

VEOLIA WATER PROJECTS LIMITED

WATER RESOURCES MANAGEMENT PLAN

MAIN REPORT WRMP 2020 - 2045

1 EXECUTIVE SUMMARY

1.1 Introduction

Thames Water Utilities Limited (TWUL) operated the water supply and sewerage function of this small water resource zone on the edge of Salisbury Plain in Southern England under an Inset Appointment since 1998.

The Inset was acquired by Veolia Water in 2007, who are now responsible for the management of the water resource zone during the 25 year planning period. Veolia Water Projects (VWP) provides water services (clean and waste) for over 1,400 civilian properties and over 120 commercial properties in Tidworth and the surrounding areas in Wiltshire on the edge of the Salisbury Plain.

The PFI agreement with the Ministry of Defence (MoD) means VWP also services a large garrison that can house up to 6,000 personnel on the site at any one time together with some 1300 Service Families Accommodation [SFA's] properties in the town and community.

All of the supply comes from groundwater, drawn from a supply of robust unconfined chalk aquifer boreholes. These water sources provide sufficient water to meet all the needs of the customers as well as providing neighbouring company Wessex Water (WW) with a number of bulk supplies.

1.2 WRMP Requirements

The previous Water Resources Management Plan (WRMP) 2014, created by VWP showed the supply and water balance over the 25 year planning period until 2040 and this has been updated in 2017 to more accurately reflect the future situation up until 2045.

The WRMP is a statutory document which has been subject to public consultation. In order to compose this plan, studies were undertaken to understand how the supply and demand of water will change over the next 25 years, taking into account and making due allowance for any uncertainty associated with MoD developments.

A principle driver for the review is the proposal for a number of large new housing developments on land recently sold by the MoD in and around the town together with the latest Army predictions around its basing requirements called Army Basing Project 2020. This plan seems likely to expand to include Army Basing Project 2025.

The outcome of the supply versus demand analysis considering issues such as climate change, environmental impact, outages and headroom assessments over the period. VWP have referenced numerous guidance notes such as UKWIR 2014 - Source yield methodologies and UKWIR 2016 - Risk based planning methods for deployable output during the creation of this document.

Veolia Water Projects intends to continue working in a sustainable manner, promoting efficient water use and continuing to improve its own assets to reduce water waste.

This document demonstrates VWP has a sound and through understanding of its new demand and supply situation and will continue to assess the situation given that the network is rapidly evolving as military land is developed for local housing purposes.

1.3 Supply Demand Balance

The supply demand calculations indicate no deficit exists for the zone on average based on the initial supply demand balance throughout the period from the year 2017 to 2045. The main emphasis is maintenance to ensure a reliable output at Boreholes 2, 3 and Chalkpit.

The predicted supply demand balance will be compared with figures returned as part of the June return to ensure that the prediction is as accurate as possible.

There are numerous new developments currently under construction totalling 1203 additional houses by 2021. The growth in demand will continue to be monitored to ensure that there is sufficient headroom to ensure a reliable supply of water to customers.

Demand will continue to grow as the new developments come on line as their additional use will more than offset the benefits of leakage reduction and efficiency of water use by existing and new customers. The growth in demand is being continuously monitored to ensure the actual demand growth agrees with the prediction.

1.4 Resilience

As part of the options appraisal Veolia Water Projects will prioritise security of supply, conservation of stressed aquifers, protecting river flows and their ecology while considering the cost of capital which, due to the nature of the Inset Appointment Conditions, cannot be linked to customer bills through the Periodic Review mechanism in the usual way.

VWP aim to use Borehole 2 (BH2) and Borehole 3 (BH3) while restraining use at the Chalkpit (CP) source, thus participating in the protection of the Nine Mile River from abstraction effects. Environment Agency catchment modelling studies are ongoing to determine the combined impact of the MoD, Wessex Water, Southern Water and VWP on the Salisbury Plain catchment area.

