Review of Geothermal Provisions of the Bay of Plenty Regional Water and Land Plan:
Tauranga Geothermal Resource

Efficiency and Effectiveness Review
in accordance with Section 35(2)(b) RMA

Prepared by Conroy and Donald Consultants Ltd, June 2015

Contents

EXECUTIVE SUMMARY

Extending from Waihi to Maketu, the Tauranga Geothermal Resource comprises mainly conduction-heated groundwater aquifers with temperatures less than 70°C. Its greatest heat concentration is around Tauranga City Centre, Otumoetai, Te Puna and Omokoroa. Geothermal heat and fluid are used for residential and commercial heating as well as horticultural purposes. The sustainability of the resource relies on the management of the geothermal heat capacity as well as the geothermal water for heat transfer.

This report presents the outcome of a review of the Regional Water and Land Plan geothermal provisions, as they relate to the Tauranga Geothermal Resource. This review looked at the overall effectiveness, appropriateness and efficiency of these provisions.

The review found that many of the provisions do not fully address or relate to the particular issues associated with the Tauranga Geothermal Resource. The ineffectiveness of many of the provisions has been due to poor implementation and/or policy wording. In particular:

- There is a lack of consideration of the Tauranga Geothermal Resource as a heat resource first and foremost. As a result, the Tauranga Geothermal Resource is not being managed with the sustainability of the heat resource in mind.
- There is a lack of quality information in which to consider the sustainability of the Tauranga Geothermal Resource and the effects of geothermal takes on the heat and water resource.
- The provisions are designed primarily for convective systems e.g. Kawerau Geothermal Field. The Tauranga Geothermal Resource is a unique resource. It is a conductive system that is part of a wider groundwater aquifer.

There are significant social and economic benefits of ensuring that sustainability is the foundation for continued use of the Tauranga Geothermal Resource.

This report reinforces the need expressed in the Regional Policy Statement approach of developing a System Management Plan specifically for the Tauranga Geothermal Resource.

1 INTRODUCTION

The Tauranga Geothermal Resource (TGR) is a low temperature geothermal system (from 30°C to 70°C) extending from Waihi to Maketu. Heat is concentrated around Tauranga City Centre, Otumoetai, Te Puna and Omokoroa.

Chapter 7 of the Regional Water and Land Plan (RWLP) contains provisions[1] relating to geothermal resources within the Bay of Plenty[2] region. This Plan became operative in December 2008. Since then, more information has been gathered and modelled about the characteristics of the TGR and risks associated with abstraction and use of the resource.

A new Regional Policy Statement (RPS) has also been developed. Becoming operative in October 2013, the geothermal provisions of the RPS include a requirement to develop Geothermal System Management Plans for the multiple small-user Geothermal Systems at Rotorua and Tauranga. It is anticipated that the geothermal chapter of the RWLP will be updated to give effect to the RPS.

1.1 Report Purpose

This report presents the outcomes of an effectiveness and efficiency review of the current RWLP provisions, as they relate to the TGR. This is to meet the requirements of Section 35(2A) of the RMA[3] and the RWLP plan review process (section 1.3). This review is a means of determining how well the geothermal provisions, relating to the TGR, are working in practice.

1.2 Report Content

This report comprises:

1. A high level assessment of:
- overall structure
- overall effectiveness
- plan efficiency
- plan appropriateness

discussed in Section 3.

2. A detailed assessment of:
- whether the objectives were achieved
- the efficiency and effectiveness of plan provisions
- the anticipated environmental outcomes

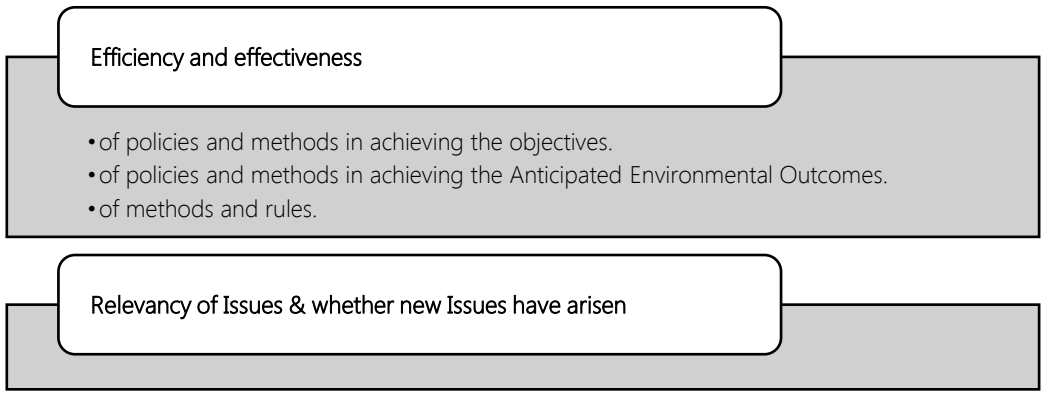
included as appendices to this report.

[1] Issues, Objectives, Policies and Methods including Rules
[2] Excluding the Rotorua Geothermal Field
[3] Section 35(2A) of the RMA seeks to ensure that Council's make publically available the outcome of plan effectiveness monitoring carried out under section 252(a) "*every local authority shall monitor- the efficiency and effectiveness of policies, rules or other methods in its policy statement or its plan;*

The assessments look back at what worked (or did not work) in relation to the existing provisions. This evaluation then recommends changes to address any deficiencies associated with existing RWLP geothermal provisions as they relate to the TGR. New provisions for a TGR Geothermal System Management Plan are also recommended.

1.3 Review and Evaluation Method

In accordance with Chapter 11 of the RWLP ("Plan Review Process"), the RWLP provisions relevant to the TGR were assessed against the following:



This evaluation draws on a range of sources of information, including:

Information on sustainability of, and risks to, the resource

- Tauranga Basin Geothermal Reservoir Model (Pearson and Alcaraz, 2013)
- Groundwater resource investigations of the Western Bay of Plenty Area, Stage 1 (White, Meilhac, Zemansky and Kilgour 2009)

In the absence of robust State of the Environment monitoring, these technical reports form the benchmark sustainability of, and risks to for the TGR.

Other sources of information

- Issues and Options Report for the TGR (Conroy & Donald Consultants Ltd, 2014)
- Analysis of data from the Consents and Wells databases
- State of the environment monitoring[4]
- Feedback from Council staff (via workshops and survey)
- Compliance monitoring of consent conditions
- Research from environmental and compliance investigations

The evaluation focuses only on those provisions that relate to the TGR. This excludes provisions relating to specifically Geothermal Management Groups 1-4, geothermal surface features and geothermal hazards.

[4] Barber, J., & Harvey, D. (2013). NERMN Groundwater Monitoring Report. Environmental Publication 2013/02. Whakatane: Bay of Plenty Regional Council.

2 BACKGROUND

The section provides context, in particular what is known about the TGR, to support the evaluation of geothermal plan provisions.

2.1 Tauranga Geothermal Resource

The TGR is a low temperature geothermal system (from 30°C to 70°C) extending from Waihi to Maketu. Heat is concentrated around Tauranga City Centre, Otumoetai, Te Puna and Omokoroa (Figure 2).

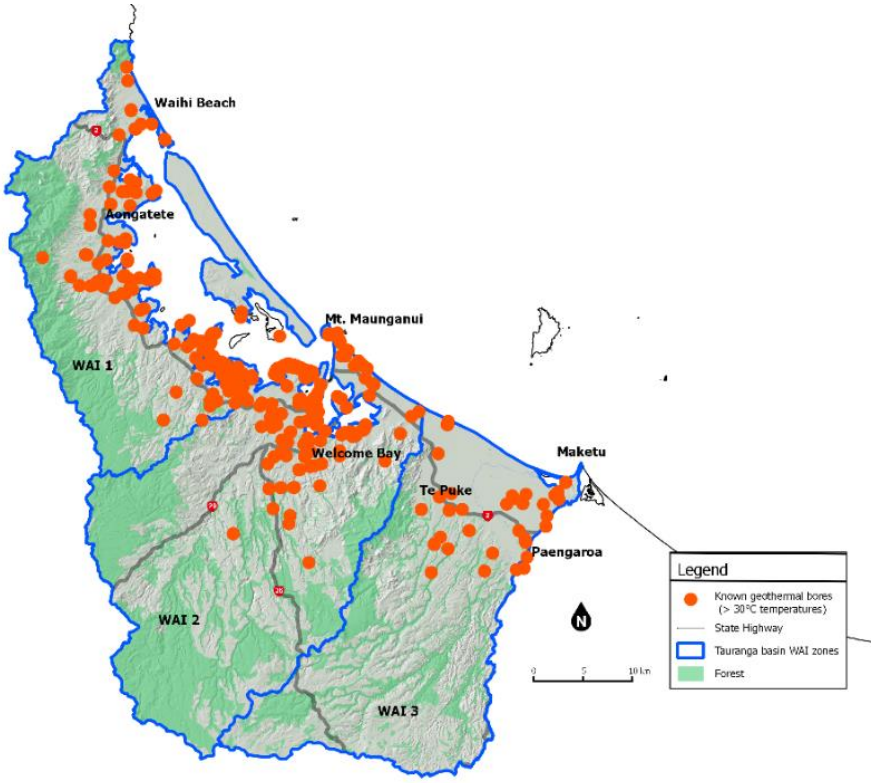


Figure 1. Map of Tauranga basin showing known bores with geothermal water (above 30 °C bore temperatures)

The TGR comprises the warm parts of the deeper Waitеariki-Aongatete Ignimbrite Aquifer and the water quality is the same as the freshwater resource in the region (i.e. it is all the same aquifer – just some parts are warm and others are cold). This makes the TGR unlike the deep high temperature systems where the fluid is highly mineralised (e.g. Kawerau and Rotorua geothermal systems)[5].

There are no known significant geothermal surface features within the TGR. However, there are some areas, in which geothermal springs are located (e.g. Sapphire Springs).

[5] Robertson, 2011

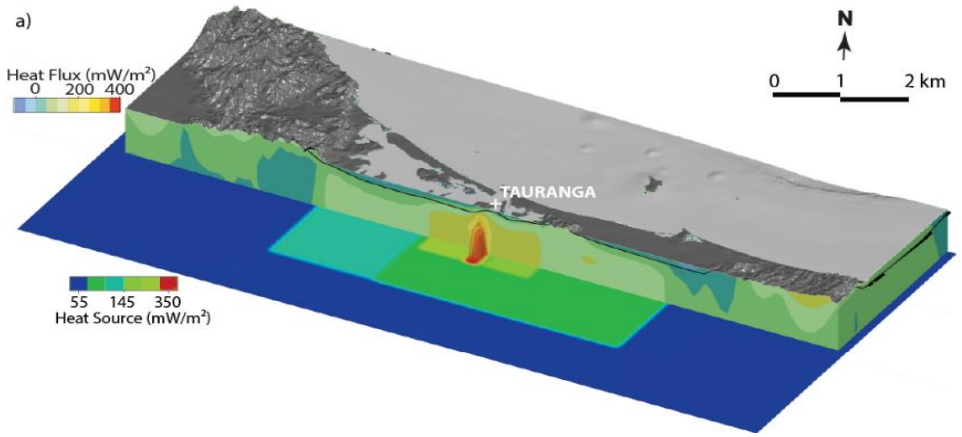


Figure 2. Heat flux in the study area with ten times vertical exaggeration. Heat flux at the source at depth (bottom layer) and resulting heat flux are highest under Tauranga City (Pearson & Alcaraz, 2013)

2.2 Geothermal Resource Use

As of May 2014, there were 137 resource consents to take, use and discharge geothermal water and/or heat. Most users of the TGR are primarily interested in the heat resource: using geothermal fluid as a source of hot fluid for direct use, or to extract heat for space heating.

