324	Otiria Stream – SH1 culvert
5376	Otiria Stream – Swimming Pool
5323	Otiria Stream – opposite entrance – Tranz Rail
3352	Orauta Stream – Kawiti bridge
3353	Orauta Stream – Ngapipito bridge
3994	Orauta Stream – 500m downstream of FDE 937
3354	Orauta Stream – pine forest

Parameters to be sampled

At all sites

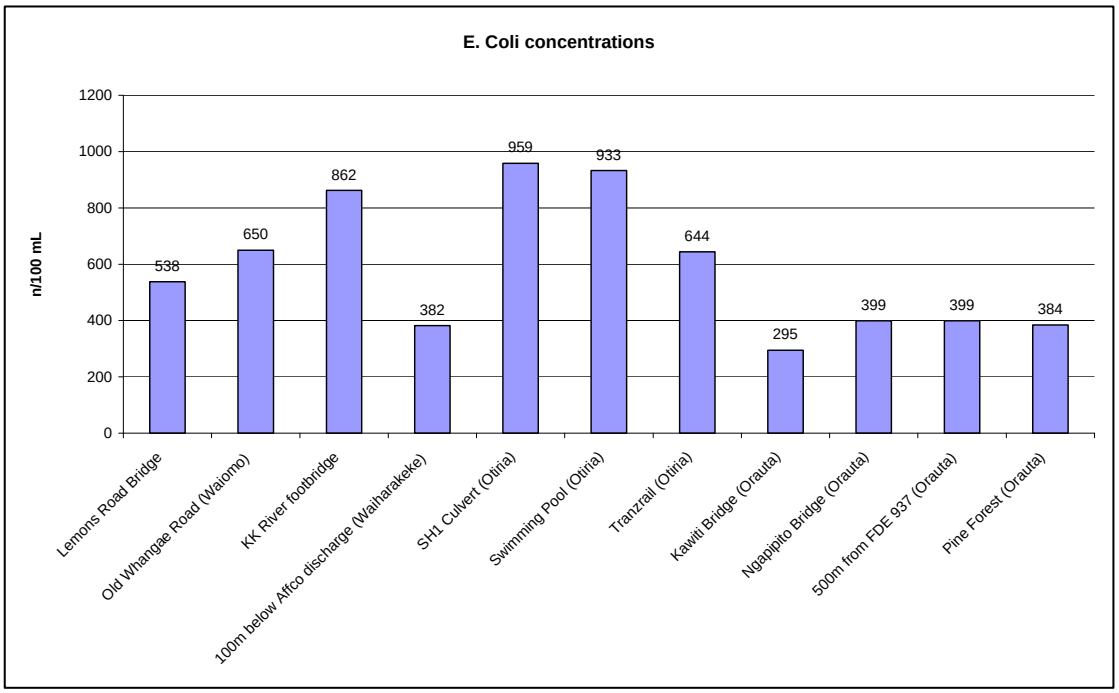
- DO%-1
- DO-1
- Temp-6
- Ecoli-1
- Col-4
- Cond-5

