VEOLIA WATER PROJECTS LTD
DRAFT WATER RESOURCE MANAGEMENT PLAN 2024
ANNEX ONE - SUPPLY AND DEMAND BALANCE

In accordance with the regulatory requirements of the WRMP, VWPL has predicted the supply/demand balance of Tidworth WRZ for the next 25 years. It is essential that this data accurately reflects the conditions of the WRZ as it directly impacts on VWPL's ability to secure water supply for its customers, protect and enhance the environment and prepare associated investment plan. VWPL have produced WRMP planning tables for inclusion within this plan. The tables have been formatted by VWPL in such a way that the historical data can easily be compared against the forecast.

1. WRMP Planning Tables

VWPL Water Resources Management Plan (WRMP) is supported by a series of planning data tables. The planning tables present the supply/demand balance of the predicted plan and some of the key supporting information, including forecast leakage demand. They are used to help regulated water company customers and other organisations understand and appraise VWPL's plan. The format of these tables has been set by the Environment Agency (EA) in order to ensure the information is provided in a consistent manner for all water companies, based upon the pre-agreed definitions and requirements.

VWPL planning tables combine supply-demand historical data for 2019/20 to 2021/22 (submitted in annual returns) and the supply-demand predicted forecast from 2022/23 to 2049/50. These tables have been included within Appendix 1.

VWPL has completed four versions of the planning tables to represent different planning scenarios that might be encountered across the network within the statutory planning period. These include the following:

- Current abstraction licence of 9.00 Ml/d with the Leckford Bridge bulk transfer at recent-actual forecast.
- Current abstraction licence of 9.00 Ml/d with the Leckford Bridge bulk transfer at the Wessex Water reported forecast of 2.74 Ml/d.
- A capped abstraction licence of 7.50 Ml/d with the Leckford Bridge bulk transfer at recent-actual forecast.
- A capped abstraction licence of 7.50 Ml/d with the Leckford Bridge bulk transfer at the Wessex Water reported forecast of 2.74 Ml/d.

The findings of the planning tables are discussed in more detail within the following sections of this annex.

Exclusion: it has been agreed with the EA during the pre-consultation phase that VWPL is not required to complete the sections of the planning tables that make reference to business plans. VWPL is a small business and does not submit business plans to OFWAT for review.

2. Abstraction Licence Changes

All VWPL water supply is abstracted from groundwater sources within the underlying chalk aquifers. The main way that EA ensures that VWPLs daily operations do not present an unacceptable impact on the environment is through abstraction licensing. The volume of water that can be abstracted from the three borehole wells (Chalkpit, BH2 and BH3) is limited to an annual daily average of 9.02 Ml/d and a peak daily flow of 12 Ml/d as specified in licence SW/043/0024/006.

The risk of deterioration of VWPL abstractions within the wider Wessex Basin has been considered to be moderate (please refer to Annex 4) as the PR19 WINEP AMP7 investigation confirmed that the VWPL abstractions (as well as Wessex Water and MOD's abstractions) have an impact on the river flow and the extent of the drying period on the Nine Mile River and Pillhill Brook. The EA has confirmed that a reduction of VWPL current abstraction will be required to meet waterflow targets and that VWPL should expect a capping of their licence during the licence renewal process (due in 2025).

Therefore, to encompass VWPL environmental obligations and the upcoming abstraction licence renewal in 2025, two sets of planning tables were produced as part of the WRMP PR24, these include:

- The current abstraction licence of 9.00 Ml/d.
- A capped abstraction licence of 7.50 Ml/d based upon the recent-actual scenario*

**Note*: the recent actual abstraction licence figure of 7.50 Ml/d has not been confirmed by the EA and might change in the final version of the WRMP as the other licence renewal criteria (growth and demand requirements) are being reviewed.*

3. Supply

3.1. VWPL Supply System

VWPL currently supplies 14,380* customers within the Tidworth Inset with high quality drinking water and wastewater services. The water supply is sourced from three abstraction boreholes and distributed from two strategic reservoirs (either Mathew Tanks or Clarendon Reservoir) to VWPL customers through an interconnected distribution network of approximately 100 km of water mains and 25 km of service pipes. In 2021/22, 5.88 million litres of water* (Ml/d) were treated and distributed each day to VWPL customers.

**Note*: figures were obtained from the regulatory annual return submitted in March 2022 for the reporting period of 2021/22*

3.2. Historical Supply Situation

VWPL's historical supply situation (from 2011/12 to 2021/22) has remained consistent throughout the time period with an average abstraction flow of approximately 5.89 Ml/d.

The historical supply situation is presented in Figure 1.

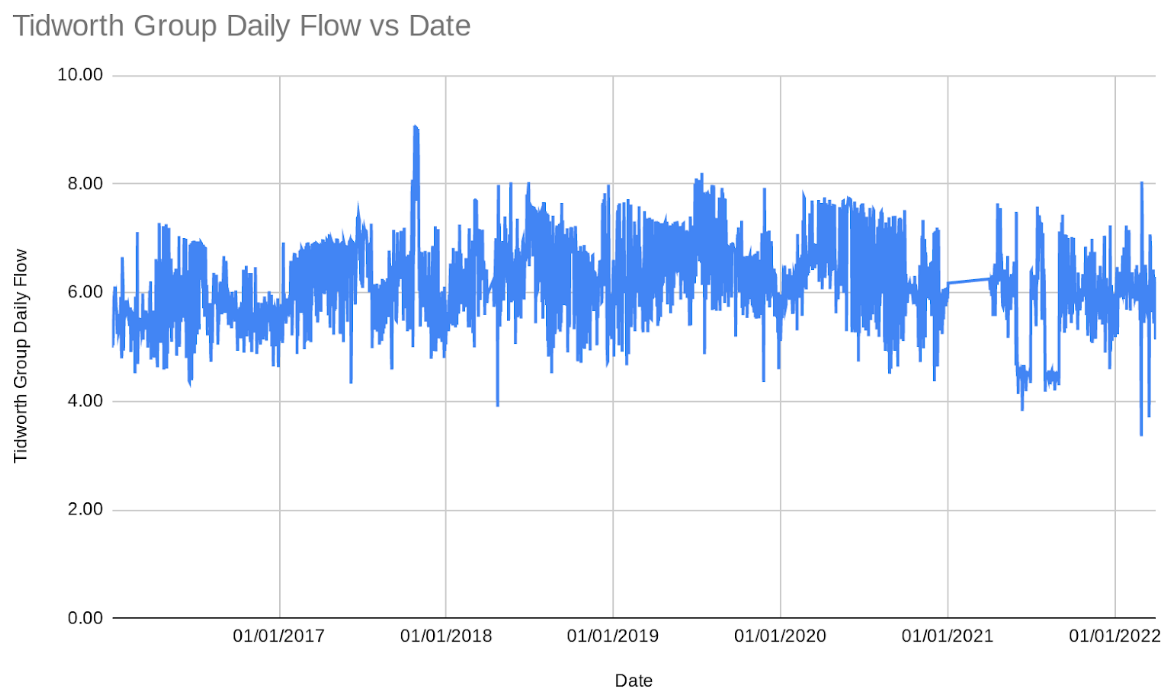
Figure 1. VWPL historical supply

	SUPPLY		2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
A	Resources												
1AR	Raw water abstracted	Ml/d	5.52	5.49	5.45	5.52	5.59	5.94	6.29	6.36	6.52	6.34	5.81
2AR	Raw water imported	Ml/d	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3AR	Potable water imported	Ml/d	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4AR	Raw Water Losses and Operational Use	Ml/d	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5AR	Raw water exported	Ml/d	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.1AR	Non potable water supplied	Ml/d	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6AR	Potable water exported	Ml/d	1.66	1.66	1.66	1.67	1.68	1.62	1.75	1.81	1.90	2.19	1.73
7AR	Deployable output (adjustement only)	Ml/d	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B	Process Losses												
9AR	Treatment works losses and operational	Ml/d	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.005
10AR	Outage experienced	Ml/d	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.016

Throughout the duration of the WRMP19 cycle, VWPL operated within the agreed abstraction licence and has been able to supply up to approximately 9 Ml/d during high demand events. The combined flow rates of Chalkpit abstraction borehole and Borehole 2 (BH2) and Borehole 3 (BH3) abstraction boreholes from 2016 are presented in Figure 2.

The recorded supply profile within the VWPL-operated Inset has always varied seasonally. The primary reason for this is MoD usage; there are large military barracks embedded within the Tidworth distribution system, which do not have usual household demand patterns. MoD consumption represents more than 30% of the water supply.

Figure 2- Graph showing the combined average daily flow between 2016 to 2022



3.3. Bulk Transfers/Supply out of the Water Resource Zone

VWPL provides a bulk potable water supply to Wessex Water at Leckford Bridge, which is governed by the Leckford Bridge Bulk Supply Agreement. The Leckford Bridge agreement was renewed in 2021 for 15 years but for the purpose of its WRMP Baseline, VWPL has assumed that the agreement will continue throughout the statutory period until 2050. The current agreement allows for a maximum transfer of 3 Ml/d, an instantaneous maximum flow of 36.5 l/s and a maximum yearly exported volume of 1000 Ml (equivalent to a daily average flow of 2.74 Ml/d).

VWPL will continue to fulfil the requirements of the Leckford Bridge Bulk Supply Agreement on the basis that:

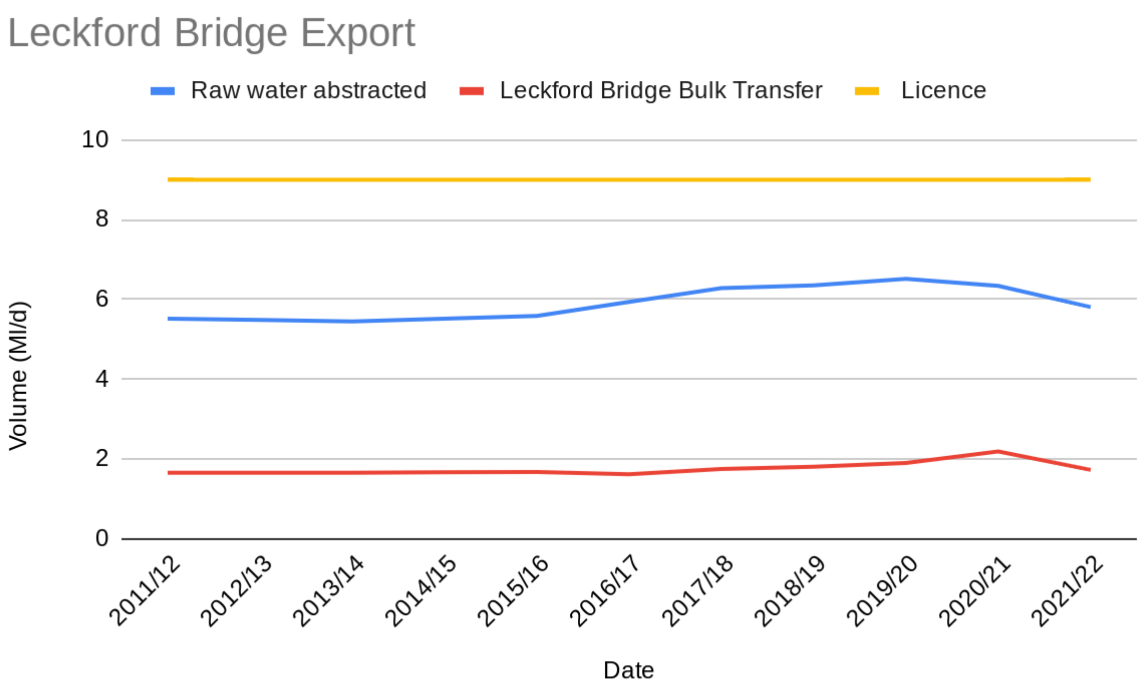
- Wessex Water critical period demand is forecast to occur during peak summer periods when there is hot/dry weather related demand. Approximately 50% of VWPL demand is associated with the MoD, which typically does not have a domestic influenced demand profile. As such, MoD peak periods are unlikely to occur within the same period as domestic customers.
- VWPL's integrated system has an internal reservoir storage of approximately 12Ml/d, which should provide resilience to meet additional peak period demand for a minimum of 2 consecutive days.
- VWPL's drought management plan details demand- and supply-side actions to be implemented at the different stages of a drought.

The agreement also includes the provision for the export to be reduced on a litre by litre basis (after notification to Wessex Water) if the following situations are encountered:

- VWPL direct customer demand is greater than 5.4 Ml/d.
- The maximum quantity of water permitted to be abstracted by VWPL under its EA licence is reduced below VWPL's reasonable assessment of the Deployable Output.
- The water supply source comes under strain as a result of drought-like conditions.

The potable water supplied to Wessex Water through the Leckford Bridge agreement between April 2011 to March 2022 is shown in Figure 3. The Leckford Bridge bulk transfer represents approximately 30% of the overall demand within the network.

Figure 3 - Graph of the Leckford Bridge Export from 2011/12 to present.



During the WRMP19, Wessex Water reported that they planned to import 2.74Ml/d through the Leckford Bridge transfer, however the actual exported volumes during the WRMP19 period were significantly lower despite a gradual increase in demand.

VWPL WRMP planning tables have considered two supply scenarios: Leckford Bridge export volumes based on recent actuals and Leckford Bridge export volumes set at 2.74 Mld.

It is worth noting that if VWPL's abstraction licence were to be capped at 7.5Ml/d* as part of the upcoming licence renewal, a Leckford Bridge transfer of 2.74 Ml/d would not be sustainable as VWPL would be in deficit.

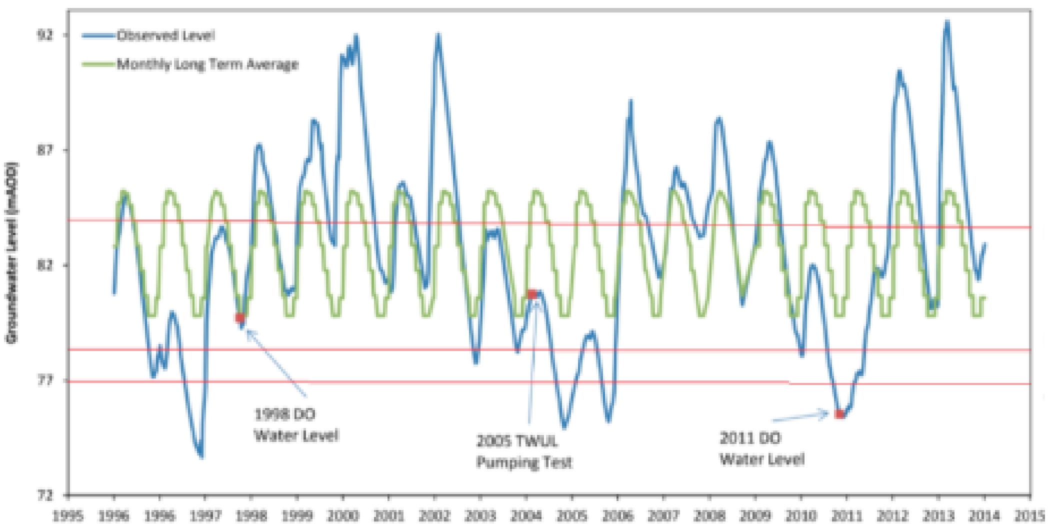
Note: *this figure has not yet been agreed and might be different within the final version of the WRMP. Please see section for 2 for more details.*

3.4. Deployable Output (DO) Assessment

As part of WRMP24 preparation work, VWPL undertook an assessment of the deployable output for the three abstraction boreholes and the Tidworth network. This involves a high level review of the groundwater source and associated hydrogeological modelling. The assessment was originally undertaken by the British Geological Society (BGS) in 2015 and was supplemented by AECOM in 2022.

There has been a limited assessment of drought borehole performance within the Tidworth network. It was observed during the assessment that in previous time periods used within the creation of the DO assessments for boreholes 2 and 3, groundwater levels were close to the monthly long term average groundwater levels. However, groundwater levels recorded within the 2011/2012 drought (blue line on Figure 4), which negatively impacted water supply companies' ability to provide sustainable sources of potable water, were significantly lower than the average levels. This scenario does therefore provide a useful basis for a revised assessment of drought borehole performance and deployable output as the 2011/12 drought event was comparable to the 1975/76 drought event, which is used to generate the 1 in 500 year vulnerability modelling.

Figure 4 - BGS diagram Groundwater level time series for Clanville Lodge Gate OBH showing key points in the Tidworth DO Assessment. Data from the National Groundwater Level Archive © Natural Environment Research Council, including water level measurements made by the Environment Agency.



It should be appreciated that the drought curves developed using the DO assessment approach are highly uncertain and must be treated with caution. Abstraction borehole performance within drought conditions is affected by the extent to which the groundwater flow horizons within the underlying chalk are still saturated. In reality, drought borehole performance may follow a range of different water level-yield relationships and thus the curves presented should be considered as draft estimations until additional pump tests can confirm them. In addition to revised drought curve estimates, a number of potential DO constraints have been added to the diagrams. Water level DO constraints consist of the depth of the casing, the estimated top of the Whitway Rock, the depth of the pump intake and 50% of the saturated thickness of the borehole. Abstraction rate DO constraints consist of the current pump capacity and average and peak licence rates.

On the basis of the developed scenarios, it seems plausible that under drought conditions, increased abstraction from boreholes 2 and 3 will result in pumping water levels below the base of the casing. The produced geophysical logs suggest that the groundwater flow to abstraction boreholes BH2 and BH3 is from the underlying Whitway Rock. The estimated drought curves for both abstraction BH2 and BH3 suggest that pumping water levels may drop below the Whitway Rock during drought conditions. If pumping water levels go below the Whitway Rock it is plausible that drawdowns will increase substantially due to a reduction in flow to the borehole. Below the Whitway Rock, the next significant flow horizon is the Chalk Rock at the base of the Lewes Nodular Chalk, towards the base of the boreholes, which exceeds the Deepest Advisable Pumping Water Level (DAPWL).

Due to the below average recharge and low groundwater levels and the pumping regime at the time of the drought, it was concluded that the groundwater levels within abstraction boreholes BH2 and BH3 were located on or below the base of the steel casing. There are likely to be a number of water quality issues associated with this pumping regime. The 2011/2012 drought recorded a significant increase in the total concentration of coliforms recorded within the sampled groundwater. The reported concentrations showed increases of up to 250 mpn/100ml.

Note: the operation of both pumps will increase overall turbidity. High turbidity has the potential to negatively impact the Nine Mile River. As such, VWPL's current abstraction licence for the Tidworth network states that water should be preferentially recovered from abstraction BH2 and BH3 prior to the use of Chalkpit.

The assessment concluded that the deployable output for Tidworth abstractions is 9.00 Ml/d.

