# Doubtless Bay

## Catchment Description

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| **Project Sponsor** | Tony Phipps |
| **Sign off** | Waiora Northland Water Steering Group |

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# Executive Summary

Under the Resource Management Act 1991 (RMA) Northland Regional Council (NRC) is responsible for managing the region's freshwater quality and quantity by controlling discharges, water takes and land use activities that impact on water.

Waiora Northland Water is NRC's programme for improving the management of water quality and quantity across the region. It brings together and coordinates a number of NRC's water management responsibilities, including its programme for implementing the National Policy Statement for Freshwater Management 2011 (NPS). Waiora Northland Water includes both catchment specific and region-wide approaches to water management.

Doubtless Bay is one of the most important recreational areas in Northland and also has very high cultural and historical values with many archaeological sites and sites of significance to Tangata Whenua. A working group comprising NRC and FNDC councillors and staff, and community/sector representatives (i.e. representing tangata whenua, farming, forestry, tourism and urban) has been established to further clarify water related issues and identify practical solutions. This document provides a description of the catchment and current state of its freshwater bodies.

The Doubtless Bay catchment's surface water quality is described as "fair[1] ". Water takes sourced from both surface and groundwater reflect predominant land uses with the water primarily used for domestic supply, stock drinking and irrigation. Parts of the catchment have high ecological value for aquatic species and the catchment is regionally and locally important for its recreational and amenity value.

Major features of the catchment include:

- Mixed landuse – Coastal urban landuse in Mangonui, Coopers Beach and Taipa and a large proportion of pastoral land in the catchment.
- Soils/peat sediment
- Three main catchments: Oruru, Aurere and Oruaiti Rivers.

[1] Fair means median values for three or four of the six variables are within guideline values, of which dissolved oxygen is one variable that must be met.

# 1 Introduction

## 1.1 Background

**Northland Water**

Waiora Northland Water is a programme for improving the management of water quality and quantity across the region. It brings together and coordinates a number of Northland Regional Council's water management responsibilities, including its programme for implementing the National Policy Statement for Freshwater Management 2011 (NPS).

The NPS requires Northland Regional Council to establish freshwater objectives and set associated water quality and quantity limits for every stream, river, lake, wetland, and aquifer across the region. It then requires Northland Regional Council to implement regulatory and non-regulatory actions to achieve the freshwater objectives.

Northland Regional Council has committed to an approach that involves setting a combination of specific objectives and policy limits in priority catchments and region-wide interim and/or default limits for other freshwaters. Northland Regional Council is also aware of the strong correlation between freshwater and coastal water in Northland, especially given that all of the region's major river systems drain to estuaries and harbours. The proposed Regional Policy Statement for Northland (proposed RPS), notified in October 2012, establishes a framework for the integrated management of fresh and coastal waters, including by identifying a number of regulatory and non-regulatory actions to be implemented by Northland Regional Council.

Actions include regulations, and incentives. Achieving objectives is also dependent on a good deal of landowner and community commitment. Robust information is critical to the process and very important to assess the on-going achievement of freshwater objectives.

Northland Regional Council has identified the Doubtless Bay catchment as one of several catchments where a catchment specific approach should be used and a working party established to assist in implementing the Waiora Northland water (WNW) programme.

# 2 Purpose of the document

This document has been prepared to provide an up-to-date overview of the Doubtless Bay catchment, describing landuse, water quality monitoring results, locations of water related consents, and the context for decision making and water management within the Waiora Northland Water Programme.

The catchment description is intended to inform the Doubtless Bay Catchment Working Party of current NRC knowledge concerning the catchment's freshwater quality and allocation and invite representatives of the group to contribute their local knowledge and identify knowledge gaps.

# 3 The Doubtless Bay catchment

## 3.1 Overview

Doubtless Bay catchment, one of the most important recreational areas in Northland, is located on the east coast of Northland, approximately 33 Km east of Kaitaia. The catchment's three subcatchments have high cultural, recreational, ecological and environmental values. With moderate water quality and ecological condition, the catchment provides habitat for a range of plants and animals. .

## 3.2 Geology

Doubtless Bay catchment is bounded by a block of Tangihua Complex volcanics extending to Berghan Point/Te Whatu in the east and the Karikari Peninsula in the west. Karikari Peninsula is tombola, starting as a dacite volcanic island, with successive rises and falls of sea level laying down sand between the island and the mainland to form a peninsula.

The 'hard shore' of the bay between Aurere and Hihi comprises Tangihua Complex volcanics but is overlain in places by layers of gravel, lignite, sandstone and consolidated sand. Beaches between the hard points are formed from both local and transported sands.

## 3.3 Waterways

Three larger rivers and numerous streams drain into Doubtless Bay. The largest, Oruaiti River, drains from Otangaroa on the northern edge of Omahuta Forest and, after a tortuous route, discharges into Mangonui Harbour.

The Peria River, Waikainga and Te Awapuka Streams, and numerous smaller streams, all of which drain steep hill country around Maungataniwha, converge just downstream of Peria to become the Oruru River. The Oruru River flows northwards for another seven to eight kilometres before reaching the tide, joining with the Paranui River and becoming the Taipa River.

Further west, the Aurere and Parapara Streams, both of which drain lower hill country, converge at Aurere to form the tidal Awapoko River.

## 3.4 Landuse

Urban development extends almost continuously along SH10 and the coast from Hihi in the east, through Mangonui, Coopers Beach and Cable Bay to Taipa in the west.

**Table 1 Inner Doubtless Bay Primary Land Cover (Oruaiti, Taipa Rivers)**

| | |
|---|---|
| High Producing Exotic Grassland | 40% |
| Indigenous Forest | 20% |
| Manuka and/or Kanuka | 20% |
| Exotic Forest | 11% |
| Broadleaved Indigenous Hardwoods | 4% |
| Low Producing Grassland | 2% |
| Gorse | 1.5% |

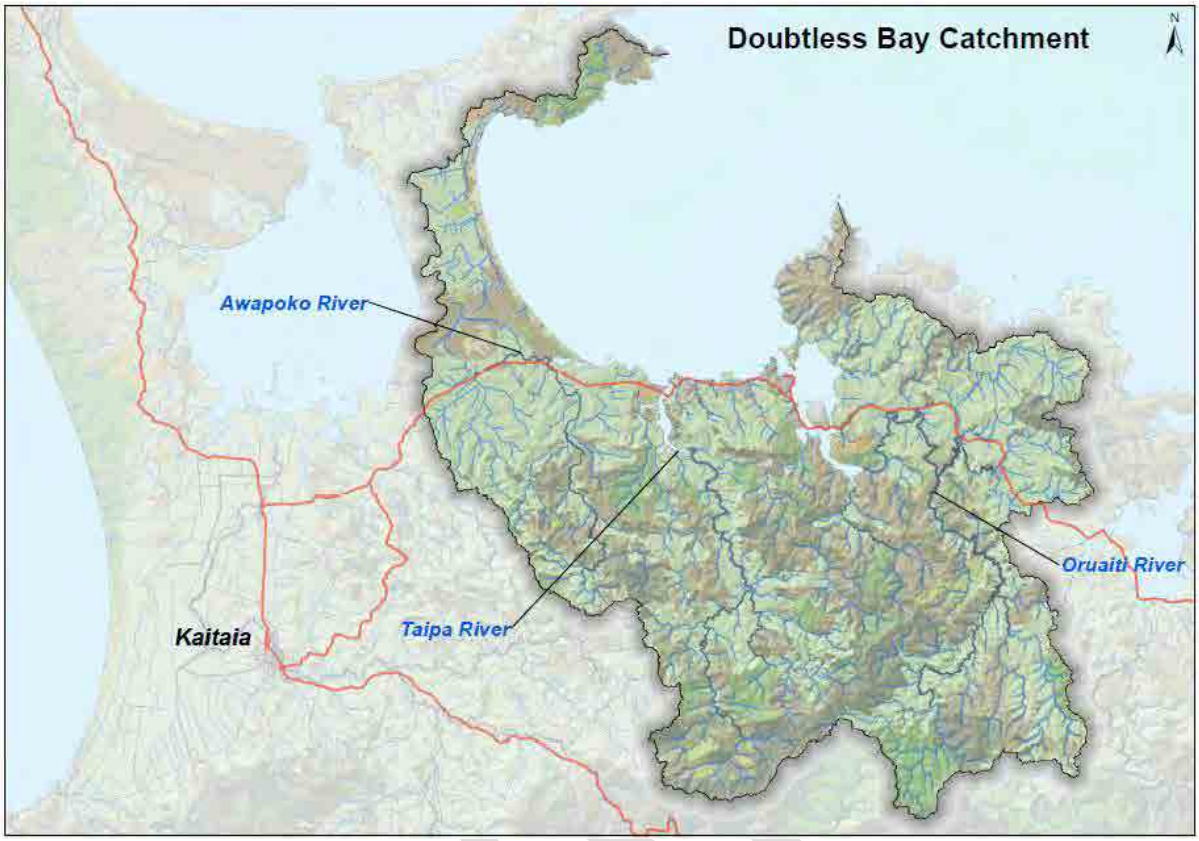



**Figure 1** The Doubtless Bay catchment

## 3.5 Catchment Description

### 3.5.1 Oruaiti sub catchment

Wainui Stream and its tributaries drain the northern and north-western side of Omahuta Forest; greywacke hill country with Rangiora soils in one of the higher rainfall areas of Northland. The steeper land is either in native bush, is regenerating to bush or is in pine forest.

The streams flow through unstable banded sandstone hill country with Taumata and Omahuta soils (from banded sandstone) and Whaka soils (from calcareous mudstone) before the valley opens out onto a wider floodplain at Otangaroa. Land in the vicinity of the saddle between the Wainui River catchment (east coast) and Opurehu River catchment (Hokianga Harbour, west coast), while relatively fertile, is particularly unstable. There are large earthflows affecting Otangaroa Road, farmland and even the extensive pine forests in the area. Experience has shown that poplars and willows are useful erosion tools in this location, as they have a better root system for controlling gully and earthflow erosion than pasture, pines or even native bush.

Wainui River is joined by one major left bank tributary, Rautahi Stream, at Otangaroa but generally these left bank tributaries, draining Otangaroa Forest (bush and regenerating scrub on this side of the ridge) which covers Tangihua Complex hill country west of the valley, are small , short streams. While Rautahi Stream drains younger and more fertile Te Kie soils, the

smaller streams drain older and more deeply weathered Awapuku, Mangonui and Rangiuru soils. The Mangonui and Rangiuru soils are very deeply weathered with concentrations of colloidal clay in their subsoil. When exposed by erosion or earthworks, the exposed clay layers are very difficult to revegetate and will continue to shed fine sediment.[2]

About two kilometres downstream of Otangaroa the stream is joined by a right bank tributary, Takakuri Stream, before being confined to a gorge. Takakuri Stream drains an area of claystone and shale, mainly gumland hill country, most of which is within Landcorp Farming's Takakuri Station and Takakuri Forest. Takakuri Station is operating under an environmental farm plan which is already reducing the risk of sediment and nutrient discharge.

Downstream of the Takakuri Stream confluence, Wainui River becomes Oruaiti River which is deeply entrenched as it cuts its way through the Otangaroa massif. As it emerges from this gorge, Stony Stream joins Oruaiti River as right bank tributary. Stony Stream drains a large catchment extending beyond SH10 to Mangonui Forest, behind Totara North, and beyond Taupo Bay Road.

Kohumaru Stream, Kenana River and Tokatoka Stream are left bank tributaries of Oruaiti River in its tidal reaches and all three drain mainly scrub and pine forest-covered catchments. Tokatoka Stream previously discharged directly to Mangonui Harbour but its flow was diverted across to the Oruaiti River in the 1950s by a SH10 causeway. This diversion of Tokatoka Stream is of local concern and has been the subject of correspondence with the New Zealand Transport Authority as it is causing erosion of estuary channel banks adjoining SH10, threatening the bridge on Kohumaru Road and is most probably responsible for the accumulation of sediment in an arm of Mangonui Harbour.

### 3.5.2 Taipa Oruru sub catchment

The tributaries in the upper Oruru River catchment, Peria River, Waikainga and Te Awapuka Streams all drain steep Tangihua Complex hill country. The soil types over the highest and steepest country are Te Kie steepland soils, relatively fertile soils which, while subject to storm induced slipping when under bush, revegetate quickly. Much of this land is in bush.

Awapuku soils cover the gentler slopes, although some gradients are still greater than 30o. This is a more mature and more deeply weathered red soil. It is capable of supporting strong pasture cover if top-dressed. Strategic planting of poplar and willow trees would reduce the risk of slip and gully erosion. Exclusion of stock from streams may be difficult on this country and may only be necessary if heavier stocking rates are required or on parts only of streams. Easier country occurs closer to the right bank and along all of the left bank of the Peria River catchment, where clay hill country soils have developed mainly on sandstone and limestone. This land is typical Northland 'Waiotira-type' hill country, prone to slip, gully and some earthflow erosion. The incidence and seriousness of these forms of erosion can best be controlled by strategic plantings of poplars and willows. Adequate subdivision enables better control over grazing, improving pasture density and length, as well as increasing stock production and reducing soil loss.

[2] While some of this land would have previously carried native bush, some would have been shrub-covered and most certainly mainly scrub for the last 5-600 years. That is, soil erosion and the discharge of fine sediment from these old volcanic soils are not new.

