IMPACT OF RAINWATER TANKS ON THE LEVELS OF SERVICE FOR WATER SUPPLY IN AUCKLAND

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ABSTRACT

Rainwater tanks are a viable alternative water resource option used around the world. Their effectiveness is a function of local climate, uptake, roof and tank size and demand characteristics. Watercare carried out an assessment of rainwater tank potential in the context of the Auckland supply-demand balance to compare them with other water resource options.

The assessment considered their benefits at Watercare’s two relevant Levels of Service, which drive the selection of water sources in Auckland. Ambitious uptake rate scenarios for new and existing properties were developed, which modelled between 23% and 66% of Auckland households having a tank installed by 2050. A synthesized 1000 year rainfall sequence was applied to determine the conjunctive yield of the tanks and Watercare’s lake supply system for the different scenarios of rainwater tank use.

The work modelled a range of scenarios including the implementation of a programme installing large rainwater tanks on a widespread basis throughout Auckland. Outputs demonstrated that the most favourable scenario would result in tanks supplying up to 16% of the forecast demand at the drought level of service and 35% at the peak level of service. The capital cost of implementation of such a programme would be of four times that of a river source able to supply 100% of the forecast demand at both levels of service. This paper solely addresses the water resource benefits of rainwater tanks; any wider benefits are excluded.

KEYWORDS

Watercare, rainwater tanks, level of service, water resources, water supply

1 INTRODUCTION

Watercare Services Limited (Watercare) is the water and wastewater service provider for Auckland. It is a council-controlled organisation (CCO) wholly owned by Auckland Council (the Council). It funds all its activities itself, receives no fund from the Council or from central government and is prohibited by statute from paying a dividend. Each day, Auckland households, businesses and communities use an average of 354[1] megalitres of water supplied by Watercare. Watercare also treats approximately 392 megalitres of wastewater each day. This varies significantly depending on the amount of rainfall, as some of the Auckland wastewater system is combined with stormwater.

Watercare is required to plan and provide water resources and treatment capacity to meet Auckland's demand now and to accommodate future growth. The CCO prepares and updates forecasts to estimate the future demand for water and regularly reviews options for meeting it, considering a combination of water use efficiency measures and potential new water sources.

On the demand side, Watercare has placed water efficiency at the core of its objectives. The 2011 Auckland Regional Water Demand Management Plan committed to reducing region-wide gross per capita consumption (gross pcc)[2] by 15% by 2025, compared with 2004 usage levels of 298 Litres per person per day (L/p/d). The 2025 target is to reduce gross per capita consumption to 253 L/p/d and by doing so to defer the need for new water sources by ten years. This objective was included in the 2012 Auckland Plan. Auckland is progressing well towards the target, with the 2016 gross pcc measured as 272 L/p/d[3]. However, the remaining water efficiency gains to be made by 2025 are significant. The 2013-2016 Auckland Water Demand Management Plan set the strategy for meeting the target and is currently being updated.

On the supply side, a consent application was lodged by Watercare in 2013 for an increased water take from the Waikato River following a review of the available water resources options. Since then, members of the community have challenged Watercare to give greater consideration to decentralised water sources and to rainwater tanks in particular. Commentators considered that new water sources would not be required if a large proportion of Auckland households and businesses installed rainwater tanks on their properties. Though rainwater tanks had been included in the water resources options assessment, Watercare felt that more work was needed to fully respond to the communities' concerns. The CCO commissioned research by CH2M Beca and Tonkin + Taylor to develop a precise understanding of the potential contribution of large scale rainwater tank implementation to the security of water supply in Auckland over its planning period to 2050. The results are presented in this paper.

2 RAINWATER TANKS IN AUCKLAND

Auckland generally receives year-round rainfall. Households and businesses can choose to install a tank and capture rainwater for use in the garden or indoors.

In rural areas with no connection to mains water supply, it is common for households to install a large tank (20,000 to 50,000 Litres) to cater for all water uses. If the tank becomes empty in summer when rainfall is reduced and demand increased, households require the services of a water delivery company to refill their tank. These water tankers get their supply either from Watercare or from their own sources.

The Council recommends that Auckland business and households that have the option to connect to to a mains water supply use rainwater to complement mains water but for reasons of public health do not cater for all uses. This implies installing a rainwater tank for non-potable purposes only (outdoor water use, toilet flushing and washing machines). Where a public water supply is available, installing a rainwater tank is a sustainability or

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[1] Metered consumption for the 2016 financial year

[2] Gross per capita consumption is the overall water put into supply divided by the population connected to the mains network. It includes households and business usage, as well as leakage and non-revenue water. Residential per capita consumption only includes metered consumption from households and was 157 L/p/d in 2015.

[3] 2016 financial year

lifestyle choice. Watercare supports its customers in this choice by providing information in the “Be waterwise” booklets on its website and at the Watercare-EcoMatters stand at home shows.

Whilst no direct subsidy is provided for rainwater tanks, financial incentives for water efficiency are provided through the unit charging of water and wastewater. In Auckland, households and businesses are charged for water on a volumetric rate and each connection has a meter to measure water use. The outcome of this is that installing water efficient appliances or substituting some of the water supply with tank water will result in a lower monthly water invoice from Watercare.

3 APPROACH

3.1 GUIDING PRINCIPLES

The work assessed the potential contribution of rainwater tanks in Auckland. This assessment followed the three key guiding principles below.

1. A BEST CASE APPROACH

The potential yield of rainwater tanks can vary greatly depending on the tank size, the type of water use connected to the tank and community uptake rates. The aim of this research was to quantify the potential maximum benefits that could be achieved by the implementation of rainwater tanks. This methodology determines the ‘best case’ scenario for rainwater tanks in Auckland.

Initially the most beneficial case was modelled for each variable. For example, modelling considered extremely high uptake rates of large tanks in both new and existing properties. This initial modelling did not take into account potential barriers such as the difficulty to retrofit or that households may choose small to medium tank sizes. Only once ‘best case’ scenarios had been modelled was a more realistic approach analysed to enable the sensitivity of the assumptions to be understood.

2. A FIRST STEP TOWARDS THE ASSESSMENT OF RAINWATER TANK BENEFITS FOR AUCKLAND

The potential benefits associated with the use of rainwater tanks are varied and can accrue to different stakeholders. Examples include the individual satisfaction of harvesting one’s own water and the collective benefit of stormwater runoff attenuation. Aggregating these benefits would require complex and wide ranging analyses. The assessment presented here was therefore limited to the potential water resource benefits of rainwater tanks and how this could change the timing and scale of additional water sources and associated treatment infrastructure in Auckland.

