



Appendix E:

Demand Forecast



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1. Introduction

1.1 Purpose

This Appendix describes the analysis that has been carried out to derive the “baseline” demand forecast across the planning horizon to 2065. This baseline demand forecast includes current demand management policies with respect to leakage reduction, customer metering and water efficiency programmes. The baseline demand forecast is used to understand, when combined with baseline supply forecasts, what the potential deficit is that needs to be addressed by the plan. Therefore, the baseline demand forecasts exclude the effects of additional demand management measures that may be identified in best value decision making to resolve any supply demand deficits or resilience improvement requirements (such as smart metering and Active Leakage Pressure Management). The impacts of such measures are included in the final planning demand forecasts that are summarised in the Main Report.

1.2 Current water demand

We supply around 19MI/d to 39,000 homes and 3,440 commercial properties across the island. Approximately 97% of properties are metered and so Jersey Water’s customers have a direct incentive to conserve non-essential water use to save on their water bills. Customers can benefit from various water saving advice and devices that are made available to them.

Demand for water is generally higher in the summer months than the rest of the year, due to increased water use by domestic households (for example, due to garden watering, increased frequency of washing etc.) and agriculture/horticulture water demand under the hotter, drier weather conditions experienced in summer, combined with more visitors to the island during the summer months.

Overall, the average amount of water we put into supply each year has remained relatively steady at about 19-20MI/d from 2010 to 2019, except for some leakage-driven increases due to issues with meter cases around 2015-17 (see Figure 1-1) More recently, there is an observable slight decrease since 2019 of around 0.5MI/d. Over this time, the population on the island has increased by 6% from 97,100 in 2010 to 103,200 in 2022 (our base year for the demand forecast). However, the potential increase in water demand associated with population growth over this time has been minimised by demand management actions to reduce leakage and by implementation of comprehensive customer metering. The further driver behind the decrease in demand for water since 2019 is likely driven by reductions in tourism and leisure and changes to water-using behaviours driven by the Covid-19 pandemic. The volume of water lost due to leakage has also reduced from 3.5MI/d in 2010 to less than 2.1MI/d in 2023, whilst the customer metering programme has resulted in 97% of customers being metered in 2022 compared with only 43% in 2010.

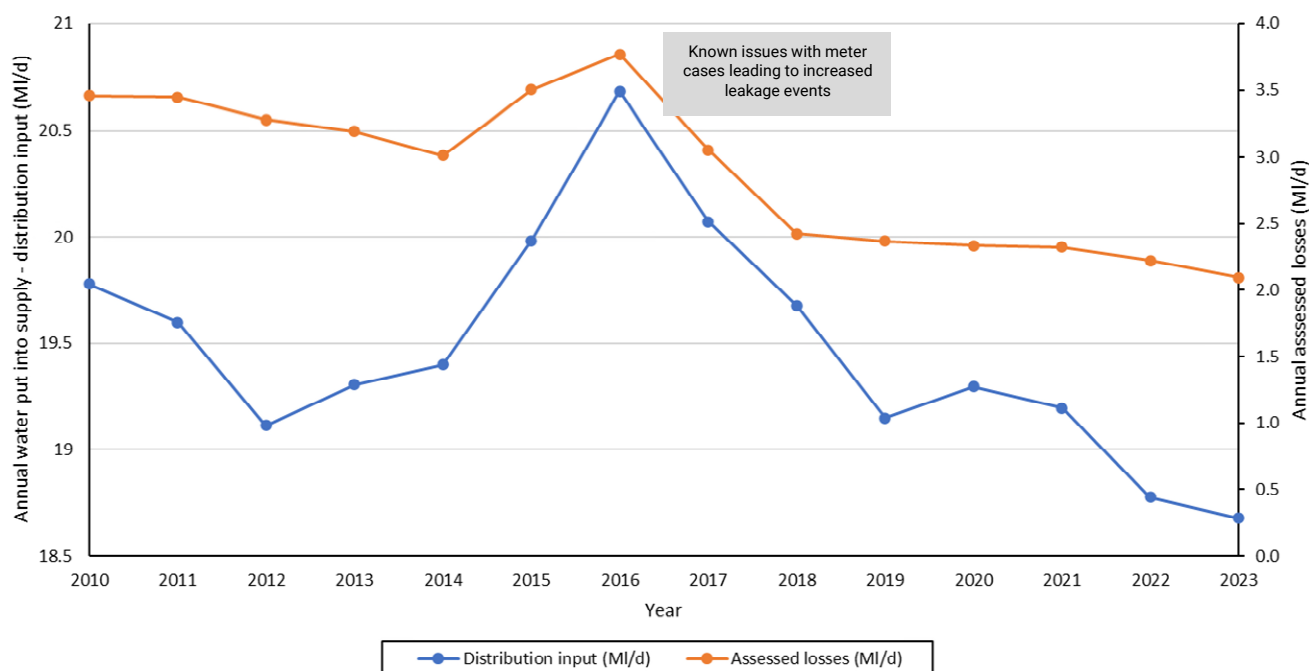


Figure 1-1 - Water put into supply and losses since 2010

1.3 Current activity to manage demand

Jersey Water's actions to manage water demand, and hence minimise the quantity of water needing to be put into supply, play an important part in maintaining reliable water supplies. Demand management measures can be categorised as:

- Customer metering
- Promotion of water efficiency actions
- Leakage control measures

1.3.1 Customer metering

Customer water meters are acknowledged as an effective way of incentivising using less water and avoiding wastage. Customers on a meter pay according to the amount of water they use and so have a direct financial incentive to minimise their non-essential use of water.

All new properties in Jersey have been metered since the early 1990s, and since 2000 domestic customers have been able to voluntarily opt to be metered through a free meter option scheme. In 2010, a universal metering programme commenced, which was a critical water conservation measure to help ensure adequate reliable water supplies for Jersey. In consequence, about 97% of customers now have water meters installed, of which about 95% are charged on an individually metered consumption basis, and the remaining 2% are "bulk" metered (e.g. groups of flats with only one meter). The residual 3% of properties remain unmeasured as for these customers it was found to be impractical to install a meter because of common supply pipes or other complex pipework arrangements.

Customer supply pipe leakage can be detected when the meter readings are downloaded using "drive-by" technology, after which the meter readings can be analysed to identify cases of high customer water consumption that may indicate underground customer supply pipe leakage or customer property plumbing losses such as leaking or over-flowing toilet cisterns or dripping taps. Where appropriate, the customer can be visited or contacted to

inform them of potential leakage or losses, with the aim of achieving prompt resolution of the leaks or water wastage.

Metered properties are charged a standing charge (i.e. fixed charge irrespective of the volume used) and a volumetric charge in accordance with the quantity of water used. Other types of tariff for metered customers (e.g. seasonal or rising block) are not currently in use. The remaining unmeasured customers are charged on an assessed charge or rateable value basis.

1.3.2 Promotion of water efficiency

Jersey Water recognise the importance of taking action to help customers manage their water use, and so carry out a wide range of activities to promote water efficiency by customers to help them save water. These include the provision of:

- Benchmark information presented on billing leaflets to help customers compare their consumption with that of a typical home
- Water saving tips published on the website
- Free water saving devices available for example via the website
- Free water audits and advice to domestic customers found to have high consumption
- Free school visits and water saving advice
- Media campaigns by radio, social media and TV to promote water savings tips during the summer and advise on cold weather pipe protection measures during the winter
- Meetings with key customers including farmers and housing associations, to discuss opportunities for water saving
- Water fittings visits to commercial sites to check compliance with regulations and provide advice on efficient water appliances
- Attendance at major farming and trade shows on the island to offer advice

1.3.3 Leakage control

Jersey Water take a proactive approach to controlling leakage and have successfully reduced the volume of already low levels of leakage by a quarter from about 3.5 MI/d in 2010 to less than 2.2 MI/d in 2022 and 2.1 MI/d in 2023. This has been achieved through intensive monitoring of night-time flows in District Meter Areas (DMAs, each of which is a small discrete part of the distribution network with a meter to continuously monitor water flows). Each day the metered flow information is used to identify any areas with high nighttime flows (indicating potential leakage) and to then direct leakage detection activity to those areas. Jersey Water have a dedicated leak detection team who determine the exact location of leaks identified by flow monitoring or any reports of leaks from customers. It is important that leaks are repaired as quickly as possible to reduce the total amount of water lost from the pipe: leaks are generally repaired within 6 hours of their precise location being determined.

As described above, Jersey Water have also been pro-active in identifying cases where there is leakage on customer pipework and asking customers to repair those leaks as quickly as possible. The current estimated volumes of leakage represent about 11% of the water put into the distribution system, which is a low percentage relative to UK and Ireland leakage levels.

2. Demand Forecast Approach

Water demand forecasting for water resources planning has been undertaken in the UK for many years. As a result, there is an extensive set of methodologies for carrying out demand forecast calculations: in particular the good practice methods developed by UK Water Industry Research Limited (UKWIR) and the latest national guidance for water resources planning prepared by the Environment Agency in England & Wales (2023). Table 2-1 outlines the key UK guidance and methodologies.

The demand forecasting approach used for this plan, and the demand forecasting model (which has been updated from the model developed for the previous plan) remains consistent with good practice methods developed by the UK water industry. As such we have followed a similar approach to that reported in WRDMP21 but have updated data inputs and assumptions where necessary to reflect the most up to date understanding of the customer base, future population projections, water-use consumption and demand-weather relationships. Updates are detailed throughout this Appendix and the Demand chapter within the main report.