Type of Use	Consents %	Daily Allocation %
Domestic heating (space heating and water heating for swimming and spa pools)	50	16
Commercial heating (holiday parks, motels, hotels, retirement villages and municipal swimming pools)	18	33
Horticultural (irrigation for kiwifruit, avocados and citrus fruit as well as glasshouse heating)	25	38
Other (including racecourse irrigation, aquaculture and heating of education facilities)	7	13

Geothermal bores range in depth from 42 metres to 916 metres and are on average 300 metres deep.

The long term management of the TGR requires consideration of it as both a geothermal resource and groundwater resource. It is used in its geothermal capacity for heat, and the same aquifer is used by freshwater users.

2.3 Reservoir modelling

GNS Science Limited developed a reservoir model to assist in determining the effects of extracting geothermal fluid from the TGR. The model compared the effect of varying proportions of allocation from 10% to 100% of the amount allocated by resource consent. The model indicates what happens if:

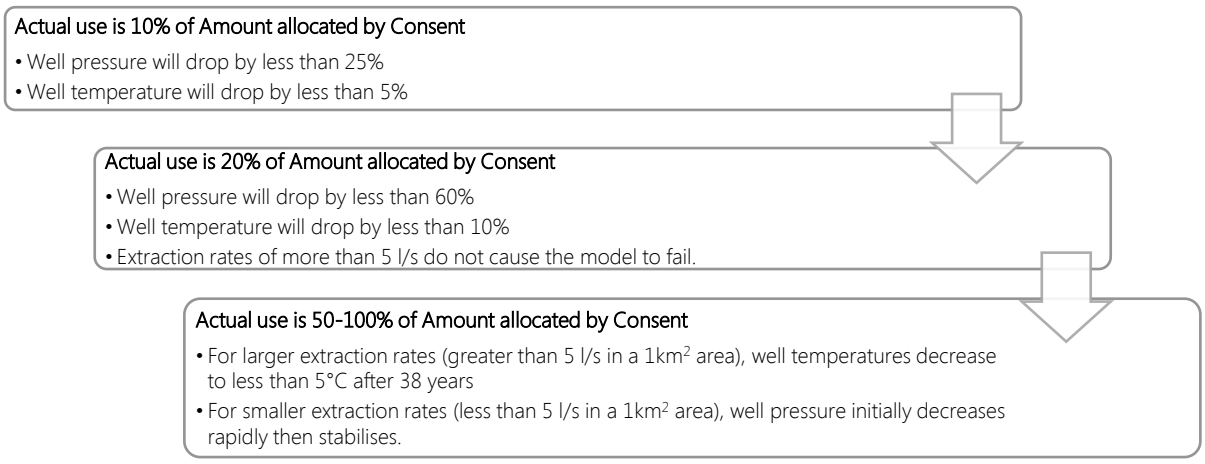


Figure 3. Modelled effect of extraction from the TGR – based on 106 resource consents (Pearson & Alcaraz, 2013)

The model indicates that if all resource consent holders were using their full allocation, those areas with extraction rates greater than 5 L/s would see localised cooling of the resource within 38 years. The geothermal resource is not exhaustive nor can it recover quickly (i.e. within our lifetime) once the temperatures have cooled.

2.4 Monitoring and Investigations

Across the region, Council monitors 56 bores as part of the Natural Environment Regional Monitoring Network. Six of these monitoring bores intercept warm groundwater. A 2013 Council monitoring report identified that of the bores monitored, 12 show an overall decline in water levels over time. Two of these are warm water bores associated with the TGR. The monitoring report shows that:

- The water level in Bore 2829 has declined by 1.8 metres since 1997. This bore is located in Katikati and used for orchard irrigation.
- The water level in Bore 1386 has declined by 6 metres since 1998. This bore is located in Tauranga City (18th Avenue) and used for commercial heating. Although this bore is inland of the coast, it is near the harbour. The water level is below sea level.

The NERMN programme (outlined in the report) provides limited value in monitoring the state of the TGR. The bores are also not in the places where the threat of cooling is greatest. There has been no temperature profile monitoring within the TGR as part of this monitoring programme. Therefore, it has been difficult to determine whether there has been any temperature loss with water level decline.

Investigations underway or ongoing for the TGR[6] include the following:

- Compliance monitoring of consent conditions
- Identifying potential unlawful takes by comparing and cross checking the Consents and Wells databases. An action plan is being developed for dealing with unlawful takes.
- Investigation programmes for measuring actual flows in Tauranga have commenced. The dataset for most of the authorised geothermal consents in Tauranga is almost complete, with options (including metering) to investigate the small number of remaining larger flows being investigated.

2.5 Planning Context

For both the RPS and RWLP, the primary provisions, relevant to the TGR, are those relating to geothermal resources. However, because the TGR is part of the same aquifer systems as groundwater, provisions relating to groundwater allocation and use may also be relevant.

Regional Policy Statement *Operative Geothermal Resource Provisions, 1 October 2013*	• Issues 1-4 • Objectives 8-9 • Policies GR 1A, GR A2, GR 3A, GR 6, GR 7B, GR 8B • Methods 2, 3, 25
Regional Water and Land Plan, *Geothermal Chapter, 1 December 2008*	• Issues 50, 51 and 53 • Objectives 65, 69, 70 & 72 • Policies 119(b), 119(c), 119(e), 119(f), 120, 121 123, 124, 126, 128 • Methods 240, 242, 249, 253 • Rules 73 and 75
Regional Policy Statement *Water Quantity Chapter, 1 October 2014*	• Issues 1-5 • Objectives 31 • Policies WQ 2A, WQ 3B, WQ 4B,
Regional Water and Land Plan, *Water Quantity and Allocation Chapter, 1 December 2008*	• Issues 29, 32 • Objectives 39 & 43 • Policies 70, 71, 72 & 73 • Methods 155, 156, 157, 161, 162, 165, 166, 167, 168, 169, 170, 174, 183

This evaluation focuses only on the geothermal provisions within the RWLP.

Objective 8 of the RPS requires sustainable management of geothermal systems. The geothermal policy provisions require multiple-user geothermal systems (Policy 7B) to provide for this integrated management through a System Management Plan, which must include a geothermal discharge strategy (GR 8B).

Accordingly, a System Management Plan is required for the TGR. This System Management Plan would be a sub-section of the RWLP geothermal chapter.

[6] Section 5.4 of the Report to Regional Direction and Delivery Committee on 1 April 2015 (http://www.boprc.govt.nz/media/417969/regional-direction-and-delivery-committee-agenda-1-april-2015-part-1.pdf)

3 EVALUATION

This section provides a high level assessment of overall structure; overall effectiveness; plan efficiency and plan appropriateness of the RWLP geothermal provisions, as they relate to the TGR. A detailed assessment of whether the objectives were achieved; the efficiency and effectiveness of plan provisions and the anticipated environmental outcomes are included as appendices to this report.

3.1 Overall Structure

This section looks at how the geothermal provisions are structured within the RWLP.

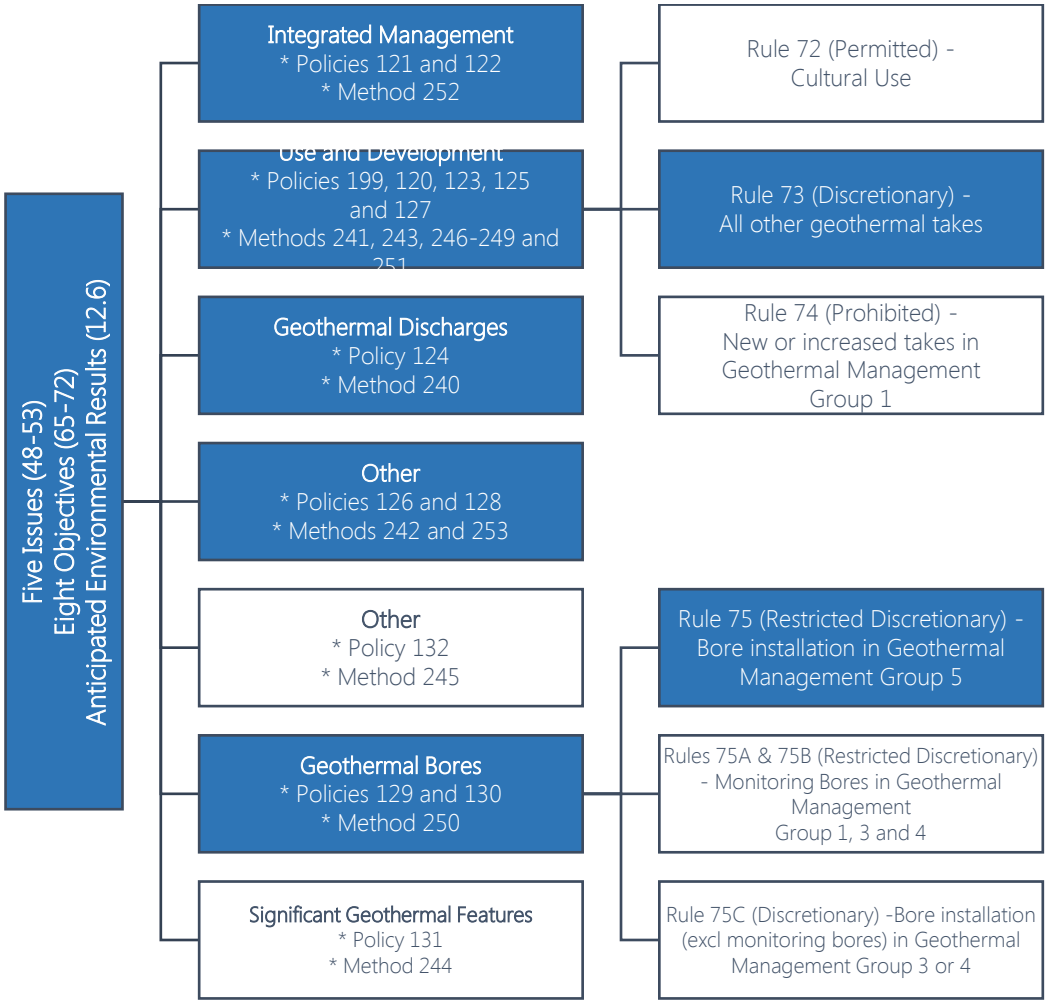


Figure 4. Geothermal provisions within the RWLP. The provisions relevant to the TGR are highlighted in blue.

All geothermal provisions (excluding rules) are contained within Chapter 7, while all regional rules are found within Chapter 9 of the RWLP. Explanatory text is provided in the beginning and end of Chapter 7 to outline the scope and reasons for provisions.

Policies 119, 120 and 123 and Method 252 are arranged in a table. From a formatting point of view, this reduces its usability. For example, tables are difficult to copy and paste into other documents.

3.2 Overall Effectiveness

Effectiveness is an assessment of whether the outcome sought was achieved. This is often determined by assessing:

- whether the Anticipated Environmental Result (AER) has been achieved
- whether the Objectives have been achieved
- whether the policies and methods achieve the Objective

To what extent has the anticipated environmental result been achieved?

The RWLP contains one AER for geothermal resources. This AER relates to geothermal surface features, which is used as an indicator for geothermal reservoir health for high temperature systems. For low temperature geothermal systems where there are few or no surface features, this logic does not apply. This means the AER is not relevant for the issues facing the sustainability of the TGR, and it is not possible (or useful) to assess the RWLP geothermal provisions against this single geothermal AER.

Given that there is no relevant AER, this report now considers whether the objectives provide a more relevant outcome statement for the TGR.

To what extent have the objectives, relevant to the TGR, been achieved?