It is possible that other organisations may now elect to assess the role such a programme of rainwater tanks could play in relation to other outcomes, for example stormwater attenuation or water quality. This would progress towards a fuller picture of the potential benefits of rainwater tanks for Auckland.

3. THE IMPORTANCE OF THE LEVELS OF SERVICE FOR WATER SUPPLY

Several studies have investigated rainwater tanks in Auckland in the past. Prior to commissioning the research presented in this paper, Watercare undertook a thorough examination of these previous reports, along with rainwater tank research from other cities in New Zealand and Australia.

The findings of past Auckland studies have proven difficult to include in Watercare’s planning for future demand. Their focus was on water end-use and average climatic conditions with detailed work modelling water use at the household level, comparing scenarios with and without rainwater tanks. Assumptions were made that the reduction in water consumption at the household level in an average climatic year could be extrapolated to the region-wide water supply and as a result defer the need for new infrastructure and water sources. Without taking into account the drivers for investment in water supply at a system level, these findings are disconnected from the long term planning for water supply in Auckland.

To enable infrastructure development to be deferred, rainwater tanks like any other water source must be reliable at Watercare’s Levels of Service (LoS) for water supply.

Watercare has adopted two LoS to meet water demand for drought and peak periods:

- The drought LoS relates to meeting annual average demand during a drought of a certain frequency. The LoS is controlled by the yield of the water sources at these extremes. Three potential LoS were assessed in this work, based on failure of the water resources in 1 in 50, 1 in 100 and 1 in 200 year drought events. Currently Watercare plans new sources to meet a 1 in 100 year drought event, while keeping 15% residual capacity in the storage lakes. Proactive demand restrictions may be required to ensure that there is sufficient water available to meet an event more severe than a 100 year event, however these cannot be imposed more frequently than in a 20 year event in line with the peak day LoS.

- The peak (day or three day) LoS is based on meeting the peak demand that is expected to occur during a dry summer without imposing restrictions more frequently than one in every twenty years on average. This LoS is constrained by the capacity of the infrastructure (tunnels, water treatment plants, etc.) used to convey and treat sufficient raw water to meet demand.

The last time Aucklanders experienced demand restrictions within the metropolitan region was during the 1993/94 drought event. Numerous assessments of that event have suggested that it had a return period of between 20 and 50 years. It was after this drought that the current LoS were adopted by Watercare.

In more recent times, the summer of 2013 was reported as a significant dry period for much of the country, with the Ministry for Primary Industries (MPI) stating it was the worst in 70 years (MPI, 2013). A review of Auckland's water sources for 2013 indicates that, in Auckland, the event had less than a 20 year average recurrence interval and did not result in the need for water demand restrictions.

3.2 PROCESS

Figure 1 summarises the process followed, including the following key activities:

- **Levels of Service** – Watercare's two LoS for water supply are the key requirements for water supply planning in Auckland and form the basis of this assessment;

- **Selection of variables -** Variables were selected to model rainwater tank yield. Some of them are fixed and some are not (described as test variables) as shown in Figure 1;

- **Scenario definition -** The values selected for the test variables define different scenarios, with varying uptake levels, usage types and tank sizes; and

- **Modelling -** The impact of the scenarios on both LoS was modelled using GoldSim software.

