THE CHANGING FACE OF GEOTHERMAL SYSTEM MANAGEMENT PLANS IN NEW ZEALAND.

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ABSTRACT

System Management Plans (SMPs) are today a well-recognised and accepted tool in geothermal management. The concept of SMPs is embedded in the regional policy statements of the Bay of Plenty and Waikato Regional Councils where policy directs that systems subject to more than a certain level of use and/or a Development classification must prepare a system management plan. The policy intent is to ensure whole system management which is integrated and responds to changes caused by its use.

The concept of management plans is not new, with field management plans integral to the commencement of geothermal development in New Zealand. A drive towards a 'catchment management' type has resulted in SMPs being developed as part of consent processes. Regional policy documents now prescribe the minimum content of SMPs, including such matters as system characteristics, adaptive management, production and discharge strategies, and management of geothermal surface features. However, the form and content is flexible. In the Waikato SMPs have been required as part of resource consent applications for Development Systems, such as Rotokawa, and to inform adaptive management on largely single user fields. In the Bay of Plenty at Kawerau the SMP has taken a different form, as a non-statutory document akin to a multi user protocol. This includes agreed operational protocols between consent holders and between consent holders and Bay of Plenty Regional Council to achieve sustainable and integrated development of the Kawerau Geothermal System. In Rotorua the SMP currently under development will include traditional components, but is likely to evolve as a multi-party document with a strong influence from Māori and the community. Its scope will go beyond traditional components of system characteristics modelling and allocation and extends into wider matters of principle such as community value setting, matauranga Māori and Māori aspirations. It is also likely to touch on matters of Governance. While performing an integrated and sustainable management function, SMPs therefore must be flexible in form, to provide for specific unique needs of each geothermal system and their communities of interest.

1. HISTORY OF GEOTHERMAL MANAGEMENT IN NEW ZEALAND

Most of the Regions of New Zealand have low temperature geothermal resources, but three also have high temperature resources. The characteristics of these Region's systems vary considerably, as does their management. These three Regions are:

- Northland, which has one high temperature system;
- Bay of Plenty, which has 12 systems, eight of which are high temperature; and
- Waikato, which has over thirty small systems and fifteen high temperature systems.

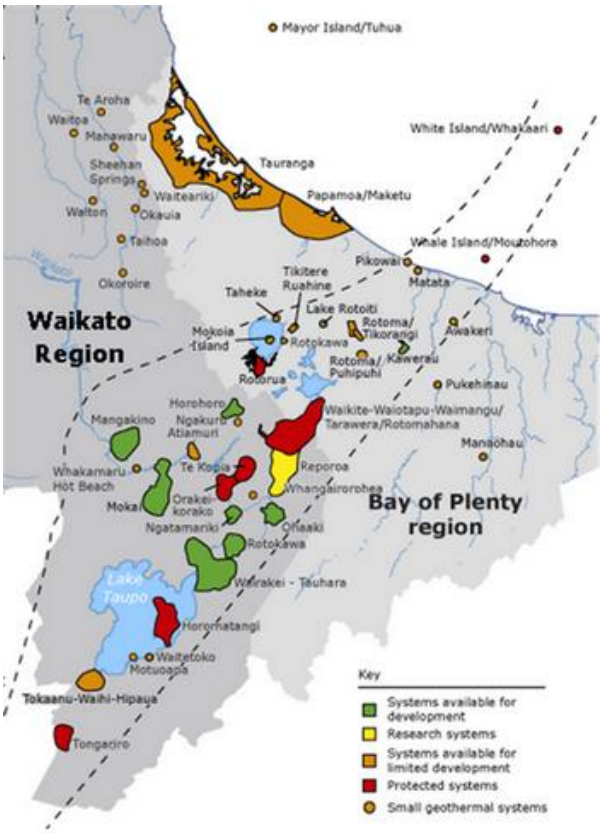

Figure 1: The Taupo Volcanic Zone showing the different high temperature systems in the Bay of Plenty and Waikato Regions.

All the Bay of Plenty and Waikato high temperature systems are found within the Taupo Volcanic Zone (TVZ), which accounts for 95% of geothermal activity in New Zealand. Northland has the only high temperature system outside the TVZ.