In addition, at sites 631 and 11

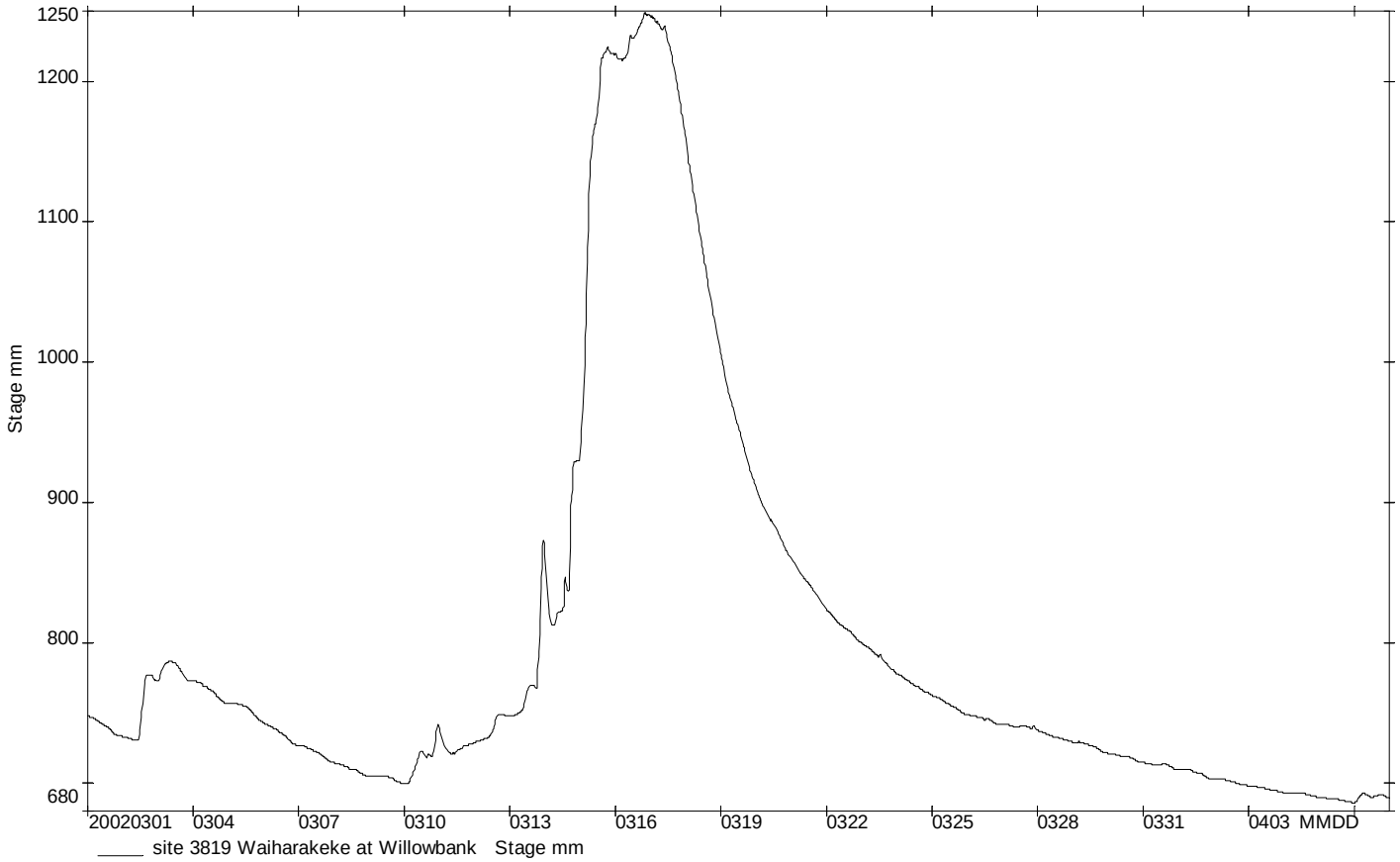
- Sal-1

Sampling should occur during dry weather with normal river flows. Using 100 mL disposable sample bottles, collect 3 samples from each site. Sample water where depth is 0.5m. Collect sample 15cm – 20cm below water surface.

Results



E-coli concentrations at selected sites (sampled 03/04/02).



Flow at Waiharakeke Station (01/03/02 – 06/04/02)

Appendix D

Moerewa Stream Santiary Survey: Interim report, January 2003, T. Morton, Northland Health.

MOEREWA STREAMS SANITARY SURVEY: INTERIM REPORT

January 2003

Tahi Morton

During December 2002 a sanitary survey and a short term water sampling survey commenced for Otiria and Waiharakeke Streams.

The sanitary and sampling surveys are carried out in response to a 'State of the Environment report' released by Northland Regional Council during September 2002. The surveys are a joint project involving Mataitai Mahinga o Ngatihine Inc., Northland Health, Far North District Council and conducted in conjunction with Northland Regional Council. At the time of this report, the sanitary survey has yet to be completed.

Water samples were organised and collected by Mataitai Mahinga o Ngatihine Inc., an environmental monitoring group based in Moerewa. The group liased with the Moerewa community to ensure continued access to all sampling sites.

Pathogens and Indicators

Microbiological water quality is assessed by determining the concentration of microbiological indicator species in water samples. Indicator species are chosen for their reliability in predicting the presence of pathogens and for the ease and cost-effectiveness of processing them.

