

VEOLIA WATER PROJECTS LIMITED

WATER RESOURCES MANAGEMENT PLAN

APPENDIX 5 – SUPPLY / DEMAND BALANCE

INTRODUCTION

The WRMP forecasts likely growth in demand and then determines if there is sufficient source water.

VWP produce an annual supply / demand return as part of the WRMP commentary. The accuracy of the data used in the supply / demand tables has improved significantly. These tables have been used to assist in predicting growth in demand until 2045.

The supply / demand planning table has been formatted in such a way that historic data can easily be compared with forecast data. The VWP Tidworth network has a significant number of ongoing new developments (both military and civilian). It is essential that actual demand growth can quickly be compared with forecast to provide early warning if additional investment in water sources, further effort in leakage control or demand management activities need to commence.

The current indication is that there is sufficient source water beyond 2045 assuming that boreholes 2, 3 and Chalkpit are capable of maintaining an output of 8 MI/d (current average group licence is 9 MI/d).

1 HISTORIC SUPPLY SITUATION

Row No.	DESCRIPTION	UNITS	DP	2012	2013	2014	2015	2016	2017	2018
	SUPPLY									
A	Resources									
1 _{AR}	Raw water abstracted	MI/d	2dp	5.52	5.49	5.45	5.52	5.59	5.94	6.29
2 _{AR}	Raw water imported	MI/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3 _{AR}	Potable water imported	MI/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4 _{AR}	Raw Water Losses and Operational Use	MI/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5 _{AR}	Raw water exported	MI/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.1 _{AR}	Non potable water supplied	MI/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6 _{AR}	Potable water exported	MI/d	2dp	1.66	1.66	1.66	1.67	1.68	1.62	1.75
7 _{AR}	Deployable output (submit data by exception)	MI/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B	Process Losses									
9 _{AR}	Treatment works losses and operational use (submit data by exception)	MI/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10 _{AR}	Outage experienced	MI/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.00

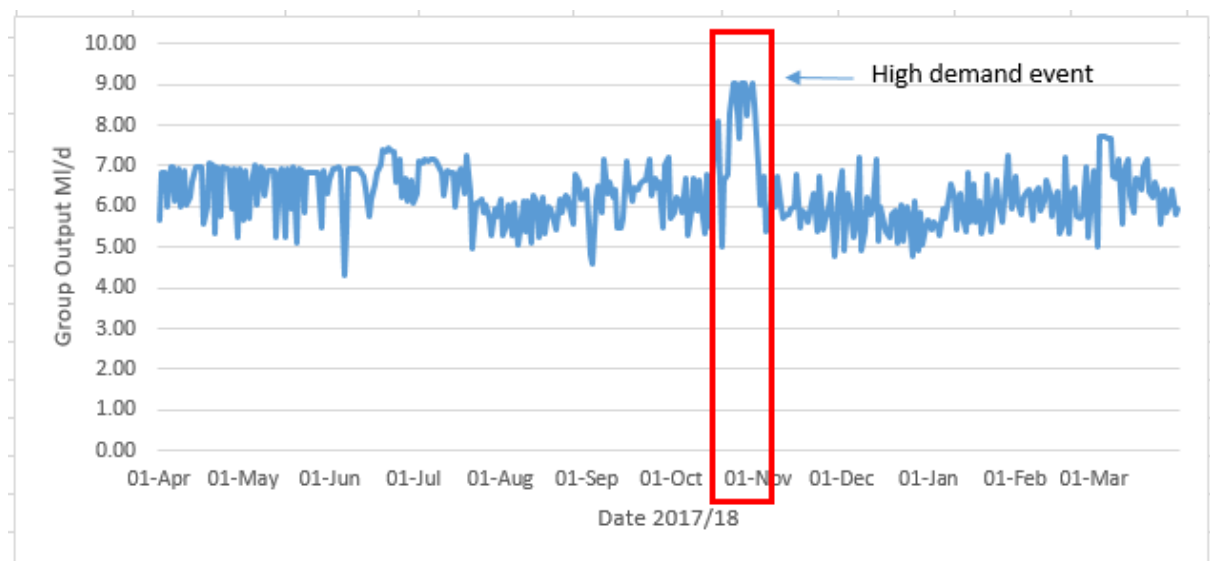
The supply situation has been stable from 2012 to 2016 with deployable output from the sources averaging approximately 5.4 MI/d. There are no losses due to the water treatment process, hence zero line entries.

However, there has been significant growth in 2017 and 2018 as new developments have been constructed.

Date	Tidworth No 2 Daily Flow	Chalkpit Daily Flow	Tidworth No 3 Daily Flow	Tidworth Group Daily Flow
<u>Output</u>				
Average	2.20	1.85	2.26	6.30
Peak Day	2.55	3.02	4.50	9.04
<u>Licence</u>				
Average	3.68	3.64	3.68	9.02
Peak Day	4.32	4.69	4.32	12

The average deployable output for 2018 was 6.3 MI/d, well within the average group licence of 9 MI/d.

Boreholes 2, 3 and Chalkpit have been proven to be able to supply up to 9 MI/d due to a high demand event. This event provided confidence in the boreholes meeting unusually high demands.



1.1 High Demand Event June 2017

There was an apparent high demand situation that occurred from 1st June to 19th June 2017 which corresponded with record breaking high temperatures. The deployable output of the boreholes was increased to 9 Ml/d in response to the observed increase in demand.

All customers received adequate supplies during the event with no need to implement the drought management plan. However lessons were learned from this event and have been incorporated into the drought plan.

A subsequent investigation revealed a number of reasons for this high demand event which are not attributed to normal environmental peak demand conditions:

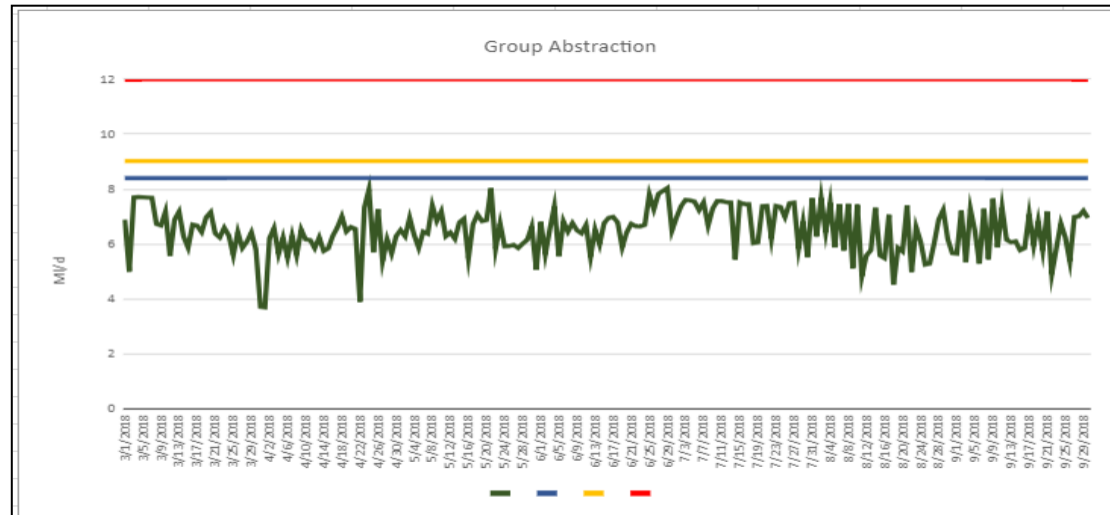
- Work had commenced on installing improved treatment facilities at Chalkpit and this impacted on the reliability of the output of the plant. This was resolved once the permanent treatment process was fully installed. Project work will not occur during periods of predicted high demand.
- Wessex Water took more water from the Leckford Bridge export than was being reported. Closer communications with Wessex Water have been organised to allow better management of the transfer of flow. Daily flow to Leckford Bridge is now being recorded.
- A 6 inch wheel valve was subsequently discovered to be fully open allowing in excess of 1 Ml/d of water to escape in an uncontrolled fashion to a vehicle washing facility within the military complex. All such valves have been locked to prevent unauthorised and wasteful operation.

Better monitoring of existing telemetry data will provide early warning of problems with reliability at Chalkpit, increased Leckford Bridge export and significant non-legitimate demand occurring within the military facility.

This event indicates that the existing sources are capable of meeting exceptional dry weather events and predicted growth in demand. The supply / demand balance will be closely monitored given the uncertainties associated with the Ministry of Defence usage that is embedded within the regulated water network.

1.2 Summer 2018

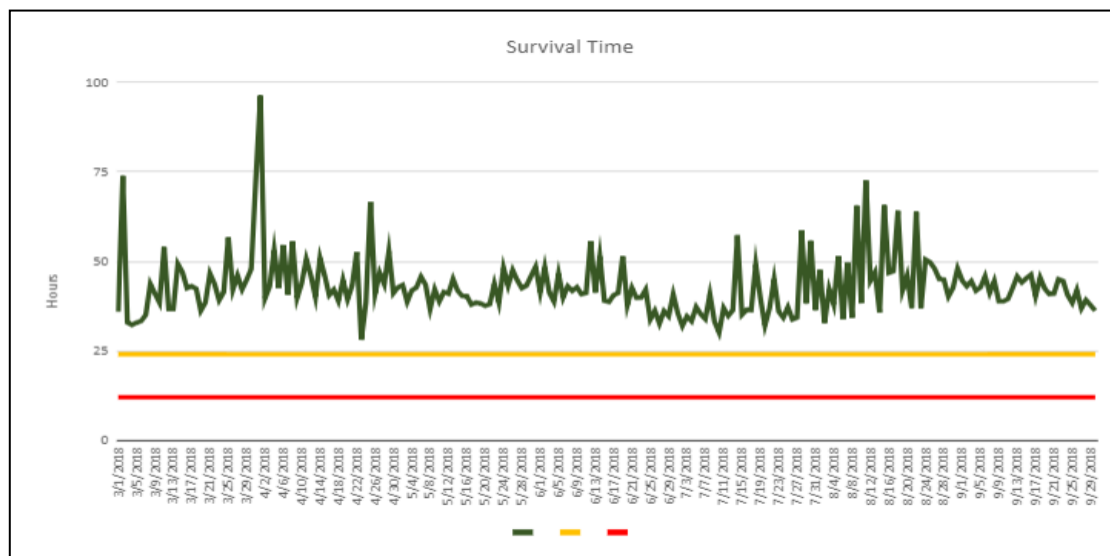
After the high demand event it was decided to implement improved monitoring of the network and this was in place prior to the high demand of 2018.



This indicated that the daily source output did not exceed any of the trigger points:

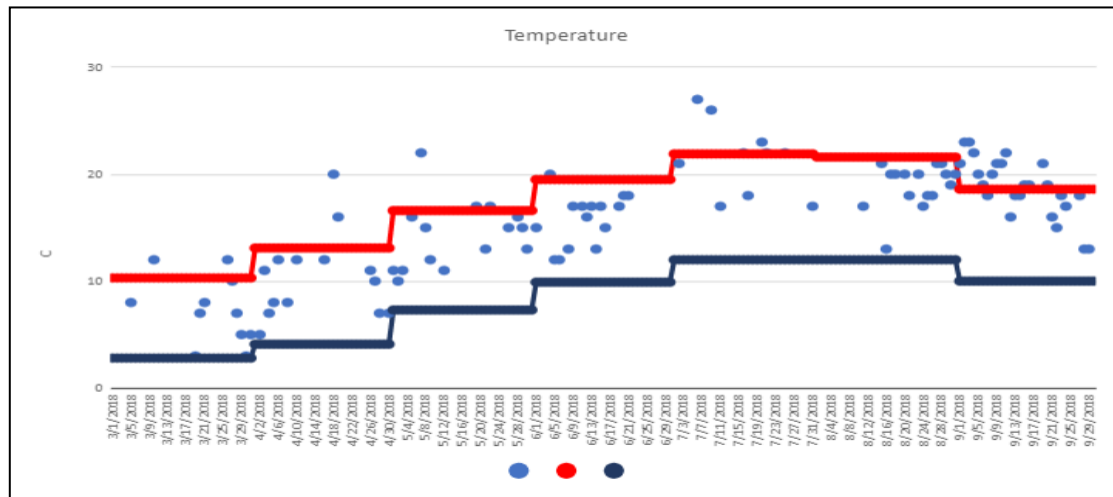
- Blue line indicates the theoretical point at which VWP could instruct Wessex Water to take less through the Leckford Bridge bulk supply.
- Orange line indicates the average group licence of the boreholes.
- Red line indicates the peak group licence of the boreholes.

Further there was considerably more than 24 hours (orange line) and 12 hours (red line) of storage throughout the 2018 summer period.