The landform on this clay hill country also lends itself more to the creation of wetland sediment and nutrient traps. Fencing of streams, drains and drainage depressions will both exclude stock from sensitive areas and trap sediment/nutrient runoff.
Streambank erosion is a problem on some sections of these upper catchment streams, particularly where they carry a gravel load and/or there are trees blocking the channel. Standard channel management practices, including control of weed-willows, planting eroding banks with shrubby willows and harvesting excess gravel, would reduce the incidence of this form of erosion.

There are two and even three terrace levels above the current floodplain within the Peria-Oruru River system. The higher terraces have heavier and less free draining soils, some even podzolised. There are pastoral farming properties throughout the valley where stock still have access to streams. These streams need fencing as do some remaining swampy areas where water drains from one terrace down to the next. This landform lends itself to the installation of wetland sediment/nutrient traps.

Further down the valley, downstream of the Peria saleyards, the hills to the east of the valley, between Paranui Stream and Oruru River, are capped with mudstone which has podzolised to form Hukerenui soils. These are the same soils that Landcorp is managing so well and reducing sediment discharge from on Takakuri Station. Large sections of it are reverting to shrubland.

### 3.5.3 Awapoka Aurere sub catchment

The headwaters of both of these streams are in banded sandstone rolling hill country. This land is typical Northland clay hill country where slip, gully and earthflow erosion can readily be controlled with strategic willow and poplar planting. The soils are relatively fertile so where farmed they are capable of supporting a strong, dense pasture cover. Remnant patches of bush on potentially unstable land should be fenced to aid recovery for soil conservation reasons.

Again, streams should be fenced to exclude stock which will, in turn, require effort on weed control with the areas from which stock are excluded. Occasional quick grazing with light cattle, perhaps once or twice each summer, may assist to control these weeds.

Further north within each catchment the slopes are much easier and the soils podzolised. Gully and sheet erosion are the most common erosion forms. This includes some podzolised terraces and sand deposits on ridge tops. Tree planting may not be the best option or may not work alone in all cases on these soils so Regional Council can advise other methods as appropriate. The answer to sheet erosion is improving the length and density of pastures and reducing the incidence of pugging.

Care is required to avoid deep gully erosion on some of this land as it will cut down into acid shale and even oil shale. Not only are the erosion products toxic in water, the gullies are very difficult to control. There may well be other shale pits, like the one alongside SH10, where rehabilitation is required to control any discharges

There are also intensive beef and dairy farms within the catchment where stock need to be excluded from drains and streams and where wetland sediment/nutrient traps would help to reduce the impact of land use on water.

# 4 Surface water

## 4.1 Small streams within the Mangonui Harbour Catchment

Several small streams drain directly into Mangonui Harbour, the larger streams draining hill country east and north of the harbour. The comments on deeply weathered red soils apply equally to all of these subcatchments.

## 4.2 Kanekane, Otanenui, Opoi and Owhetu Streams

These three streams, draining old red volcanic hill country between Mangonui Harbour and Taipa River, drain directly to Coopers Beach, Chucks Cove and Cable Bay. There is deep-seated slumping, gully, streambank and earthflow erosion within the Kanekane and Otanenui catchments, with the latter most likely associated with sedimentary rocks of the Northland Allochthon[3] but which also expose old red volcanic material. Regional Council is already working with two larger landholders in these two catchments providing advice and some assistance through the Environment Fund for fencing, riparian planting and soil conservation planting.

The seaward ends and tops of ridges are capped with podzolised sand, as a consequence of kauri forest growing, most probably, on sediment deposited during periods of much higher sea level. While not generating the fine clay sediment produced by the old volcanic soils, the subsoils of these gumland soils are also highly erodible and difficult to revegetate.

There is a need for greater sediment control and retention within both the developed urban area and during future urban development. Sediment is being washed off road banks and out of eroding stormwater drainage systems and, because there is no in-stream deposition of sediment, it gets washed straight through to the beaches.



[3] Allochthon means in structural geology, an **allochthon**, or an allochthonous block:a large block of rock which has been moved from its original site of formation, usually by low angle thrust faulting.

# 5 Geology

## 5.1 Tangihua Complex Volcanics

The Tangihua Complex comprises fault-bounded massifs (very large blocks) of former seafloor igneous and associated sedimentary rocks that rafted in over Northland in the Northland Allochthon between 23.5 and 21.5 million years ago. The igneous rocks include basaltic pillow lava, with intercalated mudstone and limestone, and intrusive gabbro and dolerite. The Tangihua Complex contains 'volcanic massive sulphide' copper deposits and these have been mined at Pupuke, just south of the Oruaiti River catchment, and at Parakao and Pakotai, between Dargaville and Kaikohe.

Most of the higher points in Northland – the Tangihua, Maungaru, Mangakahia, Maungataniwha, Waima, Panguru and Herekino Ranges and high points like Motatau, Houto and Hikurangi are blocks of Tangihua Complex material.

Soils developed on these different volcanic rocks, all within the Te Kie Suite, reflect steepness or stability of the site and therefore how long the soil has remained in situ, chemical content, hardness of the rocks and the vegetation that it supported. The youngest soils in the Suite are three Te Kie Steepland soils, each formed on slightly different parent materials.

These soils are relatively fertile and support dense broadleaf forest. Weathering of Tangihua volcanic soils increases the clay content, producing a high proportion of red colloidal clay. Even small amounts of this clay cause serious discolouration of water.

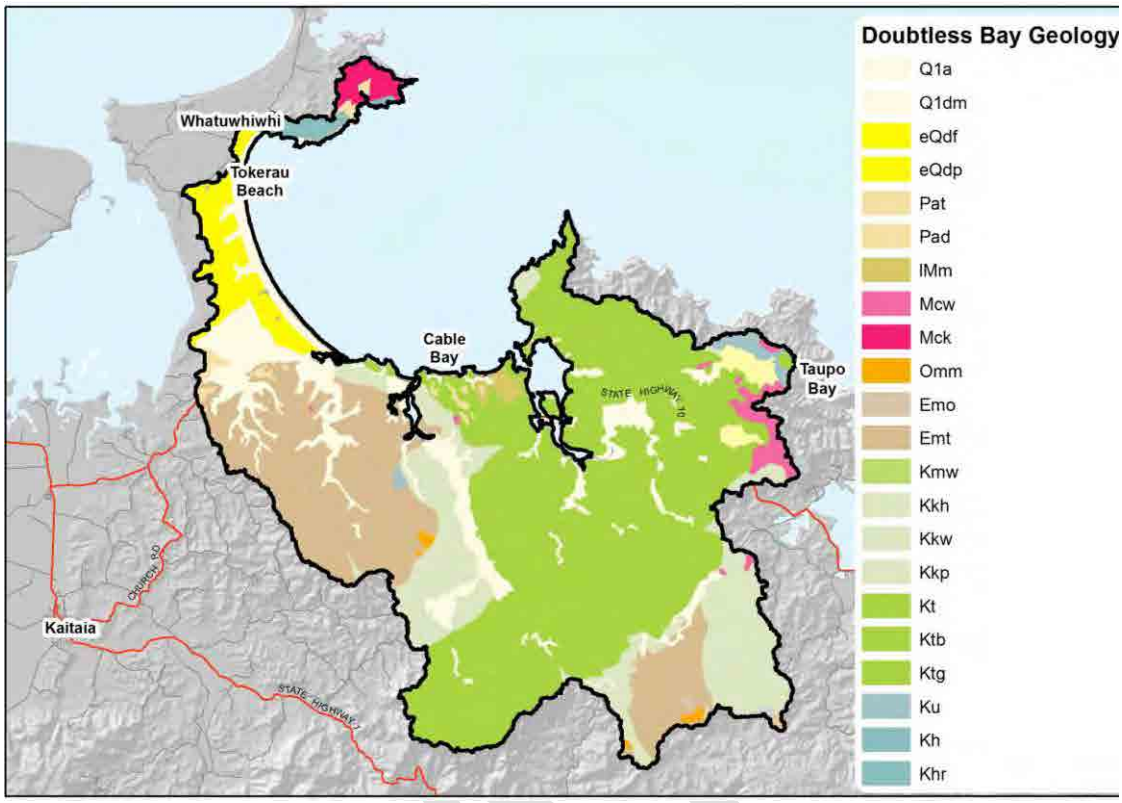



**Figure 2 - Geology of the Doubtless Bay Catchment**

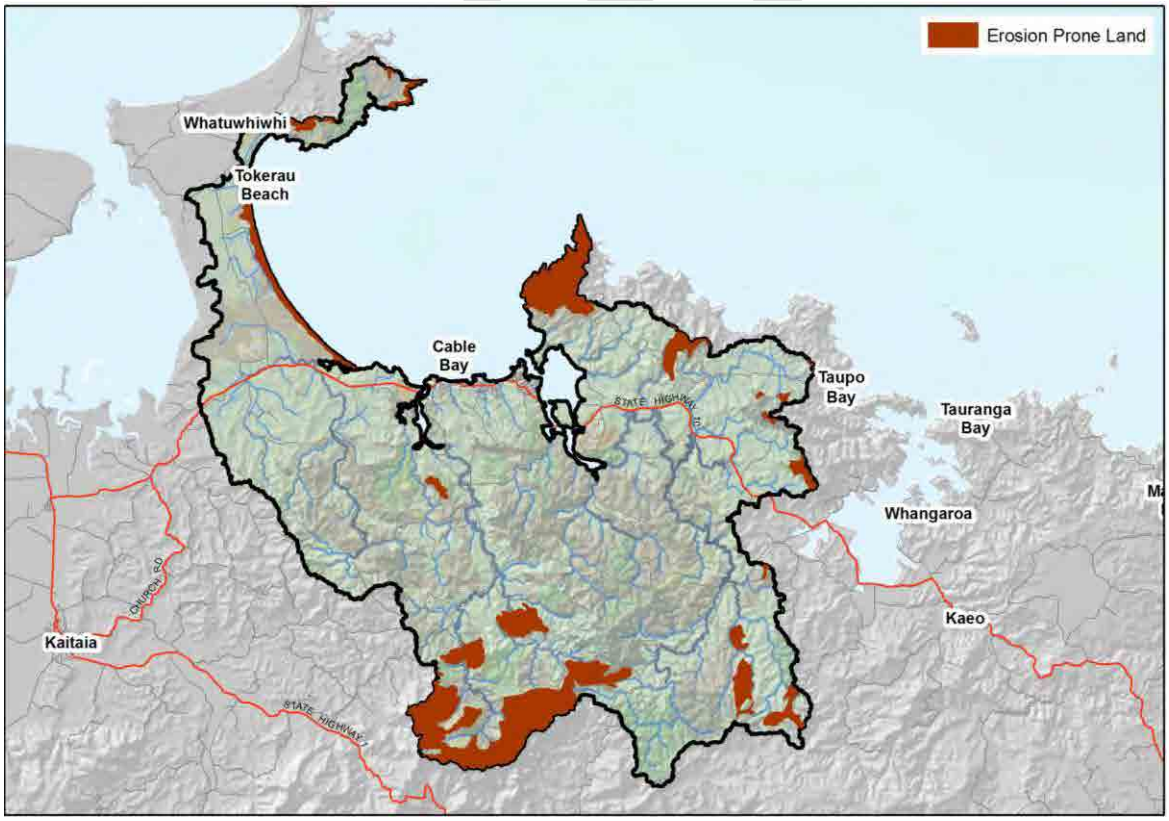



**Figure 3 - Erosion prone land in the Doubtless Bay Catchment Regional Water and Soil Plan**

# 6 Land use

Northland has a variety of landforms, soil types and associated land uses. In Northland, farming, forestry and horticulture collectively contribute 13.7% of the Gross Domestic Product (GDP) of the region.

The future of these industries depends on maintaining the productive capacity of Northland's soils. The consequence of poor soil management is not only the loss of productivity but also an increased environmental impact including the downstream degradation of water quality.

## 6.1 Land use pressure on water quality and biodiversity

Intensification of land use can impact on water quality and indigenous biodiversity in a number of ways. Although in recent years there has been retirement and regeneration of some areas of marginal land, this has often been negated by the intensification of land use on the more productive areas. Increased fertiliser use and the corresponding increase in stocking rates can lead to higher levels of loss of effluent and nutrients from farms to surrounding areas.

Dune lakes, gumlands, bogs and fens are examples of some of the habitat types in Northland that are particularly at risk. These ecosystems have developed under naturally low fertility conditions and the plant and animal species present are adapted to these conditions. Nutrient enrichment brought about through the intensification of land use within the catchment can lead to rapid invasion by weeds leading to a system dominated by introduced species.