Escherichia coli is the most specific indicator of faecal contamination readily available. *E. coli* is nearly always found in the gut of humans and animals and usually in high numbers. It can survive up to four to six weeks in fresh water and is a definite indication of recent faecal contamination. While it is not possible to know whether *E. coli* are of human, animal or avian origin, all these species can act as carriers of micro-organisms that can cause disease. Hence the presence of *E. coli* indicates that there may be a health risk. *E. coli* is currently the preferred indicator for fresh water monitoring. (Ministry for the Environment 1999).

Guidelines for freshwater bathing in Northland (from MfE)

	E. coli (n/100mls)			
	Safe	Alert		Action
		Mode 1	Mode 2	
Running Median	<126	127 - 273	-	-
Single Sample Maximum	-	-	274-410	>410

** Per 2002 NRC Report*

Rainfall

No significant rainfall occurred during sampling period (yet to access rainfall data for area).

Sample results and explanation

Otiria Stream

Of particular concern is site 5. (Otiria Falls). The median here exceeds the limit where action is required to reduce bacteriological contamination at the swimming hole.

On the days that runny cow faeces were seen at site no 8, sample results at Otiria Falls were extremely elevated (see above table).

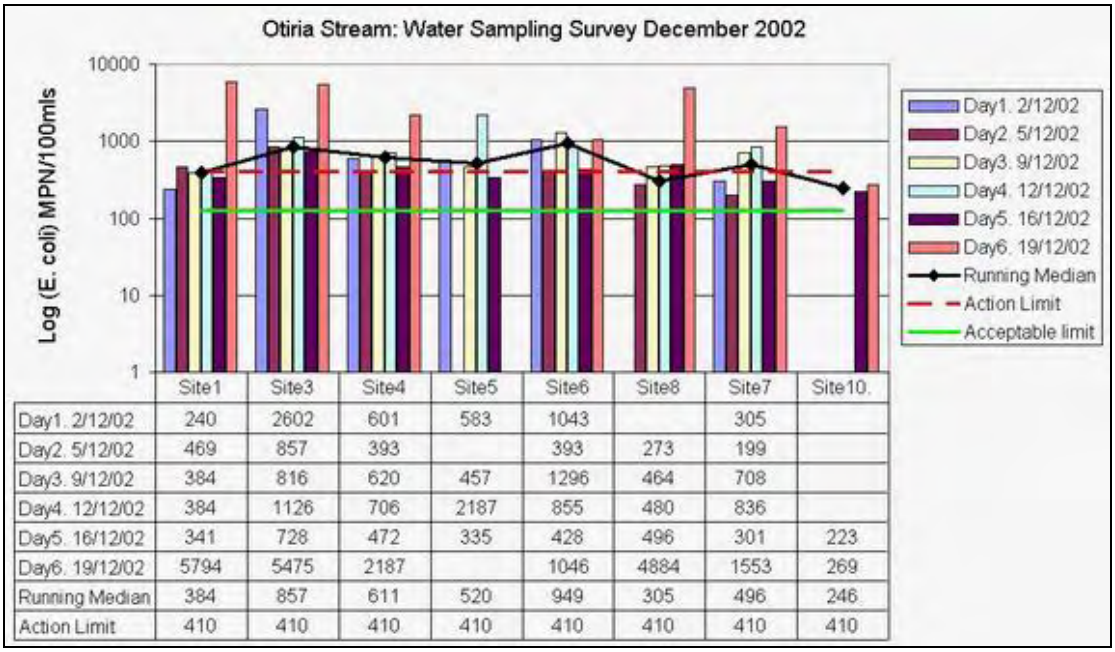
Septic tank(s) cannot be discounted as contributing to elevated bacteriological levels in the Falls swimming hole.

A stream inspection (from the Falls to Te Rito Marae) must be done in order to more conclusively ascertain contamination sources above the swimming hole.

Sample results indicate that a health risk exists to persons who bathe in Orauta/Otiria Stream at areas down stream of Te Rito Marae.

