GROUNDWATER MONITORING

Groundwater resources in Northland vary in both quantity and quality, depending on the geology of the aquifer system. The main aquifer systems exist in the basalts such as Kaikohe and Whangarei, and in the Aupouri sands. There are also many other smaller sand and gravel coastal aquifers, and generally less productive greywacke aquifers throughout the region. Rainfall is the main recharge source for Northland's aquifers.

Monitoring of groundwater resources in the Northland Region can be divided into three main areas; State of the Environment monitoring to meet the **performance targets** (refer page 15) for groundwater monitoring, compliance monitoring, which is the monitoring of drilling activities and groundwater takes and specific groundwater investigations.

The primary objective of State of the Environment monitoring is to identify environmental issues and trends in groundwater and promote informed environmental decision-making. Several different networks are in place to collect this information including a regional groundwater level monitoring network and two groundwater quality monitoring programmes, one the national programme and the other a regional network.

Groundwater level monitoring (refer page 2) was carried out at 68 sites in total throughout Northland to provide information to monitor the effects of climate, land use change and groundwater abstractions. Low groundwater levels were recorded at many sites from Kaikohe to Mangawhai as a result of low rainfall recharge in 2004-2005.

Groundwater quality monitoring (refer page 5) was carried out at seven sites as part of the National Groundwater Monitoring Programme (NGWMP) and 26 as part of the regional Groundwater Quality Monitoring programme (GWQMP).

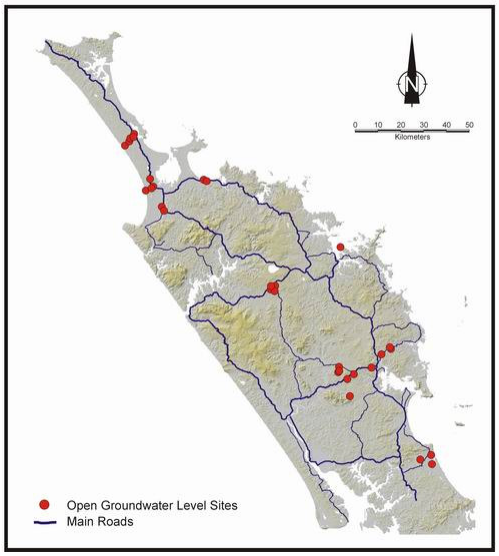
Specific groundwater investigations (refer page 8) were undertaken in the Ruawai, Taipa and Russell areas. Areas of saline (saltwater) contamination have been discovered at Ruawai, elevated nitrate levels still occur in a number of bores in Taipa, and monitoring at Russell has indicated bacterial contamination and the increased risk of saline (saltwater) contamination. A telemetry system has been installed in a monitoring bore in Russell. This will enable access to up-to-date groundwater level information and risk of saltwater contamination.

Hydro-geological investigations (refer page 11) were carried out in 3 'at risk' aquifers; Coopers Beach/Cable Bay, Glenbervie, and Mangawhai, to review sustainable yield. Future groundwater monitoring will also include investigations to review sustainable yield in Three Mile Bush, Kaikohe and Glenbervie aquifers.

Compliance monitoring (refer page 13) includes the monitoring of bore construction for bores that require a bore permit and monitoring of groundwater take resource consents. During 2004-2005 there was only minor compliances with bore construction permits and enforcement action was taken against only one groundwater take consent holder for exceeding the allocated daily abstraction rate.

Groundwater Level Monitoring

Groundwater level monitoring provides information on the effects of climate, land use change and groundwater abstractions. Groundwater level monitoring is carried out as part of the region wide hydrometric network. Regional groundwater level monitoring began on a monthly basis during the late 1980s with some records extending back to 1975. Groundwater levels are recorded continuously at eight sites, monthly at 38 sites, and quarterly at 22 sites. These sites have been chosen to provide adequate regional coverage as well as targeting specific environmental concerns. In 2004-05 Continuous groundwater level monitoring sites were installed at Ruawai and Mangonui to provide real-time date of groundwater levels in these areas. The locations of the current groundwater level monitoring sites are shown on the map.



