

Groundwater

Groundwater is water that exists beneath the earth's surface, and is a highly useful and often abundant resource. However, over-use can cause major problems to human users and to the environment.

The quantity and quality of groundwater largely depends on the underground rock formation within which it is contained, e.g. sand, gravel, fractured volcanic rock. In Northland, the main aquifer systems are contained in basalt rock, like Whāngārei and Kaikohe, or in the Aupōuri sands. Rainfall is the main groundwater recharge source for these aquifers.

The Council monitors groundwater in Northland in three main ways:

- State of the Environment (SoE) monitoring to record the general state of groundwater quality and quantity, and change over time (trends);
- Monitoring of activities that may affect groundwater to prevent or minimise any adverse effects caused by these activities; and
- Investigating individual aquifers where specific problems have been identified.



Regional Council groundwater monitoring bore.

Groundwater quantity

Monitoring groundwater levels provides information on the effects of climate, land use and abstraction on groundwater resources, and can tell us how much groundwater is available for use. A region-wide network of hydrometric stations is used to monitor groundwater. Levels are currently recorded continuously at eight sites, monthly at 42 sites and quarterly at 32 sites. The location of groundwater level monitoring sites is shown on the map opposite.

In 2009-2010, groundwater levels were found to be below average when compared to historic levels, falling significantly in February. The groundwater recharge was similar to previous years over winter 2009, but due to summer drought conditions combined with high water demand, groundwater levels dropped significantly in summer 2010. Most of the aquifers have now recovered but levels are still below those recorded last year.

The results of groundwater level monitoring for two sites during the last five years are shown in the graph (page 33). These sites are located in two different aquifers and respond differently to rainfall recharge. Puriri Park bore is located in the fractured basalt aquifer which shows a strong seasonal rainfall recharge response. This site responded strongly to the

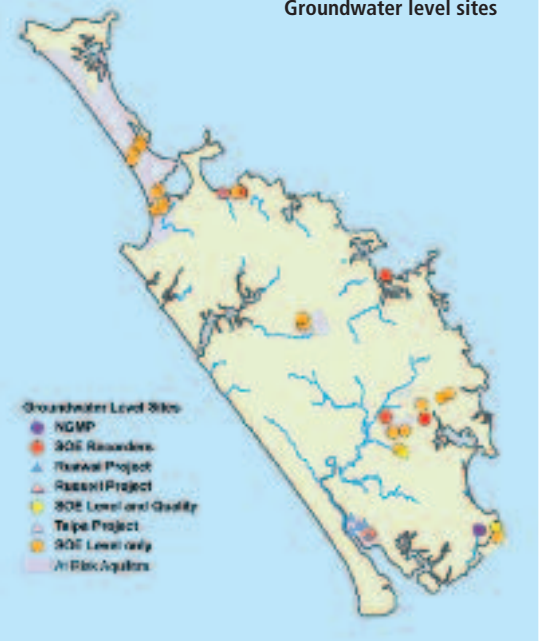


Groundwater performance targets

Continue to implement and improve a prioritised State of the Environment monitoring programme and monitor compliance with, and the effects of, the exercise of resource consents and Regional Plans by:

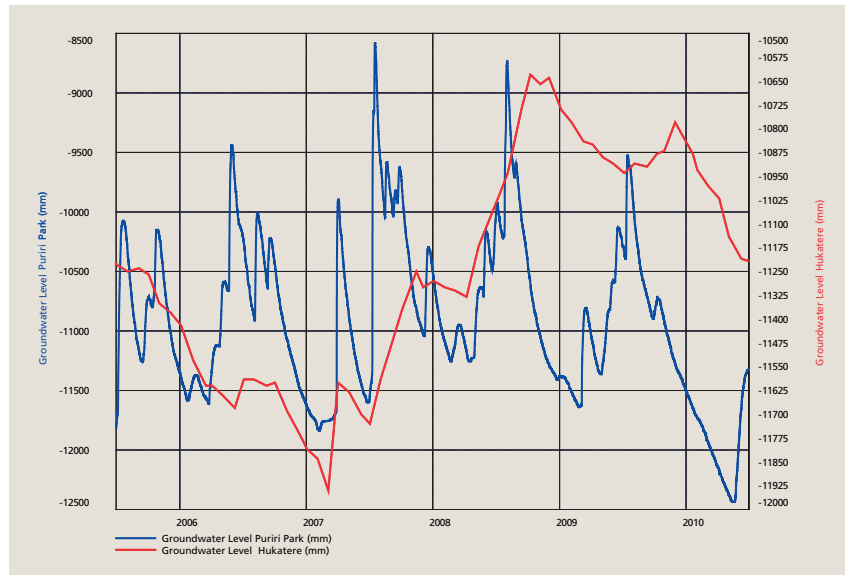
- Carrying out investigations into the water resources of 'at risk' aquifers.
- Operating a region-wide water quality network for the measurement, recording and reporting of groundwater quality trends.
- Collecting water use records and measuring stream flows, groundwater and lake levels associated with significant water abstractions.
- Report the results from the SoE monitoring programmes in the annual monitoring report and make available on the Council's website at www.nrc.govt.nz/soe by 31 October each year – (loaded six weeks late).