These geothermal resources have been used sustainably for hundreds of years by Māori who have uninterrupted relationship with this resource. Since the early 19th Century geothermal features have contributed to the economy, especially through tourism, in areas such as Taupo and Rotorua. In the mid 20th Century geothermal resources started being used for domestic, commercial and industrial

scale direct heat use, and geothermal now accounts for over 17% of NZ's electricity generation. The significant ecological, landscape, cultural values also contribute to community wellbeing and the economy.

2. POLICY FRAMEWORK

2.1 The Resource Management Act 1991

Historically, New Zealand's geothermal resources were managed under various legislation, including the Geothermal Energy Act 1953, that made provision for the taking and use of geothermal energy and the Water and Soil Conservation Act 1967, which required water rights or permits for use of geothermal water. Neither Act provided for the integrated and sustainable management of the resource. Since 1991 geothermal resources have been managed under the Resource Management Act (RMA). The RMA allows allocation of natural and physical resources such as land, air and water, with sustainable management of these resources the overriding goal (RMA 1991). It enables activities provided their adverse effects are avoided, remedied or mitigated and the overall purpose of the Act is met. The machinery for implementing the RMA relies on the relationship between central government and the two-tier local government structure of regional and territorial councils, which have specific functions and responsibilities under the Act. The sustainable management of geothermal resources is the responsibility of regional authorities. In the TVZ these are the Waikato Regional Council (WRC) and the Bay of Plenty Regional Council (BOPRC).

The Act defines any fluid over 30 degrees Celsius as geothermal, and the taking and discharge of geothermal heat and fluid, and emissions to air and water, is controlled by regional councils through resource consents. Access to the geothermal resource also requires agreement with the land owner, often Māori land trusts.

The RMA specifically defines energy produced from geothermal sources as renewable energy. Part II of the Act requires that certain matters of national importance are recognised and provided for or had regard to. For example, it requires regard to be had to the benefits of renewable energy and provides for matters such as the relationship of Māori with their land, water and taonga, the concept of kaitiakitanga or stewardship, the protection of significant indigenous vegetation and habitat of indigenous fauna, and the protection of outstanding natural features and landscapes. All of these matters are relevant when considering the sustainable management of geothermal resource, and a whole system management approach.

2.1 Regional Policy Framework

The RMA is given effect to through a hierarchy of policy documents. National Policy Statements (NPS) are prepared by Central Government and provide consistent national guidance. Of particular relevance to geothermal are the NPS on Electricity Transmission (2008) and the NPS on Renewable Electricity Generation (2011). Regional councils provide further interpretation of the Act via a Regional Policy Statement (RPS), that identifies resource management issues, objectives, policies and methods to achieve integrated resource management in the region. Regional Plans (and District Plans) must give effect to the RPS and contain rules for the use, development and protection of natural and physical resources including for the geothermal resource.

Community participation in policy development and in the resource consent process is integral to the RMA. The development of these policy documents is a public process, and geothermal provisions have attracted significant public submissions and litigation in Court. These documents must be reviewed at least every 10 years.

Geothermal provisions in Regional Policy Statements

The RPS sets the overall direction for management of a region's geothermal systems. The Waikato and Bay of Plenty Regional Councils' RPSs reflect broadly similar policy approaches to the management of geothermal resources. Notably:

- Requirements for sustainable management of geothermal resources
- System categorisation/classification
- A requirement for System Management Plans in certain circumstances
- Provisions for the protection of Significant Geothermal Features
- Provisions for research and information

System classification

Classification of geothermal systems is a critical part of this management regime, where geothermal systems are managed to ensure that different (possibly conflicting) demands on the regional geothermal resource can be satisfied (WRC 2016). Different geothermal systems within a region are managed to maximise the different characteristics of a regional geothermal resource. To achieve fit for purpose management regional councils have classified systems as Development, Limited or Conditional Development, Special Purpose, Protected, Research, or Small Geothermal Systems. The classification is based on:

- existing uses,
- the presence of significant geothermal features and their vulnerability to extractive uses of geothermal energy and fluid,
- the state of knowledge about the system, its surface features, and its possible connection to a Protected Geothermal System, and
- the potential for development to cause significant adverse effects on the geothermal system and other natural and physical resources.

Within the Waikato Region, the depletion of unique characteristics of the geothermal resource will be avoided and recognition will be given to the development potential of the resource. The Bay of Plenty considers uniqueness across the TVZ.