In addition to this and as detailed within Annex 3, VWPL has conducted an impact assessment of climate change on Deployable Output. It was concluded that the supply system was at a low vulnerability risk from potential impacts derived from a changing climate. The uncertainty associated with low vulnerability classification was less than 5% and as a result, the assessment confirmed that by 2030, the DO for a DYAA scenario will have reduced by -0.84 Mld while the DO for a DYCP scenario will have reduced by -0.83 Mld. This represents a reduction of 0.30% and 0.20% respectively.

A reduction in DO has been applied accordingly to VWPL WRMP planning tables from 2030.

3.5. Treatment Works Operational Use

Treatment works operational use is a volume of water abstracted from source that does not enter the distribution supply as it is 'used' during VWPL treatment processes. It is important that the treatment work operational use figure is accounted for in the calculation for total water available for use (hereby after 'WAFU') as it can directly affect the overall available supply to the network.

The treatment work activities used within the calculation of the treatment work operational use figure are outlined in Table 1.

Table 1- Outline of VWPL Treatment Work Activities

Treatment Work Activity	Treatment Work Operational Use (Ml/d)
The inspection and flushing of the contact tank at the water treatment centre - This process is undertaken every 5 to 7 years and involves draining the contact tank and flushing the structure.	0.0045
GAC cleaning and flushing - This activity is undertaken every quarter within the reporting year.	0.0031
Analyser - This equipment is checked on a weekly basis as part of the Water Operations Technicians checks.	0.0020
Sampling Point Flushing - This activity is completed twice a week in-line with scheduled sampling.	0.0001
Total (Ml/d)	**0.0061**

In accordance with the statutory 25-year planning period, VWPL has considered all upcoming activities and how they could impact treatment work operational use throughout the period. It has been concluded that the operational use would not be significantly impacted.

Therefore, a fixed treatment work operational loss figure of 0.0061 Ml/d has been used by VWPL within both the baseline and final scenarios within the attached planning tables.

3.6. Distribution Operational Use

Distribution operational use is a volume of water which enters the distribution system (including trunk main and reservoirs) but which is not available to supply customers as it is ‘used’ during VWPL operational activities. It is important that the distribution operational use figure is accounted for in the calculation for total water available for use (hereby after ‘WAFU’) as it can directly affect the overall supply within the network.

The activities used within the calculation of the distribution operational use figure are outlined in Table 2.

Table 2 - Outline of VWPL Distribution Operational Work Activities

Work Activity	Treatment Work Operational Use (Ml/d)
Fire Hydrant Testing - This activity is undertaken annually to ensure fire hydrants within the network are operating at the required standard.	0.20 Ml or 0.0005 Ml/d
Network Flushing	0.50 Ml or 0.0017 Ml/d

New Main Commissioning	0.05 Ml or 0.0001Ml/d
Other Maintenance Activities within the network	0.01 Ml/d
The inspection and flushing of Matthew Tanks - This activity is undertaken every 5 to 7 years and involves draining the whole structure one cell at a time. There are 2 cells present within Mathew Tank 1 and 2 cells Mathew Tank 2.	0.015 Ml/d (per cell)
The inspection and flushing of the Swinton Tank - This activity is undertaken every 5 to 7 years and is set to be undertaken in 2023/24.	0.015 Ml/d (per celle)
The inspection and flushing of the Clarendon Reservoir - This activity is undertaken every 5 to 7 years and involves draining one cell at a time. There are 3 cells present within the Clarendon Reservoir and the task will be undertaken on a cycle.	0.0246 Ml//d (per cell)
Total for an average year without inspection of Reservoir (Ml/d)	**0.012**
Total for an average year with Mathew Tank or Swinton Tank inspections (Ml/d)	**0.027**
Total for an average year with the Clarendon Reservoir inspection (Ml/d)	**0.037**

It should be appreciated that VWPL will not undertake the inspection and flushing of Mathew Tanks and Clarendon Reservoir cells in the same year to ensure the sustainability of the supply for the wider network and customers. The planning tables have been produced in accordance with this assumption.

In accordance with the statutory 25-year planning period, VWPL has considered all upcoming activities and how they could impact the treatment work operational use throughout the period. It has been concluded that the operational uses would not be significantly impacted.

3.7. Outage Assessment

Outage is defined as a temporary loss of deployable output due to planned maintenance and/or unplanned events such as power failures, asset failure or water quality issues (including source pollution). It is important that sufficient allowance is made for such temporary reductions in deployable output when calculating overall water supplies available within the network.

Note: outage is usually assumed to be less than three months in duration.

VWPL has followed the WRMP24 guidance, which states that the assessment should use the principles in the UKWIR 1995 and the UKWIR Risk Based Planning guidance in the UKWIR 2016 when developing the outage allowance for both critical period planning scenarios and dry year annual average.

Large outages, including planned outages exceeding 90 days, and their potential impact on the available water supply have not been considered within the outage allowance assessment. However, key large outage events that exceed the threshold have been included with the scenario analysis and stress testing within section 6.1.4 of this annex.

A single resource zone outage model has been developed for this plan. The data used to support the model was obtained from company outage records and abstraction data.

3.7.1. Analysis Methodology

VWPL implemented the UKWIR 1995 methodology for the outage allowance assessment and also followed recommendations reported within the WRMP 2019 report. The implemented methodology is outlined below.

- Reviewed the historical outage data record to assess the accuracy and the legitimacy of the outage events. VWPL removed any outage events that lasted less than one day and events that were longer than 90 days.
- Assessed the supply system for any significant changes - relating to both network and treatment improvements.
- Reviewed the frequency magnitude and duration of each outage event at source by fitting a range of probability distributions of the magnitude, duration and frequencies of the outage events.
- Select the most appropriate distribution for each outage type at each source, considering the legitimacy of the historical record as representative of outages in the future.
- Run the Monte-Carlo sampling from each source and set of distributions to derive an overall outage allowance.

3.7.2. Outage Assessment Results

Table 3 shows the assessment of the dry year annual average (DYAA) outage distribution . The median of the DYAA outage distribution is 1.79 Ml, with a range from 1.38 Ml to 2.2 Ml, which equates to 23% to 38% of deployable output. Although this allowance assessment represents almost 30% of the operational DO for an average day within the inset, the network can comfortably account for this level of outage as the reservoir storage facilities (i.e Mathew Tanks and Clarendon Reservoir) have large volume capacities. These large reservoir facilities have the capacity to hold supply water for at least 48 hours’ worth of demand.

Table 3 - Average Outage Allowance Assessment Findings

Average Outage Allowance Findings					
Resource Zone	Average DO	Average Outage Ml			
		10%ile	50%ile	90%ile	95%ile
1	5.52	1.38	1.79	1.8	2.2
% of DO		23	30	31	38

Table 4 - Dry Year Critical Period Outage Allowance Assessment Findings

Critical Period Outage Allowance Findings					
Resource Zone	Peak DO	Average Outage Ml			
		10%ile	50%ile	90%ile	95%ile
1	7.05	1.7	2.09	2.03	2.48
% of DO		26	32	31	38

Table 4 shows the assessment of the dry year critical period (DYCP) outage distribution. The median of the DYCP outage distribution is 2.09 Ml, with a range from 1.70 Ml to 2.48 Ml, which equates to 26% to 38% of deployable output. The DYCP figures are impacted by turbidity issues mainly associated with minor surface run-off events.

The UKWIR risk-based planning guidelines state that there has been no guidance as to the percentile to choose to derive the outage allowance assessment. Academic theory suggests that a lower percentile is selected for the assessment. However, for practicalities associated with resource management and drought management, it is recommended that a planning allowance in the range of 75% to 90% is used within the assessment. VWPL has selected to use the 90th percentile for outage allowance throughout the planning period for both the DYAA and DYCP, which gives an outage allowance figure of 0.04 Ml/d or 0.05Ml/d respectively.

The outage allowance has not been reassessed across the required 25 year planning period as no significant changes to the VWPL supply system are planned. Therefore, the outage allowance is not predicted to change. It should be noted that VWPL outage allowance has been considered separately to VWPL headroom analysis which is covered in Section 5.

4. Demand

A Green Future published by HM Government in 2018, indicated a desire for a reduction in domestic household water consumption. Research undertaken by regulatory bodies and private consultants on behalf of the government had demonstrated a significant and growing risk of severe drought conditions occurring in England as a direct result of climate change, population growth and external environmental drivers.

It has been requested by regulatory bodies and the Government that water supply companies should aim to reduce the demand for water within their networks by around 1,400 million litres per day (Ml/d) by 2050 by a number of potential routes, including demand management, compulsory metering and customer education. This would result in a per capita consumption (PCC) to under 110 litres/head/day (l/h/d) by 2050.

Reducing leakage has also been identified as an essential part of managing demand for water companies. OFWAT's new performance commitments will require water companies to reduce leakage by a further 50% from the baseline 2017/18 levels by 2050.

The following section describes VWPL's demand situation and how VWPL intends to achieve the regulatory demand management targets.

Note: leakage is discussed in more detail in Annex 5 of this WRMP report.

4.1. Historical Demand Situation

The historical demand situation for the VWPL operated inset from 2011/12 to 2021/22 is presented within Figure 5. Historical demand varied significantly over the past five years, heavily influenced by the effects of the Covid-19 pandemic. High demand events recorded throughout the WRMP19 cycle are discussed in more detail within section 4.1.1 of this annex.

During 2020/21, non-household consumption decreased as a result of government lockdown measures, when all but non-essential personnel had to remain in their homes. In parallel, VWPL observed an increase in household consumption from 141 to 178 l/h/d, which represented an increase of 25% compared to the reporting year 2019/20.

Similarly the MoD consumption decreased and then increased as the result of the government respectively implementing and revoking Covid-19 restrictions. During the 2021/22 reporting period, demand from the MoD increased from 1.91 Ml/d to 2.09 Ml/d. While MOD consumption is always difficult to predict due to the nature of their activities, it is anticipated that MoD consumption will return to pre-pandemic levels in 2022/23.

Figure 5 - The historical demand situation from 2011/12 to 2021/22.

				2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
	DEMAND													
11AR	Distribution input	Ml/d	2dp	3.86	3.83	3.79	3.85	3.91	4.32	4.54	4.55	4.62	4.11	4.06
C	**Consumption**													
19AR	Measured non household water delivered	Ml/d	2dp	0.37	0.48	0.59	0.54	0.48	0.50	0.45	0.47	0.42	0.46	0.40
20AR	Unmeasured non household water delivered (optional)	Ml/d	2dp	1.39	1.44	1.49	1.79	2.08	2.27	2.96	3.26	2.74	1.91	2.09
21AR	Measured household water delivered	Ml/d	2dp	0.19	0.27	0.35	0.24	0.13	0.15	0.28	0.39	0.51	0.70	0.67
22AR	Unmeasured household water delivered	Ml/d	2dp	0.18	0.18	0.18	0.16	0.13	0.12	0.13	0.12	0.14	0.16	0.08
23AR	Measured non household - consumption	Ml/d	2dp	0.37	0.48	0.59	0.54	0.48	0.50	0.45	0.47	0.42	0.46	0.4
24AR	Unmeasured non household - consumption	Ml/d	2dp	1.39	1.44	1.49	1.79	2.08	2.27	2.96	3.26	2.74	1.91	2.09
25AR	Measured household - consumption	Ml/d	2dp	0.19	0.27	0.35	0.24	0.13	0.15	0.28	0.39	0.51	0.70	0.67
26AR	Unmeasured household - consumption	Ml/d	2dp	0.18	0.18	0.18	0.16	0.13	0.12	0.13	0.12	0.14	0.16	0.08
29AR	Measured household - pcc	l/h/d	0dp	174	265	356	244	132	103	98	116	132	174	167
30AR	Unmeasured household - pcc	l/h/d	0dp	244	229	214	185	155	160	160	160	185	202	110
31AR	Average household - pcc	l/h/d	0dp	202	246	291	217	143	122	112	124	141	178	158
32AR	Water taken unbilled	Ml/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
33AR	Distribution system operational use	Ml/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.001
D	**Leakage**													
34AR	Measured non household - uspl	Ml/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.005
35AR	Unmeasured non-household - uspl	Ml/d	2dp	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.00	0.01	0.07	0.07
36AR	Measured household - uspl	Ml/d	2dp	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.00	0.04	0.08	0.08
37AR	Unmeasured household - uspl	Ml/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.02	0.02
38AR	Void properties - uspl	Ml/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
39AR	Total mains and trunk mains leakage	Ml/d	2dp	1.73	1.46	1.18	1.14	1.09	1.28	0.72	0.32	0.81	0.68	0.65
40AR	Total leakage	Ml/d	2dp	1.81	1.54	1.26	1.22	1.17	1.36	0.80	0.32	0.90	0.86	0.81
41AR	Total leakage	l/prop/d	2dp	793.63	664.90	536.17	510.82	485.48	530.63	249.09	96.41	251.89	232.68	216.22

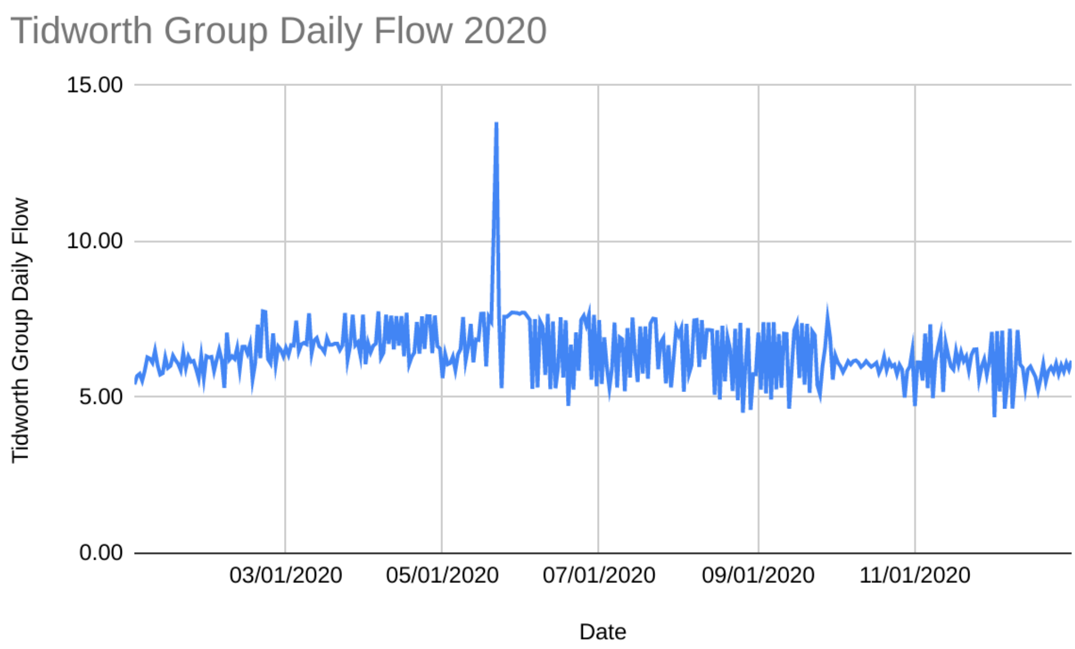
4.1.1. High Supply/Demand Event

2020 - National Covid Lockdown

A high demand event was documented for 2020, when a national level lockdown was implemented by the government in order to prevent the spread of COVID-19. The lockdowns required members of the public not to leave their houses unless it was essential.

The combined daily flow for the Chalkpit abstraction borehole and abstraction boreholes BH2 and BH3 are presented in Figure 6. The average combined daily flow within 2020 was 6.41 Ml/d with a maximum flow rate of 9.04 Ml/d on 23 October 2017. This peak relates directly to a burst main within the wider Tidworth network.

Figure 6 - Graph showing the combined average daily flow during 2020.



During the reporting period, the average household per capita consumption also increased from 141 to 178 l/h/d. This represents a 25% increase from the 2019 reporting period.

The potable water exported to Leckford Bridge (Wessex Water) during the same period was 2.19 Ml/d, this represents a 14% increase in demand from the 1.90 Ml/d reported in the 2019 reporting period.

However, non-household MoD demand significantly reduced from 2.74 Ml/d within the 2019 reporting period to 1.91 Ml/d in 2020. This represents a 21% decrease in demand. The decrease in demand was due to the short term effects of Covid-19 and military personnel being sent home during national lockdowns.

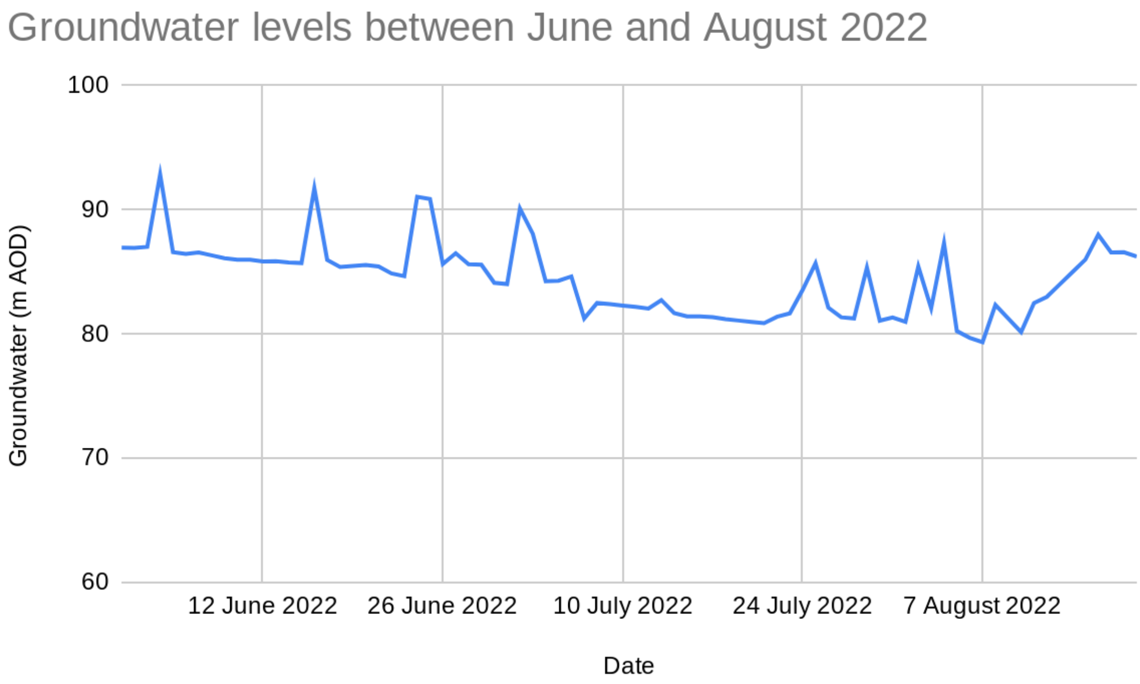
Throughout 2020, all customers received adequate supplies and there was no need for VWPL to implement any drought management triggers.

Summer 2022- Prolonged Hot/Dry Weather

A high demand event was documented during summer 2022, when the West Country experienced prolonged dry and hot weather with very limited precipitation, which resulted in the EA declaring a drought across the wider Wessex County.