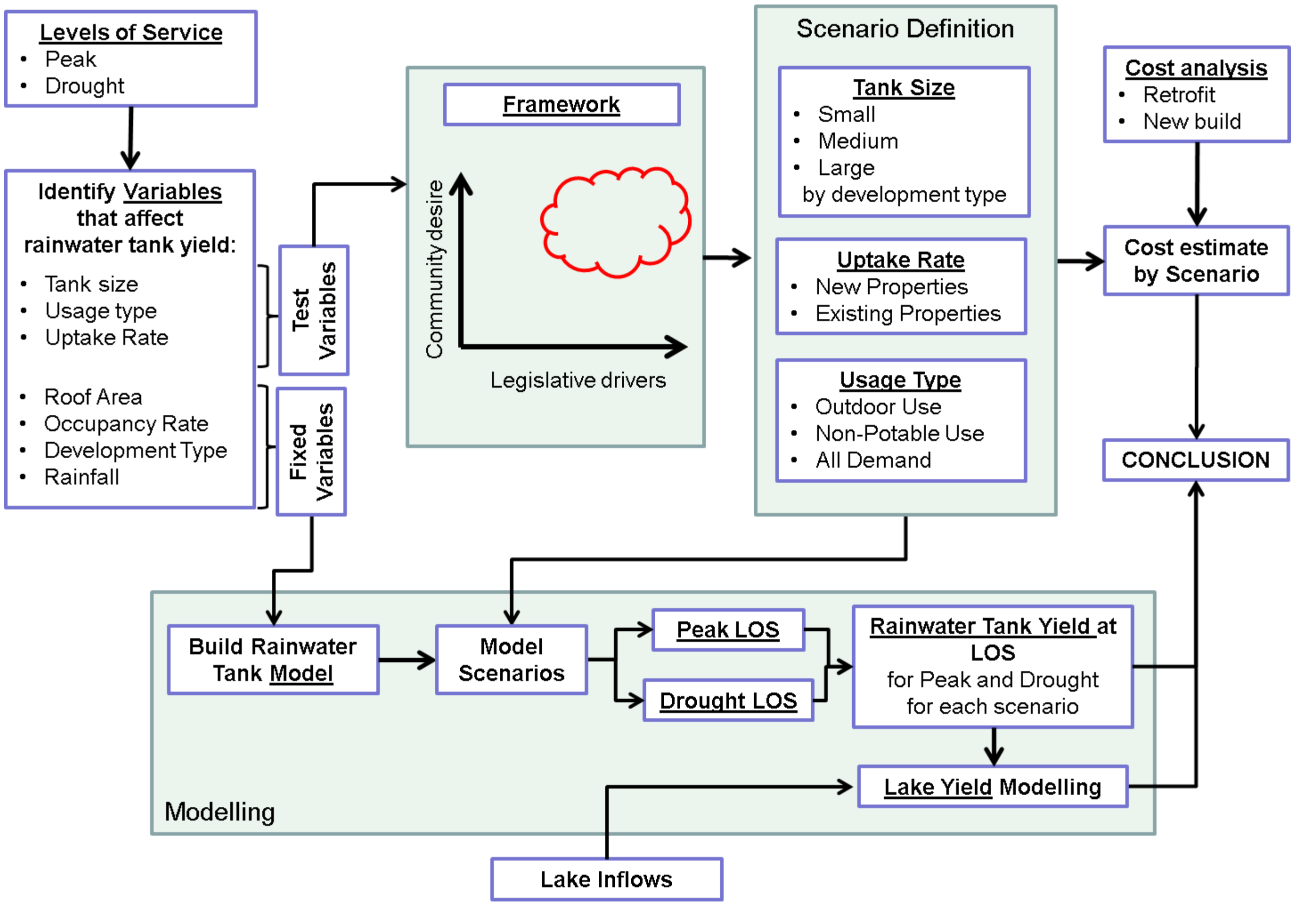

Figure 1: Overview of the approach

4 MODELLING

This section summarises the GoldSim model and the approaches taken to calculate the reliable yield of the rainwater tanks at the average and peak levels of service.

4.1 RAINWATER TANK MODELLING

The purpose of the model is to identify, given a certain scenario and input variables, the demand that can be met by the rainwater tank. The scenario is used to determine the test variables, whereas the other variables are fixed as attributes of each property type. Figure 2 shows an overview of the modelling process for a single house type. Outputs are summed to provide region-wide totals.

The model, built using GoldSim software, simulates rainfall, rainwater tank storage and demand for each day of the time series. A daily time step is used and an output produced that demonstrates:

- The demand supplied by the rainwater tank; and
- The number of days where the rainwater tank 'fails' and therefore demand is provided by the network.

The results of the modelling are then used (post processed) to determine the yield of the rainwater tanks at both the drought and peak LoS.

The model used a synthetic daily rainfall time series of 1,000 years to calculate the volume of water that can be used to meet demand for each house type. The model was run 250 times for each house type and on each occasion a different occupancy is selected by the stochastic model. The occupancy figure selected was based upon typical distributions of occupancy for each development type in the Proposed Auckland Unitary Plan (2013) using Census 2013 data.

Often a sub-daily model is used to assess the potential benefit of rainwater tanks to determine if sub-daily peak demands can be reduced. Watercare's service reservoirs are used to meet short term peaks in demand and it is therefore the output from the water source and treatment plant that is considered at the LoS. Modelling of sub-daily demands would not change this overall daily demand and therefore a daily timestep was adopted to model the rainwater tanks at the average and peak LoS.

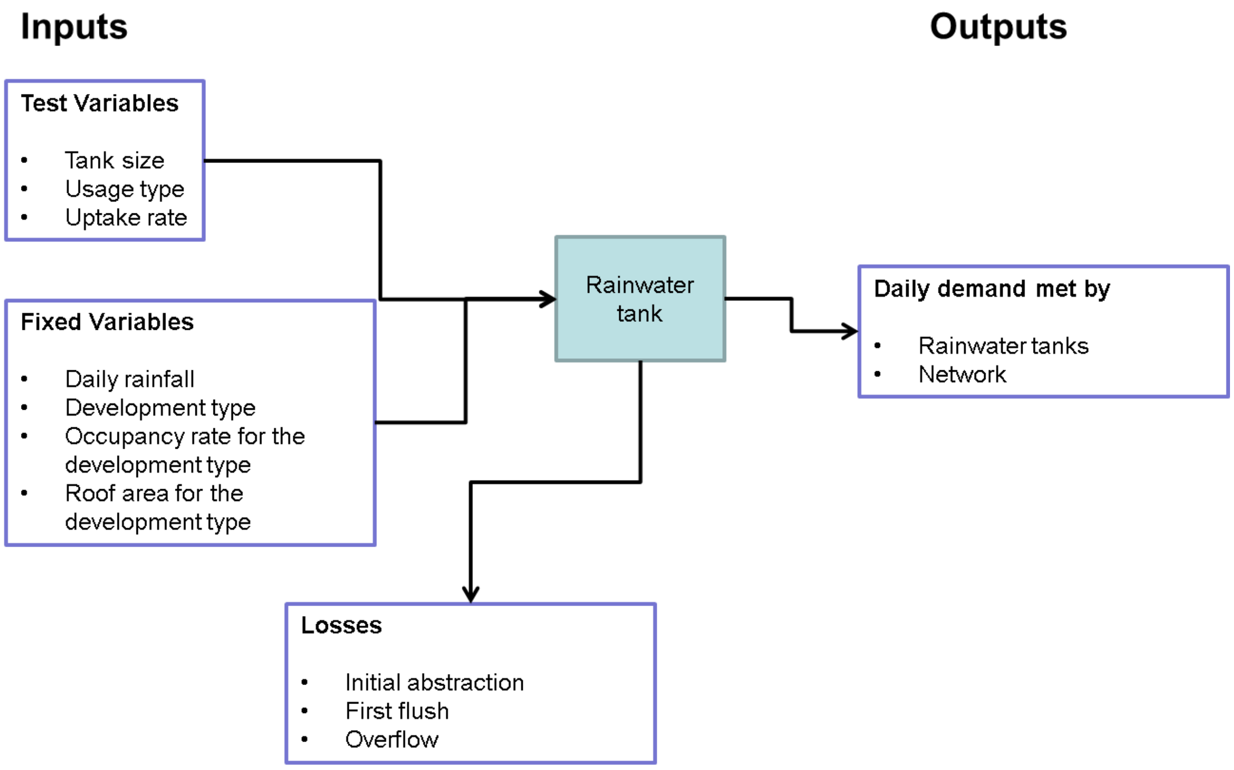

Figure 2: Overview of the rainwater tank modelling process for a single house type

4.2 SCENARIOS MODELLED

Scenarios for modelling considered:

- Installation of rainwater tanks at a large number of both new build and existing properties;
- The use of the largest tank sizes at each different property type, with property types defined by the Proposed Auckland Unitary Plan; and
- Assessments based on using rainwater to meet one of three demand (or water use type) scenarios – irrigation demand, non-potable demand and all household demands.