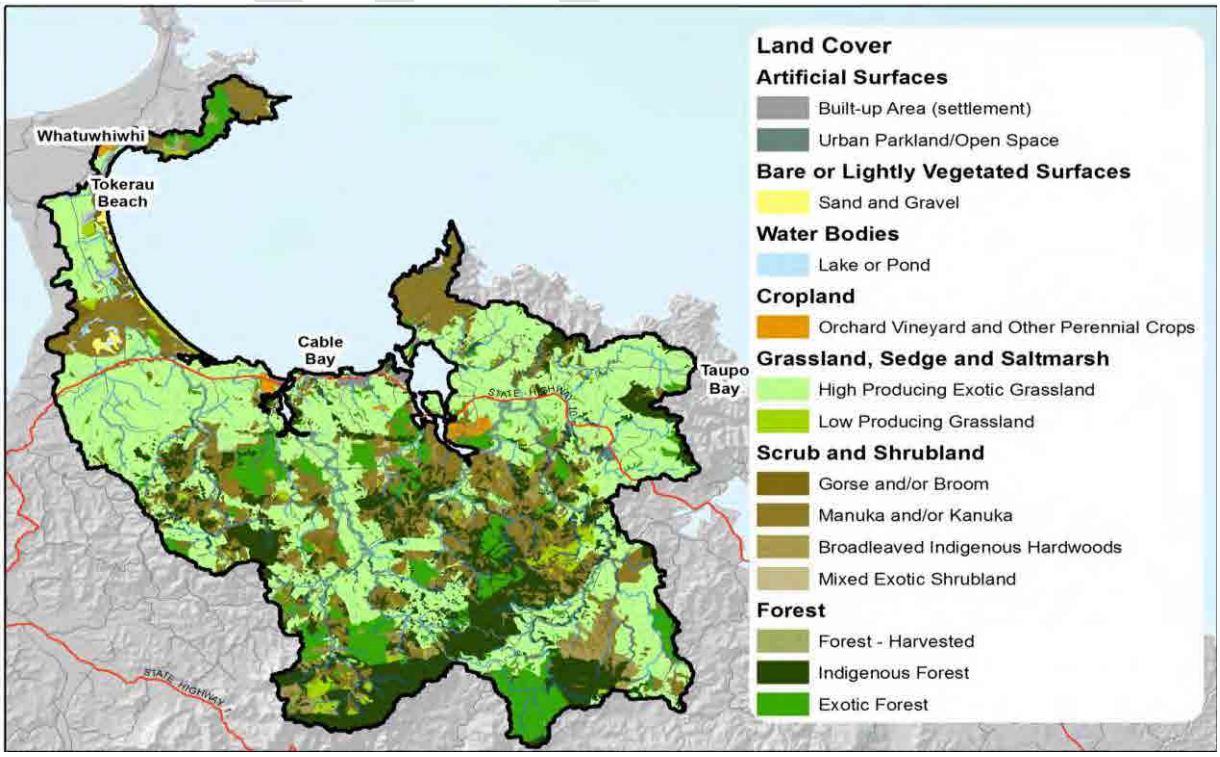



**Figure 4 Land uses within the Doubtless Bay Catchment**

# 7 Current monitoring in the catchment

Northland Regional Council currently undertakes the following monitoring in the Doubtless Bay catchment:

**River Water Quality Monitoring Network** (RWQMN) established in 1996. 36 river sites throughout Northland encompassing 22 river catchments are monitored monthly for a range of parameters, including temperature, dissolved oxygen, pH, water clarity, nutrients and bacterial levels. This monitoring includes one site in the Oruru River catchment located at Oruru Road approximately 300m downstream of the bowling club, or 5.8km up the road from the one lane bridge in Taipa. This site was added to the Network in 2007. Annual and 5 yearly reports are available here:
http://www.nrc.govt.nz/Resource-Library-Summary/Environmental-Monitoring/State-of-the-Environment-Monitoring/

**Stream invertebrate monitoring** at RWQMN sites since 1997. Every site in the Network is monitored once a year in summer. Monitoring at the one network site on Oruru River started in 2008. Annual reports are available here:
http://www.nrc.govt.nz/Resource-Library-Summary/Research-and-reports/Rivers-and-streams/

**Stream habitat assessments** at RWQMN sites since 2004. Assessments are typically carried out every second year. The Oruru River site has been assessed in 2008, 2010 and 2012. Reports are available here:
http://www.nrc.govt.nz/Resource-Library-Summary/Research-and-reports/Rivers-and-streams/

**Lake Water Quality Monitoring Network** (LWQMN) established in 2005. 28 lakes throughout Northland are monitored four times a year for a range of parameters including total and dissolved nutrients, chlorophyll α, suspended solids, water clarity, pH, temperature and dissolved oxygen. This monitoring includes one location at the deepest point in each lake. Each lake is sampled at the surface and bottom and temperature/dissolved oxygen profiles are done. Monitoring includes Lake Waiporohita, a small dune lake (5.6 ha) located near Tokerau Beach on the Karikari Peninsula. Annual reports are available here:
http://www.nrc.govt.nz/Resource-Library-Summary/Environmental-Monitoring/State-of-the-Environment-Monitoring/

As well as specific monitoring programmes some ad hoc monitoring has also been carried out to check compliance with resource consent conditions and to investigate environmental incidents.

Together, the information is central to assessing the state of the Oruru River. The data obtained through these programmes and consent monitoring has been used to provide an overview of water quality and ecosystem health in the Oruru River.

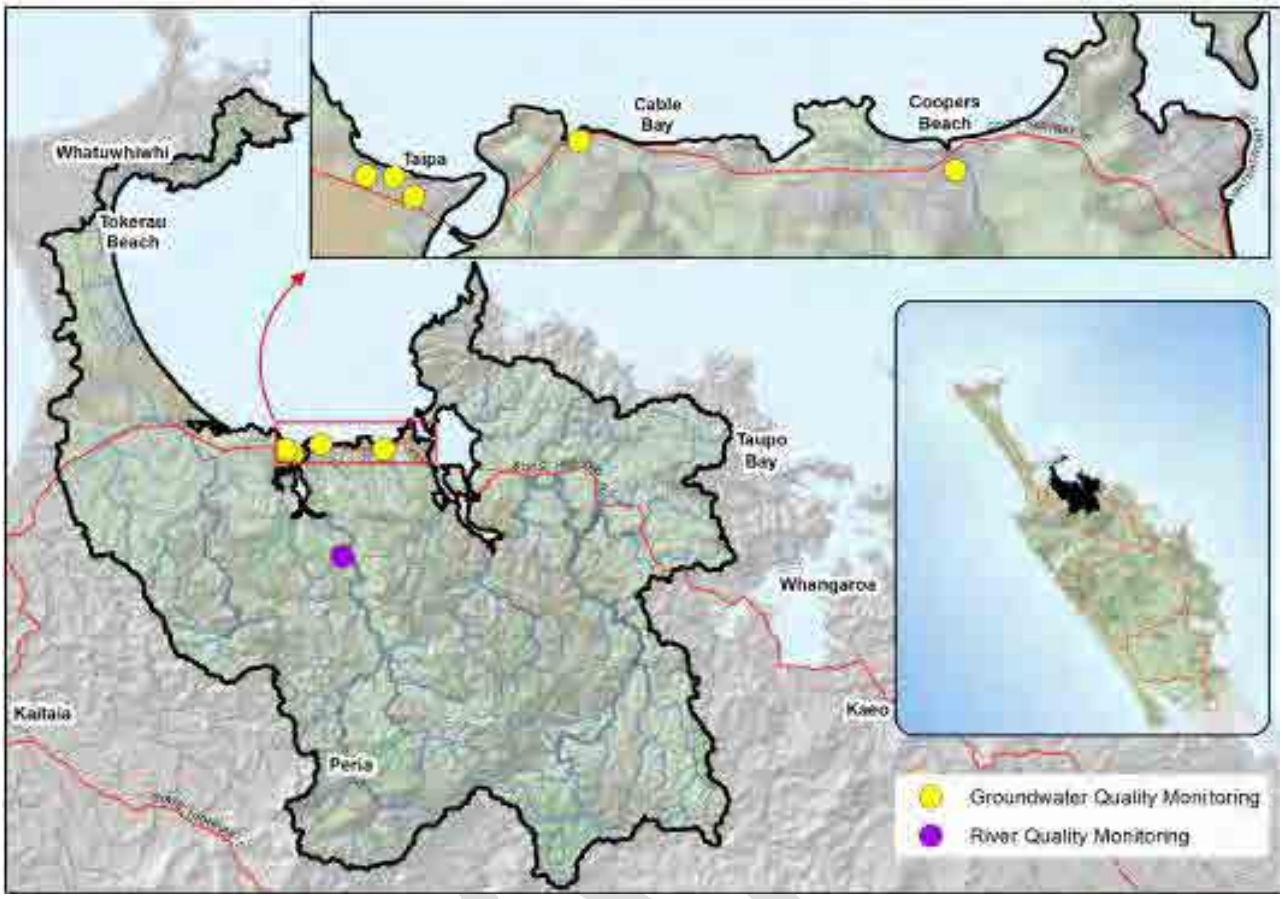



**Figure 5 shows the sites currently monitored in the Doubtless Bay catchment**

# 8 River ecosystem and water quality

The ecological health, or integrity, of river ecosystems are related to a number of environmental factors including, but not limited to, the availability of suitable habitat types (e.g. diverse range of substrate sizes, aquatic plants, large woody debris and varied flow types), food and light availability, disturbance and high water quality. It is important to note that the relationship between ecosystem health and environmental factors is often very complex and unpredictable.

In rivers the water quality parameters of concern in terms of ecological health are, in no particular order, temperature and dissolved oxygen, clarity, nutrients, suspended solids. Faecal pathogens are not known to affect aquatic ecosystems, but do affect the suitability of a water body for swimming and stock drinking water. Biological monitoring information, such as invertebrates, periphyton,habitat assessments and fish, can be used to help determine the impacts of water quality on river ecosystems, however as mentioned above causal effects are not always clear. A water quality index is used to facilitate inter-site comparisons of the state of water quality in the region's rivers and streams. The water quality index is calculated using the median values for the following six variables: dissolved oxygen (% saturation), turbidity, ammoniacal nitrogen, nitrite-nitrate nitrogen, dissolved reactive phosphorus, and *Escherichia coli.* The application of the water quality index enables water quality at each site to be classified into one of four categories according to how many medians meet national guideline values for protection of aquatic ecosystems (**Error! Reference source not found.**).

- **Excellent:** median values for all six variables are within guideline values.
- **Good**: median values for five of the six variables are within guideline values, of which dissolved oxygen is one variable that must be met.
- **Fair**: median values for three or four of the six variables are within guideline values, of which dissolved oxygen is one variable that must be met.
- **Poor:** median values for <3 of the six variables comply with guidelines.

Within the Doubtless Bay catchment there are 4 major rivers and streams; the Oruaiti and Oruru rivers, and Parapara and Aurere streams. However, at present only the Oruru River at Oruru Road is monitored as part of the monthly region wide River Water Quality Monitoring Network (RWQMN). The Oruru is classed as having **FAIR** overall water quality, typical of lowland rivers impacted by agricultural activities (Table 3). No trend analysis has been carried out on data for the Oruru River due to insufficient data.

**Table 2: National guideline values for the protection of aquatic ecosystems**

| Identifier | Abbreviation | Reference | Guideline value |
|---|---|---|---|
| Dissolved Oxygen | DO | RMA 1991 Third Schedule | ≥80 (% saturation) |
| Dissolved Reactive Phosphorus | DRP | ANZECC (2000) | ≤0.010 (mg/L) |
| *Escherichia coli* | E.coli | ANZECC (1992) | ≤126 (cfu/100 mL) Stock Drinking Water |
| Ammoniacal Nitrogen | NH4 | ANZECC (2000) | ≤0.021 (mg/L) |
| Nitrite-Nitrate Nitrogen | NNN | ANZECC (2000) | ≤0.444 (mg/L) |
| Turbidity | TURB | ANZECC (2000) | ≤5.6 (NTU) |

## 8.1 Water quality results

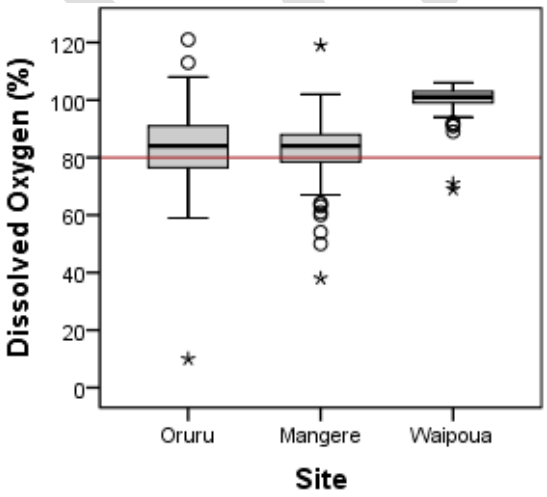
The Oruru River at Oruru Road is classed as having fair overall water quality as summarised in the table. Three of the Water Quality Indicator variables, DO, NH4, and NNN are compliant with the national guidelines however DRP, E coli and TURB levels fail with medians of 0.021g/m3, 292 MPN/100ml and 6.65 NTU respectively during the 2007 – 2011 period. The high nutrient levels, elevated faecal indicators (E coli) and high turbidity (TURB) may be linked to farm run off and stock access to the river.