It was reported by the EA that the winter period between October 2021 to April 2022 was the driest winter since 1975/76 with recorded rainfall below average. Groundwater levels within the VWPL network were also below average and fluctuated between 137 and 88 m AOD between January and August 2022 (Figure 7).

Figure 7- Graph of groundwater levels within the network between June and August 2022



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4.2. Customer Demand Management

The Government indicated in their 2018 '25 Year Environment Plan' that it wanted to see household water consumption reduced in light of the significant and growing risk of severe drought impacts arising in England and Wales from climate change, population growth and other environmental factors. The plan has requested that demand for water is reduced by around 1,400 million litres per day (Ml/d) from the industry average by 2050. This would result in a per capita consumption (PCC) to under 110 litres/head/day (l/h/d) by 2050.

Therefore, Water UK commissioned Artesia Consulting Ltd in 2019 (Artesia, 2019) to carry out an assessment on what mitigation measures could be implemented across the wider water industry to help reduce water consumption as detailed below.

The single most cost-effective intervention to save water is a mandatory government-led scheme to label water-using products, linked to tightening Building Regulations and water supply fittings regulations. This would reduce industry average consumption by an additional 31 l/h/d or 2,012 Ml/d by 2065. Of all the interventions analysed, this scores most highly on two key metrics: volume of water saved and cost:benefit ratio, and second overall on marginal cost. The strongest performing interventions are those that improve the efficiency of all households over time, through technology and behaviour change.

The Water UK report also listed the following as key findings that will help to reduce long-term PCC usage.

- **Household Visits** were considered to be a sufficient way to reduce long-term PCC. These visits could be either to deliver water audits or to reduce wastage, e.g. from leaking plumbing. These audits have relatively low marginal cost but do save small amounts of water. Currently VWPL will write to any customers with very high water consumption suggesting that there might be a leak within the property. As part of this process, VWPL will offer to attend the property to carry out an inspection.

- **Smart Metering** was considered to be a sufficient way to reduce long-term PCC. Smart metering will enable much better customer communication and so will be important in driving customer behaviour change. It also brings a number of key additional benefits associated with water wastage and leakage. Extensive smart metering, outside areas of serious water stress, could reduce water use by between 368 and 482 Ml/d at a marginal cost of between £2,000/Ml and £3,200/Ml. In Tidworth, approximately 84% of the household properties are metered and in accordance with the new government legislation, all new built properties are fitted with a meter. All non-household customers on the wholesale/retail market are metered.

The below section describes in detail how VWPL manages the different aspects of the Inset demand while aiming to achieve the demand reduction targets.

4.2.1. Regulated Customer (Household) Consumption

Reducing the demand for water and household consumption is a core area of focus for the WRMP and associated stress testing, given the number of uncertainties surrounding the growing risk of severe drought conditions arising in England and Wales.

The modelling approach to calculating PCC is for water supply companies to understand their current PCC ambitions in relation to government and regulatory requirements. The following aspects of the planning tables were utilised to calculate household PCC:

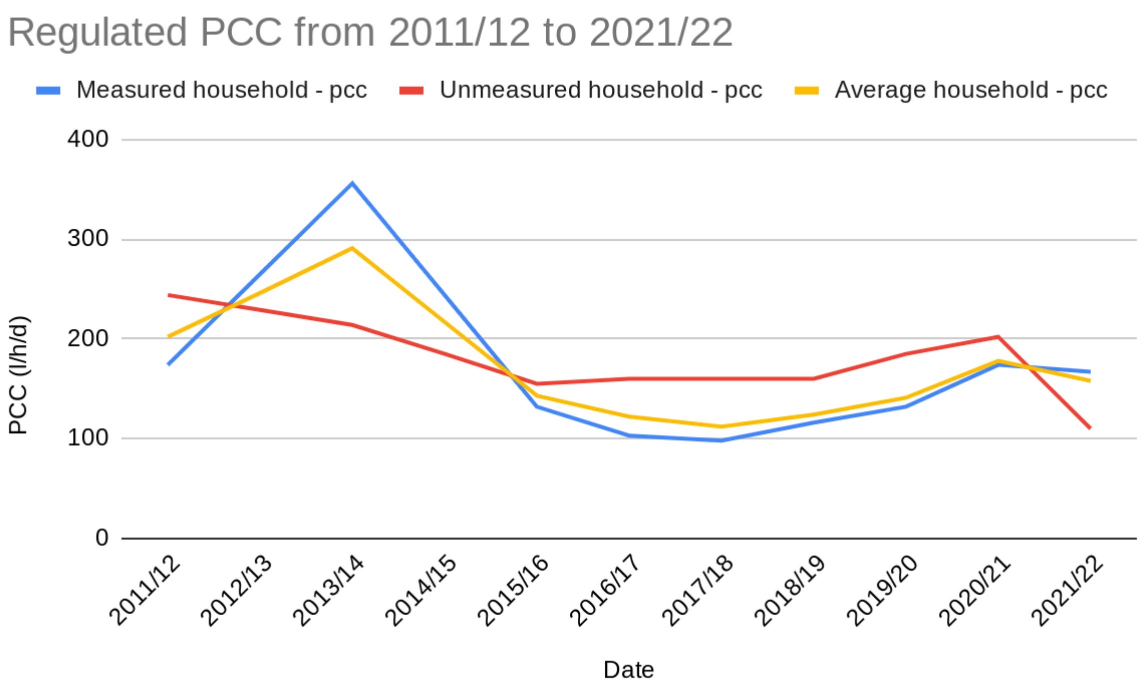
- Number of measured households/properties within the network (excluding voids);
- Number of new properties proposed for the network;
- Number of unmeasured households/properties within the network (excluding voids);
- The total population within measured households within the network;
- The total population within unmeasured households within the network;
- Occupancy rate of measured households/properties within the network (excluding voids);
- Occupancy rate of unmeasured households/properties within the network (excluding voids); and
- Total household metering penetration (excluding voids).

Approximately 84% of VWPL regulated customers within the wider network are metered, which is above average within the water industry. Their consumption can be established by real time usage figures and the meters have been installed with a system that automatically informs VWPL of increased or continuous usage, potentially due to customer-side leakage. This system has enabled VWPL to respond quicker to suspected leaks and to prevent the mismanagement of potable water. This system also enabled VWPL to generate data that has helped improve the accuracy of PCC calculations.

The unmetered and metered household PCC and average household PCC recorded within the network between 2011/12 to 2021/22 is presented in Figure 9.

Figure 9 - Regulated PCC within the VWPL network*.

** Note: PCC information reported inVWPL regulatory annual returns.*



The overall PCC trend for the network has continued to decrease since 2013/14 when VWPL started implementing its smart metering campaign.

As customer demand increased within the 2019/20 and 2020/21 reporting years that were directly impacted by the Covid-19 pandemic, overall PCC also increased. Since pandemic restrictions have been lifted, customer demand and the overall PCC have started to decrease again.

4.2.2. MOD Consumption

In Tidworth, MoD consumption accounts for approximately 40 to 50% of demand and customer connections. However, current MoD consumption does not impact VWPL's PCC as the water was supplied as part of the PFI contract and is reported as part of unmeasured non-household consumption.

Historically, MoD consumption has been difficult to forecast due to the confidential nature of the MoD activities and limited metering coverage within these areas of the network. Currently there are a number of district meters located in close proximity to the military garrisons. However, these meters do not only record the water supply to the MoD garrisons as they are embedded into the wider network and therefore, only provide a limited picture of MoD consumption .

VWPL has therefore calculated MoD consumption using the following equation:

<u>MoD consumption = 0.5 Ml/d + (300l/h/d x estimated number of soldiers within the network)</u>

The figure of 0.5 Ml/d is directly associated with the ~1,300 Service Family Accommodation (SFA) and the ~320 MoD operational buildings.

While 300 l/h/d seems relatively high, especially as there is a regulatory influence to reduce overall consumption, the figure has made allowances for the military uncertainty factor. This includes activities that are unique to the garrisons, such as armoured vehicle wash downs and the presence of additional military personnel on exercise. Given the level of uncertainty associated with MoD planning activities within the network, VWPL has applied a 1.3 multiplier factor to the MOD garrisons' consumptions in the WRMP planning tables

The water supply to the MoD is currently managed by VWPL under the PFI contract, which is due to expire in 2023. Post-PFI, the PFI properties, including SFAs outside of the MoD garrisons will become regulated customers. SFA consumption will then directly influence VWPL's PCC. In preparation for this, VWPL will install meters at the boundary of the MoD garrisons and at the SFA properties. This will enable an accurate measurement of the MoD garrison and SFA consumption.

The regulatory annual returns from 2023/24 will be updated to reflect the management change.

It is important to note that water consumption within the SFA areas of the network has always been significantly higher than the average consumption within the water industry. While during the WRMP24 cycle VWPL in conjunction with the MoD will be implementing an educational campaign on water saving and leakage reporting, it will remain challenging for VWPL to achieve the government PCC targets.

As for the MOD garrisons, the implementation of MoD sustainability strategy should support in reducing legitimate consumption within the MoD properties and reducing leakage.

There is a level of uncertainty associated with MoD demand. Therefore, to ensure the water supply is able to sustain a sudden increase in army personnel, the planning tables have been produced with a 1.3 multiplier factor on overall consumption.

This conversative approach has resulted in an annual increase in unmeasured non-household consumption of 0.003Ml/d from the 2023 consumption value.

Adopting a conservative approach, VWPL has applied an annual increase of 0.003Ml/d to the unmeasured non-household consumption value from 2023.

Once the metering of the MoD garrisons is complete in 2023, VWPL has assumed that unmeasured non-households will be nil from 2023/24.

4.2.3. Measured Non-Household Consumption

All non-household properties on the wholesale/retail market are metered and as such, their consumption can be established by real time usage figures. Their consumption does not impact the PCC figures for the network.

As discussed in section 4.2.2, the PFI contract will cease in 2023 and the MoD Tidworth and Perham Down Garrisons will be transferred into the regulated business. Their water supply will be metered and therefore the MOD water consumption will be accounted for as "measured Non-household" consumption.

The regulatory annual returns from 2023/24 will reflect this change.

4.3. Population and property growth

In accordance with regulatory guidance, VWPL has forecast a realistic growth in population and properties within the Tidworth network until 2050. This will enable VWPL to assess the available supply sources against predicted demand to ensure a favourable supply/demand balance is maintained. The following sections describe the growth within all aspects of the VWPL network.

4.3.1. MOD population and property growth

It is estimated that military personnel account for approximately 60% of the Inset population. VWPL consulted with the MoD to assess any changes and/or proposed forecasts in military personnel population within the inset. The total number of military personnel is currently estimated to be around 6,000 and no further significant net increase is expected by the MoD over the next few years.

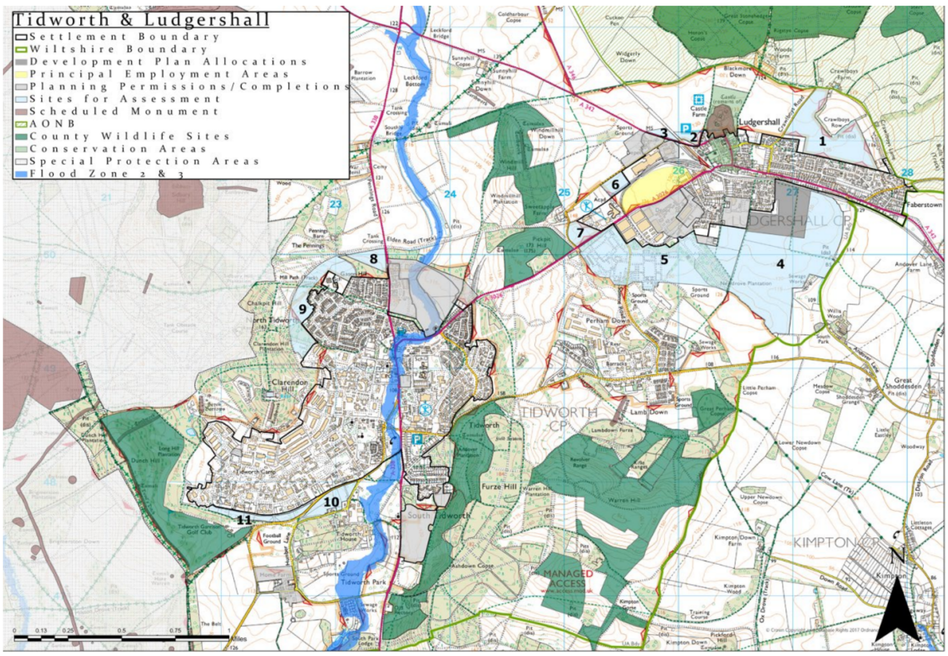
The MoD have confirmed that no further property development is planned for either garrison within the network.

4.3.2. Household population and property growth

Wiltshire County Council (WCC) Housing Land Supply Statement 2021 has confirmed that approximately 504 new residential properties are proposed for the network between 2021 and 2025 to enable WCC to achieve their housing quota for the area. This is the Drummond Park residential development which is currently under construction and is due to be completed in 2026/27.

WCC does not currently have further long term plans for future housing development but the WCC Housing Land Supply Statement 2021 lists a number of potential development sites within the network (areas highlighted in blue in Figure 10).

Figure 10 - A map produced by WCC outlining potential development areas within the network.



VWPL followed up with the MoD as a large percentage of the potential development sites are located within MoD land. The MoD informed VWPL that there were no plans to sell those lands for development as they are active land used for military training etc. Therefore, VWPL considers these areas to have negligible development potential.

On that basis, VWPL has forecast a property growth of 80 properties per year between 2022/23 and 2026/27 (Drummond Park) and of approximately 10 properties per year for the rest of Tidworth area, which is significantly below the average for England and Wales.

On that basis, forecast demand growth of approximately 0.003Ml/d per year from 2025/26 to 2049/50 and additional demand growth of 0.028 Ml/d per year between 2022/23 and 2026/27 (for Drummond Park) have been applied.

As discussed in section 4.2.2, when the PFI contract terminates in 2023, approximately 1300 SFAs will become regulated household customers. VWPL understands that 80% of those properties are already metered so 1040 SFAs will be included within the measured household property count and 260 SFAs will be included within the unmeasured household property count. The WRMP planning tables have been updated to reflect this.

A 0.40 Ml/d increase in measured household demand and a 0.10 Ml/d increase in unmeasured household demand have been applied from 2023/24 in the WRMP planning tables to reflect this change.

However, in accordance with the metering scheme, it is anticipated that the unmeasured SFA properties and associated demand will transfer to the measured household property count by 2030/31.

It is anticipated that the non-measured household properties and population within the network will continue to decrease as all new houses must be built with a suitable meter and there is an ‘opt-in’ metering campaign currently active within the network. As such VWPL has not applied a growth increase assumption for unmeasured households.

VWPL has assumed a population ratio of 2.4 per measured and unmeasured property.

4.3.3. Non-Household population and property growth

VWPL liaised with WCC to understand any non-household development proposed in the Tidworth Inset area. It was established that future non-household development will be undertaken in the second phase of the Castledown Business Park in Ludgershall. While the development land has been allocated as employment land only within Wiltshire Core Strategy and as such can only be developed into categories B1 and B8*. It is considered likely that this land will be developed into low water demand businesses including retail and office spaces.

*****B1*** *- an industrial or business use that can be undertaken in any residential area without detriment to the amenity of that area by reason of noise, vibration, smell, fumes, smoke, soot, ash, dust or grit.* ***B8*** *- storage and distribution businesses.*

Tidworth Civic Centre has been granted planning permission by WCC. WCC have not yet received an application for the discharge of pre-commencement conditions that were set on the application. Therefore, it is likely that this facility will be developed within the WRMP24 cycle and allowances have been made within the planning tables.

Finally, as detailed in section 4.2.2, when the PFI contract terminates in 2023, the MoD garrisons will be metered and therefore be captured within measured non-household. There is no further growth expected. The WRMP planning tables have made allowances for this change of category but no growth increase has been applied.

Adopting a conversative approach, VWPL has applied an annual increase of 0.003Ml/d to the unmeasured non-household consumption value from 2023.

Once the metering of the MoD garrisons is complete in 2023, VWPL has assumed that unmeasured non-households will be nil from 2023/24.

4.3.4. Leckford Bridge

It has been observed that the Leckford Bridge export demand has been increasing with time since 2011/12. However, Wessex Water Ltd have informed VWPL that there are no new developments proposed for this area of their supply.

Adopting a conversative approach, VWPL has applied an annual increase of 0.008Ml/d* to the Leckford Bridge Export value from 2023 in WRMP planning tables.

**Note: the assumption figure is based upon the VWPL realistic gradual demand forecast, not the flat 2.74Ml/d export volume that Wessex Water inputs in their planning sheets. If the VWPL abstraction licence is reduced in 2025, the Leckford Bridge transfer of 2.74 Ml/d will not be sustainable as the planning tables highlight supply issues.*

5. Target Headroom Assessment

There is an element of uncertainty associated with some elements of the supply/demand balance forecast and therefore, it is essential that a margin, known as headroom, is allowed for as part of the water resource planning process.

Headroom is the minimum buffer that is applied to the supply/demand balance to ensure that the chosen level of service can be achieved. Available headroom is the actual difference between water available for use and the distribution input (total demand) at any given time. Where available headroom falls below the target figure, the supply/demand balance will be in deficit as the required level of service cannot be fulfilled.

In Tidworth, this is particularly relevant as the demand required for the MoD is traditionally hard to predict due to the transient nature of MoD activities. MoD activity can result in an influx of hundreds of troops deployed to facilities at Tidworth and Salisbury Plain thus increasing the overall demand requirements. This is known as the ‘Military Uncertainty Factor’.

VWPL contacted the MoD within the pre-consultation process of the WRMP to discuss future growth within the network. The MoD has confirmed that there should be no significant net increase in personnel or new buildings affecting water demand in the next five years. However, there is the possibility that this might change in light of the Strategic Defence Review due in 2025.

5.1. Methodology

VWPL implemented the UKWIR 1995 methodology to complete the target headroom assessment. The target headroom comprises components, as listed below, that have the potential to influence the water available for use within a water supply network or the actual demand.

D1 - Accuracy of demand/sub-compound data

This component accounts for water distribution metering inaccuracies in the base data. In order to obtain this data, VWPL uses the Netbase software to assess demand and output level trends. When this approach is applied, it is considered to represent the lowest uncertainty allowance, with minimum and maximum allowances of plus or minus 1.4% from the central baseline demand forecast.

D2 – Demand forecast variation

This component accounts for variation around the baseline demand forecast. This includes the potential demand requirements from new housing and non-household developments and the Military Uncertainty Factor within the Tidworth network.

D3 - Uncertainty of impact of climate change on demand

This component accounts for variation in the baseline demand forecast from the effects of climate change. The Tidworth network is considered to be at a low vulnerability risk from climate change.