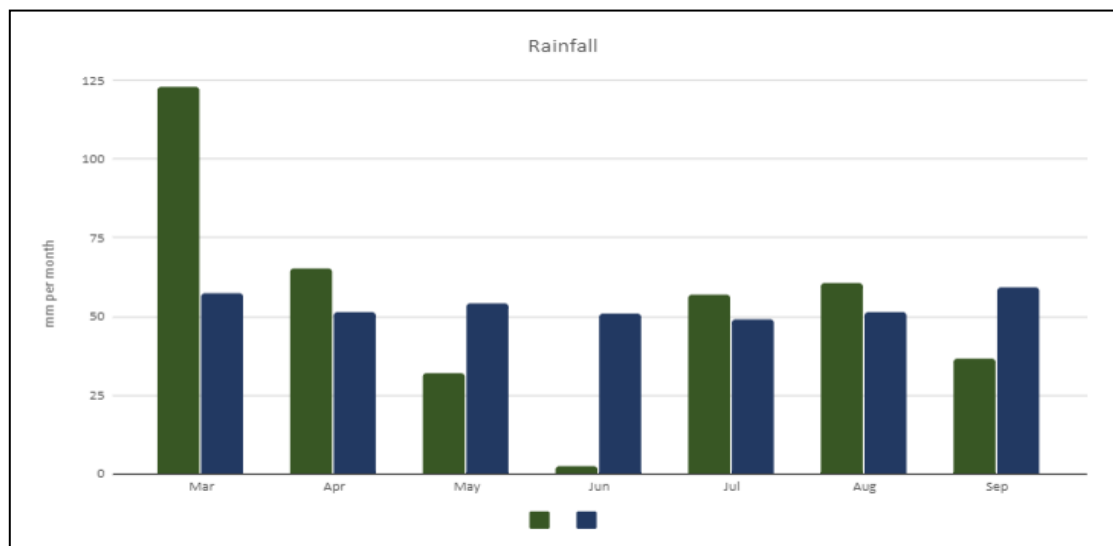


- Reliable production and sufficient reservoir storage was maintained throughout the summer of 2018. Ground water levels also remained high (refer to Appendix 2 – Resilience) even though there were elevated temperatures and long periods of low rainfall.

Temperature were regularly exceeding the normal monthly highs (red line):



Periods of very low rainfall when compared to monthly norms (blue is normal monthly rainfall while green is the observed rainfall).



1.3 Resilience of Supply

Although the source works are capable of a sustained output of 9 MI/d (as shown in section 1.1) and have met historic extreme weather events (refer to section 1.2) consideration will be given to improving resilience of supply.

The VWP Tidworth network is a single supply zone and there is therefore no backup supply from neighbouring zones. Further the supply / demand balance scenario 'LB 2.74 Table' indicates that should Wessex Water wish to import

2.74 MI/d from VWP via Leckford Bridge then there could be a supply / demand imbalance in 2034 / 35.

To address this VWP will:

As part of the Security Emergency Measures Directive (SEMD) consideration is being given to the installation of a connection that would allow the removal of single points of failure on the network.

Look to increase the output of BH2 and BH3 from 3 MI/d to 4 MI/d each. An assessment of the impact of increasing the output will be completed prior to the 2034 WRMP and will consider environmental impact (as part of planned ground water modelling), water quality by testing higher outputs from the sources and network constraints (through network modelling which is also planned).

1.4 Freeze – Thaw Event March 2018

During March 2018 there was a prolonged period of cold weather followed by a sudden thaw. Although background leakage increased this was rapidly brought back under control and the supply / demand balance remained favourable and high reservoir levels were maintained (refer to Appendix 2 – Resilience for further information).

1.5 Levels of Service

Zone	Situation	Impact to Customers	Probability	Historic Events
1	High Demand	No restrictions	1 in 5 years (20%)	0
2	2 years of High Demand	Proactive approach to water efficiency	1 in 10 years (10%)	0
3	Temporary Ban	Hosepipe Ban and Non-Essential Business Use	1 in 50 years (2%)	0
4	Drought Order	Possible rota-cuts in worst case scenario	1 in 200 years (0.5%)	0

Additional long term historic data is available which provides rainfall and British Geological Survey (BGS) borehole levels that correlate well with the observation borehole at Tidworth.

This provides data back to 1920 and climate change modelling has provided predictions up until 2091. This provides confidence that reliability of supply will be maintained in the long term (refer to Appendix 2 – Resilience for further information).

1.6 Imports

There are no imports to the VWP Tidworth network.

1.7 Exports (Leckford Bridge)

There is a significant export to Wessex Water at Leckford Bridge.

The Leckford Bridge Agreement (LBA) is an operating agreement dated 16th November 2006 between TWUL and WW endorsed by the MOD. It is a bulk supply agreement comprising a maximum volume of 3 MI per day with a maximum instantaneous flow equivalent to 36.5 litres per second, with a maximum take of no more than 1,000MI per year, giving an average value of 2.74MI/d. Key to any changes in this agreement revolve around a 'critical figure' agreed to be 5.4MI/d (as a daily peak) which VWP needs to be able to provide for its own customers.

If the peak daily demand exceeds this figure VWP can reduce the volume of this bulk transfer on a litre by litre basis (the day after WW receives notice of this occurring). This also applies if VWP has its licence reduced to a value below the critical figure.

Wessex Water did take a full entitlement during the high demand event of June 2017 but this was due to a burst main on their network.

For the purposes of the WRMP VWP and Wessex Water have assumed that the agreement (which was expected to terminate in 2022) will continue throughout the period of the Plan up until 2045.

Veolia will continue to provide the following transfer volumes to Wessex via Leckford Bridge:

- Wessex Water's critical period demand is forecast to occur during peak summer periods, as a dry weather related demand uplift. A significant proportion (50%) of VWP demand is from a military base, which does not have a typical domestic driven demand profile, and peak periods are unlikely to occur at the same time as peak demand from Wessex Water due to summer leave for military staff.
- VWP has internal reservoir storage in the system of 12MI, which relative to total demand provides resilience to meet additional peak period demand for several consecutive days.
- VWP drought plan details demand reduction strategies – refer to the Drought Management Plan for more information.
- Additional borehole work to lift capacity from 9MI/d to 12MI/d would improve peak output capacity as well as improve resilience of supply during periods of future maintenance.

The triggers that may bring this arrangement into question are:

- A sudden large development on the VWP network which increases demand beyond the capability of the existing sources to meet demand. There is nothing planned, however a project called Army Basing 2025 is planned to commence after conclusion of Army Basing 2020. The situation will be reviewed ahead of Army Basing 2025.
- A reduction in average and peak licence at boreholes 2, 3 and Chalkpit
- A sudden increase in demand within the Wessex area that exceeds the 3 MI/d limit – this is not likely and Wessex have indicated there are no new developments planned within their area of supply

Alignment with Wessex Water Supply of 2.74 MI/d at Leckford Bridge:

Wessex Water report an import from Leckford Bridge of 2.74 MI/d which is different to the gradual increase in demand predicted by VWP. A second supply demand scenario has been generated called 'LB 2.74 Table' to consider the impact of this higher usage.