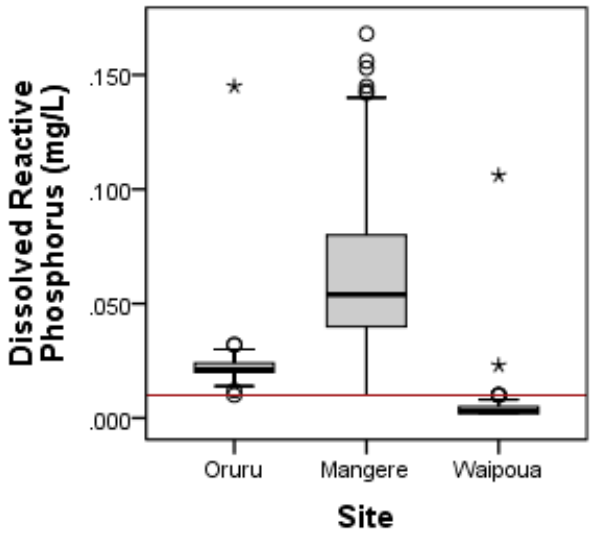
**Table 3**: **Water quality statistics for 2007-2011 for Oruru River at Oruru Road**

| | DO% % sat | DRP mg/L | E.coli MPN/100ml | NH4 mg/L | NNN mg/L | TURB NTU |
|---|---|---|---|---|---|---|
| **Median** | 84.2 | 0.021 | 292 | 0.01 | 0.026 | 6.65 |
| **Minimum** | 9.5 | 0.01 | 63 | 0.008 | 0.002 | 2 |
| **Maximum** | 120.5 | 0.145 | 17329 | 0.05 | 0.592 | 180 |
| **Number of samples collected** | 52 | 51 | 53 | 53 | 53 | 50 |
| **Number of samples meeting guideline** | 35 | 1 | 8 | 47 | 51 | 21 |
| **Number of samples exceeding guideline** | 17 | 50 | 45 | 6 | 2 | 29 |
| **% of samples meeting guideline** | 67.3% | 2.0% | 15.1% | 88.7% | 96.2% | 42.0% |
| **Median within guidelines** | yes | no | no | yes | yes | no |
| **Classification: Fair** | | | | | | |

**Figure 6 Water quality comparison box plots for Oruru River**

The following boxplots display water quality data collected at the Oruru RWQMN sites over the period 2007-2011. For comparison, the most degraded and most pristine rivers in the RWQMN, the Mangere and Waipoua respectively are also included. The red lines indicate the national guideline value for each water quality indicator. Please note that for display reasons the scale for the *E.coli* and turbidity boxplots is logged.

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Oruru
Mangere
Waipoua
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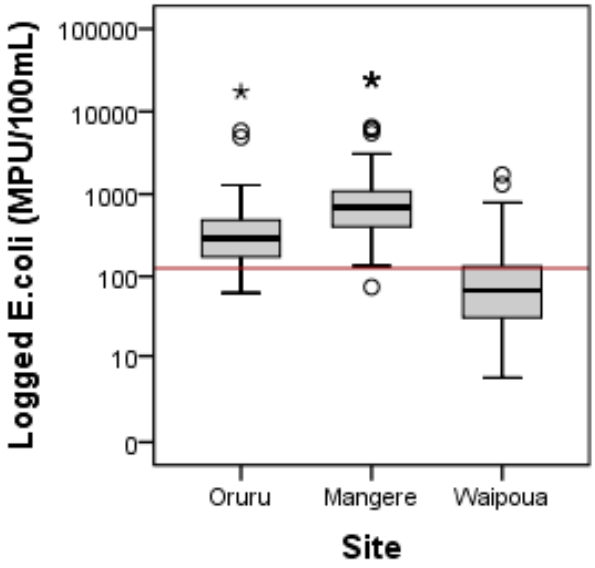
Logged E.coli (MPU/100mL)
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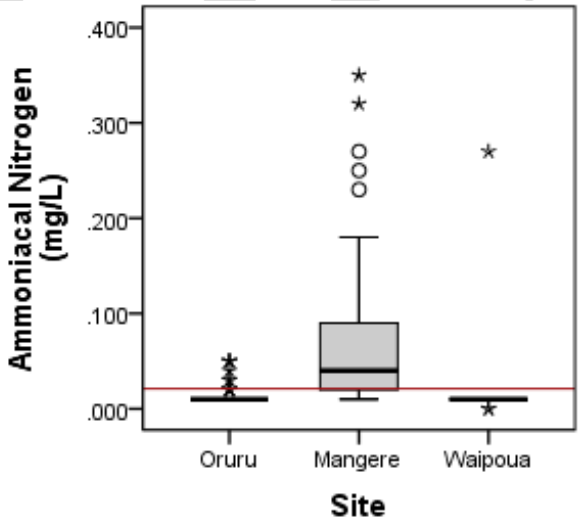
Waipoua
Site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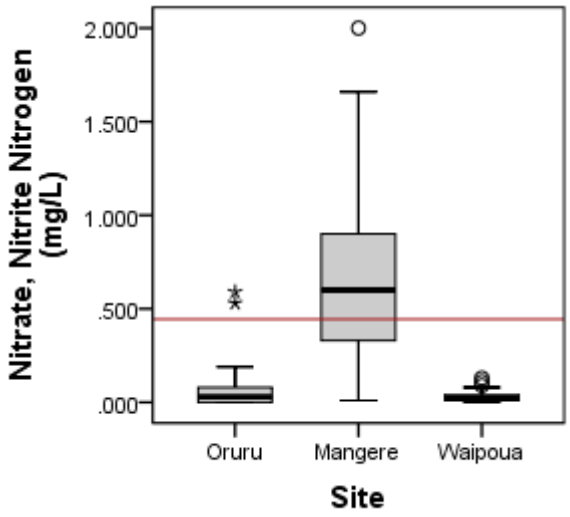
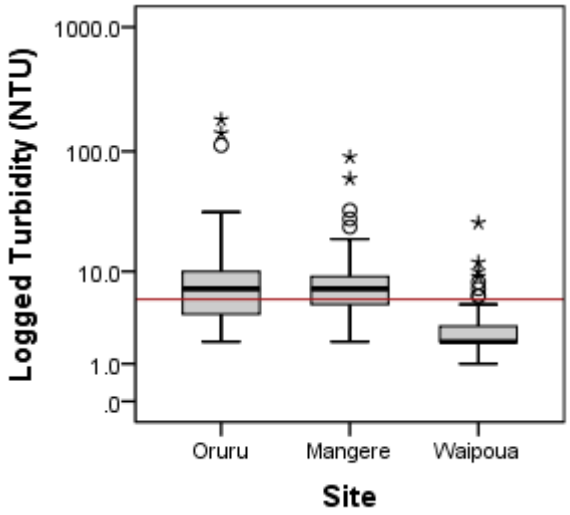
Waipoua
Site




## 8.2 Dissolved oxygen

Dissolved oxygen is important for freshwater invertebrates and fish, with some species being more sensitive to low oxygen levels than others. Dissolved oxygen levels vary with temperature, biological activity and how quickly it transfers from the atmosphere. Biological activity includes microbial activity by bacteria and primary production by plants and algae. Aquatic plants photosynthesise during the day (producing oxygen) and respire at night (using oxygen). With its high levels of macrophytoes (aquatic plants) the Oruru River is likely to have large fluctuations in dissolved oxygen throughout the day compared to rivers such as the Waipoua within pristine native habitat with little of no aquatic plants.

Between 2007 and 2011 the lowest dissolved oxygen recorded in the Oruru River was 9.5%, well below national guidelines and at a level which would potentially put aquatic plants and animals under stress. The median was 84.2%, just within national guidelines. The highest level recorded was 120.5%. These excessive levels can also be harmful to aquatic life, causing 'gas bubble' disease in fish and invertebrates.

## 8.3 Nutrient levels

Nitrogen and phosphorus are the two main nutrients required by algae, plants, and animals for metabolism and growth. Nitrogen and phosphorus naturally occur in water as a result of natural processes, such as the erosion of soil, atmospheric deposition, and the breakdown of organic matter. Nitrogen is highly soluble and can leach through soil, whereas phosphorus usually enters water in direct discharges or associated with sediment. Whilst they are necessary for life, high levels of nitrogen and phosphorus can cause excessive growth of aquatic plants and algae.

Nitrogen levels in Oruru River are typically low with nitrate-nitrite nitrogen (NNN) and ammonical nitrate (NH4) medians well below the guidelines but dissolved reactive phosphorus (DRP) levels are high with a median well above the guidelines between 2007 and 2011. These elevated levels are probably associated with the high sediment loads in the catchment as evidenced by high turbidity levels (Table 2).

## 8.4 Faecal pathogens (Escherichia coli)

Although faecal pathogens are not known to affect aquatic ecosystems they are of concern for both human and animal health. E coli, while not harmful in its self, indicates a source of faecal matter which can potentially contain harmful pathogens. The median for *E coli* of 292 MPN/100ml recorded between 2007 and 2011 is well above guideline values and the maximum score of 17329 MPN/100ml is extreme, probably associated with a rainfall event and associated run off of faecal matter from land. It should be noted that natural background levels of *E coli* tend to be slightly higher in warm wet lowland areas compared to other river environments in New Zealand (McDowell et al, 2013), nevertheless the excessive levels of *E coli* in the Oruru highlight the need for good land management and sewage disposal systems in protecting both the freshwater and the receiving marine environment in Doubtless Bay.

## 8.5 Water Clarity

Good water clarity is important for light availability for periphyton growth, the primary food resource for stream life. Clear water is also important for visual feeding by fish and invertebrates. Water clarity is influenced by suspended sediment and algal biomass. Suspended sediments are typically elevated following large rainfall events, causing low water clarity and high turbidity. Turbidity is one measure of water clarity.
The average turbidity for 2007 to 2011 was 6.65 NTU (Table 2), which is above the national guideline value of 5.6 NTU (Table 1). The maximum turbidity recorded over this same period was 180 NTU, which was associated with an elevated flow event. Even rivers in pristine native forested catchments have elevated sediment levels following heavy rain, being a combination of sediment washed into the river from surrounding land and sediment re-suspension from the river bottom due to the increased flows. However where there is intensive agriculture, forestry harvesting, subdivision, a lack of riparian vegetation and/or stock access to waterways, sediment loads increase considerably. The effects on turbidity from these activities are exacerbated in the Doubtless Bay catchment due to the highly erodible red volcanic soils in the area. The soils are made up of very fine textured clay sediment, much of which stays suspended in water indefinitely, reducing water clarity. These soils require careful land management to avoid further deterioration of water quality.

## 8.6 Invertebrate community health

Stream invertebrates (macroinvertebrates) can be used as biological indicators of water quality and stream health. The number of taxa (taxanomic diversity) at a site is a good indicator of the health and conservation value of a site. However, identification as part of the invertebrate monitoring programme is not to species level, so the diversity is likely to be higher than the data suggests.

The Macroinvertebrate Community Index (MCI) is an indicator of organic enrichment, where taxa are assigned predetermined scores on a scale of 1 to 10 depending on their sensitivity to organic pollution. The total MCI score at a site is based on the taxa present with the categories in Table 3 used to determine the overall level of enrichment. The Semi-Quantitative Macroinvertebrate Community Index (SQMCI) is similar to the MCI but takes into account the relative abundance of each taxa present. The categories used to determine the level of organic enrichment for SQMCI are also shown in Table 4. "Fuzzy boundaries'" of ± 5 MCI units and ± 1.0 SQMCI unit are often used when interpreting the categories (Pohe, 2012), to account for the complexity and variation in invertebrate communities.

**Table 4 Categories for MCI and SQMCI (Boothroyd & Stark, 2000).**

| Category | MCI | SQMCI |
|---|---|---|
| Clean water | > 120 | > 6.00 |
| Possible mild pollution | 100 – 119.9 | 5.00 – 5.99 |
| Probable moderate pollution | 80 – 99.9 | 4.00 – 4.99 |
| Probable severe pollution | < 80 | < 4.00 |

Most mayflies (Ephemeroptera), caddisflies (Trichoptera) and stoneflies (Plecoptera) are more sensitive to changes in their environment. Therefore, like the MCI and SQMCI, the number of Ephemeroptera, Trichoptera and Plecoptera taxa present as a proportion of the total number of taxa recorded can be used as a measure of likely organic pollution at a site (%EPT).

The invertebrate indices are consistent with the water quality data, showing that Oruru River is in a degraded condition. The MCI consistently falls in to the 'probable severe/moderate pollution' categories with scores ranging from 71.9 to 84.5 and an average of 74.5 (Table 4). The SQMCI also consistently indicates high organic enrichment with scores ranging from 2.4 to 2.59, with an average of 2.4 (Table 4). The site is dominated by pollution sensitive taxa, with less than half of the taxa present being EPT taxa in all five years of sampling (Table 4).

## 8.7 Fish Community

The use of fish as an indicator of ecological health is complicated in New Zealand by the fact that many species are diadromous (spend part of their life cycle at sea) so their presence is influenced by factors such as barriers to migration, distance inland as well as habitat availability, water quality etc. They are an important part of the food web however and

their absence will skew normal predator prey relationships. Their presence is an important measure of ecological stability and underpins a stream's ecological value.

There is just one fish record on the New Zealand Freshwater Fish database (NZFFD) for the Oruru catchment, the regionally rare banded kokopu (Miller & Holland 2007). However the greater Doubtless Bay catchment has records of nine native fish species. These include longfin eel, shortfin eel, inanga, giant bully, common bully, smelt, torrent fish, redfin bully and banded kokopu. The pest fish gambusia is also recorded in the catchment.

## 8.8 Periphyton community

Periphyton is an important indicator of environmental quality, as the main primary producer in stream ecosystems, but also because of its ability to respond quickly to changes in water quality and form excessive growths under ideal conditions, affecting instream values, such as biodiversity and recreational use. However periphyton growth normally requires a stable substrate such as rocks and cobbles to become established. At the Oruru River the substrate is mainly fine sediment which is easily disturbed making it difficult for periphyton to become established. For this reason the Oruru River has not been sampled for periphyton.

## 8.9 Stream habitat quality

Where there is a diverse habitat available with a variety of flow types (runs riffles and pools) and good quality riparian vegetation, there tends to be high ecological health. Different flow types offer a variety of different habitats, encouraging greater diversity. Riparian cover stabilises banks, provides a sink for nutrients, traps sediment, and provides shade during hot summer months as well as a source of food in the form of falling vegetation and terrestrial invertebrates.