System Management Plans

Both RPSs require the development of SMPs in certain circumstances (ie. for Development Systems, or for systems where the cumulative take of fluid is 1000 tonnes or more per day). A SMP is a whole system management approach, that recognises the need to consider the use and development of a system, and all its parts in an integrated manner and to provide strategies for adaptive use and development.

Both RPSs stipulate the broad content, but their focus and specific content can vary between different systems. Common elements include the requirement for system objectives, adaptive management strategies, strategies for cooperation, production and discharge strategies and the establishment of a Peer Review Panel (PRP).

Neither RPS stipulates the specific process for the development of an SMP, and these may be developed either by resource consent holders (for example as part of consent applications), by the Regional Council on behalf of the community, or jointly. Neither is the nature and form of SMPs limited by policy. For example, in the Bay of Plenty Region the document could form a chapter of the Regional Plan (ie. have statutory policy weight), form a standalone document to support a resource consent application or inform a regional plan, or form an operational protocol. Some of these options are further described below.

SMPs are required to be publicly available (although some content could be treated as commercially sensitive) so that the community can determine that their concerns and agreed expectations are being effectively addressed. As discussed below, there is also a transition towards more involvement of community in the development of SMPs, recognising community values, relationships and aspirations.

Neither RPS requires an SMP for other classes of Geothermal System, until such time as the level of use changes, but arguably this would be an effective approach, especially for Limited/Conditional Development Systems. The result is that in the Bay of Plenty Region, SMPs are currently required for three systems: Kawerau, Tauranga and Rotorua. The Tauranga and Rotorua Geothermal Systems have a long history of development and many consent holders and their SMPs will be developed by the Council on behalf of the community with this in mind. The Kawerau Geothermal System also has a high level of existing use, but few consent holders, and relatively long term, sizeable consents (some of which were granted quite recently). The SMPs for these different systems will therefore naturally take different forms and this aligns with the RPS policy. The RPS is not specific about the process for developing a SMP in recognition of the unique characteristics of the different systems.

The Waikato Regional Plan (WRP) classifies Horohoro, Mangakino, Mokai, Ngatamariki, Ohaki, Rotokawa and Wairakei-Tauhara as Development Geothermal Systems allowing the large-scale take, use and discharge of geothermal energy and water, and therefore require an SMP. In the Waikato the implementation for this policy rests with the Resource Consent Holder(s). The policy provides for the possibility of multiple operators being consented in a Development Geothermal System and how this would be reflected in the SMP. In the Waikato, the actual key elements of the SMP are determined by the resource consent conditions (Luketina 2010).

2. RESOURCE MANAGEMENT PLAN EXAMPLES

2.1 Historical Field Management Plans

The concept of geothermal field or system management plans is not new and such plans were written as part of early geothermal developments before the enactment of the RMA. An example is the draft Wairakei Geothermal Field Management Plan (1989) (WRC 1989). These early management plans were focussed on describing the energy resource, with a science and technical focus. They did not consider matters such as adaptive management approaches, conflict resolution strategies, principles of sustainable management or iwi and community relationships. This reflects the culture of geothermal development in New Zealand at that time, which was focused on the effective fuelling of geothermal power stations and production of reliable electricity.

The RMA widened the focus to sustainable management and some of the integrated system management plans were developed shortly after the RMA was promulgated in 1991. Since then regional councils have adopted different and flexible approaches to the development of SMPs, and this continues to evolve with a move towards increased collaboration and a broadening of the scope and purpose of SMPs. The discussion below describes four different SMPs, each with a slightly different focus.

2.2 Mokai

Background

The Mokai Geothermal System is classified as a Development System under the WRPS. It is located about 25 km north west of Taupo. Tuaropaki are landowners and hold mana whenua over Mokai. The Mokai power station was commissioned in 2000, a 11ha glasshouse that uses geothermal heat has been established and in 2011 a dairy factory was built that uses clean geothermal steam. Resource Consents allow the take, use and discharge of 47,000 t/d of geothermal fluid (WRC 1994).

System Management Plan

The initial instance of a Geothermal SMP was part of the Mokai Geothermal consents approved in December 1994. Expectations of the SMP were for the Consent Holder and Council to:

1) identify goals, objectives, key results and an operational management plan for the efficient development of the Mokai Geothermal System,
2) assimilate the resource data, information and model results and use this information to identify optimum production and injection points, and fluid flow rates. Update the management plan using the resource monitoring and development data and information.
3) use the data and information to provide conceptual scenarios of the resource state, in five years, ten years and thirty years' time.
4) after each new model update produce a public report that describes the initial state of the resource, the previous year's scenarios, the actual state of the resource, and the predicted state of the resource in five years, ten years and thirty years' time.