Figure 3 summarises the five scenarios modelled. Each of these scenarios is split into three sub-scenarios according to the demand type that is met by the rainwater tanks (outdoor, non-potable or all demands). Scenario 5 has been modelled to supply non-potable use only.

Scenarios 1-4 were chosen as they provide an upper bound for rainwater tank benefits. These could be considered as 'best case' scenarios as they include both high uptake rates and large tanks. However, they are not realistic given the changes that would be required in terms of the size of tanks households select, the complexity of retrofitting and the very high uptake rates.

A final and more realistic scenario was modelled, named the 'optimistic' scenario (Scenario 5). This scenario has an uptake for new properties which is phased as per Scenario 1. For existing properties the uptake rate is 3,000 rainwater tanks per year. This is based on information provided by the Energy Efficiency & Conservation Authority regarding uptake of schemes subsidising the retrofitting of insulation in existing properties.

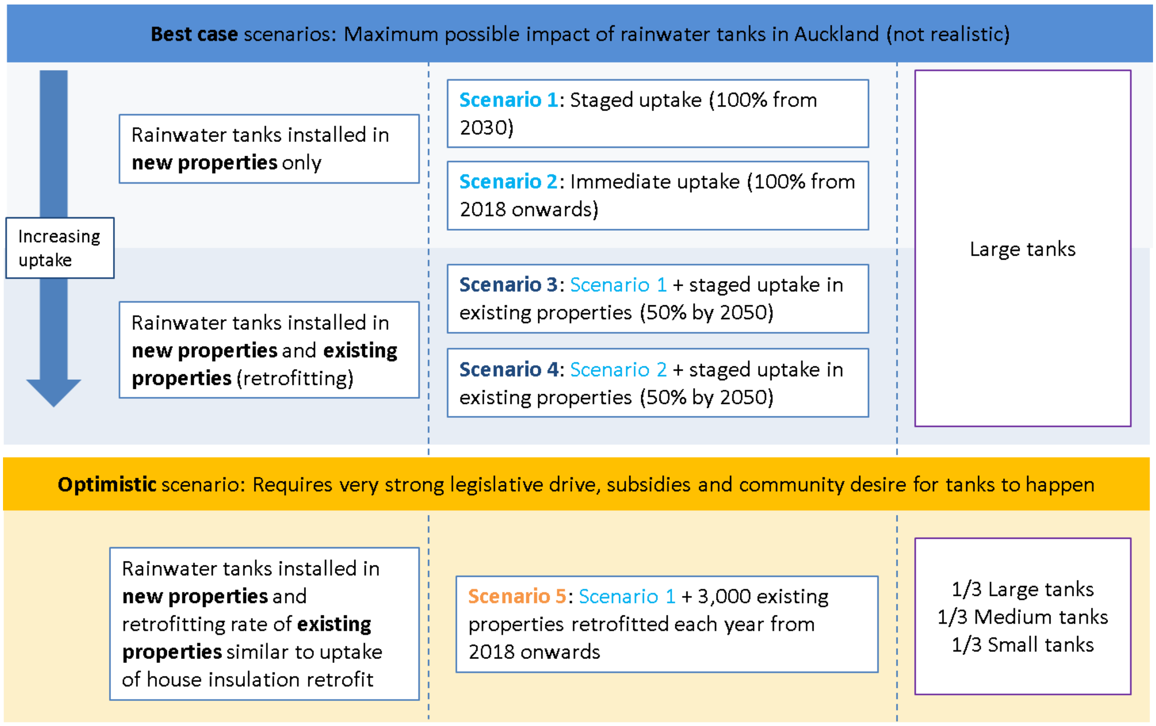

Figure 3: Modelled scenarios

4.3 RELIABLE YIELD AT THE DROUGHT LEVEL OF SERVICE

The drought LoS is determined by the number of failures across a period of time, for example a frequency not exceeding once every 100 years. The drought LoS is constrained by the yield available from Watercare's water sources. The 1,000 year sequence of rainfall was applied to the GoldSim model for each scenario. The output from this analysis was a 1,000 year time series which shows, for any year required during the planning period, the volume of water that can be supplied by rainwater tanks for an individual property. The individual property supply was then multiplied by the assumed uptake rate for each property type to estimate the total demand supplied by rainwater tanks. The impact on the lake yield was calculated by subtracting the water supplied by rainwater tanks from the total daily demand.

The results are presented as a frequency distribution for the demand that is expected to occur in 2050. This distribution is used to calculate the volume of water that can be supplied by rainwater tanks at the relevant LoS. The following percentiles are used:

- The 98th percentile result to reflect a 1 in 50 year level of service;
- The 99th percentile result to reflect a 1 in 100 year level of service; and
- The 99.5th percentile result to reflect a 1 in 200 year level of service.

4.4 RELIABLE YIELD AT THE PEAK LEVEL OF SERVICE

The yield of Watercare's sources at the peak LoS is constrained by infrastructure capacity, rather than hydrology. There would therefore be no change to the yield of Watercare's sources at the peak LoS following the implementation of rainwater tanks.

The peak LoS is to meet peak day demand during a dry summer, without imposing restrictions more frequently than 1 in 20 years on average. Daily demand and how it varies during a hot, dry summer is the main driver for the peak LoS. As daily demand changes due to a multitude of factors it is not possible to adequately model peak demand across the 1,000 year time series. The 2013 and 2014 summers were both dry, and although not as dry as Watercare's peak LoS, they give the closest representation to the peak LoS in recent years. The model was run over the period April 2012 to October 2014 to understand rainwater tank performance during the peak period using the actual recorded demand.

5 DROUGHT LEVEL OF SERVICE RESULTS

5.1 RAINWATER TANK YIELD

The key findings from the analysis were:

- **With a greater uptake rate more supply can be met from rainwater tanks**
  As would be expected, as the number of properties with rainwater tanks increases, from Scenario 1 through to 4, so does the demand that can be met. Therefore the retrofitting of existing properties has a large impact on the water supplied by rainwater tanks, as even with projected growth they remain a large proportion of forecast properties at 2050.

- **Lower LoS do not change the results significantly**
  The yield at the three LoS that were tested (1:50, 1:100 and 1:200) remains relatively similar for each scenario. The results for the outdoor water usage modelling are the same for the three LoS.