The analysis indicates that there will be a point in 2041 when demand starts to exceed supply when 2.74 MI/d to Wessex is considered. There are actions that could address this situation including:

- Implementing the Leckford Bridge agreement that if demand within the VWP exceeds 5.4 MI/d then the supply to Wessex can be reduced on a litre by litre basis. In the 'LB 2.74 Table' supply / demand table in 2034/35 the demand within VWP exceeds 5.4 MI/d and the impact of Leckford Bridge export could be prevented by reducing the volume exported to Wessex on a litre by litre basis.
- Reduce the headroom and outage by investing in BH2 and BH3 so that they can produce 4 MI/d instead of the normal 3 MI/d (bringing them in line with their licence). This would be the preferred option as this action not only addresses the potential supply / demand issue in this scenario but also generally would improve operational resilience.

Projects related to Leckford Bridge:

- The Leckford Bridge agreement needs to be formally recognised ahead of the termination date of 2022, but from a supply / demand balance point of view there is no issue in renewing the transfer agreement. The need to renew the Leckford Bridge agreement has been raised at VWP project governance. A target date of the end of 2020 has been set to sign up to a future agreement with Wessex Water regarding Leckford Bridge.
- Further consideration is being given to an emergency cross connection as part of the Security Emergency Management Directive (SEMD) that

will enhance security of supply to the whole network including the transfer to Wessex via Leckford Bridge.

- The maximum transfer capacity to Wessex has also been included in a 'LB 2.74 Table' to ensure adequate supply can be maintained. VWP initially considered a growth in demand of Leckford Bridge transfer based upon historic demand. However, Wessex have entered a flat transfer rate of 2.74 MI/d in the Wessex WRMP. VWP therefore also created a scenario to consider this higher export rate in line with the Wessex WRMP to determine the impact on supply / demand. There is an apparent imbalance from 2041 / 42 onward.

This can be addressed by:

1. Reducing the export to Leckford Bridge in line with the existing agreement because the Tidworth internal demand has exceeded the 5.4 MI/d trigger level in 2041 / 42.
2. Increasing deployable output from BH2 and BH3 from 3 MI/d to 4 MI/d. This will be investigated and has been added to the implementation plan. This would reduce headroom and outage requirements as there would be improved resilience. However, this alone is unlikely to resolve the supply / demand imbalance alone.
3. Implement advanced flow modulated pressure control to minimise leakage. A business case is under investigation as part of the WRMP to determine if this option is feasible.

2 HISTORIC DEMAND SITUATION

	DEMAND									
11 _{AR}	Distribution input	MI/d	2dp	3.86	3.83	3.79	3.85	3.91	4.32	4.54
C	Consumption									
19 _{AR}	Measured non household water delivered	MI/d	2dp	0.37	0.48	0.59	0.54	0.48	0.50	0.45
20 _{AR}	Unmeasured non household water delivered (optional)	MI/d	2dp	1.39	1.44	1.49	1.79	2.08	2.27	2.96
21 _{AR}	Measured household water delivered	MI/d	2dp	0.19	0.27	0.35	0.24	0.13	0.15	0.28
22 _{AR}	Unmeasured household water delivered	MI/d	2dp	0.18	0.18	0.18	0.16	0.13	0.12	0.13
23 _{AR}	Measured non household - consumption	MI/d	2dp	0.37	0.48	0.59	0.54	0.48	0.50	0.45
24 _{AR}	Unmeasured non household - consumption	MI/d	2dp	1.39	1.44	1.49	1.79	2.08	2.27	2.96
25 _{AR}	Measured household - consumption	MI/d	2dp	0.19	0.27	0.35	0.24	0.13	0.15	0.28
26 _{AR}	Unmeasured household - consumption	MI/d	2dp	0.18	0.18	0.18	0.16	0.13	0.12	0.13
29 _{AR}	Measured household - pcc	l/h/d	0dp	174	265	356	244	132	103	98
30 _{AR}	Unmeasured household - pcc	l/h/d	0dp	244	229	214	185	155	160	160
31 _{AR}	Average household - pcc	l/h/d	0dp	202	246	291	217	143	122	112
32 _{AR}	Water taken unbilled	MI/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.00
33 _{AR}	Distribution system operational use	MI/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.01

Demand within the Tidworth VWP network has increased from approximately 3.8 MI/d in 2012 to 4.5 MI/d in 2018.

2.1 MoD Use (line 20 – Unmeasured non-household water delivered)

There has been an increase in MoD use as the number of soldiers has grown from 1247 in 2012 to 5595 in 2018 (although these numbers are quite specific they are actually estimated based on Per Capita Consumption calculations).

The MoD users are metered and the data is returned via an Automated Meter Reading (AMR) system so there is confidence in the volume used, if not the total number of personnel on site.

By comparing previously reported population figures and demands it has been possible to derive a demand calculation for the MoD:

$$\text{MoD Use} = 0.5 \text{ MI/d} + (400 \text{ l/h/d} \times \text{Number of Soldiers})$$

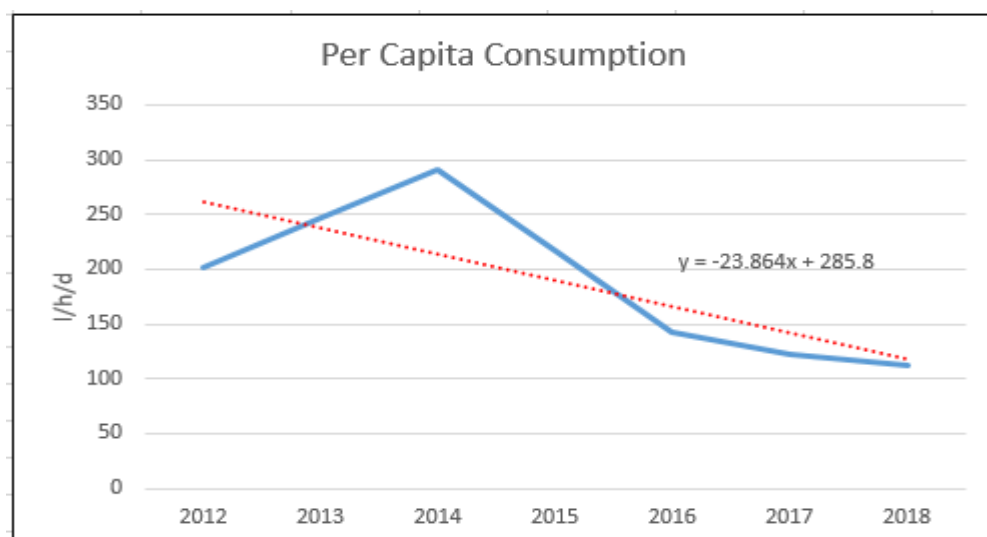
The value of 0.5 MI/d is a base load for 1,300 service family accommodation and the 200 operational buildings that exist on the MoD site.