Table 2-1 - Main UK demand forecasting guidance and methodologies

Document	Summary description
Water Resources Planning Guideline (Environment Agency and Natural Resources Wales, April 2023)	Describes the principles that UK water companies should use in calculating their demand forecasts
WRMP19 methods – household consumption forecasting – Guidance Manual (UKWIR, 2016, report 15/WR/02/09)	Provides guidance on the steps involved and alternative methods for forecasting household consumption
Population, household property and occupancy forecasting – Guidance Manual (UKWIR/ Environment Agency, 2015, report 15/WR/02/08)	Provides guidance on how to forecast population and households for use in water resources management plans
Customer Behaviour and Water Use: A good practice manual and roadmap for household consumption forecasting (UKWIR/ Environment Agency, 2012, report 12/CU/02/11)	Provides detailed guidance on how to undertake micro-component analysis for household water consumption
Integration of behavioural change into demand forecasting and water efficiency practices (UKWIR/ Environment Agency, 2016, report 16/WR/01/15)	Provides guidance on how to take account of differences in behaviour of different types of household customer
Future estimation of unmeasured household consumption (UKWIR, 2017, report 17/WR/01/16)	Provides guidance on how to ensure adequate monitoring of unmeasured household consumption now and in the future
Forecasting water demand components (UKWIR, 1997, report 97/WR/07/01)	Describes the use of econometric modelling for forecasting non-household water consumption. Getting out of date.
Demand forecasting methodology (UKWIR, 1995, report 95/WR/01/1)	Seminal general demand forecasting methodology. It includes description of the use of maximum likelihood estimation for reconciliation of the water balance. Getting out of date.
Peak water demand forecasting (UKWIR, 2006, report 06/WR/01/7)	Provides a framework methodology for the calculation of peak (critical period) demand
Managing Leakage 2011 (UKWIR, 2011, report 10/WM/08/42)	Updated guidance for water companies on leakage management planning and analysis.
Providing Best Practice Guidance on the Inclusion of Externalities in the Economic Level of Leakage calculation (Ofwat, 2008)	Describes how to assess the sustainable economic level of leakage (SELL) for water resource zones

Impact of Climate Change on Water Demand (UKWIR/ Environment Agency, 2013, report 13/CL/04/12)	Examines the evidence and provides estimates for the impact of climate change on water demand.
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2.1 Demand components

In line with good practice, the starting position for forecasting future demand is to first assess the water for each of the main components of demand in the base year from Jersey Water's water balance (detailed further in Section 3). Each demand component can then be forecast from that starting point into the future over the planning horizon to 2065 (detailed further in Section 4). The demand components are summed to calculate the total demand in each year.

Our demand forecasting has been undertaken for each of the following demand components:

- **Measured domestic consumption** – i.e. water use at homes with a meter, where customers are charged according to their measured consumption.
- **Unmeasured domestic consumption** – i.e. water use at homes without a water meter.
- **Measured commercial consumption** – i.e. water use at commercial (non-domestic) premises with a meter, where the commercial customers are charged according to their measured consumption. Measured commercial customers have been sub-divided into the following six sectors: Agriculture, Industry, Miscellaneous, Offices and retail, Public services, Tourism and leisure.
- **Unmeasured commercial consumption** – i.e. water use at commercial premises without a water meter
- **Minor water use** – e.g. water used at hydrants by the fire service and local authorities etc., and operational water use by Jersey Water (e.g. to clean water pipes).
- **Total leakage** – including distribution losses from our water distribution system and underground supply pipe leakage from customer pipes.
- **Unaccounted for water** – i.e. the small volume of water put into supply in the base year that cannot be specifically allocated to one of the above components with any certainty.

The calculation approach that has been used for each demand component is summarised in Table 2-2 signposting more detailed descriptions that are provided in the following sections. The way in which forecasting methods have been applied reflects the data availability. In many cases, very good data are available and so comprehensive application of methods has been undertaken. However, in some cases where there is less detailed data available, for example the forecasting of future domestic water consumption rates, we have relied on UK studies instead of Jersey data.

Table 2-2 - Basis for calculation of demand components

Demand component	Method of calculating base year volumes	Method for forecasting future volumes	Signpost to further detail in this Appendix
Measured domestic consumption	Total metered consumption derived from volumes recorded at customer billing meters at homes that receive bills on metered tariffs. Used to derive per capita consumption	Forecast average consumption per metered domestic property (PPC) (incorporating expected future changes in water appliance use based on analysis of how components of domestic demand may be expected to change in the future) Multiplied by: Forecast number of metered households.	Base year: Section 3 Forecast: Section 4.2

Demand component	Method of calculating base year volumes	Method for forecasting future volumes	Signpost to further detail in this Appendix
Unmeasured domestic consumption	Average consumption per property (PPC) at unmeasured domestic properties (estimated from volumes recorded at properties that have been recently metered) Multiplied by: Number of unmeasured domestic properties as estimated from the billing system.	Forecast average consumption per unmeasured domestic property (incorporating expected future changes in water appliance use) Multiplied by: Forecast number of unmeasured domestic properties.	Base year: Section 3 Forecast: Section 4.2
Measured commercial consumption for each of 6 sectors: Agriculture; Industry; Miscellaneous; Offices and retail; Public services; and Tourism and leisure	Total metered consumption for each sector derived from volumes recorded at customer billing meters.	Forecast volumes for each sector are based on analysis of past trends, but a “decay” factor has been applied where necessary to avoid unrealistically high predicted growth.	Base year: Section 3 Forecast: Section 4.3
Unmeasured commercial consumption	Average consumption per property (PPC) at unmeasured commercial properties (estimated from volumes recorded at properties that have been recently metered) Multiplied by: Number of unmeasured commercial properties as estimated from the billing system.	Forecast average consumption per unmeasured commercial property Multiplied by: Forecast number of unmeasured commercial properties.	Base year: Section 3 Forecast: Section 4.3
Minor water uses	Estimated as 2% of distribution input, based on UK assessments.	Continuation of 2022 water use volume assumption.	Base year: Section 3 Forecast: Section 4.4
Total leakage	Estimated from Jersey Water’s frequent monitoring of leakage volumes.	The baseline forecast of total leakage assumes continuation at the 2022 level.	Base year: Section 3 Forecast: Section 4.4
Unaccounted for water	Estimated as the difference between total water put into supply and the sum of the above component volumes.	The baseline forecast of unaccounted for water assumes continuation at the 2022 level.	Base year: Section 3 Forecast: Section 4.4

3. Base year demands

For this current WRDMP, 2022 was chosen as the base year as it provided the most recent complete record of supplies to customers. It also aligned with the base year used for the latest Jersey Statistic population and property forecasts. The demand in the base year is derived from the base year water balance using the water volumes measured:

- Recorded volumes from meters at Jersey Water’s water treatment works at Handois and Augrès.
- Billing system information on customers and the quantities supplied to those that are metered

- Flow and pressure recording across the distribution network that is used each day to estimate leakage volumes.

The quantity of water put into supply from the treatment works (distribution input) is compared with the sum of component volumes. As is common, a small variance is generally found between these “bottom up” and “top down” values. For this plan, we have adopted the same method as used in the WRDMP21, where the total (small) variance volume has been allocated as “unaccounted for water”. The values for each component of total demand are shown in Figure 3-1 and the estimated water balance for 2019 to the 2022 base year for this plan is shown in Table 3-1.

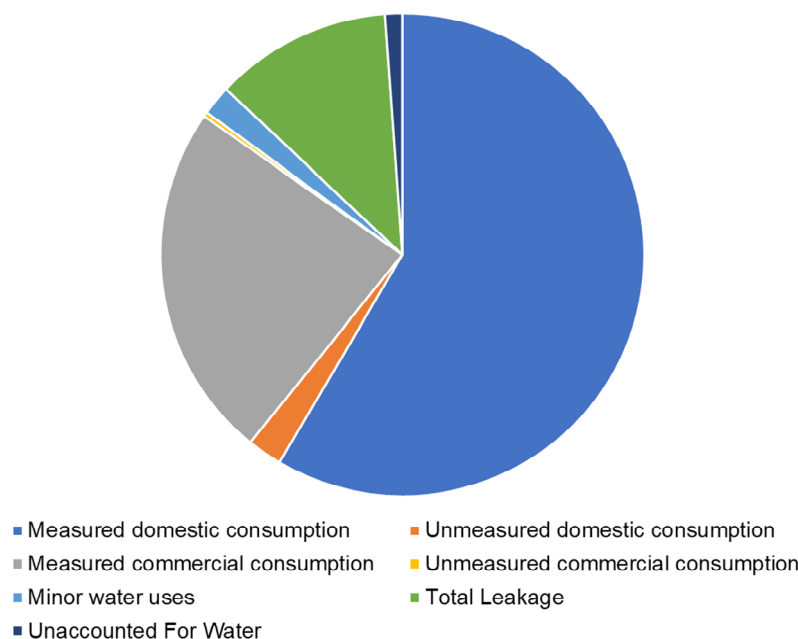


Figure 3-1 - Breakdown of water into supply 2022

Table 3-1 – Consumption volumes taken from Jersey Water’s billing system¹

	2019	2020	2021	2022
Estimated consumption volume (MI/d):				
Measured domestic	10.8	11.9	11.7	11.2
Measured commercial	4.8	4	4.1	4.4
Total measured	15.6	15.9	15.8	15.6
Total unmeasured (based on Assessed charges)	0.4	0.3	0.3	0.3
Commercial metered volume by sector (MI/d):				
Agriculture	0.1	0.1	0.1	0.1
Industry	0.3	0.2	0.2	0.3
Miscellaneous	0.8	0.7	0.7	0.7
Offices and retail	0.7	0.6	0.6	0.6
Public services	1.2	1.2	1.1	1.1
Tourism and leisure	1.7	1.2	1.4	1.6
Total (all sectors)	4.8	4	4.1	4.4

¹ Volumes before adjustments for meter under-registration and supply pipe leakage

Total Leakage (MI/d):	2.4	2.3	2.3	2.2
Minor water uses (MI/d):	0.4	0.4	0.4	0.4
Unaccounted for water (MI/d):	0.6	0.5	0.5	0.4
Total Demand/Distribution Input (MI/d):	19.4	19.4	19.3	18.9

Note: Values may not sum exactly due to rounding

4. Forecasting demand

4.1 Planning conditions

Water resources planning requires assessment of a variety of planning conditions that take account of different levels of resilience. Demand forecasts have been assessed for the following conditions:

- Normal year annual average (NYAA) that reflects water demand in a typical year
- Dry year annual average (DYAA) calculated by applying uplift factors to the NYAA demands to reflect higher demands that are experienced during dry or drought conditions (hotter, drier weather). Further detail of how the DYAA was calculated is provided in section 5 of this Appendix.