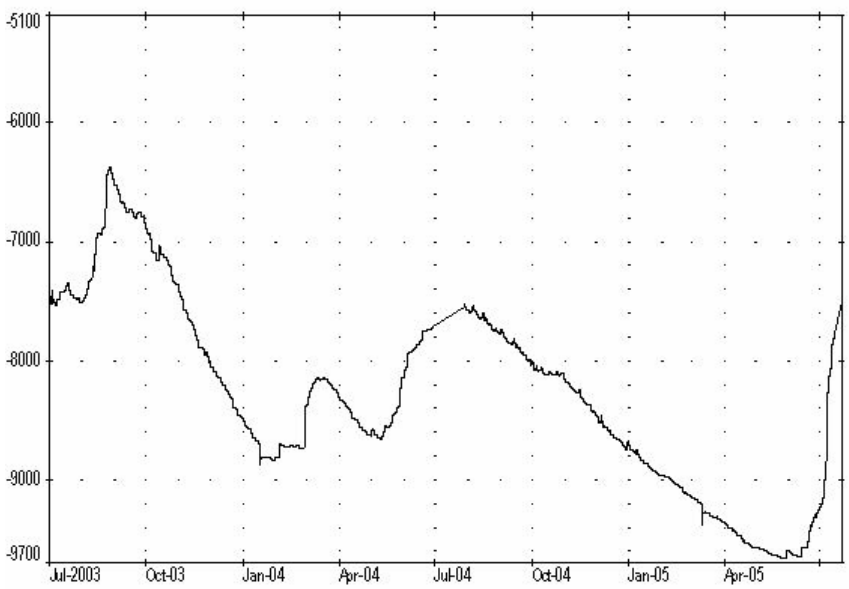
Results of Groundwater Level Monitoring

Groundwater levels in June 2005 were at or near the lowest recorded levels for the past 16 years in the Kaikohe, Whangarei, and Mangawhai areas. Groundwater level monitoring from Kaikohe to Mangawhai also indicates the lowest winter recharge since the early 1990's. The low groundwater levels are a result of low winter recharge in 2004, followed by a reasonably dry summer. The low groundwater levels in the basalt areas such as Kaikohe, Maungatapere and Maunu, has also resulted in low baseflows for rivers and streams. Unless there is above average rainfall during the coming spring, groundwater levels and stream flows are likely to be low next summer.

Groundwater level results for the 2004-05 financial year are presented below for several aquifer's monitored throughout Northland in some cases with historical results for comparisons.

Whangarei Basalt Aquifer

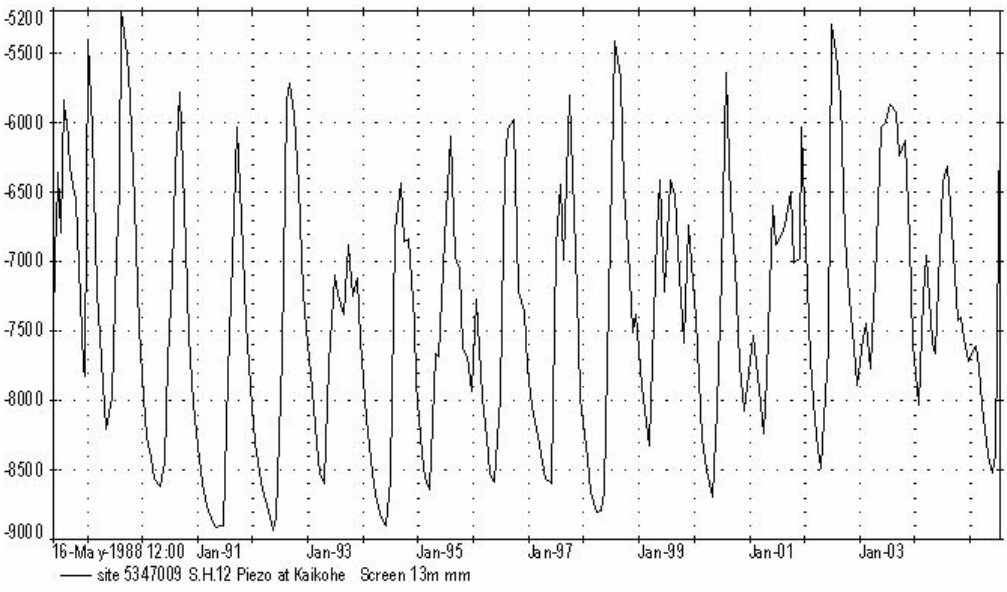
As expected, groundwater level is generally highest from July to September and then drops during the summer months as shown in the graph below for Poroti West monitoring bore in the Whangarei basalt aquifer. Note: the vertical axis of the graph is depth below ground level in millimetres.



The low rainfall in the winter of 2004 has resulted in a recharge peak (July to September 2004) approximately 1 metre less than the average recharge peak recorded for this time of year. This trend is typical for the majority of the groundwater level monitoring sites from Kaikohe to Mangawhai. The low winter recharge in 2004 resulted in the lowest groundwater level since the record began in 1980.

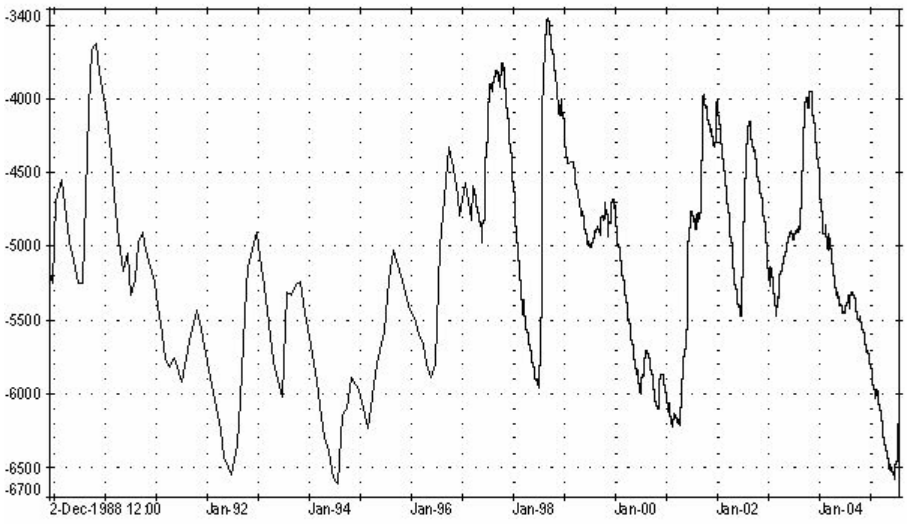
Kaikohe Basalt Aquifer

The groundwater level in the State Highway 12 monitoring bore in July 2005 was approximately 0.5 metres above the lowest on record, as shown in the graph below. However, other groundwater level monitoring sites did record the lowest groundwater level on record in July 2005 such as the monitoring bore on Monument Hill. Note: the vertical axis of the graph is depth below ground level in millimetres.