In the three years the Oruru River has been assessed for habitat quality it has consistently scored as marginal. The surrounding land use at this site is mainly pasture, stock has access to the river, there is very little shading from exotic cover and the banks are relatively unstable. The river shows evidence of high sediment loads (often associated with high intensity land use/stock access) with most of the substrate being composed of sediment/sand and high turbidity (TURB) levels. The stream also provides little habitat diversity with a mainly uniform substrate and flow type (NRC 2012).

# 9 Groundwater

The Doubtless Bay catchment captures two main aquifers; Taipa Beach and Cable Bay/Coopers Beach (see Figure 5). These two aquifers have been listed in Schedule B of the Regional Water and Soil Plan for Northland (NRC 2004) as 'At Risk' (short to medium term) of seawater intrusion.

The Taipa Beach aquifer is a shallow unconfined sand aquifer fed by rainfall recharge. The aquifer is a valuable source of water for public and private domestic water use. The aquifer is sensitive to saline intrusion and the effects of land use activities. There have been historic incidences of saline intrusion resulting from dewatering activities; petroleum contamination; and elevated nitrate concentrations. Groundwater level and groundwater quality is regularly monitored. The groundwater levels are relatively shallow, in most cases around 0.5-3.5 meters below the ground surface. The current groundwater quality monitoring indicates in most cases water is safe to drink, however two bores do show positive bacteria likely to be a result of surface contamination at these sites.

The Cable Bay/ Coopers Beach aquifer is a fractured basalt system predominantly fed by rainfall recharge. The groundwater system is a valuable source of water for public water supply, private domestic use and minor irrigation. Groundwater levels and quality are regularly monitored in the area. Several bores indicate high bacteria levels likely to be a result of surface contamination at these sites. Some of the bores have naturally occurring elevated iron and manganese. Groundwater systems also occur in the Karikari peninsula and other small coastal areas such as Hihi.

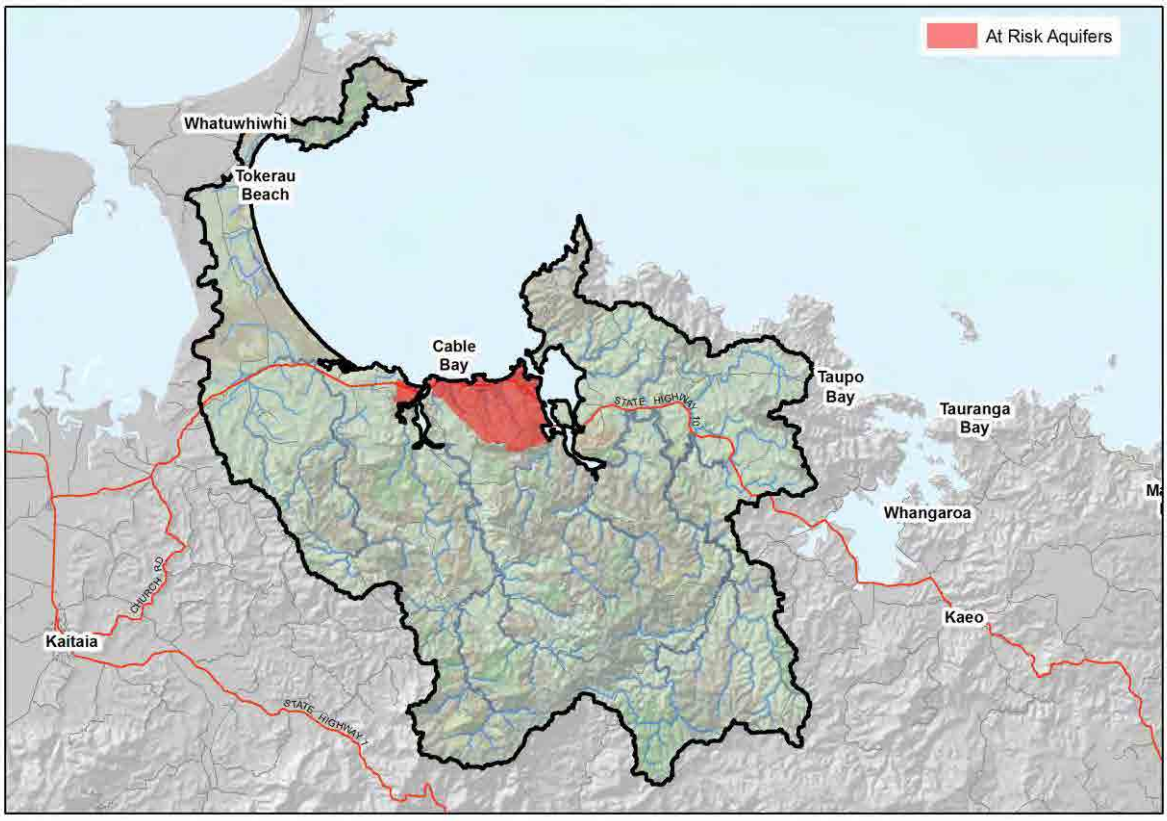



**Figure 7** **Taipa beach and Cable Bay/ Coopers beach aquifers Regional Water and Soil Plan**

# 10 The lake ecosystem and water quality

The ecological health, or integrity, of lake ecosystems are related to a number of environmental factors including, but not limited to, the availability of suitable habitat types (e.g. diverse range of emergent and submerged indigenous plants), lack of invasive exotic species, disturbance and high water quality. It is important to note that the relationship between ecosystem health and environmental factors is often very complex and unpredictable.

Lake water quality parameters of concern in terms of ecological health are, in no particular order, temperature and dissolved oxygen, clarity, nutrients, suspended solids and chlorophyll a levels. Faecal pathogens are not known to affect aquatic ecosystems, but do affect the suitability of a water body for swimming and stock drinking water.

The Trophic Level Index (TLI) can be used to determine the state of lakes (Burns et al. 2000). The TLI is calculated using four key variables: chlorophyll α (an indicator of algal biomass), water clarity, total nitrogen (TN) and total phosphorus (TP) (Table 5). Together, these provide an indication of a lake's overall health. The overall score is categorised into seven trophic states indicating progressively more nutrient enrichment, more algal productivity and reduced water clarity. The states of most relevance in the Northland region are:

- Microtrophic lakes, which are very clean
- Oligotrophic lakes, which have low levels of nutrients and algae
- Mesotrophic lakes, which have moderate levels of nutrients and algae
- Eutrophic lakes, which are green and murky, with higher amounts of nutrients and algae
- Supertrophic lakes are fertile and saturated in phosphorus and nitrogen, with very high algae growth and blooms during calm sunny periods
- Hypertropic lakes are highly fertile and supersaturated in phosphorus and nitrogen. They are rarely suitable for recreation and habitat for desirable aquatic species is limited

**Table 5 Trophic states relevant to Northland lakes and the water quality ranges that define each trophic level (Burns et al. 2000)**

| Lake type | Trophic level | Chlorophyll α (mg/m$^3$) | Clarity (m) | TP (mg/m3) | TN (mg/m3) |
|---|---|---|---|---|---|
| **Microtrophic** | 1.0 – 2.0 | 0.33 – 0.82 | 25 – 15 | 1.8 – 4.1 | 34 – 73 |
| **Oligotrophic** | 2.0 – 3.0 | 0.82 – 2.0 | 15 – 7.0 | 4.1 – 9.0 | 73 – 157 |
| **Mesotrophic** | 3.0 – 4.0 | 2.0 – 5.0 | 7.0 – 2.8 | 9.0 – 20 | 157 – 337 |
| **Eutrophic** | 4.0 – 5.0 | 5.0 – 12 | 2.8 – 1.1 | 20 – 43 | 337 – 725 |
| **Supertrophic** | 5.0 – 6.0 | 12 – 31 | 1.1 – 0.4 | 43 – 96 | 725 – 1558 |
| **Hypertrophic** | 6.0 – 7.0 | > 31 | < 0.4 | > 96 | > 1558 |

## 10.1 Lake Waiporohita

Lake Waiporohita is a small dune lake (5.6 ha) classified as "outstanding" in the Northland Lakes Strategy which is located near Tokerau Beach on the Karikari Peninsula. This shallow lake (maximum depth of 3.5 m) is located in a pastoral dominated catchment which is completely fenced. Lake Waiporohita is listed as a dune lake in Schedule E of the RWSP and therefore subject to particular controls on water extractions.

**Figure 8 Lake Waiporohita**

**Table 6: Five year median, minimum and maximum results for 13 water quality parameters for Lake Waiporohita.**

| Parameter | Min | Max | Median |
|---|---|---|---|
| Temperature (°C) | 12.5 | 25.3 | 18 |
| Dissolved Oxygen (% sat) | 83.5 | 128.2 | 94.65 |
| Chlorophyll a (mg/l) | 4 | 99.9 | 24.55 |
| Water Clarity (m) | 0.3 | 3.1 | 1.75 |
| Total Nitrogen (mg/m³) | 727 | 3020 | 927 |
| Total Phosphorus (mg/m³) | 23 | 832 | 45 |
| Ammoniacal Nitrogen (mg/m³) | 3 | 349 | 6 |
| Nitrate Nitrogen (mg/m³) | 0.5 | 70 | 0.5 |
| Dissolved Reactive Phosphorus (mg/m³) | 0.5 | 28 | 2 |
| Suspended Solids | 0.25 | 63 | 5.4 |
| Conductivity | 12.7 | 20.9 | 17.25 |
| pH | 6.4 | 9 | 6.95 |
| Trophic Level Index | 3.43 | 7.30 | 5.13 |
| **Trophic Level Index Grading: Supertrophic** | | | |

## 10.2 Lake Rotopokaka (Coca Cola)

Lake Rotopokaka is classified as having “medium” ecological value in the Northland Lakes Strategy and is approximately 11 ha in area, and . 3.5 m in depth. The surrounding catchment is manuka scrub, with pohutukawa, cabbage tree and flax along the eastern margin. The lake has no inflows or outflows. Access is off Ramp Road, with well formed tracks to the western and northern shores. Lake Rotopokaka is listed as a dune lake in Schedule E of the RWSP and therefore subject to particular controls on water extractions.

**Figure 9 Lake Rotopokaka Regional Lakes Strategy**

## 10.3 Water Quality

Lake Waiporohita is classified as supertrophic which means it is fertile and saturated in phosphorus and nitrogen, with very high algae growth and blooms during calm sunny periods. High nutrient loads are likely to be associated with nutrient run off from pastoral land as well as high densities of bird life on the lake. However the whole catchment has been fenced and there are signs of improving trends in water quality. A significant decreasing trend in Trophic Level Index (TLI) was observed despite no changes in chlorophyll a, turbidity, total nitrogen and total phosphorus being found. TLI is decreasing at a rate of 0.19 units per year with a five year median of 5.13 places this lake in the supertrophic classification.

## 10.4 Biodiversity assessment

The lake Biodiversity Assessment gives an overall ranking for each lake taking into account endangered species identified, wetland extent, species composition, submerged vegetation abundance and composition (Submerged Plant Indicators (SPI)), water bird, fish and aquatic invertebrate presence and abundance as assessed by NIWA (Wells and Chapman, 2011).

The SPI component is based on the macrophyte community structure and composition (Clayton and Edwards 2006(a) (b)). There are three indices:

- Native Condition Index: a measure of the native vegetation within a lake. A higher score means a healthier, more diverse community of native plants growing to greater depths.

- Invasive Condition Index: a measure of the invasive vegetation within a lake. A higher score means more impact from exotic plants.

- Lake SPI Index: this is a combination of the Native Condition Index and the Invasive Condition Index and gives an overall indication of lake condition. The higher the score the better the condition of the lake

Lake SPI is presented as a percentage of a lake's maximum scoring potential and corresponds to the depth of each lake.

Lake SPI grades:

- >75% "Excellent"
- >50-75% "High"
- >20-50% "Moderate"
- >0-20% "Poor"
- 0 "Non-vegetated"

Incorporating the Lake SPI the biodiversity assessment is based on three components; indigenous biota, endangered species (both plant and animal) and habitat availability and is interrelated with water quality. Each parameter is scored on a scale or 1 -6 and then ranked as either Outstanding; High; Moderate-High; Moderate; Low-Moderate; or Low. Outstanding Lakes are of national importance, high in diversity and contain self sustaining populations of endangered species. Low ranked lakes are usually de-vegetated with poor water quality or infested with invasive pest species.

Despite its low water quality Lake Waiporohita is ranked as 'Outstanding' as the lake contains nationally endangered plants and birds with indigenous submerged plant communities. The Lake has been surveyed twice for Lake SPI. On both occasions it was graded as 'excellent', scoring 93% in 2005 and 88% in 2010 reflecting the extent of native vegetation. The slight decline reflects the appearance of small amounts of the invasive species *Utricularia gibba* (NIWA, 2011). Increased spread of pest plants is likely to reduce this ranking which has remained the same since records began in 2005.

