Auckland Drought Management Plan

March 2023

Lower Huia Dam

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Amendment register

Version	Description of changes	Changed by	Date
Version 2	Adopted the feedback from Council, as discussed and agreed	Mark Bourne	23/08/2022

Introduction

The Auckland Drought Management Plan consists of two parts:

Part A is a summary that provides the context, planning framework and drought management responses.

Part B provides detailed information that supports the management responses.

Part A – Summary of the Auckland Drought Management Plan

Context

Watercare Services Limited (Watercare) is an Auckland Council controlled organisation (CCO) that provides water and wastewater services to 1.7 million people in metropolitan Auckland and nearby communities. The water supply system is designed and operated to meet two Council-endorsed levels of service (LoS) which require Watercare to supply unrestricted demand unless circumstances impact their capacity to do so. The first LoS, also called the drought standard, is that unrestricted demand is to be met while keeping the volume in Auckland's storage lakes above 15%. Known as total system storage (TSS) this volume is the combined amount of water currently stored behind the Waitākere and Hūnua Range dams. During a drought, restrictions on certain uses of water may be imposed so that Watercare can prudently manage supply and reduce the likelihood of reaching 15% TSS which would trigger an emergency. The hydrologic model on which the water supply system is based predicts no more than a 5% chance of restrictions being needed in any given year. That probability is the second LoS.

Levels of service:

- Meeting demand while keeping storage volumes above 15%
- No more than a 5% chance of restrictions being needed in any given year

Two consecutive years of low rainfall in 2019 and 2020 demonstrated how fast storage lake levels can fall, especially when combined with high rates of customer demand during hot dry summers. A structured approach to managing short-term rainfall deficits – 'hydrological droughts' – is therefore essential for Watercare. This Drought Management Plan (DMP or 'the/this Plan') fulfils that purpose by specifying the activities Watercare undertakes at each stage of a drought, including planning during non-drought times and when low rainfall persists, as well as after a drought has ended. Watercare's approach to this water supply continuum are shown in Table 2.

The DMP is not a strategic plan for long-term water security, but rather a tactical plan that guides Watercare personnel and communicates how the Auckland community plays their part in managing drought. The *Auckland Water Strategy*, released in early 2022, is Auckland Council's 30-year blueprint to protect and enhance *te mauri o te wai*, the life-sustaining capacity of water. Among other important objectives, the Water Strategy outlines how water security will be strengthened to meet the challenges of climate change and population growth. Short- and medium-term actions under the Water Strategy will build on water security plans already developed by Watercare, such as the *Asset Management*

Plan 2021-2041, Water Efficiency Plan 2021-2025 (WEP), and *Demand Management Plan 2013-2016*.

Framework

Figure 1 below shows the framework within which the Drought Management Plan operates. The strategy plans in each level respond to the directions/shifts enunciated in the level above:

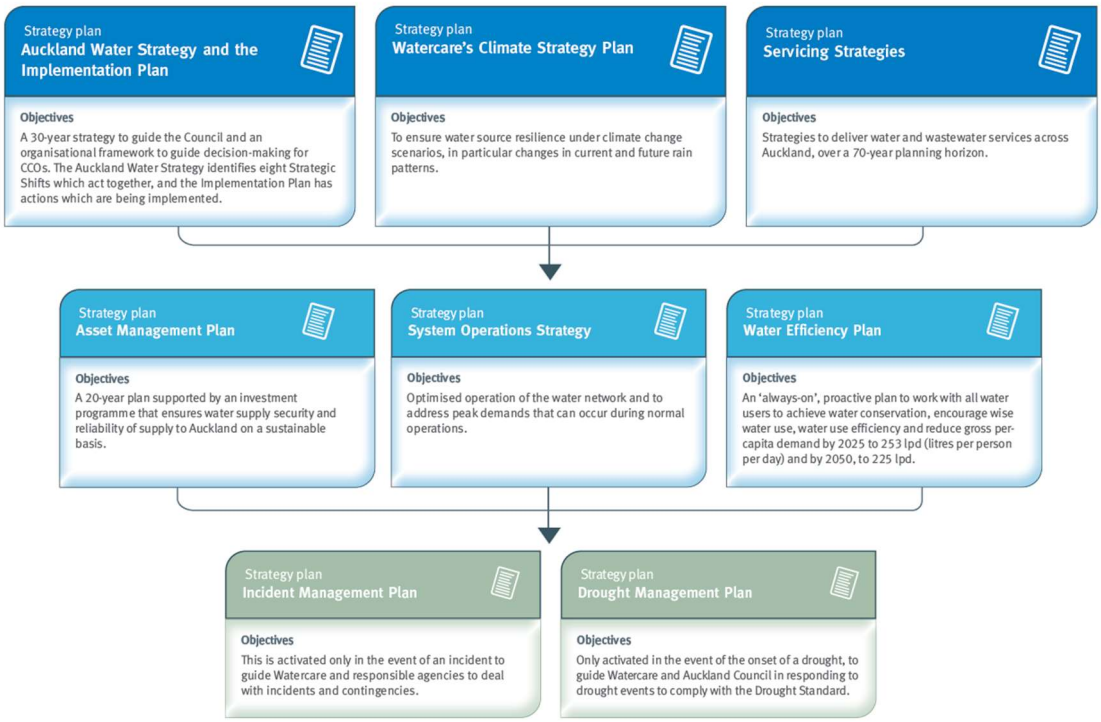

Figure 1. The hierarchy of Strategy Plans for water security and reliability of water services

This DMP is an update of the 2020 version and it:

- incorporates learnings from previous Auckland droughts and from drought management specialists in other jurisdictions
- builds on previous drought management work by Watercare and others to broaden the evidence base (key information sources are listed in **Appendix A**)
- revises the projections for annual average, summer, and peak-week water demand (in megalitres per day (ML/d))
- incorporates new supply sources (additional raw water volumes plus increased treatment and transmission capacity) and improved system operation
- reflects the relationship and partnership-based approach of Watercare with its customers and the community in managing demand
- builds on Watercare's engagement with residential and non-residential customers during non-drought times to enhance water use efficiency, seek alternative water sources for non-potable uses, and reduce overall baseline consumption
- specifies the supply-based triggers for each stage of a drought and how Watercare and its customers need to respond
- modifies the restricted water uses should they be required to manage a deepening drought.

Watercare developed a set of guiding principles (Figure 2) to facilitate the updates to the Plan. The guiding principles reflect leading practice in planning for drought management and water security more broadly.

Figure 2: Guiding principles for updating the DMP

Drought resilience is a shared responsibility between Watercare, all water users and Auckland Council. The DMP update has considered the experiences from the most recent drought, feedback from previous reviews and has been prepared in consultation with Council, commercial and residential customers. In developing the management responses to drought, the DMP addresses supply side measures, demand side measures and operational measures.

The DMP is to be reviewed every two years and/or after each drought event and/or after changes in Watercare's operating environment or the planning framework. This provides assurance that the DMP remains contemporary and effective. Future DMP updates will address the objectives, targets and performance measures identified in the *Auckland Water Strategy*.

The DMP applies to all customers who use water from Watercare's supply system. This includes people who rely on private tankers that source water from Watercare's network. The area currently serviced by Watercare is shown in Figure 3. Most customers access potable (drinking) water from the metropolitan bulk water supply network. There are also smaller communities supplied by stand-alone sources. Those communities may experience hydrological drought at different times or have water supplies that are not highly susceptible to drought conditions.

Please note, the DMP does not preclude the procedures contained within this plan being used to manage other non-drought events that require a significant reduction in water supply consumption.

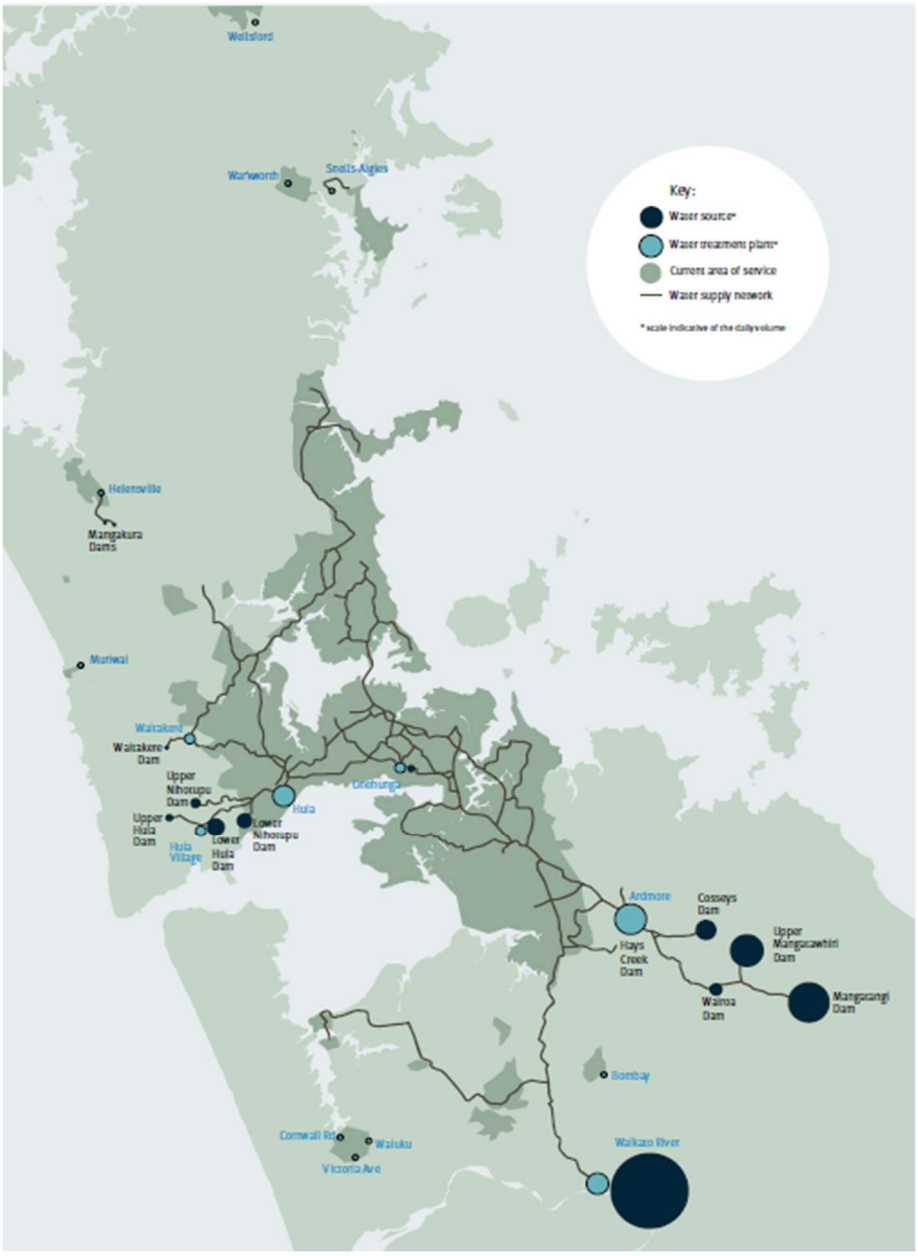

Figure 3: Map of Auckland water supply area subject to the DMP

(includes metropolitan and non-metropolitan areas)

Watercare has recently invested in a range of new supply sources and network operating efficiencies to enhance Auckland's resilience to drought. While supply and operational improvements are business-as-usual for Watercare, the focus of managing short-term droughts is about reducing demand via:

- demand management programs, e.g., communication campaigns on how to conserve water, targeted education programs, direct engagement with large water users to enhance efficiency and seek alternative sources for non-potable uses
- formal water restrictions if TSS falls to certain trigger levels.