Table showing *E. coli* (MPN/100mls) results for some Otiria Stream sites

E. coli MPN / 100mls	2.12.02	5.12.02	9.12.02	12.12.02	16.12.02	19.12.02
Site 5: Otiria Falls	583		457	**2187**	335	
Site 6: Bridge upstream from Falls	1043	393	1296	855	428	1046
Site 8: Cattle crossing,		273	708	**480 (**fresh runny cow faeces)	496	4884
Site 7: Te Rito	305	199	464	836	301	1553
Site 10: Orauta Br.					223	269



	Site1	Site3	Site4	Site5	Site6	Site8	Site7	Site10.
Day1. 2/12/02	240	2602	601	583	1043		305	
Day2. 5/12/02	469	857	393		393	273	199	
Day3. 9/12/02	384	816	620	457	1296	464	708	
Day4. 12/12/02	384	1126	706	2187	855	480	836	
Day5. 16/12/02	341	728	472	335	428	496	301	223
Day6. 19/12/02	5794	5475	2187		1046	4884	1553	269
Running Median	384	857	611	520	949	305	496	246
Action Limit	410	410	410	410	410	410	410	410

Exceedingly high sample results for all sites except site 1 are a bit unusual in comparison to results of other days.

Contamination sources

- Animals

Cattle have access to many areas of Otiria Stream, therefore bacteriological input from their faeces is significant.

- Farming

Bacteriological input from farming activities will also be of significance.

- Septic Tanks

Otiria has a known history of failed and non-maintained septic tanks. Many such septic tanks have run-off which discharge into or near to Otiria stream.

Recommendation

That bathing in Otiria Stream is discouraged until such time the water quality improves to acceptable levels.

That a sign warning of health risks associated with bathing in bacteriologically contaminated water be erected at Otiria Falls swimming hole.

Actions planned

- Continuation of Otiria Stream sanitary survey, which includes a walk upstream of 'The Falls' swimming hole to determine further contamination sources.
- Contamination sources identified up-stream of the 'Falls' to be addressed.
- Conduct a septic tank survey of houses backing on to Otiria Stream
- Write report in conjunction with Mataitai Mahinga o Ngatihine Inc.

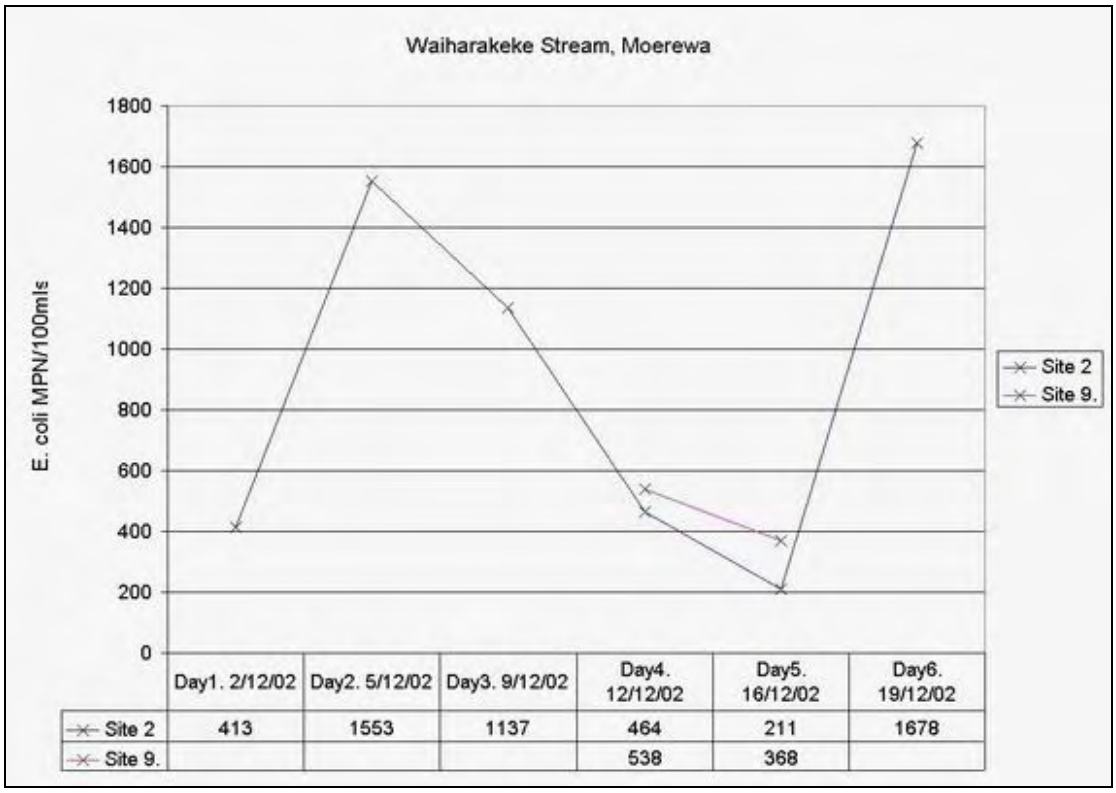
Waiharakeke Stream

E. coli results indicate that the health risks related to swimming in Waiharakeke Stream are also high. Further sampling upstream of Affco is required.