**Table 7: ANIMAL species identified in lake Waiporohita (Green = rare/endangered. Red=pest species)**

| Native Species | Exotic Species |
|---|---|
| bittern (*Botaurus poiciloptilus*) | black swan (*Cygnus atrelus).* |
| Caspian tern (*Sterna caspia*). | Mallard (*Anus platyrhyncus*) |
| dabchick (*Poliocephalus rufopectus*) | gambusia (*Gambusia affinnis*). |
| Grey duck (*Anas superciliosa)* | water boatmen (*Sigara arguta).* |
| Common bully (*G. cotidianus*) | |
| leech (*Richardsonianus mauianus*) | |

# 11 Coastal environment

## 11.1 Coastal Environment

Doubtless Bay catchment has an abundant marine life. Scallops are plentiful in the bay itself, and are frequently washed up onto Tokerau Beach after storms. Shellfish such as tuatua are also abundant in the low inter-tidal of the open sand beaches. With a warm sub-tropical climate, over 70kms of unspoiled coastline and an abundance of safe beaches, Doubtless Bay on the Pacific Ocean is valued as a holiday paradise. There are a range of water recreational activities, including swimming, water skiing and jet skiing, fishing, yachting, diving, sail boarding, canoeing/kayaking and waka ama. The surrounding catchment is used for a range of activities, such as camping, picnicking, walking and mountain biking.

The Regional Coastal Plan provides for a number of uses in the Harbour. There are two areas zoned (Marine 4 Management Areas), catering for around 152 moorings (mostly swing moorings) and providing trailer boat launching access. The Harbour also includes a commercial wharf which is recognised by way of Marine 6 Management Area zoning.

The remainder of the Harbour is zoned Marine 2 (Conservation), which is a generic zoning used to provide for a range of uses and applied to much of Northland's coastal water space. The upper Harbour is typically shallow but provides significant amenity, recreational and biodiversity value. Like most harbours it acts as a receiving environment and is the discharge point for numerous freshwater bodies.

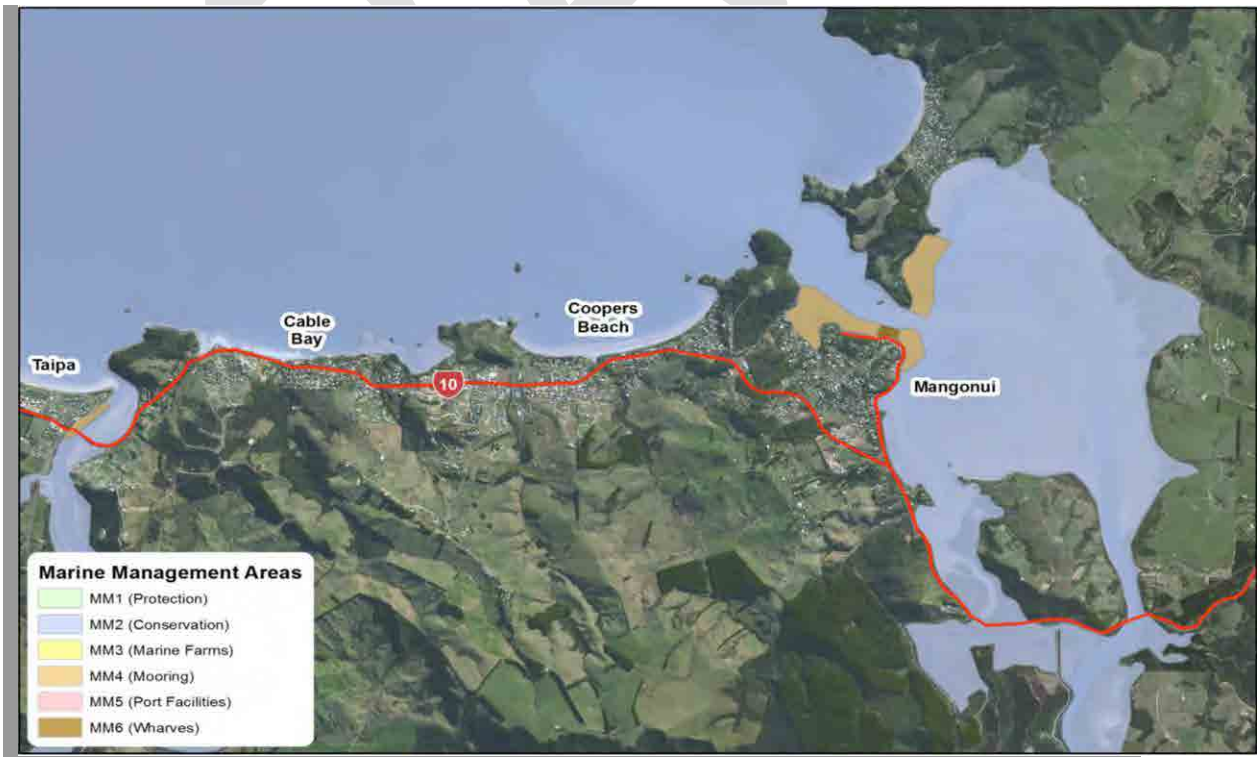



**Figure 10** Doubtless Bay Marine Management Areas Regional Coastal Plan

## 11.2 Coastal Monitoring Sites

Northland Regional Council monitors three recreational bathing sites within the Doubtless Bay Catchment at Taipa Estuary, Cable Bay and Coopers Beach.

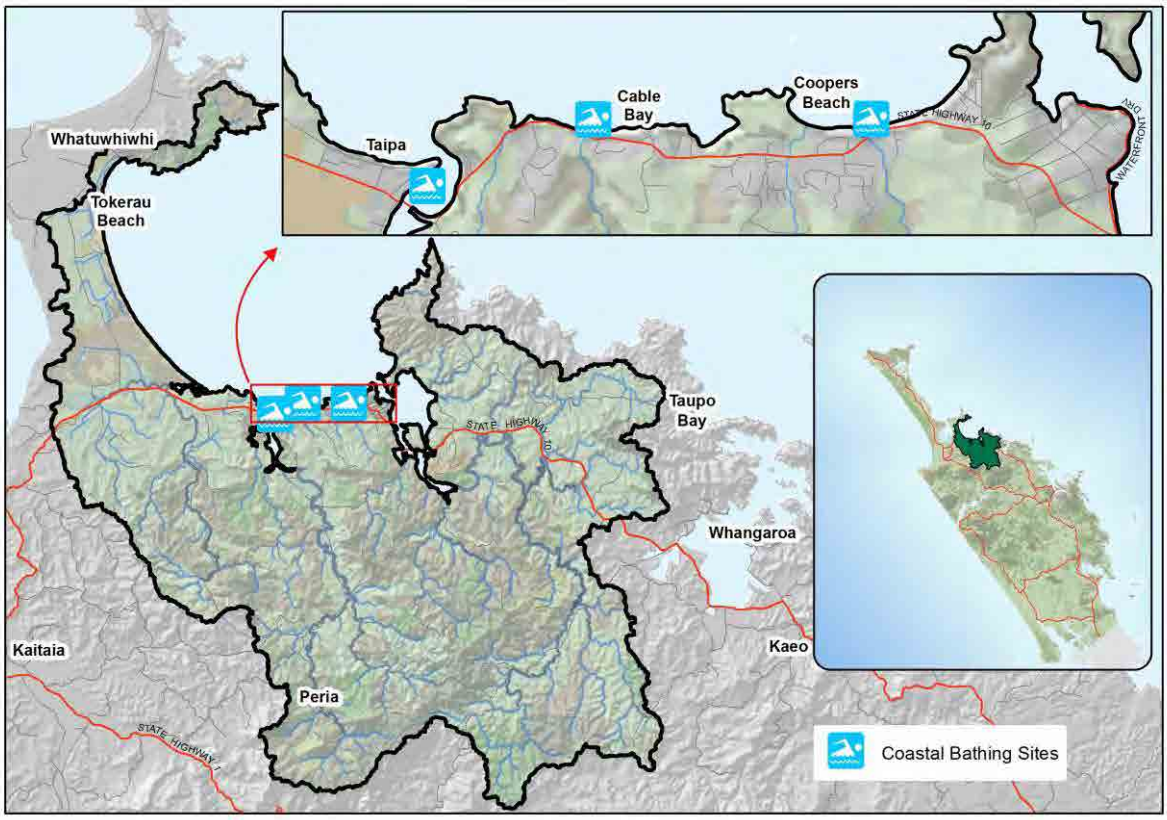



**Figure 11 Sites monitored for coastal bathing water quality**

## 11.3 Coastal Monitoring Results

Northland Regional Council has a four tier status system for end of season results. This is based on assessing the risk of contamination at a coastal swimming site using levels of the indicator bacteria Enterococci (Ent.).

**Blue:**
Suitable for swimming 95-100% of the time

**Green:**
Suitable for swimming 90-95% of the time

**Orange:**
Suitable for swimming 75-90% of the time

**Red:**
Suitable for swimming less than 75% of the time

## 11.4 Cable Bay to Taipa

End of season median results show that the Doubtless Bay Catchment is suitable for recreational uses 95 – 100% of the season.

| LOCATION | Site No. | End of season median | Compliance |
|---|---|---|---|
| **Cable Bay** | 105780 |  **Blue** Median 10 | 100% |
| **Coopers Beach** | 101066 |  **Blue** Median 10 | 100% |
| **Taipa** | 105777 |  **Blue** Median 10 | 100% |

# 12 Managing the catchment

## 12.1 Management of the catchment

Contaminants can enter waterbodies from direct and diffuse discharges. Direct discharges are sources of contaminants that discharge from discrete points or identifiable localised areas. Direct discharges, including stormwater and wastewater, to streams, rivers, and land are controlled by rules in the Regional Water and Soil Plan (RWSP). Diffuse discharges typically arise from land use activities that are spread across a catchment.

Diffuse contaminants can enter waterbodies by sub-surface drainage (leaching) and surface run-off. Diffuse discharges can include fertilisers, animal faeces and soil from agricultural land, and soil and fertilisers from forestry and horticultural land use. Diffuse discharges also includes stormwater from areas that are not reticulated, including from some roads (without drains) and road banks, which can be a significant source of sediments.

## 12.2 Consents

Under the Resource Management Act 1991 (RMA) Northland Regional Council is responsible for managing the region's freshwater quality and quantity by controlling discharges, water takes and land use activities that impact on water. Under the Local Government Act 2002, the Far North District Council is responsible for the provision and operation of wastewater, stormwater, and potable water infrastructure, as well managing use and development of land generally. Integrating the functions of the two councils for managing the use of land is important for ensuring effective management of water quality.

## 12.3 Permitted activities

The Regional Water and Soil Plan for Northland (NRC 2004) provides rules for taking and using water without consent.

There are three permitted dairy farm discharge activities to land in the catchment. Permitted water takes for stock drinking and non–consented dairy use is estimated to be 1666 cubic metres per day (m3/day). This is calculated based on land use capabilities for stocking rates.

Many coastal properties in the small coastal areas particularly Coopers Beach/Cable Bay and Taipa also have permitted groundwater takes for domestic use.

## 12.4 Consented water takes

There are 15 active water take consents within the Doubtless Bay catchment (Figure 11); three of these are surface water takes and twelve are groundwater takes. Seven of these surface water takes are for less than 100m3/day.

The two largest surface water takes are 3110 m3/day for domestic water supply and 3000 m3/day for irrigation.

The largest groundwater takes are2085 m3/day for stock drinking in Rangiputa and 400m3/day and 200m3/day both for public water supply in the Coopers Beach/Cable Bay area.

The total consented water allocated in the catchment is 15587 m3/day; for both ground and surface water takes.

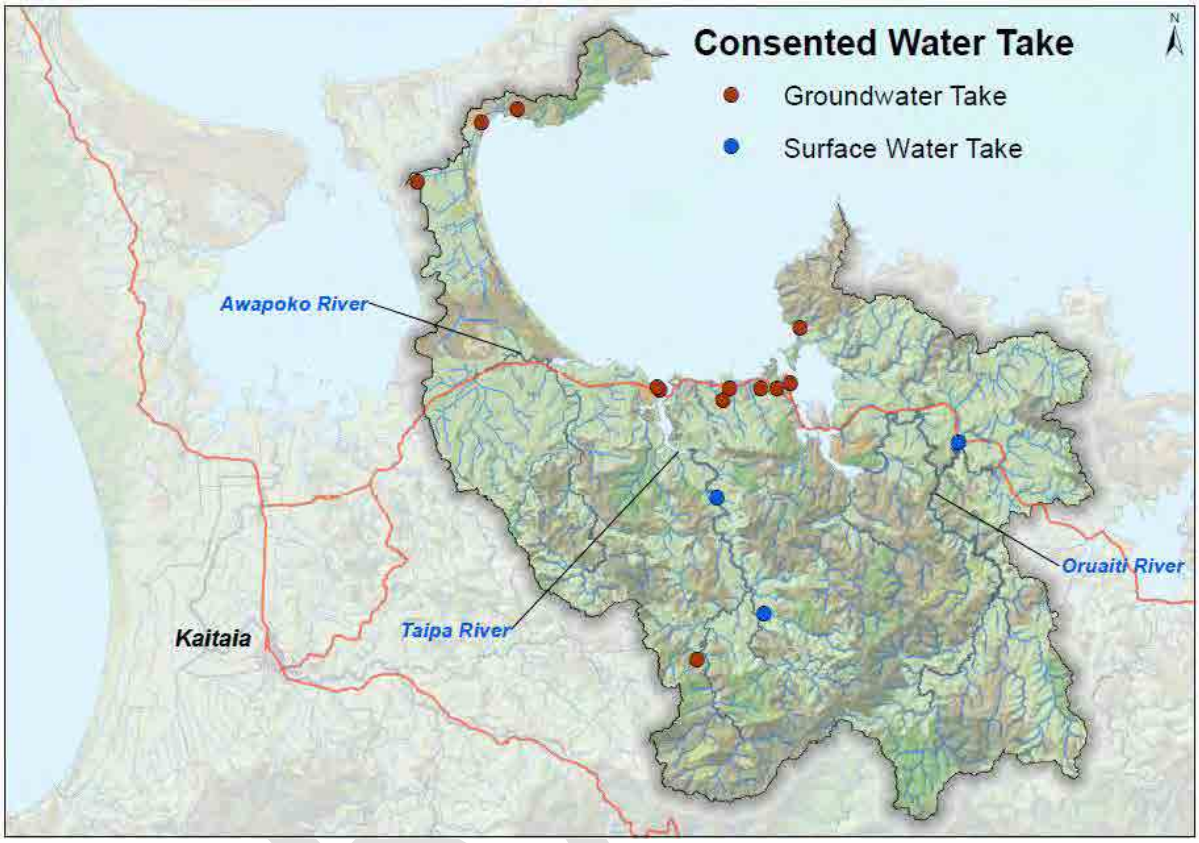



**Figure 12 – Active water take consents in the Doubtless Bay catchment**

## 12.5 Consented Discharges

There are 41 consented discharges within the catchment which are broken down into three groups: land, water and coastal discharges.

