How the Decision on the Lee Valley Dam will affect Council’s Water Supply Activity

Introduction

The Tasman District Council is planning to construct the Lee Valley Dam to augment flows in the Wairoa and Waimea Rivers during dry summers to ensure the irrigation and water supply activities on the Waimea Plains can continue. While this project is in advanced stages, it is not certain that it will be constructed. Council are changing their regional plan, the Tasman Regional Management Plan (TRMP), to establish the policies and rules around how Waimea Plains water resource will be managed in either eventuality – with Lee Valley Dam constructed and without Lee Valley Dam constructed.

Council has six water sources that draw water from aquifers in the Waimea Plains Zones and that will benefit from the construction of the dam. If the dam is not constructed, it is almost certain that water allocations will have to be revised downwards to re-establish allocation limits at an environmentally sustainable level. This presents a significant risk for the long term security of supply to Council’s water supplies. This paper explains the issues that Council will face for the future scenarios of the dam being constructed or not constructed.

How Much Water Does Council Think It Will Need?

Council commissioned a 100 year demand forecast for the Waimea Basin urban water suppliers to substantiate Council’s water allocations that have been used to design the Lee Valley Dam. Demand forecasts of 100 year durations are rarely completed because there are so many uncertainties over this timeframe, however Council considered it prudent to have a rational assessment to support their allocation even though there is high uncertainty.

The demand forecast is reproduced here as Figure 1. It shows a high growth, low growth and a medium growth projection. Each growth projection has a variety of assumptions around population growth and where that might occur, whether there will be any significant increase in industrial/commercial water demand and whether communities adjacent to the Waimea Plains remain being supplied from Waimea aquifers, or whether Council decide to serve part or all of them from other sources (ie, Brightwater and Mapua).

The low growth scenario assumes that growth is minimal, there are no new major industries with significant water demand and Mapua is supplied from Motueka aquifers rather than Waimea aquifers as is presently the case.

The medium and high growth scenarios assume that there will be one new major industry with a significant water demand and Mapua remains supplied from the Waimea aquifers. They are based on either the medium or high growth projections provided by Statistics New Zealand, extrapolated for the full period.
The current consented allocations for Council water supplies on the Waimea Plains are as follows:

<table>
<thead>
<tr>
<th>Water Supply Sources</th>
<th>Waimea Plains Zone</th>
<th>Current Allocations (Peak Day Demand)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>l/s</td>
</tr>
<tr>
<td>Waimea Delta</td>
<td></td>
<td>178.2</td>
</tr>
<tr>
<td>Richmond Lower Confined Aquifer</td>
<td></td>
<td>84.2</td>
</tr>
<tr>
<td>Brightwater Reservoir</td>
<td></td>
<td>32.4</td>
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<tr>
<td>Redwoods – Golden Hills Delta</td>
<td></td>
<td>2.3</td>
</tr>
<tr>
<td>Redwoods – O’Connors Creek Delta</td>
<td></td>
<td>4.1</td>
</tr>
<tr>
<td>Redwoods – River Road Delta</td>
<td></td>
<td>6.9</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>308.1</td>
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Given the water demand forecasts in Figure 1, the current consented allocations may not be sufficient for the future needs of the communities that are supplied from the Waimea aquifers. There are a number of uncertainties that the influence how long Council can live within current consents. Significant among them are the actual growth in the district that occurs and decisions around how other communities such as Mapua and Brightwater are supplied in the future. However taking the medium growth projection, it is evident that the current allocations may only be sufficient for 20 years.
What Are the Council’s Current Water Supply Vulnerabilities?

Council’s two water sources that serve the greater Richmond area need to be improved to be able to provide long term security of supply. The Richmond Water Supply draws from the Lower Confined Aquifer (LCA) and the Waimea Water Source draws from the Delta Zone aquifer. The main vulnerabilities with these water sources are summarised as follows.

Saltwater Intrusion

Both the water sources are within 700 metres of the coast on flat coastal plains drawing from bores that penetrate below mean sea level. In drought times when the river flows and aquifer levels are falling, sea water can permeate further in land than in normal conditions and threaten to contaminate aquifers within the coastal margin. Council have already had four wells abandoned and replaced with new wells further inland as a direct result of saltwater intrusion. If saltwater were to contaminate the lower confined aquifer, it may take weeks to months to flush the contamination out of the aquifer sufficiently to allow abstractions to resume. Meantime, abstractions would have to cease entirely.