Collaborative and Open Approach

The focus of the initial discussions and subsequent consenting was on the sustainable management and development of the resource, and this was reflected in the relatively high-level framework of principles around

information and data flows captured in the resource consent conditions. It was recognised that this was a relatively green-fields development occurring under the newly promulgated RMA, the initial Waikato RPS and the developing Waikato Regional Plan. Little was known about the system and therefore the effects of activities, so monitoring for effects, open information flows about the geothermal system, robust scientific peer review of interpretations, and effective adaptive management was going to be critical for successful development. The intent was for a highly collaborative approach between the Consent Holder, Council (as regulator), the geo-science and the interested informed community to the green-field development. A fundamental principle was that open collaboration across multiple parties would help all, but especially Tangata Whenua, Tuaropaki.

A Template for Other Systems

Subsequently, the fundamental consenting concepts initially developed with Tuaropaki at Mokai have been applied when new or renewed applications have been lodged and consented for Ohaki, Rotokawa, Wairakei-Tauhara and Ngatamariki Geothermal Systems. They have all included and progressively developed the collaborative management approach and framework based around the SMP and PRP. There have also been multiple hearings in front of the Environment Court, High Court and three Boards of Inquiry (BoI). Decisions have all accepted or actively supported the concept and implementation of geothermal SMPs. The BoI for Renewable Electricity Generation recommended that all NZ regions with known geothermal resources change their RPSs to reflect the geothermal objectives and policy developed and implemented in the Waikato (MfE 2010).

2.2 Rotokawa

Background

The Rotokawa Geothermal System is classified as a Development System under the WRPS. It is located about 14 km north east of Taupo. Ngati Tahu – Ngati Whaoa are landowners and hold mana whenua over Rotokawa. A prominent feature of this system is the relatively large geothermally influenced Lake Rotokawa. A 29 MWe power station was commissioned in 1997 and over time understanding and confidence has grown in the capability of the geothermal system to the extent that two further stations have been built resulting in an installed generation capacity of 196 MWe. These power stations were collectively operating until recently on maximum consented takes of 70,500 t/d (WRC 2008).

Recent Developments

A joint venture (RJVL) between the Ngati Tahu – Ngati Whaoa and Mercury NZ Limited had existing resource consents allowing the take, use and discharge of geothermal fluid expiring in 2043. These consents powered the Rotokawa geothermal stations. However, geothermal fluid changes lead to an application by RJVL to: extend the consented area, increase the fluid take, and extend the expiry to date 2051. The application was granted by the WRC with conditions including the requirement to continue to maintain the SMP and the PRP.

However, Tüwharetoa Māori Trust Board appealed the WRC decision to the Environment Court and successfully sought a kaitiaki role in the management of the resource. The Court considered two overlapping issues (NZEnvC 2018):

a) The holding of mana whenua (authority over the land) and the exercise of kaitiakitanga (guardianship); and
b) The management of the geothermal resource under the RMA.

In its decision, the Court noted that the physical aspects of the geothermal resource were already being effectively safeguarded, protected and cared for in accordance with the principles of kaitiakitanga, the ethic of stewardship and the purpose of the Act. But, they noted the appeal was "… addressed to social or cultural effects, including the metaphysical aspects of those effects, and these are equally relevant in terms of the duty under [RMA] s6(e) to recognise and provide for the relationship of Māori with this resource." The Court then proceeded to prescribe changes to the consent conditions to more effectively enable the kaitiaki role including changes to the SMP Monitoring Programme and Tüwharetoa participation in the Annual PRP Meeting.

The Court concluded that Tüwharetoa have an ancestral connection to the Rotokawa Geothermal System and the land to be recognised and provided for under s 6(e) of the RMA, and that they hold mana whenua with Ngati Tahu – Ngati Whaoa. The Court also concluded that metaphysical considerations are fairly and reasonably related to the exercise of the consents and that Cultural Indicators be included in the SMP Monitoring Programme.

As well the Court noted in its conclusion "… the need to recognise that pursuing the sustainable management of a resource may well involve tensions and disputes. These are not necessarily adverse results: the process of participation at least provides a forum for civil dialogue and may enable better exchanges of information and analysis which could enhance the sustainable management of the resource."