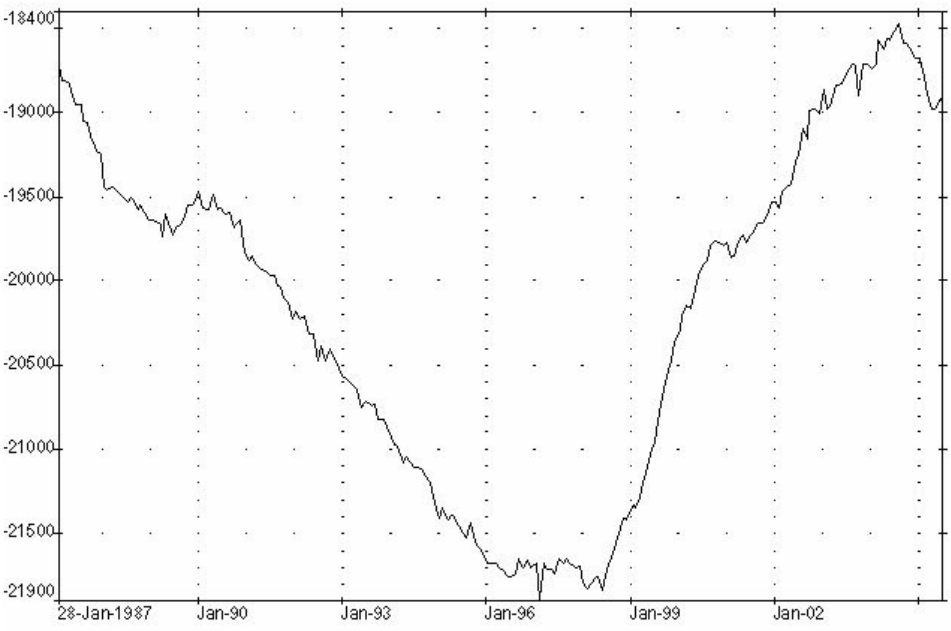
Mangawhai Sand Aquifer

The winter recharge in 2004 in the Mangawhai sand aquifer was equivalent to that recorded in 1991, which can be seen in the graph below. The subsequent decline of groundwater level during the 2004-05 summer is also of a similar magnitude to the groundwater level decline in the 1991-1992 summer. The rainfall during the year of 1991 was estimated to be a drought of a 1 in ten year return period. Note: the vertical axis of the graph is depth below ground level in millimetres.



Aupouri Sand Aquifer

The Aupouri aquifer has a large storage capacity. The large volume of water in storage within the deep sand and shell bed aquifer buffers the effects of rainfall recharge. The decline in the water level in the Hukatere Forest monitoring bore from 1987 to 1996 (shown in the graph below) is likely to be a result of less than average rainfall in the late 1980's to early 1990's, and the effects of plantation forestry reducing recharge to the system. Felling of the forestry and increased rainfall is likely to have resulted in the increase in groundwater levels recorded from 1998 to 2004. Note: the vertical axis of the graph is depth below ground level in millimetres.

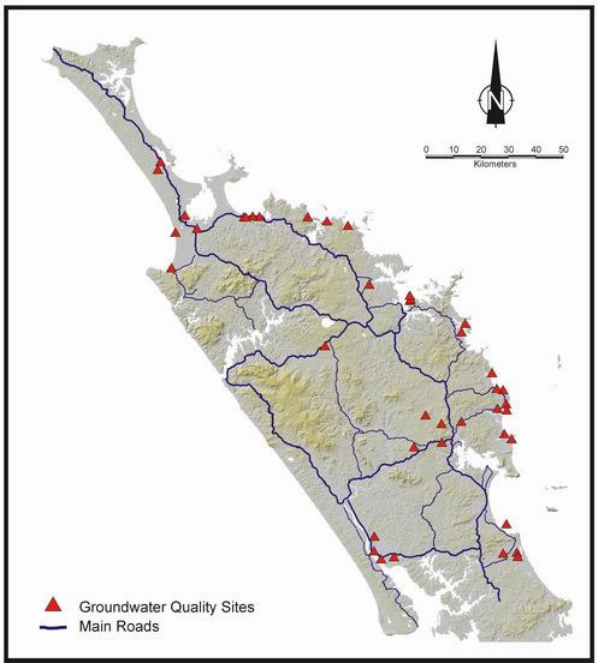


Groundwater Quality Monitoring

The Northland Regional Council participates in the National Groundwater Monitoring Programme (NGWMP), which is a joint project between the Institute of Geological and Nuclear Sciences (IGNS) and Regional Councils. The focus of this research is to determine national groundwater quality trends.

Seven sites are situated in Northland, and have been sampled every three months since September 1996. These sites are located at Houhora, Paparore, Ahipara, Kaikohe, Tutukaka, Glenbervie and Tara as shown on the map below. Samples from each site are analysed for major cations, anions, nutrients and trace elements such as iron.