Objective 65

Objective 65 addresses the sustainable use and development of geothermal water, heat and energy, although it caveats it with "*with regard to the effects on geothermal surface features and ecosystems*", and then concludes with "*and individual field characteristics*". Since there are no surface features, Objective 65 could be condensed, for the purpose of evaluating in relation to the TGR, to read:

> *Sustainable use and development of geothermal water, heat and energy, with regard to the effects on […] field characteristics".*

This is supported by RWLP Policy 120, which seeks to "*require the use and development of geothermal resources of the region to sustain the potential of the resources for the reasonably foreseeable needs of future generations".*

This has not been achieved. Limited consideration has been given to sustainable use of the resource when resource consents have been issued within the TGR. There is a lack of quality information in which to consider the sustainability of the TGR, system capacity (e.g. amount of heat available for allocation) and the effects of geothermal takes on the heat and water resource. Policy 65 of the RWLP directs Council to take a precautionary approach to allocation, where knowledge is limited. Instead, consent applications have been granted on the basis of groundwater availability (since the geothermal resource is from the same aquifer) and potential effect on nearby bores.

Objective 69

Objective 69 seeks the reinjection of geothermal fluid. This has not been achieved. Within the TGR, at least 7% of geothermal discharges within the TGR are via reinjection[7]. The majority of discharges are via land soakage, stormwater or are not specified in the consents database.

While reinjection is not always appropriate of feasible, it is not actively promoted or prioritised either. Consent applicants are not required to demonstrate that the most appropriate method of discharge for the site has been selected. Consent officers assess geothermal discharges and make reference to Policy 124 within officer reports. However, there is no explicit assessment and documentation against the hierarchy (& associated requirements) established by Policy 124.

Objective 70

Objective 70 seeks to ensure that bores are constructed to appropriate drilling standards. It is unclear whether this has been achieved. There is no available information regarding compliance monitoring of granted bore permits to confirm that bores are constructed to appropriate drilling standards.

Bore permits are granted on the basis that the New Zealand Standards NZS 2403, Code of Practice for Deep Geothermal Wells will be used. These standards have been developed for wells that penetrate hot subsurface conditions (i.e. for power generation purposes). Given that the TGR is a low temperature geothermal system, the groundwater bore standards (NZS 4411:2001 Environmental Standard for Drilling of Soil and Rock) may be more appropriate.

Objective 72

Objective 72 seeks efficient use of geothermal resources. This has not been achieved.

The primary resource for geothermal is heat, with geothermal fluid used as a way of transporting that heat. There is limited practical guidance around how a consent officer assesses whether or not a proposed take within the TGR is an efficient use of the heat resource. For example, horticultural takes are only assessed on the basis of efficient water use i.e. is the amount sought reasonable for the intended use.

[7] Based on a review of resource consents in May 2014

To what extent have the policies and methods achieved the objectives?

The policies and methods have been assessed for effectiveness and rated according to whether they have been achieved or not. The detailed assessments are provided in Appendix 3 (policies) and 4 (methods).

Overall, many of the policies and methods were ineffective and therefore did not achieve the objectives due to poor policy wording and/or implementation. It is considered that the reasons for this are:

1. A lack of quality information in which to consider the sustainability of the TGR and the effects of geothermal takes on the heat and water resource. This includes information:
   - about the amount of heat and warm water available for allocation from the TGR
   - to help a consent officer to assess the efficient use of geothermal takes within the TGR (domestic, commercial, greenhouse use)

2. A lack of consideration of the TGR as a heat resource first and foremost. As a result, the TGR is not being managed for heat sustainability. For example:
   - Consent officer reports did not acknowledge the primarily focus of the TGR as a heat resource, or the limited knowledge associated with TGR and the effects of geothermal takes on the geothermal resource.
   - A precautionary approach has not been taken in the absence of quality information, as directed by Policy 119(b) of the RWLP. Instead, consent applications have been granted on the basis of groundwater availability and potential effect on nearby bores.

3. Provisions designed primarily for convective systems e.g. Kawerau Geothermal Field. The TGR is a unique resource. It is a conductive system that is part of a wider groundwater aquifer.

3.3 Appropriateness

The appropriateness evaluation assesses whether the plan provisions are the 'right' provisions. In other words:

- Issues addressed in the plan are still relevant
- Additional issues have arisen which require attention within the Plan

Are the current issues still relevant to the TGR?

A number of issues were not relevant are related to surface features and geothermal hazards which are not present within the TGR.

The remaining issues (50, 51 and 53) are still relevant, although they could be reworded to be expressed more clearly and succinctly. The issues tend to be activity focussed (e.g. discharges, bores) but address the same types of effects e.g. effect on geothermal surface features, ecosystems and taonga, so could be condensed to 1-3 core issues. They also need to be refined to be consistent with the RPS (Issue, content and style) and best practice[8].

Are there any additional issues that have arisen since the RWLP became operative?

None of the existing issues directly focus on the effects of geothermal heat extraction for reservoir sustainability, which is the main issue for the TGR.

The RWLP predates awareness of the factors that affect the sustainability of the TGR. It is primarily a conductive system, with the heat coming from warmed groundwater, rather than deep heated geothermal fluid making its way to the surface. This means the TGR must be considered as both a geothermal resource (for its heat) and groundwater resource. The interaction of these two uses - heat resource and fluid allocation - requires policy direction. Its management is not linked to effects on surface features.

3.4 Efficiency

Plan efficiency is a measure of the benefit of policy relative to its cost. In other words, efficient provision(s) will achieve the outcome (the benefit) at the lowest cost.

Did it achieve the outcome?

As outlined in Section 3.2, the geothermal provisions, as they relate to the TGR, did not achieve their outcome.

What are the benefits of existing geothermal provisions, as it relates to the TGR?

Resource consent holders	Access to geothermal heat which has meant reduced energy costs.
General public	▸ Employment - mainly within the commercial and horticultural sectors. ▸ Pleasure – there are 10 geothermally heated public pools within the TGR
Council	Resource users (authorised by resource consent) are known, which means that allocation and rate of take can be quantified and monitored

[8] http://www.qualityplanning.org.nz/index.php/plan-steps/writing-plans/writing-issues-objectives-and-policies

What are the economic and social costs of existing geothermal provisions, as it relates to the TGR?

Resource consent holders	▸ Resource consent processing costs ▸ Consent administration and compliance monitoring costs ▸ Water user charges (s36 RMA) ▸ Potential loss of access to the geothermal resource if the TGR cools
General public	▸ Potential loss of access to the geothermal resource if the TGR cools
Council	▸ Designing and administering resource allocation process (consents, compliance, administration, plan implementation and review) ▸ Understanding the resource - science, modelling, staff time on consent / compliance data amalgamation and interpretation (e.g. gaps in data, inconsistent format, not in a database).

What are the environmental costs of existing geothermal provisions, as it relates to the TGR?

- Risk of collapse of the geothermal field. If the TGR cools, recovery is very slow (i.e. not within our lifetime).
- Cost of heat loss due to inefficient use e.g. allocation vs actual use; inappropriate use (e.g. irrigation where warm water is not essential)
- Environmental (and social) cost of a large number of potential unlawful takes within the TGR.

There are significant social and economic benefits of ensuring that sustainability is the foundation for continued use of the TGR. Generally speaking, the Council bears the majority of the economic cost of the current suite of policies, methods and rules. However, given the poor implementation of these provisions, the biggest risk is localised cooling of the TGR, which has significant environmental, economic and social costs, particularly to those who are reliant on the TGR as a heat source.

The overall efficiency of the RWLP geothermal provisions - as it relates to the TGR – is evaluated as low. Improve efficiency requires:

- better implementation of existing provisions
- quality information within which to be make decisions
- improved wording of provisions (via future plan change)
- provisions specifically for the TGR (System Management Plan via future plan change)

4 CONCLUSION

Overall, the geothermal provisions have not performed well in meeting the geothermal objectives for the TGR.

The review found that many of the provisions do not fully address or relate to the particular issues associated with the TGR. The ineffectiveness of many of the provisions has been due to poor implementation and/or policy wording. In particular:

1. There is a lack of consideration of the TGR as a heat resource first and foremost. As a result, the TGR is not being managed for heat sustainability.
2. There is a lack of quality information in which to consider the sustainability of the TGR and the effects of geothermal takes on the heat and water resource.
3. The provisions are designed primarily for convective systems e.g. Kawerau Geothermal Field. The TGR is a unique resource. It is a conductive system that is part of a wider groundwater aquifer.

There is limited publically available information in relation to the TGR, the different uses and the associated risks of overuse. There has been no proactive attempts to increase public awareness within the TGR. While a Communications Plan has been drafted, implementation is not evident.

There are significant social and economic benefits of ensuring that sustainability is the foundation for continued use of the TGR. Key requirements to this are:

- better implementation of existing provisions[9]
- quality information within which to be make decisions
- improved wording of provisions (via future plan change)
- provisions specifically for the TGR.

Developing a System Management Plan specifically for the TGR, as required by the RPS (GR 3A), will provide for integrated management of the resource.

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[9] As detailed in Appendices 3 (policy evaluation) and 4 (method evaluation)

5 RECOMMENDATIONS

Recommendations are provided for the individual RWLP provisions relevant to the TGR. These are found in the evaluation tables (Appendices 1-5). These are grouped according to whether they relate to changes to policy design/wording; improvements to internal processes and areas where further research is needed.

Recommended TGR-specific Provisions

Of importance is the need for provisions specifically for the TGR to recognise the particular characteristics and uses of the system. This includes the following:

Provision Type	Description
Issue	New Issue(s) about: • effects of geothermal heat and water extraction on the TGR • interaction between geothermal and groundwater
Objective	New Objective seeking the sustainable use and development of the TGR
Policy	• New policy about transfers – to specify that transfer will not be provided for within the TGR • New policy with assessment matters – on what is assessed and what the applicant needs to demonstrate, beyond the effect on nearby bores (e.g. TGR & aquifer sustainability). • New policy with minimum consent condition requirements. This includes water meter installation and reporting requirement • New policy about consent terms – to specify a maximum of 10 years for resource consents within the TGR (precautionary approach)
Method	Nil
Rule	Nil
Anticipated Environmental Result	New AER which requires temperature, pressure and water level to be within the acceptable range for the TGR

Implementation of existing provisions

The development and use of a Standard Operating Procedure for consents within the TGR will help to improve implementation of existing RWLP provisions. Likewise for increasing public awareness about the in relation to the TGR, the different uses and the associated risks of overuse.

Changes to existing provisions

The geothermal discharge rules (77 and 77A) require review as land soakage activities appear in both rules. This reduces certainty as it is difficult to determine whether land soakage is a restricted discretionary or discretionary activity.

Any changes to the RWLP provisions will need to give effect to the RPS and take into account relevant Iwi and Hapu Management Plans.

6 BIBLIOGRAPHY

This evaluation has been informed by BOPRC technical and State of the Environment reports. In particular:

1. Conroy and Donald Consultants Limited (2014). Tauranga Geothermal Resource: Issues and Options Report. Technical report prepared for the Bay of Plenty Regional Council.

2. Pearson, S., & Alcaraz, S. (2013). Tauranga Basin Geothermal Reservoir Model. Taupo: GNS Science Report 2013/13. Technical report prepared for the Bay of Plenty Regional Council.

3. Barber, J., & Harvey, D. (2013). NERMN Groundwater Monitoring Report. Environmental Publication 2013/02. Whakatane: Bay of Plenty Regional Council

4. White, P., Meilhac, C., Zemansky, G., & Kilgour, G. (2009). Groundwater resource investigations of the Western Bay of Plenty area stage 1 - conceptual geological and hydrological models and preliminary allocation assessment. Taupo: GNS Science

APPENDIX 1: EVALUATION OF ISSUES

Exclusions: Issues 48, 49 and 52 relate to geothermal surface features and are not present within the Tauranga Geothermal Resource. These issues have not been included in the evaluation.