Results for this stream are all elevated, Tuna Town swimming hole appears 'bacteriologically unsafe' to bathe at. However, further sampling is required to determine bathing water quality at the swimming holes sites above 'Affco' (site 2).

Table showing *E. coli* (MPN/100mls) for two sites on Waiharakeke Stream

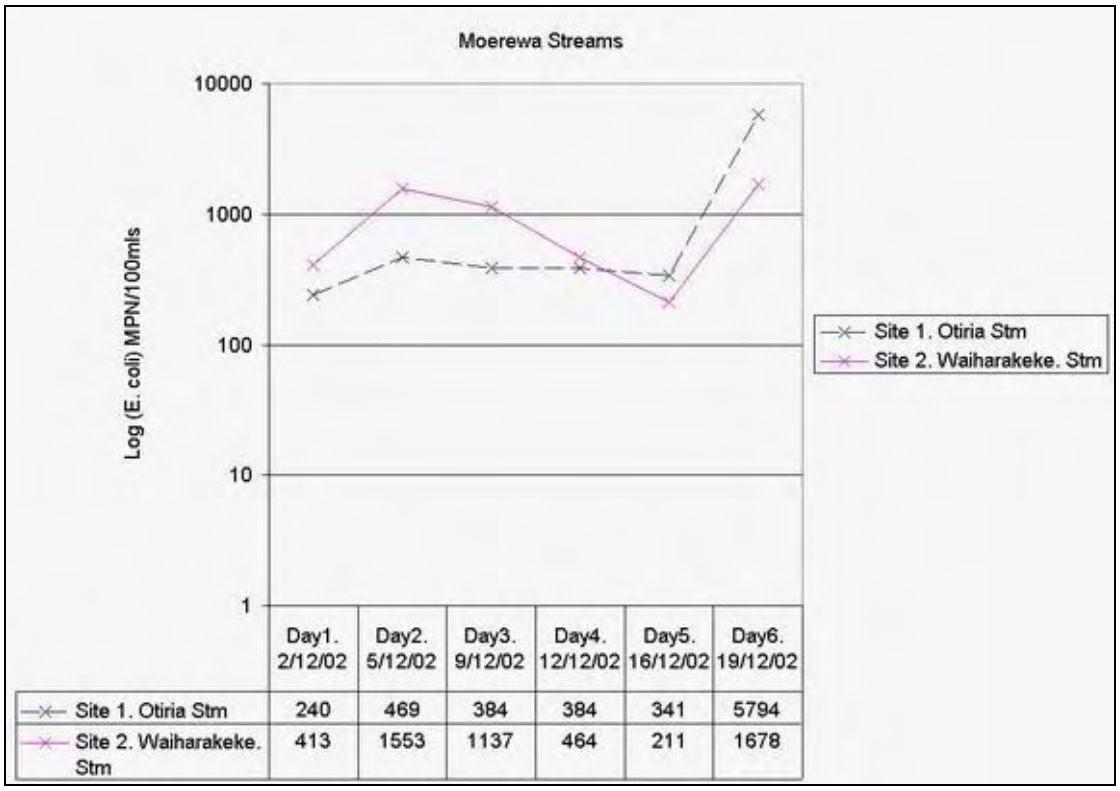
Site 2: Bridge on Sales Rd (Affco)	413	1553 (extreme turbity)	1137	464	211	1678
Site 9: Tuna Town				538	368	



Bacteriological contribution to Taumarere (Kawakawa River)

Otiria and Waiharakeke Streams are tributaries to Kawakawa River. The southern-most sites of both streams are sites 1. (Otiria Stream) and Site 2. (Waiharakeke Stream). *E. coli* levels were elevated on all days sampled.