- Discharges to land: treated human effluent (10), industrial (1), stormwater (1), Farm Dairy Effluent (3)
- Discharges to water: treated human effluent (3), industrial (1), stormwater (3), Farm Dairy Effluent (18)
- Coastal discharges: stormwater (1)

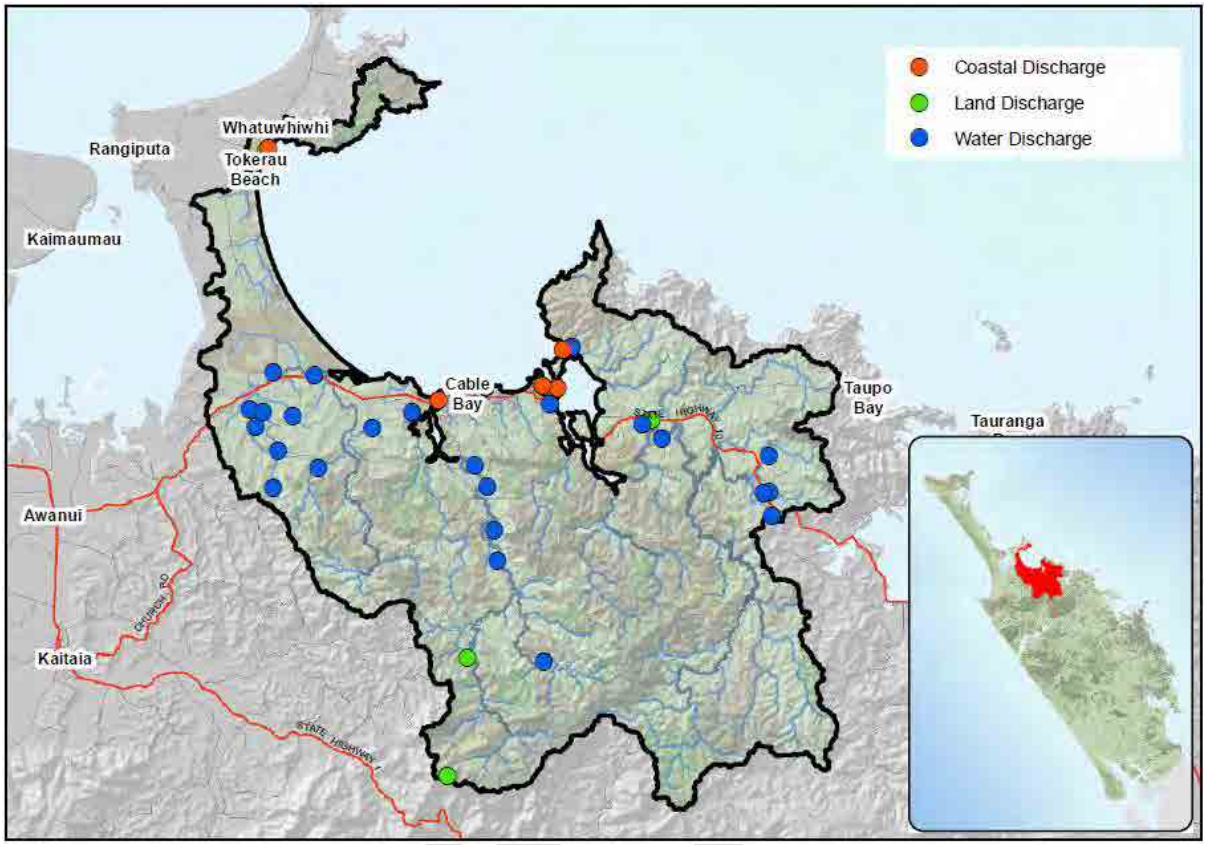



**Figure 13 – Discharge Resource Consents within the Doubtless Bay catchment**.

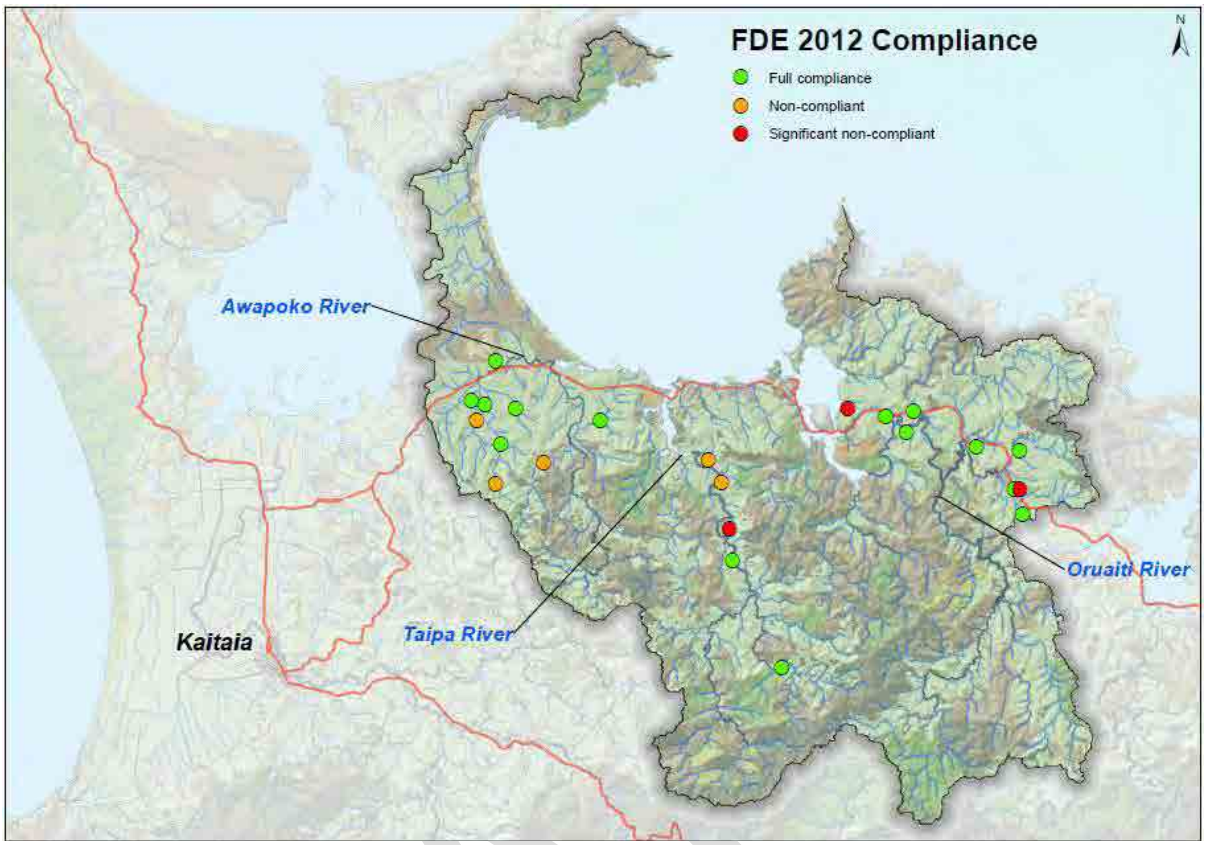



**Figure 14 Farm Dairy Effluent Compliance for 2012**

## 12.6 Mining Activities

Minerals are important natural resources being used for a range of agricultural, building and infrastructure purposes. They are by their very nature non-renewable and limited in their distribution. The fixed locational nature of minerals means that consideration needs to be given to land uses which may restrict or prevent their utilisation.

Northland has a well established aggregate industry which serves not only the region but also the Auckland metropolitan area. The region's greywacke and volcanic rocks serve as a source of aggregate. Limestone is also extracted for producing cement and agricultural lime.

Mineral production statistics indicate that around 2.3 million tonnes of building and roading aggregate and sand is produced annually in the region. The other principal material currently extracted in the region is high quality clay which is used for ceramics and other manufacturing purposes. The largest operation is based at Matauri Bay.

The extraction of land based minerals generally involves disturbance to the landscape. Such operations can also have significant effects on water and other natural resources. Extraction of sand and other minerals from the Coastal Marine Area also raises a number of environmental issues particularly relating to natural sediment processes, and protection of seafood and other highly valued resources.

The Regional Water and Soil Plan covers the effects of land use activities on water and soil in Northland. The Plan identifies the significant water and soil issues faced by Northlanders

and seeks to address these through the policies and rules. The Plan also proactively promotes a programme of environmental education, advocacy, information provision and advice.

- Sections 32 provide the environmental standards for land disturbance.
- Section 33 provides the rules for land disturbance activities.
- Section 34 provides the rules for land disturbance within the riparian management zone.

The Regional Council monitors six active consented quarrying activities and 4 inactive quarries within the Doubtless Bay Catchment

There are also a number of small quarries operated within permitted activity guidelines. These are, sited on farms and in some forestry blocks within the catchment for onsite use only.

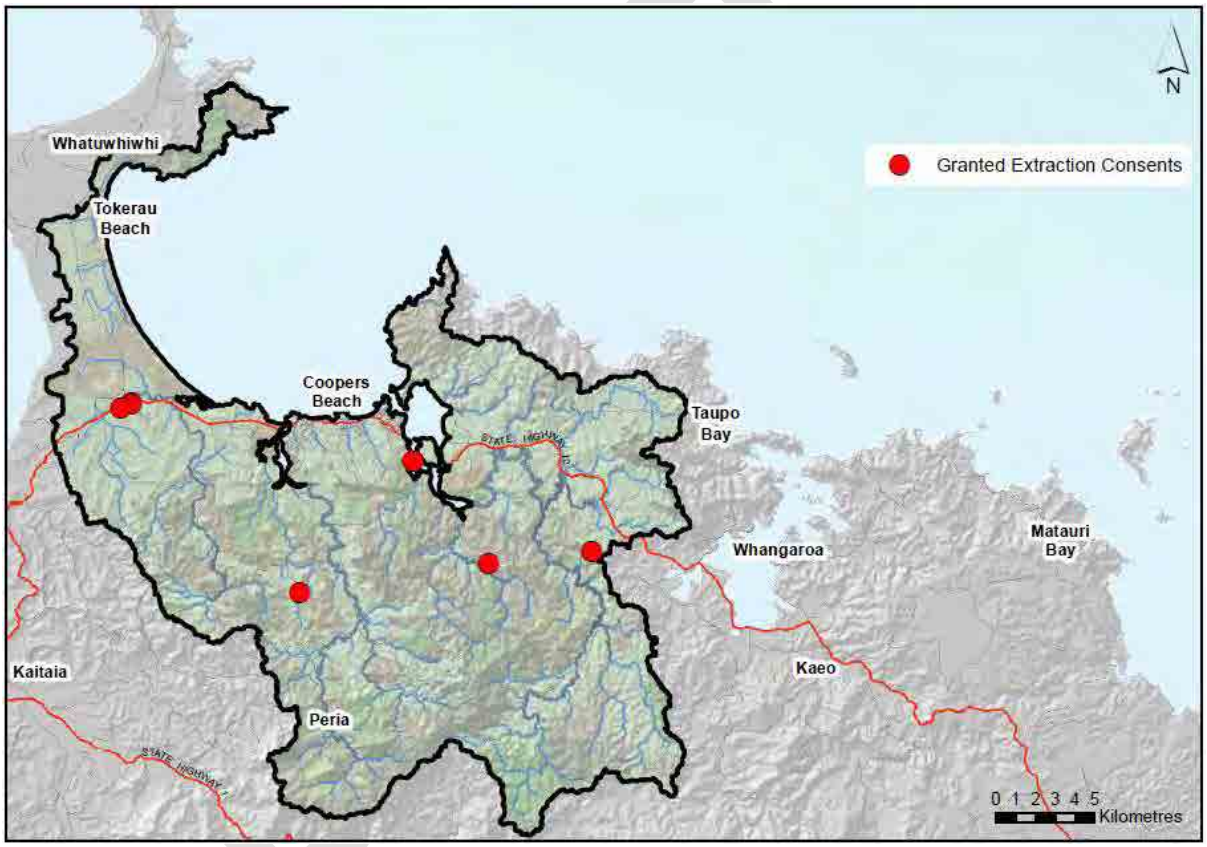



**Figure 15 Quarrying activities with the Doubtless Bay Catchment**

# 13 Iwi environmental management

Iwi Maori have a living relationship with freshwater that is founded in the respective cultural values of each iwi and that has spanned, and will continue to span, the full breadth of cultural, environmental, social and commercial interests. The nature of the relationship between iwi and freshwater forms the basis of iwi rights, interests, values and objectives pertaining to freshwater management. Iwi assert foundation rights to freshwater based on the Treaty, customary, and aboriginal rights and that these rights continue to hold relevance in the wider legal framework of water management.