WRDMPs adopt a precautionary approach and plan for how water suppliers could meet higher demands in dry years with constrained supplies available due to drought conditions. In the previous WRDMP21, the dry year peak week was also examined, however, given the system resilience to peak events, this was not analysed for this current plan.

The baseline demand forecasts presented in this Appendix exclude the effects of any additional demand management measures considered in the Plan for resolving any forecast supply demand deficits and/or water supply resilience requirements. The effects of such measures are included in the final planning supply-demand balance forecasts.

The demand forecasting and WRDMP assumes the following:

- The whole of Jersey Water's water supply system can be treated as a single water resource zone
- The base year providing the latest complete data set of outturn (actual) information is 2022
- Forecasts are required for each year of the planning horizon to 2065
- Jersey Water's billing system provides a reliable source of information on customers and their volumes of water consumed for 2022 and previous years
- All new properties in Jersey will be served by Jersey Water and will be metered
- No targets have been set for leakage reduction, extra customer metering or water efficiency activity, but demand management options are considered as part of the option appraisal (as described in the Main Report).

4.2 Domestic consumption forecast

The analysis of domestic consumption has been undertaken in line with UK good practice guidance, in particular UKWIR/Environment Agency's "Household consumption forecasting" (2015). The approach has therefore included:

- Basing current consumption rates on the measured volumes at domestic properties that are metered, with adjustment based on UK studies for properties that are not metered.
- Applying the results from UK studies for future changes in micro-component water use by domestic customers
- Evaluating the impact of uncertainties on domestic water consumption through scenario testing detailed further in Section 6.

4.2.1 Properties and population forecasts

Observed population and property numbers were taken from the billing system for the base year of 2022. The historic trends show that the population and number of homes that Jersey Water supply with water are increasing year on year as more people live on the island and more houses are built. To forecast future growth in domestic customers we have used the latest available projections produced by the States of Jersey Statistics Unit (2023) for a range of demographic scenarios, which are illustrated in Figure 4-1. These represent an updated set of projections since the last plan, and key changes include:

- The population projections forecast a less extreme increase in population than those used in the previous WRDMP21 with an upper expected migration limit of +1000 people to the island every year compared to an upper limit of +1500 people to the island in the previous plan.
- The latest population projections include a new consideration of negative net migration. In the previous plan all population forecasts expected either no change or an increased movement of population to the island. For this plan, the updated and latest projections from the States of Jersey Statistic Unit also include a decreasing population scenario representing migration from the island (migration of -100 people per year from the island).
- The principal base forecast of population (central scenario) for the previous plan was +700 net migration each year as this was consistent with the most recent population growth rates at that time. However, population growth rates on the island have decreased in recent years and therefore for this plan the central growth rate is lower (+325 net migration). We have used this as our base scenario as it is more representative of the reduced growth rates experienced in recent years. Alternative migration scenarios have been used in our scenario framework (see Appendix H for details).
- In the previous WRDMP21 the Jersey Statistics Unit data were used as the basis for estimated future growth in domestic properties to be served to provide a trend-based forecast. The same approach has been adopted for this plan to ensure consistency. However, property forecasts from the Jersey Statistics Unit were only available up to 2040, while for this plan, our forecast period is longer than the previous plan, covering the period out to 2065. Therefore, to extend the property forecasts for the remainder of the planning period (i.e. from 2041 to 2065) we took an average of the occupancy rate based on the changes forecast for 2035 to 2040 and applied these rates to the Jersey Statistics Unit population forecasts (which are provided beyond 2040) to derive property forecasts for the later years of the planning period.

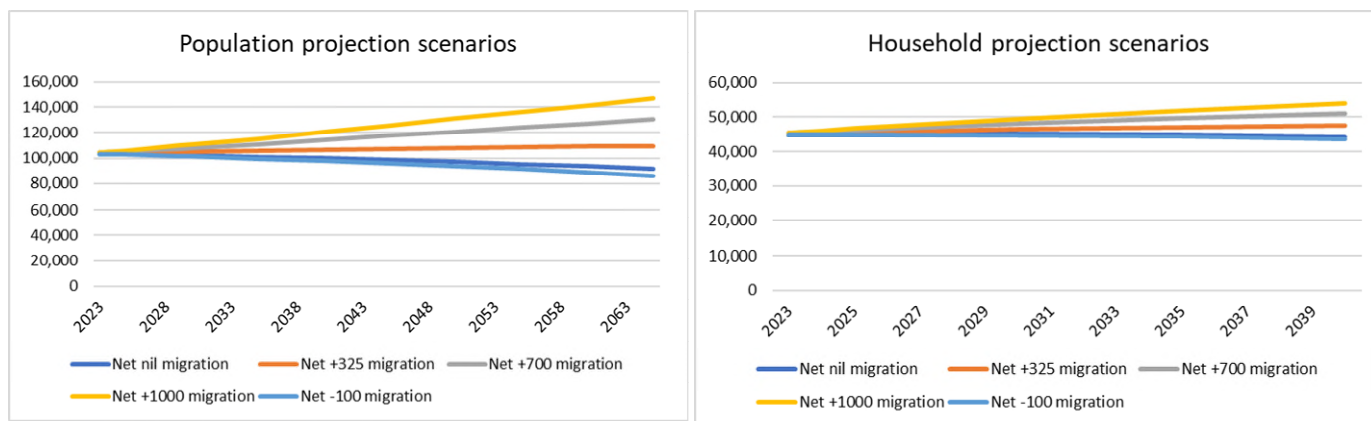


Figure 4-1 - States of Jersey Statistics Unit: projections of resident population and households

Figure 4-2 shows that the forecast total resident population used in Jersey Water's previous WRDMP, prepared in 2018, is significantly higher than the latest forecast. For example, the 2018 WRDMP expected that the total resident population would be 109,560 at 2022, whereas the latest States of Jersey statistics record an estimate of 103,200. This confirms that population growth has been significantly lower than was expected in 2018.

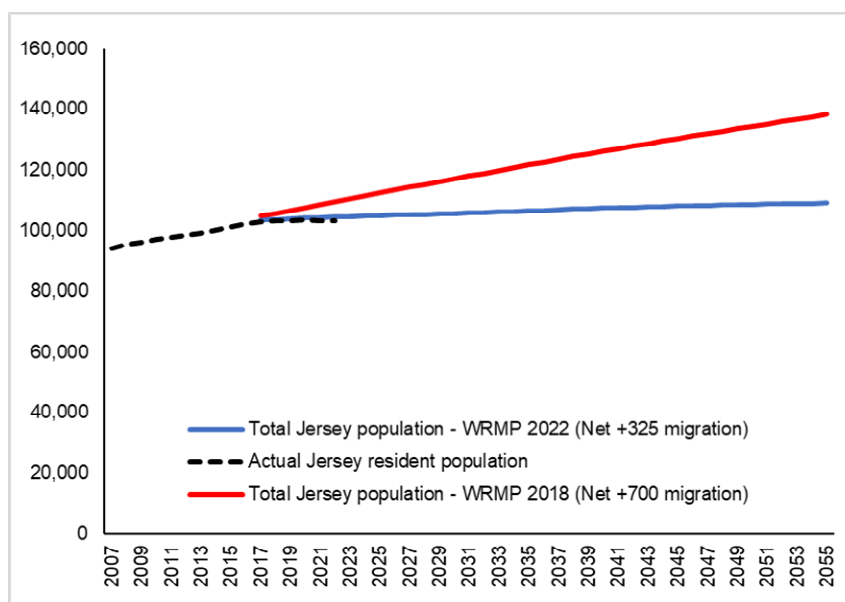
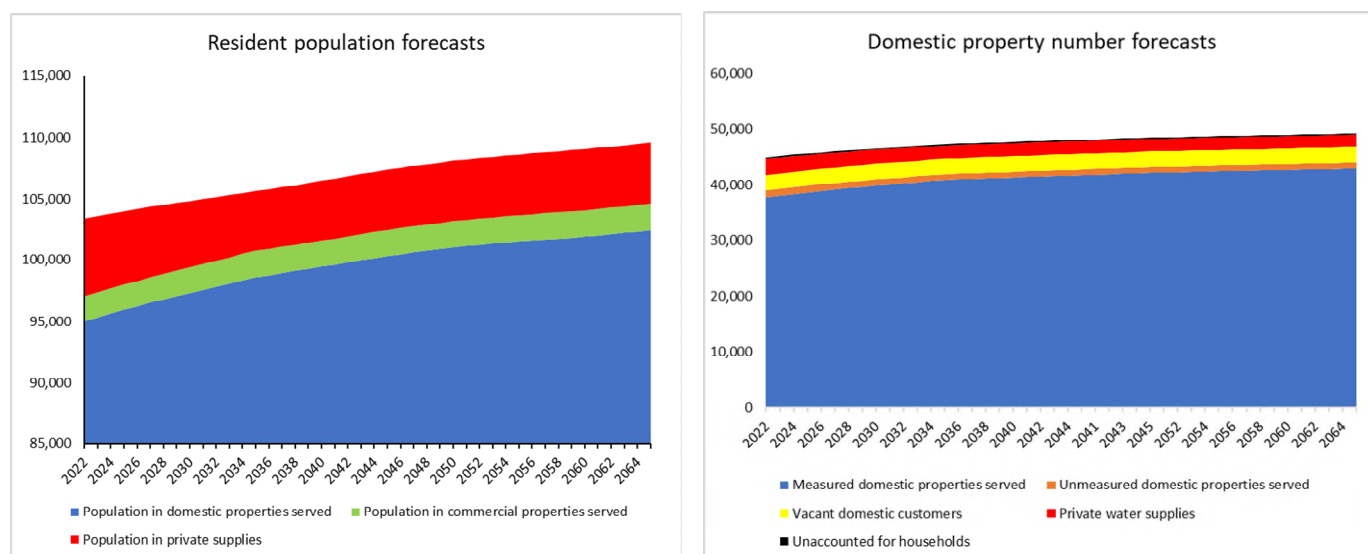


Figure 4-2 - Comparison of population forecasts for WRDMP 2018 and WRDMP 2025 (this plan)

Table 4-1 summarises the key population and property information for the central scenario of the demand forecast and the base year. It shows that the total number of domestic properties receiving water supplies from Jersey Water is forecast to increase by 13% over the planning period from 2022 to 2065, excluding the small number of properties that have their own private water supplies. This rate of change is smaller than was forecast in the previous plan and is reflective of the revised central scenario of property growth in the range of Jersey Statistics Unit projections. This reduction in growth rate since it was last reported is also reflected in the total population receiving water supplies from Jersey Water, with a smaller increase (8% increase between 2022 and 2065) in population living in domestic or commercial properties than was previously forecast in the WRDMP21 plan (30% increase between 2017 and 2045). The trends are also demonstrated in Figure 4-3.

