

KAPITI COAST DISTRICT COUNCIL WATER SUPPLY PROJECT

TECHNICAL ADVISORY GROUP SECOND REPORT

September 2012

A. INTRODUCTION

Since our first report to the Council in August 2010, TAG has met six times. By the end of the period the number of active members had reduced to four as a result of two resignations and the inability of other members to attend.

Our main activity has been to monitor, and comment on, the work of the officials and the consultants which developed from the Council's decision to accept the consultants' recommendation that "staged river recharge" should be agreed as the preferred solution.

We have considered the various reports which are now available to Councillors and we are satisfied that the work has been thorough and has answered many of the questions posed at the time of the Council's decision in principle. However, the management of risk remains a live issue.

B. SUMMARY OF TAG'S POSITION

The two main conclusions reached by officials as a result of the various tests, experimental drilling, modelling and expert reports, are that:

- (a) there is now a better understanding of the hydrological nature of the borefield; and
- (b) there is also a better understanding of the likely environmental effects of the discharge of bore-water into the Waikanae River.

For our part we have concluded that while the additional work has confirmed the borefield has the theoretical capacity to meet peak demand under extreme conditions, and that the environmental impacts of river recharge are likely to be minimal and manageable, nevertheless the risks to which we drew attention in our first report remain and must be taken into account in any further decision-making.

We have not done any more work on the financials but we have been assured that the findings of the two years of further study have not resulted in any appreciable increase in the estimated cost of the preferred option nor have they led to a reassessment of the relative value or efficacy of the various options considered by the Council.

C. RECOMMENDATIONS FROM TAG'S FIRST REPORT

The recommendations of TAG's 17 August 2010 report are attached together with a commentary by KCDC on the progress/action taken on each recommendation. TAG is pleased that the majority of items are completed. Where there are outstanding matters they are generally covered by planned work. We comment below on such matters.

D. GROUNDWATER MODELLING

A significant amount of work has been done on additional ground water modelling. This is based partially on new data on the subsurface geology that has come available from the bores which have been drilled for the project and from work done for the Kapiti Expressway. The pump tests on the bore field have also yielded important hydrology data. The aquifer model is now quite different from last year, with redefinition of aquifers and the key ones being interpreted to be interconnected so there are flows between them. Last year they were isolated. The interconnections lead to more drawdown in both deep and shallow aquifers when pumping but also allow for quicker recharge.

To do model tests the existing 35 year time series of rainfall and river flow has been modified to include a 50 year drought. This provides a 36 year "supply simulation". Four demand scenarios have been defined. Two for constant population numbers as at 2049, and two at 2060 with respectively medium and high population growth. For each scenario the model is run with and without pumping and the differences used to determine potential drawdown of water levels at various depths. The model shows that bores can supply the necessary peak daily demand. In the 2049 population cases the eight existing or under construction wells are sufficient. For the 2060 population cases two or three extra wells, at already identified locations, are required. The borefield is required for between 61% and 72% of the years in the 36 year simulation. The maximum use in any one year is 93 days with the longest continuous period being 59 days.

The interconnections between aquifers mean that there can be fairly wide draw down effects. The modelling shows that there could be effects on some of the 30 to 50 existing private wells completed to depths of 20m or less in the Parata aquifer and to 10 to 15 deeper wells in the Waimea and Pleistocene aquifers. KCDC consider that suitable mitigation can be provided to bore owners. This may require provision of new submersible pumps, pump repositioning or in extreme cases well replacement. TAG considers that this an issue that will need careful owner consultation.

Drawdown effects on the shallowest aquifers and shallow groundwater beneath wetlands was a concern last year. The new modeling shows predicted drawdowns to be less than variations that occur naturally so it should not be an issue. Never the less public communication on this will be important.

Saline intrusion was a potential risk identified last year. A programme of measurement in some 100 domestic bores in the coastal area did not identify any saline effects. However the groundwater model tests do indicate situations when pumping could lead to saline water moving inland. The report states that

“... the long term risk of intrusion of marine (saline) water is considered to be moderate for the operating system proposed. It can be adequately managed through monitoring and mitigated, if indicated. The potential for saline water intrusion will be further assessed through monitoring and implementation of a Saline Water Intrusion Programme planned for 2013 and through the ongoing monitoring of water levels.”