Several measures have been taken to mitigate these risks, including the construction of emergency bores further upstream. Also the aquifer resource is managed to avoid river flows and aquifers dropping to the point at which contamination would occur, and going forward, new minimum river flows are likely to be established to safeguard the aquifers. However, there are uncertainties in the knowledge and thus risks. Council’s water supply bores are closer to the coast than almost all other operating bores and will be among first to experience saltwater intrusion. The hydrogeological models are not sufficiently accurate to fully simulate the coastal hydrogeologic dynamics around river flows, tidal effects and aquifer effects and thus do not provide absolute answers on risks of saltwater intrusion. It should be noted that the model limitations are a result of knowledge limitations of the full extent and composition of the aquifers in the coastal and inshore margins where hydrogeological research is difficult and very expensive.

The gradual manifestation of sea level rise and possibly climate change will make this worse and increase Council’s exposure to salt water intrusion risks.

Water Treatment

Currently Council only provides limited treatment to the two Richmond urban water supplies. Both water sources draw from high quality water sources and historically the needed for further treatment has not been considered necessary. The Richmond (LCA) Water Source is not treated at all. The Waimea Water Source is chlorinated and has some pH correction. This level of treatment is not sufficient to meet New Zealand Drinking Water Standards. The Richmond (LCA) Water Source has nitrates that exceed acceptable values and the well headworks and bore casings need upgrading to protect against surface water contaminating the wells. The Waimea Water Source does not have adequate protozoa protection and thus needs a higher level of treatment than chlorination. It would also benefit from a better treatment of pH than is currently provided. Both water sources need upgrades to meet Drinking Water Standards.

Water Rationing and Water Restrictions

Rationing of water abstractions on the Waimea Plains is now a regular almost annual occurrence. The rationing of all water abstractions (both irrigation and water supply) is initiated under the TRMP to manage the overall aquifer resource in the light of river flow and aquifer level data. When rationing is applied, the Council as a water supply manager has to control public water use in the urban water supplies to meet the rationed take limits. Council does this by applying water restrictions. These take the form of irrigation bans.
and hosing constraints to modify the public’s behaviour and kerb water use. As rationing increases, so the severity of the water restrictions increases.

What Are Council Planning If Lee Valley Dam Proceeds?

The Tasman District Council has plans to address the above vulnerabilities. Whether or not Lee Valley Dam is constructed makes a big difference to what Council can do. The plans that Council has adopted are based on the assumption that the dam is constructed. If it is not constructed, Council will face a different future and their plans will have to change. This scenario is discussed in the section below.

If Lee Valley Dam is constructed, Council plan to:

1. Construct a new water source in the Reservoir Zone sufficiently inland to be at no risk from saltwater intrusion. This source would be developed in stages over a long period to gradually replace the bores in the coastal margin. The first stage would be completed soon to provide absolute certainty that a minimum supply can be maintained through a season when saltwater intrusion is experienced in the coastal water sources. Subsequent stages would only be constructed as needed when the effects of sea level rise and climate change start being noted and the existing sources are increasingly affected. By taking this staged approach, the key risk exposure is reduced while maximising the benefits of the investment in the existing assets. The new water source would also be used to increase Council’s consented allocation to cater for population growth and associated demand increases.

2. Construct a new Richmond Water Treatment Plant to treat water from all sources to meet drinking water standards. Council is able to do this with a low technology, mixing and UV disinfection based system. The mixing dilutes the nitrates to acceptable levels and achieves partial pH correction. The UV disinfection provides protozoa protection. Once complete, this plant will provide Council with greater flexibility to draw water from any source and reticulate it across Richmond. This will give Council greater ability to manage the supply through a drought, diverting abstraction from water sources where the saltwater intrusion risk is increasing.

3. Manage demand to improve water conservation and reduce water leakage. Council has taken a proactive approach to managing demand. Council invested in water metering and volumetric charging of all properties on urban water supply areas in 1993 and has observed significant reduction is water use since then. Tasman District Council is one of only 11 out of 73 territorial local authorities (prior to Auckland amalgamation) that have metering and volumetric charging. Water New Zealand stated in their Water Metering and Volumetric Charging on Domestic Dwellings Policy that they support the introduction of these tools into more local authorities to assist in the management of water demand by reducing household use and the volume of wastewater requiring transportation and treatment. Council also has developed demand management plans for 6 of their 16 water supplies (including Richmond) with an overarching district wide plan to summarise and direct water demand efforts to where they are needed most. Council has also adopted water demand management targets in their Water Supply Activity Management Plans. In doing this, Council is going further than most Council’s in New Zealand.