Ref	Wording	Is the issue still relevant to the Tauranga Geothermal Resource? Do the issues statements still address the issues identified in current information?	Recommendations
Issue 50	Geothermal fluid contains toxic components and the discharge of such fluids to the environment can: a) Contaminate water and soil resources. b) Damage aquatic or terrestrial ecosystems. c) Lead to flooding of a geothermal surface feature, taonga, or a geothermal ecosystem.	Issue 50(a) and (b) are most relevant to the TGR. Although the water quality within the TGR is generally potable, the discharge of warm water to land (soakage), rivers, streams and coastal water may still have an effect on soil and water resources as well as aquatic ecosystems. Issue 50(c) is not relevant to the TGR as there are no geothermal surface features	Of most relevance to the TGR are Issues 50(a), 50(b), 51(a), 51(b), 51(d) and 53. This is in relation to: • Geothermal takes and potential depletion of the geothermal field • Geothermal discharges and potential effect on soil and water resources and aquatic ecosystems • Bore construction and the potential effect on the field characteristics and other users. The Issues are still relevant and therefore should be retained. One are of improvement could be the structure and wording of the Issues. The issues tend to be activity focussed (e.g. discharges, bores) but address the same types of effects e.g. effect on geothermal surface features, ecosystems and taonga, so could be condensed to 1-3 core issues and articulated more clearly and succinctly.
Issue 51	The drilling and construction of geothermal bores can: a) Degrade natural field characteristics, including field pressure, b) Cross contaminate freshwater groundwater and geothermal aquifer systems, c) Contaminate water and soil resources as a result of the discharge of drilling fluids, and uncontrolled discharges from blowouts from bore construction, and d) Adversely affect existing users of the resource.	Issues 51(a) and (d) are still relevant to the TGR as drilling and the construction of bores can affect the natural field characteristics and other existing users of the resource. Issue 51(b) is not relevant to the TGR because the geothermal and groundwater resource are from the same aquifers. Both the geothermal and groundwater resource are of the same water quality. Issues 51(c) is partially relevant to the TGR. Uncontrolled discharges from blowouts from bore construction is less of a problem within the TGR because it is a low pressure geothermal system. Cross contamination of aquifers is not an issues as geothermal fluid is the same quality as the freshwater aquifers.	
Issue 53	The take of geothermal water, heat or energy may deplete the geothermal field, and degrade geothermal surface features, ecosystems and taonga.	The first part of this issue is still relevant to the TGR *"The take of geothermal water, heat or energy may deplete the geothermal field".* The relevance of this issue statement is reinforced by the risks highlighted by the 2013 Pearson report. The report presents modelling showing that the resource can cool when high rates of abstraction and the taking of large quantities of fluid across the system can cause cooling of the resource. The second part of the issue statement is not relevant to the TGR as there are no geothermal surface features and ecosystems.	

APPENDIX 2: EVALUATION OF OBJECTIVES

Exclusions: Objectives 66, 67, 68 and 71 relate to geothermal surface features and hazards. These are not relevant to the Tauranga Geothermal Resource, therefore have not been included in this evaluation.

Ref	Wording	Is the Objective still relevant to the TGR?	Was the objective achieved?	Recommendations
Objective 65	Sustainable use and development of geothermal water, heat and energy with regard to the effects on geothermal surface features and ecosystems, and individual field characteristics.	Sustainable use and development of water, heat and energy with regards to the effects on the TGR is a fundamental objective for the TGR. The recent modelling and subsequent 2013 Pearson report presents the risks of use and development to the TGR. These risks include the potential permanent cooling of parts of the system from large rates of take and taking too much fluid/heat from the wider system. Since there are no surface features and associated ecosystems, the effects on these are not relevant to the TGR.	The Objective has not been achieved. Limited consideration has been given to sustainable use of the resource when resource consents have been issued within the TGR. There is a lack of quality information in which to consider the sustainability of the TGR, system capacity (e.g. amount of heat available for allocation) and the effects of geothermal takes on the heat and water resource.	Objective is appropriate and still relevant, retain unchanged. A specific objective would need to be developed the TGR which excludes reference to surface features and ecosystems as these are not present in the TGR. .
Objective 69	The reinjection of abstracted geothermal water into the same geothermal field from which it came, subject to an assessment of effects.	The reinjection of abstracted fluid back into TGR is still a relevant objective.	The objective has not been achieved. Reinjection has not been required of a large proportion of consents to take from the TGR: • 7% reinject geothermal fluid[10] • 48% discharge to land or water • 45% are unspecified in the consents database.	Objective is appropriate and still relevant, retain unchanged. However poor implementation and/or wording of associated policies appears to be the underlying cause for not achieving this Objective, in relation to the TGR. The categorisation of discharge permits (i.e. discharge location) within the consents database requires improvement.

[10] Based on a review of resource consents in May 2014

Ref	Wording	Is the Objective still relevant to the TGR?	Was the objective achieved?	Recommendations
Objective 70	Geothermal bores are constructed to appropriate drilling standards.	The construction of bores to appropriate drilling standards in TGR is still a relevant objective.	It is unclear whether compliance monitoring of granted bore permits has confirmed that bores are constructed to appropriate drilling standards. Policy 129 refers – via footnote – to the use of the NZ Standard for drilling of soil and rock for bore drilling. Based on a review of Consent Officer reports, there are expectations that geothermal bores are to be drilled in accordance with the most recent version of New Zealand Standards NZS 2403, Code of Practice for Deep Geothermal Wells. These are standards developed for wells that penetrate hot subsurface conditions, with a particular focus on geothermal power generation. Given that the TGR is a low temperature geothermal system, the groundwater bore standards (NZS 4411:2001 Environmental Standard for Drilling of Soil and Rock) may be more appropriate.	Objective is appropriate and still relevant, retain unchanged. Clarification is needed as to the degree of compliance in relation to bore drilling standards. Consideration of the groundwater bore standards (NZS 4411:2001 Environmental Standard for Drilling of Soil and Rock) for the TGR
Objective 72	Efficient use of geothermal resources.	The efficient use of the TGR is still a relevant objective.	The objective has not been achieved.	Objective is appropriate and still relevant, keep unchanged.

APPENDIX 3: EVALUATION OF POLICIES

Exclusions: Policies 119(a), 122, 125, 127,131 and 132 relate to geothermal surface features, taonga and hazards as well as damming and diversion.

- Geothermal hazards and surface features are not present within the TGR
- Based on a review of Iwi and Hapu Management Plans, there are no known areas of traditional use and/or geothermal surface features.
- All geothermal takes within the TGR occur via geothermal bore - there is no damming or diversion of geothermal water
- Policy 122 provides guidance relating to the classification of new geothermal management groups. In this case, the TGR is already classified.

As a result, these policies are excluded from evaluation.

All references to data or statistics within the evaluation is based on an analysis of all resource consents within the TGR as at May 2014.

Ref	Wording	RELEVANCE & APPROPRIATENESS: Is it relevant to the TGR? In what way did it relate to the Objective? Did the policy provide enough guidance / tools on how to meet the Objective?	EFFECTIVENESS: Did this policy work? How effective was this policy in achieving the objectives? Was it implemented - by who? & how? - If not why not?	RECOMMENDATIONS: Changes needed to policy design / wording? Changes needed to internal processes? Further research and monitoring?
Policy 119	To manage effects of the use and development of geothermal resources according to the following: ...			
Policy 119	(b) Precautionary approach (i) To constrain resource allocation based on the level of understanding of field dynamics and resource availability. This may include staged development of a field. (ii) To take into account the level of knowledge available, while recognising that perfect knowledge of the effects of geothermal resource use is not possible.	Yes, relevant to the TGR Knowledge is limited about the TGR. This policy directs Council to take a precautionary approach to allocation to ensure its sustainable development and use. i.e. staged development (as defined in Para 5 of section 7.1.5 of the RWLP). Implementation of this policy is also guided by Methods 247-249 in relation to consent processes.	**This policy was ineffective because of poor implementation.** A precautionary approach has not been taken in relation to the TGR. This is due to implementation rather than policy design/wording. Information in relation to the TGR is limited to groundwater availability (White et al 2009) and a preliminary assessment of the modelled effects of consented warm water abstraction (Pearson and Alcaraz, 2013). There is no available information in relation to system capacity (e.g. amount of heat available for allocation). Allocation from this system has taken no account of the understanding of the TGR's field dynamics and resource availability. Consent officer reports did not acknowledge the primarily focus of the TGR as a heat resource, or the limited knowledge associated with TGR. Instead, consent applications were processed on the basis of groundwater availability (since the geothermal resource is from the same aquifer) and potential effect of nearby bores. State of the Environment monitoring is limited within the TGR. This is limited to six bores, representing <5% of all geothermal takes within the TGR. They are also not in the places where the threat of cooling is greatest, so their value is limited.	Changes to Policy ► Nil - Retain Policy 119(b) Changes to Internal Processes (consents & science) ► A precautionary approach to allocation needs to be taken for the TGR. ► Determine what information is needed to be able to assess the effects of a geothermal take on the heat resource ► Determine what type of geothermal takes and uses need to be providing more robust information e.g. large rate of take ► Determine when a consent application should be declined Further research and monitoring (science) ► Refined reservoir model of the TGR Amount of heat and warm water available for allocation from the TGR

Ref	Wording	RELEVANCE & APPROPRIATENESS: Is it relevant to the TGR? In what way did it relate to the Objective? Did the policy provide enough guidance / tools on how to meet the Objective?	EFFECTIVENESS: Did this policy work? How effective was this policy in achieving the objectives? Was it implemented - by who? & how? - If not why not?	RECOMMENDATIONS: Changes needed to policy design / wording? Changes needed to internal processes? Further research and monitoring?
Policy 119	(c) Efficient use (i) To require the use of any geothermal water, heat or energy to be efficient. (ii) To promote multiple use of extracted resources, where this does not compromise reinjection. Note – the efficient use of geothermal water, heat or energy will be assessed on a case by case basis.	Yes, relevant to the TGR Policy 119 (c) addresses the efficient use of geothermal resources I.e. Objective 72 in its entirety. Implementation of this policy is guided by Methods 241 and 249. Consent officers assess the efficient use of geothermal water, as it relates to irrigation takes. There is no guidance around how a consent officer assesses whether a proposed take within the TGR is an efficient use of the heat resource. Examples include the heat requirements for a greenhouse or residential village.	This policy was ineffective because of poor implementation and policy design/wording ► Consent application form- The consent application form contains a question about the applicant's measures taken to "protect against resource wastage". ► Consent process - Consent officers do not currently assess the efficient "heat use" of geothermal takes. Examples include the heat requirements for a greenhouse, hotel or domestic pool. Consent officers have calculations for efficient "water use" for irrigation takes but this does not take into account the efficient use of the heat resource. ► Consent conditions - 28 resource consents have been granted within the TGR since the RWLP became operative. All of these have a condition requiring the measurement and reporting of geothermal water taken. 27 of these consents also have a specific condition to ensure water conservation and energy efficiency. ► Consent monitoring - There is uncertainty as to level of monitoring of, and compliance with, the 'efficient use' condition. It is understood that compliance officers follow-up consents where actual water use is greater than that authorised by consent. This is based on information provided by water use records and only limited to those consent holders who have water use reporting conditions (55% of all TGR consents). It is uncertain what action is taken where actual water use is significantly lower than allocation. ► Multiple Use - While the multiple use of extracted resources is largely limited by the low temperature of the TGR, some cascade use takes place e.g. there is a consent holder who uses geothermal water/heat in underfloor heating and then a swimming pool then used to irrigate a 3.5ha orchard. The multiple use of extracted resources within the TGR is not currently promoted within internal Council procedures e.g. SOP for consent processes, officer report templates, consent application form, Council communications.	Changes to Policy ► Nil - Retain Policy 119(c) Changes to Internal Processes (consents & compliance) ► Consider whether certain types of take (e.g. summer irrigation) are an appropriate use of geothermal water ► Promote greater multiple use of the TGR internal Council procedures e.g. SOP for consent processes, officer report templates, consent application form, Council communications. ► Consider approach where water use records are significantly lower than allocation and consider reviewing the resource consent Further research and monitoring (consents and science) ► How to assess the efficient use of geothermal takes within the TGR (domestic, commercial, greenhouse use)