Groundwater level sites



drought conditions through the summer – the water level in the aquifer was almost a metre below the minimum water levels recorded in the last couple of years.

Hukatere piezo 2 (39 metres below ground level) is located in the Aupōuri sand/shell bed aquifer. This aquifer buffers seasonal variations and shows long-term rainfall variations with only minimum seasonal change.



Aquifer Management Boundaries and recharge estimates were completed for 5 alluvial/basalt aquifers (Pakaraka, Okaihau, Waimate North, Moerewa and Marsden/Ruakaka), and 6 small coastal aquifers (Teal Bay, Tauranga Bay, Church Bay, Kowharewa Bay, Ohawini Bay and Taiharuru).

Groundwater quality

The Council monitors groundwater quality and change in water quality over time (trends). Seven sites are monitored quarterly (since 1996) through the National Groundwater Monitoring Programme. Samples are taken from the bores located at Houhora, Paparore, Ahipara, Kaikohe, Tutukaka, Glenberrie and Tara and analysed for major minerals, chemicals and metals.

In addition, as part of the SoE groundwater monitoring programme, 29 sites are sampled four times a year. The aim of this programme is to assess the water quality in Northland and identify any changes over time.

While nitrate and bacteria (*E. coli*) concentrations are probably the most important indicators of the impact of human activities on groundwater quality, many other measurements are made. These include pH, total dissolved solids, pesticides and some metals, e.g. arsenic and iron. The map opposite shows the locations of groundwater quality sites monitored in Northland.

In general, groundwater in Northland is of a high enough quality that it can be consumed without treatment. During 2009-2010, the results of groundwater quality monitoring indicated that the majority of samples complied with the New Zealand drinking water standards. However, some sites were found to have elevated levels of iron, manganese, bacteria and nitrate.

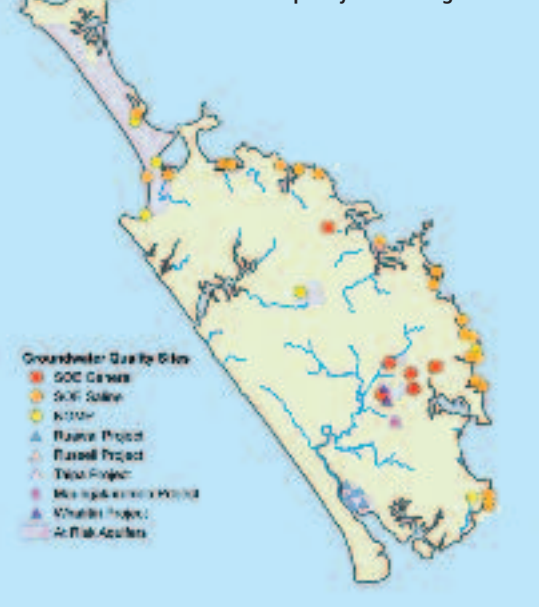
Ten of the monitoring sites had median iron concentrations above the aesthetic guideline value of 0.2 mg/L. In regards to manganese concentrations, 13 monitoring sites had median values higher than the aesthetic guideline value of 0.04 mg/L, four of them having concentrations very close to the maximum recommended drinking water level of 0.4mg/L. Elevated concentrations of iron and manganese in groundwater are commonly the result of natural processes.



Groundwater Monitoring in Northland during 2009-2010

- In general, groundwater in Northland is of a high enough quality that it can be consumed without treatment.
- 36 sites (that is, wells or bores) were monitored for groundwater quality in Northland; 7 of them as part of the National Groundwater Monitoring Programme and 29 as part of the Regional Groundwater Quality SoE Programme.
- 5 specific groundwater investigations were carried out on aquifers – Ruawai, Russell, Taipā, Whatitiri and Maungakaramea, where a total of 24 sites were monitored.
- 83 sites were monitored for groundwater levels.
- 98 new bores (or wells) were registered in the Council's database.
- 197 resource consents for groundwater use were monitored for compliance with consent conditions.
- 8 sites were age tested to determine the average age of the groundwater in certain aquifers in the region.