Implementation of actions in the WEP aims to achieve a 5% reduction in daily water use, thus creating a new (lower) baseline demand. Together with additional supplies from non-dam sources, particularly the Waikato River, the drought trigger levels now occur at lower TSS percentages than in the previous DMP. In other words, supply sources other than the Waitākere and Hūnua Range dams (on which the

drought standard was based) now supplement supply so that the dams can be drawn down further before drought responses are triggered. This provides more reliability to Watercare customers.

The seasonal triggers that apply to metropolitan Auckland for each drought stage, based on TSS percentages, are shown in Figure 4. The data that underpin this graph are revised regularly as part of normal planning cycles to reflect changes in population and any new supply sources. These trigger levels may be updated independent of this drought management plan. Drought triggers for applicable non-metropolitan customers on stand-alone supplies are provided in **Appendix B**.

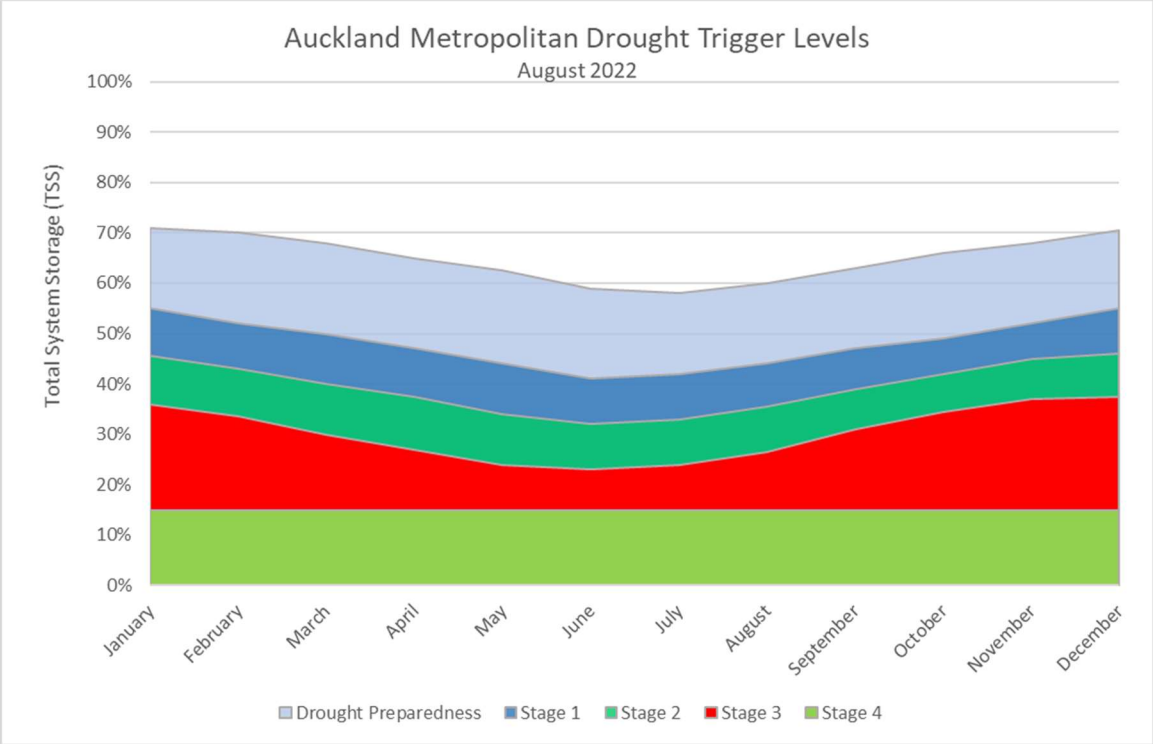

Figure 4: Metropolitan Auckland drought trigger levels (updated August 2022)

Management Responses

Table 2 outlines the range of Council approved activities and measures undertaken in response to each drought stage except Stage 4[1], as well as under normal operating conditions and in the recovery period after a drought. The responses involve all aspects of water security – supply, demand, and system operation – where reducing demand offers the greatest opportunity to manage the effects of hydrological drought.

The drought preparedness stage includes communications campaigns aimed at raising awareness of impending water scarcity and encouraging the voluntary uptake of water saving measures. The more successful this stage is, the longer Aucklanders can defer, or even avoid, the introduction of water restrictions should the rainfall deficit continue.

Table 1: Savings targets per drought stage

Phase	Performance objective	Water saving measures	Savings target per stage	Cumulative savings
BAU combined with drought preparedness	WEP targets	**Voluntary**	5%	New baseline
Stage 1 restrictions	5% probability of occurring	**MILD** Mandatory residential and voluntary non-residential	5%	5%
Stage 2 restrictions	2% probability of occurring	**MEDIUM** Mandatory residential and non-residential	5%	10%
Stage 3 restrictions	1% probability of occurring	**HIGH** Mandatory residential and non-residential	5%	15%
Stage 4 restrictions	0.5% probability of occurring	**CRITICAL**	TBC	TBC

Stage 1 sees the introduction of **mandatory** outdoor water restrictions for **residential customers** and **voluntary** demand reduction targets for **non-residential customers**.

Stages 2 and 3 introduce more restrictions progressively and the savings are incremental and cumulative. The 5% savings targets appear uniform but it is acknowledged that reducing demand becomes progressively harder, once the outdoor use is minimised. Stages 2 and 3 will trigger:

- **mandatory** restrictions are introduced for **non-residential** customers,
- *outdoor and/or non-core-business related uses of potable water* for **all customers** are restricted further, and
- *indoor water use efficiency* is strongly promoted to encourage behaviour change and wise water use.

Implementation of the DMP is a shared responsibility of Watercare and Council, and is governed by legislation and protocols. Once activated, the Incident Management Plan will direct response actions. The DMP is designed to be proactive, thus reducing the need for reactive enforcement.

Further guidance on permitted non-essential water uses under the different water restriction stages is provided in Appendix C.

[1] Stage 4 constitutes a state of water supply emergency that would require extreme interventions by Council and Government. There is a very low probability of TSS falling below 15%.

Table 2: Drought management responses

		Operational Phase					
		Normal operations	**Drought preparedness**	**Drought - Stage 1**	**Drought - Stage 2**	**Drought - Stage 3**	**Drought recovery**
Weather conditions		No rainfall deficit	Dry seasons/ potential drought	Rainfall deficit	Worsening rainfall deficit	Severe rainfall deficit	No rainfall deficit
Drought Triggers – Metropolitan Auckland	Total system storage (refer to Figure 3)	Above the drought preparedness range for the time of year	Within the drought preparedness range for the time of year, trending down	Within the stage one range for the time of year	Within the stage two range for the time of year	Within stage three range for the time of year	Above the drought preparedness range for the time of year
	Waikato River levels	River flows above minimum rates specified in consent conditions	Abstraction from the Waikato River may be restricted by 15%.				River flows above minimum rates specified in consent conditions
Consumption Monitoring	Reduction Targets	WEP 2025 to achieve ~253 L/p/d (~430 ML/d total production) and Water Strategy 2050 to achieve ~225 L/p/d		**5%**	**10%**	**15%**	WEP 2025 to achieve 253 L/p/d (~430 ML/d total production) and Water Strategy 2050 to achieve ~225 L/p/d
Planned response	Drought Management Team	Not applicable	Drought Management Team in place with monitoring	Drought incident and response team in action			Post drought review

		Operational Phase					
		Normal operations	**Drought preparedness**	**Drought - Stage 1**	**Drought - Stage 2**	**Drought - Stage 3**	**Drought recovery**
	Resource management and supply projections	Baseline monitoring - daily abstraction data, rainfall and dam levels, river flows and groundwater	Increase to weekly monitoring, start tracking against early warning indicators and resource trigger curves, enhanced water level and quality monitoring. Increase to monthly resource projections	Daily monitoring and resource tracking. Projections on request (Drought Management Team)			Return to monitoring as per normal operations
	Environmental Monitoring	Adherence to resource consent conditions					
	Communications	Always on: Waterwise campaigns, delivered through multiple channels	Strengthen messaging in communications and target key customer groups with owned (e.g. company websites /apps /newsletters /social media) and earned (e.g. mainstream media) channels	Continue to strengthen messaging in communications, target key areas including paid for activity and increase frequency	Combination of reach and targeted activity across all paid, owned and earned channels on a frequent basis with escalations as and when required		Share case studies of customer initiatives/innovations to save water; and thank customers for their savings efforts
	Pressure and leakage management	Always on: Leak detection and pressure management	Proactive leak management and increased resources for reactive work	Increase investment in leak detection and resources to unplanned work. Commit to faster service level agreements on leaks			Return to leak detection and pressure management as per normal operations
	Source and plant optimisation	Routine operations	Review need for proactive maintenance, abstraction regimes Prioritise drought related investment, optimise abstraction regimes				Routine operations

		Operational Phase					
		Normal operations	**Drought preparedness**	**Drought - Stage 1**	**Drought - Stage 2**	**Drought - Stage 3**	**Drought recovery**
	Non-potable Sources	Monitor demand for existing non-potable services	Investigate additional locations to set up non-potable sites	Set up for commercial customers	Mandated for commercial segments such as construction and cleaning services		Monitor demand for existing non-potable services
RESTRICTIONS							
Residential		**Communications** Always on: Waterwise campaigns, delivered through multiple channels	**Communications** Strengthen messaging in communications and target key customer groups with owned (e.g. company websites /apps /newsletters /social media) and earned (e.g. mainstream media) channels Engage with Council to prepare for the triggering of water restrictions under Clause 12 of the *Water Supply and Wastewater Network Bylaw 2015*.	Outdoor water use only permitted with irrigation system, trigger nozzle on hand held hose, or bucket on alternate days with recommended time of day. Indoor water saving messages will be promoted.	Outdoor water use only permitted with irrigation system with a moisture sensor, trigger nozzle on hand held hose or bucket. Exterior house washing only by a qualified water efficient exterior cleaner Indoor water savings tips will be promoted heavily.	Total ban of irrigation sensors and trigger nozzle. Only use of bucket is allowed outdoors unless for health and safety reasons. Indoor water savings tips and water resuse will be promoted heavily.	Always on: Waterwise campaigns, delivered through multiple channels