Ref	Wording	RELEVANCE & APPROPRIATENESS: Is it relevant to the TGR? In what way did it relate to the Objective? Did the policy provide enough guidance / tools on how to meet the Objective?	EFFECTIVENESS: Did this policy work? How effective was this policy in achieving the objectives? Was it implemented - by who? & how? - If not why not?	RECOMMENDATIONS: Changes needed to policy design / wording? Changes needed to internal processes? Further research and monitoring?
Policy 119	(d) Users of the resource To promote the integrated management of each individual geothermal field, including allowing, where appropriate, consortia or a single body to take and use geothermal resources from any one field. The appropriateness of multiple users, a single tapper, or a consortia, will be assessed on a case by case basis relative to the sustainable use of the individual field, including effects on existing users of the field.	Yes, relevant to the TGR This policy relates to use and development (Obj 65 and 72) and discharges (Obj 69) There are multiple statements contained within the two sentences. As a result, policy is difficult to read and interpret. It is also wordy, poorly structured and therefore unclear. Implementation of this policy is guided by Methods 247-253 in relation to consent processes, system classification and monitoring.	**This policy was ineffective because of poor implementation and policy design/wording** Integrated management of the TGR has not happened in terms of sustainable heat use or consideration of the sustainability of the heat resource. Staff from the consents and science teams have not assessed the effects of proposed geothermal takes on the sustainable use of the TGR (especially the heat resource). Assessments focused on the geothermal water resource and the effect of the take on bores within close proximity (<1km). The potential impact of over allocation/overuse is system cooling which would adversely impact ALL users within the TGR. The policy is wordy, poorly structured and therefore unclear and difficult to understand/interpret in one reading. This in turn reduces the effectiveness of the policy if it is difficult to understand.	Changes to Policy ► Retain Policy 119(d) ► Clarify, in this context, what is meant by integrated management ► Restructure, using numbering, to improve readability and clarify intention. Changes to Internal Processes (consents & science) ► Determine what information is needed to be able to assess the effects of a geothermal take on the heat resource Further research and monitoring (science) Refined reservoir model of the TGR to determine: ► Amount of heat and warm water available for allocation from the TGR ► How to assess the efficient use of geothermal takes within the TGR (domestic, commercial, greenhouse use)
Policy 119	(e) Discharge of geothermal fluid To actively encourage geothermal water to be reinjected into a geothermal reservoir, where appropriate to the circumstances and subject to an assessment of effects.	Yes, relevant to the TGR (with the exception of geothermal takes for horticultural irrigation where the fluid is sprayed onto the crop soil / canopy) This policy clearly articulates a preference for reinjection, where appropriate. Implementation of this policy is guided by Policy 124 (geothermal discharge hierarchy) as well as Method 240	**This policy was ineffective because of poor implementation** Based on observations to date, reinjection is not actively promoted or prioritised. Consent application forms do not require information about alternative methods and locations of discharging geothermal fluid. For this reason, consent applicants do no need to demonstrate consistency with Policy 124. There is minimal assessment of alternative methods and locations of discharging geothermal fluid, particularly for renewals. Some consent officer reports make reference to some alternative methods, but this is variable and doesn't address all discharge types.	Changes to Policy ► Nil - Retain Policy 119(b) Changes to Internal Processes (consents & science) ► Ensure consent application forms require information about alternative discharge methods and locations ► Ensure consent officers assess and document alternative discharge methods and locations in line with Policy 119 and 124 – to include in Standard Operating Procedure for consent officers.

Ref	Wording	RELEVANCE & APPROPRIATENESS: Is it relevant to the TGR? In what way did it relate to the Objective? Did the policy provide enough guidance / tools on how to meet the Objective?	EFFECTIVENESS: Did this policy work? How effective was this policy in achieving the objectives? Was it implemented - by who? & how? - If not why not?	RECOMMENDATIONS: Changes needed to policy design / wording? Changes needed to internal processes? Further research and monitoring?
Policy 119	(f) Geothermal abstraction - To recognise that (i) Geothermal development can result in land subsidence. (ii) Geothermal resources are renewable, but limited resources, and have some finite characteristics similar to minerals	Yes, relevant to the TGR (with the exception of land subsidence) Policy 119(f)(ii) the TGR is a renewable but finite resource, requiring use and development to be sustainable This policy provides no useful guidance with regards to implementation. This is more of a generic issues statement rather than a directive and measurable policy.	**This policy was ineffective because of poor implementation and policy design/wording** This policy provides no useful guidance with regards to implementation. This is more of a generic issues statement rather than a directive and measurable policy. The policy intent could be implemented more effectively through other plan provisions. The TGR, both as a source of geothermal heat and water, is a finite resource. The capacity of the heat resource has to be quantified. Allocation to date does not seem to recognise the finite nature of the TGR. Nor is a precautionary approach taken, in the absence of quality information about system capacity.	Changes to Policy ► Remove Policy 119 (f)(ii) as it is redundant. Changes to Internal Processes (consents & science) ► Determine what information is needed to be able to assess the effects of a geothermal take on the heat resource Further research and monitoring (science) ► Refined reservoir model of the TGR ► Amount of heat and warm water available for allocation from the TGR
Policy 119	(g) Activities ancillary to geothermal abstraction and use To sustainably manage the effects of ancillary activities.	Yes, relevant to the TGR Policy 119(g) is a vague catchall policy that can relate to all Objectives This policy more of a generic statement rather than a directive and measurable policy. It provides no guidance with regards to implementation, in particular what is meant by 'ancillary activities'. This is a term that could have multiple meanings.	**This policy was effective** Discussions with consent staff indicate that ancillary activities relate to anything required to run a geothermal take. In addition to the associated discharge, ancillary activities includes bore and bore head maintenance; piping; underfloor heating; pumps and heat exchanger maintenance. These matters are typically assessed at the time of consent application due to the presence of Policy 119(g). Consent staff indicate that Policy 119(g) has been useful as a catchall to account for all of the different uses and methods of use of a geothermal resource (e.g. underfloor heating is gaining in popularity and is an ancillary activity).	Changes to Policy ► Retain Policy 119 (g) ► Clarify the term 'ancillary activities'

Ref	Wording	RELEVANCE & APPROPRIATENESS: Is it relevant to the TGR? In what way did it relate to the Objective? Did the policy provide enough guidance / tools on how to meet the Objective?	EFFECTIVENESS: Did this policy work? How effective was this policy in achieving the objectives? Was it implemented - by who? & how? - If not why not?	RECOMMENDATIONS: Changes needed to policy design / wording? Changes needed to internal processes? Further research and monitoring?
Policy 119	Policy 119 *Overall*	Yes, relevant to the TGR This policy - as a whole - seeks to provide guidance in relation to managing the effects of geothermal use and development This policy has many subsections, some of which provide clear guidance, others that are not clear and/or directive with regards to implementation. There is also a lot of duplication in provisions. For example, reinjection is encouraged in both Policy 119(e) and Policy 124.	**This policy was ineffective because of policy design/wording** In trying to cover many matters, this policy loses clarity and effectiveness. Many of the matters listed are also already covered by other policies and methods.	Changes to Policy ► Split the combined table into separate policy relating to specific matters e.g. allocation, discharges ► Combine with other existing policies e.g. Policy 119(e) and 124.
Policy 120	To require the use and development of geothermal resources of the region to sustain the potential of the resources for the reasonably foreseeable needs of future generations.	Yes, relevant to the TGR This is the main policy relating to the use and development of the TGR. This policy mirrors Objective 65 which is contrary to best practice[11]. It is also broad in scope and provides no guidance with regards to implementation.	**This policy was ineffective because of poor implementation and policy design/wording** Current modelling indicates that current allocation is not sustainable and would potentially see cooling of the system within 38 years in localised areas. There has been no consideration of the sustainability of the geothermal heat resource, let alone the geothermal water resource. This is because, there is no available information in relation to these matters. Consent officer reports do not acknowledge the primarily focus of the TGR as a heat resource, or the limited knowledge associated with TGR. Instead, consent applications were processed on the basis of groundwater availability (since the geothermal resource is from	Changes to Policy ► Remove Policy 120 as other policies and methods will be achieving the same outcome

[11] "avoid policies that simply restate the objective" – Quality Planning Website (http://www.qualityplanning.org.nz/index.php/plan-steps/writing-plans/writing-issues-objectives-and-policies)

Ref	Wording	RELEVANCE & APPROPRIATENESS: Is it relevant to the TGR? In what way did it relate to the Objective? Did the policy provide enough guidance / tools on how to meet the Objective?	EFFECTIVENESS: Did this policy work? How effective was this policy in achieving the objectives? Was it implemented - by who? & how? - If not why not?	RECOMMENDATIONS: Changes needed to policy design / wording? Changes needed to internal processes? Further research and monitoring?
			the same aquifer) and potential effect of nearby bores.	
Policy 121	To use the following Geothermal Management Groups to **guide decisions** on the take, use, damming and diversion of geothermal water, heat and energy: … 5 Geothermal Management Group 5 30-70 degrees Celsius, few or no geothermal surface features. Low temperature geothermal systems available for sustainable use and development – The use (including abstraction) of geothermal water, heat and energy where the adverse effects of the activity can be avoided, remedied or mitigated, while recognising that the discharge of geothermal fluid is the major constraint on the development of these geothermal resources: (a) Mayor Island (Tuhua) (b) Tauranga/Mount Maunganui (Mauao) ….	Yes, relevant to the TGR Policy 121 classifies the TGR into Management Group 5 (low temperature field). This policy purely classifies the TGR. It does not provide any guidance on decisions relating to geothermal takes within this field.	**This policy was ineffective because of poor policy design/wording** The TGR was classified as a Management Group 5 field. However, being classified did not appear to influence or shape the way the TGR was actually managed. Policy 121 does not provide guidance on decisions relating to takes, uses and discharges within the TGR. There are no special rules for geothermal takes or discharges within Geothermal Management Group 5. Policy 121 identifies that discharges are the major constraint for the Geothermal Management Group 5 fields. This is not necessarily the case for the TGR, where the constraints are primarily limited knowledge about the capacity of the system and the TGR being part of a wider aquifer system (comprising warm and cool parts). Integrated management is not acknowledged within this policy. It only focuses on the take and use, damming and diversion of geothermal water, heat and energy. There is no recognition of the effects of, or need to manage, geothermal discharges within Geothermal Management Group 5 fields.	<u>Changes to Policy</u> ► Retain Policy 121 and include widen scope to include the need to manage the effects of discharges ► Include TGR-specific policies and methods (via System management Plan) to guide decisions around take, use and discharges