D4 - Demand Management Measures

This component accounts for variation in the baseline demand forecast from the effects of demand management measures and the impacts if demand is not correctly managed. The Tidworth network has a demonstrated history of fulfilling the demand requirements of VWPL's customers. Therefore, no uncertainty was included in the analysis to account for the variation in baseline demand forecast generated from demand management measures.

S5 - Gradual Pollution of Sources

This component accounts for variation in the forecast supply-demand baseline resulting from pollution within the catchment area. VWPL's drinking quality team monitors the levels of contaminants, including nitrate, present within the potable water. The recorded concentrations of these contaminants has remained low and below VWPL drinking water screening levels.

S8 - Climate Change on Supply

This component accounts for variation from the effects of climate change. The Tidworth network is considered to be at a low vulnerability risk from climate change.

S9 – Uncertainty of new sources

Within the Tidworth network, there are no new sources and as such there is no uncertainty. This component has therefore not been considered within the following headroom assessment.

5.2. Assessment Results

The findings of the target headroom assessment is presented in Table 5 below.

Table 5 - Results of the headroom analysis

Target Headroom		2022	2027	2032	2040	2045	2050
Company Average Baseline	%	6	7	8	9.5	9.5	9.5
	Ml/d	0.330	0.385	0.440	0.5225	0.5225	0.5225

The headroom assessment has recorded figures between 6%/0.33 Ml/d and 9.5%/0.52 Ml/d. However, taking into consideration the size of the WRZ, the ‘Military Uncertainty Factor’ and the level of DI combined with the flexible distribution of the network, a headroom of 9.5% is considered a reasonable worst case figure.

The worst case headroom figure of 9.5%/0.52 Ml/d has been retained and utilised as a long-term supply/demand target for 2045.

6. Supply Demand Balance

The overall balance of the supply system is assessed by comparing the forecast of total water available for use with the forecast of demand (distribution input) plus target headroom. Total water available for use accounts for the deployable output of VWPL operated sources, minus the allowances for source outage and water used by treatment processes and the net balance of exports with neighbouring companies.

As part of the WRMP process, two supply/demand balances are produced for each scenario, the baseline supply-demand and the final supply/demand scenario accounting for any changes resulting from any agreed options.

Within both supply/demand balances, VWPL has provided a Dry Year Annual Average (DYAA) and a Dry Year Critical Period (DYCP). This has been produced to show how the WRMP and supply system have planned for peak strain events, including seasonal demand associated with a heatwave, winter leakage or an increase in MoD consumption. VWPL’s WRMP tables present a supply/demand balance when VWPL’s supplies are low and the network demand is high.

In addition to this, VWPL has considered different scenarios to take into account the assumptions and factors that have the greatest influence and impacts on the WRMP and produced a WRMP table for each one. The following section presents the stress-testing scenario process that VWPL carried out and the scenarios that have been considered by VWPL.

6.1. Stress - Testing Scenarios

Stress testing and sensitivity analysis is a critical component of the UKWIR decision-making framework. It has been designed to help water companies understand the assumptions and factors that have the greatest influence and impacts on the WRMP. The process will provide confidence that the plan is robust under a range of uncertainties that have the potential to directly affect daily operations and services.

The following sections of this report describe the scenarios that have been considered by VWPL.

6.1.1. Potential Sustainability Reductions: Reduction in Abstraction Licence

As presented in section 2 of this Annex, the EA has confirmed that a reduction of VWPL current abstraction will be required to meet waterflow targets and that VWPL should expect a capping of their licence during the licence renewal process (due in 2025).

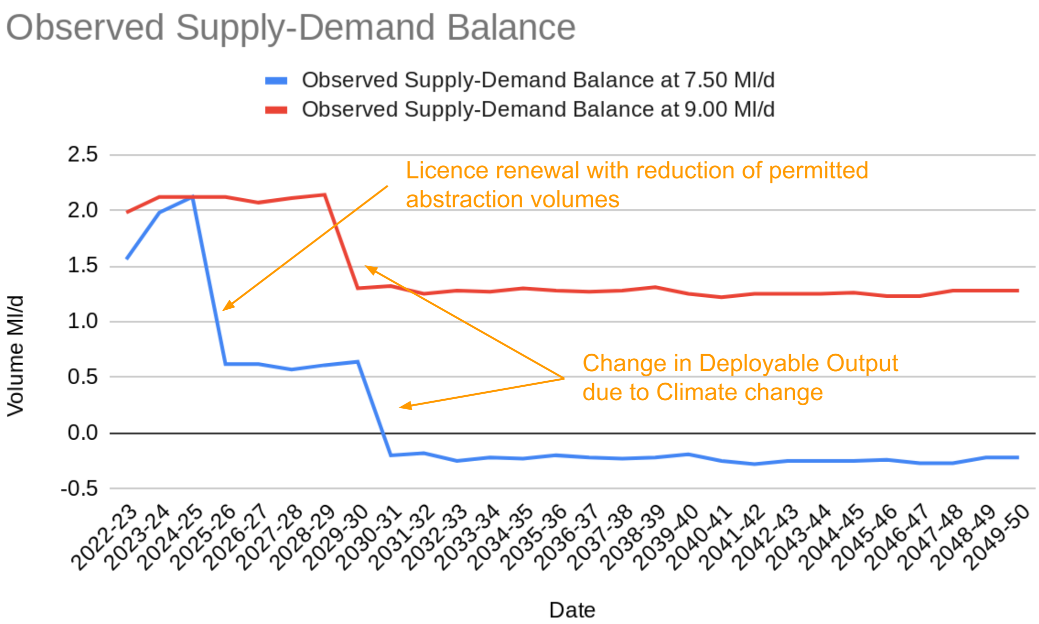
Therefore, to encompass VWPL environmental obligations and the upcoming abstraction licence renewal in 2025, two sets of planning tables were produced as part of the WRMP PR24, these include:

- The current abstraction licence of 9.00 Ml/d.
- A capped abstraction licence of 7.50 Ml/d based upon the recent-actual scenario*

**Note*: *the recent actual abstraction licence figure of 7.50 Ml/d has not been confirmed by the EA and might change in the final version of the WRMP as the other licence renewal criteria (growth and demand requirements) are being reviewed.*

In order to assess how the reduction in abstraction would impact on the daily operations of the network, additional planning sheets were produced as part of the WRMP process. The observed supply/demand balance between the current abstraction rate of 9.00 Ml/d and reduced abstraction rate of 7.50 Ml/d is shown in Figure 12 below.

Figure 12 - The observed supply demand balance within the Tidworth Network



The modelling shows that under the current abstraction licence of 9.00 Ml/d - assuming Leckford Bridge volumes at recent actuals, VWPL has a surplus supply demand balance. However, if the VWPL abstraction licence were to be capped at 7.50 Ml/d, VWPL would be in deficit from 2030/31 and for the duration of the planning period. Therefore, careful consideration will need to be given to demand management within the option appraisal of the WRMP.

6.1.2. Revoking the Leckford Bridge Bulk Transfer

As presented in Annex 4 and Section 2 of this Annex, the PR19 WINEP AMP7 investigation confirmed that the VWPL abstractions (as well as Wessex Water and MOD's abstractions) have an impact on the river flow and the extent of the drying period on the Nine Mile River and Pillhill Brook. This means that the risk of deterioration of VWPL abstractions within the wider Wessex Basin is considered to be moderate.

VWPL PR19 WINEP AMP7 option appraisal then concluded that the capping of VWPL's abstraction licence will not be sufficient alone in addressing the VWPL proportionate impact and highlighted that the Leckford Bridge supply is currently accounted for twice - within VWPL's abstraction flows and within Wessex Water's abstraction licence. Therefore the EA requested that VWPL model the revoking of the Leckford Bridge bulk transfer.

VWPL commissioned John Woods Plc as part of the PR19 WINEP AMP7 investigation to undertake the modelling of the revoking of the Leckford Bridge bulk transfer and the findings are summarised in this section.

<u>Note</u>: more details can be found in the PR19 VWPL WINEP - AMP7 report

6.1.2.1. Environmental Assessment

The stress-test option - VWPL abstraction volumes reduced by approximately 27% from the current abstraction rate; this was modelled under scenario 610 (Table 6). A 27% reduction was considered to represent VWPL average proportion of the Leckford Bridge export.

The reduction was applied equally across the VWPL abstraction boreholes: Borehole 2, Borehole 3 and Chalkpit.

Table 6 - Scenario 610 reduction

Run	**Borehole 2** Average daily flow*	**Borehole 3** Average daily flow*	**Chalk pit** Average daily flow*	**Wessex & MOD**
610	1.66 Mld	1.55 Mld	1.26 Mld	Full Licence

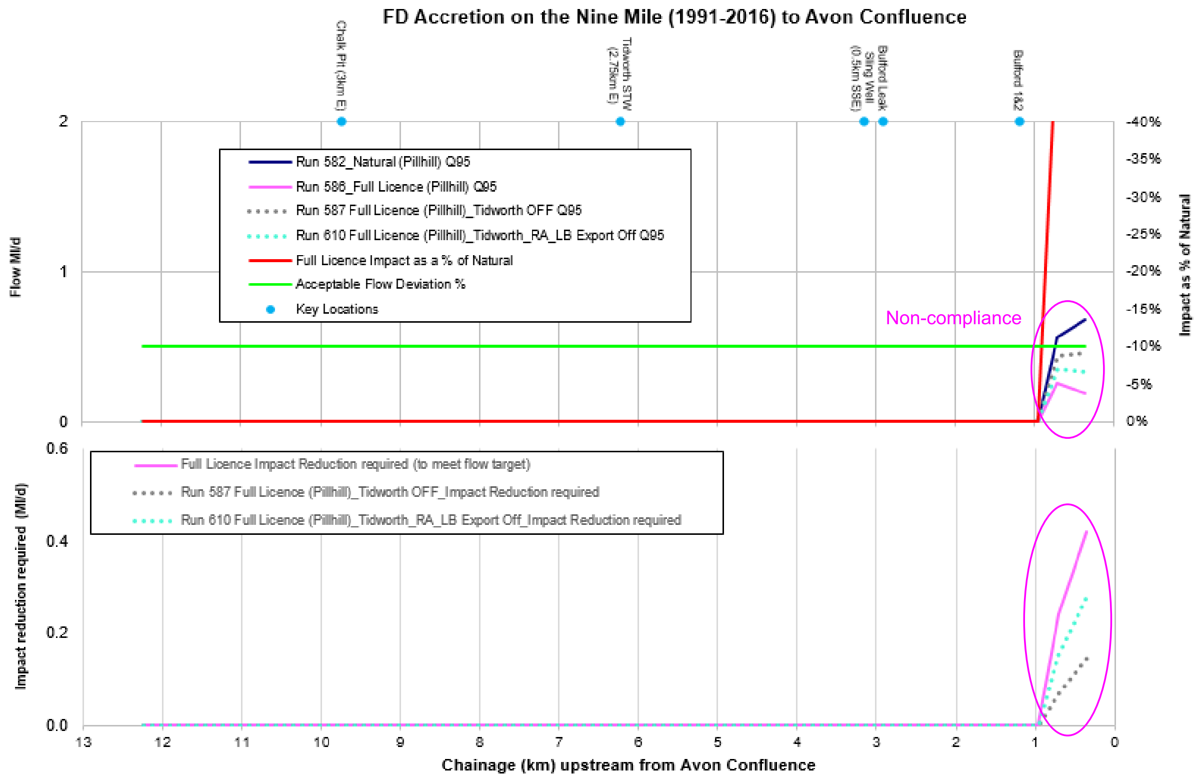
**flat profile mainly*

In the abstraction condition of this option, at Q95, Nine Mile River does not meet its flow target. The river flow reduces by up to 0.35 Mld - i.e by 51%, against the Natural flow (against 0.49 Mld reduction at full licence) and the deficit to the flow target is 0.28 Mld (against a deficit of 0.42 Mld at full licence).

The option does provide a 0.14 Mld flow gain on the Nine Mile River against the full licence, which represents a 3% efficiency on the abstraction reduction (abstraction reduced by 4.55 Mld to achieve a river flow gain of 0.14 Mld) .

Figure 13 - Nine Mile - flow accretion and flow deficit against the flow target at Q95

On the graph, full licence (Run 586) in pink, Veolia turned off (Run 587) in grey dotted line, Option 2 (Run 590) in blue dotted line and Natural (Run 582) in blue



As shown on Figure 13, the reduction of the Leckford Bridge bulk supply has a visible impact on the drying period of the Nine Mile winterbourne reach only up to 7.33 km upstream of the confluence. The main variation to Natural is observed at 0.96 km with an additional 31.0 days with no flow compared to Natural. For the remainder of the impacted section, the number of drying days increases up to 5.5 days per year but on average by 1.0 days per year compared to Natural.

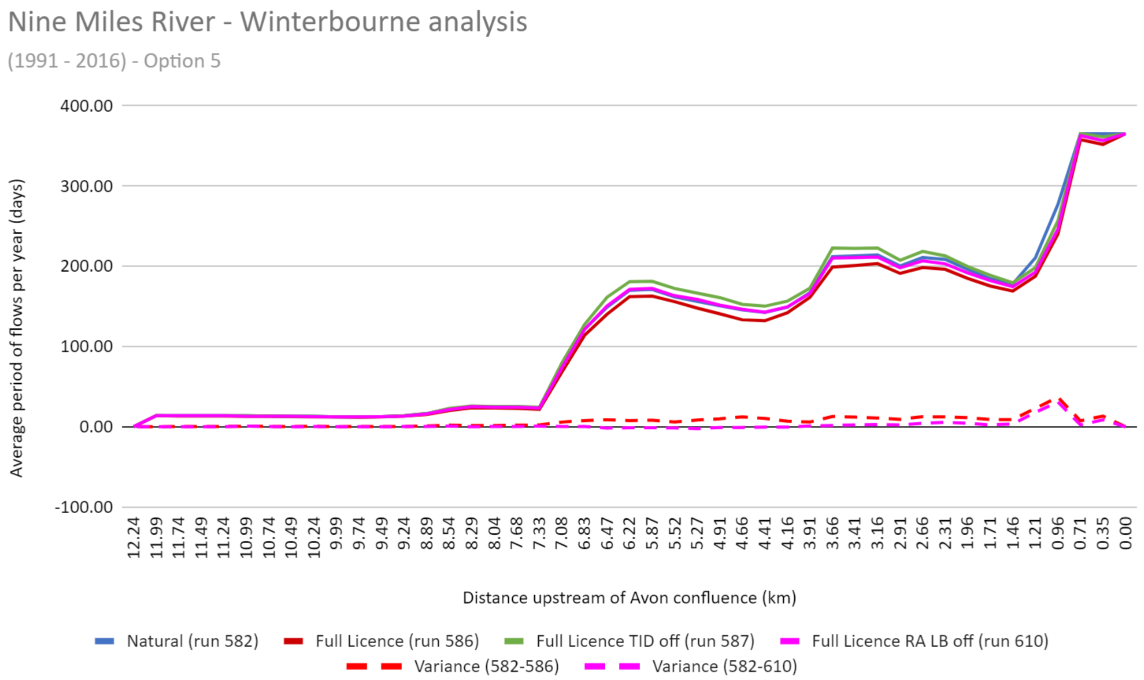
**Note: Between 4.16 km and 6.47km, the model provides an average 1.1 days of additional flow days compared to Natural because the model still accounts for STW discharge and leakage.*

Upstream of 7.33 km of the confluence, the drying period of the winterbourne only increases by an average of 0.2 days per year compared to Natural with a maximum of 0.8 additional days of no flow.

This option provides an average of 8.2 days additional flowing days compared to full licence.

Figure 14 - Nine Mile Winterbourne - extent of the drying period

On the graph, full licence (Run 586) in red, Veolia turned off (Run 587) in green, Option 5 (Run 610) in pink and Natural (Run 582) in blue



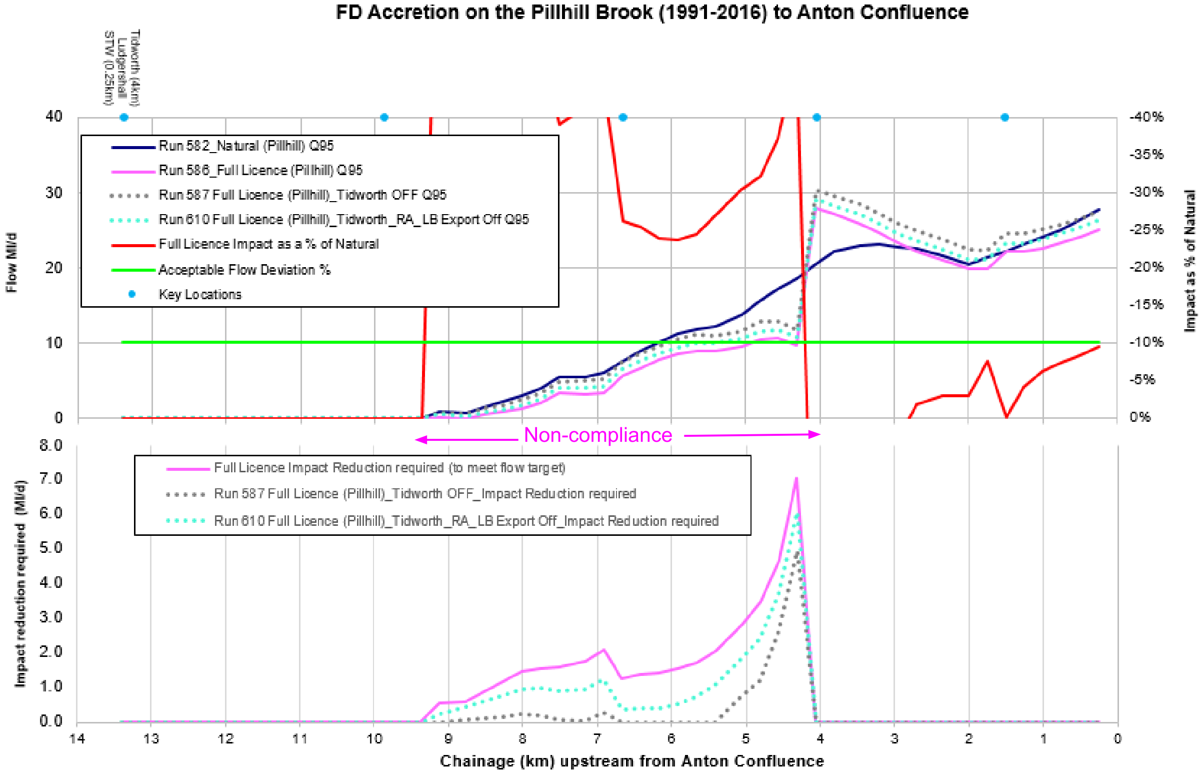
As for Pillhill Brook, in the abstraction condition of this option at Q95, the river does not meet its flow target from 9.12 to 4.31 km upstream of the confluence. On this section of the river, the river flow reduces by an average of 2.10 Mld - i.e by 31%, against the Natural flow (against 2.87 Mld at full licence) and the average deficit to the flow target is 1.28 Mld (against 2.05 Mld at full licence) with a maximum deficit of 6.06 Mld at 4.31 km.

