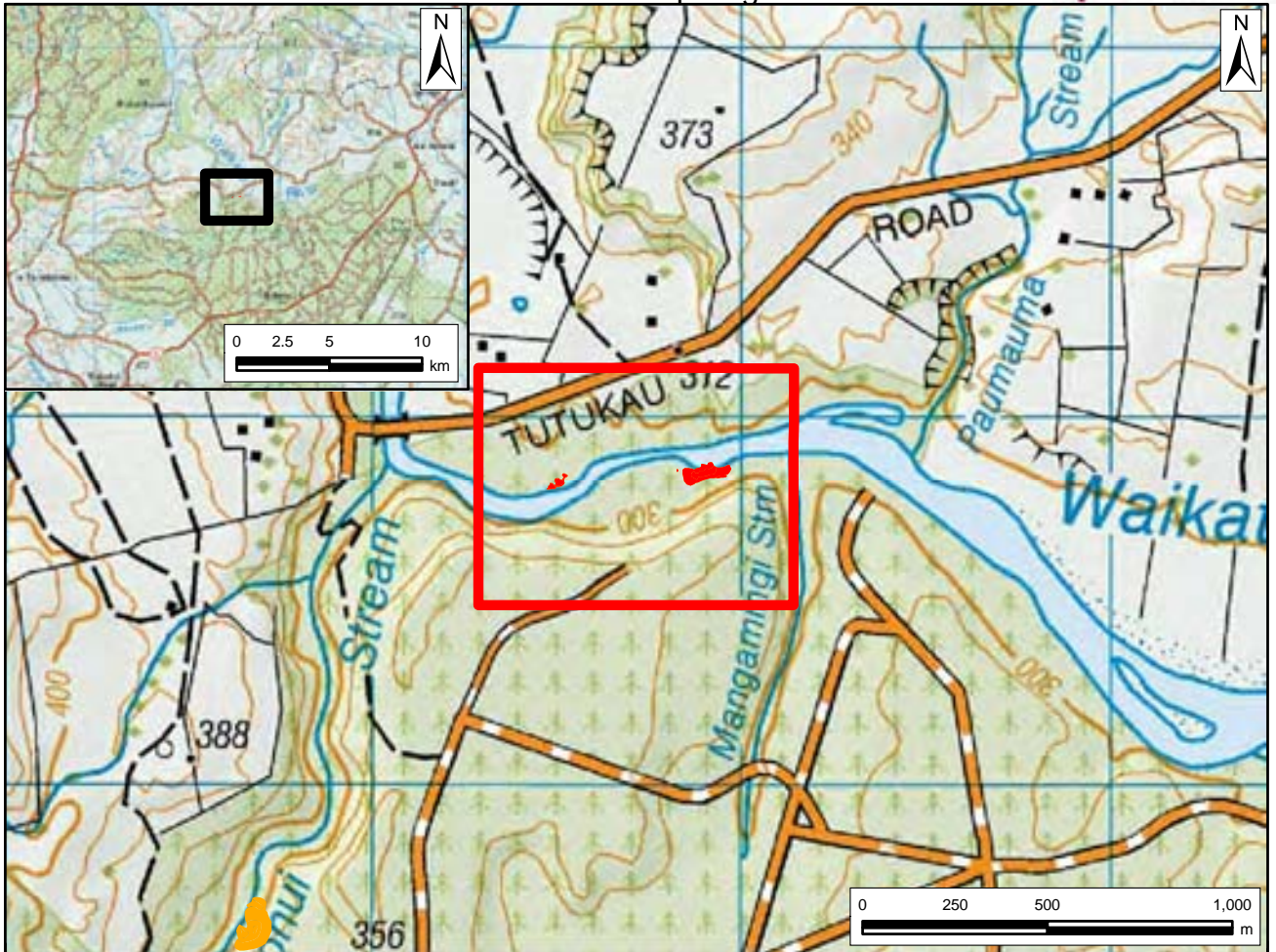


1.8 NGATAMARIKI GEOTHERMAL FIELD

List of Geothermal Sites

NMV01	Waikato River Springs
NMV02	Ngatamariki



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WAIKATO RIVER SPRINGS

Site Number: NMV01¹
Grid Reference: NZTopo50 BF37 779 319
GPS Reference: NZTM E1877904 N5731853
Local Authority: Rotorua
Ecological District: Atiamuri
Geothermal Field: Ngatamariki
Bioclimatic Zone: Lowland
Tenure: Protected (Ngatamariki Hot Springs Scenic Reserve administered by DOC)
Altitude: 295 m
Extent of Geothermal Habitat: c.0.6 ha
Extent of Geothermal Vegetation: c.0.4 ha
Date of Field Survey: 2-3 February 2011

