# NGAWHA GEOTHERMAL FIELD

**Highlights 2001-2002**

- The geothermal power station operating at Ngawha is subject to a comprehensive environmental monitoring programme.
- The monitoring carried out over the period 1 July 2001 to 30 June 2002 did not indicate any significant changes to the local environment in terms of air, water and soil quality as a result of the geothermal fluid take or discharges from the power station.
- The vegetation in the wetland area immediately below the holding pond at the NG9 well site, which had been damaged or killed as the result of early discharges from the pond, is recovering. Populations of mudfish in the area also seem to be increasing, however, this is more related to higher water levels during 2001 and therefore better conditions for mudfish breeding.

## Background

The Ngawha geothermal field is located approximately 5 km east of Kaikohe. It covers an area of between 25 to 50 $km^2$, and is the only high temperature geothermal field in New Zealand outside of the Taupo Volcanic Zone.

The geothermal field lies within a small topographic basin and is centered on the town of Ngawha Springs. At the surface, the geothermal system consists of hot water springs and gas seepages. The productive reservoir consists of the permeable volume within the greywacke basement, which is thought to be more than 1,000 m thick.

There are about 20 hot springs in the area, many of which are used as baths. Most of these occur in a small area in Ngawha Springs. They are a sacred taonga to the local hapu and all of Ngapuhi.

The waters in the springs are typically between 40 to 50°C, slightly acidic and give off a weak smell of hydrogen sulphide. The water chemistry includes high concentrations of boron, ammonia and bicarbonate, and mercury mineralisation. Given its water chemistry, and its geology, the Ngawha geothermal field is quite different to other geothermal fields in New Zealand.

**Aerial view of the Maori and Spa Baths with Lake Tuwhakino on the upper left (Tricia Scott)**

The Ngawha Geothermal Field is tapped by a single power station, which started to produce power in July 1998. The power station was constructed by a joint venture between Top Energy and the Tai Tokerau Maori Trust Board. Up to 10,000 tonnes of geothermal fluid per day can be taken from two "production wells" - NG9 and NG12, and is used to generate around 8MW (net) of electricity. The used fluid is then returned to the ground via two "reinjection wells" - NG11 and NG18.

## Monitoring

Under the resource consents for the power station, the consent holder was required to undertake at least 12 months of "baseline" monitoring in the Ngawha area before it could start generating power. More than 18 months of comprehensive baseline data were collected before the production wells were purged and commissioning of the power station began.

Since then, the joint venture has been comprehensively monitoring the environmental effects of the power station in line with various consent requirements and the recommendations of a "Peer Review Panel". This panel is made up of four professionals with expertise in geothermal science, water quality, terrestrial and aquatic ecology, and a representative of the tangata whenua.

Monitoring in the period 1 July 2001 to 30 June 2002 can be summarised as:

### *Geothermal and Groundwater*

**Aims**

1. To monitor the Ngawha thermal features.
2. To build on previous monitoring, by sampling and analysis, for temperature variation, mass flow rates of chemical species in solution, gas species discharged and total deep water reservoir fluid discharged at the surface in the Ngawha Springs locality.
3. To establish whether any long term changes are taking place.

**Summary Results**

1. The mean annual temperatures for April 2001 to March 2002 were higher than in the previous year for Jubilee, Tiger, Universal and Jupiter bath.
2. Chloride content of Universal declined over the past year. However, the annual rate of decline has slowed. The chloride change could be part of a steady decline since the 1980s.
3. The gas flow and gas chemistry in Universal did not change.

4. The chloride concentration and the chloride flux in the total outflow were low due to changed management practices at the Waiariki Baths.
5. Rates of inflow to Universal and Jupiter Baths appear to be decreasing with time.

## *Stream Receiving Thermal Discharges*

**Aims**

1. To monitor changes of streams and creeks draining the Ngawha thermal area.
2. To determine temperature variation, mass flow rates of chemical species in solution, gas species discharged and total deep water reservoir fluid discharged at the Ngawha Spa locality.
3. To establish, together with data from earlier sampling, the variability of these parameters and any long-term changes taking place.

**Summary Results**

1. Flow variations and chloride flux changes were within baseline data.

## *Lakes*

**Aims**

1. To monitor the water levels of Lake Waiparaheka and Lake Ngamokaikai.
2. To record ambient temperatures monthly.

**Summary Results**

1. Lake levels, temperatures, and chloride concentrations were not significantly different to the baseline or historic data.

## *Groundwater*

**Aim**

1. To monitor ground water temperature, chemistry and levels for comparison with baseline data to identify any geothermal intrusion.

**Summary Results**

1. Temperature variations in groundwater were seasonal.
2. Groundwater levels were consistent with rainfall responses.
3. Mean arsenic concentrations at all three monitoring bores met the New Zealand drinking water standard.
4. Mercury concentrations measured were all below the detection limit (0.08 ppb).

## *Ecosystem*

**Aim**

1. To monitor receiving waters downstream of the Ngawha geothermal development to determine whether the operations are having any effect on water quality.

**Summary Results**

1. All parameters measured were within the baseline range. No changes, trends or elements of ecological concern were detected in the monitoring undertaken.

## *Water Quality*

**Aim**

1. To monitor water quality, prior to and during pond discharge, both natural and controlled.
2. To monitor water quality in streams receiving water from the power station site.

**Summary Results**

1. Boron concentrations decreased at the Bannister Road Bridge, NGSDP and NG9WI sampling sites over the last six months.

## *Air Quality and Meteorology*

**Aim**

1. To continually monitor weather conditions in the Ngawha Springs area.
2. To monitor air quality in the vicinity of the Ngawha geothermal development to determine whether the operations are having any effect on air quality.

**Summary Results**

1. Meteorological monitoring showed weather patterns similar to the baseline apart from rainfall, which was approximately three times higher than the baseline monitoring undertaken from 1997 to 1998.
2. Hydrogen sulphide measurements in the village were within the baseline range for the prevailing weather conditions.

Sampling for the burgundy mudfish *Neochanna heliosis* has been implemented primarily to establish baseline trends in numbers of this endangered mudfish, but also to assess whether there are any long-term impacts from the geothermal water discharge (which contained high boron concentrations) that occurred in 1998. Sampling over the last two years has shown an increasing number of mudfish being caught for each survey. This is thought to be more related to higher water levels in 2001 and, therefore, better conditions for mudfish breeding. Monitoring will continue in the future to see if such trends continue, and to further quantify the various influences on mudfish populations.

Most of this monitoring is either carried out or co-ordinated by an environmental consultant employed by the consent holder. The consultant is accompanied by a Council monitoring officer during some of her monthly stream water quality and geothermal spring sampling visits to check that the monitoring is being carried out according to approved standards. Another Council officer liases with this consultant and other representatives of the consent holder on a regular basis. This includes six-monthly "audit checks" on consent compliance. NIWA (Auckland) monitor the air quality and weather. All the testing is carried out at laboratories with registered quality assurance procedures.

The results of the monitoring are routinely provided to the Council and are also audited by the Peer Review Panel every six months.

**Ngawha Spa Mineral Pools**