**Note: between 5.66 km and 6.66km, the model presents an average deficit to the flow target of only 0.47 Mld compared to Natural. This is assumed to be due to the positive impact of the Cressbed discharge back into the river.*

This option provides 0.77 Mld flow gain on Pillhill Brook against the full licence which represents a 16% efficiency on the abstraction reduction (abstraction reduced by 4.55 Mld to achieve a river flow gain of 0.77 Mld).

Figure 15 - Pillhill Brook - flow accretion and flow deficit against the flow target at Q95

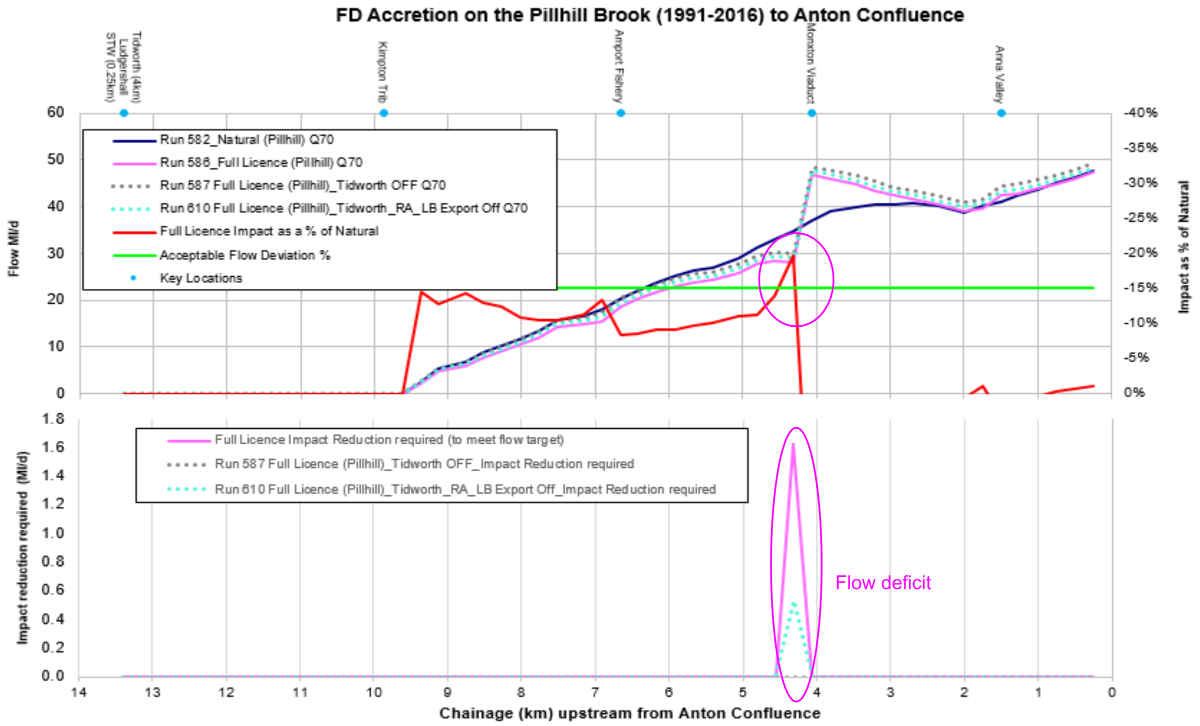
On the graph, full licence (Run 586) in pink, Veolia turned off (Run 587) in grey dotted line, Option 5 (Run 610) in blue dotted line and Natural (Run 582) in blue



In the abstraction conditions of the model, Pillhill Brook will become fully compliant at Q50, but will still be non-compliant at Q70 at 4.32 km upstream of the confluence with a flow deficit of 0.53 Mld.

Figure 16 - Pillhill Brook flow accretion and flow deficit against the flow target at Q70

On the graph, full licence (Run 586) in pink, Veolia turned off (Run 587) in grey dotted line, Option 5 (Run 610) in blue dotted line and Natural (Run 582) in blue



Implementing this option will reduce the flow deficit of the Nine Mile River Natural flow compared to full licence by 0.14 Mld which represents VWPL's proportion of abstraction impact to resolve. However it is important to note that this is achieved with a very low efficiency (3%) due to the very low flow in the Nine Mile River and the distance of the abstraction boreholes to the river.

Implementing option 5 will benefit the Pillhill Brook as well but will not enable the restoration of flow compliance at Q95 and Q70.

6.1.2.2. Operational/Demand Management Assessment

Revoking the Leckford Bridge bulk supply would have a limited impact on Veolia's operations and capital investment but will materially affect Veolia Tidworth Inset revenue (reduction by around 15% to 30% of VWPL regulated revenue) and consequent ability to operate. However, this option would provide a demand saving of approximately on average 2Ml/d*.

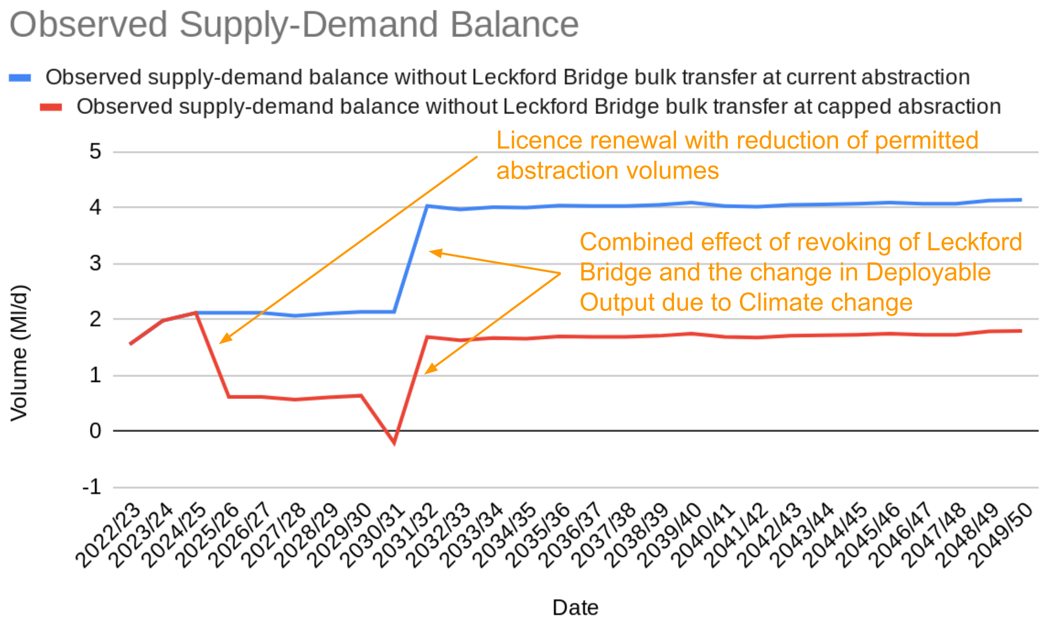
**Note: average figure based upon historical data.*

Modelling work has been undertaken by VWPL and the updated surplus within the supply/demand balance is shown in Figure 17 for both the current abstraction rate and a capped abstraction rate without the Leckford Bridge bulk transfer. To provide Wessex Water a suitable time period to source another potable water supply or to recommission an existing abstraction borehole not currently in use, the model has assumed that VWPL will continue to supply the Leckford Bridge bulk transfer until 2030/31.

When the current abstraction licence of 9.00 Ml/d is applied to the model, the data shows a significant increase in surplus of the supply-demand balance as soon as the Leckford Bridge export is revoked (Figure 17).

When the scenario with a capped abstraction licence at 7.50 Ml/d is applied to the model, the data shows a significant increase in surplus of the supply-demand balance as soon as the Leckford Bridge export is revoked (Figure 17). The supply-demand balance shows a deficit in 2029/30 as under this scenario, VWPL would revoke the Leckford Bridge bulk transfer in 2030/31 only. From 2031/32, the network supports a positive supply demand balance.

Figure 17 - Observed Surplus within supply-demand balance without the Leckford Bridge bulk transfer.



6.1.3. Reduction in Household Demand

Reducing the demand for water and household consumption is a core area of focus for the WRMP and associated stress testing. This is due to the number of uncertainties surrounding the growing risk of severe drought conditions arising in England and Wales.

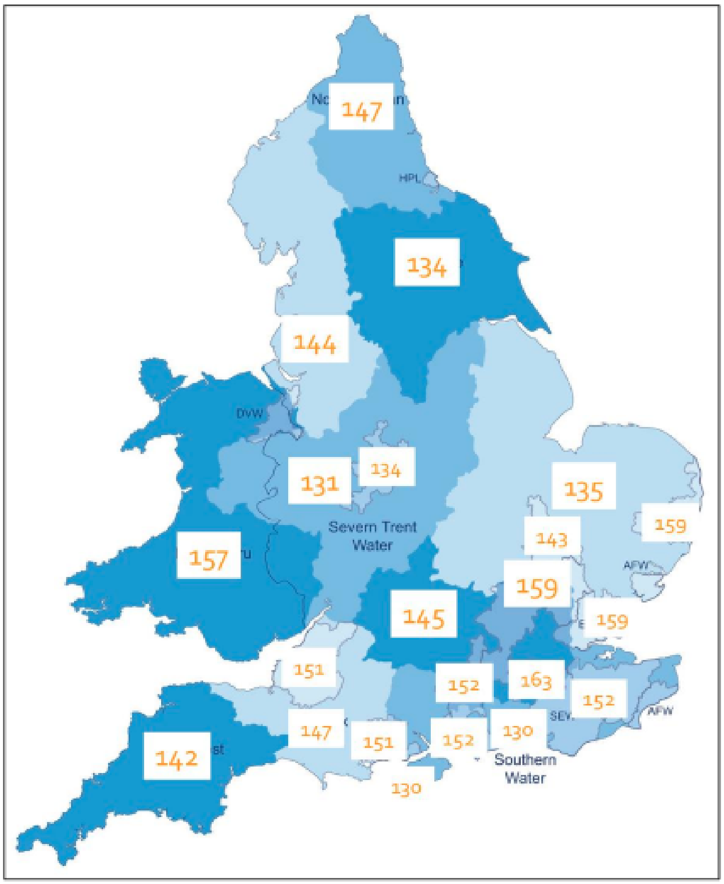
As mentioned in section 4.2, Artesia in conjunction with Water UK published a report titled ‘Pathways to Long-term PCC reduction’ in 2019 which detailed the variables between water companies across different regions of England and Wales and the potential for making significant reductions in household water consumption. The VWPL network is situated within an area of the country that records PCC between 147 and 151 l/h/d.

The report concluded that there was high geographical variation in PCC around England and Wales (Figure 18) and the likely cause of this variation is due to a range of factors including:

- Occupancy rate within the water supply network;
- Age of occupants;

- Types of property present within the water supply network;
- Socio-demographic factors, including social status, level of affluence, culture, religion, lifestyle and household or individual value towards water consumption.
- The level of metering present within households in the water supply network; and
- The effects of the weather.

Figure 18 - Regional variations of PCC across varying water supply companies within England and Wales (Artesia, 2019)



The modelled scenarios explored by Artesia and Water UK cover a range of potential outcomes as well as highlighting the relative roles of water companies and government in delivering the interventions required to reduce household consumption.

Table 7- Water UK Scenarios

Scenario	Intervention Name	Scenario Should Be Undertaken By	Implementation Date
Extended	Progressive smart metering with voluntary switching	Water Company	2025 to 2031
	Increased media campaigns and school education		
	Leaky loo find and fix		

Enhanced-01	Mandatory water labelling with no minimum standards	Government	2021
Enhanced-02	Progressive smart metering with voluntary switching	Water Company	2025 to 2031
	Innovative tariffs		2031
	Target assisted audits		2025 to 2031
	Community wastewater recycling	Other	2021
	Increased media campaigns and school education	Water Company	2025 to 2031
Water Labelling Only	Mandatory water labelling with minimum standards	Government	2021
Enhanced-03	Progressive smart metering with voluntary switching	Water Company	2025 to 2031
	Mandatory water labelling with minimum standards	Government	2021
Enhanced-04	Progressive smart metering with auto switching (compulsory)	Water Company/ Government	2025 to 2031
	Innovative tariffs	Water company	2031
	Target assisted audits	Water Company	2025 to 2031
	Leaky loo find and fix	Water Company	2025 to 2031
	Mandatory water labelling with no minimum standards	Government	2021
	Community wastewater recycling	Other	2021
	Increased media campaigns and school education	Water Company	2025 to 2031

Figures 19 show the scenarios modelled by Artesia and Water UK and the PCC values that could be achieved within the wider water industry in accordance with each of the scenarios referenced in Table 7.

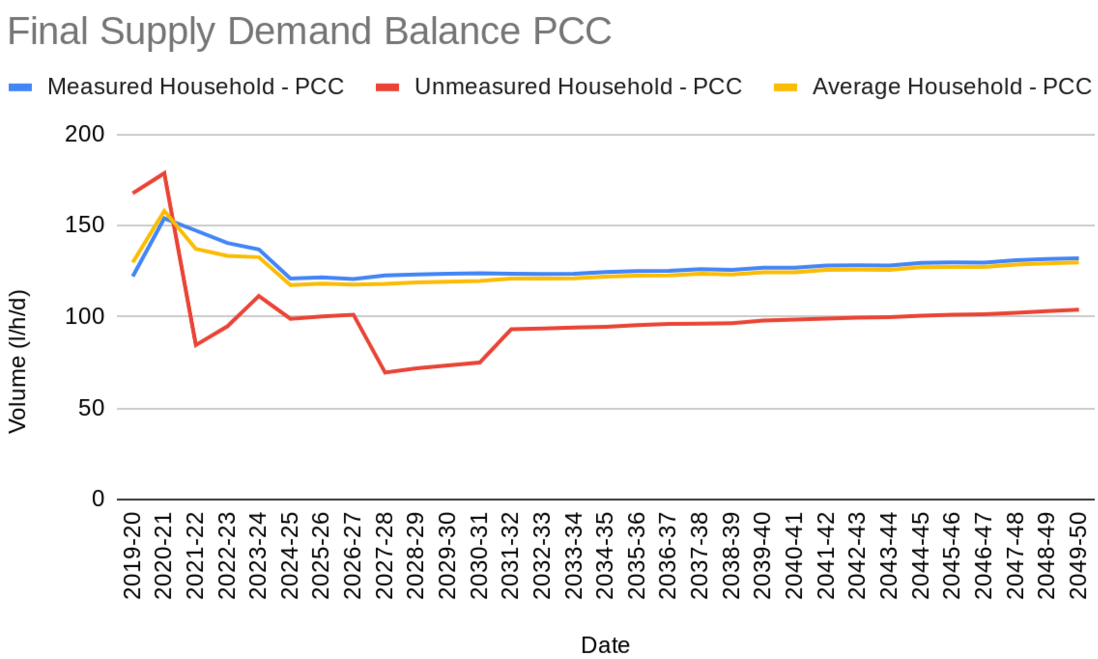
Figure 19- The modelled PCC data by Artesia and Water UK for the six scenarios.

	PCC (l/head/day)				
Scenario	04/2021	04/2025	04/2035	04/2045	04/2065
Current ambition	137.7	132.1	124.0	119.4	114.2
Extended	137.7	132.0	118.6	113.6	107.3
Enhanced-01	137.7	130.6	114.9	106.4	101.2
Enhanced-02	137.7	129.9	114.0	109.0	107.1
Enhanced-03	137.7	128.9	101.4	88.1	81.9
Enhanced-04	137.7	127.0	99.0	91.6	86.6
Water labelling with minimum standards	137.1	128.9	105.0	92.2	86.9

VWPL has considered the extended modelling scenario most relevant to the Tidworth network and the model is shown in Figure 20. The Extended scenario will see household PCC reduce to approximately 113.6 l/h/d by 2045 while within the Tidworth network it is set to reduce to 127.4 l/h/d. This is mainly due to the fact that Service Family Accommodations represent more than 50% of the household population in Tidworth and have historically had a water consumption higher than the industry average - not having a financial incentive to drive their consumption down.

Without the support of government led schemes, VWPL will not be able to achieve the 100 pcc target.

Figure 20 - VWPL's modelled average household PCC



6.1.4. Large Outage

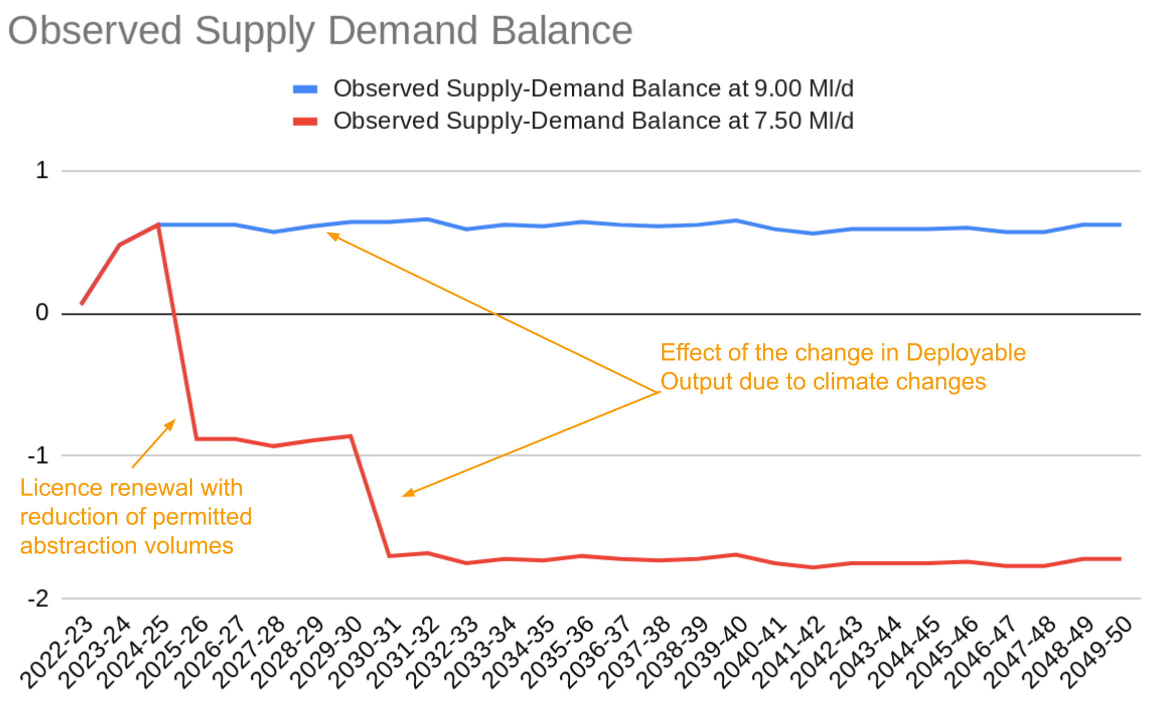
In Section 3.7, VWPL presented our outage allowance. This assessment was derived from a stochastic analysis of VWPL historical datasets. While this method is considered sufficient for successfully analysing smaller and more frequent outage events, it is considered less appropriate for understanding the impacts of larger source outages on VWPL's supply/demand balance.