	Operational Phase					
	Normal operations	**Drought preparedness**	**Drought - Stage 1**	**Drought - Stage 2**	**Drought - Stage 3**	**Drought recovery**
Non-residential	**Communications** Always on: Waterwise campaigns, delivered through multiple channels Water savings plans developed with segmented customers where needed	**Communications** Strengthen messaging in communications and target key customer groups with owned (e.g. company websites /apps /newsletters /social media) and earned (e.g. mainstream media) channels	Commercial voluntary savings 5-10% Indoor water saving messages will be promoted	Commercial sectors who can use non-potable water for their core business must use it, e.g. construction, cleaning, car washers Potable water cannot be used for non-core business activities, e.g. garden watering, vehicle washing Exterior building washing only by a qualified water efficient exterior cleaner, i.e. Exterior Cleaning Industry Association (ECIA) member following water efficient cleaning standards. Indoor water savings tips will be promoted heavily	Water efficiency audits in place and customised water savings plans agreed with top 50 water-using customers Remaining commercial customers 15% mandatory savings	Always-on: Waterwise campaigns, delivered through multiple channels Water savings plans developed with segmented customers where needed

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Glossary

Term	Meaning
Abstraction	The pumped or gravitational release of water from a supply source into the water treatment and distribution system.
Aquifer	An underground body of water between layers of rock; water sourced from an aquifer is called groundwater.
BAU	'Business as usual'; refers to normal system operations.
Catchment	The area of land where rainfall collects and drains into a waterway. Water supply catchments are those that collect rainfall which drains into a storage lake behind a dam or any other waterway that is used as a source for human water supply.
Critical customers	Customers, such as dialysis patients, who rely on water availability more than most.
Cumecs	Cubic metres per second; an engineering and hydrological term for measuring the flow rate of water flowing past a certain point.
Dam	A constructed barrier in a waterway to hold back water for later use
Demand management	A suite of measures to reduce daily water consumption by both residential and non-residential customers to prolong existing water supplies; an important tool during times of drought.
Drinking water	Water that has been treated to a standard that is safe for human consumption. Drinking water is also called potable water.
Drought	A shortage of rainfall that has caused or threatens to cause depletion in water storage lakes or other raw water sources to levels that may lead to an imbalance between supply and demand. A Severe drought is modelled to have a 1% (1 in 100) probability of occurring in any given year.
Drought standard	See Level of service
Drought yield	Drought yield is used to quantify the maximum yield available from a source during drought conditions. The maximum yield could be limited by the yield derived from the stochastic data set for periods of drought, capacity constraints of the infrastructure connected to the water supply or consent limits.
EPA	Environmental Protection Authority (NZ)
Fit-for-purpose water	The level of treatment of water required for its intended use. Often used to describe the amount (and associated cost) of retreatment (or recycling) of wastewater to a standard that is suitable (i.e., fit) for its subsequent purpose.
Gross demand	The volume of water (in ML) produced by all WTPs combined over a 24-hour period, minus the portion of bulk water stored in reservoirs across the network for use the following day
Gross per capita demand	See L/p/d
Hydrological drought	An extended meteorological drought (lower than normal rainfall) that affects urban water supply.
Integrated Source Management Model (ISMM)	A computer model used by Watercare to make daily decisions on the most efficient and cost-effective supply source to abstract water from (when used in Real Time mode). Other modes enable the model to be used for different planning processes and timeframes.

Term	Meaning
kL	Kilolitre (one thousand litres), equal to cubic meters
kL/d	Kilolitres per day
Level of service	Risk-based framework that the metropolitan water supply system is designed and operated to meet. Referred to as LoS.
L/p/d	Litres of water per person per day. A gross per capita consumption figure calculated by dividing the total volume of drinking water produced (in ML/d) by the current Auckland population. It is not a measure of actual use by each person because the daily production volume also includes non-revenue water and water for the non-residential sector. Individual residential consumption would be a much lower figure.
Mains water	Treated drinking water supplied to customers directly through a metered connection to the public water reticulation system. It includes tankered potable water taken from the Watercare system.
m^3	Cubic metre (one cubic metre equals one thousand litres), equal to kL
ML	Megalitre (one million litres)
ML/d	Megalitres per day
Non-residential use	Water used for commercial, industrial, public open space and other purposes not associated with residential homes.
Non-potable water	Water that is not safe for humans to drink.
Non-revenue water	Treated water produced and distributed but does not pass through a meter and therefore is not paid for; most non-revenue water is leakage (e.g., burst water mains), the rest includes emergency uses (e.g., from fire hydrants), operational use by Watercare, faulty meters and unauthorised use.
Potable water	Water treated to a standard that is suitable for human consumption; it is often referred to as 'drinking water'.
Rated capacity	The maximum capacity of a treatment plant to produce output water to the required quality, at a point in time. Rated capacity may vary in response to factors such as change in raw water quality (e.g., increased sediment after heavy rain), or temporary mechanical problems.
Raw water	Water in its natural state that has not been treated.
Reservoir	Large storage tank for treated water within the distribution network. Reservoirs assist network operators to balance variations in demand at different locations across the service area so that supply is maintained evenly.
Residential water use	Water used by householders either within the home or outdoors. Can also be called domestic use.
Restrictions	Water restrictions are a key demand management measure that specifies water uses not permitted. Restrictions may become more severe as droughts deepen.
Run-off	Water that accumulates on the ground surface when it rains and flows down the surface. In water supply catchments, run-off is

Term	Meaning
	collected and stored in dams, thus increasing the volume in the storage lake. Urban run-off (also called stormwater), such as from roads, is channelled into the stormwater drainage system.
Run-of-river	A situation where water is abstracted directly from a naturally flowing river without an in-stream barrier or dam to hold back water.
Smart water meter	A water meter that communicates water consumption to a computerised reader. Smart meters enable Watercare to routinely read meters much more efficiently.
Spilling	When a dam / storage lake is full, additional inflow from rainfall causes water to passively 'spill' from the dam to the downstream environment.
Spillway	An engineered structure at the top of a dam wall designed specifically for the spilling of water.
Standpipe	A free-standing potable water supply point. Fire hydrants are a type of standpipe. If water shortages become very severe, emergency standpipes can be installed to manage usage.
Storage lake	A body of water held behind a dam constructed in a waterway for the purpose of water supply.
Total system storage (TSS)	The quantity of water available in Auckland's water storage lakes at a given time, expressed as a percentage of the total combined volume of all lakes when they are full.
Water Efficiency Plan (WEP)	Watercare's Plan to achieve water efficiency across its system. As at April 2022 the WEP 2021- 2025 was in effect.
Water Savings Plans (WSP)	Plans developed by commercial customers to achieve and maintain water efficiency within their premises or operations. Sometimes referred to as Water Efficiency Management Plans (WEMP)
Water meter	Mechanism at each customer connection to the mains water supply that measures the volume of water used. Meter readings are the basis of customer water bills.
Water recycling	The re-treatment of water already used for one purpose to a standard that is fit-for-purpose for one or more subsequent purposes. Where the purpose does not require potable-standard water, such as industrial cooling, the use of recycled water reduces demand on the potable water supply.
Water reuse	The reuse of water already used for one purpose for another without active retreatment. For example, household 'grey water reuse' refers to water first used in the laundry, kitchen or bathroom (excluding the toilet) that is collected and subsequently reused for garden watering or other non-potable purposes. Stormwater harvesting and reuse schemes are examples of larger/municipal scale collection and reuse of urban run-off for non-potable uses such as irrigating sporting fields or other open spaces.
WTP	Water treatment plant
WWTP	Wastewater treatment plant

1 Context for drought management

Watercare defines drought as a shortage of rainfall that has caused or threatens to cause depletion in water storage lakes or other raw water sources to levels that may lead to an imbalance between supply and demand. An extended meteorological drought that affects urban water supply is termed 'hydrological drought'.

Drought management is a challenge for all water utilities, particularly as weather patterns are becoming warmer and more unpredictable because of climate change. Every drought is different in terms of its duration, severity and frequency, therefore Watercare constantly monitors supply levels, daily demand, and network operations to allow sufficient preparation time should periods of low rainfall persist.

Being a short-term tactical plan, the DMP is based on prevailing supply, demand and operational parameters, and updated when they change. This section provides an overview the water supply system that services Auckland's metropolitan and non-metropolitan customers.

1.1 Levels of service

The Auckland's metropolitan water supply system is designed and operated to meet the following two levels of service (LoS):

- **LoS 1** – often referred to as the Drought Standard
  Annual average demand within the metropolitan supply area can be met in a severe drought (modelled to have a 1% probability of occurring in any year) while leaving 15% residual capacity in its water supply lakes. Watercare can supply the required volume of potable water to meet demand during a severe drought while keeping the combined lake storage volume of all Auckland's water supply dams (total system storage or TSS) above 15%. 'Watercare would expect to impose some restrictions during this event (see LoS 2).
- **LoS 2** – demand restrictions
  Proactive demand restrictions will be required no more frequently than that required for an event with a 5% probability of occurring in any given year. The modelled peak supply/demand balance is designed to show the forecast peak demand (without restrictions) during a dry summer with a 5% (1 in 20) probability. Under drier conditions (leading to higher demand), Watercare could impose restrictions to reduce peak demand while continuing to meet the LoS.

1.2 Current water supply system

Water for Auckland's metropolitan region comes from three main source types:

- Surface water storage (dams) in the Waitākere Range west of the city, and the Hūnua Range to the south
- Groundwater
- Run-of-river flows

The non-metropolitan communities are supplied as follows:

- Helensville/Parakai – Mangakura Dam and groundwater (Sandhills Spring)
- Warkworth – groundwater
- Wellsford – run-of-river flows
- Snells/Algies – groundwater

- Muriwai – groundwater
- Bombay – groundwater
- Waiuku – groundwater

Table summarises the volumetric contributions of metropolitan water sources.