The result of this survey is that levels of *E. Coli* fed into Kawakawa River would contribute in a significant way to its water quality and therefore contributes to marine water contamination such as at Waikaire Inlet.



	Day1. 2/12/02	Day2. 5/12/02	Day3. 9/12/02	Day4. 12/12/02	Day5. 16/12/02	Day6. 19/12/02
Site 1. Otiria Stm	240	469	384	384	341	5794
Site 2. Waiharakeke. Stm	413	1553	1137	464	211	1678

Appendix E

Environmental incidents in the Otiria Catchment from NRC incidents database.

Table 5: All environmental incidents recorded on the NRC environmental incident database in the Otiria Catchment from November 1993 to June 2008.

Incident number	Incident details	Location	Incident type	Resource affected	Start date	Agenda Comment	Impact
400033	Concerns over signage for possum bait laying.	Moerewa	Hazardous substances	Land	16/11/1993	Resolved by discussion.	Unknown
400203	Low flow & poor water quality in lake outflow	Tenewatoa Stream, Lake Kaiwai, Orauta	Natural phenomena	Inland waters	8/02/1994	Natural dry conditions leading to stagnant pools along stream. Water yield from catchment probably reduced due to maturing pine.	Natural
400919	Multi-pipe culvert causing a partial barrier to upstream migrating eels	Otiria Rd, Moerewa.	Natural phenomena	Inland waters	9/02/1995	Request made to the owner and forestry company to make modifications so that eels can more easily get past the structure in the Waihakere Stream.	Minor
401514	Dead horse in stream by school.	Otiria Road, Moerewa	Dead or dying organisms	Inland waters	7/11/1995	School principal arranged for the horse to be removed.	Minor
401552	Chemical spill at rail head.	Trans-Link Depot, Otiria, Moerewa	Hazardous substances	Inland waters	21/11/1995	15 ton of urea formaldehyde glue spilt when bladder split. Cleaned up by Fire Service, NRC and Trans-Rail. Prosecution for discharge to stream under consideration.	Large
402410	Dust nuisance from rail yards.	Otiria.	Dust nuisance	Air	25/11/1996	Investigation ongoing, DP gauge to assess dust nuisance.	Minor
402431	Stream is discoloured and has an odour.	Otiria Road, Otiria.	Natural phenomena	Inland waters	11/12/1996	Water discoloured by run-off from rail yards log storage area. To be revisited in wet weather.	Minor
402849	Rubbish thrown in stream.	Ngapipi Road, Kaikohe.	Refuse & other dumping	Inland waters	14/05/1997	Site investigated. No lasting environmental effects.	Minor
402957	Erosion of hillside into river.	Ngapipito Road, Kawakawa	Flooding hazards & erosion	Land	30/06/1997	Site visit undertaken. Advised land owner and contractor to apply for Resource Consent. Awaiting application.	Minor