Table 4-1 - Forecast domestic properties and population served by Jersey Water

	2022	2030	2045	2065
Number of properties served:				
Measured domestic	37,809	39,971	41,840	43,051
Unmeasured domestic	1354	1145	1015	1015
Total domestic properties served	39,163	41,116	42,855	44,066
Percentage increase in domestic properties from 2022		5	9	13
Population served:				
Domestic	95,038	97,335	100,315	102,518
Commercial	2,068	2,097	2,147	2,192
Total population supplied by Jersey Water	97,106	99,432	102,462	104,710
Percentage increase in total population from 2022		2	6	8
Average domestic property occupancy	2.42	2.36	2.34	2.33



Note: This graph presents the “Base” forecast which applied the “Net +325 migration” demographic scenario

Figure 4-3 - Domestic population and property forecasts 2022 to 2065

The following assumptions were adopted when applying the population and property forecasts to the demand forecast:

- Jersey Water estimate that there are up to 2800 properties that currently receive private water supplies. There are no plans for any of these properties to be supplied by Jersey Water, but it is possible that some

property owners will request connection to Jersey Water's distribution network. For the demand forecast it is assumed that 20% of the unconnected properties (i.e. 560) will request to be transferred onto the public water supply by 2030.

- The number of measured domestic properties served will increase, as it is assumed that:
 - all new homes will be metered;
 - all homes transferred from private supply will be metered; and
 - that 25% of homes served by Jersey Water that are currently unmeasured will be metered over time. This is the same assumption adopted in the previous WRDMP.
- Unmeasured domestic customers served by Jersey Water are expected to gradually reduce over time as opportunities arise for further metering.
- For the demand forecast, the estimated number of vacant properties has been assumed to remain at the 2022 level for the duration of the planning period.
- The remainder (i.e. total households in Jersey minus number of private supplies minus domestic properties served by Jersey Water) are assumed to be households that are served by Jersey Water but are not individually counted on the billing system. This arises because there are differences in the methods of counting households by States of Jersey and Jersey Water, because the States of Jersey count multiple households within single dwellings. Similar differences are found by UK water companies.

4.2.2 Current consumption rates

The average per property consumption (PPC) rates for measured domestic properties in recent years are shown in the Table 4-2. They have been calculated from:

- The number of metered domestic properties in the billing system in each year. It should be noted however, that some property references on the billing system are for shared properties (for example groups of flats), and so the number of individual properties is likely to be higher than the billed numbers quoted below.
- The total volume of water supplied to these properties. The volumes presented for metered customers have been estimated from the meter readings as recorded on the billing system, but after adjustment for meter under-registration and supply pipe leakage included in the meter readings in line with normal UK practice. Our meter-under-registration and supply pipe leakage figures are in line with similar companies in the south-east of the UK.

Table 4-2 - Domestic consumption rates 2018 to 2022

	2018	2019	2020	2021	2022
Number of billed metered domestic properties	35,704	36,494	37,075	37,497	37,809
Measured volume at metered domestic properties (m³/d)	10,616	10,556	11,736	11,471	10,984
Average PPC at metered domestic properties (l/prop/d)	297	289	317	306	291
Estimated average PPC at unmeasured domestic properties in 2022 (l/prop/d)	243	252	229	230	230

Note: l/prop/d = litres per property per day.

4.2.3 Future consumption rates

The derivation of forecast domestic consumption rates should take account of the ways in which domestic water use is likely to change in the future. Consumption can be expected to reduce because of:

- wider installation of modern water-efficient toilets
- wider use of water efficiency measures such as shower flow regulators and water butts
- more people washing by showering instead bathing
- increased awareness of the benefits of water saving for the environment and reduced energy bills (for water that is heated)
- increasing proportion of homes that are metered.

Conversely, consumption rates may increase because of:

- more frequent personal washing using showers
- increased affluence, which may result in consumers using new or higher water using appliances than currently, or a feeling that they are happy to pay extra for using water more
- the impacts of climate change on the way consumers use water.

Micro-component analysis has been widely used by UK water companies for forecasting future domestic consumption rates. It is a method that takes these issues into account: it estimates the consumption rates associated with each component of household consumption e.g. toilet flushing, personal washing (showering and bathing), clothes washing, dishwashing, other internal use and external use. The application of micro-components analysis is described in detail by UKWIR/Environment Agency (2012).

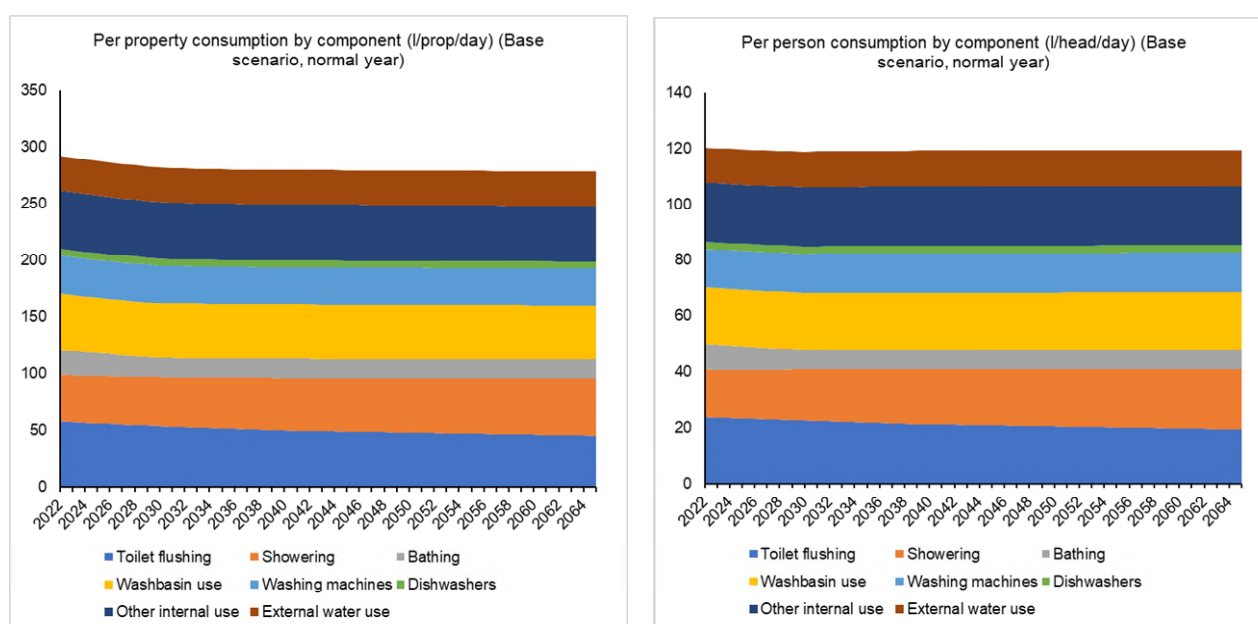
The assessment of future domestic water use has been based on UK studies, in particular the work of the Market Transformation Programme sponsored by the Department for the Environment and Rural Affairs (Defra). The results are presented in Table 4-3 and Figure 4-4. These summarise the assumed forecast changes in average consumption rates for each micro-component, which show a reduction from the base year in the short to medium term, but then only very minor further reductions in per property water use through the rest of the planning period. The Market Transformation Programme trends end at 2030 and therefore the trends were extrapolated beyond 2030 in the forecast to 2065. From 2040 onwards the trends were extrapolated at half the rate to account for greater uncertainty in savings as we move beyond the end date of the research forecasts.

Table 4-3 - Forecast average PPC values by micro component 2022 to 2065 (l/prop/d) under normal weather conditions

Component	PPC 2022	PPC 2035	PPC 2050	PPC 2065	Comment
Toilet flushing	57.7	51.4	47.8	45.1	Reducing due to installation of lower flush volume toilets
Showering	41.2	44.7	47.8	50.1	Increasing due to increased ownership, frequency of use and volume per use of showers
Bathing	22.3	16.7	16.7	16.7	Reducing due to less use of baths in line with increases in showering, and then remaining constant
Washbasin use	49.6	48.0	47.7	47.4	Reducing due to reducing occupancy reductions

Clothes washing	33.7	33.7	33.7	33.7	Consumption remains constant
Dish washing	6.2	6.2	6.2	6.2	Consumption remains constant
Other internal use	51.2	49.5	49.2	49.0	Reducing due to reducing occupancy
External water use	30.4	30.3	30.3	30.3	Consumption remains constant
Total PPC	291.6	279.9	278.8	277.9	

Note: Values may not sum exactly due to rounding.