2.2 Kawerau

Background

The Kawerau Geothermal System is in the Bay of Plenty Region and is categorised as a Development System under the RPS. The geothermal system has been developed for electricity generation, direct heat use for industrial processes, including process heat (eg. steam for timber drying kilns), clean steam for tissue manufacture and treatment of pulp. Approximately 176,000 t/day of geothermal fluid is allocated under resource consents to four consent holders:

- Mercury NZ Limited:
- Ngāti Tūwharetoa Geothermal Assets Limited,
- Geothermal Developments Ltd, and
- Te Ahi O Māui Partnership.

New consents for abstraction were granted in 2014, prior to the requirement for a SMP under the RPS. As such it was not reasonable to require a SMP to be developed retrospectively and to subsequently reopen allocation decisions. In addition, the Kawerau System is somewhat unique in New Zealand due to its 'multi tapper' nature.

Where usually a SMP might be developed by a single resource consent holder (as is the case for Mokai and Rotokawa described above), the Kawerau SMP needed to be developed collaboratively by the four consent holders. BOPRC agreed to facilitate this process.

Purpose and content of the Kawerau SMP

As with other SMPs, the purpose of the Kawerau SMP is to provide an integrated approach to sustainable management of the geothermal system, including an understanding of the actual and potential adverse effects of the use of the resource and how these can be managed. Given consents were already granted, it was agreed that the Kawerau SMP would be a largely operational document, akin to a multi operator protocol. The intent is that the SMP also provides guidance to the council in the administration of consents. While the broad intent of consent conditions is reasonably similar between the four consent holders, in some cases there was inconsistency and ambiguity. The SMP provides an opportunity to provide consistent interpretation and principles to guide implementation and interpretation. It also guides future resource consent applications (including changes to existing consents and reviews), where conditions of consent should reflect the requirements of this SMP. This consistency is achieved through agreed principles and processes. Examples include:

- Overall system objectives
- Form and purpose of the peer review panel
- Principles and processes for adaptive management
- Principles to guide Council's discretionary decision making (eg. changes to casing depth)
- Processes for consultation/engagement between consent holders
- Production and discharge principles
- Annual reporting processes/whole system reporting
- Guidelines for commercially sensitive information
- Processes to provide for kaitiakitanga

The SMP does not undermine or limit the existing rights and obligations of consent holders or re-litigate fundamental RMA matters already addressed through the RPS and consent processes. Nor does the KSMP pre-empt or limit Council's statutory discretion in discharging its functions. Rather it describes how these functions should occur and provides consistent interpretation of resource consents.

Development of the Kawerau SMP

Unlike SMPs developed for single taker systems, the Kawerau SMP was developed through a series of collaborative meetings between the four major consent holders and Council. As it was not supporting a consent application process or a regional plan process, consultation requirements were minimal (although Council still needed to develop the SMP in a way consistent with its Local Government Act 2002 responsibilities). The document was made available for targeted non-statutory input (ie. comments rather than formal submissions) from iwi, hapū, and key stakeholders. An evaluation of the document was also sought from the Kawerau Peer Review Panel and Waikato Regional Council. Given its operational nature, the document was approved by Council, however it is not considered formal Council policy in the way in which an RMA planning document might be.

Providing for kaitiakitanga

Providing for kaitiakitanga was a matter specifically raised in the development of the SMP. While a kaitiaki perspective on reservoir sustainability is important, the SMP could not force new obligations on users, without changes to consents. Instead the SMP contains broad principles and a framework to provide for kaitiaki perspectives on overall system management rather than day-to-day decision making. For example, the SMP promotes processes for a kaitiaki perspective on sustainability (eg. cultural indicators) to be provided to Council and the PRP. This will occur through system-wide community reporting and discussion between Council and kaitiaki groups about overall system performance.

Implementation

The SMP is a non-statutory document and will be periodically reviewed and updated to ensure that it remains relevant and fit for purpose. It provides a framework for Council's ongoing sustainable management of the Kawerau System, within the legal constraints of resource consent conditions. While it currently has limited legal weight, any departure from its agreed principles would need to be clearly justified. In addition, in some cases minor changes to resource consents (via a RMA section 127 or 128 application process) could be made to streamline consent conditions or to better reflect principles of the SMP.