- **Rainwater tanks have a low yield at the Drought LoS**
  The mean supply met by rainfall across the 1,000 year rainfall record can be relatively high, especially when considering the higher uptake rate scenarios and when all household use is supplied. However, during the periods that define the drought LoS, the yield is substantially reduced for all scenarios. This is most evident for those scenarios that rely more heavily on the rainwater tank for supply (those with all water use). For example, in Scenario 4 where all household water use is supplied by rainwater tanks, the rainwater tanks can supply 134 ML/d during an average year. At the 99th percentile, representing the very driest periods in the time series, this reduces to 17 ML/d.

- **Supplying only non-potable demand has the greatest benefit at the LoS**
  At all LoS and for every uptake rate, the scenarios with tanks connected for non-potable use only provide the greatest yield from rainwater tanks. This is because the tank sizes that have been tested are able to meet the non-potable supply for a greater proportion of years compared to the all use scenarios.

As an example of the outputs, Figure 4 illustrates the performance for Scenario 3.

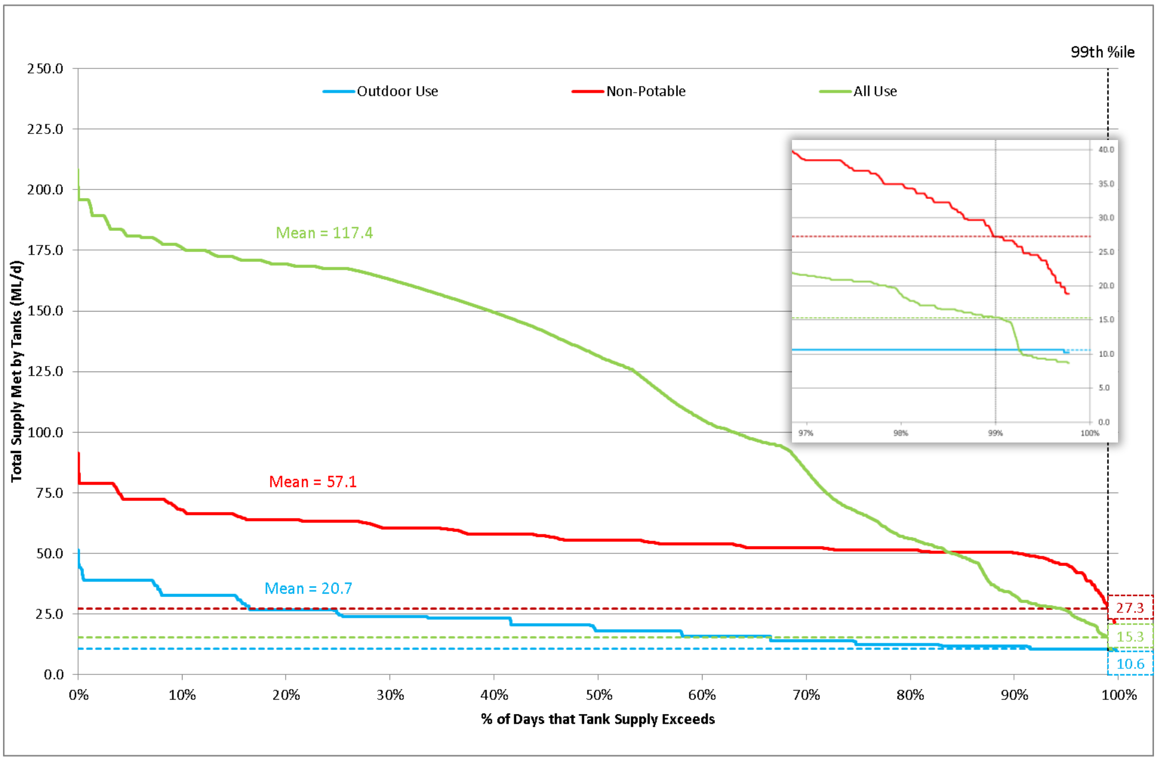

Figure 4 Scenario 3 Rainwater tank yield analysis at 2050 – 57% of properties have a rainwater tank by 2050

5.2 TOTAL BENEFIT OF RAINWATER TANKS AT THE DROUGHT LOS

The total benefit of rainwater tanks at the drought LoS is a combination of the water supplied by the rainwater tanks and any increase in yield from the lakes. The change in performance of the lakes was investigated and this showed that the water supplied by the lakes remains almost constant until the few periods where the lakes fail (the ten periods of time over the 1,000 year record). At this point the modelled water supplied by the lakes reduces to zero.

The performance of the rainwater tanks is very different, with the water that could be supplied reducing as drought severity increases.

The supply-demand balance at 2050 is illustrated in Figure 5. This shows the yield of Watercare's sources at the 1 in 100 year LoS compared with the forecast demand in 2050. The baseline deficit (shown as a black bar), is the additional supply needed in 2050 over and above the current capacity of the sources, approximately 128 ML/d.

The additional possible yield from rainwater tanks is shown by a red hatched block for three scenarios, which reduces the overall deficit in demand. The rainwater tank yield is greatest for Scenario 4 (non-potable use) but the remaining deficit (shown in black) is still approximately 100 ML/d and would need to be met by an alternative source. Therefore, even with a substantial investment in rainwater tanks, a new source with a capacity of 100 ML/d would still be required by 2050 to meet demand at the drought LoS.