Groundwater quality monitoring sites



Groundwater

Two monitoring sites in Pataua North and Cable Bay showed elevated chloride and sodium concentrations during summer period. These sites are located in close proximity to the sea and likely to be influenced by saltwater. During summer concentrations of sodium and chloride are above drinking water guidelines, however neither of these bores are used for domestic use.

Results of bacterial analysis undertaken during 2009-2010 indicate that 15 groundwater sites have bacteria present above the drinking water guideline value of <math><1/100\text{mL}</math>. However, only one of these sites, located in Taipā, showed repeated bacterial contamination. Other nearby bores are compliant with the guidelines so this appears to be an isolated event and the Regional Council is investigating this further.

Monitoring has also shown that average nitrate concentrations at all groundwater quality sampling sites are well below the drinking water limit of 11.3 mg/L-N except for one site at Maungakaramea. Nitrate concentrations at this site exceeded the drinking water limit on two occasions in 2009. The elevated bacteria and nitrate levels are due to land use/human activity, and specific investigations are carried out by the Council when elevated levels are recorded.

Compliance monitoring

Bore compliance monitoring

Bores are holes drilled vertically to pump groundwater. All drillers have to provide the Council with details of bores they have drilled (e.g. depth, diameter, location), and these bores are then registered on the Council's database. There are in excess of 4000 bores in the database, 98 of which were registered during 2009-2010.

All bores drilled under resource consent from the Council are monitored to ensure they comply with the conditions of their consent. During 2009-2010, 20 consented bores were monitored and 15 were found to be fully compliant. Of the remainder, five were found to have minor non-compliance. No formal enforcement action was taken in 2009-2010. The Council will continue to inspect for compliance with bore construction requirements in all the remaining new bores.

Specific groundwater investigations

Aquifer systems

The Council undertakes a specific groundwater investigation where a potential issue has been identified, e.g. elevated nitrate or increased risk of saltwater intrusion in coastal areas. High salinity may be associated with saltwater intrusion in low-lying coastal aquifers (the movement of saltwater into fresh groundwater). There are currently five aquifers in Northland that are subject to further investigation – Ruawai, Taipā, Maungakaramea, Russell and Whatitiri.

Ruawai and Taipā

Important for: irrigation, stock and public drinking water supply.

Issues: water quality degrading and risk of saltwater intrusion.

Test results: Ruawai – six bores are currently monitored for saline indicators, bacteria and iron on quarterly basis. The results of sampling over the 2009-2010 period indicate no



significant changes in water quality but chloride, sodium and iron concentrations remain elevated. **Taipā** – four bores were sampled on quarterly basis for chloride and nitrate concentrations. During 2009-2010, there was no significant variation in chloride or nitrate concentrations. Nitrate concentrations are below the NZ Standard but elevated in two sites and the Council will continue to monitor.

Russell

Important for: domestic use.

Issues: risk of saltwater intrusion.

Test results: four bores are currently monitored for saline intrusion on monthly and quarterly basis. The results of monitoring undertaken during 2009-2010 show no significant change in water quality and no increase in saltwater intrusion in Russell.

Maungakaramea

Important for: domestic use, stock drinking water and irrigation.

Issues: elevated nitrate concentration in groundwater.

Test results: four bores are currently monitored in Maungakaramea on monthly basis. The results from the 2009-2010 period indicate a reduction in nitrate concentrations in three bores and an increase in one. The concentrations are still elevated but remain under the New Zealand drinking water standards of 11.3 mg/L-N. The Council will continue to monitor.

Whatitiri

Important for: horticulture, stock drinking water.

Issues: elevated nitrate concentration in groundwater.

Test results: in collaboration with Waimarie Marae Based Nursery, six bores are currently being monitored for nitrate levels. The results of monitoring undertaken during 2009-2010 indicate elevated nitrate levels in two bores, potentially as a result of fertiliser use and land use changes. The results are still under the health-related drinking water guideline and the Council will continue to monitor and investigate.

Age testing

During 2009-2010, eight bore sites were sampled to determine the average age of groundwater. Understanding the mean age of groundwater is important for interpreting the water quality results and the potential effects of land use on groundwater quality. Results not available at time of publication.