The regional council also operate a regional Groundwater Quality Monitoring Programme (GWQMP), which commenced in November 2002. The data gained from this monitoring will improve understanding of the region's groundwater aquifer system and help assess the sustainable management of the groundwater resources. The primary aim of the regional GWQMP is to gain a perspective on baseline water quality of the different aquifers in Northland and identify any trends in groundwater quality over time as a result of the climate, land use and groundwater abstraction.



As part of the regional GWQMP 26 sites are sampled (in addition to those sampled for the National Groundwater Monitoring Programme) on a three monthly basis. Twenty of these sites are located in coastal aquifers, which are analysed for saltwater and bacterial indicators every six months and chemical properties (the same set as for the national programme) on the sampling runs inbetween. Groundwater levels are also recorded at each site. The remainder of the sites are located in basalt aquifers, which are sampled quarterly and analysed for a full range of determinants. All these sites are listed in the table below.

Coastal	General
Mangawhai Heads east	
Mangawhai Heads west	
Sandy Bay	
Taupo Bay	
Tauranga Bay	
Te Ngaire Bay	
Tapeka Point	
Pataua Bay	Maunu Basalt
Whananaki Bay	Whatitiri Basalt
Taiharuru Bay	Three Mile Bush Basalt
Ngunguru	Matarau Basalt
Whangaumu Beach	Glenbervie Basalt
Matapouri Bay	Kerikeri Basalt
Oakura Bay	
Bland Bay	
Cable/Mangonui Bay	
Coopers Beach	
Waipapakauri Beach	
Waipapakauri East	
Houhora	

Results of Groundwater Quality Monitoring

Groundwater quality in Northland is generally high enough that water can be consumed without treatment. Three areas of potential concern are contamination of groundwater resources by nitrate, bacteria and saltwater (saline). The median concentration of each determinant was calculated for each monitoring site and compared to the Maximum Allowable Values (MAVs) in the '*Drinking Water Standards for New Zealand*' (Ministry of Health, 2000). The '*Drinking Water Standards for New Zealand 2000*' can be viewed under publications on the Ministry for the Environments website.

The results from the NGWMP and regional groundwater quality monitoring programme indicate that concentrations of major ions are well below New Zealand drinking water limits in the aquifers monitored in Northland. Ten monitoring sites had median Iron (Fe) concentrations above the guideline value for iron of 0.2 mg/L for aesthetic reasons and 11 monitoring sites had median Manganese (Mn) concentration in excess of the guideline value for Manganese of 0.05 mg/L set for aesthetic reasons. Out of these 11 sites only two sites had a median Manganese concentration above the Maximum Allowable Value for health reasons of 0.5 mg/L. Most of the bores that have median Iron and Manganese concentrations in excess of guideline values intersect groundwater in either basalt or fractured greywacke. High concentrations of Iron and Manganese are common in these rock types within the Northland region.

Following on from an audit of the Council's groundwater sample collection technique, an improved sampling technique was used in 2005 to avoid samples getting contaminated during collection. Results of bacterial analysis indicate only four sites in both the coastal and the basalt groundwater systems were above the guideline value. Out of these four sites only one shows repeated bacterial contamination in the last three sampling runs. This is a shallow bore in Taupo Bay. This may be an indication of onsite wastewater contamination. It is important to note that the bacterial limit set in the *'The Drinking Water Standards for New Zealand 2000'* is 1 cfu/100 ml. Therefore any positive result for bacteria exceeds these drinking water standards.

Nitrate (NO_3^-) is considered a broad indicator of groundwater contamination from a variety of sources, including fertilisers, agricultural and human wastes. Nitrate is considered toxic in excessive concentrations. Bottle-fed infants are most at risk, as a high concentration of nitrate affects the ability of the blood to transfer oxygen. High nitrate concentrations in water and diet have been linked to some types of cancers.

The current New Zealand drinking water standard for nitrate/nitrogen is 11.3 mg L^{-1} (as NO_3^-N, taken from the '*New Zealand Drinking Water Standards 2000*'). Monitoring has shown that average nitrate concentrations at all NGWMP and regional network sites are well below this level. Nitrate concentrations are generally higher in the basalt boreholes than they are in the sands and other geology. This may be a result of the horticultural and agricultural land use in the areas surrounding the basalt aquifers. Elevated nitrate concentrations have been recorded in several sites in Taipa. The results of this monitoring are reported in the **specific groundwater investigation** (refer page 9) section.