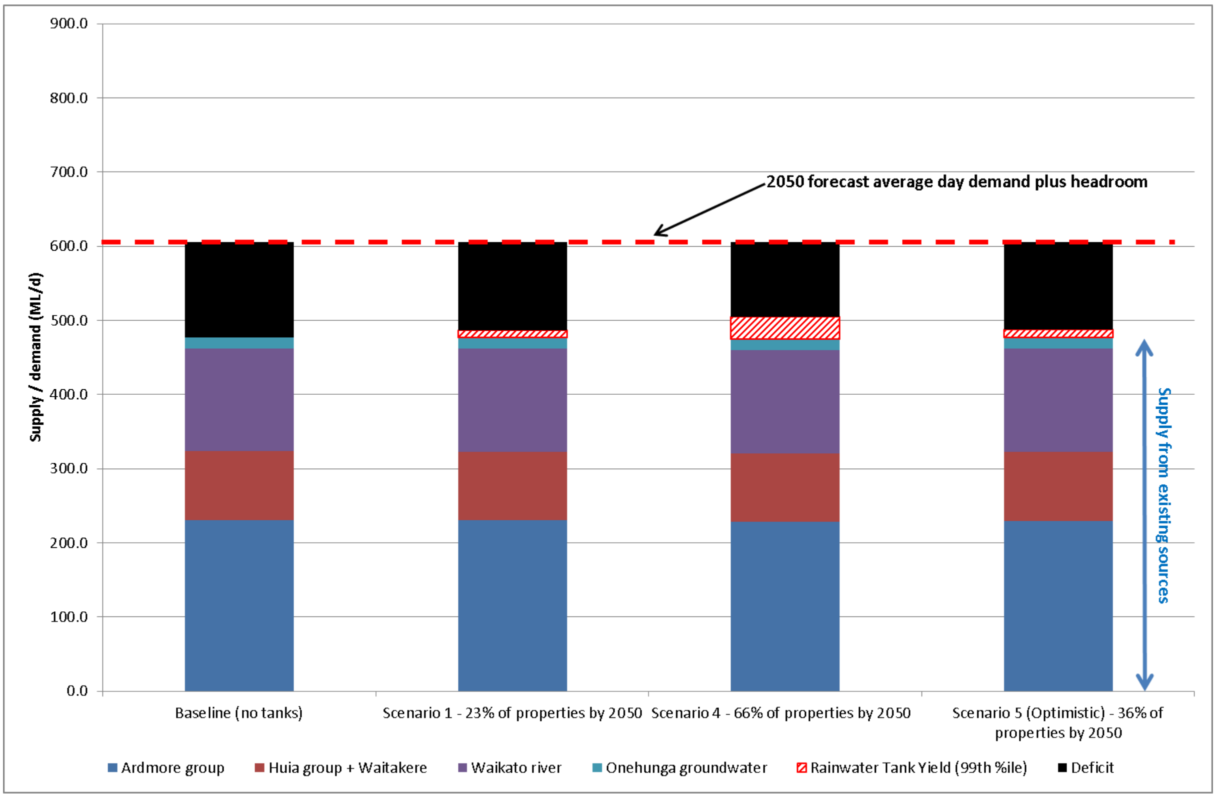

Figure 5: Benefit of rainwater tanks supplying non-potable use at the drought level of service (99th percentile) in 2050

6 PEAK LEVEL OF SERVICE RESULTS

6.1 THE SUMMER PERIOD

Analysis was carried out to assess the volume of water that could be supplied by rainwater tanks during climate events representing the 2013 and 2014 summers. An example of these results for Scenario 4 is shown as Figure 6. This graph highlights the interaction between rainwater tank size and the demand usage type for the two summer periods for large, medium and small tanks separately. The yield is based on the results in 2050.

The results suggest that the yield of the rainwater tanks increases with tank size, and results are reasonably similar for both non-potable and all demand models. The summer yield for both non-potable and all demand scenarios are broadly similar. Yields were between 30 and 60 ML/d (daily average) in 2013 for medium and large tanks, respectively.

This analysis was repeated for the optimistic scenario which resulted in a yield of 17 ML/d (daily average) in a dry summer such as 2013 and 23 ML/d (daily average) in 2014. Although there are many more tanks installed in this scenario compared to Scenario 1, the overall benefit is small as two thirds of the properties have small or medium tanks, which results in a limited impact in terms of water supply.

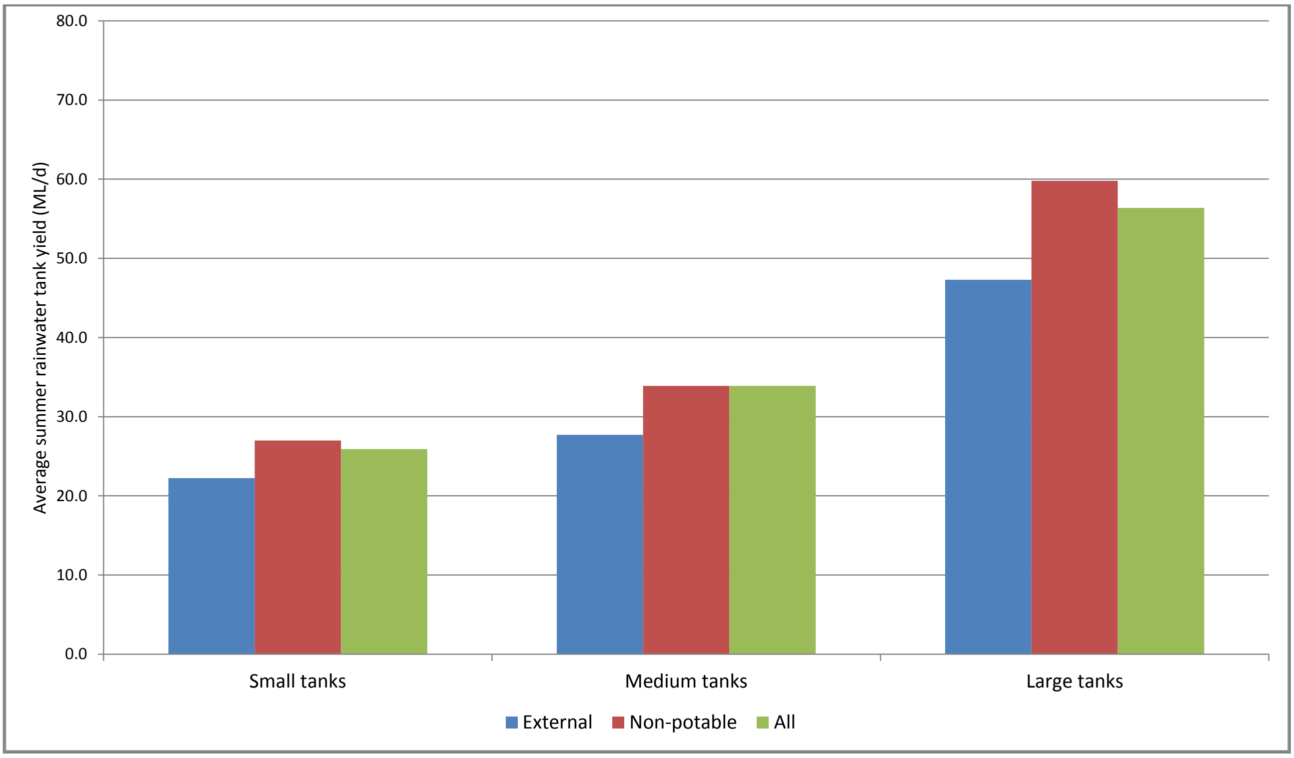

Figure 6: Yield of rainwater tanks based on the forecast demand at 2050, rainwater tanks as Scenario 4 (66% of properties by 2050), rainfall and demand as the 2013 summer (January to March) period

6.2 RAINWATER TANK YIELD ON THE PEAK DAY

Although the overall summer yield of rainwater tanks is of interest, Watercare's key planning driver is to meet peak day demand at its LoS. Analysis was carried out using the antecedent rainfall for the 2013 peak day (31st January 2013) and the forecast 2050 peak demand. The results of this analysis are presented in Figure 7.