Ref	Wording	RELEVANCE & APPROPRIATENESS: Is it relevant to the TGR? In what way did it relate to the Objective? Did the policy provide enough guidance / tools on how to meet the Objective?	EFFECTIVENESS: Did this policy work? How effective was this policy in achieving the objectives? Was it implemented - by who? & how? - If not why not?	RECOMMENDATIONS: Changes needed to policy design / wording? Changes needed to internal processes? Further research and monitoring?
Policy 123	To allocate geothermal water, heat and energy according to Policy 119 and Policy 120, and the following: (a) Efficient Use - To require the efficient use of geothermal water, heat and energy by individual geothermal abstractions to ensure the amount allocated in terms of energy or heat (thermal) equivalents does not exceed an amount adequate to service the use sought. *Note – the efficient use of geothermal water, heat or energy will be assessed on a case by case basis.*	Yes, relevant to the TGR Policy 123 (a) seeks to ensure allocation is done efficiently which relates to Objective 72. Policy 123 provides enough guidance and has a clear statement that users should only be allocated what they need. However, the methods to implement this policy (241 & 249) do not provide enough guidance regarding how to assess efficient geothermal resource use. In contrast, Method 168 provides specific matters to consider when assessing the efficiency of a freshwater take for irrigation, commercial or municipal use.	**This policy was ineffective because of poor implementation and policy design/wording** Data analysis of consents shows that the amount used is often less than the amount allocated by a large margin. Pearson and Alcaraz (2013) estimate that actual use of the TGR is only about 10% of consented allocation. There was no assessment of the efficiency of the heat use of the extracted resource. Consent officers focused instead on the efficiency of geothermal water use. Efficient water use calculations are only available for geothermal takes for horticultural irrigation (based on evapotranspiration rates). There are no known efficient water or heat use calculations being used, in relation to the TGR, for greenhouse, commercial or domestic use of geothermal resources.	Changes to Policy ► Retain Policy 123(a) Changes to Internal Processes (consents & science) ► Determine what information is needed to be able to assess the efficiency use of the geothermal heat and water resource ► Ensure allocation (new and renewals) are limited to no more than that required for use ► Impose seasonal limits for irrigation takes. ► Ensure all granted consents are subject to use monitoring, reporting and review conditions. Further research and monitoring (science) ► How to assess the efficient use of geothermal takes within the TGR (domestic, commercial, greenhouse use)
Policy 123	(b) First in first served basis To allocate geothermal water, heat and energy on a first in first served basis while ensuring efficient use as defined in (a).	Yes, relevant to the TGR Policy 123(b) is clear and directive regarding intention and implementation	**This policy was effective** All allocation of geothermal water, heat and energy has been on a first in first served basis. As covered above, the assessment of efficient use (outlined in Policy 123(a)) was not implemented well.	Changes to Policy ► Retain Policy 123(b)

Ref	Wording	RELEVANCE & APPROPRIATENESS: Is it relevant to the TGR? In what way did it relate to the Objective? Did the policy provide enough guidance / tools on how to meet the Objective?	EFFECTIVENESS: Did this policy work? How effective was this policy in achieving the objectives? Was it implemented - by who? & how? - If not why not?	RECOMMENDATIONS: Changes needed to policy design / wording? Changes needed to internal processes? Further research and monitoring?
Policy 123	(c) Tradable permits To consider the use of tradable permits in geothermal fields where there is a high demand for geothermal water, heat and energy.	Yes, relevant to the TGR Transfers (via tradeable permits) are an effective tool in improving the efficient use of geothermal resources, where demand is high. Policy 123(c) does not provide guidance as to when permit transfers should occur and how they should be handled. In the absence of clearer policy or a specific method, the provisions outlined in s136 of the Resource Management Act applies (i.e. when, where what is assessed)	**This policy was effective** There have been no transfers of allocation between bores within the TGR. Only transfers from consent holder to consent holder (same site) have occurred. To date, there has been no demand for tradeable permits within the TGR. However, this may change once allocation limits are established for the TGR. Although providing for transfers within the TGR may increase use efficiency, it could also have a detrimental effect on the sustainability of the system. This is because transfers would unlock dormant allocation and increase the cumulative effect on the TGR, a system that is sensitive to overuse **Refer to Appendix 6 for details**	Changes to Policy ► Retain Policy 123(c) ► Add a TGR-specific policy to specify that transfers will not be provided for within the TGR
Policy 124	To manage the discharge of geothermal water according to Policy 119 and Policy 120 and the following: (a) Reinjection - To prefer reinjection where practicable ... (b) Discharge to water - To allow the discharge of geothermal water to water only where: ... (c) Discharge to land soakage - To manage discharges of geothermal water into and onto land by soakage	Yes, relevant to the TGR Policy 124 addresses geothermal discharges i.e. Objective 69 in its entirety for reinjection and Objective 65 for all types of discharges. Policy 124 is directive and flexible enough in terms establishing criteria for each discharge method. It provides clear guidance in terms of the preferred hierarchy of geothermal discharge methods while acknowledging the constraints associated with each type of discharge. For example, reinjection of discharge fluid is preferred, but only where practical and	**This policy was ineffective because of poor implementation** Based on observations to date, reinjection is not actively promoted or prioritised. Within the TGR, at least 7% of geothermal discharges within the TGR are via reinjection. The majority of discharges are via land soakage, stormwater or are not specified in the consents database Based on a review of officer reports, it is clear that consent officers assess geothermal discharges and make reference to Policy 124. However, there is no explicit assessment and documentation against the hierarchy (& associated requirements) established by Policy 124. Consent applicants are not required to demonstrate that the most appropriate method of discharge for the site has been selected. There are no specific questions in the consent application form. It is unclear whether applicants are asked for this information.	Changes to Policy ► Retain policy and combine with Policy 119(e) Changes to Internal Processes (consents & science) ► Require consent applicant to demonstrate that the most appropriate method of discharge for the site has been selected i.e. justify why reinjection was not chosen / feasible ► Assess and document discharge applications against the hierarchy (& associated requirements) established by Policy 124.

Ref	Wording	RELEVANCE & APPROPRIATENESS: Is it relevant to the TGR? In what way did it relate to the Objective? Did the policy provide enough guidance / tools on how to meet the Objective?	EFFECTIVENESS: Did this policy work? How effective was this policy in achieving the objectives? Was it implemented - by who? & how? - If not why not?	RECOMMENDATIONS: Changes needed to policy design / wording? Changes needed to internal processes? Further research and monitoring?
		appropriate.		
Policy 126	To gather and maintain sufficient quality information to enable the effective management of geothermal resources, including contemporary modelling data where appropriate.	Yes, relevant to the TGR Good quality and robust information is needed to make good decisions on the allocation and management of the TGR The policy was clear and directive about what it needed to achieve. However the associated methods (247, 249, 253) seem to target the resource user and SOE monitoring. There is no requirement for Council to undertake research / investigations and gather information to meet Objective 65.	**This policy was ineffective because of poor implementation** <u>Information gathered since 2010</u> Council has limited quality information on the TGR. Since the Plan became operative, information gathered has been limited to: ► State of the Environment monitoring of six geothermal bores. Consent monitoring of geothermal takes within the TGR (~137 consents as at May 2014) ► Reservoir modelling of the TGR (2013). <u>What is missing</u> Quality information is needed for the effective management of the TGR. In particular the amount of heat available for allocation; temperature profiles; more information about actual water use <u>Consent Monitoring</u> Out of the 137 consents within the TGR (as of December 2014): ► only 57% require water use monitoring ► 45% require temperature monitoring. Consent holders are required to submit this data (water use, temperature) data. There is no verification of the quality of this information i.e. no requirement for telemetry of most takes. One potential option is for Council to carry out temperature monitoring on behalf of all consent holders. This is to ensure a consistent and cost effective means of collecting information. There is a large variability in the conditions imposed on resource consents with the TGR, especially around the type and frequency of monitoring (water use, temperature) and reporting. This has meant that information submitted to Council by consent holders has been variable (e.g. 67796 & 67825, both granted in 2014)	<u>Changes to Policy</u> ► Retain Policy 127 (unchanged) ► Broaden Method 253 to include research and investigation. <u>Changes to Internal Processes</u> (consents & science) ► Improve linkage between consents - compliance – science regarding information collected via consents & SOE monitoring ► Science to confirm what information they need to make an informed decision when assessing TGR consent applications ► Ensure consent conditions are consistent ► Ensure all granted consents have clear water use and monitoring (geothermal water and discharge) conditions <u>Further research and monitoring</u> (science) ► Refined reservoir model of the TGR (i.e. capacity of geothermal heat and water) ► Broaden SOE monitoring to include more bores in areas where the threat of cooling is the greatest. ► Explore the option of carrying out temperature monitoring on behalf of consent holders

Ref	Wording	RELEVANCE & APPROPRIATENESS: Is it relevant to the TGR? In what way did it relate to the Objective? Did the policy provide enough guidance / tools on how to meet the Objective?	EFFECTIVENESS: Did this policy work? How effective was this policy in achieving the objectives? Was it implemented - by who? & how? - If not why not?	RECOMMENDATIONS: Changes needed to policy design / wording? Changes needed to internal processes? Further research and monitoring?
Policy 128	To raise community awareness of: (a) The finite availability of geothermal water, heat and energy. (b) The long-term effects of depletion of geothermal resources. (c) The vulnerability of geothermally-dependant ecologies to adverse effects. (d) Geothermal hazards.	Yes, relevant to the TGR. Policy 128 was clear and directive about what it needed to achieve. Implementation is guided by Methods 240 and 242.	This policy was ineffective because of poor implementation This policy was well articulated but has been ineffective. This is because it was not implemented and there have been no proactive attempts to increase public awareness. There is very little publically available information in relation to the TGR, the different uses and the associated risks of overuse. All community awareness regarding geothermal resources seems to focus on Rotorua and Kawerau. Anecdotal evidence confirms that there is poor awareness about the existence of the TGR let alone the efficient and sustainable use of the resource. There is no information on the BOPRC website about the TGR, other than a few sentences about low temperature geothermal systems.	Changes to Policy ► Retain Policy 128 (unchanged) ► Establish a TGR-specific method combining the requirements for Methods 240 and 242. Changes to Internal Processes (consents, science & communications) ► Develop a TGR-specific communications plan. This is to ensure that communication is effective, in terms of the message(s), target audience(s) and methods of communication. This is essential, given the number of different types of geothermal systems and associated city/district councils. ► Include TGR-specific information on the BOPRC website and on geothermal consent application forms ► Produce an information sheet regarding: - The TGR (where, what are the problems & risks) - Geothermal discharges. This should be made available on BOPRC, TCC and WBOPDC websites and be attached to BOPRC consent application forms.
Policy 129	To require the use of National Drilling Standards for the drilling and installation of geothermal bores.	Yes, relevant to the TGR This is policy implements Objective 70 requiring geothermal bores are constructed to an appropriate drilling standard.	Yes. Requiring a bore log as a consent condition meant that information recorded by the bore drillers was submitted to Council. This included confirmation that the bore was constructed to the NZ drilling standards, thus meeting Objective 70.	Changes to Policy ► Correct typo in Method 249(g) – "bog lore" which should be "bore log" ► Confirm the use of the NZ Standard for drilling of soil and rock for bore drilling within the TGR

Ref	Wording	RELEVANCE & APPROPRIATENESS: Is it relevant to the TGR? In what way did it relate to the Objective? Did the policy provide enough guidance / tools on how to meet the Objective?	EFFECTIVENESS: Did this policy work? How effective was this policy in achieving the objectives? Was it implemented - by who? & how? - If not why not?	RECOMMENDATIONS: Changes needed to policy design / wording? Changes needed to internal processes? Further research and monitoring?
		Implementation was guided by Method 249(g) which requires the provision of a bore log as a condition of consent. The bore log requires confirmation that the bore was constructed in accordance to NZ standards. Policy 129 is clear and directive, referencing the specific NZ Standard for drilling of soil and rock as a footnote. However, the template for consent officer reports refers to New Zealand Standards NZS 2403, Code of Practice for Deep Geothermal Wells, which is more appropriate for high temperature geothermal systems.	A disadvantage of referring to some external reference documents is the limited ability to access the information. In this case, the NZ Standards are not publically available due to copyright and must be purchased. It is assumed that all well drillers have a copy of the NZ drilling standards.	
Policy 130	To require bore log information to be collected and provided to Environment Bay of Plenty for the purpose of establishing an accurate record of geothermal resources in the region.	Implementation is guided by Method 249(g) which requires the provision of a bore log as a condition of consent. The bore log includes confirmation from the driller that the requirements of NZ Standard 4411:2001 Environmental Standard for Drilling of Soil and Rock were met. There was no guidance on the minimum level of information needed in the bore logs, due to a lack of associated method(s) and difficulty in accessing the National Drilling Standards (which require purchasing) for additional	Yes Requiring a bore log as a consent condition meant that information recorded by the bore drillers was submitted to Council. This included information about the well and associated geology (e.g. location, depth, temperature). However implementation could be improved by requiring better information from well drillers. For example, temperature readings and profiles would be useful to gather information about the TGR and wider groundwater aquifer. It would also confirm whether or not a drilled well was accessing groundwater or the geothermal resource. Environmental scientists have confirmed a few instances where, bore permit applications have been submitted for 29°C water resource in areas with known geothermal waters (>30°C). In those particular instances, compliance checks are essential to confirm whether or not the associated take is accessing the	<u>Changes to Policy</u> ► Retain Policy 130 (unchanged) <u>Changes to Internal Processes</u> (consents & science) ► Science to confirm what information is needed in bore logs e.g. temperature monitoring (i.e. temperature profiles) ► Consents staff to impose, as a consent condition, temperature monitoring for all bore permits (groundwater and geothermal) within the Western Bay of Plenty – Update SOP. ► Consents to check bore logs, when processing associated water permit, to ensure that the correct type of water permit (groundwater vs geothermal) has

Ref	Wording	RELEVANCE & APPROPRIATENESS: Is it relevant to the TGR? In what way did it relate to the Objective? Did the policy provide enough guidance / tools on how to meet the Objective?	EFFECTIVENESS: Did this policy work? How effective was this policy in achieving the objectives? Was it implemented - by who? & how? - If not why not?	RECOMMENDATIONS: Changes needed to policy design / wording? Changes needed to internal processes? Further research and monitoring?
		information/clarity.	groundwater or the geothermal resource.	been applied for.