Table 3: Raw water sources for metropolitan Auckland

Source	Total usable[2] volume (ML)	Sustainable drought yield (ML/day)
Dams – Waitākere Range		
Waitākere Dam	1,760	14.8
Upper Nihotupu Dam	2,200	14.3
Lower Nihotupu Dam	4,600	23.5
Upper Huia Dam	2,200	11.7
Lower Huia Dam	6,400	27.7
Dams – Hūnua Range		
Cosseys Dam	14,030	37.1
Wairoa Dam	11,600	28.1
Upper Mangatāwhiri Dam	16,200	57.9
Mangatangi Dam	35,300	97.5
Hays Creek Dam	1,100	6.2
Total dam supply	**95,390**	**313.6**
Groundwater sources		
Kaawa Aquifer (Pukekohe)	N/A	5
Run-of-river source		
Waikato River[3]	150 (Consent 960089)	150 or 127.5[3]
	150[4] (Consent AUTH 131259.01.01)	150 or 127.5[4]

A customised risk-based model – the Integrated Source Management Model (ISMM) – is used to inform the operating strategy and enables decisions to be made that maximise the yield of the water supply system while minimising the cost of operation. The model generates an 'optimised' abstraction

[2] For dams, the total usable volume is the amount of water that can be physically drawn from the storage lake behind each dam. It is calculated as the volume (in megalitres (ML)) between the spillway at the top and the lowest abstraction point at the bottom. Any remaining water below the abstraction point is called dead storage. The sustainable drought yield per day is the volume of water that is available – through modelling the whole supply system and rainfall dynamics – while meeting the adopted LoS.

[3] Both resource consents contain a condition that under designated low flow rates upstream at Rangiriri, maximum daily take by Watercare is reduced by 15%.

[4] The second 150 ML/d consent was granted in early 2022. Permanent water intake works are yet to be constructed to utilise this volume.

rate from each source per day over a one- to four-week timeframe through input data on how full each storage is, how wet the catchments are, the expected demand, any operational constraints, and forecast rainfall. For example, if the dams are relatively full and normal rainfall is forecast, the model will likely indicate greater abstraction volumes from dams than the Waikato River because dam abstraction is gravity fed (minimal cost) whereas water from the Waikato River needs to be pumped 30 km which requires substantial energy. As a drought progresses, the proportion of water from the Waikato River increases to preserve dam storage for as long as possible. Likewise depending on forecast weather patterns water from the western dams may be abstracted in priority over water from the southern dams and vice-versa.

Watercare operates six water treatment plants (WTPs) that produce drinking water for the metropolitan network plus eight small stand-alone WTPs for non-metropolitan communities. Operators adjust production output from each metropolitan WTP to meet daily and seasonal fluctuations in overall demand as well as daily demand peaks and troughs experienced in different zones within the metropolitan service area. Cost efficiency is also factored into decisions on sources and production locations.

Drinking water produced at the metropolitan WTPs is distributed throughout the city via bulk transmission pipelines then into local distribution networks.

Note, the Onehunga Aquifer has been taken out of service due to water quality issues. This has no material impact on the DMP, or the activities undertaken.

1.3 Demand for water

1.3.1 Overview of demand

Demand refers to the volume of drinking water used by Watercare's customers over a specified timeframe. There are many ways to express demand, all of which depend on the type and veracity of data available.

Watercare generally quantifies demand as the overall volume of water consumed per day. Known as 'gross' demand, it equates to the volume of water (in ML) produced by all WTPs combined over a 24-hour period, minus the portion of bulk water stored in reservoirs across the network for use the following day.[5] In some circumstances, Watercare also uses gross per capita demand in litres per person per day (L/p/d) as a baseline or target demand figure[6].

Gross demand in the Auckland metropolitan area has grown from a rolling 12-month average of 326 ML/d in 2000 to about 420 ML/d in 2020. Actual usage fluctuates from day-to-day and there are marked seasonal increases during the summer.

Water demand in metropolitan Auckland comprises:

- residential demand
- non-residential demand
- bulk water sales

[5] Also referred to as the 'demand proxy' when used for forecasting future demand.

[6] Gross L/p/d is calculated by dividing the gross daily treated water production by the current Auckland population. While it may be useful for assessing trends in daily water usage, it should not be interpreted as residential usage per individual because almost one-quarter of gross daily production is used by the non-residential sector.

- non-revenue water.

The volumes and percentages of daily water used by the above demand segments, averaged for the month of November 2020, are shown in Figure .

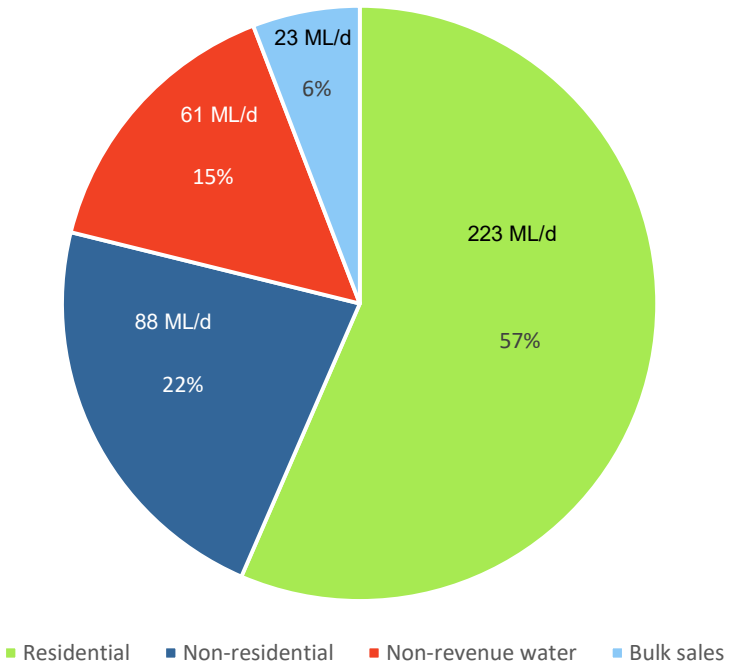

Figure 5: Breakdown of demand, November 2020

1.3.2 Residential water use

About 57% of the total volume of water produced is used by the residential sector in freestanding houses or townhouses. This figure does not include many multi-unit dwellings where water bills are paid by body corporates which are classified as commercial (non-residential) customers.

Residential demand applies to individual households which have metered connections to the network and covers all water use inside and outside the home. Outdoor uses include garden and lawn watering, swimming pool filling and topping up, property maintenance, and washing vehicles or recreational craft.

In 2008, Watercare commissioned research to better understand how household water was used. Conducted by BRANZ, the water end-use study of 51 Auckland homes over summer and winter periods revealed the breakdown (averaged over the two seasons[7]) in Figure .

[7] Note that the averaged outdoor water use (12%) was made up of 6% in winter and 18% in summer. The much higher percentage over summer is an important factor in drought management where restricted water uses target outdoor use particularly in drier summers when overall consumption increases across the community.

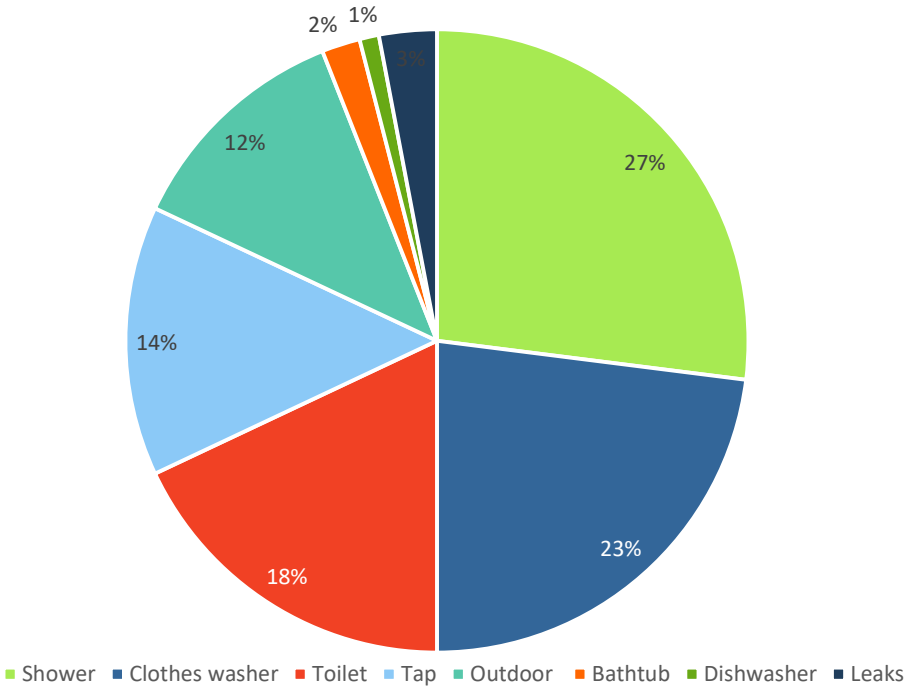

Figure 6: Breakdown of residential water use in Auckland (BRANZ, 2008)

1.3.3 Non-residential water use

Non-residential demand makes up the next largest segment, and comprises:

- **the commercial sector**[8] – shopping centres, office buildings, hotels, laundromats, restaurants, entertainment venues, etc.
- **the industrial sector** – food and beverage processing and packaging, manufacturing, refining, warehousing, distribution, chemical, textiles, and printing
- **the institutional sector** – power stations, airports, government organisations (Auckland Council is a major water user), hospitals, universities, colleges, schools, sporting facilities, etc.
- **'other'** – small percentage of customers outside the above three classifications.

[8] Multi-unit dwellings where water bills are paid by body corporates are classified as commercial (non-residential) customers.

An indicative breakdown of consumption by these sectors is provided in Figure , adapted from the *Auckland Regional Water Demand Management Plan 2013-2016.*

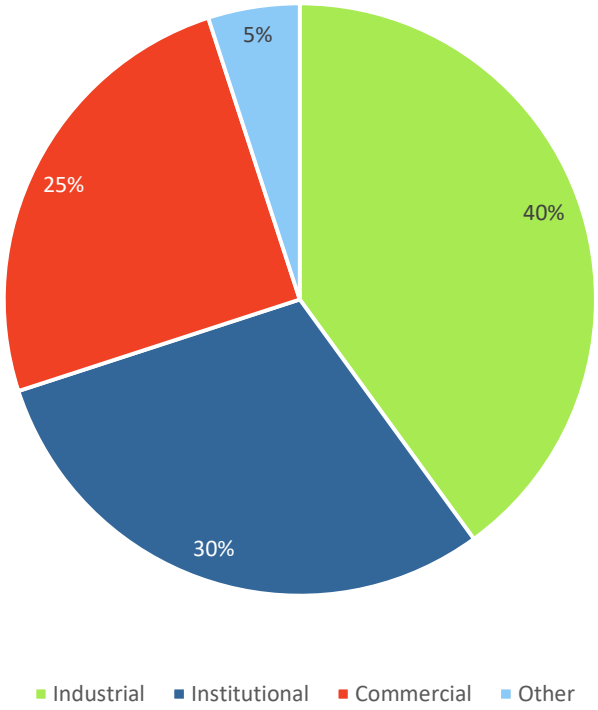

Figure 7: Breakdown of Auckland's non-residential water use

1.3.4 Bulk sales

Watercare sells bulk drinking water via Bulk Water Agreements to other water utilities who on-sell to their customers. Currently, Veolia purchases bulk water for distribution to the community of Papakura, and Waikato District Council on-sells bulk water to Pōkeno and Tuakau. Under the supply agreements, these communities are subject to the same drought response measures as metropolitan Auckland.