Iwi environmental management plans are a vision of how the management and protection of natural and physical resource can be achieved based on cultural and spiritual values of tangata whenua[4].

## 13.1 Te Runanga A Iwi O Ngati Kahu

Te Runanga A Iwi O Ngati Kahu takes responsibility for all government related matters such as the claims against the Crown (involving both fisheries and land), social welfare, training and employment programmes, conservation and resource management matters, health, housing, and economic development programmes[5].

## 13.2 Te Runanga O Whaingaroa

Environmental resource management is an important focus for Te Runanga O Whaingaroa . Resource management staff provide advice in relation to resource consents for developments, territorial management and quality, fisheries, aquaculture, coastal environment, biosecurity, biodiversity, climate change, pest management, forestry, minerals and heritage. They also engage with a number of government agencies and Crown entities that have decision making and management roles for various aspects of our environment including Department of Conservation, Ministry for Primary Industries, Environmental Protection Authority, , New Zealand Transport Agency, Ministry of Business, Innovation and Employment and the Historic Places Trust6.

There are a number of community environmental groups within the Doubtless Bay catchment area.

[4] Mfe (2000) Te Raranga A Mahi
[5] http://www.ngatikahu.iwi.nz
[6] http://www.whaingaroa.iwi.nz

## 13.3 The Doubtless Bay Marine Protection Society

The aim of this group is to get representatives from all local community groups, hapu and iwi, to work together to

- protect and restore Doubtless Bay's marine environment.
- raise public awareness about the marine environment as it is now and how it used to be in the past.
- prepare an overall plan for improved coastal marine management in the Doubtless Bay/ Tokerau area; and
- to express Kaitiakitanga/ guardianship for our local marine area=

## 13.4 Whakaangi Landcare Trust

Whakaangi Landcare Trust's stated goal is the protection of the existing large Kiwi population of North Island Brown Kiwi by providing it with a secure habitat with no known enemies and with a plentiful food source that is not competed for by non-native ground dwelling animals. This is to ensure the Kiwi population will increase quickly, reversing the trend now common around New Zealand. A secondary aim is to increase the overall health of the ecosystems on the peninsula. This will encourage native flora and fauna to re-establish themselves and for other species to be able to be introduced into a protected area[7].

[7] http://www.whakaangi.co.nz

# 14 Education and awareness

Northland Regional Council is tasked with monitoring and providing advice, incentives and regulations to protect our environment whilst balancing the economic needs of the community. Ultimately, the state of the environment is determined by the people who live in and use it. Ongoing monitoring helps the council to keep abreast on what's happening to the environment but it's a joint effort, and council looks forward to continuing to work with communities to set and meet environmental expectations.

## 14.1 Education

The Enviroschools programme is available to all schools in Northland. The North's Enviroschools programme is funded by and operated through the Northland Regional Council, with support from The Enviroschools Foundation and the Department of Conservation.

In Northland, 70 schools and three kindergartens are currently on the pathway towards creating sustainable communities. They are all working at their own pace to achieve a range of sustainability actions, with some choosing to go for awards along the way.

The following schools within the Doubtless Bay Catchment have received support through facilitation, resources, professional development and a nationwide network of schools.

### 14.1.1 Taipa Area School

Taipa Area School is part of the Enviroschools programme and hosted the coastal-themed Northland Regional Council teacher workshop in 2012. The workshop was themed on empowering teachers to take action to care for the coastand included topics such as estuary catchment health, dunes management, and native plants.

### 14.1.2 Oruaiti School

Oruaiti is part of the Enviroschools programme and have covered topics such as wetlands and water catchment discovery over the past five years.

### 14.1.3 Peria School

Peria School is part of the Enviroschools programme and has over the past two years covered enhancing our waterways and understanding wetlands.

Mangonui School and Te Kura Kaupapa Maori o Rangiawhia are the only schools within the catchment that have yet to engage in any of the Enviroschools activities or programmes.

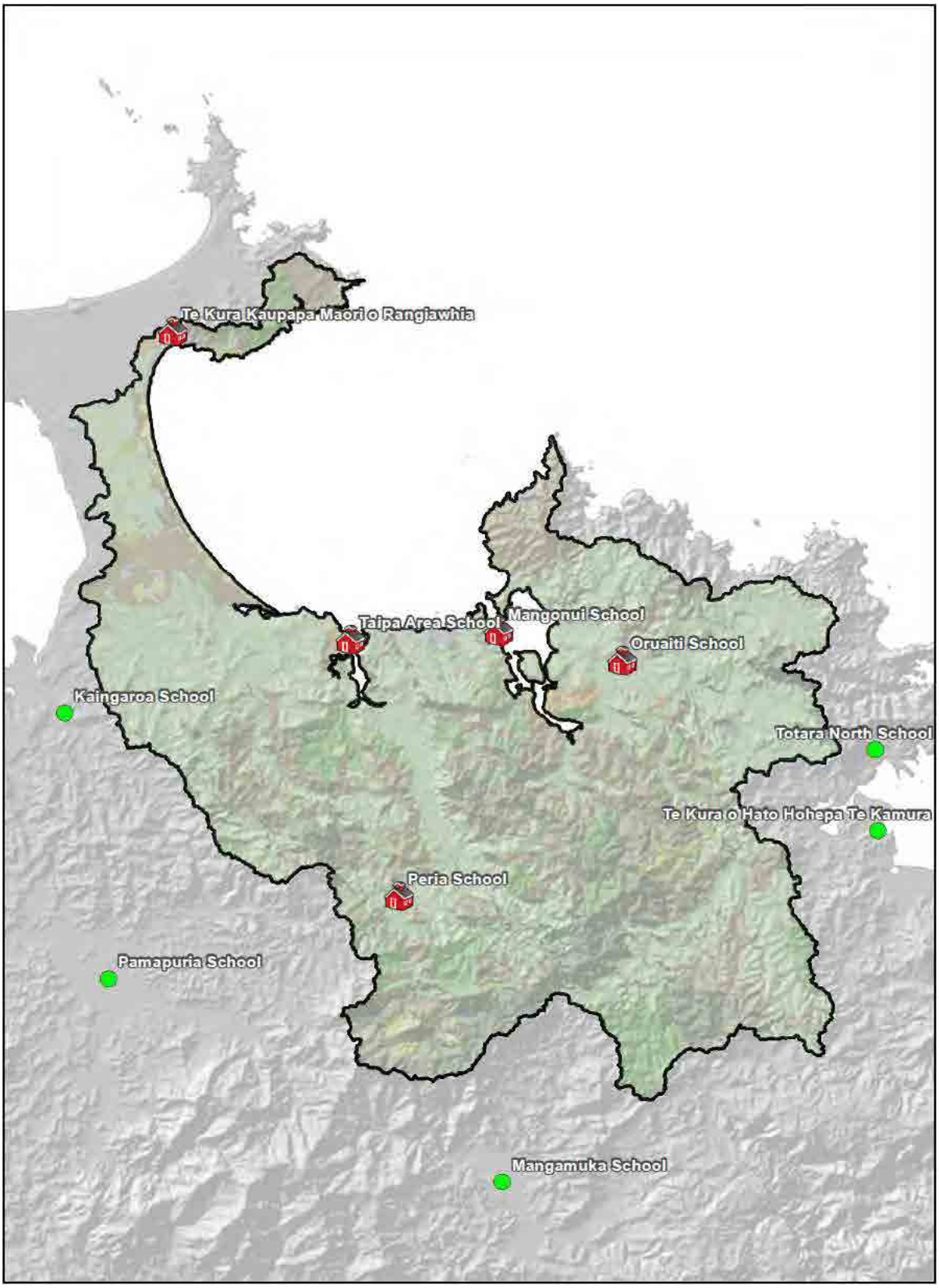



**Figure 16** Schools within the Doubtless Bay catchment

## 14.2 Awareness

On the whole, Northland's environment is in good health. There have been steady improvements in water quality with more rigorous monitoring and enforcement of resource consents that allow discharges to waterways. Council's Waiora Northland Water (WNW) programme will assist to build awareness across Northland communities about the uses, values and goals for managing water.

The WNW programme is a key strategic focus for Northland Regional Council. Water is one of our most precious natural resources and much of the council's work revolves around it. Established in late 2012, Waiora Northland Water is a long-term programme that integrates both existing and new work we do around improving water quality in Northland.

The programme incorporates the government's new direction for improving freshwater management, which requires objectives and limits to be set and implemented for every freshwater body in Northland by 2030.

In a new approach, we will be working at a catchment level to enable better integrated management of our freshwater systems. This will be guided by catchment groups, to be formed from locals with an interest in their local water issues, to help determine how each catchment can best be managed.

Implementing the government's new direction for freshwater is a huge job so we are taking a prioritised approach, focussing on the most urgent water bodies first (our most precious and pristine water bodies and those that have been significantly degraded by human activities).
Regional environmental improvements are also the target of other important Council work programmes that integrate with the WNW programme, including the Priority Rivers Project, the Top Wetlands Project, Community Pest Control Areas, and Farm Management Plans

Northland's landscape is changing – there's increasing pressure from pest plants and animals and while overall stock numbers have decreased, farming systems have intensified. Population growth on urban fringes has increased pressures on infrastructure while diverting quality land away from production. This changing context has meant we've adopted a wider approach to environmental reporting and have included information about our people and our economy.

### 14.2.1 Regional State of the Environment Report

The State of the Environment report provides quality environmental information that is accessible and understandable to Northlanders and which can be used to make important resource management decisions in the future. The report is arranged into five chapters: Our people; Our place; Our land, our air; Our freshwater; and Our coast. The chapters provide a broad picture of the core components that make up the state of our environment.

- Each chapter begins with a scene-setting introduction which explains why this part of the environment is significant for Northlanders and what the major pressures on the environment are;

- Describes the current state of each aspect of the environment – core information is presented on the state of the environment and key trends or changes over time;
- Outlines the management responses to environmental conditions now and into the future.
- Information is presented on what is being done now to address issues raised and what might be done in the future; and
- Provides a summary of progress in implementing regional objectives and policies.

### 14.2.2 Environment Fund

The Northland Regional Council Environment Fund has provided around $4 million to help people enhance and protect Northland's natural environment since 1996.

The Regional Council recognises the effort and commitment that Northlanders are putting into addressing their environmental issues and the continuation of funding reflects this. The fund is provided through five different funding streams with projects funded at up to 50% of their total costs.

Priority Funding Streams have been identified to ensure that recipients of funding are proposing activitiesaligned with Regional Council Land Management priorities.

### 14.2.3 Priority Funding Streams

**Soil conservation** – Targeting the maintenance and control of erodible soils, e.g. erodible land soil stabilisation via tree planting, fencing to exclude stock, pest control and other suitable means.

**Biodiversity** – targeting the restoration and protection of wetlands and lakes, e.g. fencing to keep out stock, riparian planting, pest control.

**Coastal** – targeting the restoration, protection and maintenance of estuaries, dunes and salt marsh, e.g. the planting of spinifex and pingao for dune stabilisation, pest control, fencing to exclude stock and riparian planting.

**Water quality** – targeting dairying and clean stream accord targets, dry stock exclusion from waterways and similar projects within recreational bathing site catchments e.g. fencing to exclude stock from waterways, riparian enhancement.

# 15 Conclusion

While there is some relatively localised degradation of water quality around outfalls and in enclosed waters following rain, on the whole Doubtless Bay catchment waters are of a moderate standard.

While water quality in the Oruru River overall is assessed as fair, there is evidence of degradation, with dissolved oxygen, ecoli and turbidity data indicating characteristics of moderate pollution. These would appear to be related to diffuse source contaminants (E.g. run-off of sediment and nutrient) rather than point source discharges.

Unlike point source discharges, which are generally well understood and managed, diffuse sources are a much greater challenge given multiple origins and cumulative nature (E.g. sediment and nutrient run off from production land, stream bank erosion and stock access to water). MCI and habitat surveys also consistently scored the Oruru River stream health as marginal indicating poor ecological condition, due largely to low levels of riparian vegetation and sediment levels.

However there are areas in the catchment where ecological values are very high, particularly in the lakes. Despite its low water quality Lake Waiporohita is ranked as 'Outstanding' given it supports nationally endangered plants and birds with indigenous submerged plant communities.

Coastal water quality (except for periods of heavy rainfall) is very good particularly within Doubtless Bay itself which is consistently suitable for recreational uses 95 – 100% of the season.

An action plan developed collaboratively by the Doubtless Bay Catchment Working Party will ensure water quality can be maintained and in some cases enhanced for the benefit of present and future generations.

# APPENDIX 1 FURTHER SOURCES OF INFORMATION

1 Northland Regional Water and Soil Plan

2 Northland Regional Coastal Plan

3 Northland State of the Environment Report

4 Northland Lakes Strategy

5 Northland Wetlands Strategy

6 Intertidal and subtidal habitats of Doubtless Bay

7 Improve our marine life for now and future generations? Discussion document

**Websites**

1. www.nrc.govt.nz
2. www.ngatikahu.co.nz
3. www.whakaangi.co.nz
4. www.livingseadoubtlessbay.org.nz
5. www.qualityplanning.orgnz

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