TAG considers the issue of saline intrusion is important. Adaptive management including reinjection may well be able to handle it. At the time of TAG's last meeting, 23 July 2012, a consent for reinjection was not being considered. KCDC has subsequently advised that modelling on reinjection has been done and reinjection will be included in the consent application. TAG has not seen the reinjection modeling work and cannot comment on it. TAG has also not seen any plans for reinjection tests similar to the type of testing done over the last two years for borefield flow. We expect that such testing will be done.

E. DEMAND MODELLING

The timing for initiating Stage 2 of the River Recharge with Groundwater process is determined by peak water demand and can be brought forward or deferred from the 2033 date when it is forecast to be needed if predicted water demand exceeds or falls short of the best estimate. TAG concurs with this approach and the associated information in the report which means that if the best estimate proves to be inaccurate and in particular too low, monitoring can ensure that Stage 2 can be advanced so that adequate water supply is maintained.

Further, TAG considers that the information on demand forecasting and the modelling in the BECA work is adequate - it might be improved, as indicated in the report, by disaggregation but it cannot be known whether the extra work would achieve improved results sufficient to justify the costs of the work. However, we wish to draw attention to two points which indicate that peak demand forecasting is far from an exact science, meaning that the risk of having to advance Stage 2 is very real.

First, the estimates of peak demand in Table 2, p 2 of Beca's memo to KCDC(29 June 2012) are simply based on the target of 490 litres/person/day and the medium population growth series. This was, we understand, based on instructions from KCDC, together with the KCDC position that if necessary demand can be managed downwards with water metering and water conservation measures. In 2032 these assumptions generate demand at the peak of 23,500 m³/day, very close to the maximum abstraction, with stage 2 therefore kicking in the following year. The headroom estimates, based on the high population growth assumption would, of course, generate substantially higher demand, although such large population growth is highly unlikely with the current world and New Zealand economic scenarios. Nevertheless, TAG draws attention to the risk that the reduction in demand to 490 litres/ person/day may not be achieved even with meters and conservation measures in which case Stage 2 would need to be advanced.

Second, the more sophisticated attempts to explain past daily demand variations show that the more complex models with more variables perform no better than simple models. The preferred model uses mainly the trend based on previous demand. Most explanatory variables tried in the

equations to explain daily demand failed to provide statistical improvement to the model. Past demand provides most of the explanatory force, with rainfall also important, but temperature and seasonality, for example, failing to improve the model. Further, the model has to treat the Paraparaumu/Raumati and Waikanae areas separately, with the Waikanae average per capita demand about 50% higher than in Paraparaumu/Raumati. This is attributed in the report to higher losses and higher outdoor water use (the Waikanae garden watering feature). However there is no statistical analysis of this - it is simply taken as given rather than explained in the model. There is also an unexplained jump in per capita demand in Waikanae between 2003 and 2005 which meant that only the data after this jump is used in the model.

The best model shows results for predicting recent daily demand that are not highly impressive (Demand Modelling Report, 19 June 2012, Appendix A p4/5) and underestimates peak demand. As a result, a peak day scaling factor was introduced into the model. With all these issues, TAG concurs with the conclusion in this Appendix that the modelling may not be useful as an operational tool without further understanding of the non-climate factors affecting demand and hence improvements to the model. Of course, there is expected to be a major change to behaviour downwardly impacting on demand with the introduction of meters and any future sophisticated modelling would need to allow for this. The demand forecasts actually used are, as mentioned earlier, based not on the sophisticated models but on the simple per capita usage, assuming the anticipated reductions in water use, together with the (medium growth) population estimates.

F. ENVIRONMENTAL ISSUES

A key environmental issue for the river recharge is potential impacts on the ecosystem of the river from the introduction of bore water that will have different properties to the river water. To address this concern NIWA, with KCDC, have carried out a variety of studies.

The physical, chemical and biological attributes of the river were reviewed in 2010 and the chemical and nutrient properties of bore water in relation to river water compared to other areas of New Zealand. It was concluded that the effects of bore water property differences would not be major.

To further consider this, field experiments were carried out in February/April 2011 and April/May 2012. Both involved comparison of effects with various mixtures of natural river water and bore water. The 2011 work involved building baffles in the river to observe algae, invertebrates and fish and also tank experiments with captured fish. Both the in situ and tank tests had operational difficulties which limited the rigour of the results. NIWA concluded that "Overall, the results of the studies conducted appear to show that no consistent ecological effect could be detected as a result of discharge of groundwater into the Waikanae River."