APPENDIX 4: EVALUATION OF METHODS

Exclusions: Method 243-246 and 252 relate to geothermal surface features, taonga and hazards as well as protecting commercially sensitive information.

- Geothermal hazards and surface features are not present within the TGR
- Based on a review of Iwi and Hapu Management Plans, there are no known areas of traditional use and/or geothermal surface features.
- Method 246, which refers to protecting commercially sensitive information, relates more to other geothermal fields, such as Kawerau.
- Method 252 relates to the classification of new geothermal fields

As a result, these policies are excluded from evaluation.

All references to data or statistics within the evaluation is based on an analysis of all resource consents within the TGR as at May 2014.

	Wording	RELEVANCE & APPROPRIATENESS: Is it relevant to the TGR? In what way did it relate to the Objective? Did the policy provide enough guidance / tools on how to meet the Objective?	EFFECTIVENESS: Did this policy work? How effective was this policy in achieving the objectives? Was it implemented - by who? & how? - If not why not?	RECOMMENDATIONS Changes needed to policy design / wording? Changes needed to internal processes? Further research and monitoring?

	Wording	RELEVANCE & APPROPRIATENESS: Is it relevant to the TGR? In what way did it relate to the Objective? Did the policy provide enough guidance / tools on how to meet the Objective?	EFFECTIVENESS: Did this policy work? How effective was this policy in achieving the objectives? Was it implemented - by who? & how? - If not why not?	RECOMMENDATIONS Changes needed to policy design / wording? Changes needed to internal processes? Further research and monitoring?
Method 240	Produce an information leaflet on the guidelines for the discharge of geothermal fluid in Management Group 5 areas. This may be carried out in conjunction with relevant city and district councils.	The TGR is a Management Group 5 field. This Method implements Policy 119(e), 124 and 128. Method 240 was clear and directive regarding what was needed i.e. TGR geothermal discharges information leaflet.	This method was ineffective because of poor implementation This method was not been implemented. Council has not produced any information leaflets regarding geothermal discharges within the TGR. Tauranga City Council produced an information leaflet regarding geothermal discharges from domestic pools within the Tauranga City, but this does not fulfil the requirements of Method 240. It simply restates Policy 124 and refers pool owners to the BOPRC regarding geothermal discharges. Refer to Policy 128 for additional information regarding the effectiveness of the 'community awareness provisions'.	Changes to Policy ► Retain Method 240 Changes to Internal Processes (consents, science and communications) ► Produce an information sheet regarding: - The TGR (where, what are the problems & risks) - Geothermal discharges. This should be made available on BOPRC, TCC and WBOPDC websites and be attached to BOPRC consent application forms.

	Wording	RELEVANCE & APPROPRIATENESS: Is it relevant to the TGR? In what way did it relate to the Objective? Did the policy provide enough guidance / tools on how to meet the Objective?	EFFECTIVENESS: Did this policy work? How effective was this policy in achieving the objectives? Was it implemented - by who? & how? - If not why not?	RECOMMENDATIONS Changes needed to policy design / wording? Changes needed to internal processes? Further research and monitoring?
Method 241	Promote measures to ensure the efficient use of geothermal water, heat and energy, including: (a) Measures for the optimum value usage from extracted geothermal water, heat and energy, such as: (i) The secondary use of extracted heat and water (cascade use), and (ii) The extraction of useable by-products (such as minerals) from water prior to reinjection or other discharge to the environment. (b) Encouraging organisations, industry groups and individuals to develop ways in which their geothermal takes can be reduced through the adoption of good management practices. (c) The use of down-hole heat exchangers.	Yes, relevant to the TGR (particularly for (a)(i), (b) and (c)) This method seeks to promote a range of measures to ensure efficient use of geothermal water, which directly implements Objective 72. This method implements Policy 119(c), 120 and 123(a) Method 241(a) and (c) are clear and directive statements. Method 241(a) uses examples to explain terms such as secondary use = cascade use; useable by-products = includes minerals Method 241(b) is vague. Method 241 does not provide any guidance regarding how to assess efficient geothermal resource use.	**This policy was ineffective because of poor implementation and policy design/wording** This method was not implemented well nor does it provide enough guidance regarding efficient geothermal resource use. The multiple use of extracted resources within the TGR is not currently promoted within internal Council procedures. Method 241 does not provide any guidance regarding how to assess efficient geothermal resource use. In contrast, Method 168 provides specific matters to consider when assessing the efficiency of a freshwater take for irrigation, commercial or municipal use. Method 241(b) is unclear about what is meant by good management practices. No reference is provided to any particular industry standard. This potentially leaves interpretation of this sub-method up to organisations, industry and individuals. Refer to Policy 119(c) and 123(a) for additional information regarding the effectiveness of the 'efficiency provisions'.	In addition to the recommendations outlined in Policy 119(c), 120 and 123(a): <u>Changes to Policy</u> ► Retain 241 but clarify what is meant by good management practices in (b) ► New method - guidance around what constitutes efficient water and heat use (similar to Method 168)

	Wording	RELEVANCE & APPROPRIATENESS: Is it relevant to the TGR? In what way did it relate to the Objective? Did the policy provide enough guidance / tools on how to meet the Objective?	EFFECTIVENESS: Did this policy work? How effective was this policy in achieving the objectives? Was it implemented - by who? & how? - If not why not?	RECOMMENDATIONS Changes needed to policy design / wording? Changes needed to internal processes? Further research and monitoring?
Method 242	In conjunction with city and district councils, raise community awareness and understanding of geothermal resources and hazards using appropriate education and promotion techniques and mechanisms, including those listed in the Environment Bay of Plenty Environmental Education Strategy for Environment Bay of Plenty 1999-2005	Yes, relevant to the TGR This method implements Policy 128 and 132 Method 242 was clear directive regarding what was needed and left it up to Councils to determine the appropriate ways/tools to raise awareness e.g. media release, information sheet etc.	**This policy was ineffective because of poor implementation** This method was not implemented. There has been no proactive attempts to increase public awareness within the TGR. There is very little publically available information in relation to the TGR, the different uses and the associated risks of overuse. Refer to Policy 128 for additional information regarding the effectiveness of the 'community awareness provisions'.	Changes to Policy ► Retain Method 242 but widen to include Method 243 (cultural use) Changes to Internal Processes (consents, science and communications) ► Develop a TGR-specific communications plan. This is to ensure that communication is effective, in terms of the message(s), target audience(s) and methods of communication. This is essential, given the number of different types of geothermal systems and associated city/district councils.
Method 247	Require resource consent applicants to provide the following information, where the information is appropriate to the scale and significance of effects that the proposed activity may have on the environment: (a) Modelling and research data relating to the potential of the field and its characteristics and values. (b) The amount of geothermal resource available for allocation from the field. (c) The extent of geothermal surface features and associated ecosystems. ...	Yes, relevant to the TGR (with the exception of (c)) This method implements Policy 119 and 120. Method 247 is clear and directive. However, it did not provide enough guidance for the TGR. This method appears to be more relevant for the convective, high temperature geothermal fields (Groups 1-4).	**This policy was ineffective because of poor policy design/wording** The intention behind this method is sound/logical, however the content of the method is not particularly relevant or useful for the TGR: ► Method 247(a) - this data has only recently become available via GNS reservoir model, which was commissioned by Council ► Method 247(b) - Council does not have any information about the amount of geothermal water, heat or energy available for allocation. It would not seem fair to expect applicants to find this information ► Method 247(c) - this is not relevant for the TGR This method appears to be more relevant for the convective, high temperature geothermal fields e.g. Kawerau. In practice, consent applicants do not need to provide the information outlined in Method 247 for geothermal takes within the TGR. Standards consent application forms – which apply to all geothermal fields – do not ask for the matters outlined in (a)-(c).	Changes to Policy ► Guidance specifically for the TGR – via new policy - which an applicant must provide or demonstrate. This could include: – rate of take (L/s and daily) – timing of take (every day, only certain months) – purpose of take – measures to ensure efficient use of geothermal heat – volume of geothermal water/heat sought is reasonable for the intended purpose – method and location of geothermal discharge – alternative methods and locations considered for the geothermal discharge

	Wording	RELEVANCE & APPROPRIATENESS: Is it relevant to the TGR? In what way did it relate to the Objective? Did the policy provide enough guidance / tools on how to meet the Objective?	EFFECTIVENESS: Did this policy work? How effective was this policy in achieving the objectives? Was it implemented - by who? & how? - If not why not?	RECOMMENDATIONS Changes needed to policy design / wording? Changes needed to internal processes? Further research and monitoring?
Method 248	As part of the assessment of a resource consent application for the use or development of geothermal resources, consider: (a) Requiring geothermal field development to be staged in order to establish field characteristics prior to full development, where appropriate to the scale and effects of the activity. (b) Establishing, and as appropriate reviewing, the amount of geothermal resource available for allocation from the field as this relates to the sustainable use and development of the field. This may include establishing appropriate limits to allow for natural, seasonal or other variation in field water levels and pressure.	This method implements Policy 119(b) and 119(c) Method 248 was clear directive regarding what was needed.	This policy was ineffective because of poor implementation This method has not been implemented, in relation to the TGR. In particular: ► there has been no staged development of the TGR, or ► allocation limits set for the geothermal (heat/water) resource. As discussed in the assessment for Policy 119(b), a precautionary approach has not been taken in relation to allocation from the TGR. In other words, allocation from the TGR continues in the absence of allocation limits and quality information about the resource.	Changes to Policy ► Retain Method 248 as it is still applicable region wide, including the TGR Further research and monitoring (science) ► Refined reservoir model of the TGR ► Amount of heat and warm water available for allocation from the TGR ► Allocation limits for the TGR
Method 249	Use resource consent conditions to require persons who take and use geothermal water, heat or energy to: (a) Install devices to ensure the efficient use of geothermal water, heat or energy where the abstracted amount in terms of energy or heat (thermal) equivalents does not exceed an amount adequate the service the use. This is to ensure the wastage of geothermal water, heat or energy is minimised.	Yes, relevant to the TGR Method (a) is wordy and not clear. It is unclear what is intended by this sub-method. The typographic error within the sentence also reduce its clarity. Methods 249 (b)-(h) are clear and directive. Method 249 (g) contains a typographic error. Method 249	This policy was ineffective because of poor implementation Consent conditions imposed since the Plan became operative have varied significantly. This has resulted in inconsistencies between consents, particularly in relation to consent purpose, frequency of metering, monitoring and reviews. There are 137 consents within the TGR (as of May 2014). 28 of these were granted after the RWLP was made operative. Of those 28 consents: a) 0% have a condition requiring the installation of devices to ensure efficient use of geothermal water, heat or energy. b) 100% have a condition requiring the measurement of geothermal fluid abstracted. The measurement frequency	Changes to Policy ► Retain Method 249 as it is still applicable region wide, including the TGR ► Correct typographic errors in Method 249 (a) and 249(g) Changes to Internal Processes (consents, science and communications) Develop and use consistent consent conditions for geothermal takes and discharges within the TGR

