
REPORT 6
(1215/52/IM)

WELLINGTON METROPOLITAN BULK WATER SUPPLY REVIEW OF SECURITY OF SUPPLY STANDARD

1. Purpose of Report

This paper seeks the Committee's endorsement for the retention of the 1 in 50 dry-year security of supply standard for potable water supplies, which is being recommended by Greater Wellington Regional Council (GWRC). The paper also reports on the results of new modelling by GWRC that shows this security of supply standard is currently being met.

2. Executive Summary

Greater Wellington Water (GWW; a division of the Greater Wellington Regional Council) has been operating within a water security of supply standard of a 1 in 50 year drought since the late 1990's. The standard aims to ensure that sufficient bulk water is available to the four metropolitan cities to cope with a one in 50 year drought. Put another way the standard means that there is a 2 percent chance of a total ban on all outdoor water use. It should be noted that even with a 1 in 50 dry year standard, some lesser types of water restrictions (such as sprinkler bans) may still be imposed in drought conditions less severe than a 1 in 50 year drought.

In effect this equates to a level of service to water consumers, which relates to the frequency, severity and duration of water restrictions being imposed. The frequency is an average over a long period of time and does not preclude more frequent occurrences if there is a particular run of very dry years.

GWW use the probability of a shortfall to plan water supply development to cope with increased demand from projected increased consumption from population and economic growth. The current standard has recently been the subject of discussion in the region and as a result consultants Montgomery Watson Harza (MWH) were commissioned to investigate and report on the standards used by a number of similar bulk water suppliers in New Zealand and overseas, and advise on what would be an appropriate standard for the Wellington region's water supply.

Based on the surveyed water suppliers, it appears the current standard used by GWW is a reasonable target level of service for supply. This was the most common drought return period target level of service used by others, and it is recommended that GWW confirm their target level of service of a 1 in 50 year drought return period.

The security of supply standard is essentially an indicator of the level of risk a community is prepared to take in terms of more frequent, more severe, and longer duration restrictions and supply shortfalls on households, commerce and industry compared to the cost of a more certain water supply.

A lower standard brings uncertainty of supply and a greater dependence on onerous water restrictions, as well as potentially greater impacts on supply sources like the Hutt River. A higher standard may require earlier investment in supply augmentation works which in turn brings greater certainty and security of supply, thereby minimising or avoiding the need for supply restrictions and having minimal detrimental impact on existing supply sources.

On balance the existing 1 in 50 security of supply standard is considered an appropriate standard in the interim; however this standard should be further reviewed at the time of planning future medium to long term supply augmentation works.

New modelling by GWW shows that the region's water supply system currently meets the one in 50 year standard, which is significantly better than earlier modelling had estimated. This is because water use has actually reduced – as a result of leak detection, other conservation measures and favourable weather conditions – even though population has increased.

3. Recommendations

Officers recommend that the Committee:

1. *Receive the information.*
2. *Agree that a 1 in 50 security of supply standard is an appropriate standard and should remain as the security of supply planning standard in the interim pending future decisions on the need for water supply augmentation.*
3. *Note that recent modelling by Greater Wellington Regional Council shows that the water supply system currently meets the 1 in 50 dry year security of supply standard.*

4. Background

Greater Wellington Water (GWW) has been operating within a water security of supply standard of a 1 in 50 year drought since the late 1990's. This standard is aimed at ensuring sufficient bulk water is available to the four metropolitan cities to ensure they incur no more than a 2% probability of being short of water on any one day in a year. This is equivalent to providing enough water at current levels of demand to cope with a one in 50 year drought.

GWW uses this standard and the probability of shortfall to plan water supply developments to cope with increased demand from projected increased

consumption from population and economic growth. GWW are now also factoring in the potential impacts of climate change on river flows, weather patterns and water demand in assessing future supply and demand.