Drinking water is also available to water tanker operators who have access to 14 filling stations across the city. Tankered water can be purchased by residents of properties that are not connected to the main metropolitan network for filling rainwater tanks during dry periods. It is also commonly used in the road and building construction industry for dust suppression and other onsite purposes.

1.3.5 Non-revenue water

Non-revenue water is the volume of treated water produced and distributed but not paid for. It includes emergency uses (e.g., fire hydrants), operational use by Watercare, faulty water meters that provide lower-than-actual readings, unauthorised take, and finally leakage, (known as real loss). Real losses form most of the non-revenue water and 12% to 13% of gross demand. Watercare's recent corporate target has been to keep leakage below 13%. With implementation of the WEP, that target is reduced to below 12%.

1.4 Demand forecast

Planning for water security, including for short-term drought management, requires a baseline forecast of likely demand. By starting with baseline demand, various drought response measures can be tested to determine their impact on the water balance. Figure shows metropolitan Auckland's actual water usage (historical demand) since 2000, and the demand forecast adopted for the DMP. Three different forecasts are plotted:

- **Annual average demand – typical year** – the rolling 12-month average projected using the 2000 to 2019 trend line
- **Summer demand** – average projected demand over December, January and February each year
- **Peak week demand** – seven-day rolling averages, based on the 2020 peak weeks.

All the above forecasts assume full implementation of the WEP and the demand savings it aims to achieve (5% to 2025).

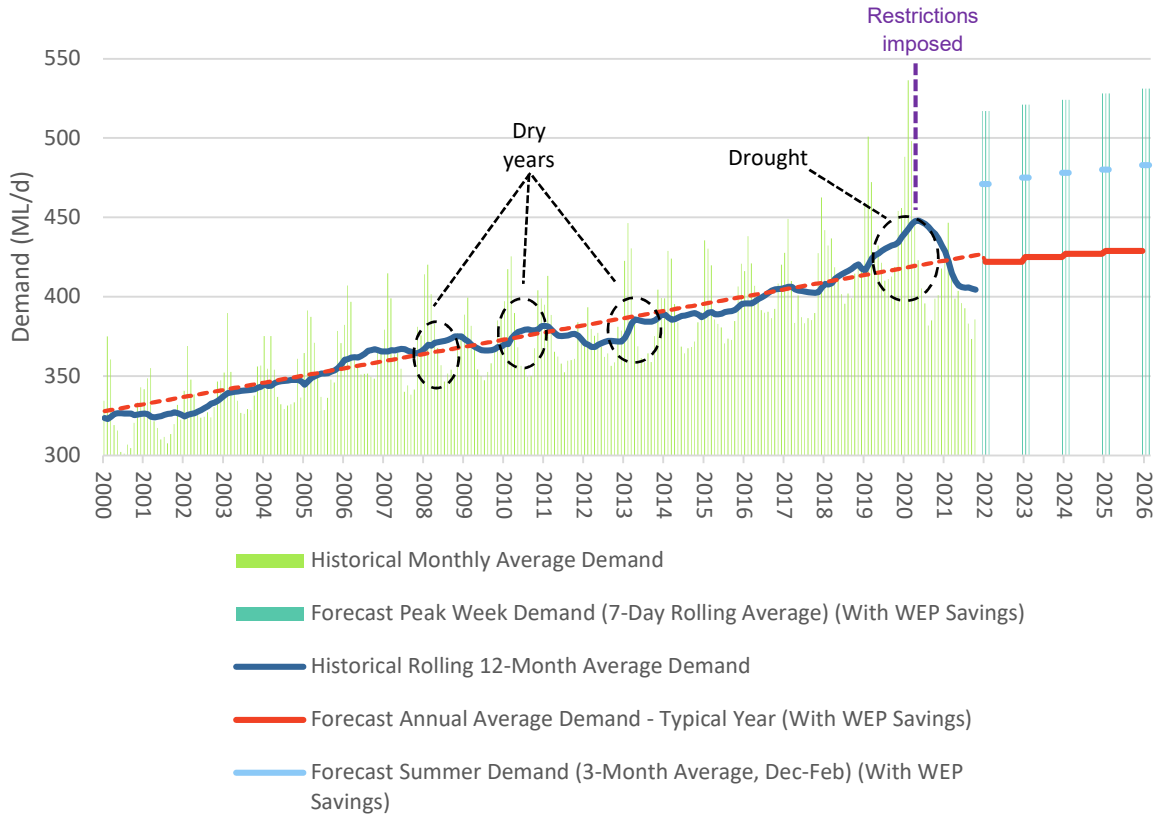

Figure 8: 20-year historical demand and 2022 – 2026 demand forecast

2 Options for managing drought

Drought management refers to the cycle of planning and preparing for droughts as well as responding to and recovering from droughts. Any management options must aim to enhance 'drought resilience' which means the combined capability and capacity of Council, Watercare, and the community to manage through future droughts by taking a collaborative approach.

2.1 Three potential levers

Resilience to drought can be enhanced through adjusting one or more of the three interdependent components (often referred to as 'levers') of the water supply system, i.e., increasing supply capacity, optimising system operation, and managing (i.e., reducing) demand (Figure 9). Supply-side measures, demand-side measures and operational measures work together to achieve the LoS.

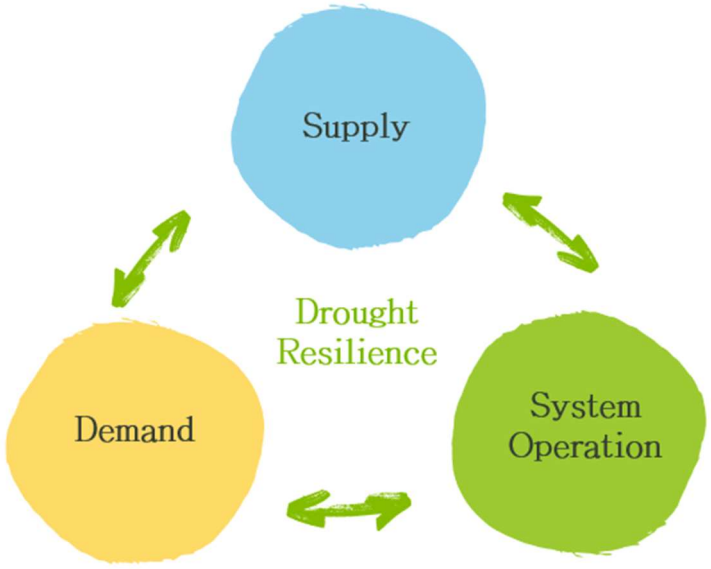

Figure 9: Three interdependent levers to enhance drought resilience

2.1.1 Augment / increase supply

Since the onset of the 2019-2020 drought, Watercare has undertaken an extensive program of supply augmentation through new or upgraded WTPs and securing a resource consent for additional supply from the Waikato River. Table summarises the current drought yield available from the system as identified within the *Asset Management Plan 2021-2041*, including any sources accelerated in response to the 2019-2020 drought.

Table 4: Auckland water supply system drought yield

Supply source	Current drought yield (ML/d)	Notes
Surface Water Storages		
Dams – Waitākere Ranges	87	Reflects the sustainable yield of the Waitākere dams
Dams – Hūnua Ranges	227	Reflects the sustainable yield of the Hūnua dams
Groundwater		
Kaawa Aquifer (Pukekohe)	5	
Run-of-river		
Waikato River	255	Reflects the two 150 ML/d resource consents reduced by 15% during low flow periods. Until a permanent intake is constructed to abstract under the second (issued in 2022) consent, the drought yield is half the 255 ML/d stated (127.5ML/d).
Total	**574**	See notes above

2.1.2 Optimise system operation

As outlined in Section 1.2, Watercare optimises the daily mix of raw water sources via the Integrated Source Management Model (ISMM). This model is a key tool during hydrological drought to extend the total volume of water in Auckland's storage lakes for as long as possible.

Operators of the water treatment and distribution system can adjust WTP production in real time to meet demand variations. This flexibility in the operating system also extends to the movement of water around the network and use of network reservoirs (tanks) in certain supply zones to store treated water in anticipation of higher demand than in other zones, particularly the peak demand at certain times of the day. Ring mains also provide supply resilience and greater operational flexibility.

2.1.3 Reduce demand

Reducing demand is the responsibility of all water consumers, even though the specific actions for each sector may be different. Watercare takes two approaches to facilitate the reduction of demand:

1) Demand management programs, e.g., implementation of the WEP, mass media messaging on how to conserve water, targeted education programs, direct engagement with large water users,
2) Formal water restrictions when TSS reaches certain trigger levels.

Managing **residential** demand requires reductions both inside and outside homes. Most indoor water uses are essential for daily life, but there are many ways for customers to reduce the water used. For example, replacing old and water-wasting shower heads, toilets, taps, and clothes washers with newer, more efficient ones can save hundreds of litres per week per household. Alongside those

technological solutions, changing water-use behaviour also has a significant impact on water consumption. Shortening the time spent in the shower, turning taps off while brushing teeth, and only washing clothes when there is a full load all help to save water.

Outdoor water use is often called ‘discretionary’ use and is typically more of a lifestyle choice, rather than being an absolute necessity especially when water becomes scarcer. Greater scope exists to reduce outdoor use and is the reason that formal water restrictions address these uses first.

Reducing **non-residential** demand requires methods that are tailored to different sectors because their water end uses vary greatly and some businesses and industries may have greater scope than others to reduce consumption while maintaining their core business.

Watercare focuses efforts to encourage water savings through engagement with customers who have the highest usage rates. During the 2019-2020 drought these customers were supportive of investigating ways to reduce their consumption. As with residential customers, discretionary uses by non-residential customers are also subject to mandatory water restrictions.

3 Drought responses

This section provides a greater level of detail to the summary of drought management responses presented in Table 2.

3.1 Drought triggers

Watercare has a drought warning system in place for its bulk water storage system. The combined TSS level for its metropolitan surface water storages is used as an indicator of drought risk and is routinely monitored against drought trigger levels[9]. Figure 10 shows the seasonally adjusted trigger levels for each phase of drought response, including an initial phase (drought preparedness) for Watercare to ramp up drought planning and preparation and communication. This graph is revised regularly as part of normal planning cycles to reflect changes in population and any new supply sources. These trigger levels may be updated independent of this drought management plan.