	Wording	RELEVANCE & APPROPRIATENESS: Is it relevant to the TGR? In what way did it relate to the Objective? Did the policy provide enough guidance / tools on how to meet the Objective?	EFFECTIVENESS: Did this policy work? How effective was this policy in achieving the objectives? Was it implemented - by who? & how? - If not why not?	RECOMMENDATIONS Changes needed to policy design / wording? Changes needed to internal processes? Further research and monitoring?
	(b) Measure their use of geothermal water, heat or energy. (c) Measure the loss in field pressure resulting from the activity, where appropriate. (d) Minimise heat loss from extracted geothermal water, heat or energy by: (i) Using an appropriate method to take and use geothermal water, heat or energy to minimise the heat loss from the abstracted water, heat or energy. (ii) Installing and adequately controlling appropriate heat transfer equipment. (iii) Insulating mass and heat abstraction and exchanger systems and associated pipework, where appropriate. (iv) Effectively maintaining the heat exchange and reticulation system. (e) Ensure that the borehead design and construction includes a manual bore control valve and provide for the installation of an orifice plate and water meter after the bore control valve, where practicable. …	(e) - borehead design - is detailed, possibly too detailed. Some sub-methods outline why they are needed (a) & (f), which is useful but not essential. In the context of sub-method (a) the explanation is useful to understand the intention of the sub-method, given its lack of clarity	ranges from daily to 5x per year c) 0% have a condition require the loss in field pressure to be measured d) 96% have a condition requiring use to be efficient (with details provided via an Advice Note). A third of these specify the requirement to install a restrictor device. e) 100% have a condition requiring access to the borehead although this is worded differently from that specified in the sub-method. f) 93% have a condition requiring regular reporting of geothermal fluid abstracted. The reporting frequency ranged from monthly to five times every three years. g) bore log conditions were not relevant for the take/use/discharge consents but imposed on bore permits h) conditions relating to subsidence were not relevant for the TGR A number of resource consents only require water use measurement reporting 10 times over the life of the consent. For example consent 66641 relates to a geothermal take for a swimming pool (346 m^3/day). The consent holder is only required to measure actual use five times in 2012 and again in 2015. This is the same for temperature monitoring (take and discharge). The consent expires in 2022. Conditions such as this mean that insufficient quality information about the actual use and the effects of the activity is gathered over the term of the consent. Method 249 does not provide guidance for geothermal discharges, even though all consents are for the combined take/use/discharge.	

	Wording	RELEVANCE & APPROPRIATENESS: Is it relevant to the TGR? In what way did it relate to the Objective? Did the policy provide enough guidance / tools on how to meet the Objective?	EFFECTIVENESS: Did this policy work? How effective was this policy in achieving the objectives? Was it implemented - by who? & how? - If not why not?	RECOMMENDATIONS Changes needed to policy design / wording? Changes needed to internal processes? Further research and monitoring?
Method 250	Consider issuing a resource consent for multiple drilling sites within a defined area where an existing resource consent is held for the use and development of a geothermal field. The drilling consent will address the protection of geothermal surface features in accordance with Policies 119 and 121; compliance with Policies 129 and 130; and address adverse effects on other users of the field.	Yes, relevant to the TGR This method does not relate to any specific Objective - instead it relates to internal procedures for consent processing The method was clear and directive.	This method does not relate to any specific Objective - instead it relates to existing internal procedures for consent processing. This method is not considered necessary.	<u>Changes to policy</u> ► Remove Method 250
Method 251	Consider issuing composite consents for the development and use of geothermal resources, which will cover all relevant activities restricted by rules in section 9.11 of this regional plan.	Yes, relevant to the TGR This method does not relate to any specific Objective - instead it relates to internal procedures for consent processing The method was clear and directive.	No. This method does not relate to any specific Objective - instead it relates to existing internal procedures for consent processing. This method is not considered necessary.	<u>Changes to policy</u> ► Remove Method 251

APPENDIX 5: EVALUATION OF RULES

Exclusions: Rules 72, 74, 75A, 75B, 75C and 76 as they do not relate to Geothermal Management Group 5 which the TGR is part of.

Ref	Description	EFFECTIVENESS:	EFFICIENCY	RECOMMENDATION
Rule 73	Take and Use of Geothermal Water, Heat or Energy. Discretionary Activity	This is the main rule which triggers the requirement for consent to take and use water and heat from the TGR. This rule is effective as a catchall for geothermal takes within the region[12]. This provides certainty regarding the status of geothermal takes and avoids the need for rules for all individual geothermal fields. This also allows each application to be assessed on a case by case basis in relation to policies and methods.	This rule is efficient, as all geothermal abstraction activities are listed under one rule. Activities with potential adverse effects can be considered on a case by case basis. This increases costs to the applicant however these are balanced out by the benefits to the environment from ensuring these activities are controlled by appropriate, tailored consent conditions, and checked for compliance.	Retail Rule 73
Rule 75	Installation of Geothermal Bores in Geothermal Management Group 5, and Take and Use of Geothermal Water, Heat or Energy for Bore Testing Restricted Discretionary Activity	This is the main rule which triggers the requirement for consent to construct a bore within the TGR This rule is effective. The activity status acknowledges bore installation within the TGR has a lower risk of causing adverse environmental effects than that within high temperature systems.	This rule is efficient, as all geothermal construction activities within the TGR are listed under one rule. Activities with potential adverse effects can be considered on a case by case basis. This increases costs to the applicant however these are balanced out by the benefits to the environment from ensuring these activities are controlled by appropriate, tailored consent conditions, and checked for compliance.	Retain Rule 75

[12] Except for takes within the Rotorua Geothermal Field and takes prohibited by Rule 74

Ref	Description	EFFECTIVENESS:	EFFICIENCY	RECOMMENDATION
Rule 77	Discharge of Geothermal Water by Land Soakage or Reinjection Restricted Discretionary Activity	Rules 77 and 77A are partially effective. There is a level of uncertainty regarding the status of certain geothermal discharges. This is because the term "land soakage" appears in both rules. Therefore, it is difficult to ascertain whether land soakage is a restricted discretionary or discretionary activity. Irrespective of the activity status, these rules ensure that all geothermal discharges within the TGR are consented. The activity status for Rule 77 provides an incentive to discharge geothermal water via reinjection, in accordance with Objective 69, Policy 119(d) and Policy 124.	All geothermal discharges require resource consent. Activities with potential adverse effects can be considered on a case by case basis. This increases costs to the applicant however these are balanced out by the benefits to the environment from ensuring these activities are controlled by appropriate, tailored consent conditions, and checked for compliance.	Retain Rule 77
Rule 77A	Discharge of Geothermal Water Discretionary Activity			Retain Rule 77A

APPENDIX 6: PERMIT TRANSFER RESEARCH

This Appendix presents research to inform the evaluation of Policy 123(c) of the geothermal provisions (Appendix 3).

The Tauranga Geothermal Resource Issues and Options Report[13] recommended:

i) The development of RWLP policy, specifically criteria to establish when a transfer may occur.
ii) Research on the most flexible mechanisms of transferring allocation without compromising the Tauranga Geothermal Resource (TGR).

This paper summarises the current approaches and constraints to the effective management of water permit transfers. In this case, the research undertaken relates to water permits for cold water. However, the considerations for warm water permit transfers will be similar.

INTRODUCTION

What is a Water Permit Transfer?

A water permit[14] may be transferred (in full or part) to another consent holder and/or another site. Such transfers may be permanent or for a limited permit. A transfer must be within the same catchment/aquifer, be expressly allowed by the regional plan and approved by the consent authority[15].

In processing such an application, Council would need to assess the effects of the proposed transfer. This would include the effect of ceasing or changing the exercise of the permit under its current conditions as well as the effects of allowing the transfer.

Water permit transfers become important where the demand on a water resource is already high. They may also be a means by which opportunities for diverse consumptive use of the resource can be achieved.

What does the RWLP Provide?

Policy 123(c) of the RWLP provides for "the use of tradable permits …where there is a high demand for geothermal water, heat and energy". Unlike Chapter 18 (Transfer of Allocations) of the Rotorua Geothermal Regional Plan, there is no guidance or criteria in relation to the process by which transfers can occur.

CURRENT APPROACHES TO WATER PERMIT TRANSFERS

A review of regional plans found that transfers were expressly allowed subject to criteria. The type and number of criteria varied between Councils. More detailed criteria was evident in the various Canterbury Catchment-based Regional Plans. Furthermore, no transfers were permitted within over allocated catchments.

[13] REVISED Tauranga Geothermal System Issues and Options Report July 2014
[14] Includes fresh water, coastal water and geothermal water
[15] s136 Resource Management Act – Transferability of Water Permits

CONSIDERATIONS FOR THE TGR

It would be fairly straight forward to develop policy to provide guidance or criteria in relation to transfers within the TGR. However a number of matters need to be considered:

Providing for Discharge Permits

Every resource consent to take geothermal water or heat from the TGR has a corresponding discharge permit, with a specific discharge point, type of discharge and rate of discharge. Any transfer of geothermal water within the TGR would trigger the need to also transfer the associated discharge permit (in whole or part) under Section 137 of the RMA.

In processing such an application, Council would need to assess the effects of the proposed discharge, such as the environmental effect of changing the location of the discharge and in some cases, the type of discharge (e.g. to surface water instead of reinjection). This, in addition to assessing the effect of the transfer on the TGR and the groundwater resource increases the level of complexity (and staff time to process) with these applications.

Managing Dormant Allocation (a.k.a. Sleepers)

The Issues and Options Report noted that consented allocation does not currently reflect actual use. While water permit transfers are a favoured mechanism for maximising the value of a resource, in the case of the TGR, it could also have adverse effects. As mentioned in the Issues and Options Report, transfers may 'unlock' allocated water that is not currently in use.

> *For example, Mr Blogs has a resource consent to take up to 250 m^3/day of geothermal water for horticultural use. He only uses up to 100 m^3/day so decides to transfer the remaining 150 m^3/day to a neighbour.*

This means that the actual use and associated cumulative effect on the TGR has increased, even though allocation (on paper) remains unchanged.

The reservoir model developed by Pearson and Alcatraz indicated that extractions within the TGR would cause greater adverse effect if actual use was between 50-100% of allocated use. Putting this into perspective, the model indicated that extracting the full amount allocated by resource consent could cool parts of the resource within 38 years.

CONCLUSION AND RECOMMENDATION

Although providing transfers within the TGR would increase the efficiency of use, it could have a detrimental effect on the sustainability of the system. Unlocking dormant allocation through transfers, would increase the cumulative effect on the TGR, a system that is sensitive to overuse. This is the greatest concern relating to transfers within the TGR.

Recommendation:

That the RWLP specifically does not provide for transfers within the TGR. This position may be revised once a number of the recommendations within the Issues and Options Report are completed. This includes:

- establishing sustainable allocation limits for the TGS
- knowing actual use through water use measurement and reporting
- aligning allocation with actual use