Note: These values are weighted average values across measured and unmeasured homes.

Figure 4-4 - Forecast average PPC and PCC values by micro-component 2022 to 2065 under normal weather conditions

4.2.4 Weather and climate change effects

Jersey Water's previous WRDMP applied demand and climate change relationships to domestic water use that were derived from the UKWIR 2013 study². This is still the most up to date study on climate change and demand and is widely used by water companies in England and Wales. As such this WRDMP continues to apply the relationships derived by the UKWIR 2013 study however the previous WRDMP domestic forecast only modelled a single mid climate change percentile. This has been refined for this WRDMP and, as demand is largely temperature driven, we have sampled a high, medium and low percentile from UKWIR 2013, and mapped this to the temperatures sampled

² UKWIR, 2013. IMPACT OF CLIMATE CHANGE ON WATER DEMAND, Report Ref No. 13/CL/04/12

and modelled on the supply-side (e.g. the 2, 3 and 4 degree samples). This scenario development is detailed further in Section 3 of Appendix H.

4.2.5 Domestic consumption forecast

The domestic consumption forecast is summarised in Table 4-4. The consumption volumes are expected to increase in the future due to growth in the number of domestic customers despite overall reductions in per property consumption (PPC).

Table 4-4 – Summary of baseline domestic consumption forecast

	2022	2035	2050	2065
NYAA PPC for measured domestic properties (l/prop/d)	290.5	278.9	278.0	277.2
NYAA PPC for unmeasured domestic properties (l/prop/d)	322.8	318.3	313.1	308.0
NYAA average PPC (l/prop/d)	290.5	278.9	278.0	277.2
Number of domestic properties served by Jersey Water	39,162	41,982	43,238	44,066
NYAA measured domestic consumption (m ³ /d)	11,421	11,750	12,054	12,245
DYAA measured average PPC (l/prop/d)	310.4	300.4	301.0	301.7
DYAA Distribution Input (m ³ /d)	20,943	20,029	20,429	20,818

Note: NYAA = normal year annual average, DYAA = dry year annual average.

In the UK and across much of Europe it is common to express domestic consumption rates as per capita consumption (PCC) measured as litres per head per day (l/hd/d). So, in Table 4-5, estimated average occupancy rates have been used to calculate estimated PCC values for Jersey Water's baseline demand forecast.

Table 4-5 – Summary of baseline domestic consumption rates (per person - PCC)

	2022	2035	2050	2065
NYAA PPC (l/prop/d)	290.5	278.9	278.0	277.2
DYAA PPC (l/prop/d)	310.4	300.4	301.0	301.7
Average occupancy of domestic properties	2.43	2.35	2.34	2.33
NYAA PCC (l/prop/d)	119.7	118.7	118.9	119.1
DYAA PCC (l/prop/d)	127.9	127.9	128.8	129.7

Note: NYAA = normal year annual average, DYAA = dry year annual average.

4.3 Commercial consumption forecast

Commercial premises comprise properties that receive drinking water supplies but are not classed as domestic properties. This includes water used by agriculture, offices, hotels, retailers, hospitals, schools, local authorities, communal establishments, factories and utilities. The analysis of commercial consumption has been undertaken in line with UK good practice guidance (Environment Agency, 2023 and UKWIR/Environment Agency, 1997). The methodology has therefore included:

- Updating the statistical analysis undertaken in our previous WRDMP which used past sectoral consumption to assess economic and other factors that may affect water consumption by each commercial sector.
- Developing consumption forecasts for a range of planning scenarios.
- Testing the uncertainty in commercial consumption forecasts through the demand forecast scenarios (see section 6 for further detail).

4.3.1 Commercial properties

For the purpose of the demand forecast, it is assumed that the number of commercial properties served by Jersey Water will remain at 2022 levels: estimated as 3390 measured and 53 unmeasured. This assumption has negligible effect on the overall demand forecast as the volume supplied to measured commercial properties is calculated based on modelled volume trends which do not directly depend on the numbers of properties.

4.3.2 Analysis of commercial consumption

The primary data source used for the analyses was the billing system, which provided details of customer numbers and volumes at those customers with a meter for each year from 2010 to 2022. When undertaking commercial consumption forecasting, it is usual good practice to segment (i.e. categorise) customers into broad sectors so that differences in trends between sectors can be examined. Commercial customers were allocated to the following sectors:

- Agriculture
- Industry
- Miscellaneous
- Offices and retail
- Public services
- Tourism and leisure
- Unmeasured commercial

The data on the billing system for 2022 (the base year) is summarised in the following table. The volumes presented for metered customers are based on meter readings, but after adjustment for meter under-registration and supply pipe leakage in line with normal UK practice. The total number of metered commercial properties was available but not split down by commercial category. Therefore, the percentage split of categories in 2016 (the last year with this level of data available) was used to disaggregate the total metered commercial property numbers into categories.

For the 53 remaining unmeasured commercial properties in Jersey, the estimated consumption was derived using an assumed average per property consumption of 1072 l/prop/d, estimated from analysis of consumption at 30 commercial properties that were metered in 2022. Sectoral estimates have not been estimated as the volume has minimal impact on the total distribution input forecast and therefore a simple approach was sufficient.

Table 4-6 - Summary of commercial customers 2022

Sector	Estimated number of properties	Estimated consumption 2022 (m ³ /d)
Agriculture	95	119
Industry	262	258
Miscellaneous	803	720
Office and retail	936	601
Public services	537	1085
Tourism and leisure	758	1618
Total (all sectors)	3390	4401
Total unmeasured	53	57

Note: Values may not sum exactly due to rounding

4.3.2.1 Measured consumption

In the previous WRDMP analysis suggested that sectoral demand was found to be more strongly related to a time trend with secondary relationships with Gross Value Added (GVA) being very weak. Therefore, for this WRDMP we have updated the commercial demand forecast based on past time trends without using GVA data. The graphs in Figure 4-5 present the recent annual data for each sector and provide indication of potential time trends:

- **Agriculture:** Water consumption by agriculture has fluctuated from year to year with a slight upward trend. This trend was adopted to forecast agricultural commercial consumption.
- **Industry:** Water consumption by industry has been stable but with a noticeable impact to consumption in , 2020 and 2021. It is likely that this was influenced by the Covid-19 pandemic however the 2022 consumption figures suggest that industrial consumption is returning to its pre-Covid levels. Therefore, the trend was assumed to remain constant in the forecast.
- **Miscellaneous:** This category includes, for example, lodging houses/hostels, laundries, and washdown facilities. The trend was assumed to remain constant in the forecast.
- **Offices and retail:** Historically the data suggests that there has been strong growth in the measured volume of water consumption by the offices and retail sector. However, there is a noticeable impact of the Covid-19 pandemic which is likely due to an increase in working from home behaviour. The 2022 consumption suggests that the trend is returning to a positive trend therefore the trend was adopted in our commercial consumption forecast.
- **Public services:** This category includes, for example, water use at local authority buildings, hospitals, schools, and health and community centres. Water consumption has fluctuated historically however the upward trend was adopted for the forecast.
- **Tourism and leisure:** This category is the largest consumer of water as shown in Table 4-6. It includes, for example, hotels, restaurants, pubs, golf courses, and sports and leisure centres. Water use has steadily declined with a marked decline related to the Covid-19 pandemic. The consumption for 2022 appears to be returning to the pre-Covid trends so the slightly declining trend was adopted for forecasting.

It should be noted that, where the historic trends were adopted for commercial sectors, if applied indefinitely, it would likely result in unrealistic consumption values by 2065. It was therefore decided to apply progressively reducing rates of growth (or decline). This was achieved by applying a decay factor of 20% whereby the volume of growth (positive or negative) in a particular year would be estimated as 80% of the volume growth in the previous year.

The resulting forecasts are shown in Figure 4-6 with the alternative scenarios shown in Figure 4-7.