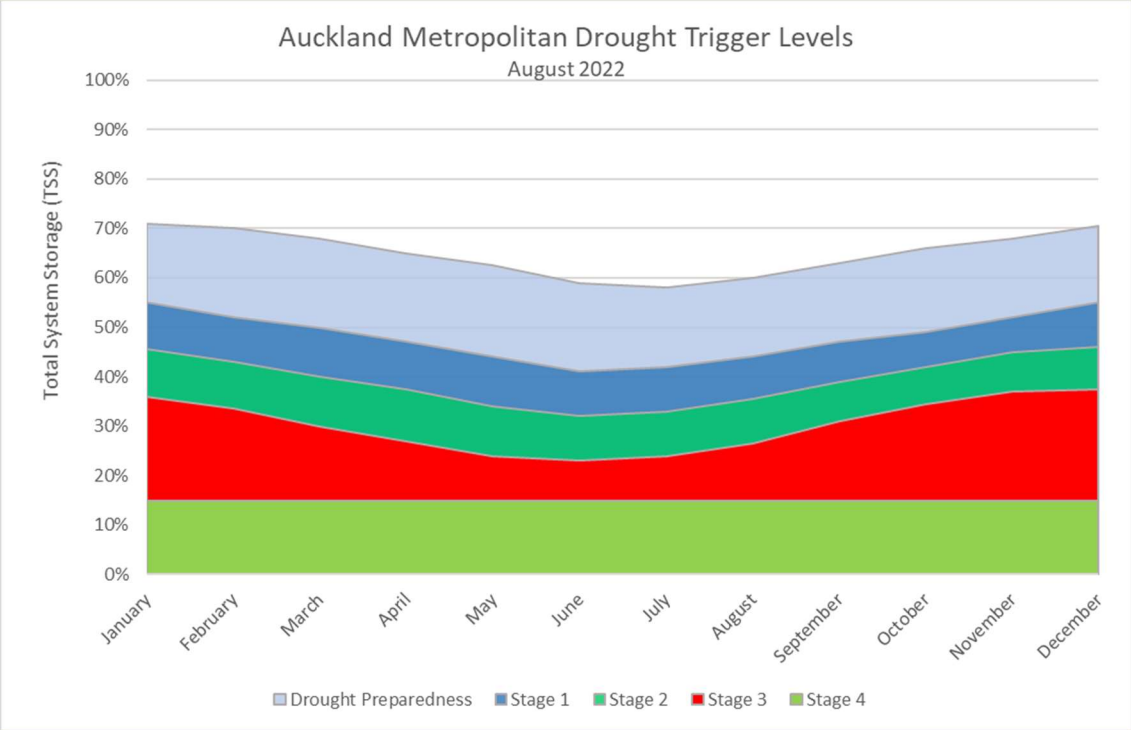

Figure 10: Auckland metropolitan drought trigger levels based on total system storage (updated August 2022)

[9] Although the TSS percentage is the metric used for drought response triggers, water from other sources, e.g., Waikato River, is part of the model and therefore factored into the rate of TSS depletion during hydrological drought.

The TSS trigger levels incorporate the reduction in demand required to ensure there is no system failure due to shortage of water. The following assumptions were made in the calculation of these trigger levels.

- Dry weather demand is higher, including increased demand for tankered water for non-reticulated domestic use.
- The Waikato Water Treatment Plant follows historical reliability.
- There is variation during summer/autumn historical low flow periods.
- There are four weeks of lead time for savings attributable to particular water saving measures to be realised.
- Current maximum outputs of storage lakes and WTPs were used.

3.2 Objectives and targets

A key update since the previous (2020) DMP is the release and implementation of the WEP. The WEP aims to sustainably reduce water demand to a lower baseline for Auckland by improving water use data, optimising network pressure, reducing losses, and increasing residential, community and commercial water efficiency. Overall, the WEP is targeting a reduction of 36 L/connection/day (or achieving gross per capita consumption[10] of 253 L/p/d by 2025). This DMP assumes that the WEP savings will be achieved as part of the BAU and drought preparedness phases, outside of water restrictions.

As dam levels can fall very quickly in dry periods, a phase of ramped up drought preparedness activities is triggered first. Drought preparedness includes communications campaigns aimed at raising awareness of impending water scarcity and encouraging the voluntary uptake of water saving measures. The more successful the voluntary stage is, the longer Aucklanders can defer, or even avoid, the introduction of water restrictions should the drought continue. The performance objectives and total savings target of 5% per drought stage remain unchanged from the previous DMP, as summarised in Table . Water savings realised at each phase may exceed these targets, and if so, place the community in a better water security position.

In Stage 1 **mandatory** outdoor water restrictions are introduced for **residential customers** and **voluntary** demand reduction targets for **non-residential customers**. In Stages 2 and 3 more restrictions are introduced progressively and the savings are incremental and cumulative. The 5% steps in savings targets appear uniform but it is acknowledged that reducing demand becomes progressively harder, once the savings in outdoor water use have been achieved. Restriction measures and their expected outcomes must be easy to implement, measure, monitor and communicate widely, demonstrating effectiveness, equity and fairness. The accuracy of measuring savings over such short time steps combined with the low resolution of end-use demand are inadequate to fine-tune restrictions.

Stages 2 and 3 will trigger:

- **mandatory** restrictions are introduced for **non-residential** customers,
- *outdoor and/or non-core-business related uses of potable water* for **all customers** are restricted further, and
- *indoor water use efficiency* is strongly promoted to encourage behaviour change and wise water use.

[10] Gross consumption is the volume of treated water produced each day divided by the Auckland population. As it includes non-residential consumption and non-revenue water, it is not a measure of everyone's domestic consumption per day. The Auckland Water Strategy's longer-term target is to achieve 225 L/p/d gross consumption by 2050.

Table 5: Savings targets per drought stage

Phase	Performance objective	Water saving measures	Savings target per stage	Cumulative savings
BAU combined with drought preparedness	WEP targets	Voluntary	5%	New baseline
Stage 1 restrictions	5% probability of occurring	MILD Mandatory residential and voluntary non-residential	5%	5%
Stage 2 restrictions	2% probability of occurring	MEDIUM Mandatory residential and non-residential	5%	10%
Stage 3 restrictions	1% probability of occurring	HIGH Mandatory residential and non-residential	5%	15%
Stage 4 restrictions	0.5% probability of occurring	CRITICAL	TBC	TBC

Note: Stage 4 restrictions are required in an emergency when the drought standard (LoS 1) cannot be met. Commencement of detailed planning regarding Watercare's emergency response to Stage 4 restrictions would be based on forecast drought risk. Community engagement regarding minimum expected standards of water supply will help to inform the critical restrictions.

The metropolitan drought management approach will also be applied to those non-metropolitan communities supplied from local stand-alone sources. The formal schedule of restricted water uses will be implemented in a consistently staged approach, using tailored drought response triggers to match the localised risk of shortfall. **Appendix B** provides an overview of triggers for each of the communities where a drought trigger is applicable.

3.3 Drought Management Team

Activating the Drought Management Team – also referred to as the Drought Incident and Response Team – is the first major action Watercare undertakes should the drought-preparedness stage be triggered. This action is a requirement of Watercare's *Incident Management Plan* which comes into play when any 'non-normal' situation or event has the potential to negatively impact achievement of Watercare's operational and strategic objectives. Drought is categorised as an event to be escalated within the incident management framework.

The Drought Management Team brings together all relevant expertise within the organisation to focus efforts on the drought response in a coordinated way.

3.4 Monitoring water sources

Monitoring water supply levels is integral to Watercare's standard operations. However, if a drought is triggered, monitoring efforts are increased because they are the basis upon which decisions for greater investment in the drought response are made.

Baseline monitoring of water availability under normal operations includes short- and long-range weather forecasts, actual rainfall in the dam catchments, dam storage levels, river flow rates, groundwater levels and daily abstraction data. During the drought preparedness stage, these data are collated and reported weekly to enable closer tracking against water resource trigger curves and the preparation of monthly resource projections.

If a drought enters stage 1, 2 or 3, the frequency of resource availability monitoring increases to daily, thus enabling supply projections to be prepared at any time.

Environmental monitoring including water quality and any other parameters required by resource consent conditions, occur in parallel under normal operations and drought conditions.

3.5 Monitoring demand

As outlined in Section 2.1.3, the reduction of demand is a key lever in drought management. Different responses are required to reduce the different components of demand, e.g., restrictions to manage residential and non-residential consumption, and leakage management to reduce a major portion of non-revenue water.

Watercare continues to invest in technologies such as smart meters for customer consumption and at key nodes in the distribution network to detect leaks. Being able to monitor consumption and losses more efficiently enables targeted and timely responses.

3.6 Communications

3.6.1 Continuing to strengthen relationships

Engaging with stakeholders and the general Auckland community is critical to the successful implementation of any future drought response. Valuable lessons were learned during the 2019-2020 drought which places Watercare in a good position to build on increased water literacy that developed from the collective drought experience.

Ongoing communication about the value of water is important to maintain water saving behaviours established during the drought and to inform new residents that come to the city. Watercare is continuing the water saving conversation with regular meetings with residential customer and via the web page “Water for Life” **https://www.waterforlife.org.nz/water-saving-tips** where there are numerous tips on how to save water in the home and garden. The WEP identifies greater engagement with residential customers as a key mechanism to promote the adoption of water-efficient fixtures and appliances.

Targeted engagement with large consumers in the commercial, industrial, and other organisational sectors is also vital to embedding water efficiency in preparation for droughts. Watercare is continuing one-on-one engagement with the top 100 non-residential customers to facilitate the uptake of water saving practices, ranging from small changes such as trigger nozzles on hoses to larger potential investments such as onsite water reuse or recycling.

3.6.2 Drought communication and engagement

Watercare will undertake a range of communication and engagement activities associated with each stage of the drought response. Each stage has a specific engagement campaign aimed at supporting all sections of the community as they endure increasingly severe restrictions. Watercare has a particular duty of care to maintain a safe and secure water supply to critical customers such as hospitals and those on home dialysis. The staged implementation program also has requirements for

greater frequency of public reporting of Auckland's water security position and how daily demand is tracking.

Managing drought is a shared responsibility so a partnership approach involving Watercare, Auckland Council, Government, businesses, and the community is the philosophy that underpins communication and engagement programs. Communications will be clear, consistent, and suitable for a range of audiences with varying levels of general and water literacy. Messaging can have greater reach through graphics and comparing water savings to tangible items such as buckets or bathtubs for litres and swimming pools for megalitres.

Auckland Council is a key stakeholder in the drought response, owing to its legislative power to impose restrictions, enforce compliance and lift water restrictions under Clause 12 of the *Water Supply and Wastewater Network Bylaw 2015*. If TSS is trending toward the Stage 1 trigger, Watercare will instigate the necessary processes and Council engagement to facilitate timely implementation of restrictions. Similarly, when Watercare's water security assessment indicates the drought exit is appropriate, proactive engagement with Council is necessary to formally lift restrictions in a timely manner.

3.7 Source and plant optimisation

In responding to the 2019-2020 drought, Watercare brought forward several projects to augment supply and associated treatment and distribution capacity. These included:

- recommissioning a disused dam
- upgrading and constructing new water treatment plants
- constructing a new reservoir to improve the efficiency of treated water distribution
- obtaining additional short-term water allocations
- applying for a significant long-term additional surface water allocation.