Code	Type	Landform	Extent
08.08 08.08.02	Reed sweet grass-dominant grassland Reed sweet grass-raupo-<i>Schoenoplectus tabernaemontani</i> grassland Reed sweet grass, raupo and <i>Schoenoplectus tabernaemontani</i> dominate the margins of a geothermally influenced pool (temperatures up to 45°C in the northern pools at the time of survey). Grey willow, blackberry, harakeke, Chinese privet, bracken and radiata pine are emergent on the drier margins. Other species present include <i>Cyperus ustulatus</i> , mercer grass and localised patches of blackberry.	Stream margins, pond margins	c.0.4 ha
08.08.03	Raupo/reed sweetgrass-<i>Schoenoplectus tabernaemontani</i> swamp millet grassland Occasional raupo is emergent over reed sweetgrass (<i>Glyceria maxima</i>), <i>Schoenoplectus tabernaemontani</i> , and swamp millet. Other species present include <i>Carex maorica</i> , lotus, <i>Cyperus ustulatus</i> , mint, and pohue.	Wetland	<0.1 ha
22.01 22.01.01	Geothermal water Geothermal water Hot spring, hot stream, pools. In cooler water, water lily (<i>Nymphaea alba</i>) is common.	Stream, pools	c.0.2 ha
28.01 28.01.01	Nonvegetated raw-soilfield Nonvegetated raw-soilfield Geothermally-heated soil.	Terraces	<0.1 ha

Indigenous Flora: Plants of *Christella* aff. *dentata* (“thermal”) (classed as ‘At Risk-Declining’ in de Lange *et al.* 2009) have previously been recorded at this site (Wildland Consultants 2006). No specimens were located during the current survey but the entire site couldn’t be inspected due to high river conditions and the population probably still exists.

Fauna: North Island fernbird (classed as ‘At Risk-Declining’ in Miskelly *et al.* 2008) has been recorded at this site (Wildland Consultants 2006). Common indigenous and exotic species including Californian quail, greenfinch, blackbird, tui, yellowhammer, goldfinch and fantail are also present.

¹ Previously identified as U17/29 in Wildland Consultants (2004).

Current Condition (2011 Assessment): Weed species such as reed sweet grass dominate the wetland areas of this site.

Threats/Modification/Vulnerability:

Invasive pest plants (2011 Assessment): Chinese privet (1-5% cover), radiata pine <1% cover), reed sweet grass (75-100% cover), grey willow (1-5% cover), buddleia (1-5% cover), and blackberry (1-5% cover) are all present at this site.

Human impacts (2011 Assessment): Radiata pine plantations border the southern area of this site and forestry operations (silt and sediment runoff, harvesting and replanting) may result in further degradation of its ecological values.

Grazing (2011 Assessment): Grazing is not an issue at this site.

Adjoining land use (2011 Assessment): Waikato River marginal strip; plantation forestry.

Site Change:

Recent change: The water levels of the river were high during the 2011 field survey, so overall change is difficult to assess. However the site appeared similar to earlier surveys.

Historical: This site is too small to see any evidence of change since 1941 (Historical photos: SN 172 Run 1168 Photos 15-16, 1941) and the site is subject to water level fluctuations in the Waikato River.

Management Requirements: Chinese privet (on the southern side of the river), grey willow and radiata pine should be removed from this site before weed management becomes an issue. The pest plant reed sweet grass dominates this site but its control may be insurmountable as infestations are extensive along this section of the Waikato River.