400 litres / head / day for a soldier may seem excessive, but this also includes significant military use, such as armoured vehicle washing that is unique to this site.

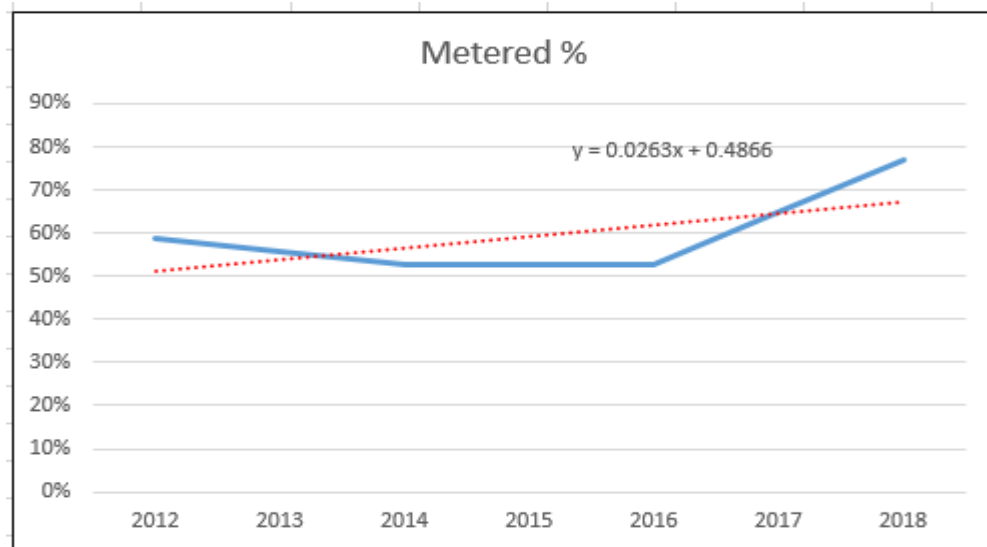
2.2 Domestic Per Capita Consumption (line 31)

There has been a reduction in per capita consumption of domestic users due to an improvement in metered coverage. All new development properties are fitted with a meter and the PCC has reduced as a result.

PCC reduction:



Metered coverage increase:



Meter coverage will increase from the current 77% to approximately 85% when all the new developments are completed.

- Meter strategy for the unmetered properties remains 'opt-in' because there would only be a 0.05 Ml/d benefit for a cost of 206,000 GBP (refer to Appendix 4 – Demand Management for further information).

3 CUSTOMER NUMBERS

CUSTOMERS										
E Properties										
43AR	Unmeasured household - properties	000's	3dp	0.307	0.329	0.350	0.350	0.350	0.313	0.341
42AR	Measured household - properties	000's	3dp	0.455	0.433	0.410	0.410	0.410	0.608	1.193
46AR	Unmeasured non household - properties	000's	3dp	1.400	1.420	1.440	1.460	1.480	1.500	1.500
45AR	Measured non household - properties	000's	3dp	0.109	0.120	0.130	0.130	0.130	0.128	0.161
44AR	Void household - properties	000's	3dp	0.012	0.016	0.020	0.020	0.020	0.014	0.014
47AR	Void non households - properties	000's	3dp	0.000	0.000	0.000	0.000	0.000	0.000	0.000
48AR	Total properties	000's	3dp	2.283	2.317	2.350	2.380	2.410	2.563	3.209
F Population										
50AR	Unmeasured household - population	000's	3dp	0.737	0.788	0.840	0.840	0.840	0.751	0.818
49AR	Measured household - population	000's	3dp	1.092	1.038	0.984	0.984	0.984	1.459	2.863
52AR	Unmeasured non household population	000's	3dp	4.607	4.794	4.981	5.847	6.712	7.290	9.195
51AR	Measured non household - population	000's	3dp	0.262	0.287	0.312	0.312	0.312	0.307	0.386
53AR	Total population	000's	3dp	6.697	6.907	7.117	7.983	8.848	9.807	13.263
G Occupancy										
55AR	Unmeasured household - occupancy rate	h/pr	2dp	2.400	2.400	2.400	2.400	2.400	2.400	2.400
54AR	Measured household - occupancy rate	h/pr	2dp	2.400	2.400	2.400	2.400	2.400	2.400	2.400
H Metering										
56AR	Total Household Metering penetration (excl. voids)	%	2dp	55.00%	55.00%	55.00%	55.00%	55.00%	66.02%	77.77%
57AR	Total Household Metering penetration (incl. voids)	%	2dp	58.77%	55.67%	52.56%	52.56%	52.56%	65.03%	77.07%

A break-down of the number of customers is included above and is used to calculate the PCC and percentage meter coverage shown in section 2.

- Attention should be paid to the total population served, including Leckford Bridge as the SEMD strategy triggers if this exceeds 25,000. However, consideration should also be taken into account as to whether the MoD personnel should be classed as a 'normal' population. MoD personnel could be classified as a transient population and could be moved off site to alternative barracks.

4 LEAKAGE

D	Leakage									
34 _{AR}	Measured non household - uspl	MI/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35 _{AR}	Unmeasured non-household - uspl	MI/d	2dp	0.06	0.06	0.06	0.06	0.06	0.06	0.06
36 _{AR}	Measured household - uspl	MI/d	2dp	0.02	0.02	0.02	0.02	0.02	0.02	0.02
37 _{AR}	Unmeasured household - uspl	MI/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.00
38 _{AR}	Void properties - uspl	MI/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.00
39 _{AR}	Total mains and trunk mains leakage (Distribution Losses)	MI/d	2dp	1.73	1.46	1.18	1.14	1.09	1.28	0.72
40 _{AR}	Total leakage	MI/d	2dp	1.81	1.54	1.26	1.22	1.17	1.28	0.80
41 _{AR}	Total leakage	l/prop/d	2dp	793.63	664.90	536.17	510.82	485.48	499.41	249.09

Leakage has reduced significantly. A dedicated resource is now performing active leakage control and leakage levels are being reported monthly.

Leakage per connection point is a poor measure for VWP due to the MoD barracks being multiple-occupancy dwellings.

Refer to Appendix 1 – Leakage for further information.

5 GROWTH IN DEMAND

As part of the WRMP VWP are required to produce a planning table that predicts a realistic growth in demand up until 2045. Screen shots of the situation up until 2025 (the short term planning period) are included in this section.