This shows that there is an expected deficit of approximately 148 ML/d[4] on the peak day in 2050. Rainwater tanks could be used to form part of this supply and therefore reduce the demand to be met by Watercare's other sources. The analysis suggests that if water tanks were developed to supply non-potable demand, the capacity of the new source could be reduced by approximately:

- 20 ML/d for scenario 1 (23% of properties with large tanks at 2050);
- 60 ML/d for scenario 4 (66% of properties with large tanks at 2050); and
- 6 ML/d for the optimistic scenario (36% of properties with a mixture of small to large tanks at 2050).

The benefit of rainwater tanks to meet peak day demand will alter based on the timing of the peak day and the nature of the preceding rainfall and demand. However, this gives an indication of the potential for a large programme of rainwater tank installation to meet peak day demand during dry years when the peak day occurs

[4] 2050 dry year peak day demand of 733 ML/d

early in the summer (i.e. late January). This suggests that even with 66% of properties with large tanks at 2050, a new source with a peak yield of 90 ML/d would still be required to meet peak day demand.

Similar analysis was carried out for the highest demand day that occurred in March 2013. During a dry summer, rainwater tanks would be expected to progressively empty and therefore meeting demand in the late summer could be a critical event for rainwater tank reliability, even though it is not the actual 'peak' day. The supply-demand balance for a March 'peak' day is shown in Figure 8. This shows that the performance of rainwater tanks is significantly reduced compared with an event earlier in the summer, although the overall deficit is little smaller (approximately 80 ML/d) as overall demand is lower.

All the peak scenarios show a consistent pattern of results, and as would be expected, the performance improves as the rainwater tank size increases. The modelling shows that meeting all the household demand for water during a dry summer period is unlikely, even when large tanks are used. The balance of rainfall, tank size and demands suggest that the most effective combination is to use large rainwater tanks to provide non-potable water uses. Where small tanks are used, it may be most effective to use them for outdoor water use.

Even with the extensive implementation of rainwater tanks as in scenario 4, there would be a requirement for a new source with a peak day capacity of approximately 90 ML/d by 2050.