Council is has a programme that includes night flow monitoring and leakage detection surveys to quantify leakage, find and repair leaks and then review improvement. Some quite major leaks and many minor leaks have been identified and repaired using this technology, notably recently in Pohara, Mapua, Brightwater, Tapawera and Wakefield.
Council has also assessed the economic cost benefit of various more aggressive demand management measures including rainwater tanks, stormwater harvesting for industrial water use, and more investment in low water use appliance rebates and community education. There are clear benefits in more investment, however the law of diminishing returns applies. The first water savings you make (for example, through education and volumetric pricing) are the easiest and the least expensive. As you move to save progressively more water (for example, through appliance rebates or source substitution), the cost also goes up. The report forecasts that the 100 year peak day demand may be reduced by up to 4,000 m³/day with a combination of measures, however this is insufficient to enable Council to live within current allocations, therefore additional measures will need to be considered. Further the report notes the assumptions made on rate of population growth for instance can have a much more significant impact (ie. if growth is slightly higher than assumed, the peak day demand could easily increase by more than 4,000 m³/day).

What Will Council Face If Lee Valley Dam Does Not Proceed?

If the Lee Valley Dam is not constructed, providing long term security of supply for Richmond will be a lot more difficult. The current status quo will not remain and it is probable that Council will face losing some of their existing water allocations and increasing rationing and thus restrictions. Council has not been able to make any robust plans because of the uncertainty around how the aquifer resources and allocations will be managed in the future. This Section therefore looks at a high level at whether Council can live within current allocations, and if not, what options there are to improve the security of supply.

Can Council live within current allocations?

Council can live within current allocations for a period of about 20 years provided it can abstract water up to their consented allocation. This statement has an important qualification about being able to abstract water up to their consented allocation. This is discussed below. That aside, Council has an allocation limit of 26,623 m³/day and forecast demand projection will exceed this in the order of 20 years away at current growth rates. There is large uncertainty around this because there are a number of factors and decisions that will influence water use from Waimea sources. However, at some point, population and community growth will have increased demand to a level that exceeds the consented supply maximum. Council will then be faced with either limiting further community and population growth, reducing demand per capita or significant capital expenditure to increase supply.

The qualification in the statement above is around the assumption that Council will be able to abstract water from their water sources to their allocation limit. This may not always be the case without the Lee Valley Dam. Depending on how the water aquifers are managed under new provisions of the TRMP, the entire Waimea Basin will be more exposed to dry summers and droughts and can expect to have rationing applied at a greater frequency than present. The community will therefore experience a lower level of service with more frequent and more severe restrictions placed on their water use. It can be expected that restrictions may be imposed on an annual basis. For domestic properties this may mean that garden watering and irrigation may have to be banned through the driest part of the year on an almost annual basis. Further, stronger restrictions may need to be applied to commercial and industrial properties, possibly affecting their productive activities and thus their economic viability.

In particularly severe droughts, the Council sources may become contaminated by saltwater intrusion. This may severely limit how much can be safely abstracted from the aquifers, with the potential water sources to
be shut off entirely. In this eventuality, Council may have to take drastic control measures to ensure sufficient water is available for fundamental public health needs.

Without the Lee Valley Dam, the long term security of supply is therefore in jeopardy. The community will have a 20 year window of growth before all available capacity would be used up, and the community will face having to stop further urban growth. There will be reduced levels of service that will impact on domestic customers and may impact on commercial and industrial activities. In particularly severe droughts, water sources may be lost altogether and drastic controls will need to be put in place to ensure the bare minimum water for public health purposes is available.

**What can Council do to improve the situation?**

Council’s current plans to improve long term security of supply will only be partially successful. Constructing the Richmond Water Treatment Plant will provide increased ability for Council to draw from either of the two existing water sources. This will provide some ability to reduce the take from a source threatened by saltwater contamination. The Council however will be more constrained in their ability to develop a new groundwater source away from the coastal margin as they currently propose if Lee Valley Dam goes ahead. The TRMP in its current form does not allow new abstractions in over-allocated aquifers and also does not allow transfers between zones. The proposed TRMP plan changes for the case of Lee Valley Dam not proceeding will be similarly restrictive. Council will therefore face being stuck with water sources in the coastal margin exposed to saltwater intrusion and the creeping effects of sea level rise and climate change, or a challenging legal exercise to secure ability to construct new sources in inland zones at the cost of other water users.