The planning table is provided as an excel spreadsheet entitled 'Planning Table'.

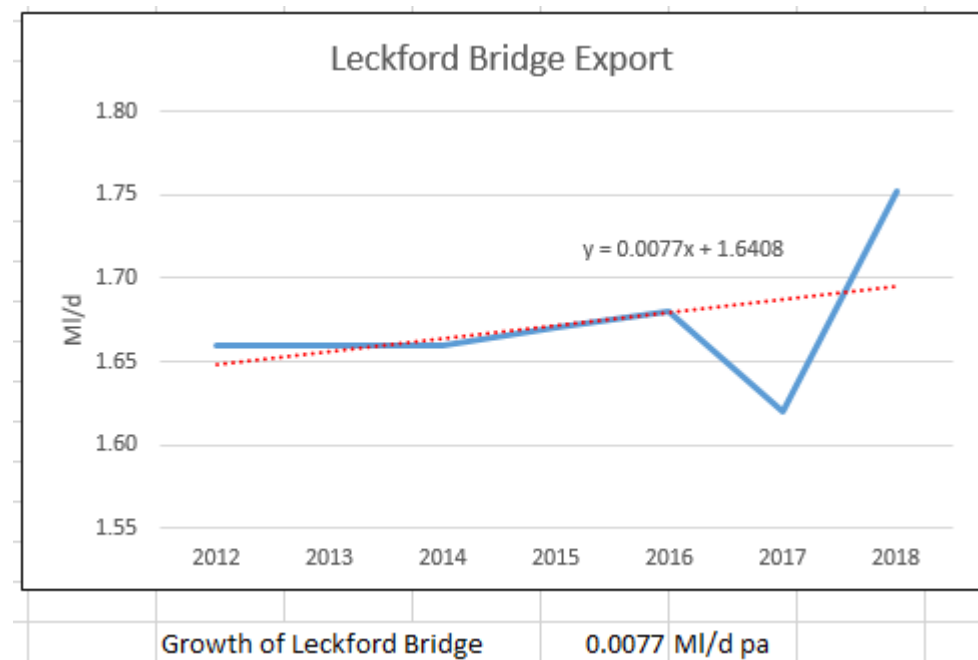
This planning table compares available supply with the demand to ensure that a favourable supply / demand balance is maintained. Headroom to cover for uncertainty has also been included (refer to Appendix 2 – Resilience).

5.1 Leckford Bridge

It has been observed that Leckford Bridge demand has increased historically. Although Wessex Water have indicated that there are no new developments within their area of supply a growth assumption of 0.0077 MI/d has been made and this has been added to the Leckford Bridge demand for each year of the forecast.

Note: This is a realistic demand forecast and differs from the flat 2.74 MI/d Leckford Bridge transfer considered by Wessex Water.

A second scenario has been included that considers the flat 2.74 MI/d transfer at Leckford Bridge (refer to section 1.6 above for more detail regarding that scenario).



This growth of Leckford Bridge has been included in line 6 of the planning table (shown below)

Growth	Row No.	DESCRIPTION	UNITS	DP	2019	2020	2021	2022	2023	2024	2025
		SUPPLY									
	A	Resources									
	1 _{AR}	Raw water abstracted	MI/d	2dp	6.20	6.31	6.49	6.64	6.69	6.74	6.79
	2 _{AR}	Raw water imported	MI/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3 _{AR}	Potable water imported	MI/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4 _{AR}	Raw Water Losses and Operational Use	MI/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5 _{AR}	Raw water exported	MI/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5.1 _{AR}	Non potable water supplied	MI/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.0077	6 _{AR}	Potable water exported	MI/d	2dp	1.76	1.77	1.78	1.78	1.79	1.80	1.81
	7 _{AR}	Deployable output (submit data by exception)	MI/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	Process Losses									
	9 _{AR}	Treatment works losses and operational use (submit data by exception)	MI/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	10 _{AR}	Outage experienced	MI/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.00

5.2 Domestic Use (line 31)

Because PCC has fallen for these users it has been assumed that the PCC going forward will be held constant. No new metering is planned and demand management is therefore limited (refer to Appendix 4 – Demand Management).

See section 2.2 of this Appendix for evidence to support this assumption.

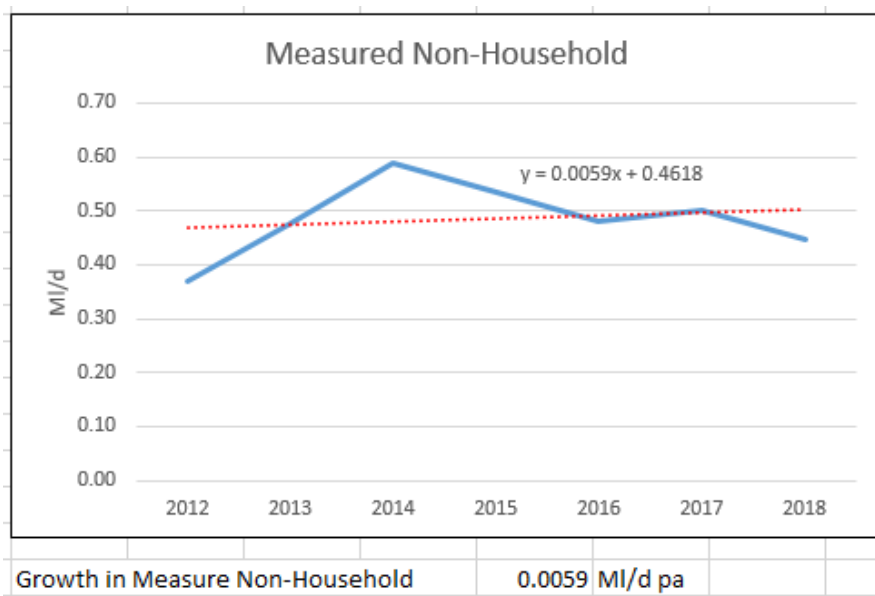
DEMAND										
11 _{AR}	Distribution input	MI/d	2dp	4.44	4.55	4.71	4.86	4.90	4.95	4.99
C Consumption										
19 _{AR}	Measured non household water delivered	MI/d	2dp	0.45	0.46	0.46	0.47	0.48	0.48	0.49
20 _{AR}	Unmeasured non household water delivered (optional)	MI/d	2dp	2.94	3.04	3.15	3.29	3.32	3.36	3.40
21 _{AR}	Measured household water delivered	MI/d	2dp	0.34	0.42	0.47	0.47	0.47	0.47	0.47
22 _{AR}	Unmeasured household water delivered	MI/d	2dp	0.13	0.13	0.13	0.13	0.13	0.13	0.13
0.0059	23 _{AR}	Measured non household - consumption	MI/d	2dp	0.45	0.46	0.46	0.47	0.48	0.49
0.0372	24 _{AR}	Unmeasured non household - consumption	MI/d	2dp	2.94	3.04	3.15	3.29	3.32	3.36
	25 _{AR}	Measured household - consumption	MI/d	2dp	0.34	0.42	0.47	0.47	0.47	0.47
	26 _{AR}	Unmeasured household - consumption	MI/d	2dp	0.13	0.13	0.13	0.13	0.13	0.13
	29 _{AR}	Measured household - pcc	l/h/d	0dp	98	98	98	98	98	98
	30 _{AR}	Unmeasured household - pcc	l/h/d	0dp	160	160	160	160	160	160
	31 _{AR}	Average household - pcc	l/h/d	0dp	112	112	112	112	112	112
	32 _{AR}	Water taken unbilled	MI/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00
	33 _{AR}	Distribution system operational use	MI/d	2dp	0.07	0.07	0.07	0.07	0.07	0.07