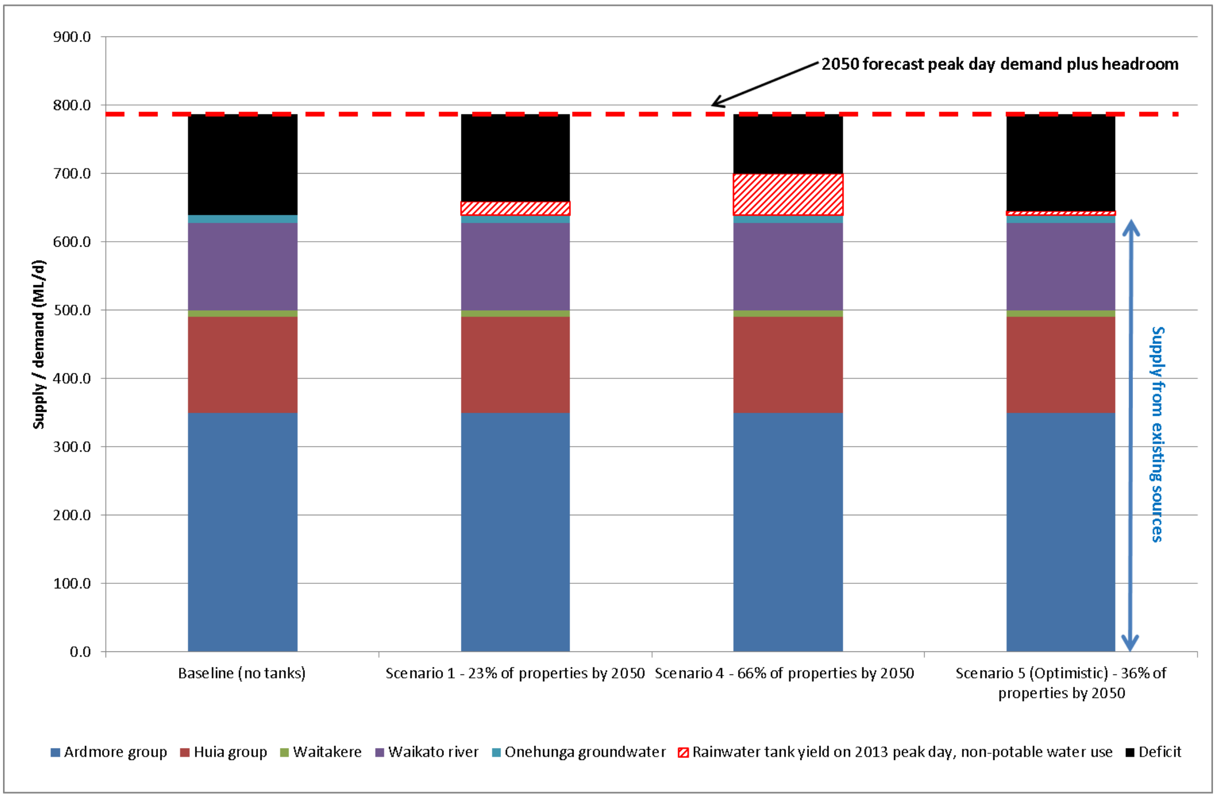

Figure 7: Peak day supply-demand balance at 2050

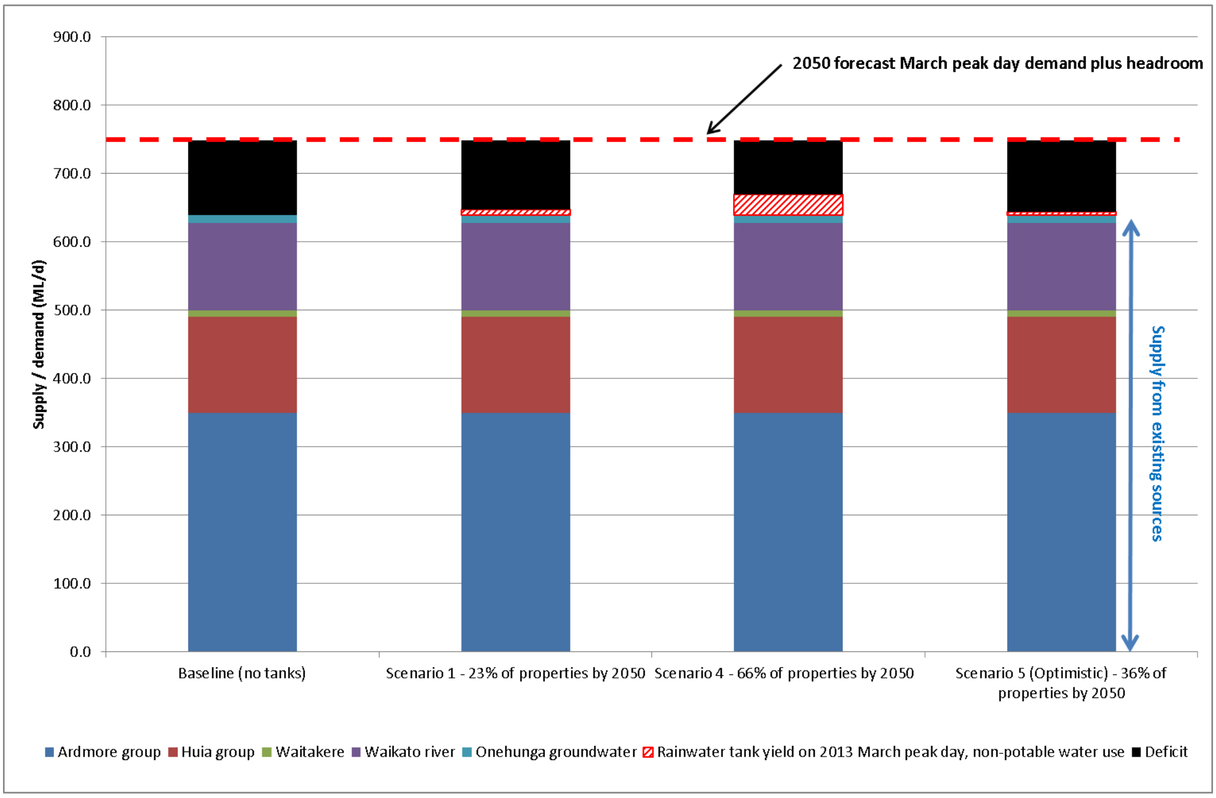

Figure 8: Estimated March 'peak' day supply-demand balance at 2050

Notes:

Large tank model results for Scenarios 1 and 4, optimistic scenario incorporates a mix of tank sizes

Outage is not included in this analysis

7 CONCLUSIONS

The overall approach taken in this research was to adopt assumptions that maximise the potential benefits that rainwater tanks could have on the supply-demand balance. Maintaining this approach throughout the research means that the conclusions can be based on the ‘best-case’ possible. This is important to note as, if rainwater tank installations were to be implemented on a large scale, the benefits identified in this report would most likely not be realised. The analysis focused on the performance of rainwater tanks at Watercare’s two LoS, drought and peak. It assessed how rainwater tanks can both reduce demand and increase the volumes available for supply at these LoS.

Table 1 shows a comparison of the potential yield of rainwater tanks at the drought and peak LoS against a second abstraction from the Waikato River, which is currently Watercare’s preferred next water resource scheme. Although wide-spread uptake of rainwater tanks can provide a substantial yield during a ‘normal’ year, during drier years the tanks provide minimal additional water supply. Therefore, to provide a water supply to Auckland in the future and maintain the drought LoS, a significant new water resource would be required whether or not rainwater tanks are implemented; any implementation of rainwater tanks will not result in deferral of a new water source.

Table 1: Comparison of rainwater tank yield against a second abstraction from the Waikato River

	Tank size	Baseline (no tanks) or other resource	Scenario 1 23% of by 2050	Scenario 4 66% of properties by 2050	Scenario 5 Optimistic, 36% of properties by 2050	Waikato Scheme
Drought LOS yield (99th %ile) (ML/d)	S1 & S4: Large S5: mixed	0.0	10.0	30.8	11.0	185.0
Drought LOS deficit (ML/d)	S1 & S4: Large S5: mixed	127.8	118.3	100.0	117.7	0.0
Peak day yield (ML/d)	Small	0.0	0.8	1.9	6.3	175.0
	Medium	0.0	2.4	9.0		
	Large	0.0	19.3	60.1		
Peak day deficit (ML/d)	Small	148.1	147.3	146.2	141.8	0
	Medium	148.1	145.7	139.1		
	Large	148.1	128.8	88.0		

An assessment of the cost of implementing a programme of rainwater tank installation was carried out. This demonstrated that the benefit provided by rainwater tanks was a maximum of 16% of the demand at the drought LoS and 35% of the demand for the peak LoS. However, the cost of this programme would be four times the cost of the proposed Waikato scheme that meets 100% of forecast demands at both LoS.

ACKNOWLEDGEMENTS

The authors would like to acknowledge Watercare Services Ltd for permission to publish this paper.

REFERENCES

Auckland Council, 2012, The Auckland Plan

Auckland Council, 2013, Proposed Auckland Unitary Plan.

Auckland Three Waters Strategic Planning Programme, Final 2008 Strategic Plan

Ministry for Primary Industries, 2013, The 2012-13 drought: an assessment and historical perspective, MPI Technical Paper No: 2012/18

Statistics New Zealand, 2013 Census

Watercare Services Limited, 2014, Be waterwise for households booklets https://www.watercare.co.nz/SiteCollectionDocuments/AllPDFs/BeWaterwise_Domestic.pdf

Watercare Services Limited, 2015, Be waterwise for businesses and organisations

Watercare Services Limited, 2011, Auckland Regional Water Demand Management Plan

Watercare Services Limited, 2013, 2013-2016 Auckland Regional Water Demand Management Plan 2013-2016