In 2005 GWW modelling showed that the bulk water system could support a population of 377,000 at 2% shortfall of supply probability. In the five years since then population has increased above projections, resulting in the estimated security of supply standard declining to the point where the region was apparently operating at a level that can only cope with a one in 19 year drought. That is with a 5.4% probability of an annual (summer) water shortage or total ban on outdoor use

GWW determined there was an urgent need to return to the adopted security standard of 2% probability of a shortfall. This need was highlighted over the 2008 summer when more stringent water restrictions were introduced for the first time in over 20 years. This initiated the short term supply augmentation proposals that have recently been reported on.

Although the short term augmentation proposals aimed to restore the water supply system to the agreed standard of 2%, the region's TLAs felt that a decision was needed on the standard they wish to go forward with before any commitment is made to medium and long term supply augmentation.

One response to an inability to meet the standard would be to change the level of service; however the view amongst the TLAs was that agreement needed to be reached on what level of service is considered appropriate and affordable in the region.

The outcome of this was GWW commissioning MWH to investigate and report on the standards used by a number of similar bulk water suppliers in New Zealand and overseas, and provide advice on what would be an appropriate standard for the Wellington region's water supply.

5. Discussion

5.1 *Security of supply standard considerations*

The region does not experience severe droughts very frequently. The most recent significant drought occurred during the summer of 2007/08 when river flows were very low. A garden sprinkler ban was imposed and very nearly a complete hosing ban. However the difficulty is that the severity of drought is not known until after the drought is over, so that more conservative demand reduction measures get imposed during the drought. As the shortfall probability increases, the need for more stringent summer demand management becomes more frequent and onerous, eventually creating consumer dissatisfaction. Public confidence in the water supply system is reduced, when in retrospect the level of restrictions may not have been needed.

The security of supply standard is essentially an indicator of the level of risk a community is prepared to take between the cost of a more certain water supply, and the impact of more frequent restrictions and supply shortfalls on

households, commerce and industry. The Auckland standard of 1 in 200 years for a water supply from large storage areas (dams) demonstrates that the city was only prepared to tolerate a very low level of risk following their drought crisis in 1994. This is because at the time of drought there is no alternative source of supply once the storage has been emptied.

A higher security of supply standard provides greater certainty of supply with the supply better able to cope with peak demands, but comes at the cost of requiring earlier infrastructure development.

A lower standard tends to defer new development, which can result in cost savings, but the frequency and severity of water supply shortfalls increases and real-time operation of the bulk water supply becomes increasingly difficult. If a standard is too low there is a greater risk of being unable to meet even the basic water needs in a severe drought.

The potential impacts of climate change have a bearing on the standard. NIWA projects greater variability in climate meaning the chances of severe drought may actually change in future. If this did happen then the higher standards for dry-year security would be better positioned to cope with such variability. However climate change is most likely to occur gradually overtime. As the recommendation of this report is retain the the current standard in the interim pending future decisions on the need for water supply augmentation, any allowance for climate change would be better accounted for in a future review of the standard.

GWW's analysis shows that as the standard falls there is a gradual increase in the opportunity to defer infrastructure but a rapid increase in shortfall days and shortfall volume. For example, a 1 in 40 year standard would only defer development a little over 2 years more than a 1 in 50 standard, but the shortfall days would increase around 33%. The potential short term savings of a lower standard do not appear to justify the substantial and disproportionate increase in supply risk.

The security of supply standards used in Wellington and Auckland are not strictly comparable due to the significant differences in the way bulk water is sourced. Auckland's supply has until recently been limited to the finite amount of useable water held in the regions storage dams; whereas Wellington's run-of-river source of supply means that even in the event of a 1 in 50 year drought there would still be sufficient water to sustain day to day residential and commercial usage – with any water restrictions applying only to outdoor water usage in most cases.

However, the Wellington region's heavy reliance on run-of-river sources with very limited off-river storage creates uncertainty looking ahead (particularly with population growth, increasing summer demand and potentially climate change) and therefore it is essential that the standard is not set too low.