As it is likely that the abstraction licence would be capped as part of the licence renewal (due in 2025) because of the sustainability concerns, the large outage assessment has been undertaken on both 9.00 Ml/d and a 7.50 Ml/d abstraction licence.

The outage model has been created using recent-actual Leckford Bridge bulk transfer and MoD consumption figures. Indeed if a large outage were to occur within the Tidworth network, VWPL would trigger the communication protocol and inform both organisations of the incident and any changes to planned service.

In order to assess the network's resilience to a large outage, VWPL has used a stress test scenario of losing one of the abstraction boreholes for approximately 3 months per year within the statutory planning period. The effects on Clarendon Reservoir of such an outage are shown in Figure 21 and reflect safety factors applied by VWPL within the initial assessment.

Figure 21 - The observed supply demand balance within a DYAA



The findings of the outage assessment show that under VWPL's current abstraction licence, the network continues to have a surplus supply and demand balance for the duration of the planning period. At VWPL current operating levels, the network is considered to be able to account for this level of outage as the reservoir storage has large volume capacities that can facilitate high levels of demand.

However, in the scenario where the abstraction licence would be capped at 7.50 Ml/d, the supply/demand balance is in deficit from 2025/26 and for the duration of the planning period. Therefore, if the licence is capped at 7.50 Ml/d, VWPL will need to review its emergency and contingency measures to mitigate this risk.

6.2. Baseline Supply Demand

In order to produce a baseline supply and demand balance for the planning tables, VWPL had to select a year to model. Within the WRMP19 cycle, there have been a number of unforeseen circumstances associated with COVID-19 pandemic which has heavily influenced water consumption within the Tidworth network. VWPL has therefore selected 2019/20 for the baseline year for the purpose of the assessment.

In accordance with the WRMP guidance, the baseline supply-demand forecast is based upon the responsiveness of the Tidworth network so that the planning table can adequately capture any system constraints and operational response. As VWPL abstract 100% of the supply water from groundwater sources, the baseline supply demand forecast includes the following:

- A deployable output for each source and any future changes to deployable output from sustainability changes; including long term environmental destination and from a changing climate. VWPL has produced two planning tables, one with an abstraction licence of 9.00 Ml/d and the other with a capped licence of 7.50 Ml/d.

- Existing bulk transfers where contractual agreements are already in place. VWPL has therefore included the Leckford Bridge bulk transfer within the baseline forecast. However, as discussed within section 3.3, two planning sheets have been produced, one accounting for recent actual figures and the other accounting for the maximum contractual agreement of 2.74 Ml/d.

- An outage allowance for short term losses of supply and source vulnerability as described in section 3.7.2.

- An allowance for any operational use of water or loss of water through the abstraction treatment process as described in section 3.6 .

- A leakage figure that will remain static from 2025/26 throughout the planning period. VWPL has calculated a leakage figure of 1.55 Ml/d from the revised OFWAT 2017/18 baseline (refer to Annex 5).

- The customer consumption forecast without accounting for any efficiency options or VWPL intervention.

- MoD consumption forecast with no efficiency options or VWPL intervention and the 1.3 safety factor applied.

- The forecast population growth within the WRZ.

- Changes in household size and property numbers without accounting for any efficiency options or VWPL intervention.

- Impact of climate change on customers' behaviour.

6.2.1. Baseline Supply and Demand for Current Abstraction Licence

Figures 22 and 23 show the baseline supply demand balance situation under VWPL current abstraction licence of 9.00 Ml/d for the DYAA and the DYCP scenarios respectively.

Figure 22 - Graph showing the baseline supply/demand balance for a dry year annual average.

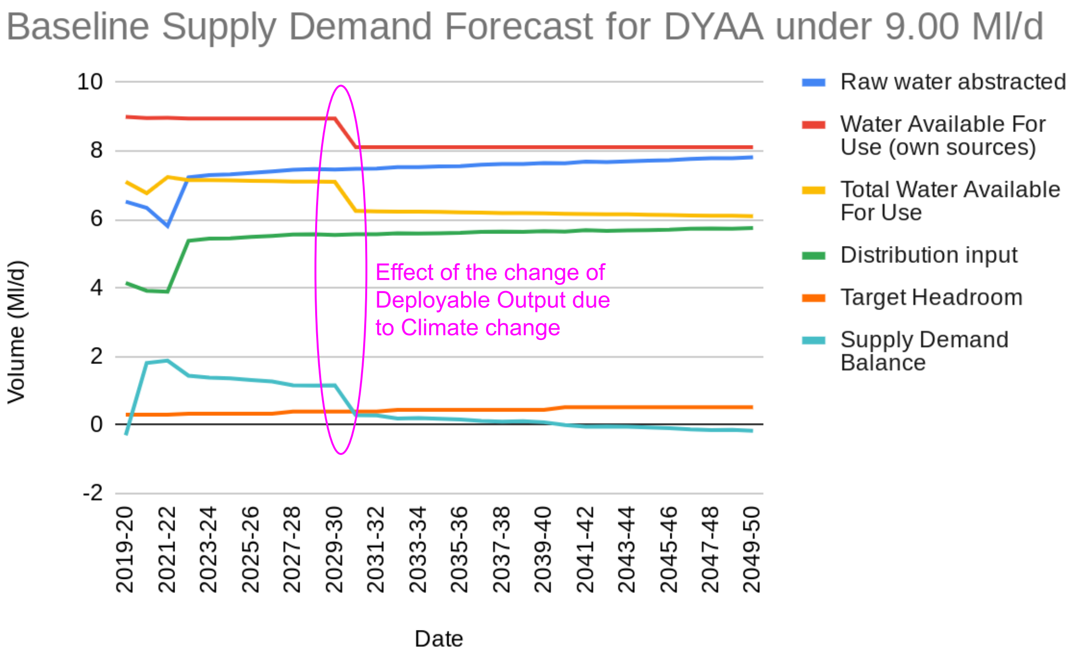
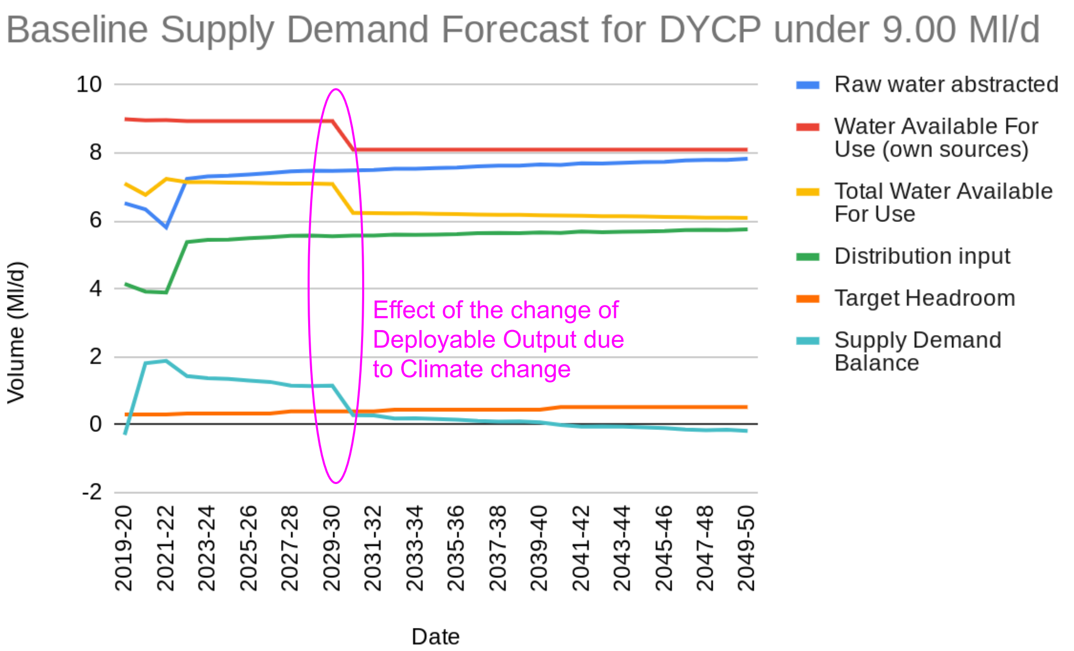


Figure 23 - Graph showing the baseline supply/demand balance for a dry year critical period.



The baseline supply demand balance under VWPLs current abstraction licence shows that when VWPL's supplies are low and the network demand is high, a deficit occurs from 2040/41 and is recorded as -0.05 Ml/d and -0.01 Ml/d for a DYAA and DYCP scenario respectively.

6.2.2. Baseline Supply and Demand for Capped Abstraction Licence

Figures 24 and 25 show the baseline supply demand balance for the DYAA and the DYCP conditions for the scenario where the VWPL abstraction licence would be capped at 7.50 Ml/d .

Figure 24 - Graph showing the baseline supply/demand balance for a dry year annual average.

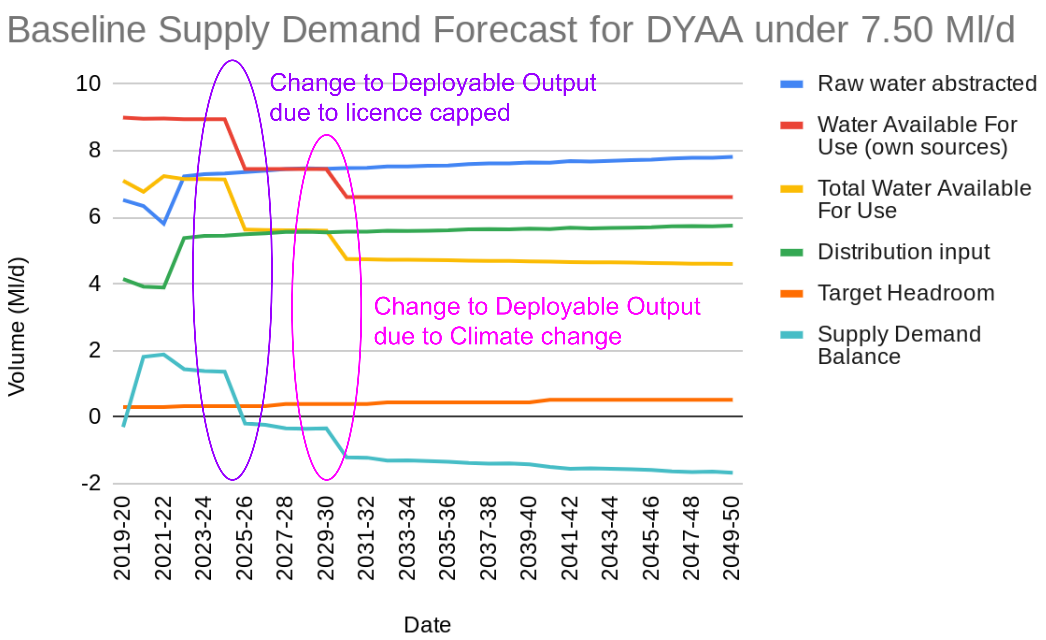
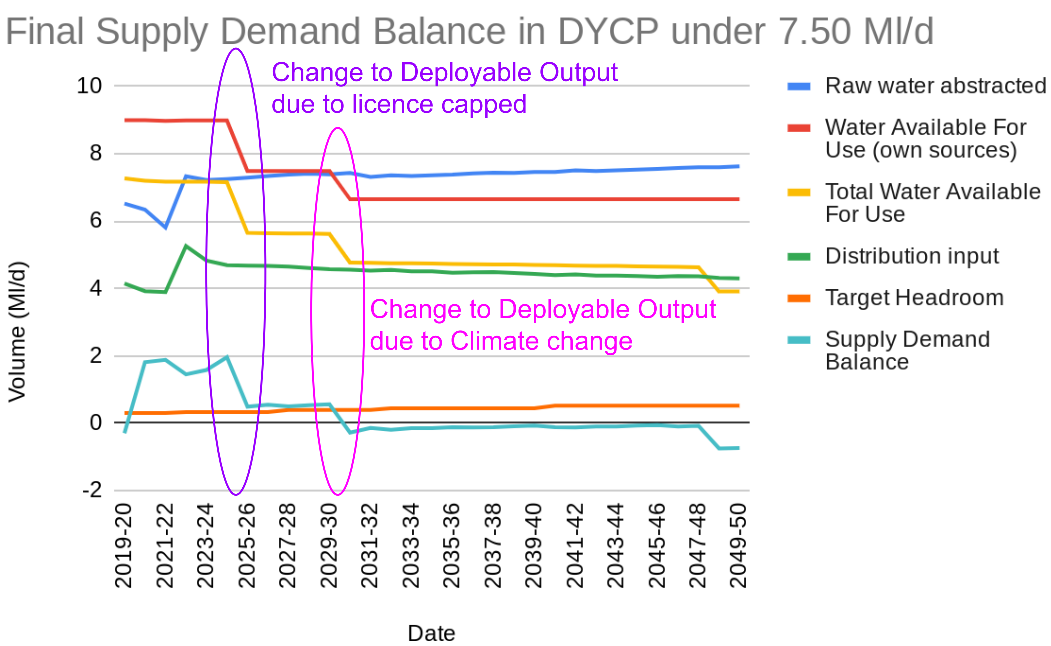


Figure 25 - Graph showing the baseline supply/demand balance for a dry year critical period.



The baseline supply demand for the scenario where the VWPL abstraction licence would be capped at 7.50 Ml/d shows that when VWPL's supplies are low and the network demand is high, a deficit occurs from 2025/26 and for the duration of the planning period and is recorded as -0.19 Ml/d and -0.17 Ml/d for a DYAA and DYCP scenario respectively.

6.3. Option Appraisal

The combination of VWPL supply, demand and headroom forecasts predicts that VWPL will have a deficit of supply resources versus demand within the WRMP24 planning period, so VWPL needs to produce a demand solution in order to reduce the supply/demand deficit. VWPL has therefore, in accordance with the aspirations and requirements of the Government, regulators for the wider water industry and other stakeholders, considered possible options that:

- Ensure the efficient use of water resources within the network.
- Help maintain the positive supply demand balance.
- Address government/regulatory expectations.
- Improve sustainability within the network.

The following requirements have been taken into consideration when preparing options for the network:

- Reduce the demand for water and household consumption, in the context of a growing risk of severe drought conditions arising in England and Wales, driving down the PCC to under 110 litres/head/day by 2050.
- Reduce leakage by 16% by 2030 and by 50% by 2050 against the baseline 2017/18 levels through the implementation of tighter leakage control measures.
- Plan resilience for a 1 in 500 year drought event by 2050, in the context of a growing risk of severe drought conditions arising in England and Wales,
- Complete environmental destination to protect the environment whilst delivering essential water services.

  Note: DEFRA and the EA have set out their expectations that water companies should take account of the objectives set out by the government and the EU Water Framework Directive. If applicable, any objectives stated within River Basin Management Plans should be consulted.

- Commit to Net Zero operational emissions by 2030

6.3.1. Unconstrained Options

The unconstrained options are generic in nature but could be reasonably used to assist with the following aspects of the WRMP:

- Help VWPL maintain and increase the positive supply/demand balance within the network.
- Achieve stakeholder and regulatory requirements and/or aspirations.

- Reduce overall leakage and water consumption within the network.
- Increase VWPL water and service efficiency.
- Improve resilience within the network.

The option types considered within the option exercise are listed below in Table 8 and mainly make reference to demand side activities. This is due to the limited size of the VWPL operated inset and the configuration of the supply system.

Some unconstrained options, which were listed within the WRMP19 plan, have also been included.

Table 8 - List of Unconstrained Options

Unconstrained Option	Comment
Reduce leakage by increasing the network renewal rate (main and service pipe)	This was initially discussed within the WRMP19 report. This option is considered to be feasible and is discussed in more detail in Table 9 and section 6.3.2
Reduce leakage by more active leakage controls	This was initially discussed within the WRMP19 report. VWPL has continued to integrate AMR data into its leakage model as AMR units have been deployed throughout the WRP19 cycle. VWPL has undertaken a thorough review of the assumptions used in our leakage calculations, including but not limited to metering data, property count, DMA configuration, network operation. This review has improved the accuracy of the leakage calculations. VWPL also appointed a Leakage Coordinator, responsible for leakage monitoring, targeting and leading resolutions on leakage issues. This option is considered to be feasible and is discussed in more detail in Table 9.
Leakage Benchmarking	This was initially discussed within the WRMP19 report. While the Linear Leakage Index (LLI) and Infrastructure Leakage Index (ILI) do have some benefit to VWPL and Veolia's internal reporting schemes due to the nature of the Tidworth contract and international water supply contracts held by Veolia. It is not considered compliant with the updated OFWAT guidance and as such is considered to represent an unconstrained option.
Reduce Leakage using an improved pressure management system	This was initially discussed within the WRMP19 report. This option is considered to be feasible and is discussed in more detail in Table 9 and section 6.3.2.
Climate change modelling	This was initially discussed within the WRMP19 report as the climate change modelling was not yet finished. This has now been completed and is presented in Annex 2 of the WRMP24. So this option is not considered further.
Universal metering within the network	This was initially discussed within the WRMP19 report, however, VWPL within the WRMP24 cycle has broken this down further into MoD metering and private regulated property metering.This option is considered to be feasible and is discussed in more detail in Table 9 and section 6.3.2
The universal metering of non-measured households within the wider network.	This was initially discussed within the WRMP19 report. This option is considered to be feasible and is discussed in more detail in Table 9 and section 6.3.2

Customer education and engagement on efficient water usage within the wider network.	This was initially discussed within the WRMP19 report. This option is considered to be feasible and is discussed in more detail in Table 9 and section 6.3.2
Offering Customers the option to undertake rainwater harvesting within their households.	This option is considered to be feasible and is discussed in more detail in Table 9 and section 6.3.2
The water consumption assessment criteria for non-measured households.	This option is considered to be feasible and is discussed in more detail in Table 9 and section 6.3.2
The renewal of the Leckford Bridge bulk transfer.	The Leckford Bridge bulk transfer was renewed and the new agreement is effective from April 1st, 2021. So this option is not considered further.
VWPL revoking the Leckford Bridge bulk export.	This was initially discussed within the WRMP19 report. This option is considered to be feasible and is discussed in more detail in Table 9 and section 6.3.2
Improving on reporting both internally and with third party regulators.	This was initially discussed within the WRMP19 report. The reporting has been improved within the WRMP19 cycle along with a wider engagement with regulators and stakeholders. Internally, VWPL holds regular meetings with key members of the operations to discuss regulatory changes and any factors that might influence daily operations within the network. So, this option is not considered further.
Updating the GIS database for the wider network to ensure reported leaks and other potential faults/outages can be located quicker.	During the WRMP19 cycle, the GIS database was improved significantly and GIS apps were created to report leakage and enable integrated data investigation. As such, this option is not considered further.
Asset and service permanence and risk	This was initially discussed within the WRMP19 report, however, this has been encapsulated within the Asset Management Register and is not considered further.
The improvement of the asset management audit process.	Within the WRMP19 cycle, the asset management audit and survey process was updated in accordance with ISO5500. The asset management reporting as discussed within Appendix 2 Section 5.7. As such, this option is not considered further.
INNS and Biodiversity	This option was discussed within the WRMP19 report, and as part of the AMP7 WINEP scheme, VWPL have implemented a range of biodiversity improvements as discussed within annex 4 of the WRMP24 report. As such, this option is not considered further.
The abandonment of the GAC at the water treatment centre	This option was discussed within the WRMP19 report due to some uncertainties surrounding the vulnerability assessment. However, the GACs located at the treatment centres within the network are considered to be critical for the disinfection producer that is governed by the DWI. As such, this option is not considered further.

