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Development of a framework to align regional development planning with geothermal resource management in the Tauranga Geothermal System, Aotearoa New Zealand.

C.Wells[1]*, Y.Carden[1] ,
GeoExchange NZ[1]* cwells@geoexchnage.nz

INTRODUCTION

Low enthalpy geothermal resources remain underutilised in New Zealand, largely due to limited awareness of their diverse applications and because they are overshadowed by the high temperature systems that the country is globally renowned for. To elevate the profile of low enthalpy geothermal, we developed a framework to present their potential strategic uses to stakeholders.

The genesis of this framework evolved while completing a comprehensive investigation into the geoheat potential of the Tauranga Geothermal System (TGS), commissioned by the Bay of Plenty Regional Council (BOPRC) in 2024.

By overlaying regional growth plans and industrial locations with resource maps, we were able to demonstrate where geoheat utilisation has the most potential, opening the door for effective outreach and investment. This approach highlights that access to clean and affordable heat is an attractive value proposition for economic development of the region.

By effectively communicating these multifaceted benefits, geoheat's profile is rising in the region, now being included in public discussions and local agency strategies.

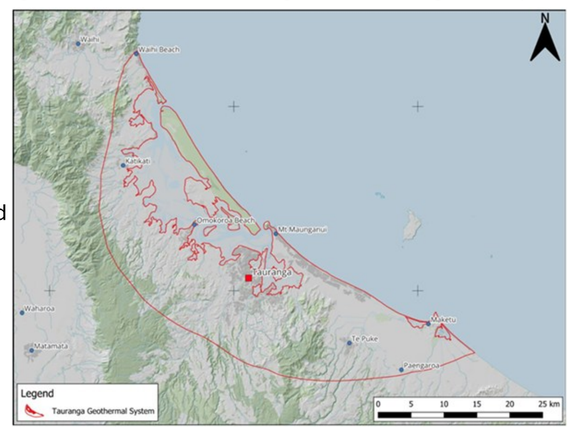


Figure 1. The TGS is a low-temperature, single aquifer system with temperatures ranging from ~15°C to ~80°C. These temperatures have good potential as geoheat, defined as the use of geothermal energy for heating purposes, either directly or indirectly using heat pumps.

MIXED METHOD, MULTI SOURCE APPROACH

This study integrated datasets, models, strategic reports, and stakeholder insights to assess the spatial resource characteristics of the TGS, providing a foundation for informed geothermal resource management and development.

Key data sources included:

- Groundwater investigation by White et al. (2009) — well data, groundwater levels, chemical analysis, geological logs, and temperature data;
- Thermal conductivity and heat flow assessment by Simpson (1987);
- Surface resistivity measurements by Stagpoole and Bibby (1998), identifying a low resistivity zone between Maketū and Te Puke;
- 3D geological model of the western Bay of Plenty and subsurface temperature distributions from geothermal gradients; and
- NZ Aquifer Potential Map (GNS Science, 2017) for regional aquifer insight.

Spatial planning integration: Nine high-growth development zones from SmartGrowth (2024) — a 50-year regional strategy for housing, employment, and wellbeing — were overlaid onto resource maps to identify where geoheat potential aligns with future growth.

System management: At BOPRC's request, an assessment of open and closed loop suitability was included across the region and key development zones, complementing Pearson et al. (2012, 2018), whose reservoir modelling assessed the TGS energy potential and identified upwelling zones. Their findings indicate current geoheat use is sustainable and should continue to be monitored.

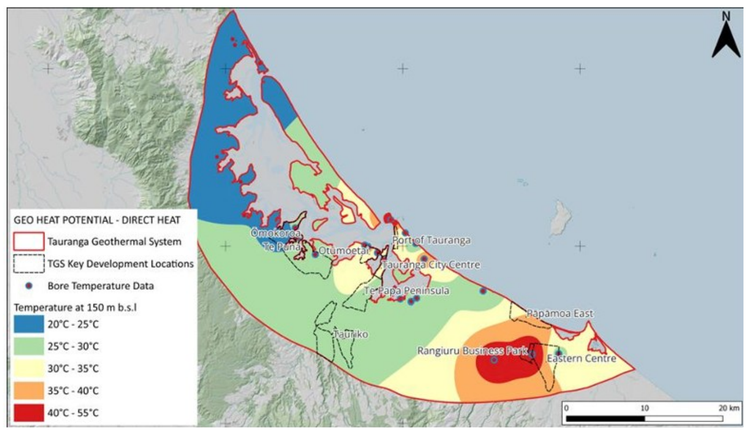


Figure 2. Interpolated temperature at 150 m b.s.l across the western Bay of Plenty

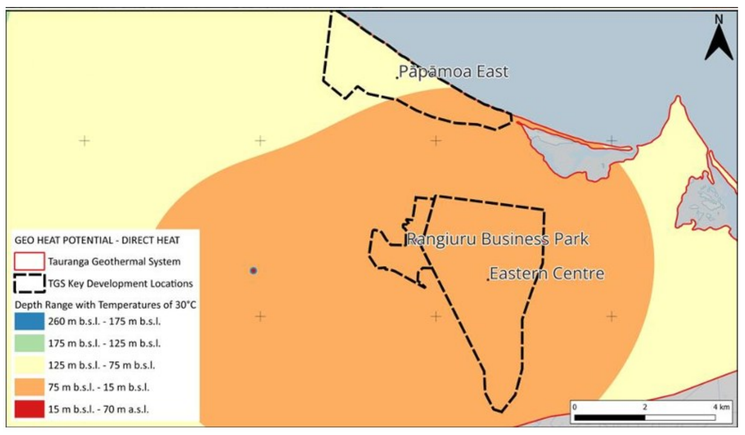


Figure 3. Presence of 30°C temperature at depths. Zoomed in on known future development locations