5.2 *Modelled impact of lower security of supply standards*

GWW modelled the 1 in 50 year standard and the lesser standards of 1 in 25 and 1 in 10 years using the upgraded sustainable yield computer model (SYM). The modelling assumed the completion of the proposed Stuart Macaskill lakes capacity upgrade.

The issue in drought years is normally lack of water source availability and the need to reduce water consumption. 50 ML is likely to be the maximum daily shortfall that could be offset by a total ban on outdoor water use during summer across all consumer types. Shortfalls exceeding 50 ML give an indication of the number of days when even basic water needs could not be supplied.

Modelling with 118 years of historical data showed that (relative to a 1 in 50 year standard) significant deferral of supply augmentation works is possible with a very low security of supply standard, but the consequence is a large increase in supply shortfall years and more severe impact both in terms of supply volume and duration. In particular there is a similar increase in the number of days the shortfall exceeds 50 ML.

The modelled results over the full 118 years are summarised in the following table:

Security of Supply Standard	Number of shortfall years	Total number of shortfall days	Total water shortfall volume ML	Number of days shortfall exceeds 50 ML	Number of years capital works can be deferred
1 in 50 year, 2% ASP*	4	63	4,283	48	0
1 in 25 year, 4% ASP	8	156	10,347	101	9
1 in 10 year, 10% ASP	15	261	17,813	166	19

*ASP = Annual Shortfall Probability

To illustrate the implications of lower standards on supply availability and the need for water restrictions a real-time interpretation of the modelled results for the last significant shortfall year (1970/71) has been carried out using the trigger points and actions contained in the region's Summer Demand Management Plan. This plan is used each summer to determine the extent and duration of any additional water restrictions that need to be imposed to manage demand. The modelled results take into account the existing odd/even days watering restrictions.

1970/71 was not a severe drought year and has been assessed as having possibly a 15 year drought return period. The modelled results show 1970/71 to be a significant shortfall year at the 1 in 10 year standard; a minor shortfall year at the 1 in 25 year standard; and not a shortfall year at the 1 in 50 year standard. However the implementation of water restrictions for the two lower standards produced very similar impacts, as shown in the table below:

Based on the Summer Demand Management Plan a sprinkler ban, followed by a hosing ban, is introduced in all cases. Since the water savings needed are lower with the 1 in 50 year standard, these restrictions are not required until later and provide the level of water savings necessary. However the savings are insufficient for the two lower standards and a full ban on outdoor water would be required for a substantial period.

Security standard	Shortfall year (1970/71)	Level 3 restrictions (Sprinkler ban)	Level 4 restrictions (Hosing ban)	Level 5 restrictions (No outdoor water use)
1 in 50 year, 2% ASP*	No	9 weeks	4 weeks	-
1 in 25 year, 4% ASP	Yes	8 weeks	1 week	6 weeks
1 in 10 year, 10% ASP	Yes	7 weeks	1 week	7 weeks

*ASP = Annual Shortfall Probability

5.3 Security of supply standard review findings

MWH surveyed a number of similar bulk water suppliers in New Zealand and overseas. It found that a variety of security of supply targets are used, including drought return period, percentage storage, low river flow level and peak demand. A 1 in 50 security of supply standard is the most common target used by water suppliers using drought return period as the security of supply target.

Bulk water suppliers with large bulk water reservoir storage capacity (i.e. dams) and or mainly aquifer use generally have a security of supply standard of 1 in 50 or lower. The exception is Auckland's Water Care Services, with a 1 in 200 year standard.

Water suppliers using mainly run-of-river sources (with little off river storage), similar to the Wellington region's situation, generally have a security of supply standard of 1 in 50, or one that is based on low river flow level and peak demand.

MWH advised that the current standard used by GWW is a reasonable target level of service . MWH considered that GWW is already using one of the identified best practice methodologies for setting the target level of service.