The ISMM is a 'living' model that is updated and refined as more and/or better data become available. Such refinements can optimise abstraction regimes even further in future droughts. The ISM informs the DMP response measures for the near term. Long-term climate change will be incorporated into the Drought Standard and the DMP will be progressively revised accordingly.

The *Asset Management Plan 2021-2041* guides future investment in water supply (and wastewater treatment) infrastructure. As it is periodically updated, there is the potential to bring forward some augmentation projects to respond to short-term droughts. Medium to long-term objectives in the *Auckland Water Strategy* for diversifying water sources to enhance water security, e.g., rainwater tanks, water reuse and recycling, will also support drought management efforts.

3.8 Non-potable sources

Several non-potable water sources, e.g., recycled water schemes, are currently available for non-residential uses such as irrigation, manufacturing and plant cooling. Watercare promotes these sources during normal operating conditions but ramps up efforts to directly support commercial customers in accessing non-potable supplies during the drought stages. Access points are established by Stage 1, and the use of non-potable water for certain commercial uses, e.g., construction and cleaning services, is mandatory under Stages 2 and 3.

Auckland Council's objectives for greater on-site water capture and reuse, in residential and non-residential settings, will enhance drought resilience.

3.9 Restrictions

Implementation of measures to reduce consumption will help to 'flatten the curve' of demand over time and therefore extend availability of water supplies during times of drought. During the 2019-2020 drought, voluntary water saving measures over the 2019-2020 summer followed by Stage 1 restrictions from autumn 2020 saw demand reduce markedly (Figure 1). Even though winter to spring rain in 2020 bolstered TSS, demand remained at a much lower level throughout the 2020-2021 summer when rainfall was again much lower than average. If the high demand experienced over the 2019-2020 summer had been repeated the following summer, TSS would have dropped to potentially critical levels.

The 2019-2021 experience demonstrated the value of voluntary and mandatory restrictions in maintaining water security during Auckland's hydrological droughts and intervening periods.

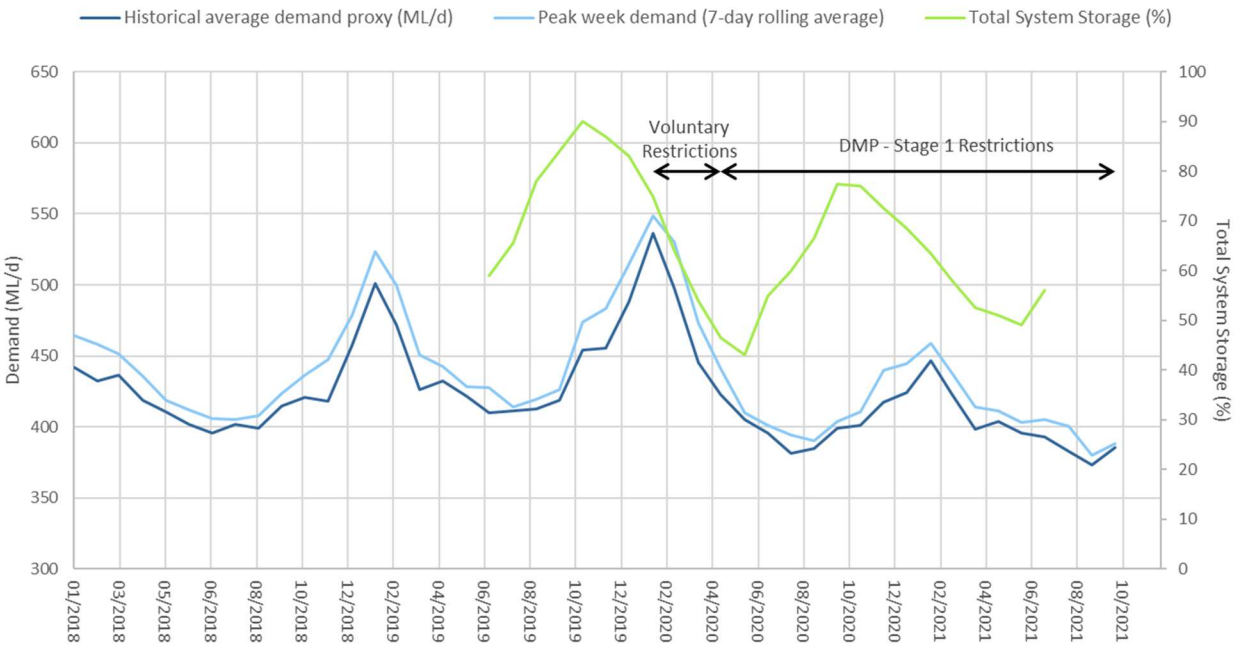

Figure 1: Impact of restrictions on water balance in 2019-2020 drought

Under the DMP, measures to reduce residential and non-residential consumption will be introduced using a staged approach, proportionate to the availability of water supplies. This means that if the drought worsens, measures including restrictions will increase in severity, with the goal of further flattening the curve to keep demand below the limit of supply.

The schedule of restrictions has been revised for this DMP.

- **Stage 1** sees the introduction of mandatory outdoor water restrictions for residential customers and voluntary demand reduction targets for non-residential customers.

- If **Stages 2 and 3** are triggered,
    - mandatory restrictions are introduced for non-residential customers
    - outdoor and/or non-core-business related uses of potable water for all customers are restricted further
    - indoor water use efficiency is strongly promoted to encourage behaviour change.

More detailed guidance on permitted and non-permitted water uses (from Table 2 in Part A) under the different restriction stages is provided in **Appendix C**.

3.10 Drought recovery

3.10.1 Staged exit

Like the stages of a deepening drought, a staged approach will be taken to exit and recover from drought, however the triggers have not been specified. Instead, the decision to ease the drought response measures will be determined using an adaptive management approach, considering the following factors:

- storage levels and hydrological conditions
- short and long-range weather forecasts
- time of year and historical seasonal trends
- trends in demand and consumption behaviours
- likelihood that restrictions will have to be reintroduced over the subsequent months to avoid de-activating and re-activating drought response measures
- economic impact of easing or continuing restrictions.

The storage levels for relaxing restrictions may not necessarily occur at the same storage levels that they are imposed at. When a decision is made to ease restrictions, this will usually occur one stage at a time. For example, if assessment of the above factors results in a decision to ease restrictions while Auckland is currently in Stage 2, customers will transition to Stage 1 restrictions before any subsequent decision is made to lift all restrictions.

Watercare and Auckland Council will need to collaborate closely to manage actions associated with drought recovery, and to ensure the formal declaration by Council of any restriction changes occur at the right time according to Watercare's advice on the water supply situation. This gradual easing allows better outcomes when drought recovery is slow and can account for the lead times of easing and restarting each measure.

Actions to be taken upon easing of drought restrictions include:

- community and customer engagement regarding changes to restrictions
- public communications and media to inform the community about changes to restriction stages
- evaluation and review of drought response performance, including assessment of supply, demand and system operation measures implemented.

3.10.2 Post-drought evaluation

3.10.2.1 Types of evaluation

The DMP should be evaluated each time it has been implemented and updated so that it remains relevant, responsive, and improves over time. Business needs will determine the type of evaluation Watercare undertakes; options include:

- Outcome evaluation – the degree to which the actions achieved their desired outcomes
- Impact evaluation – the degree to which implementation of the Plan met its overall objectives

- Process evaluation – the extent to which the Plan was implemented as designed.

All phases of the staged Implementation Plan are to be evaluated, including BAU/drought preparedness where planning work is important to the success of the drought stages. Sample questions Watercare may use for each of the above evaluation types are provided in Table 6. Watercare will tailor the evaluation questions to those where quantitative and qualitative data (if appropriate) are obtainable in the required time and quality. Watercare has the option of conducting evaluations internally or outsourcing the task.

Table 6: Sample evaluation questions

Evaluation type	Sample evaluation questions
Outcome evaluation	Has a water end user analysis study been conducted and how effective will the outcomes be in informing future demand management programs?
	Have the staged engagement campaigns been developed and tested on a pilot group of customers for feedback and improvement? What was the feedback and how have the campaigns been improved?
	How appropriate were the trigger levels, given the additional water sources that have been brought online since the 2019-2021 drought?
	How well did Stage 1 restrictions achieve 5% savings?
	How well did Stage 2 restrictions achieve a further 5% (overall 10%) savings?
	How well did Stage 3 restrictions achieve a further 5 % (overall 15%) savings?
	Could the level of compliance with restrictions be improved and how?
Impact evaluation	How well did the implementation of restrictions prevent a worsening of water security?
	How well did residential customers respond to restrictions?
	Were there social impacts of restrictions that could be better managed in future droughts?
	Were there economic impacts of restrictions that could be better managed in future droughts?
	Were there environmental impacts of restrictions that could be better managed in future droughts?
	Were there cultural impacts of restrictions that could be better managed in future droughts?
Process evaluation	Did the drought management team find the DMP straightforward to implement or are there areas for improvement?
	How well did the community respond to messaging about water savings
	How well did early engagement with Council result in restrictions being imposed when needed?
	Was Watercare adequately resourced to manage the drought in accordance with the Plan?

3.10.2.2 Monitoring and reporting

To carry out an evidence-based evaluation, appropriate data must be available. By having clear links between the objectives of the DMP and the questions to be answered during the evaluation, the required monitoring and data collection becomes apparent.

Data on overall daily consumption are readily available via WTP production volumes adjusted for network storage changes. As Watercare undertakes further research into the breakdown of residential and non-residential consumption, better data will be able to inform evaluations of the effectiveness

and impact of demand management on specific water use behaviours. Already, the rollout of smart meters is enabling real-time consumption data to be recorded.

Reporting of the water security situation throughout a drought is embedded in each stage. This has been shown in other jurisdictions to be successful in keeping the decision-makers as well as the community focused on water scarcity and how they can play their part. It often becomes part of daily conversations about the weather.

Evaluation reports will be the basis of continual improvement in drought management and water security more broadly. In support of the partnership approach, Watercare will share key evaluation findings.

4 Future updates

The DMP is to be reviewed every two years and/or after each drought event and/or after changes in Watercare's operating environment or planning framework or significant investment is made in infrastructure or the system. This provides assurance that the DMP remains contemporary and effective.

Future DMP updates will address the objectives, targets and performance measures identified in the Auckland Water Strategy 2022-2050.

Appendix A: Information sources – public

Anglian Water: *Drought Plan 2022 – Draft March 2021.*

Auckland Council: *Auckland Plan 2050 – Overview*, Auckland Council, July 2018.

Auckland Council: *Our Water Future Tō tātou wai ahu ake nei - a discussion document*, February 2019.

Auckland Council: *Auckland Water Strategy 2022-2050*

Auckland Council: *Auckland Water Strategy Implementation Plan 2022*

Auckland Council: *Review of Auckland Council Controlled Organisations*, Independent Panel appointed by the Governing Body of Auckland Council, July 2020.