6.3.2. Feasible Options

The unconstrained option list (Table 8) was subjected to a qualitative screening process where criteria such as terms of yield, technical difficulty and risk to environment were assessed to screen out options with a high level of uncertainty. The feasible option list was subsequently defined focussing on demand management options, particularly relating to:

- Network leakage management and reduction
- Enhanced metering within both civilian and MoD infrastructure within the network.
- Water efficiency services.
- Adjustment or revoking of the bulk potable water transfers.

The potential feasible options for the network have been summarised in Table 9 below.

Table 9- WRMP24 Feasible Options

Option Considered	Comment	Feasibility
The reduction of leakage by increasing the network renewal rate (main and service pipe)	This option would include VWPL installing new main and supply pipework within the wider network.	**Feasible** - While this option is feasible, it is not considered a preferred or financially viable option by VWPL. VWPL monitors and manages the network viaan integrated asset management system as discussed within Appendix 2 Section 5.7.
The reduction of leakage by implementing a better pressure management system within the network.	The average pressure within the Tidworth network is currently 49 m/h and is maintained by three pressure management systems. There is a potential opportunity to reduce the pressure to 40 m/h. This will help to reduce background leakage and subsequently reduce occurrences of burst mains within the network. However, as discussed in Appendix 5 - Section 6, the pressure within the network needs to remain high enough to sustain the requirements of the Crown Fire Fighting services of 20 l/s within the hydrants.	**Feasible** - While this option is feasible, it is not considered to be a preferred option by VWPL. VWPL's asset management team in accordance with daily clean water operations will undertake a pressure management review in specific areas of the network and confirm if this option can be moved forward.
Data consistency Leakage improvements	This option includes the installation and maintenance of District Metering Area (DMA) meters, the installation of more Automated Meter Reading (AMR) meters and the replacement of ferrule valves. In addition, this option will see VWPL maintaining their current working practice standard to leakage response which is discussed within annex 5. This option is likely to reduce leakage by approximately 5 to 35% through the duration of the planning period.	**Preferred** - This is considered to be a preferred option by VWPL and is discussed in more detail in section 6.3.3
The universal metering of the MoD Tidworth and Perham Down garrisons at the end of the PFI contract in 2023.	This option would include VWPL installing a number of meters within the Tidworth and Perham Down MoD garrisons to monitor water consumption and reduce excessive consumption. This option is likely to conserve 10% of the overall demand.	**Preferred** - This is considered to be a preferred option by VWPL and is discussed in more detail in section 6.3.3
The universal metering of the MoD SFAs within the wider network at the	This option would include VWPL installing a number of meters within non-measured MoD SFAs within the network. This will allow both the MOD and VWPL to monitor real usage	**Preferred** - This is considered to be a preferred option by VWPL and is discussed in more detail in section 6.3.3

end of the PFI contract in 2023.	figures in accordance with water consumption. This option is likely to conserve approximately 10% of the overall demand.	
The universal metering of non-measured households within the wider network.	Currently, approximately 84% of the households within the wider Tidworth network are metered. This is considered to reflect all properties that can easily have a meter installed and are not influenced by building constraints etc. Therefore, for the remaining properties, VWPL offers an opt-in type investment option within the network to install meters. The option would conserve water consumption within the region of approximately 0.05 Ml/d compared to the £206,000 GBP total network cost.	**Feasible** - While this option is feasible, it is not considered a preferred or financially viable option by VWPL due to the significant costs associated with the meter installation. As such, this will remain an ‘opt-in’ type investment.
The water consumption assessment criteria for non-measured households.	Where installing meters is not possible, VWPL assesses customer water usage using a questionnaire that details water consumption, including frequency of showers, usage of washing machine and other water using devices.	**Preferred** - This is considered to be a preferred option by VWPL and is discussed in more detail in section 6.3.3
Offering Customers the option to undertake rainwater harvesting within their households.	VWPL are considering launching a campaign to educate customers and the MoD on the benefits of undertaking rainwater harvesting within their properties. This includes the installation of VWPL provided water barrel/ butt type structures. It is likely that this option will save in the region of 0.001 Ml/d.	**Feasible -** This option is currently not listed as preferred, but it is likely to be implemented within the later stages of the reporting period.
Customer education and engagement on efficient water usage within the wider network.	VWPL has launched a campaign to educate and engage with the customers and the MoD on efficient water usage. This in turn will reduce overall customer consumption and save the customer money on their annual bills.This option is likely to save 10% on overall consumption.	**Preferred** - This is considered to be a preferred option by VWPL and is discussed in more detail in section 6.3.3
VWPL revoking the Leckford Bridge bulk export.	The Leckford Bridge bulk transfer represents approximately 15 to 30% of total consumption within the network. As such, this option would create additional supply for the VWPL operated inset and direct customers and help to reduce any potential impact on the wider environment, including the Nine Mile River.	**Feasible** -This is not a preferred option at this stage in development, however, it has been discussed in more detail in section 6.3.3 as there is a possibility that this bulk transfer could have to be revoked if the licence was capped.

6.3.3. Detailed Options Analysis of Feasible/ Preferred Options

Reducing overall demand within the network in both the short and long term can provide significant benefits to the local environment. A reduction in demand will lead to an overall reduction in groundwater abstraction, meaning more groundwater will remain within the environment to support local rivers and ecosystems.

The implementation of demand reducing options within the WRMP24 cycle should raise customers' awareness on how their water consumption directly impacts the local water environment and result in behavioural changes, and bring VWPL supply-demand balance back in surplus.

Also, reduced demand will provide VWPL with more resilience to climate change. While future climate projections are regularly updated by specialists and detail the potential impacts of a changing climate on water supplies, there are still a large number of uncertainties associated with the ever changing climate.

If VWPL are successful in reducing overall water demand within the network, then carbon emissions will also reduce and therefore reduce VWPL contribution to anthropogenic climate change. There are embedded carbon costs associated with abstracting, treating and pumping water to serve the demands of the VWPL network.

As stated within the West Country regional plan, demand within the south-west has been declining since the mid-1990s and it is of paramount importance that water companies in the south-west continue to aid this trend.

With the above in mind, preferred and feasible options have been assessed to determine its impact on either demand or supply, the environment and any wider benefits.

6.3.3.1. Preferred Option - Unmeasured Non-Household Consumption Assessment

Where installing a meter at a household property is not possible due to building constraints etc., VWPL customer services team issues to the customer a questionnaire asking for details on household consumption, such as number of people in the household, water consuming devices used in the household etc., in order to assess the household consumption of the property. This questionnaire is typically issued when the customer moves into the property or if the customer requests their situation to be re-assessed.

Moving forward, VWPL proposes to issue this questionnaire annually in March with the annual bills. The records will be used to assess any change in demand requirements and understand the potential sustainability issues generated from climate change.

Operational and Financial Impact

The implementation of this option would have limited/insignificant impact on VWPL's daily operations and financial performance.

6.3.3.2. Preferred Option - Water Efficiency and Behavioural Engagement

Educating customers and the MoD on more efficient water usage and on how a reduction in household demand can create positive impacts on the local environment surrounding Tidworth is essential. During the WRMP19 cycle, VWPL issued water saving documentation and had local workshops with the MOD to raise awareness.

VWPL also has offered tailored water audits to household properties with excessive water consumption. During these water audits, suitably qualified VWPL technicians will assess the water saving opportunities and provide free advice on how to implement them, as well as on how to spot a leak within a household and the importance of reporting it quickly. Not only does this help conserve water but it will also help create a behavioural change within VWPL customer base and help households save money on their annual bills.

In the WRMP24 cycle, VWPL proposes to extend its water saving campaigns to a wider audience and further develop the water audits service to a wider range of customers, including SFAs and any customers looking at reducing their water consumption. Water efficiency packages will be developed including literature on how to conserve water and any potential water saving household devices - such as showerheads with flow regulators, shower timers/tooth brushing timers, flow aerating tap inserts, and dual flush stickers, that are deemed suitable by VWPL for the household.

By 2030/31, VWPL aims to deliver 100 water audits annually rising to approximately 150 home visits per year in 2037/38.

Operational and Financial Impact

The implementation of this option would have limited impact on VWPL's daily operations and capital investments. The total cost for the option is likely to be £50,000 GBP for the WRMP period.

This cost figure includes time taken for a VWPL technician to attend the property and carry out the house visits and if required issue the water efficiency package.

6.3.3.3. Preferred Option - Metering of the MOD garrisons

In March 2023, the PFI contract will expire and the Tidworth and Perham Down garrisons will enter the non-household market. So there will be a requirement for VWPL to be able to accurately measure water consumption for these garrisons.

VWPL has commissioned an AMR metering project. 20 metering points in Tidworth and 8 in Perham Down have been identified, surveyed and selected. The meter installation should be completed and the data integrated in the VWPL system in 2023/24.

Operational and Financial Impact

The implementation of this option would have a limited impact on VWPLs daily operations with an estimated total cost of £150K.

6.3.3.4. Preferred Option - Universal metering for Service Family Accommodations

In March 2023, the PFI contract will expire and the PFI Service Family Accommodations (SFA) will become household regulated customers. Currently, it is assumed that approximately 70 to 80% of the SFAs are metered.

VWPL is planning to propose a metering campaign for the unmetered properties. This will enable both the MoD and VWPL to understand water consumption within SFAs in more detail and drive down consumption.

VWPL anticipates that this option will be fully implemented within the network by 2030/31, and achieve an approximately 0.10 Ml/d water demand saving.

Operational and Financial Impact

The implementation of this option would have a limited impact on VWPL's daily operations but an estimated total cost of £80K.

6.3.3.5. Feasible Option - Revoking of Leckford Bridge Bulk Transfer

As discussed in Annex 4, there is growing concern from regulatory bodies of potential risk of deterioration of the water bodies and ecosystems within the wider Wessex Basin resulting from groundwater abstraction activities. This risk was investigated under the AMP7 Hampshire Upper Avon investigation and a flow deficit of 0.42Ml/d was recorded for the Nine Mile River with VWPL apportionment being approximately 0.14Ml/d.

As part of its PR19 WINEP AMP7 investigation, VWPL completed an option appraisal which highlighted that a capping of the current licence to recent actuals would not be sufficient to address the flow deficit hence additional measures would be required.

In that context, revoking the Leckford Bridge bulk transfer to Wessex Water had to be considered even if it does not represent a preferred option for VWPL.

As presented in section 6.1.2, revoking the bulk transfer would provide 0.14 Mld flow gain on the Nine Mile River (once combined with the capping of the licence), addressing VWPL proportion of the Nine Mile River flow deficit. Also this option would provide significant demand savings by reducing the water supply requirements by 2.00 Ml/d* on average.

This option is not a preferred option and would require further review and engagement between VWPL and Wessex Water before being considered for implementation. VWPL expects this to be carried out as part of the abstraction licence renewal process in 2025.

Operational and Financial Impact

Revoking the Leckford Bridge bulk transfer would have a limited impact on VWPL's daily operations and capital investment. However, it would significantly impact the VWPL Tidworth inset revenue as it would result in a significant reduction in regulated revenue and ultimately impact VWPL's ability to operate.

In addition, Wessex Water would either have to source a new bulk transfer or rehabilitate their Leckford Bridge abstraction borehole that has not been operated for many years due to water quality issues at the source.

VWPL anticipates that this option would take at least five years to implement, considering factors such as capital upgrades that Wessex Water might need to implement.

6.3.4. Environmental screening of preferred options

6.3.4.1. Strategic Environmental Assessment and Habitats Regulations Assessment

VWPL final planning scenarios consist of demand management schemes, including the revoking of a bulk potable water transfer, metering and water efficiency measures. These options will not result in any new development or water abstraction schemes and will largely be implemented within urban MoD areas of the network. Therefore, it is considered that these options will not have a significant impact on the wider environment or on the integrity of European sites. As such, VWPL concluded that a Strategic Environmental Assessment (SEA) would not be required for the options.

6.4. Final Supply-Demand Balance

The final supply demand balance takes into account the potential savings generated by the preferred options described within section 6.3 and how this influences the overall network.

6.4.1. Final Household Consumption and PCC

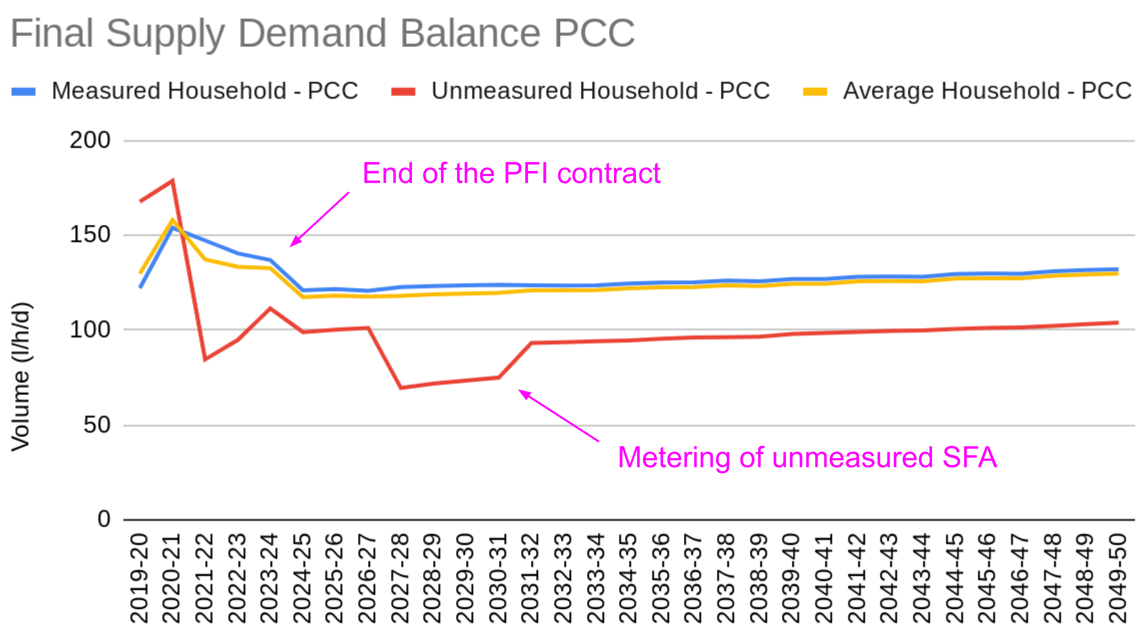
The average household PCC forecast in the baseline supply-demand balance at 2049/50 was 128.7 l/h/d, exceeding significantly the 110 l/h/d regulatory target. Therefore, as discussed in section 6.3, VWPL considered a number of options that would enable reduced demand within the catchment. The demand management options included:

- Universal metering of MoD Tidworth and Perham down garrisons at the end of the PFI contract. This option would save approximately 10% of overall MoD/measured non-household demand within the network.
- Universal metering of PFI Service Family Accommodations (SFAs) at the end of the PFI contract. This option would save approximately 10% of overall SFA measured household demand within the network.
- Periodic validation of consumption assessment for the properties that cannot be metered due to building constraints etc. This will enable VWPL to ensure that the consumption allowances for these properties are appropriate.
- Customer education and engagement on efficient water consumption within the network. This option would save approximately 10% of total demand, including household and non-household within the network.

Also, in accordance with the Water Industry Act 1991, all new properties have to be metered and VWPL Developer Services Department ensures that this is followed.

The final PCC figures for the Tidworth network are presented in Figure 29.

Figure 29 - The final supply demand balance PCC



The final supply/demand balance PCC figure at 2049/50 will be similar to the baseline and will exceed the regulatory target of 110 l/h/d. The failure to achieve the PCC target despite the inclusion of the demand management options is mainly due to the fact that it assumed no government led scheme to support further water consumption reduction and that Service Family Accommodations represent more than 50% of the household population in Tidworth and have historically had a water consumption higher than the industry average - not having a financial incentive to drive their consumption down.

In order to reduce PCC to the regulatory target of 110 l/h/d, VWPL will work in conjunction with the MoD and civilians throughout the duration of the WRMP24 cycle to see what further mitigation measures can easily be implemented within the network.

VWPL will update regulatory bodies, including the EA of all recorded PCC trends within the network in the annual regulatory returns.

6.4.2. MoD Consumption

MoD consumption accounts for approximately 40 to 50% of the demand and customer connections within the Tidworth and the level of consumption has traditionally been difficult for VWPL to forecast.

As discussed in section 6.3 of this annex, at the end of the PFI a metering programme of the water supply into Tidworth and Perham Down garrisons will be implemented. This will enable both the MoD and VWPL to monitor and utilise real-time consumption figures to validate the demand figures.

In the meantime, for the final supply/demand balance, MoD consumption has been predicted using the equation referenced in section 4.2.2. Those assumptions might appear to be relatively high because the predicted figures account for the military uncertainty factor, including activities that are unique to the garrisons, such as armoured vehicle wash downs and the presence of additional military personnel on exercise.

VWPL acknowledges that there is the potential for MoD consumption to reduce once the metering scheme is completed within the Tidworth and Perham Down Garrisons. Due to the uncertainty surrounding MoD activities within the network, VWPL are unable to provide further comment at this stage of the planning.

6.4.3. Leakage reduction

Reducing leakage and the implementation of tighter leakage control measures is essential to achieve regulatory leakage reduction targets.

As discussed with Annex 5 of this WRMP report, the OFWAT leakage reduction targets for the Tidworth network are 1.16 Ml/d for 2025 and 0.69 Ml/d for 2050. The predicted leakage figure for the network for 2049/50 was 1.55 Ml/d, which significantly exceeds the reduction targets. Therefore, VWPL considered a number of options, as discussed within section 6.3, that would help reduce demand within the network. The leakage management options included:

- Continuous asset management of the network. This option will help to reduce leakage by approximately 5%.
- Improvement of the accuracy of the leakage data. This option will help to reduce leakage by approximately 5 to 35% within the network.
- The universal metering of the MoD garrison and the SFAs within the network. This option will help to reduce leakage by approximately 5 to 15%.