However, the number of properties has been increased in line with the new development activity. Table shows total properties added since 2017.

	2017/18	2018/19	2019/20	2020/21	2021/22
Persimmon	360	460	560	634	634
Area 19	30	200	322	322	322
Corunna	0	0	80	247	247
Total	390	660	962	1203	1203

5.3 Metered Non-Household Use (line 23)

It has been observed that metered non-household use has increased and so this demand has been increased by 0.0059 MI/d year on year.



5.4 Unmeasured non household – consumption (MoD line 24)

Due to army basing 2020 the demand due to the MoD is expected to continue to rise.

The following assumption has been used regarding likely increase in military personnel and is based upon local knowledge rather than definite figures.

	2017/18	2018/19	2019/20	2020/21	2021/22
Military Personnel	0	260	520	780	1040

The uncertain nature of the MoD planning focus, the Political dimension and the general commitments of the UK Armed Forces overseas all serve to demonstrate the difficulties in assessing the overall water consumption increases in a predominantly garrison town.

Beyond army 2020 it has been assumed that the MoD demand will grow in line with the growth observed for metered non-household use. This results in the MoD demand continuing to increase by approximately 1.3%.

As a result an annual increase of 0.037 MI/d has been added year on year after 2020.

5.5 Leakage reduction (line 39 and 41)

D	Leakage									
34 _{AR}	Measured non household - uspl	MI/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35 _{AR}	Unmeasured non-household - uspl	MI/d	2dp	0.06	0.06	0.06	0.06	0.06	0.06	0.06
36 _{AR}	Measured household - uspl	MI/d	2dp	0.02	0.02	0.02	0.02	0.02	0.02	0.02
37 _{AR}	Unmeasured household - uspl	MI/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.00
38 _{AR}	Void properties - uspl	MI/d	2dp	0.00	0.00	0.00	0.00	0.00	0.00	0.00
39 _{AR}	Total mains and trunk mains leakage (Distribution Losses)	MI/d	2dp	0.57	0.50	0.50	0.50	0.50	0.50	0.50
40 _{AR}	Total leakage	MI/d	2dp	0.65	0.58	0.58	0.58	0.58	0.58	0.58
41 _{AR}	Total leakage	l/prop/d	2dp	188.08	153.22	144.04	144.04	144.04	144.04	144.04

Leakage has been reduced slightly in line with the strategy outlined in Appendix 1 – Leakage. It has been assumed that leakage will remain static from then on.