Auckland Council: *Water Supply and Wastewater Network Bylaw 2015*, Governing Body of Auckland Council, Resolution number GB/2015/62, 25 June 2015.

Beal, Cara, Stewart, Rodney Anthony: *South East Queensland Residential End-Use Study: Stage 2 final report and summary of water consumption trends from 2010 to 2014,* Griffith University 2014.

BRANZ: *Auckland water use study – monitoring of residential water end uses*, Building Research Association of New Zealand (SB10, Paper 51) 2008.

NSW Department of Planning, Industry and Environment: Draft Lower Hunter Water Security Plan – August 2021, NSW Government.

Queensland Department of Regional Development, Manufacturing and Water: *Drought Management Plans and Water Restrictions – guideline for development Version 1.00*, Queensland Government, 05/04/2021.

Seqwater: *Water for Life – South East Queensland's Water Security Program 2016-2046 (Version 2),* Queensland Bulk Water Supply Authority, March 2017.

Thames Water: *Draft Drought Plan 2022 – March 2021*

Urban Utilities: *Water Restrictions Schedules 2020.*

Watercare: *Asset Management Plan 2018-2038 (1 July 2018 to 30 June 2038).*

Watercare: *Asset Management Plan 2021-2041 (1 July 2021 to 30 June 2041).*

Watercare: *Auckland Metropolitan Drought Management Plan February 2020*.

Watercare: *Demand Management Plan 2013-2016.*

Watercare: *Incident Management Plan*, 25 November 2019.

Watercare: *Statement of Intent 2020-2023*.

Watercare: *Water Efficiency Plan 2021-2025.*

Watercare (for Waikato Resource Consent Application), various reports:

- Assessment of Environmental Effects
- Water Source Alternative Options Assessment for the Metropolitan Supply – Demand Forecast
- Water Source Alternative Options Assessment for the Metropolitan Supply – Outage, headroom and the supply/demand balance
- Water Source Alternative Options Assessment for the Metropolitan Supply – Waikato River Refresh Application.

Appendix B: Non-metropolitan area drought triggers

Of non-metropolitan supplies, only Wellsford and Helensville/Parakai have drought triggers defined by river flow rates or dam storage capacity (see tables below). The other non-metro communities – Warkworth, Snells/Algies, Muriwai, Bombay and Waiuku – draw their supplies from groundwater under allocation regimes and generally are not susceptible to short- or medium-term drought conditions. However, should the impact of dry weather lead to consumption that exceeds their specified allocation regime, Watercare may introduce measures to manage demand.

Wellsford

Phase	Definition/Trigger	General Response
BAU / Drought preparedness	Inferred flow* in Hōteo River of 0.290 m^3/sec @ Wilsons Road based on Gubbs Flow Station	Weekly review of the situation, incorporating data from Oldfields rainfall gauge, Hōteo flow gauge at Gubbs and weather forecasts. Flow gauging at Wilson Road to confirm inferred relationship.
Stage 1 restrictions	Inferred flow* in Hōteo River of 0.175 m^3/sec @ Wilsons Road based on Gubbs Flow Station	As per Auckland Drought Management Plan.
Stage 2 restrictions	Inferred flow* in Hōteo River of 0.112 m^3/sec @ Wilsons Road based on Gubbs Flow Station	As per Auckland Drought Management Plan.
Stage 3 restrictions	Inferred flow* in Hōteo River of 0.085 m^3/sec @ Wilsons Road based on Gubbs Flow Station	As per Auckland Drought Management Plan.

* 7 day rolling average continuously below for ten days.

Helensville and Parakai

Mangakura Dam 1 and Sandhills Spring supply raw water to the Helensville Water Treatment Plant which supplies treated water to Helensville and Parakai. The storage lake behind Mangakura Dam covers about 4 hectares and has a catchment area of about 200 hectares.

The drought triggers apply if the Sandhills groundwater source is unavailable for a period exceeding four weeks. The most critical activity for this community is the re-instatement of the Sandhills source. The following table only applies if the Sandhills groundwater source is not available.

Phase	Trigger (Mangakura Dam storage)^
BAU / Drought preparedness	100%
Stage 1 restrictions	95%
Stage 2 restrictions	87%
Stage 3 restrictions	83%
Stage 4 restrictions	78%

^ Owing to short timeframes for storage depletion, multiple restriction stages could be triggered and implemented simultaneously.

Appendix C: Detailed guidance for water restrictions

Residential restrictions*

No.	Water end use	Stage 1	Stage 2	Stage 3
R1	Watering lawns and gardens in residential premises	Only permitted with irrigation system, trigger nozzle on hand-held hose, or bucket in line with the following schedules: (a) Odd numbered properties – before 7am and after 7pm – Mondays, Thursdays and Saturdays (b) Even or un-numbered properties – before 7am and after 7pm – Wednesdays, Fridays and Sundays A bucket or watering can may be used at any time or any day.	Only permitted with irrigation system (with moisture sensor), trigger nozzle on hand-held hose, or bucket for watering gardens (**but not lawns**) in line with the following schedules: (a) Odd numbered properties – before 7am and after 7pm – Mondays, Thursdays and Saturdays (b) Even or un-numbered properties – before 7am and after 7pm – Wednesdays, Fridays and Sundays A bucket or watering can may be used at any time or any day.	Total ban on all irrigation systems and hoses. Only watering cans and buckets can be used.
R2	Cleaning hard surfaces in residential premises	Cleaning of hard-stand (paths, roads, driveways, etc.) or outdoor artificial surfaces is not permitted except spot cleaning for health and safety or biosecurity purposes, using a high-pressure water cleaner or water from a bucket.	Continue Stage 1 measures.	Continue Stage 1 measures.

No.	Water end use	Stage 1	Stage 2	Stage 3
R3	General outdoor cleaning (other than hard surfaces) in residential premises	General outdoor cleaning can occur at any time using: a) a bucket, or b) a high-pressure water cleaner for no longer than 10 minutes a day. General outdoor cleaning includes (but is not limited to): • exterior of building • landscaping (e.g., retaining walls) • entertainment and eating areas • vehicles (e.g., cars, boats, caravans, trailers, bikes, buses, trucks) • outdoor furniture and related equipment • rubbish bins • tools and related equipment • animal enclosures / kennels.	General outdoor cleaning can occur at any time using a bucket. Permissible activities as per Stage 1 except exterior building cleaning Exterior building washing is only permitted by a qualified water efficient exterior cleaner, i.e., Exterior Cleaning Industry Association (ECIA) member following water efficient cleaning standards.	Total ban on all use of potable water for general outdoor cleaning, except where required for health, safety, hygiene purposes, and graffiti removal - which can occur at any time by any suitable means.
R4	Swimming pools, spas and recreational water use in residential premises	Topping up an existing pool or spa to replace water lost is authorised using a handheld hosepipe or bucket only. Filling of new or renovated pool or spa pool (volume >500 L) is allowed only if a permanent pool/spa cover is in place to reduce evaporation.	As per Stage 1 for existing pools or spas, provided a permanent cover is used. Pools and spas without covers may only be topped up if an engineer certifies that this is required for structural or health and safety reasons.	Continue Stage 2 measures.

No.	Water end use	Stage 1	Stage 2	Stage 3
		Paddling or temporary pools holding more than 500 L may not be filled.	Paddling or temporary pools may not be filled.	
R5	Use of tankered drinking water	Tankers can only source drinking water from approved Watercare filling stations. Tankers supplying the wider Auckland region for essential uses only are permitted to fill from the Watercare system. Residential customers that receive water from tankers that source water from Watercare filling stations are subject to the same restrictions as Watercare's customers on the network.	Tankers can only source drinking water from approved Watercare filling stations. Tankers supplying the wider Auckland region for essential uses only are permitted to fill from the Watercare system. The volume delivered to each property will be limited to the Auckland average per capita consumption per household resident. A reasonable allowance for animal drinking water is also permitted.	Continue Stage 2 measures.

*General provisions:

- No unattended hosepipes for any purpose once restrictions are imposed.
- These restrictions also apply to the use of water from cisterns and tanks filled from Watercare's drinking water supply network.
- Limited time-of-day restrictions on watering/irrigation are intended to maximise water uptake by plants and minimise losses via evaporation.
- Alternative water sources such as rainwater, stormwater, and recycled water may be used for the restricted water uses at any time.
- 'Vehicles' include all types of cars, trucks, buses, rolling stock, trailers and boats.

Non-residential restrictions*

No.	Water end use	Stage 1	Stage 2	Stage 3
N1	Watering lawns and gardens in non-residential premises	Voluntary savings target of 5-10%	Potable water cannot be used for watering if it is not the customer's core business	Continue Stage 2 measures
N2	Non-business-related cleaning	Voluntary savings target of 5-10%	Potable water cannot be used for cleaning except where required for health, safety, hygiene purposes Exterior building washing only permitted by a qualified water efficient exterior cleaner, i.e., Exterior Cleaning Industry Association (ECIA) member following water efficient cleaning standards.	Potable water cannot be used for cleaning except where required for health, safety, hygiene purposes
N3	Commercial business functions	Voluntary savings target of 5-10%	Potable water cannot be used for non-core business activities, e.g., garden watering, vehicle washing, other discretionary cleaning except where required for health, safety, hygiene purposes. Commercial sectors who can use non-potable water for their core business must use it, e.g., construction, cleaning, car washers	Water efficiency audits must be in place and tailored water savings plans agreed with top 50 water-using customers Remaining commercial customers - 15% mandatory savings
N4	Agricultural and horticultural uses	Replace potable water with alternative sources wherever possible. Irrigation watering permitted only as required using a handheld hose with a	Continue Stage 1 measures.	No potable water use allowed other than for stock watering and domestic use.

No.	Water end use	Stage 1	Stage 2	Stage 3
		trigger nozzle, watering can or bucket, or an irrigation system with an automated weather adjustment, rain sensor or soil moisture sensor.		
N5	Use of tankered drinking water	Tankers can only source drinking water from approved Watercare filling stations. Tankers supplying the wider Auckland region for essential uses only are permitted to fill from the Watercare system. Non-residential customers receiving water from tankers that source water from Watercare filling stations are subject to the same restrictions as Watercare's customers on the network.	Continue Stage 1 measures	Continue Stage 2 Measures

*General provisions:

- Managers of public open spaces, e.g., sporting fields, parks and gardens, are assumed to already be engaging with Watercare to reduce potable water consumption for watering and other external uses.
- No unattended hosepipes for any purpose once restrictions are imposed.
- These restrictions also apply to the use of water from cisterns and tanks filled from Watercare's drinking water supply network.
- Alternative water sources such as rainwater, stormwater, and recycled water may be used for the restricted water uses at any time.
- 'Vehicles' include all types of cars, trucks, buses, rolling stock, trailers and boats.

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