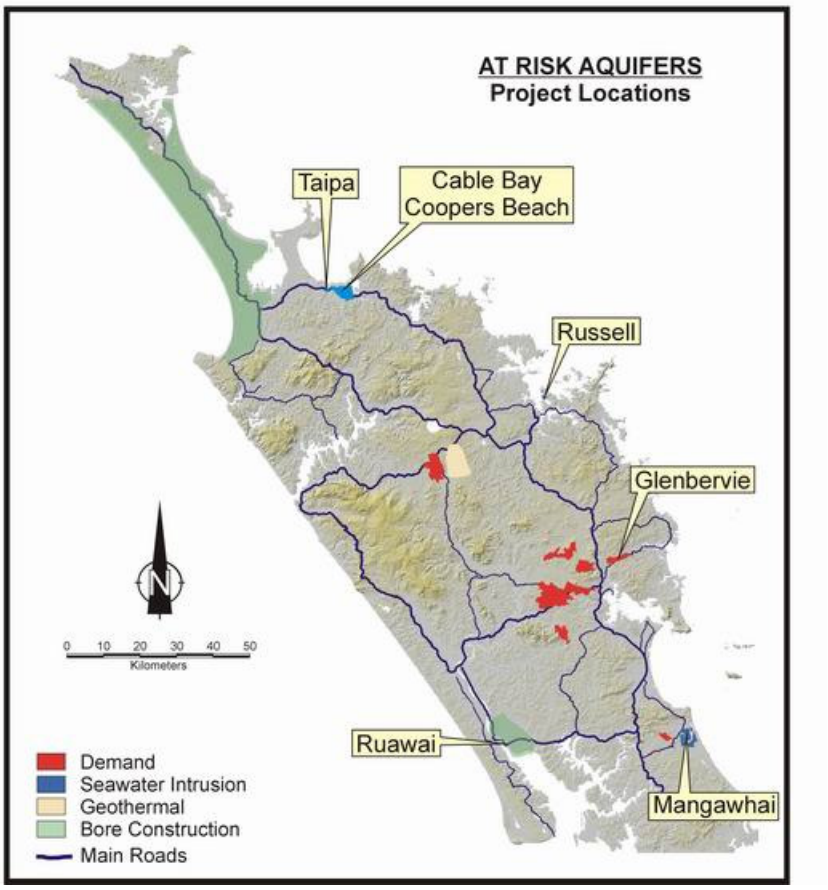
Conductivity is an indirect measure of salinity. High levels may indicate salt-water intrusion as the result of lowering groundwater levels. In 2004-05, all sites were well within the conductivity range specified in the *'Drinking Water Standards for New Zealand'*. Elevated conductivity values have been recorded at one site in the Ruawai area, which is discussed in the specific groundwater investigation section. Pataua South also registered elevated chloride concentrations during the period of low groundwater levels in 2005. This is likely to be a direct result of the influence of saltwater.

The table below shows the median results for all the parameters tested for as part of the National Groundwater Quality Monitoring Programme since 1996.

Parameter	Kaikohe	Houhora	Tara	Paparore	Ahipara	Glenbervie	Tutukaka
Alkalinity (mg/L)	66	149	27	49.5	34.5	147	83
Bromide (mg/L)	< 0.1	0.18	0.09	0.33	0.1	0.06	0.57
Calcium (mg/L)	10.8	34.2	4.8	5.8	4.25	41.8	3.2
Chloride (mg/L)	10.7	53	18	32	33	14.7	153
Conductivity (ms/m)	18	41	14.05	21	18.25	32	58.9
Fluoride (mg/L)	0.03	0.07	0.05	0.08	0.03	0.07	0.13
Iron (mg/L)	< 0.02	0.06	0.35	1.4	1.4	0.05	< 0.02
Potassium (mg/L)	1.5	2.8	1.6	1.5	1.75	1.5	2.7
Magnesium (mg/L)	6.1	5.7	4.1	3.8	3.4	6.1	6.05
Manganese (mg/L)	< 0.005	0.12	0.01	0.06	0.04	0.01	0.006
Sodium (mg/L)	12.2	43	13.6	29.3	26	17.5	98.5
Ammoniacal Nitrogen (mg/L)	0.01	0.06	< 0.01	0.02	0.07	0.02	0.01
Nitrate Nitrogen (mg/L)	3.05	0.03	2.6	0.01	0.23	0.9	2.5
pH	6.6	7.8	6.4	6.6	6.4	7.3	6.8
Silica (mg/L)	40.5	41.4	25	40.5	36	25.2	34.5
Sulphate (mg/L)	2.9	8.8	2.8	8.8	6.7	11.1	30

Specific Groundwater Investigations

In addition to the routine monitoring carried out as part of the networks mentioned in the **groundwater quality** (refer page 6) section, specific groundwater monitoring projects have been carried out in the Russell, Taipa and Ruawai areas since 2002 to investigate areas of concern identified in previous monitoring. These investigations also provide better information to the Regional Council to ensure the sustainable management of these groundwater resources, particularly where information is lacking. The map below shows the location of 'At risk aquifers' in Northland, of which three were covered by these specific investigations and the other three had hydro-geological surveys carried out on them in 2004-05.



Ruawai Groundwater Monitoring

The Ruawai area, located approximately 15 kilometres south of Dargaville, is predominantly an alluvial flood plain consisting mainly of mud, sands and peat. The Northern Wairoa River bounds the area to the west and south, and limestone hills mark the northern and eastern boundaries. The flood plain is heavily drained. The main land uses in the area are horticulture (particularly kumara growing) and agriculture (such as dairy farming).

Historical bore logs in the area indicate groundwater is present across the flood plain at varying depths and quality. Groundwater in the Ruawai area is important as most local surface water has a high salt content and its principally used for irrigation, stock water requirements and public water supply.

The main groundwater issues in the area is the potential for:

- intensive horticulture and agricultural activities to degrade water quality; and

- groundwater abstractions resulting in saline (saltwater) intrusion.

Four bores are sampled quarterly for a range of parameters to determine long term and seasonal variations in groundwater levels and quality to ensure the sustainable management of the groundwater resource.

The results of sampling over the past year indicate elevated chloride and sodium concentrations in the south-eastern boundary of the groundwater system. These results suggest saltwater intrusion is occurring in the south-eastern boundary of the Ruawai aqufier, however, this is not influencing the water quality in the western boundary at the site of the Kaipara District Council pubic water supply bores.

A bore survey of the Ruawai area has been carried out and a conceptual model of the Ruawai groundwater resource was completed in 2003.