Table 1 Geoheat Potential of the Future Development Zones/Growth Areas

Potential Development Zones	Geothermal Characterisation					Regulatory Status	Geothermal Application Suitability Assessment					
	Land Use Zoning	GNS Aquifer Potential[1]	Geology	Depth Range Encountered[2]		Consent for Groundwater Take for Consumptive Use[3]	Indirect Heating and Cooling			Direct Heating		
				>30°C	>50°C		Closed Loop System	Open Loop System	District Heating and Cooling	Closed Loop System	Open Loop System	District Heating
Port of Tauranga	Industrial	Good	Sediments over volcanites	<125 m b.s.l	<500 m b.s.l	May not be available reinjection may be required	✓	o	✓	o	o	✓
Tauranga City Centre	Mixed Use Residential/Commercial	Good	Sediments over volcanites	<125 m b.s.l	<500 m b.s.l	Available	✓	✓	✓	✓	✓	✓
Te Papa Peninsula	Mixed Use Residential/Commercial	Good	Sediments over volcanites	<125 m b.s.l	<600 m b.s.l	Available	✓	✓	✓	✓	✓	✓
Tauriko	Residential	Good	Volcanites	<125 m b.s.l	<700 m b.s.l	Available	✓	✓	✓	✓	✓	✓
	Industrial						✓	✓	✓	o	✓	✓
Rangiuru Business Park	Industrial	Good	Sediments over volcanites	<75 m b.s.l	<200 m b.s.l	Available	✓	✓	✓	o	✓	✓
Eastern Centre	Residential	Good	Sediments over volcanites	<75 m b.s.l	<200 m b.s.l	Available	✓	✓	✓	o	✓	✓
Ōmokoroa / Te Puna	Residential	Good	Sediments over volcanites	<175 m b.s.l	<500 m b.s.l	Available	✓	✓	✓	✓	✓	✓
	Industrial						✓	✓	✓	o	✓	✓
Otūmoetai	Residential	Good	Sediments over volcanites	<75 m b.s.l	<450 m b.s.l	Available	✓	✓	✓	✓	✓	✓
Pāpāmoa East	Residential	Good	Sediments	<125 m b.s.l	>150 m b.s.l	Available	✓	✓	✓	✓	✓	✓

[1]Note: New Zealand Aquifer Potential Map Version 1.0,https://www.gns.cri.nz/data-and-resources/new-zealand-aquifer-potential-map-version-1-0/
[2]Note: high uncertainty due to the limited data available, especially when localising the areas with temperatures above 50 °C.
[3]Note: BOPRC

✓ suitable o partly suitable

DISCUSSION AND OUTCOMES

Key finding: Underutilisation of geoheat stems primarily from lack of awareness. Overlaying regional growth plans and industrial zones with geothermal resource maps revealed where geoheat offers the most potential, enabling targeted outreach, investment conversations, and district heating concepts. Conveniently, some of the warmest and most accessible resources align directly with areas of highest development potential.

Impact of visualisation: At first glance, this analysis may appear simple, yet it was precisely these visualisations that prompted meaningful stakeholder discussions, identifying high-value opportunities, exploring district heating concepts, and fostering important new connections. It is also fortunate that some of the warmest and accessible geothermal resources align with areas of high development potential.

Shifting the regional conversation: Prior to this work, geothermal heat was absent from regional energy discussions — evidenced by workshop minutes from Priority One's 2024 energy strategy process, where geoheat does not appear until after this report's release. Following publication and distribution via LinkedIn, newsletters, and public presentations:

- Geoheat is now recognised as a key feature in Priority One's final regional energy strategy, *Our Energy Future* (August 2025)
- BOPRC is using the report to inform updates to their System Management Plan, ensuring anticipated growth in geoheat uptake — particularly as a replacement for gas heating — is managed sustainably and equitably

Why this approach works: Geothermal resources are location-specific and hidden underground, they are not intuitively understood by the public. Simply revealing where opportunities exist, aligned with development zones and paired with resource management recommendations and technology options, has proven highly effective in raising awareness while keeping sustainable use at the centre of the conversation.

CONCLUSIONS AND NEXT STEPS

Commissioned by BOPRC to inform energy resilience and regional development planning, this investigation combined technical resource assessments with stakeholder input to identify where geoheat opportunities align with existing and future development needs.

Geothermal energy lacks the public profile of other renewables and benefits greatly from clear visual communication. While the analysis may appear simple, it proved powerful in practice, with many stakeholders experiencing "penny-drop" moments when they realised that some of the best geothermal resources lie directly beneath established industrial areas. These insights have since sparked development discussions and, we hope, will lead to future geoheat district schemes.

BOPRC is now more aware of the opportunities geothermal presents for decarbonisation, energy security, and economic growth, and of the importance of managing the resource effectively to enable these outcomes. The work is informing updates to their System Management Plan and supporting community and stakeholder engagement, including with local iwi.

This formula could be replicated in other regions, providing a framework for geothermal resource management and development planning at broader scale.

Acknowledgements

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