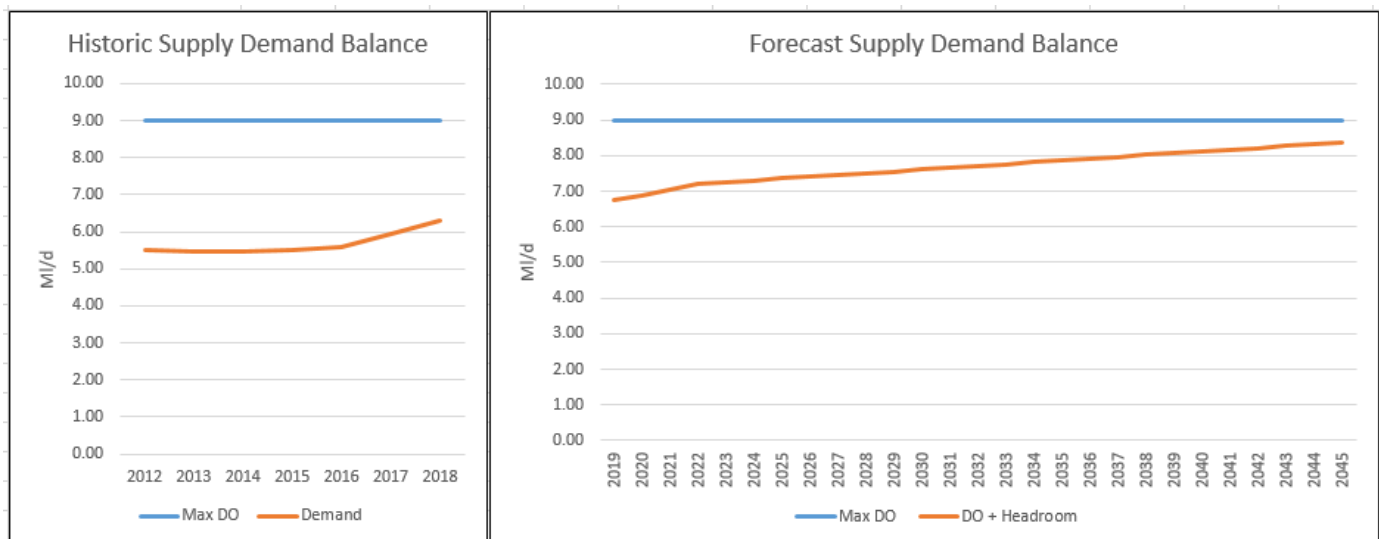
5.6 Customer Numbers

CUSTOMERS										
E	Properties									
43 _{AR}	Unmeasured household - properties	000's	3dp	0.341	0.341	0.341	0.341	0.341	0.341	0.341
42 _{AR}	Measured household - properties	000's	3dp	1.463	1.765	2.006	2.006	2.006	2.006	2.006
46 _{AR}	Unmeasured non household - properties	000's	3dp	1.500	1.500	1.500	1.500	1.500	1.500	1.500
45 _{AR}	Measured non household - properties	000's	3dp	0.161	0.161	0.161	0.161	0.161	0.161	0.161
44 _{AR}	Void household - properties	000's	3dp	0.014	0.014	0.014	0.014	0.014	0.014	0.014
47 _{AR}	Void non households - properties	000's	3dp	0.000	0.000	0.000	0.000	0.000	0.000	0.000
48 _{AR}	Total properties	000's	3dp	3.479	3.781	4.022	4.022	4.022	4.022	4.022
F	Population									
50 _{AR}	Unmeasured household - population	000's	3dp	0.818	0.818	0.818	0.818	0.818	0.818	0.818
49 _{AR}	Measured household - population	000's	3dp	3.511	4.236	4.814	4.814	4.814	4.814	4.814
52 _{AR}	Unmeasured non household population	000's	3dp	9.455	9.715	9.975	10.235	10.235	10.235	10.235
51 _{AR}	Measured non household - population	000's	3dp	2.561	2.561	2.561	2.561	2.561	2.561	2.561
53 _{AR}	Total population	000's	3dp	16.346	17.330	18.169	18.429	18.429	18.429	18.429
G	Occupancy									
55 _{AR}	Unmeasured household - occupancy rate	h/pr	2dp	2.400	2.400	2.400	2.400	2.400	2.400	2.400
54 _{AR}	Measured household - occupancy rate	h/pr	2dp	2.400	2.400	2.400	2.400	2.400	2.400	2.400
H	Metering									
56 _{AR}	Total Household Metering penetration (excl. voids)	%	2dp	81.10%	83.81%	85.47%	85.47%	85.47%	85.47%	85.47%
57 _{AR}	Total Household Metering penetration (incl. voids)	%	2dp	80.47%	83.25%	84.96%	84.96%	84.96%	84.96%	84.96%

Customer connections and population has been predicted for the planning period up to 2045 (values up to 2025 shown above).

This allows PCC to be calculated and also percentage meter coverage which will stabilise at approximately 85%.

6. SUPPLY / DEMAND BALANCE



The predicted demand shown by the orange line in the graph above has then been compared to the deployable output of the boreholes (based on licence and maximum output achieved historically).

The orange line in the 'Forecast Supply Demand Balance' part of the graph above also includes headroom and outage of:

Headroom and Outage	0.56 MI/d
Refer to Appendix 2 Section 10.9	

- Historic data will continue to be gathered as part of the WRMP annual return and this information will then be compared to the forecast to ensure that the predictions are accurate.
- It is evident that the available source water exceeds predicted growth in demand under the VWP planning table.
- Consideration is given to Wessex Water WRMP which has a value of 2.74 MI/d to Leckford Bridge by the inclusion of a scenario called 'LB 2.74 Table'. In this instance demand could exceed supply in 2041, however as the VWP internal demand exceeds 5.4 MI/d it is possible to reduce the Wessex table at Leckford Bridge on a litre by litre basis removing the concern. The preferred option would be to reduce outage and headroom requirements by enhancing the output at boreholes 2 and 3 by 1 MI/d each thus improving resilience.

7 CONCLUSIONS

Good levels of service have been maintained to customers, with supply exceeding demand even during recent events:

- June 2017 High Demand period when borehole output was successfully increased to 9 MI/d
- March 2018 when a freeze – thaw event occurred. There was an observed increase in leakage but the situation was rapidly recovered.
- Summer 2018 when daily observation of the network showed good reliability and that storage levels were maintained

The Leckford Bridge transfer agreement will be retained with Wessex assuming that there are no major changes to the supply / demand balance.

Wessex Water have considered a transfer of 2.74 MI/d in their WRMP and to agree with their plan an extra supply demand scenario called 'LB 2.4 Table' has been included. This indicates that it is possible for demand to exceed supply in 2041, but this can be addressed by either reducing the Leckford Bridge transfer in line with the existing Leckford Bridge agreement or reducing outage and headroom by increasing BH2 and BH3 to be able to provide 4 MI/d instead of the normal 3 MI/d. This second option has been included in the implementation plan.

The weighted average PCC is 112 litres / property / day which is less than the target of 118 litres / property / day set by the regulator and compares very favourably with the industry average of 139.6 l/h/d. This PCC will remain low due to high metered coverage and Automatic Meter Reading (AMR)

An opt-in metering strategy is followed by VWP as the estimated cost of installing meters to the 340 unmetered customers would be 206,000 GBP while the benefit by driving down PCC (from 160 to 98 l/h/d) would be 0.05 Ml/d. (refer to Appendix 4 – Customer Demand Management for further information).

There will be a slight reduction in leakage in line with the leakage strategy outlined in Appendix 1 – Leakage.

The supply / demand balance is favourable with supply exceeding demand.

An assessment of the reliability of sources would be beneficial in line with the maintenance and asset management process together with consideration of enhanced flow modulated pressure control to reduce leakage. This will ensure that the positive supply / demand situation is maintained even if the higher 2.74 Ml/d transfer at Leckford Bridge is included as per the Wessex Water WRMP.

The Leckford Bridge agreement includes a clause to reduce the export to Wessex on a litre by litre basis when VWP demand exceeds 5.4 Ml/d. This would be sufficient to maintain a positive supply / demand balance within the Tidworth network and at the moment is the preferred option.

8 RECOMMENDATIONS

The supply / demand balance will be compared to the forecast. This will be achieved by:

- Comparing leakage to target on a monthly basis as per the existing reporting process
- Comparing number of new connections to the network against forecast on a monthly basis as per the existing reporting process
- Comparing the WRMP supply / demand balance in October of each year with the Planning Table to ensure that the network develops as per prediction
- A 'LB 2.74 Table' has been included which assumes a 2.74 Ml/d supply via Leckford Bridge to Wessex.

Audits are planned in 2019 of the Asset Management and Maintenance processes that have been developed over the previous 2 years. This audit ensure that reliability of sources is satisfactory. A compliance audit in December 2018 by the Environment Agency did not raise and concerns and production meters have been calibrated at that time to ensure accuracy of reporting.

Leckford Bridge agreement needs to be officially signed off at Corporate level. This is due for delivery by end of 2020 and is included in the Plan of Action below.

Resilience of the sources, particularly BH2 and BH3 is included to reduce headroom requirements and outage. This is useful not only for meeting a possible supply / demand imbalance in 2041 but also to improve operational resilience in general.

9 PLAN OF ACTION

S/N	Element of Work	Pre S/N Req	2019				2020				2121				2022				2023			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
15	Supply / Demand Reporting	-																				
16	Audit of Asset Management	-																				
17	Audit of Maintenance	-																				
18	Future LB Agreed at board level																					
19	Leckford Bridge Agreement	18																				
20	Assess output of Source Works																					