In summary, the report suggests that the Ruawai aquifer is comprised of three zones:

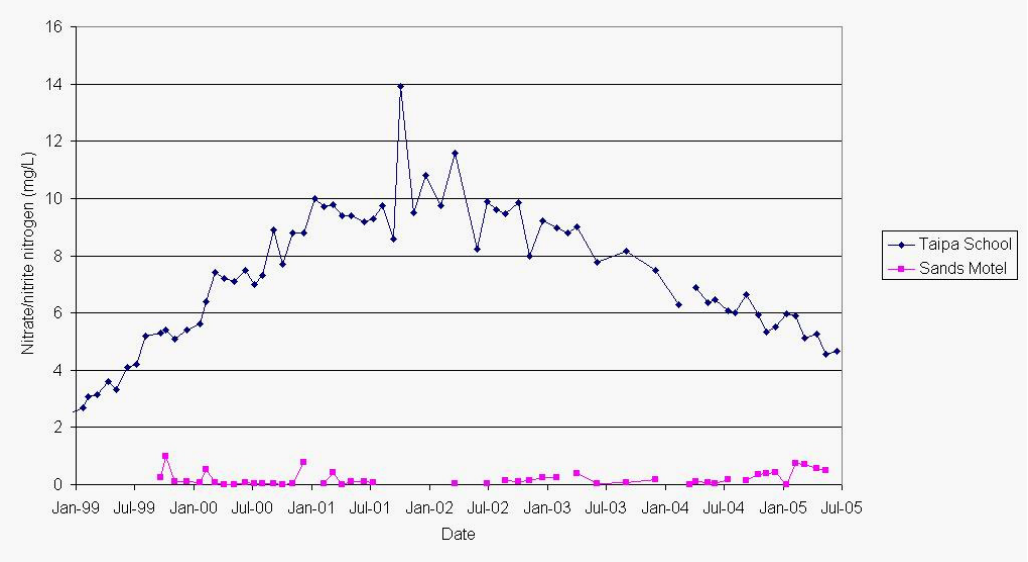
- a recharge zone to depths of approximately 10-20 m(shallow aquifer).
- a lateral flow zone at depths of 20 –40 m (intermediate aquifer); and
- a zone of high groundwater pressure (artesian) at depths greater than 40 m (deeper aquifer).

The shallow groundwater (upper aquifer) is likely to discharge into the surface water networks. Therefore, current land use activities have the potential to results in bacterial and nutrient contamination of the surface water resources in the area. The modelling indicates that this shallow aquifer is not directly linked to the deeper aquifers where most of the water is sourced. Monitoring will continue next financial year, after a review of the current monitoring sites.

Taipa Groundwater Monitoring

Taipa is a coastal aquifer with a saline boundary on the northern and eastern edge of the aquifer. The main source of recharge is rainfall. Similar issues to Ruawai are also potential risks to the groundwater resource in the Taipa area, including degraded water quality and saline intrusion. Five bores are sampled monthly and analysed for nitrate and saline indicators such as chloride.

The results from this monitoring indicate elevated nitrate levels in a number of bores in the Taipa settlement area. The results from 1997 to June 2005 are shown in the graph below for two bores, Taipa School and Sands Motel. Nitrate levels in groundwater from the Taipa School bore exceeded the drinking water limit of 11.3 mg/L on several occasions in 2001-2002. However levels had dropped below the drinking water standard by May 2002 and have been below ever since. The school does not use groundwater from the bore for drinking water. Nitrate levels in groundwater from the Sands Motel bore have been slightly elevated particularly over the last year but remain well under the drinking water limit.



To trace the source of the increasing nitrate, groundwater samples from the School Bore were collected and analysed using N-15 isotope tracer. The source was identified as being either soil organic matter and/or inorganic fertilisers. Land use in the area is predominantly urban, with some market gardening to the west of the Taipa settlement. The amount of nitrate detected in groundwater bores close to or in the market gardening area is significantly less than that recorded at the School Bore. This suggests that, there is significant preferential flow through the Taipa aquifer, or the market garden site is not the source of the nitrate in the area. Chloride levels in the bores adjacent to the foreshore have shown no significant variation over the monitoring period.

All large-scale fertiliser users in the area have been contacted and requested to keep fertiliser application diaries. On going monitoring of the nitrate and chloride levels in the Taipa groundwater will continue.

Russell Groundwater Monitoring

Russell groundwater resource consists of a gravel and fractured greywacke system in close proximity to the coast. The main sources of recharge to the system are rainfall and onsite wastewater discharges. There are many bores in the area that abstract water for domestic use. The main concern for the Russell aquifer is that reduced recharge due to wastewater reticulation and increased groundwater use will lead to an increased risk of saline (saltwater) intrusion. Previous groundwater modelling suggests that the reticulation of wastewater will significantly increase the risk of saltwater contamination of the Russell groundwater resource during prolong dry periods.

There are currently five monitoring bores in Russell and Matauwhi Bay. These bores are sampled and analysed for saline indicators as well as bacteria, iron, and manganese on a monthly basis. One bore on the Russell foreshore regularly records groundwater level and conductivity. A telemetry system has been installed to enable direct telephone access to monitoring results, and therefore enable an early warning of any increase in saltwater contamination in the aquifer.