5.4 Supply source impacts

An important consideration to be taken into account in setting the security of supply standard is the ability of the Hutt River to supply the required amount of water during a drought. Given that a very significant portion of the region's water supply is sourced from the Hutt River, during a drought a low security of supply standard would not only mean severe water restrictions or hose bans but

would also put pressure on supplies taken from the river (and the aquifer), most likely requiring maximum permissible takes over an extended period.

The converse of this is that a higher security of supply standard would inevitably require supply augmentation to cater for growth in demand. Augmentation works are most likely to involve some form of raw water storage (e.g. dam or additional lake) which would provide additional water supply during a drought independent of the river flow conditions at the time of drought.

This means that a higher security of supply standard, coupled with a likely consequential supply augmentation over time, would have a considerably lesser impact on the river than a lower security of supply standard.

The proposed Stuart Macaskill lakes capacity upgrade over the next two summers, which will require a lake to be taken out of service each summer, may dictate greater water takes from the Hutt River over an extended period. The impact of this on the health of the river will be monitored for the duration of the upgrades and this will provide valuable information for use in subsequent reviews of the security of supply standard. It would therefore be prudent to defer any change to the existing standard until after the upgrade work is complete.

5.5 Results from upgraded SYM

GWW's SYM modelling tool was upgraded in 2010 to use more recent water consumption figures and model the results of water consumption for zones within each city. The SYM upgrade was brought forward as GWW was aware that the significant reduction in water consumption over the last few years was not fully included and that consumption varied across the supply area.

The previous model showed 5.4% annual shortfall probability (1 in 19 year drought) in 2010. Following verification of the upgraded SYM, modelling has now confirmed that the system is currently achieving 2% annual shortfall probability, i.e. the 1 in 50 year drought standard.

The conservation actions, leak detection and pipeline replacement programmes by the cities is having a positive impact on demand, although it must also be acknowledged that recent summer weather conditions will also have played a significant part in lower summer water demand. 2009/10 was the lowest level of bulk water supply production in the last 10 years despite a 10% increase in population over that time. The 2010/11 total is looking similar at this stage.

These results suggest that the current 1 in 50 standard remains an appropriate standard at the present time.

6. Conclusion

An independent review of the region's water supply system supports the conclusion that increasing the security of supply standard above the present 1 in 50 year drought level does not appear to be justified, and decreasing it below 1 in 50 year drought level does not align with normal practice.

Modelling results show that the severity of water supply shortfalls and their frequency of occurrence is the trade-off for deferring investment in supply augmentation through infrastructure development. Significant deferrals can be achieved but the consequences are serious in terms of the added frequency, severity and duration of water restrictions.

GWW's analysis shows that as the standard falls there is a gradual increase in the opportunity to defer infrastructure but a rapid increase in shortfall days and shortfall volume. The potential short term savings of a lower standard do not appear to justify the substantial and disproportionate increase in supply risk.

On balance the existing 1 in 50 security of supply standard is considered an appropriate standard in the interim; however, this standard should be further reviewed at the time of planning future medium to long term supply augmentation works. New modelling by GWW indicates that the region's water supply network is current meeting the 1 in 50 year standard.

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Supporting Information

1) Strategic Fit / Strategic Outcome

The current security of supply standard is consistent with the Councils long term outcome of reducing Wellingtons environmental impact by making efficient use of energy, water, and other resources, and minimising waste (See outcome 4.5 More Sustainable).

2) LTCCP/Annual Plan reference and long term financial impact

The recommendation is to retain the existing security of supply standard in the interim and therefore there are no new financial implications.

3) Treaty of Waitangi considerations

None.

4) Decision-Making

This is not a significant decision. The report recommends that the existing 1 in 50 year security of supply standard remain and does not constitute a change in policy direction.

5) Consultation

a) General Consultation

All four of the metropolitan Councils have been consulted on whether they are satisfied that the existing standard is appropriate and should remain as the security of supply planning standard.

b) Consultation with Maori

None.

6) Legal Implications

None.

7) Consistency with existing policy

The recommendations of this report are consistent with existing WCC policies on water usage that prioritise water conservation and encourage more efficient use of water.