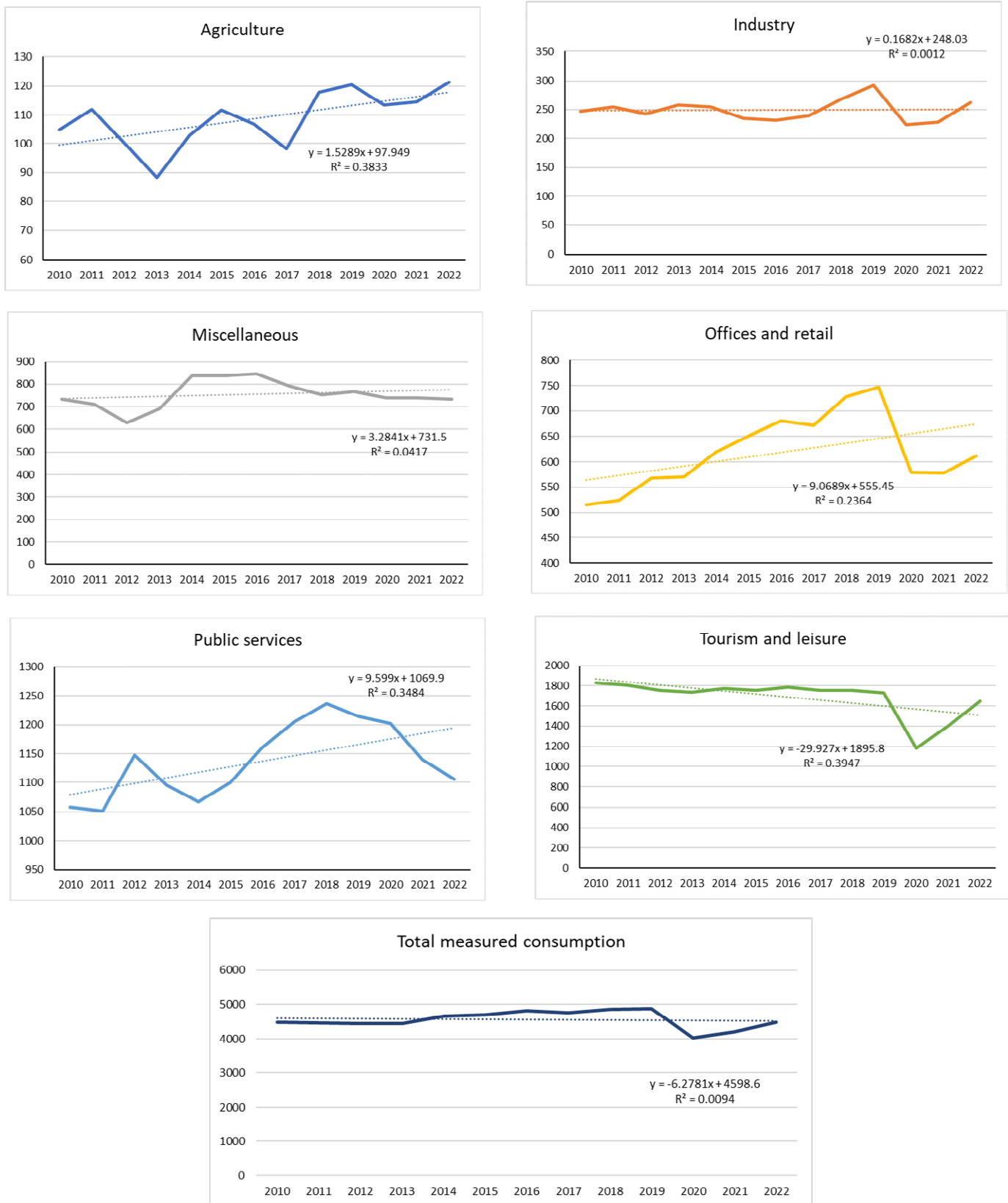


Figure 4-5 - Trends in sectoral water consumption (m³/d)

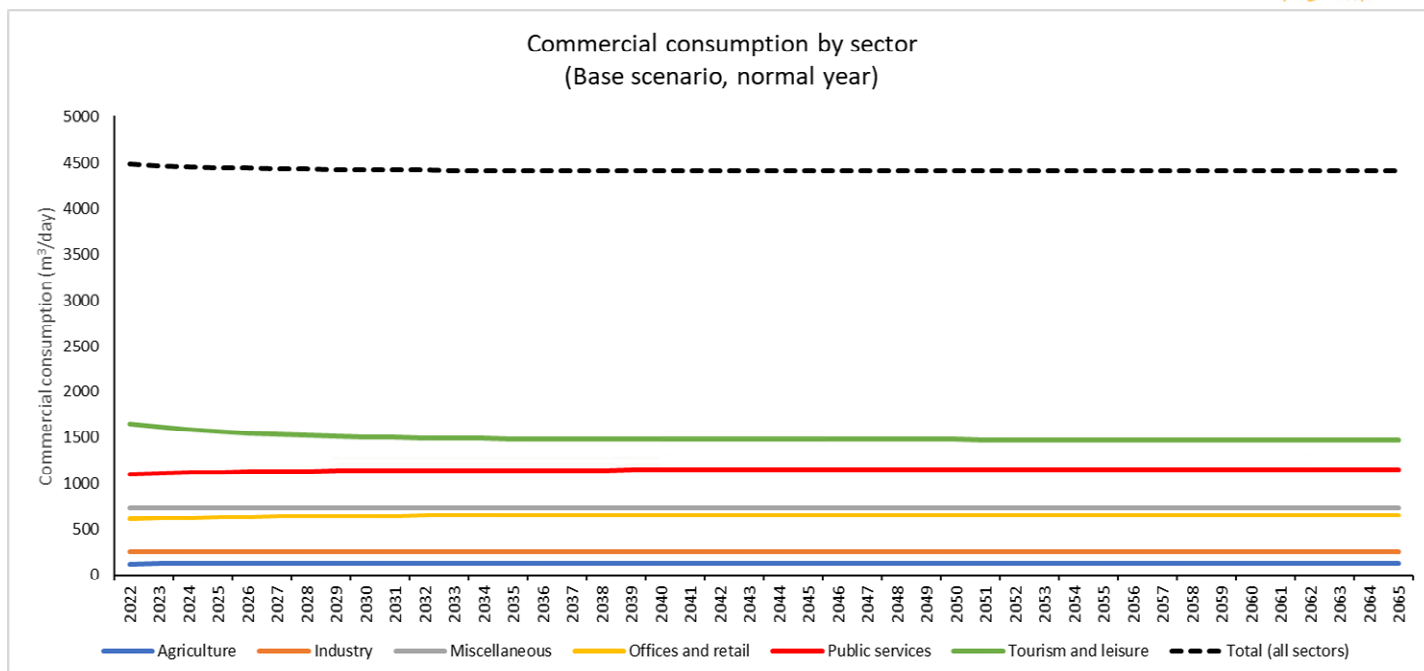


Figure 4-6 - NYAA commercial consumption forecast by sector 2022 to 2065 (m³/d)

To account for the uncertainty in the demand estimates, a range of demand forecasts have been derived which apply alternative assumptions (refer to section 7) as shown in Figure 4-7.

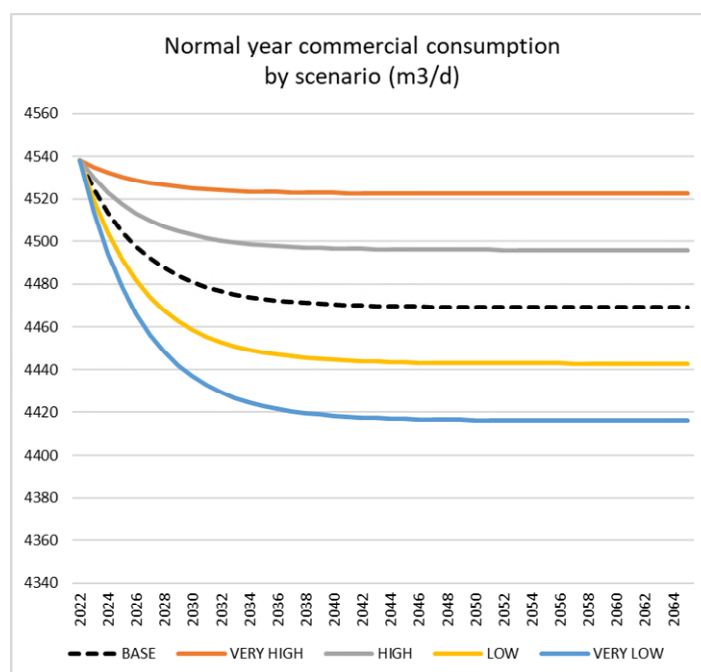


Figure 4-7 - NYAA forecasts of total commercial consumption for alternative scenarios

4.3.2.2 Unmeasured consumption

Consumption by unmeasured commercial properties is forecast to remain at the 2017 level of 56m³/d. This is a very small component of total demand.

4.3.2.3 Weather and climate change effects

It is not possible to separate the effects of weather on commercial water use from the impacts on domestic water use in Jersey. Also, there is very limited evidence from UK studies (e.g. UKWIR 2013) to precisely quantify the effects of weather or climate change on water use by commercial sectors. However, it is likely that water consumption by the agriculture and tourism/leisure sectors is influenced by weather, with increased use occurring if the summer weather is hotter/drier than usual. In the absence of specific values for commercial water use, the same dry year uplift factor as derived for domestic water use (see Section 6) has been applied to commercial consumption.

4.3.2.4 Total commercial consumption forecast

Table 4-7 - Summary of baseline commercial consumption forecast

		2022	2035	2050	2065
Consumption by measured commercial properties (m³/d)	Agriculture	121	129	129	129
	Industry	263	263	263	263
	Miscellaneous	733	733	733	733
	Offices and retail	612	655	657	657
	Public services	1105	1150	1153	1153
	Tourism and leisure	1648	1487	1478	1478
	Total	4482	4417	4413	4413
Consumption by unmeasured commercial properties (m³/d)		56	56	56	56
NYAA commercial consumption (m³/d)		4538	4473	4470	4469
DYAA commercial consumption (m³/d)		4659	4607	4618	4633

Note: Values may not sum exactly due to rounding

4.4 Minor water use, leakage and unaccounted for water

4.4.1 Minor water use

Minor water use includes:

- Standpipe use for fire-fighting, fire service training, road cleaning, and building works
- Operational water use by Jersey Water for mains cleaning or cleaning of other distribution system assets, after repair or new installation
- Unbilled use at Jersey Water offices and sites

- Water taken illegally by customers (either knowingly or unknowingly).

Jersey Water do not record these activities. Minor water use in 2022 has been estimated as 376 m³/d (i.e. approximately 2% of distribution input) and is assumed to stay at this level in the future.

4.5 Baseline total leakage

For the baseline demand forecast the volumes of total leakage have been assumed to be held constant at the current low levels. The potential for further reduction in total leakage has been considered as part of the option appraisal (section 8 in the Main Report) and investment modelling process (section 9 in the Main Report), and where it represents least cost and best value, selected leakage control measures are incorporated in the final supply-demand forecast.

Our base leakage reduction strategy (section 10.3 in the Main Report) forms part of our immediate least regrets options within our preferred plan. This comprises a set of leakage reduction activities aimed at reducing the risk of a rise in leakage (due to deterioration of the network without further interventions). Estimating leakage levels and savings from leakage reduction activities involves a high level of uncertainty and our planned set of activities balances minimising the risk of a rise in leakage with an achievable set of options at an acceptable cost.

4.6 Unaccounted for water

Unaccounted for water in 2022 is a small volume of water (218 m³/d) that could not be directly allocated to a specific demand component, as explained in Section 2.2. It represents 1% of total distribution input in 2022. It is assumed that, for the base scenario demand forecast, the volume of unaccounted for water will stay at the 2022 level.