A significant influence of saltwater contamination in the monitoring bores has yet to be detected. Even with the recent dry period no elevated chloride concentrations have been recorded in any of the monitoring bores beyond natural seasonal variations. Monitoring in Russell will continue next financial year.

Hydro-geological Investigations

Aquifers in Glenbervie, Mangonui (including Cable Bay and Coopers beach) and Mangawhai areas are recognised in the '*Regional Water and Soil Plan for Northland'* as "at-risk" aquifers with respect to groundwater demand and water quality issues. These three areas, highlighted on the "at risk aquifers" map in the **specific groundwater investigations** (refer page 9) section, were prioritised for investigations either because of the lack of information on these areas and/or the large amount of development in the area.

Due to increased drilling activity and potential demand for groundwater in these areas, the Regional Council require better information to ensure the sustainable management of these groundwater resources. Given this preliminary hydro-geological investigations were carried out in these three areas in 2004-2005.

The aim of the studies were to:

- Develop an understanding of the aquifer hydrogeology;
- Provide a preliminary estimation of the sustainable yield; and
- Recommend future actions to enable the sustainable management of the groundwater resources.

Glenbervie Groundwater Resources

The Glenbervie basalt aquifer located approximately three kilometres west of Kamo was formed as a result of volcanic activity from two eruptive vents, Pukepoto and Puketotara scoria cones. The total study area is 8.7 km^2. Groundwater from this aquifer is predominately used for horticultural irrigation and as a supplementary domestic supply.

The main issues potentially affecting groundwater quality and quantity in the Glenbervie basalt are:

- Groundwater abstraction
- Bore construction and location
- Basalt permeability

The study provided an assessment of the groundwater resources in the area, with the following recommendations:

- A numerical model based approach is required to obtain a better assessment of sustainable yield.
- Continuous groundwater level monitoring in at least two bores within the region to assess the effect of abstraction.
- Undertake concurrent monitoring of spring and stream flow at a number of locations within the study area.
- Soil infiltration tests be carried out to improve understanding of the groundwater recharge dynamics.

Monitoring of groundwater level and quality, including anions, cations and bacterial, in the Glenbervie basalt aquifer will continue in the future.

Cable Bay, Coopers Beach and Mangonui Groundwater Resources

Cable Bay, Coopers Beach and Mangonui are small coastal townships located in Doubtless Bay, Northland. The total study area is approximately 17 km^2, encompassing these towns and extending inland to the top of Cable Bay Block Road. The predominant land use is residential near the coast and rural for the remainder.

Groundwater is generally abstracted from the fractured basalt, predominately for public water supply and horticultural purposes. The main potential groundwater issues are:

- saline (saltwater) intrusions;
- water quality problems such as elevated Iron, Manganese and bacteria;
- groundwater abstractions; and
- land stability.

Based on the findings from the study the following recommendations were made:

- Monitoring of groundwater levels and quality to assess the potential for seawater intrusions at Cable Bay, Coopers Beach and the Mangonui waterfront.
- Groundwater level monitoring further inland to assess seasonal variations and the effect of abstraction.
- Measurement of spring and stream flows to assess potential adverse effects of increased groundwater demand.

Monitoring of groundwater level and quality, including anions, cations and bacterial, in the Cable Bay/Coopers beach and Mangonui area will continue in the future.

Mangawhai Groundwater Resources

Mangawhai Village and Mangawhai Heads are coastal townships located approximately 50km south of Whangarei. This area, in particular Mangawhai Heads, is currently experiencing an enormous increase in subdivision. Groundwater in the area is used mainly as a supplementary domestic supply for many of the residences, and to a lesser extent for horticultural irrigation and stock drinking water.

The predominant surface geology of the study area is Waitemata sandstones and mudstones, overlain with clays (weathered Waitemata), sands or alluvium. The sands are located on the peninsula at Mangawhai Heads and around the sand spit, while the alluvium is located in the stream valleys. The main groundwater issues are the potential for saline (saltwater) intrusion and effects from intensive subdivision.

The study indicated elevated chlorides, boron, fluoride and lithium concentrations occur in some bores located at low elevations near Mangawhai Village and along the southern end of the estuary. It is likely that these bores intercept discrete fractures within the Northland Allochthon and Waitemata rocks, through which thermal upwelling may occur. It is possible that elevated concentrations occur in other bores throughout the study area that encounter these persistent fractures or high permeability zones, in particular near the Waipu Fault or around igneous intrusions. However, there is currently no groundwater quality data to verify this.

Based on the preliminary findings the following recommendations were made:

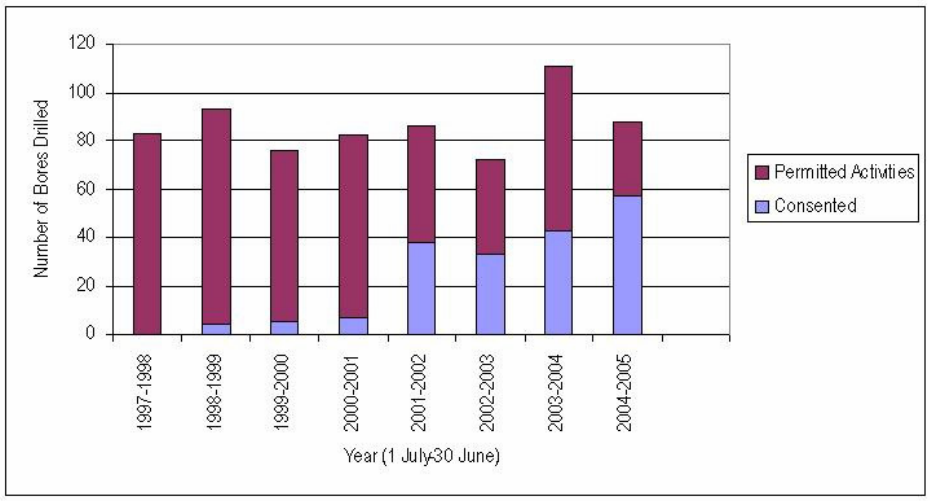
- A model based on dynamic estimates of groundwater recharge is recommended for a more accurate assessment of sustainable yield.
- A monitoring round in the Riverside Motor Camp bore that includes boron, fluoride and lithium is recommended to assess the source of saltwater.
- A saltwater intrusion and groundwater level monitoring bore be established in the sand aquifer.

