



View from the Glenure Hill, 2009

Balfour Groundwater Quality Project

Key Points

- The Balfour groundwater quality project is a collaborative project between Environment Southland, the Primary Sector Water Partnership and local landowners to address consistently high nitrate concentrations in the groundwater south-west of the Balfour Township.
- A working group was established in 2009 to better understand the extent, severity and causes of the nitrate concentrations in the groundwater and to develop a strategy for the future.
- Nitrate concentrations appear to have been high for at least 10 years. There is evidence these concentrations are increasing and the affected area is getting larger.
- There is no evidence that any single (or even a number of) point source discharges or changing land use and land management practices are responsible for the high nitrate levels.
- The aquifer appears to be particularly vulnerable to the effects of normal land use activities.
- To minimise further contamination, a range of farm management practices and ongoing monitoring needs to be undertaken on a regular basis.

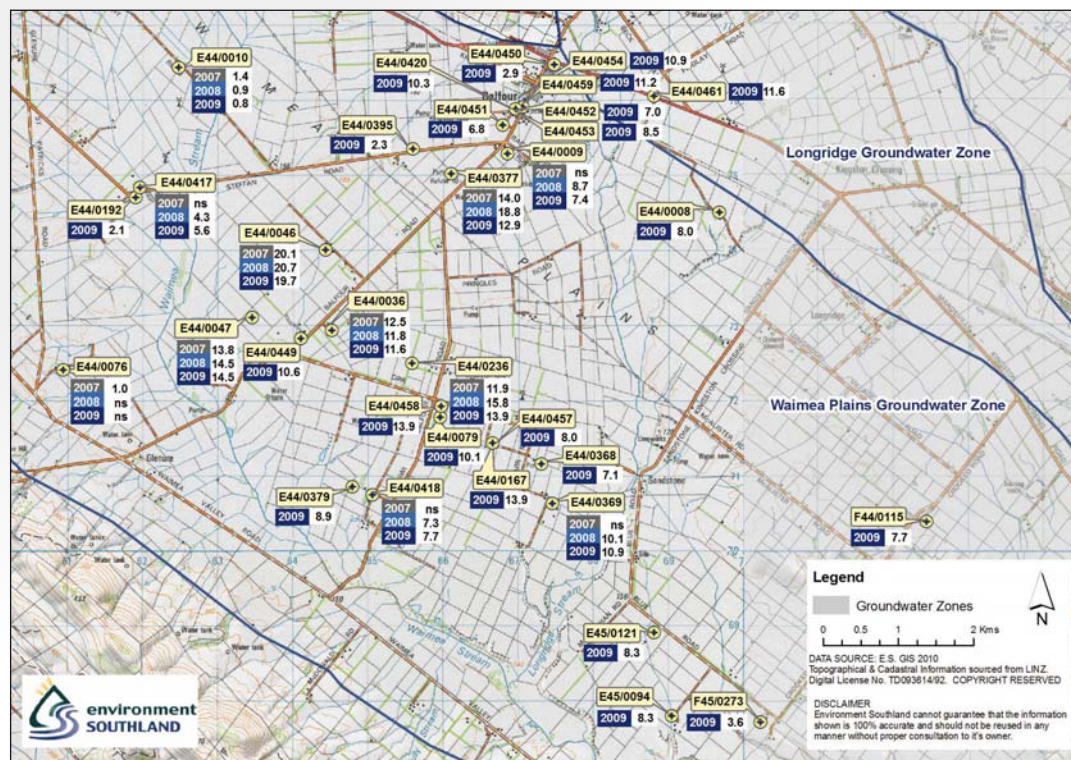


Figure 1: Map of the annual snapshot survey nitrate-N results in mg/l (note "ns" means no sample taken).

Project Overview

Environment Southland, the Primary Sector Water Partnership¹ and local landowners are collaborating on the Balfour groundwater quality project to address consistently high nitrate concentrations in bores south-west of the Balfour township.

High nitrate levels can pose a risk to human health if the water is consumed. Bottle-fed babies under six months of age are particularly at risk, so water high in nitrates is not suitable for infant formula. Elevated nitrate concentrations can also affect surface water quality by causing excessive weed growth, and can be toxic to aquatic life.

Following preliminary work by Environment Southland into the extent, severity and causes of the high nitrate concentrations in the Balfour area, the Primary Sector Water Partnership selected the area as one of five national focus catchments. A meeting with the local community was held in June 2009, where a small working group was established involving landowners, primary sector representatives and Environment Southland staff to oversee the project. The group has been working together to further define the extent and severity of elevated nitrate concentrations, investigate potential causes and develop a plan of action for reducing nitrate concentrations in the area.



An ES Environmental Technical Officer inspects one of the Waimea Plains Aquifer groundwater level sites.

Main Activities 2009/10

During October 2009 a snapshot water quality survey was carried out. Funding from the Primary Sector Water Partnership enabled the survey area to be significantly expanded from the previous snapshot surveys Environment Southland carried out in 2007 and 2008.

A piezometric survey was completed in February 2010 to gain a better understanding of the groundwater flows in the area.

To enable the working group to assess past and present land use practices that could be influencing nitrate levels, local fertilizer representatives collated information from farmers on potential point source nitrate discharges, historical and current land use information and nutrient management practices.