5. Dry year assessment

For a WRDMP we are primarily interested in testing our resilience to dry weather years – i.e. the dry year annual average (DYAA) planning condition for our demand forecast. In WRDMP21, the dry year peak week was also examined, however, given the system resilience to peak events, this has not been analysed or reported for this current plan³. In line with our previous plan we have only applied dry year adjustments to domestic water use as UKWIR research into the impact of climate change on demand⁴ were unable to find a conclusive relationship between weather and commercial demand in general.

5.1 Identification of dry years

In the first instance we assessed the weather data for summer temperature and rainfall, where the summer months for each year were assumed to be April, May, June, July, August and September. To help identify the hottest and driest year a rainfall-temperature-quadrant plot was produced (Figure 5-1). This provides an easy way to visualise the hottest and driest year in terms *average* summer weather, and thus where we may expect higher corresponding water demand. Both 2018 (the previous base year) and 2022 (our current base year) sit within the top left quadrant reflecting expected hotter and dry years (based on average summer conditions).

³ UKWIR, 2016, WRMP19 Methods – Household Consumption Forecasting

⁴ UKWIR, 2013, Impact of Climate Change on Demand

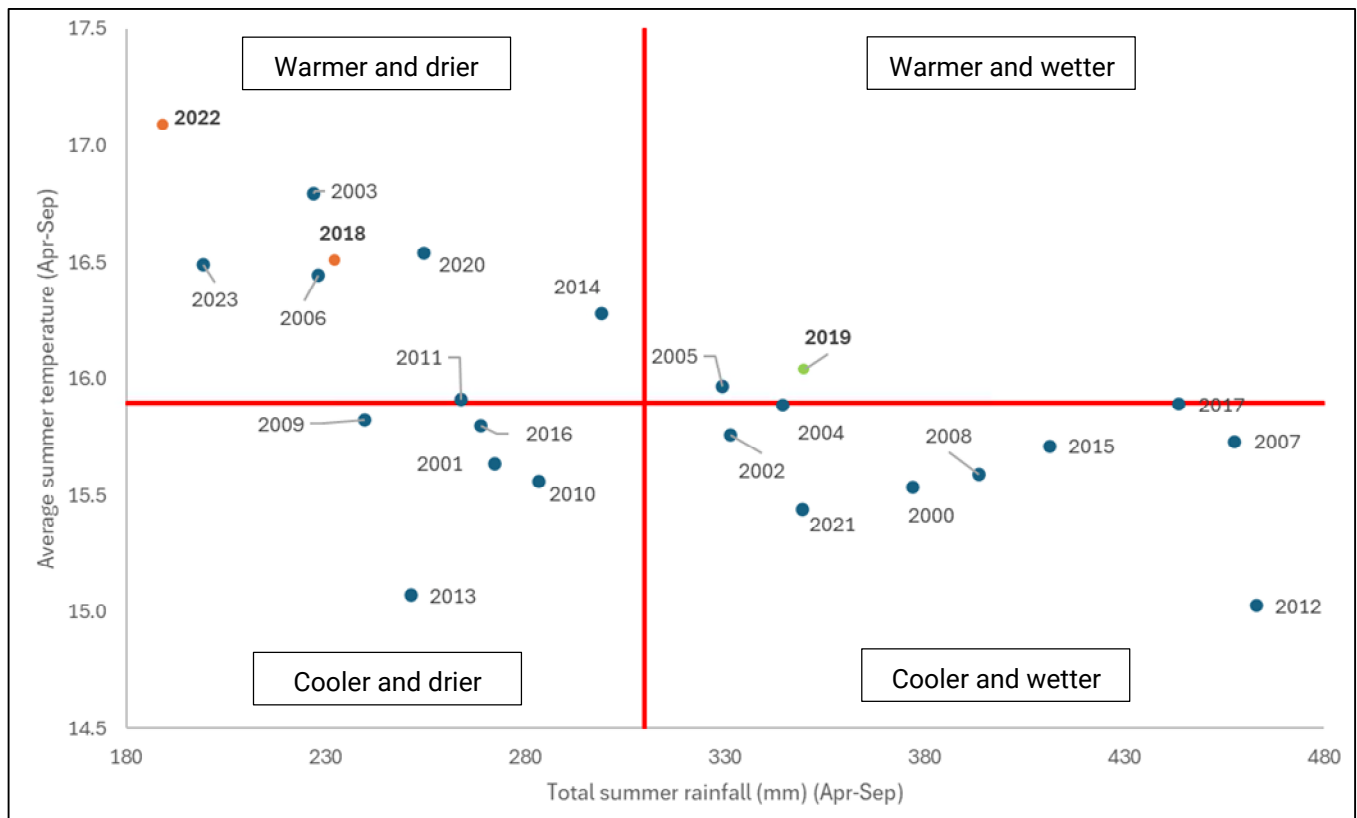


Figure 5-1 - Rainfall-temperature-quadrant plot for Jersey Water

5.2 Historic distribution input

We analysed historic distribution input (i.e. total demand) values to assess whether the dry years identified based on average summer weather corresponded with increased annual average distribution input values. As outlined in Section 1.2, there are known issues with meter readings around 2015-17 which have affected the quality of data. In addition, the further back in the historical record, the less representative of the current customer base we get, including for key demand drivers such as the percentage of households that are metered, or reductions in leakage over time. Therefore, for the purposes of this plan we only considered data from 2018 onwards for this analysis. However, 2020 and 2021 were heavily influenced by changes in water-using behaviours driven by Covid-19 and therefore were also discounted from the dry year analysis.

Climatologically 2019 was considered a relatively normal year (as indicated in the Figure above), in which Jersey Water supplied 19.1 MI/d of water on average throughout the year. 2018 and 2022 were both considered dry years based on their average summer climatology, and had an annual average volume of water put into supply of 19.7 MI/d and 18.8 MI/d respectively. Thus the hot dry year of 2022 had a lower demand than the more normal climatological annual average demand seen in 2019. However, another factor affecting demand in 2022 was the influence of Temporary Use Bans implemented in that year. As such, our calculation of dry year annual average was adjusted to reflect the assumed reductions from TUBS. Even allowing for this the adjusted annual average demand for 2022 was still very low, at only 19 MI/d.

As noted previously, the Covid-19 pandemic affected demand in 2020 and 2021, and demand in 2022 (and also 2023) seems to have kept demand constrained at lower levels, potentially reflecting long term changes to water using behaviour. However, we cannot be certain that this pattern will continue to be sustained in future, and so it is prudent to assume that pre-pandemic demand levels may return for the purposes of long term planning.

Noting all these factors, we have concluded that we should use the hot, dry year of 2018 as being representative of the DYAA value and the basis of planning, as it was similar climatologically to our 2022 base year, was not affected by Temporary Use Ban restrictions, and occurred prior to any potential pandemic-induced effects on customer demand. The **2018 year was therefore selected as reflecting our dry year annual average demand**.

5.3 Dry year uplift factor

The dry year uplift factor was calculated to be able to uplift the 2022 base year annual average demand to the selected dry year demand of 2018. Nominally 2022 was used as the “normal year”, but this was primarily on the basis of it being our base year, rather than it reflecting a normal year climatologically. Nevertheless, as the focus of the WRDMP is to identify the supplies required to meet the dry year demand, this was not considered to be a significant issue.

We have therefore applied a calculated DYAA uplift of 6.8% to produce the DYAA demand forecast (uplifting base year 2022 total Distribution Input values to the 2018 demand that is representative of the dry year annual average). As mentioned previously this uplift has been applied to the domestic demand elements of our forecast only. The figure below shows how the selected dry year annual average (plotted over the period of 2018 to 2022) compares to the historic annual average distribution input seen in each year since 2002. It is apparent that the value used does not overestimate dry year demand based on historical levels, but also takes account of Covid 19 and other recent demand trends.

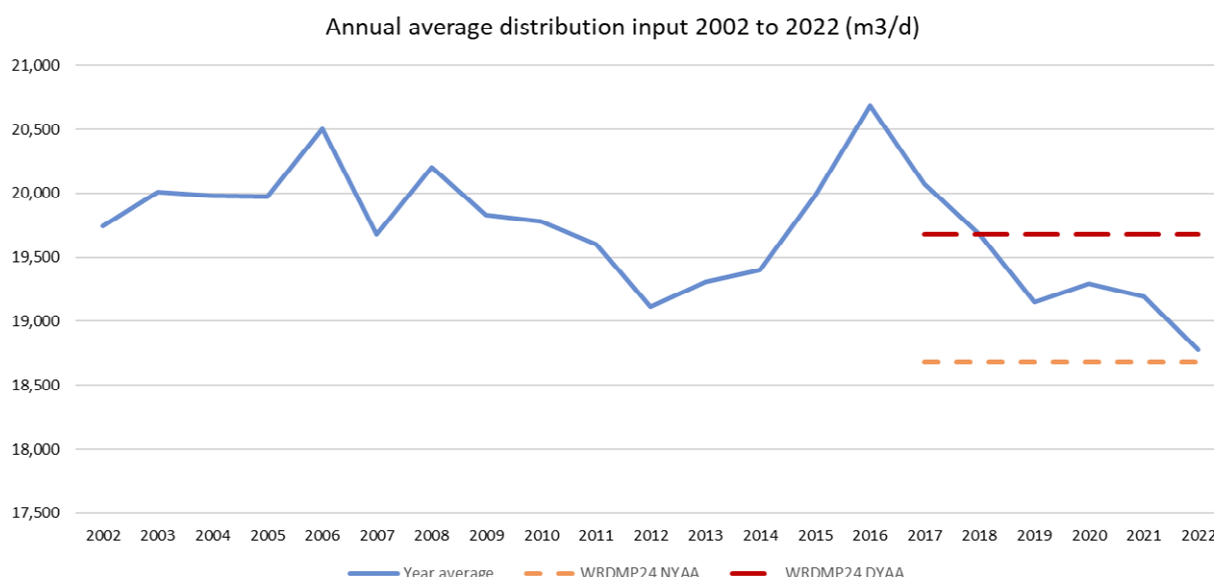


Figure 5-2 - Historic distribution input and the selected dry year annual average demand for this plan

6. Demand forecast scenarios

Uncertainty is inherently a key consideration in developing demand forecasts over the long-term (i.e. 40 years into the future) as it is difficult to accurately predict future trends. For example, growth in the number of homes, population growth, water use patterns by customers and climate change impacts may differ from the current best assessments. To help us understand the potential range of uncertainties, we developed 5 demand scenarios to represent a range of alternative futures (excluding the impact of climate change). This has enabled us to test the robustness of our proposed plan to such uncertainties. Demand forecast scenarios were produced to cover the range of:

- 5 population and property projections from Jersey Statistics Unit (see Section 4)
- Variations in behavioural change in household water consumption forecasts (varied by +/- 10%)
- Variations in behavioural change in commercial water consumption forecasts (varied by +/- 20%)

As outlined in Section 4.2.4 we applied the following climate change relationship to the domestic consumption forecast of each of the 5 demand scenarios:

- The 10th, 50th and 90th percentile projections of water demand and climate change relationship taken from UKWIR (2013)⁵ to represent a high, medium and low impact of climate change on demand.