2.2 Rotorua

Background

The Rotorua Geothermal System is located at the southern end of the Rotorua Caldera, in the Taupo Volcanic Zone. It is approximately 12km2 with electrical resistivity survey indicating the area at 500 meters depth is between 18-28km2 (Gordon et al 2001). It is best recognized for its extensive surface features and strong cultural associations. It is treated as a 'special purpose' system in the Bay of Plenty RPS, where surface features override extractive uses and system management must avoid, remedy or mitigate adverse effects on outstanding natural and cultural values. Multiple iwi have interests in the system, including through formal Statutory Acknowledgements as part of Treaty of Waitangi Settlements.

The system is managed under the Rotorua Geothermal Regional Plan (RGRP) which contains objectives, policies and rules, addressing matters such as allocation limits, discharge strategies and policies for the protection of surface features. Although written in 1999 before RPS requirements for SMPs, the plan acts as a 'defacto SMP in that it provides a whole system management approach. The plan is now overdue for a formal review under the RMA and as such a new SMP must be developed.

Process for development

The Rotorua SMP could form in its entirety a statutory regional plan, or be developed as a stand-alone non-statutory document, that is used to inform and justify formal plan change provisions. Council has chosen the latter approach. However, another consideration is the scope of the document and the degree of engagement and collaboration with the community, stakeholders and Māori in particular. Options broadly include:

- Council centric model: an SMP developed and owned by Council
- Consultative model: an SMP that is developed and approved by Council, with meaningful input from Māori and stakeholders
- Collaborative model: An SMP jointly owned and endorsed by Council and Māori.

The context to this decision is that Māori have a long and uninterrupted relationship with the geothermal resource in Rotorua and their multiple interests in geothermal management must be provided for in the development of the SMP. This includes recognising their unique relationship with the resource as kaitiaki (stewards), their role as landowners who may be potentially affected by policy decisions and as industry partners, investors and developers. Also, the geothermal system contributes significantly to the social, economic and cultural wellbeing of the wider community, and engagement with them is also crucial. Stakeholder and interest groups will also bring unique perspectives to 'the table' - based on their understanding of the geothermal system, their sense of place and their aspirations to improve the health and wellbeing of their community.

For this reason, Council is clear that the SMP must have a high level of engagement and ownership by Māori and the community, although the exact end form of this is not confirmed and will be agreed in consultation, considering various costs/risks and benefits/opportunities.

The scope of the Rotorua SMP is also evolving. Rather than address only the matters listed in the RPS (which focus on allocation), a preferred approach is to address all Council's RMA functional areas of geothermal management. This includes consenting procedures, consultation requirements/principles, compliance processes, State of the Environment Monitoring Programmes, iwi and hapu management plan policies, surface feature management, and research priorities. By broadening the scope further, it could also address historical background/traditional history, stories and relationships, community aspirations, and links with other resources – freshwater/air.

Council will be considering these options in consultation with the community, but it is likely that the SMP will present some new and unique opportunities to create a document that reflects community values and relationships and redefine the traditional concept of an SMP.

CONCLUSION

Whole system management is not a new concept in New Zealand, and early Management Plans were developed to facilitate use and development of geothermal systems. The early focus of these Plans has been describing and documenting resource use potential. With the advent of the RMA, there has been a move to a more integrated approach to resource management, an objective of sustainable management and management of effects. SMPs are now considered best practice for Development, Geothermal Systems or systems with a high level of use. The SMP approach is also evolving to enable incorporation of matauranga Māori (Māori knowledge) via inclusion of metaphysical aspects of effects in the Monitoring Programme and the participation of kaitiaki in the Annual Peer Review Panel Meetings.

Both the Bay of Plenty and Waikato Regional Councils RPS provide for the development of SMPs. These provisions have certain requirements but are not limiting as to the form and content of SMPs, and as such several different templates have been developed, including resource consent focussed SMPs (Mokai and Rotokawa), multi operator protocols (Kawerau), and a consultative community model (Rotorua).

There are several consistencies between these various approaches. All address fundamental matters such as resource description, objectives, production and discharge strategies (and allocation limits). However, the degree to which these documents address wider management issues, relationships, operational processes, community values and aspirations varies. This is influenced by the stage of development and resource consenting, the number of consents holders on the system, Councils roles and responsibilities as the resource manager, the breadth and complexity of issues, and the community of interest.

ACKNOWLEDGEMENTS

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