403163	Check river water.	Otiria Road, Otiria	Natural phenomena	Inland waters	4/09/1997	Water quality in the river is OK but there appeared to be an overflow from the septic tank to a nearby drain. FNDC to dye test tank.	Minor
404486	Pigs are being kept next to the stream.	Ngapipito Road, Moerewa	Farm dairy effluent	Inland waters	26/03/1999	No significant pollution occurring.	None
405688	Dust nuisance from railway yard.	Otiria, Moerewa	Dust nuisance	Air	10/10/2000	Owner requested to address the problem urgently.	Significant
405772	Silage pit located close to stream	Ngapipito Road, Moerewa	Other contaminant discharges	Inland waters	13/11/2000	Landowner asked to either remove pit or apply for consent as it is located within 50m of a water body.	Minor
405825	Diesel spill on road.	Main Road, Moerewa	Oil, diesel & other fuel spills	Land	30/11/2000	Small diesel spill on road, which Works Infrastructure covered with sand. No runoff to water.	Minor
406835	Stream discoloured - red/brown.	Ngapipito Road, Orauta	Natural phenomena	Inland waters	23/01/2001	The discolouration appeared to be a natural event associated with the low flows in the watercourse and high temperatures. Source was from a lake and swamp areas which could be contributing to the discolouration as well.	Natural
406038	Suspected webworm in lawn.	Moerewa	Miscellaneous	Land	18/02/2001	Site visit established that webworm was not present. Damage most likely caused by grass grub.	None
406492	Dead cow in stream.	Otiria Road, Moerewa	Dead or dying organisms	Inland waters	21/09/2001	Dead stock removed from stream and disposed of.	Minor
406779	Diesel spill at railyard.	Otiria Road, Moerewa	Oil, diesel & other fuel spills	Land	31/12/2001	Fire brigade contained a small amount of diesel by the railway tracks. No significant adverse environmental effects.	Minor
406962	Dust nuisance from railway station.	Otiria	Dust nuisance	Air	26/03/2002	Tranzrail advised to ensure appropriate measures are used to minimise adverse effects.	Minor
407009	Dust nuisance.	Otiria, Moerewa	Dust nuisance	Air	13/04/2002	Site inspection confirmed dust nuisance from log storage yard. Tranzrail advised of problem and agreed to commence frequent water applications until a more permanent solution can be arranged.	Minor
408128	Washdown of refuelling area.	Otiria Rd, Moerewa	Contaminated stormwater	Inland waters	19/11/2002	The Kawakawa Fire brigade were seen washing down refuelling area straight into drains. A letter has been sent to theNorthland Area Fire Chief, advising that this is not an acceptable practice.	Minor
408136	Dust nuisance from railway yard.	Otiria Rd, Moerewa	Dust nuisance	Air	20/11/2002	Dust nuisance from railyard confirmed. Abatement notice served upon Tranzrail requiring them to address the dust nuisance problem immediately. Investigation continuing.	Significant

408723	Dust nuisance from movement and storage of logs within railyard.	Otiria Rd, Moerewa	Dust nuisance	Air	24/03/2003	Investigation was unable to confirm offensive dust nuisance. Incident reporter advised to contact the Council again, if the problem should re-occur.	None
409528	Illegal dumping of household refuse.	Ngapipito Rd, Moerewa	Refuse & other dumping	Land	14/10/2003	FNDC have requested the landowner to remove refuse from his property.	Minor
410408	Dust nuisance.	Otiria Rd, Moerewa	Dust nuisance	Air	21/04/2004	Site visit did not confirm dust nuisance from railyards.	None
411180	Large quantities of rubbish dumped on stream side.	Ngapipto Rd, Kaikohe	Refuse & other dumping	Inland waters	26/10/2004	Photographs supplied by the complainants appear to show a large illegal dump site beside a river. An appointment has been made to inspect the site.	Significant
411322	Wetland sprayed with chemicals.	Rakautao Forest	Spraydrift	Inland waters	25/11/2004	A small wetland/watercourse has been sprayed and although plants are recovering this has raised serious concerns over the companies environmental procedures. A written warning will be sent and an explanation of the situation and remedy to avoid repe	Minor
412668	Air pollution and dust nuisance from railway.	Otiria, Moerewa	Dust nuisance	Air	1/09/2005	While no dust nuisance was evident at the time of my site inspection, the railyard was dry and vehicle movements could entrain sufficient dust to cause a nuisance. Toll-rail agreed to implement an automated water sprinkler system to control the dust.	Minor
413003	Dust nuisance from railway.	Otiria	Dust nuisance	Air	9/11/2005	Confirmed dust nuisance from the unloading of logs at the railyard. Railyard operators have been given additional information on minimising the generation of dust and warned that future justifiable complaints may lead to enforcement action.	Minor
414555	Dust nuisance.	Otiria Rd, Moerewa	Dust nuisance	Air	2/11/2006	Incident investigation continues. A site visit is scheduled in early December. Also waiting a reply from alleged offender.	Minor
414717	Alleged FDE discharge to stream.	Ngapipito Rd, Orauta	Farm dairy effluent	Inland waters	8/12/2006	Reported contamination to stream not verified. Complainant advised that stream had cleared up.	Unknown
415479	Dead cow in stream.	Otiria Rd, Moerewa	Dead stock	Inland waters	2/07/2007	Dead animal removed by farmer.	Minor
416507	Possible illegal earthworks associated with forestry operation.	Ngapipito Rd, Moewera	Earthworks & vegetation clearance	Land	13/02/2008	The forest owner requested that a site inspection of the earthworks be deferred until such time as the illegal logging operation was stopped.	Unknown