The alternatives for Council will be to:
- Construct the Lee Valley Dam solely for urban water supply purposes
- Construct an alternative water storage dam solely for urban water supply purposes
- Find a new water source
- Managing demand or “harvesting” water during wet weather to reduce water demand

The Lee Valley Dam is already established as means of providing security of supply for Richmond. Lee Valley Dam is intended to serve more than just the Richmond water supply, however it does define an upper cost against which alternatives for Council can be measured. The estimated cost of the Lee Valley Dam is $40 million.

Council could construct its own water storage for urban water supply purposes. This could be smaller and thus less expensive. It could take the form of a dam that directly feeds the community supply (like the Maitai dam in Nelson City) or a dam that releases into the river to allow a higher groundwater allocation (like the Lee Valley Dam). A dam that directly feeds the community would be a more expensive option. It would be classed as a surface water source and thus require a high level of treatment. The Nelson Water Treatment Plant that treats water from the Maitai and Roding dams cost in the order of $25 to $30 million in the early 2000’s. In addition to the treatment costs are the piping costs to convey the water from the dam to the community. The Lee Valley Dam site is around 20 km from Richmond and this was selected as the preferred site for a dam after extensive evaluation of alternatives. For a smaller dam that only serves Richmond, there may be a feasible dam site closer to Richmond, but it will still cost tens of millions of dollars. Therefore the preferable water storage option is an augmentation dam like the Lee Valley Dam that captures water and releases it into the river to increase the sustainable allocation of the aquifers.
Adopting a catch and release dam would mean Council would have to implement all the measures it is currently planning, plus fund and build the alternative dam without contribution from landowners and irrigators who will not benefit from the dam. This is clearly going to be significantly more expensive than the currently proposed Lee Valley Dam.

Council could commission a new water source, however, the options are limited and expensive. The Waimea and Wairoa Rivers are the main water resources in the immediate vicinity. To the east there are several small catchments, however the most sizeable of these are dammed to supply water to Nelson City Council area (Roding and Maitai). Further east is the Wairau but that is far removed from Richmond. South is the Wai-iti which already has one water augmentation dam in it (Wai-iti Dam) and is a relatively small catchment relative to the Waimea Basin catchment. Further south there is the Buller River which, like the Wairau River, is a long way removed from Richmond and under a conservation order. To the west is the Motueka catchment. The Motueka River also has a conservation order on it and Council has recently been through an Environment Court hearing that demonstrated the concept of pumping Motueka plains groundwater to Waimea will be prohibitively expensive and highly contentious.

Outside of these main catchments, there is a variety of smaller catchments, but it is unlikely that any can provide the quantity of flow needed in drought times in a cost effective manner to be a feasible solution for the water supply needs of Richmond.

Therefore, Council will be facing a challenging future from a water supply perspective if Lee Valley Dam does not go ahead. It will face an increasing rationing and water restrictions, the need to consider a limit on population growth for the area, the threat of salt water intrusion and bore shut-downs in severe droughts and constraints on ability to secure inland bores to mitigate the saltwater intrusion risk. The means to address these security issues will be expensive due to the lack of alternative water sources.

Without the Lee Valley Dam, Council will need to become more aggressive on their demand management programme. Any water use savings that can be made through demand management will increase the time Council can live within their allocation limits and defer significant capital expenditure. As noted previously, the quantum of savings that can practically be made may not be sufficient to fully offset major improvements, and the effectiveness of these will come at a cost to the community and may be offset if growth is higher than expected, however there is no doubt that Council’s demand management practices will need to be maintained and expanded if the Lee Valley Dam does not proceed.

**Conclusion**

Council has developed plans to improve the security of supply for Richmond assuming that Lee Valley Dam goes ahead. The construction of a new water source, a new water treatment plant and on-going demand management will provide Council with the ability to provide security of supply to their water supplies and flexibility to manage the risks of saltwater intrusion, sea level rise and climate change for many years to come.

Without Lee Valley Dam, Council will face significant challenges in providing security of supply. It will make frequent rationing and higher exposure to severe droughts. It will be difficult to secure a new source inland away from the coastal margin and it will be unable to obtain more water to cater for community growth. Options to relieve the supply constraints will be expensive and challenging. No easy alternatives exist. Alternatives that provide long term security tend to be similar to the Lee valley Dam but smaller in scale just to cater for the urban demands.