Significance Level: Regional (Table 1 - Criteria 3, 5, 9; Table 2 - Factor 12)

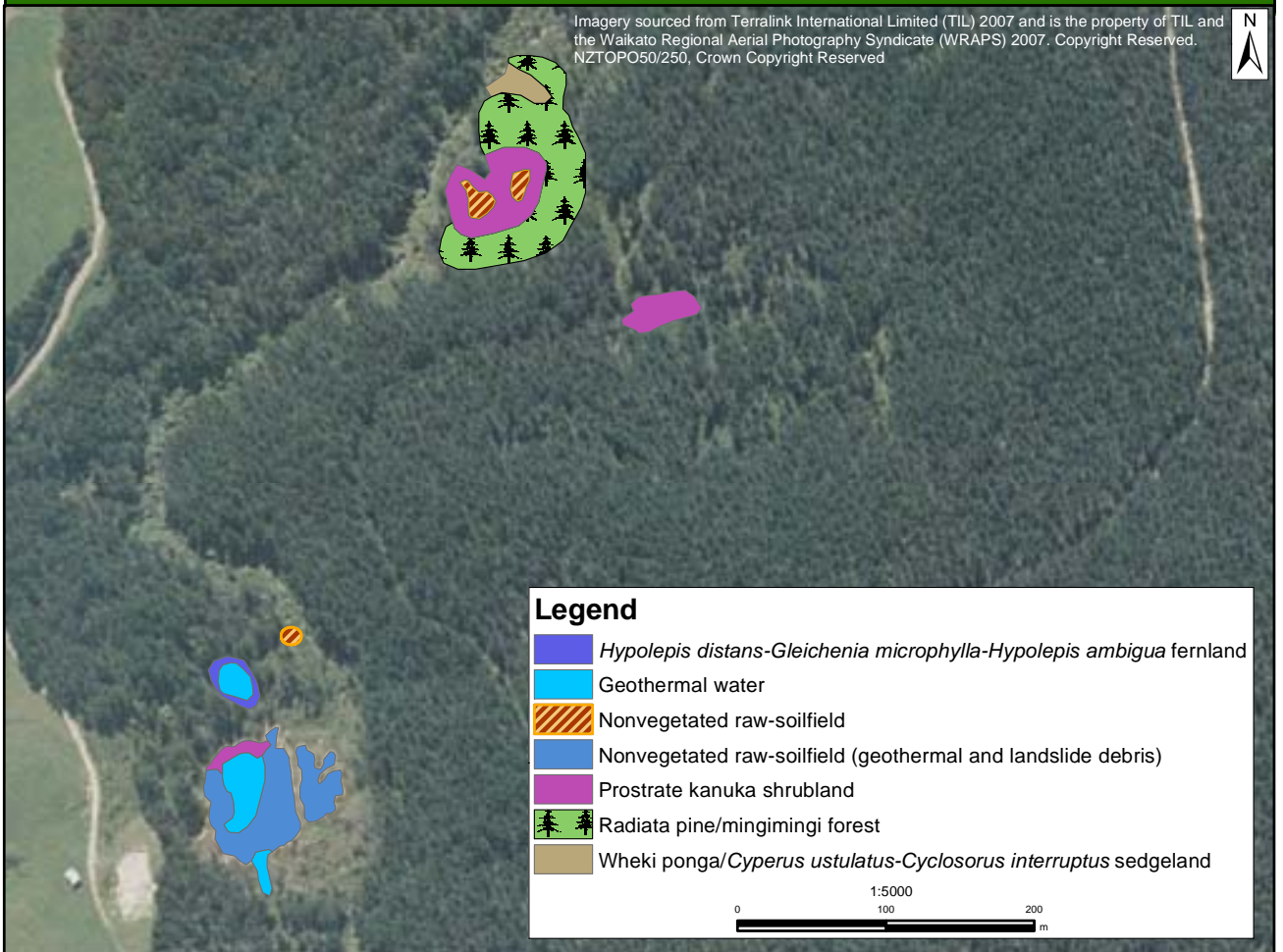
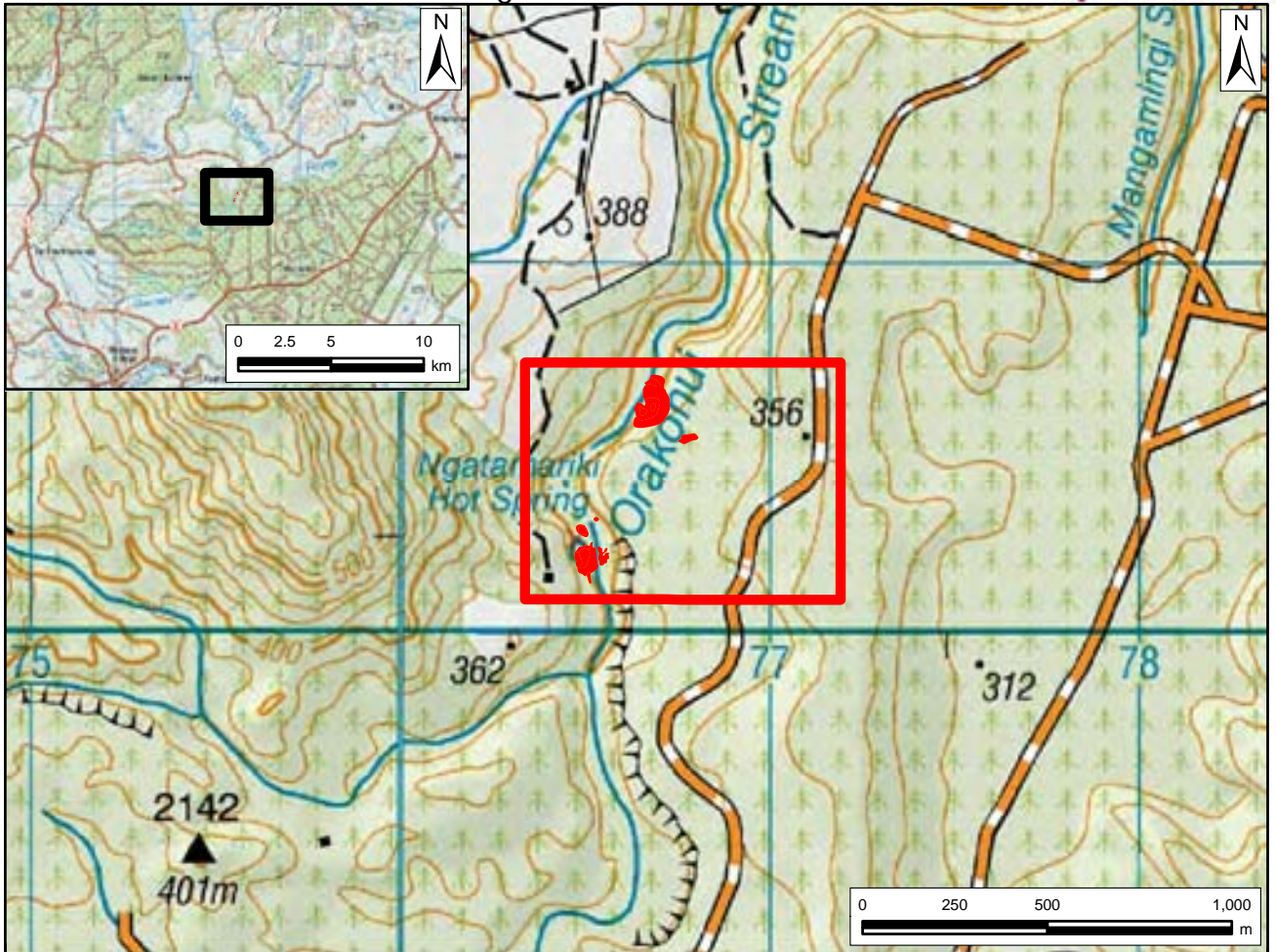
Significance Justification: This site is of regional significance because it contains a small population of *Christella* aff. *dentata* (“thermal”), which is an ‘At Risk’ species that is known from only 14 sites in New Zealand.