The 2012 work focused on the benthic algae through the construction of a series of artificial substrates. This was more controlled than the 2011 tests. It showed increased periphyton growth when bore water was introduced. This may have been due to the bore water being warmer and higher in some nutrients than the river water. NIWA recommend doing more work. Forecasting ecosystem impacts is difficult to quantify and furthermore, experiments to establish effects are very difficult. TAG recognizes that significant work has been done but notes that some of the results are

inconclusive and others do show *changes* in the ecosystem with introduction of bore water. Convincing authorities, special interest groups and the public that bore water effects will not adversely affect the river is a challenge that the council should not underestimate.

G. LEGAL AND CULTURAL ISSUES

There are a range of other "technical" matters which will bear on any decisions the Council takes, principal among them being legal and cultural issues, both of which are currently in the public domain as a result of the work of the Land and Water Forum and the decision of the Waitangi Tribunal concerning water rights. TAG considers these matters to be outside its area of competence and notes, as it did in its first report, that the Council is engaging in separate consultations with local iwi.

H. CONCLUSIONS

As a result of the further work since its first report, TAG has concluded:

- the recommendations made by TAG in its report of August 2010 have been almost completely implemented. We comment in this report where we consider there are ongoing matters although all are covered by planned project work.
- the work undertaken by Council officials and the consultants over the past two years has been painstaking and well done. There remain some gaps but it is a moot point whether the cost of further work at this stage would provide critical new information commensurate with benefit. On this basis - and with the riders we are including in our recommendations - we think the Council is in a position to make final decisions about whether and when to proceed with staged river recharge .
- the groundwater modelling is adequate as far as it has gone with current levels of knowledge but in our view it has tended to underplay the risk from saline intrusion. We welcome recent suggestions of more work. The most important discovery is that the profile of the underground aquifer is considerably different from what was thought previously and this is likely to require changes to any future management regime. It will also require the Council to discuss the outcome of the research with existing bore owners.
- the demand modelling is also adequate and can be used as a basis for decision making and planning, but in our view the Council needs to be aware that the modelling can only take us so far, and that the possibility of events turning out differently from what has been factored into the consultants' scenario, as well founded as that may be on current information and agreed assumptions, has to be factored into the equation.
- on the environment, there remain unknowns about potential effects of river recharge. These probably can never be fully predicted but Council needs to recognize that satisfying authorities, special interest groups and the public will be a challenge. The Council needs to ensure it has the ability to track and manage changes in the lower reaches of the Waikanae River if they occur

- for the bore field operations, demand modelling and the environmental work, monitoring processes will be key to good water management.

- other matters which are beyond TAG's TOR will have an important bearing on future water management.

I. RECOMMENDATIONS

We recommend, assuming the Council decides to go ahead with staged river recharge as proposed:

1. There should be consultation with owners of bores likely to be affected by draw-down in the borefield arising from the use of bore water as part of the Council's provision of future water supply to Paraparaumu/ Raumati/Waikanae;
2. The Council should carry out bore field testing to establish that saline intrusion into the western edge of the Waikanae borefield will not be a problem or that it can be managed by reinjection or other management ;
3. The Council notes that issues on the interaction of bore field groundwater with the Waikane River ecosystem need careful communication with authorities, special interest groups and the public;
4. The Council should ensure there is a comprehensive monitoring programme (alongside the new management process we recommended in our first report) based on a well-developed and sensitive risk profile, especially in areas where current knowledge should be expanded;
5. Further work should be done on the financials to include the possibility that the second stage of the recharge might have to be implemented earlier than planned and a contingency built into the budget to allow for this.

Signed by

Don Hunn, Chair

Roland Bishop,

Robin Falconer,

Prue Hyman

Technical Advisory Group

September 2012

Appendix A

Memorandum outlining TAG recommendations from it's August 2010 report and KCDC response on all the items.

Memorandum

To: Phil Stroud **Date:** 28 August 2012
From: James Luty **Our Ref:** 6515959
Copy: TAG
Subject: DRAFT Progress made on TAG recommendations

As requested, the following table provides a commentary on our progress towards fulfilling the recommendations of the 17 August 2010 TAG report.