Any new bores drilled that have high chloride levels should also be sampled for boron, fluoride and lithium. Monitoring of groundwater level and quality, including anions, cations and bacterial, in the Mangawhai area will continue in the future.

Compliance Monitoring

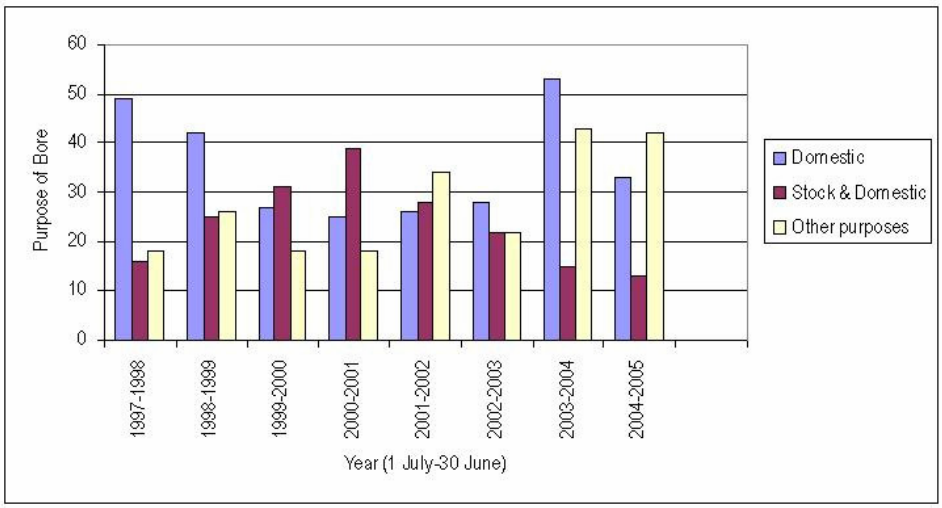
The Northland Regional Council maintains a bore log database. All the bore logs provided by drillers are incorporated in this database. Bore permits (Resource Consents) were not required for drilling activities prior to 1 April 1999. Since April 1999, bore permits have been required prior to drilling in sensitive groundwater areas identified in the Regional Water and Soil Plan for Northland as 'at risk' aquifers or if drilling in contaminated areas. The 'at risk' aquifers include the majority of the volcanic areas and the small coastal settlements.

There was a total of 88 bores constructed in 2004-2005 that were recorded in the bore log database, of which 57 were consented. The graph below shows the total number of bores drilled every financial year since 1997 including the proportion of consented to non consented (permitted activity) bores.



There is an increase in the number of drilling activities that require a bore permit (resource consent), particularly in 2001-02. This is likely to be a result of increasing subdivision and water intensive land use activities in the areas which require bore permits, as well as three additional 'at risk' aquifers being included in the Regional Water and Soil Plan in 2002.

The graph below summarises the purpose of the bores registered on the database since 1997, showing that there has been an increase in the number of bores drilled for purposes other than stock and domestic use such as for irritation purposes.



Bore Compliance Monitoring

Bores which require a bore permit prior to being installed are visited by a Regional Council monitoring officer to ensure that the bore is constructed and completed in accordance with the conditions of the consent. Of the 57 consented bores constructed in 2004-2005 only minor non-compliances with bore construction were identified, which includes bores lacking a concrete pad, a 30 cm high casing or removable cap and access point where water level readings can be taken. No formal enforcement action was taken in 2004-2005 with respect to bore construction.

The photographs below show a poorly constructed and maintained bore (left) and the correct construction of a bore (right) including a concrete pad, 30 cm high casing and removable cap.

Bad bore

Good bore

Groundwater Take Compliance Monitoring

Groundwater compliance monitoring for resources consents was continued through 2004-2005. Enforcement action was taken against one groundwater take Consent Holder in the 2004-05 year, as a result of the Consent Holder exceeding the allocated daily rate of abstraction.

Performance Targets

To continue to develop and implement a prioritised state of environment monitoring programme based on the Regional Policy Statement and regional plans by:

- Operating a region-wide hydrometric network for the measurement, recording, and reporting of groundwater levels.
- Operating a region-wide network for the measurement, recording and reporting of groundwater quality trends.

Another performance target relating to compliance hydrological monitoring rather than State of Environment monitoring of hydrology is:

Monitor compliance with, and the effects of, the exercise of resource consents, Regional Plans and statutory environmental standards by:

- Collecting water use records and measuring stream flows, groundwater and lake levels associated with significant water abstractions.