Notes: Part of this site was recorded as Lake Ohakuri/Tainui Road in Beadel & Bill 2000 and Wildland Consultants 2004.

The water temperature in one spring was 65°C with a flow rate of 1 litre a second. The water temperature in one stream was 54°C. The spring was depositing small amounts of sinter. Water flow was c.2 m/second (Wildland Consultants 2006).

This site was formerly identified as being of national significance (Wildland Consultants 2006) due to the presence of *Christella* aff. *dentata* (“thermal”) which, at that time was classified as ‘Chronically Threatened’ (de Lange *et al.* 2004).

References: Beadel & Bill 2000; Wildland Consultants 2004 & 2006.



NGATAMARIKI

Site Number: NMV02¹
Grid Reference: NZTopo50 BF37 767 306
GPS Reference: NZTM E1876675 N5730627
Local Authority: Taupo
Ecological District: Atiamuri
Geothermal Field: Ngatamariki
Bioclimatic Zone: Submontane
Tenure: Protected (Ngatamariki Hot Springs Scenic Reserve) and unprotected private land.
Altitude: 310 m
Extent of Geothermal Habitat: c.1.7 ha
Extent of Geothermal Vegetation: c.1.5 ha
Date of Field Survey: 2 February 2011 (northern part of site is based on survey undertaken on 25 May 2007)

Code	Type	Landform	Extent
01.05 01.05.04 ²	Exotic pine forest Radiata pine/mingimingi forest Radiata pine forms the canopy over mingimingi, <i>Histiopteris incisa</i> , bracken, kiokio and blackberry. Several patches of <i>Dicranopteris linearis</i> were recorded in May 2007, a species not previously recorded at this site.	Hillsopes	c.0.6 ha
05.01 05.01.01	Prostrate kanuka-dominant shrubland Prostrate kanuka shrubland Prostrate kanuka forms a shrubland around the hot pools and seepages with mingimingi, prickly mingimingi and manuka scattered throughout, as well as local patches of <i>Baumea teretifolia</i> and <i>Cyperus ustulatus</i> . The ground cover is sparse, with small patches of mosses (including <i>Campylopus capillaceus</i>) and <i>Lycopodiella cernua</i> . Radiata pine are common on margins.	Alluvial terraces	c.0.4 ha
07.05 07.05.12	Mixed fernland <i>Hypolepis distans</i>-<i>Gleichenia microphylla</i>-<i>Hypolepis ambigua</i> fernland The margins of the hot spring are covered with a mixed fernland of <i>Hypolepis distans</i> , <i>Gleichenia microphylla</i> , <i>Hypolepis ambigua</i> , bracken, with occasional kiokio and manuka.	Hot spring margins	<0.1 ha
09.02 09.02.05	<i>Cyperus ustulatus</i>-dominant sedgeland Wheki-ponga/<i>Cyperus ustulatus</i>-<i>Cyclosorus interruptus</i> sedgeland <i>Cyperus ustulatus</i> dominates vegetation surrounding a small hot water stream that flows from a hot water seepage down to the Orakonui Stream. Sixteen clumps of <i>Cyclosorus interruptus</i> , comprising c.122 fronds, were present amongst the <i>Cyperus ustulatus</i> in May 2007. Also present is wheki-ponga, occasional patches of bracken and <i>Histiopteris incisa</i> , and several prostrate kanuka shrubs. This vegetation is surrounded by tall radiata pine plantation forest.	Alluvial terraces	c.0.1 ha

¹ Previously identified as U17/15 in Wildland Consultants (2004).

² Not surveyed in 2011.

Code	Type	Landform	Extent
22.01 22.01.01	Geothermal water Geothermal water Small geothermal pools occur at this site. On the margins there is scattered kiokio, <i>Cyperus ustulatus</i> , <i>Hypolepis distans</i> , bracken, mingimingi, raupo, <i>Histiopteris incisa</i> , wheki, blackberry, prostrate kanuka, pampas, buddleia, grey willow, Yorkshire fog, karamu, koromiko, and radiata pine. <i>Lemna minor</i> and water purslane are present in cooler water.		c.0.2 ha
28.01 28.01.01 ¹	Nonvegetated raw-soilfield Nonvegetated raw-soilfield Sinter with hot pools, mud pools, springs and seepages. A good population of arrow grass present in 2004 in the northern two units of nonvegetated raw-soilfield (this area was not resurveyed during the current study). Scattered plants of prostrate kanuka, manuka, Spanish heath, bracken, <i>Histiopteris incisa</i> , and <i>Lycopodiella cernua</i> are present.	Alluvial terraces	c.0.1 ha
28.01 28.01.04	Nonvegetated raw-soilfield Nonvegetated raw-soilfield (geothermal and landslide debris) Recent geothermal activity in this area has left nonvegetated geothermal and landslide debris on both sides of the stream.	Alluvial terraces	c.0.4 ha

Indigenous Flora:

Sixteen clumps of *Cyclosorus interruptus* (classed as „At Risk-Declining’ in de Lange *et al.* 2009) were recorded in the northern part of this site in May 2007. In May 2007, *Dicranopteris linearis* (classed as „At Risk-Naturally Uncommon’ in de Lange *et al.* 2009) was discovered in the northern part of this site, under radiata pine trees. The latter species had not previously been recorded from this site and is known from only c.24 sites in New Zealand.