Recommendation	Progress / Action taken
1) The ranking of the options by the consultants should be agreed	<u>Actioned</u> The Council endorsed the ranking of options recommended by Beca in their August 2012 council meeting.
2) The programme of further work proposed by the consultants should be approved.	<u>Actioned</u> The Council endorsed the programme of further work proposed by Beca in their August 2012 council meeting.
3) Once that work has been done, the consultants, the Project Team and TAG should undertake further risk assessment in order to establish the viability and therefore the pre-eminent ranking of the River Recharge option.	<u>Progressed</u> Further risk assessment has been undertaken regarding the viability of river recharge with groundwater. In particular, groundwater modelling assessments have been expanded to consider the feasibility of aquifer injection (mitigation for saline intrusion) and additional work is being undertaken on drawdown effects on wetlands. NIWA has also completed further river investigation to determine effects algal growth and mitigation measures to manage the risk of cyanobacteria. Final risk workshop is planned for September.
4) Assuming the River Recharge option's first ranking is confirmed, and that its staging could substantially reduce its cost, the Project Team should draw up a draft water management plan which covers the whole of the Kapiti district and incorporates the following elements:	<u>Noted</u> See below points

<p>An approach which integrates both conservation and supply measures.</p>	<p><u>Actioned</u> The Council has adopted an approach that integrates both conservation and supply measures. The strategy for managing losses is the 'Water Loss Reduction Strategy (July 2010), and this is being implemented with an on-going programme of benchmarking of losses and leak detection and management work. The decision to implement universal water metering from July 2014 demonstrates Council's commitment to water conservation and managing demand for water.</p>
<p>A 50 year timeframe which manages implementation in the most cost effective manner and on a staged basis which matches supply with proven demand.</p>	<p><u>Actioned</u> Provided in the "River Recharge with Groundwater Staging" memorandum, dated 29 June 2012.</p>
<p>A modified River Recharge system to ensure supply to Waikanae/ Paraparaumu/Raumati which will then be developed to the consentability stage.</p>	<p><u>Actioned</u> The river recharge with groundwater option is progressing to planning approval with GWRC. The resource consent application is to be lodged at the end of September 2012. The assessment of effects on the environmental section of this application includes a comprehensive description of staging, anticipated environmental effects and proposed mitigation.</p>
<p>The purchase of the site for the Lower Maungakotukutuku Dam to be held as a water reserve to enable a decision to be made at an appropriate time in the future whether to extend the River Recharge system or construct the dam.</p>	<p><u>Actioned</u> As of the TAG meeting on 23 July, 2012:</p> <ul style="list-style-type: none"> ■ A conditional agreement has been signed to purchase all Ikaham land subject to resolving a covenant ■ Legal documents are now being exchanged with Kaitawa Forest in finalising purchase of the land. ■ GWRC are reviewing the agreement and have confirmed land value is suitable. <p>All three are subject to covenant. Future proofing of the dam site for development has progressed considerably and is nearing completion in terms of covenant agreements, land management plans and land purchase agreements.</p>
<p>The clarification of all the consent and covenant issues for both the river recharge and dam options (including all the legal issues).</p>	<p><u>Actioned</u> The consent application for the river recharge option is to be lodged with GWRC in September 2012. An memo entitled "Memorandum on Kapiti Water Supply Project Regional and District Council consenting requirements" identifies the resource consents required. This memo is dated 12 June 2012. GWRC has reviewed and agreed with this memo. Future proofing of the dam site for development has progressed considerably and is nearing completion in terms of covenant agreements, land management plans and land purchase agreements.</p>
<p>An ongoing programme of research into the borefield which would include constant monitoring of its behaviour and experimenting with injection.</p>	<p><u>Actioned</u> This will be covered by the consent condition proposed in the resource consent application which is currently being prepared. This is to be lodged in September 2012. Monitoring and adaptive management over time is an integral part of Councils proposal.</p>

A risk assessment process which would ensure annual review of the effectiveness of the district's water management.	<u>Noted</u> The framework for this programme is the responsibility of Cardno BTO.
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The work done towards satisfying the above recommendations illustrates the commitment of this project to being a sustainable solution to water supply in the Kapiti District. Further to this, the project is consistent with the recommendations outlined in the Parliamentary Report from 2001, 'Whose Water Is It? The Sustainability of Urban Water Systems on the Kapiti coast' which are:

- 1 To develop and implement a long-term water services strategic plan in consultation with tangata whenua, the Kapiti community and other stakeholders such as the Wellingtons Regional Council and the Regional Public Health Service
- 2 To investigate the opportunities for improving integrated water catchment management planning in both the Otaki and Waikanae Rivers and Catchments.

The progress on the project to date satisfies both of these recommendations. The process of option assessment and refinement towards a preferred solution has been comprehensive and well aligned with the Parliamentary Report. In addition, the preparation of the "Waikanae River Catchment Discussion Document" added to fulfilling the second recommendation by creating an integrated catchment management plan.

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