The predicted final leakage figure for the Tidworth network for 2025 is 1.08 Ml/d against a OFWAT leakage reduction target of 1.16 Ml/d; and 0.55 Ml/d for 2049/50 against a OFWAT leakage reduction target of 0.69 Ml/d. As such, VWPL will be compliant with the OFWAT new performance commitments.

6.4.4. Final supply/demand balance (Current Abstraction Licence)

VWPL's final planning dry year annual average supply/demand balance under VWPL current abstraction licence of 9.00 Ml/d is shown in Figure 32 and Table 11. The final supply/demand balance under both DYAA and DYCP scenarios for the Tidworth network has predicted a surplus over the planning period decreasing from 2.12 Ml/d in 2025/26 to 1.28 Ml/d in 2049/50.

Figure 32 - Graph of the Final Supply and Demand Balance for DYAA with current abstraction licence.

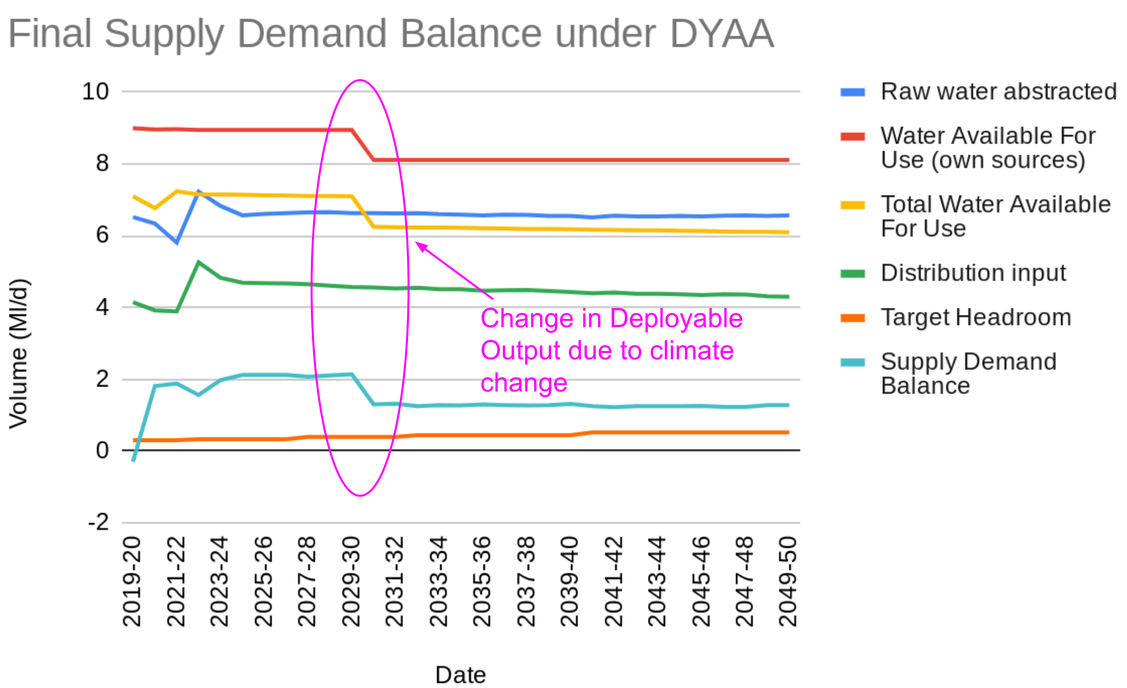


Table 11 - Table showing the final supply-demand balance for DYAA with current abstraction licence.

	2022-23	2023-24	2024-25	2025-26	2035-36	2036-37	2044-45	2045-46	2048-49	2049-50
Raw water abstracted (Ml/d)	7.23	6.83	6.57	6.61	6.57	6.59	6.55	6.54	6.55	6.57
Water Available For Use (own sources) (Ml/d)	8.95	8.95	8.95	8.95	8.11	8.11	8.11	8.11	8.11	8.11
Total Water Available For Use (Ml/d)	7.15	7.15	7.14	7.13	6.21	6.2	6.14	6.13	6.11	6.1
Distribution Input (Ml/d)	5.26	4.83	4.69	4.68	4.47	4.48	4.37	4.35	4.31	4.3
Target Headroom (Ml/d)	0.33	0.33	0.33	0.33	0.44	0.44	0.52	0.52	0.52	0.52
Supply Demand Balance (Ml/d)	1.56	1.98	2.12	2.12	1.3	1.28	1.25	1.26	1.28	1.28

VWPL's final planning dry year critical period supply-demand balance under VWPL current abstraction licence of 9.00 Ml/d is shown in Figure 33 and Table 12. The final supply/demand balance under a DYCP scenario for the Tidworth network has predicted a surplus decreasing over the planning period from 2.11 Ml/d in 2025/26 to 1.27 Ml/d in 2049/50.

Figure 33 - Graph of the Final Supply and Demand Balance for DYCP with current abstraction licence.

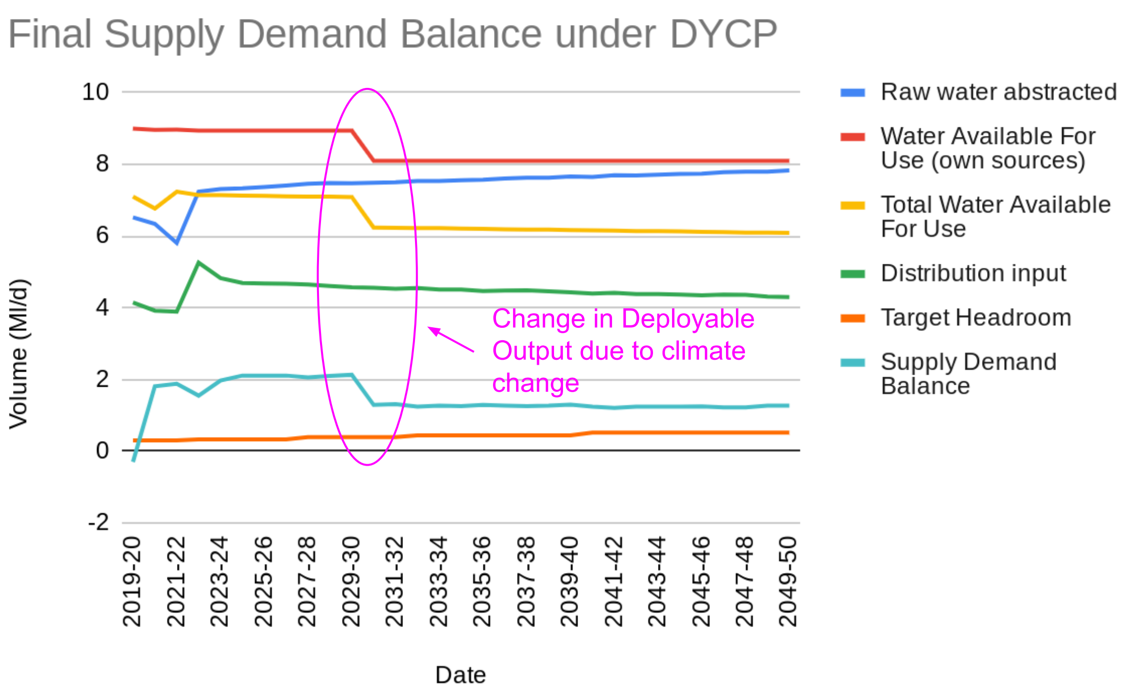


Table 12- Table showing the final supply-demand balance for DYCP with current abstraction licence.

	2022-23	2023-24	2024-25	2025-26	2035-36	2036-37	2044-45	2045-46	2048-49	2049-50
Raw water abstracted (Ml/d)	7.24	7.31	7.33	7.37	7.57	7.61	7.73	7.74	7.8	7.83
Water Available For Use (own sources) (Ml/d)	8.94	8.94	8.94	8.94	8.1	8.1	8.1	8.1	8.1	8.1
Total Water Available For Use (Ml/d)	7.14	7.14	7.13	7.12	6.2	6.19	6.13	6.12	6.1	6.09
Distribution Input (Ml/d)	5.26	4.83	4.69	4.68	4.47	4.48	4.37	4.35	4.31	4.3
Target Headroom (Ml/d)	0.33	0.33	0.33	0.33	0.44	0.44	0.52	0.52	0.52	0.52
Supply Demand Balance (Ml/d)	1.55	1.97	2.11	2.11	1.29	1.27	1.24	1.25	1.27	1.27

6.4.5. Final supply-demand balance (Capped Abstraction Licence)

VWPL's final planning dry year annual average supply-demand balance under a reduced abstraction licence of 7.5 Ml/d* is shown in Figure 34 and Table 13. The final supply/demand balance under both DYAA and DYCP scenarios for the Tidworth network has predicted a surplus over the beginning of the planning period and a deficit from 2029/30.

Therefore VWPL will investigate and engage further with the relevant stakeholders on alternative options (such as revoking the Leckford Bridgebulk supply agreement). This will be done as part of the licence renewal process due in 2025. VWPL will also have the opportunity to revalidate the MOD demand, before the issue of the final WRMP24, once the metering project is completed.

**Note: This figure is yet to be agreed with the EA and as a result might change in the final version of the WRMP.*

Figure 34 - Graph of the Final Supply and Demand Balance for DYAA with a reduced abstraction licence.

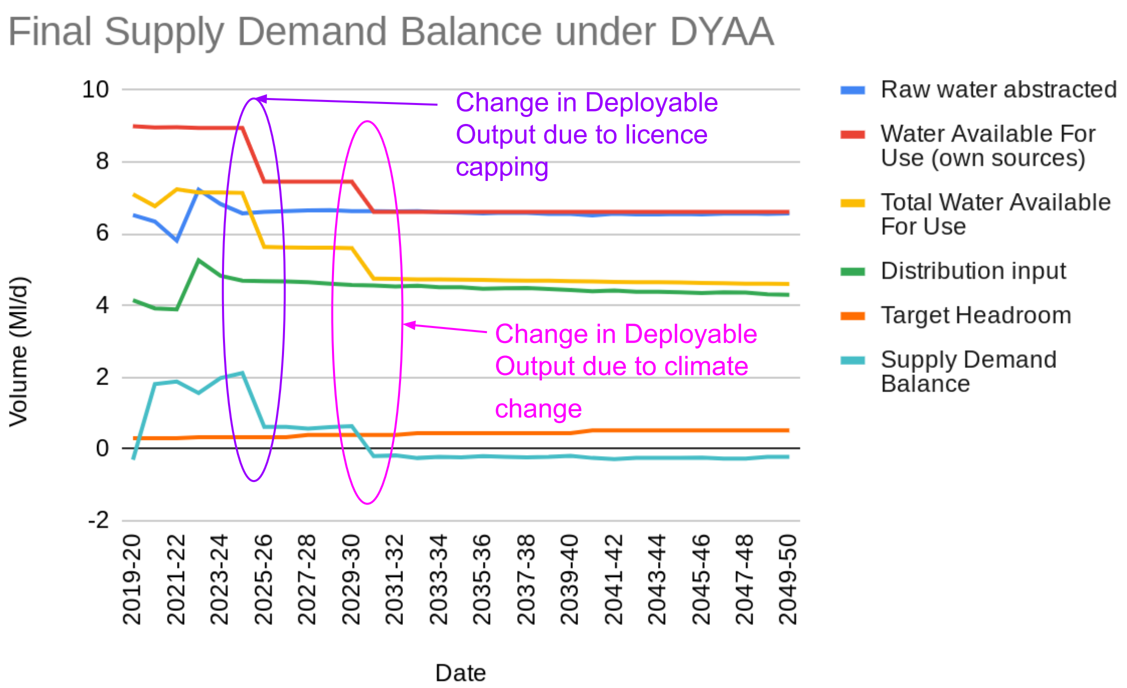


Table 13 - Table showing the final supply-demand balance for DYAA with a reduced abstraction licence

	2022-23	2023-24	2024-25	2025-26	2034-35	2035-36	2043-44	2044-45	2048-49	2049-50
Raw water abstracted (Ml/d)	7.23	6.83	6.57	6.61	6.59	6.57	6.54	6.55	6.55	6.57
Water Available For Use (own sources) (Ml/d)	8.95	8.95	8.95	7.45	6.61	6.61	6.61	6.61	6.61	6.61
Total Water Available For Use (Ml/d)	7.15	7.15	7.14	5.63	4.72	4.71	4.65	4.64	4.61	4.6
Distribution Input (Ml/d)	5.26	4.83	4.69	4.68	4.51	4.47	4.38	4.37	4.31	4.3
Target Headroom (Ml/d)	0.33	0.33	0.33	0.33	0.44	0.44	0.52	0.52	0.52	0.52
Supply Demand Balance (Ml/d)	1.56	1.98	2.12	0.62	-0.23	-0.2	-0.25	-0.25	-0.22	-0.22

Figure 35 - Graph of the Final Supply and Demand Balance for DYCP with a reduced abstraction licence.

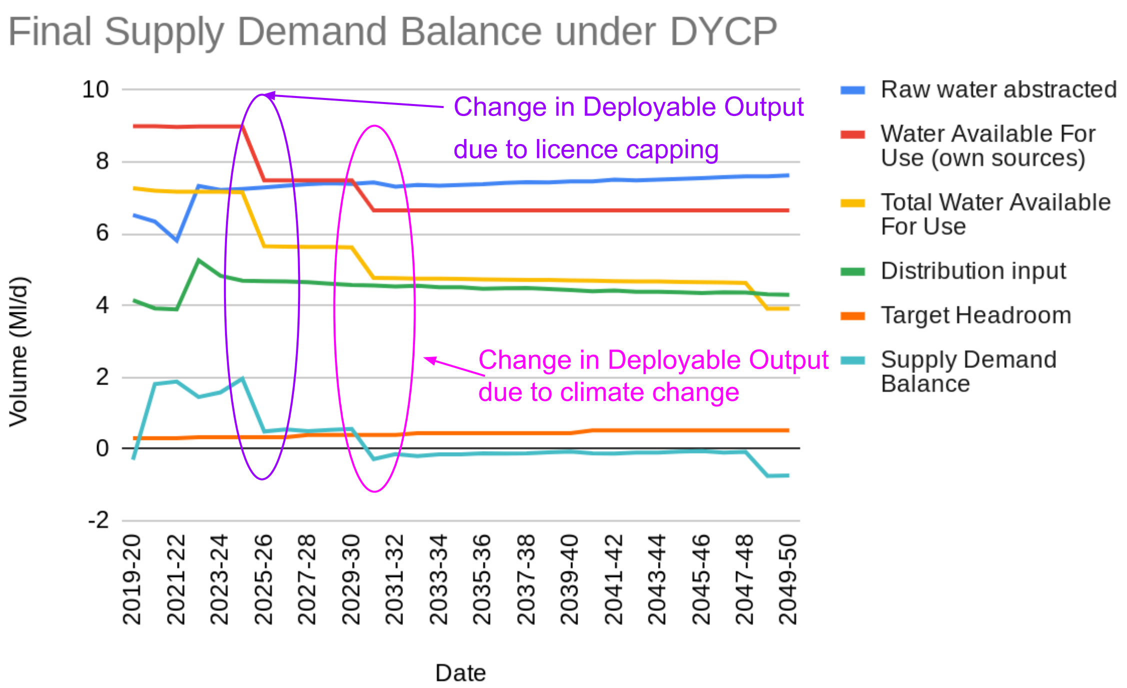


Table 14 - Table showing the final supply-demand balance for DYAA with a reduced abstraction licence

	2022-23	2023-24	2024-25	2025-26	2034-35	2035-36	2043-44	2044-45	2048-49	2049-50
Raw water abstracted (Ml/d)	7.33	7.22	7.25	7.29	7.36	7.38	7.51	7.53	7.6	7.63
Water Available For Use (own sources) (Ml/d)	8.99	8.99	8.99	7.49	6.65	6.65	6.65	6.65	6.65	6.65
Total Water Available For Use (Ml/d)	7.17	7.17	7.16	5.65	4.74	4.73	4.67	4.66	3.91	3.91
Distribution Input (Ml/d)	5.26	4.83	4.69	4.68	4.51	4.47	4.38	4.37	4.31	4.3
Target Headroom (Ml/d)	0.33	0.33	0.33	0.33	0.44	0.44	0.52	0.52	0.52	0.52
Supply Demand Balance (Ml/d)	1.45	1.58	1.96	0.49	-0.15	-0.12	-0.1	-0.07	-0.75	-0.74

Given the high likelihood of its current abstraction being capped and the forecast deficit by under a capped abstraction licence at 7.50 Ml/d, before the issue of the final WRMP, VWPL is planning:

- Continue engaging with the EA to confirm the actual capped volumes.

- Confirm the MOD consumption requirements once the metering will be in place.
- Review and confirm with Wessex Water the Leckford Bridge water supply requirements if the licence were to be capped.
- Investigate further the ability to reduce household pcc to the 100 l/h/d target.

7. Changes Between the WRMP19 and WRMP24

VWPL undertook a comparison between the findings of the WRMP19 and WRMP24. The comparison shows the following:

Household demand is higher than the consumption levels VWPL predicted within the WRMP19. The WRMP19 planning tables predicted that the average household PCC would reduce to 112 l/h/d by 2025/26 and the level would be sustained for the duration of the WRMP19 planning period until 2045.

However, as part of the planning process for the WRMP24, VWPL updated the average household PCC predictions in accordance with recent-actual figures and any upcoming changes that could influence the prediction, including the termination of the PFI contract.

Leakage volume is higher than the predicted levels within the WRMP19. The WRMP19 planning tables predicted that the leakage volume within the Tidworth network would be 0.58 Ml/d by 2025/26. However, these predicted leakage figures were calculated from the annual return reporting figure of 0.32 Ml/d in 2018/19. This low leakage figure of 0.32 Ml/d is not considered to be representative of the network. Therefore, as part of the planning process for the WRMP24, VWPL revised the leakage volume predictions.

There is a change in leakage reporting between the WRMP19 and WRMP24 reporting cycles. During the preparation work of the WRMP24, VWPL identified that the current version (23) of Netbase, Crowder & Co Ltd software used by VWPL was not fully compliant with the most recent OFWAT leakage reporting guidance.

Therefore, VWPL commissioned Crowder & Co Ltd to assess the impact of updating the leakage reporting system to assure compliance as discussed in more detail within annex 5 of this WRMP report. The change in leakage reporting has shown a significant increase in leakage across the Tidworth network and is detailed within Annex 5 of this report.

Metering penetration is higher than planned. The number of properties suitable for meter installations under the change of occupier programme is higher than figures initially forecast within WRMP19. The WRMP19 forecast a metering penetration value of 85.47% in 2044/45, however, the revised assessment as part of the WRMP24, predicted this value to rise to 91.4% by 2049/50.