Key Findings

- The Balfour area contains a relatively thin unconfined gravel aquifer, which is mainly recharged from localized rainfall.
- Groundwater discharge is into the nearby Waimea and Longridge Streams.
- These streams also outline the aquifer boundary. The northern aquifer boundary is in the Steffan Road area.
- The groundwater flow is generally towards the south with deep and shallow circulation systems operating.
- Isotope samples indicate groundwater within the study area has a mean residence time of 3 to 7 years.
- 25% of the 32 bores sampled in the 2009 annual snapshot survey contained nitrate concentrations which exceeded the maximum allowable value (MAV) contained in the Drinking Water Standards of New Zealand. Nearly half of the bores sampled had nitrate concentrations which were greater than 75% of the MAV.
- Nitrate concentrations show a statistically significant increasing trend in 3 of the 4 regular monitoring bores within the affected area (maximum monitoring period is 10 years). The remaining bore, which shows no statistically significant trend, has had nitrate concentrations approximately twice the MAV for the past 9 years.
- The area affected by high nitrate concentrations appears to be extending south.
- The high groundwater nitrate concentrations are causing elevated nitrate levels in the Waimea and Longridge Streams.
- The land use survey did not identify any potential point sources for the elevated nitrate concentrations in groundwater and did not identify any significant risks from changing land use or farm management practices.
- Nutrient budgets were prepared for over 95% of the land area using Overseer®. The average nitrate leaching concentration was calculated to be 3.9mg/L which is well within the MAV.





Conclusions

The nitrate concentrations in groundwater in the Balfour area appear to have been elevated for at least 10 years and there is evidence that these concentrations are increasing and the affected area is getting larger. In addition, the high groundwater nitrate concentrations are elevating nitrate levels in the Waimea and Longridge Streams.

Unsurprisingly, given the size of the affected area, there is no evidence that a single (or even a number of) point source discharges are responsible for the elevated nitrate concentrations, which suggests non-point source discharges are the cause (ie diffuse pollution from general land use activities). Based on the information obtained through landowner surveys, there is no evidence that the elevated nitrate concentrations can be related to land use change or changes in farm management practices. It is therefore concluded the elevated nitrate concentrations reflect diffuse pollution from the intensive land use within the catchment and historical farm management practices that were not specifically designed to minimise nitrate losses to groundwater.

It is apparent that the hydrogeological setting in the Balfour area is particularly vulnerable to the impacts of human activities on water quality. The combination of slow groundwater flow and aquifer recharge from localised rainfall increases the potential for nitrate to accumulate within the aquifer. Normal land use activities and farm management practices that would have minor effects on groundwater quality in other areas, appear to have more significant effects in this location and potentially in others like it.

Reduction of nitrate levels in groundwater will not occur immediately. To minimise further contamination of groundwater within the catchment, a range of farm management practices and on-going monitoring needs to be undertaken on a regular basis.

Where to from here?

The proposed way forward includes:

- Continued science and monitoring
 - Ongoing yearly snapshot surveys
 - Increased quarterly water quality monitoring at bores within the affected area
 - Regular reviews of the water quality monitoring data
- Advice and information on:
 - Land use practices to reduce nitrate losses (see information below)
 - Drinking water quality
- Policy
 - Environment Southland is in the process of reviewing the regional plans that deal with activities generating nitrate and is about to commence a collaborative process with its communities about how to respond to water quality issues caused by diffuse pollution from general land use activities.

The Primary Sector Water Partnership will be holding workshops and field days in the Balfour area in March 2011, to discuss land use practices that will reduce nitrate leaching. Various information sheets will be available in conjunction with these demonstration days.

The next water quality survey will be completed during November 2010. An Environment Southland representative will contact you if your bore is to be included in the survey.



Further information

You can get copies of the full technical reports this factsheet is based on, from Environment Southland (contact details below).

If you're concerned about the quality of your drinking water, we recommend you contact Public Health South or Environment Southland. Public Health South can provide information about the health risks associated with high nitrate levels and how to manage these, while Environment Southland can give you the monitoring results for bores in your area and advice on how these results should be interpreted.

If you would like another community meeting held to discuss the information in this factsheet in more detail, please contact the Primary Sector Water Partnership or Environment Southland.

References

Ministry of Health, 2008. *Drinking-water Standards for New Zealand 2005 (Revised 2008)*. Published by Ministry of Health, Wellington, New Zealand.ⁱⁱ

Pyke, N; Millar, R; Green, K; Risk, J and Wilson, K 2010. *Report on the Balfour Groundwater Quality Project*. Unpublished report prepared by the Foundation for Arable Research, Environment Southland and Ballance Agri-Nutrients.

Wilson, K L, 2010. *Groundwater Report on the Balfour Groundwater Quality Study*. Published by Environment Southland, July 2010, Invercargill.

Footnotes

ⁱ The Primary Sector Water Partnership is a group of major primary sector organisations (Foundation of Arable Research, Beef and Lamb NZ, Fonterra, Federated Farmers and Dairy NZ) who are committed to working in partnership with landowners and central/regional government towards sustainable freshwater use through a variety of mechanisms.

ⁱⁱ These standards are the basis for the management of groundwater quality in the region and are included as an objective in the Regional Water Plan for Southland 2010.

Contacts

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