Prostrate kanuka (classed as „At Risk-Naturally Uncommon’ in de Lange *et al.* 2009) and *Campylopus capillaceus*, which are both endemic species restricted to geothermal areas, occur in both the northern and southern parts of the site.

Lycopodiella cernua, which is characteristic of geothermal areas, is also present, in both the northern and southern parts of the site.

Psilotum nudum (a plant restricted to geothermal and northern coastal areas) has also been recorded below a waterfall (Ecroyd 1979b). *Psilotum nudum* was not seen during the 2004, 2007, or 2011 surveys, or by Given (1995), but this is may reflect the inaccessibility of the site rather than a population decline.

Fauna:

North Island fernbird („At Risk-Declining’ in Miskelly *et al.* 2008) has been recorded here in the past. Whitehead, fantail, grey warbler, kingfisher, tui, greenfinch, yellowhammer, magpie, and North Island robin are also present.

¹ Not surveyed in 2011.

**Current Condition
(2011 Assessment):**

The site comprises two areas of geothermal features and vegetation that contain plant species of note. The southern end of the site has changed significantly as a result of a hydrothermal eruption, which resulted in the creation of a geothermal pond and a large area of debris. Prostrate kanuka, manuka and *Cyperus ustulatus* are scattered within this area.

**Threats/Modification/
Vulnerability:**

*Invasive pest plants
(2011 Assessment):*

Radiata pine plantation is in close proximity to this site, and some trees have fallen into geothermal vegetation and features. Other adventive plant species present include buddleia (c.1-5% cover), pampas (<1% cover), blackberry (1-5% cover), and Himalayan honeysuckle (<1% cover). Some control work on radiata pine has been undertaken by the Department of Conservation.

*Human impacts
(2011 Assessment):*

This is a reasonably isolated site and human impacts are only likely to occur during future harvesting of the neighbouring pine plantation, which could severely damage the geothermal vegetation. A geothermal power scheme is planned for the Ngatamariki Geothermal Field.

*Grazing
(2011 Assessment):*

Livestock are not a threat to the site.

*Adjoining land use
(2011 Assessment):*

There are pine plantations adjacent to this site.

Site Change:

Recent change:

Geothermal activity has changed the landforms and species composition of the southern end of this site. A hydrothermal eruption has formed a new geothermal lake and mud pools, and deposited hydrothermal eruption debris.

Historical:

1941 aerial photographs (Historical photo: SN 172 Run 1168 Photo 14, 1941) were compared with 2007 aerial photographs. There is a larger buffer between geothermal features and forestry operations, particularly around the southern part of the site. There is more geothermal vegetation (scrub and shrubland) around the geothermal features in 1941. The area of bare ground is also more extensive in 1941. The northern units cannot be readily identified on aerial photographs, but there is a greater buffer of between geothermal features and plantation forests. Geothermal vegetation and habitats is likely to have declined by 10-25%, but may be mostly related to weed invasion, and change of land use to plantation forestry.

**Management
Requirements:**

Radiata pine within geothermal areas and on the margins of the site should be removed. Damage during harvesting operations is a potential threat. Ongoing monitoring should occur due to recent geothermal activity within the site, and energy extraction.

Significance Level:

Regional (Table 1 - Criteria 1, 3, 5, 6, 9; Table 2 - Factors 9, 12)

**Significance
Justification:**

Ngatamariki is of regional significance because it is protected as a Scenic Reserve and is an important habitat for three „At Risk’ species: *Cyclosorus interruptus*, *Dicranopteris linearis*, and prostrate kanuka.

Notes:

Given (1996) assessed the botanical value of many of the geothermal sites in the Waikato Region, and in this study this site was classed as Category B - the second highest category.

Part of Ngatamariki was formerly identified as being of national significance because it provides habitat for *Cyclosorus interruptus* which, at that time, was classified as a „Chronically Threatened’ species (de Lange *et al.* 2004). However, in the most recent revision of the threat classification list, this species is now classified „At Risk’ (de Lange *et al.* 2009).

Ngatamariki is the best quality area of geothermal vegetation in the Ngatamariki Geothermal Field.

References:

Beadel & Bill 2000; Department of Conservation 1997; Ecroyd 1979b; Given 1989, 1995 & 1996; Unpublished Atiamuri PNAP data 1995; Wildland Consultants 2004 & 2007b.