This resulted in 15 alternative demand forecast scenarios that include the potential range of uncertainties in population, water use behaviour and climate change. These were mapped to the temperatures sampled and modelled on the supply-side (e.g. the 2, 3 and 4 degree samples) to ensure coherence of scenarios, as outlined in Section 3 of Appendix H.

There are also uncertainties in the data inputs and estimation of the 2022 water balance volumes for components such as minor water uses, total leakage and unaccounted for water, and how these components may change in the future. These are explored within the headroom assessment (see Appendix F).

Furthermore, to ensure a robust preferred plan we identified and tested the plan against specific policies, assumptions, stresses and uncertainties that may be relevant to the selection of the preferred plan. This included a sensitivity test of the impact of meeting a low per capita consumption/water target of 110 litres/person/day by 2035. Jersey Water already have comparatively low PCC levels compared to the UK as a whole, and this tests the potential benefit to the strategy on seeking to achieve further ambitious PCC reductions to the current level of water consumption. Further detail is provided in Section 9.3 of the Main Report and Section 3.1.6 of Appendix I.

7. Demand forecast results

This section summarises the baseline demand forecasts. These exclude the effects of additional demand management measures that are part of the preferred plan and are included in the final planning forecasts presented in the Main Report and Appendix I.

Figure 7-1 and Table 7-1 summarise the dry year annual average (DYAA) demand forecast for our WRDMP24 plan under a medium climate change scenario. As discussed previously, to account for the uncertainty in the demand estimates, a range of demand forecasts have been derived which apply alternative assumptions as shown in Figure 7-2. These demand forecast results show that:

- The dry weather annual average demand is estimated to be 20.7MI/d in 2065, compared with the current 19.7MI/d DYAA in our base year (based on a medium climate change scenario). The overall effect is that distribution input is expected to increase by 5% even though the assumption that average consumption per domestic customer is forecast to reduce by about 5% as a result of future installations of more efficient water appliances and expected changes in water appliance use. However, this reduction is outweighed by strong growth in Jersey's population and the number of new homes expected on the island; it is anticipated that the number of domestic properties served will increase by 10% to approximately 49,200 by 2065.

⁵ UKWIR, 2013. Impact of Climate Change on Water Demand.

- Metered domestic demand will continue to be the largest component of total demand (see Figure 7-1) and is forecast to increase as the number of metered homes increases due the building of new homes and increasing population.
- In contrast to our previous WRDMP total commercial water use is forecast to decrease slightly, however this is negligible (only 0.07MI/d over the planning period, from 2022 to 2065). In our previous WRDMP we forecast total commercial water use would increase by 6% to 2045. However, our latest analysis for this WRDMP forecasts commercial water use to decrease by 1.5% to 2065. Similarly to our last plan water consumption by some commercial sectors (Miscellaneous, Offices and Retail, and Public Services) has been forecast to grow. Our updated analysis has also forecasted an increase in agricultural water demand by 2065, compared to a decrease reported in our previous plan. However, the key change between the last plan and this current plan is in the forecast for the Tourism and Leisure sectors which are now forecast to decline rather than remaining constant as forecast in our last plan. This change in trend supports the experiences on the island following the Covid-19 pandemic.
- For the baseline demand forecast the volumes of total leakage and non-accounted-for water have been assumed to be held constant at the current low levels. The potential for further reduction in total leakage has been considered as part of the option appraisal and investment modelling process, and where it represents least cost and best value, selected leakage control measures are incorporated in the final supply-demand forecast.
- The potential effects of climate change on demand over the period to 2065 have been taken into account in line with UK water industry guidance.

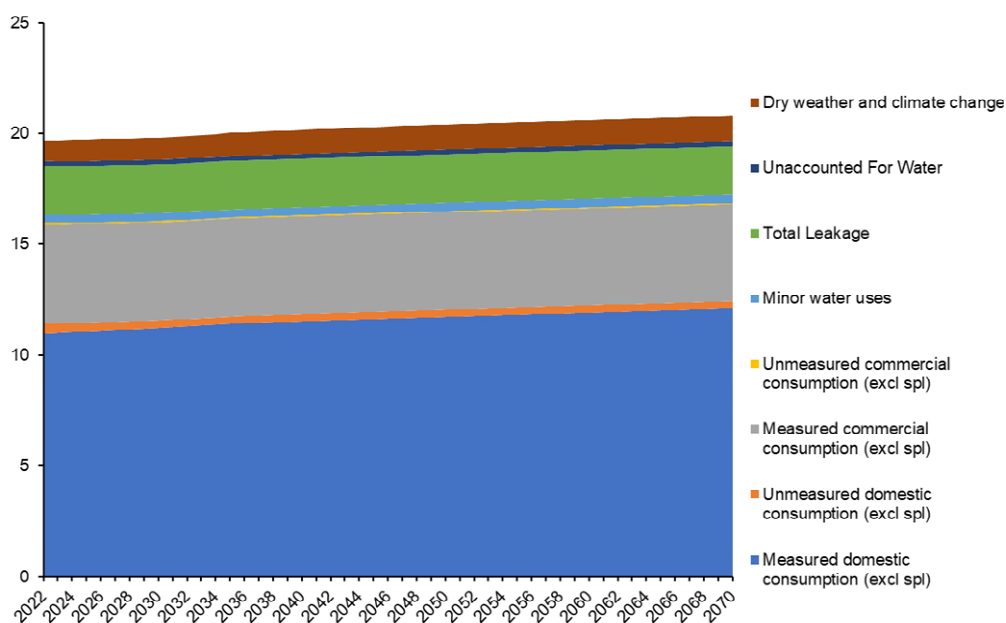


Figure 7-1 - Summary of Dry Year Annual Average demand forecast by component (MI/d) – medium climate change scenario

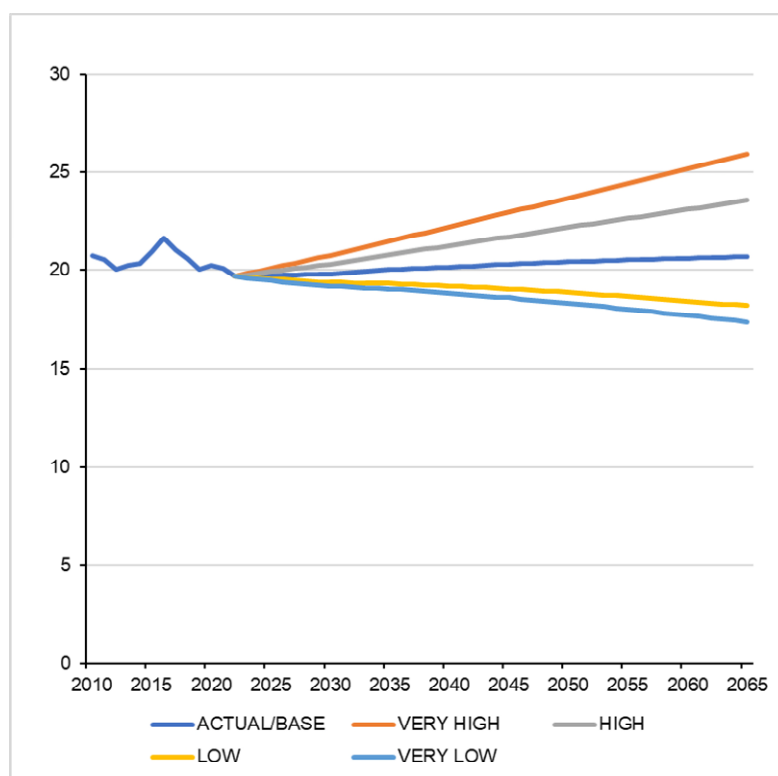


Figure 7-2 - Summary of Dry Year Annual Average demand forecast by uncertainty scenario (MI/d) under a medium climate change scenario

Table 7-1 - Baseline Dry Year Annual Average (DYAA) Demand Forecast for 2065 (MI/d) under a medium climate change scenario

	2022	2025	2035	2045	2065
Measured domestic water use	11.0	11.1	11.4	11.6	11.9
Unmeasured domestic water use	0.4	0.4	0.3	0.3	0.3
Total domestic water use	11.4	11.5	11.7	11.9	12.2
Total commercial water use	4.54	4.52	4.48	4.47	4.47
Minor water uses	0.38	0.38	0.38	0.38	0.38
Total leakage	2.22	2.18	2.18	2.18	2.18
Unaccounted for Water	0.22	0.22	0.22	0.22	0.22
Estimated extra demand due to dry year and climate change	0.90	0.97	1.03	1.10	1.15
Dry year Annual Average Demand (MI/d) including climate change	19.7	19.7	20.0	20.3	20.7

Note: values may not sum exactly due to rounding