Studies currently indicate that Boreholes 2 and 3 have a minor impact on Pilhill Brook whilst Chalkpit impacts on Nine Miles River. It is therefore a matter of balancing the output of these sources to minimise the impact on the environment.

The River Bourne has intermittent flow through the year (only flowing when water tables are high). Abstraction at Boreholes 2, 3 and Chalkpit have little impact on the River Bourne and this is offset by the sewage treatment works discharging treated effluent back into the same aquifer via soak away lagoons slightly further down the catchment (any leakage on the network will also return the same way).

2 SUPPLY



The Tidworth network consists of a single distribution system fed by the boreholes Chalkpit (CP) and Boreholes BH2 and BH3 via a service reservoir at Clarendon. The population and size of the network are such that it is classified as a single Water Resource Zone (WRZ) with major features shown in the map above.

2.1 Current Water Supply Situation (Appendix 5 Section 1)

Assessment of the borehole output against licence indicates significant spare capacity. Note that this output also supplies the export to Wessex via Leckford Bridge

Refer to Appendix 5 Section 1 for further information on the historic availability of water.

This table shows the deployable output of the sources for 2016/17.

Capacity analysis has been considered from 2012 to 2018.

Date	Tidworth No2 Daily Flow	Chalkpit Daily Flow	Tidworth No3 Daily Flow	Tidworth Group Daily Flow
Output				
Average	2.15	1.54	2.14	5.82
Peak Day	2.41	2.69	2.41	7.28
Licence				
Average	3.68	3.64	3.68	9.02
Peak Day	4.32	4.69	4.32	12

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 for 2 weeks
- 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

2.2 Water Resource Zone

A resource zone is the largest possible zone in which all resources, including external transfers can be shared and hence the zone in which all customers experience the same risk of supply failure from a resource shortfall. The VWP supply network is highly integrated and the risk of supply failure is shared throughout the Service Area, Therefore all the supply area is one water resource zone (WRZ). There are no plans to expand the network outside of existing supply area.

2.3 Imports and Exports (Appendix 5 Section 1.7)

Refer to Appendix 5 Section 1.7 for further details.

There is a single export to Wessex Water via Leckford Bridge. The export agreement is due for renewal in 2022 and a target of end of 2020 has been set for a new agreement to be signed. There are no reasons why this agreement cannot continue. A common statement has been made with Wessex Water in both WRMP's to reflect this.

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 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. This is currently the preferred option as it is free.
- 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). A project has been included to consider increased deployable output from both BH2 and BH3.
- Reduce leakage using advanced flow modulated pressure management. An investigation is underway to assess the business case of such as option.

2.4 Levels of Service and Drought (Appendix 2 Section 1 and 2)

VWP is resilient against 4 consecutive dry years and such an event has not been observed in the last 100 years of rainfall historic data and is not predicted in climate change modelling up to 2091.

Consecutive dry years	Lowest borehole level observed	Number of events in 100 years
1	92m	5
2	87m	7
3	82m	5
4	77m	0
5	72m	0

VWP is involved in the Salisbury Hydrology Group and data is being provided to the Wessex Ground Water model that is being used to assess the combined impact of organisations such as the MoD, Wessex Water and Southern Water.

Given the small scale of VWP activities when compared to these companies and the close proximity of VWP abstraction to discharge points (only 5 km from each other) then impact on ground water levels is likely to be limited.

There is a low probability of an adverse impact on levels of service to customers shown below. In line with 3 (c) of the WRMP direction the probability of a drought will not change during the WRMP planning horizon.

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	Emergency drought order and Possible rota-cuts in worst case scenario	1 in 200 years (0.5%)	0

The likelihood of drought now aligns with Wessex Water as VWP have been able to access a longer history of British Geological Survey (BGS) borehole levels and prove a correlation to VWP observation borehole levels. This together with climate change prediction scenarios up until 2091 indicate that a drought order will likely occur every 200 years and a hosepipe ban every 50 years. A new Drought Management Plan will be produced end of 2020 and will review the classifications of drought and the probability.

2.5 Deployable Output (Appendix 2 Section 4.1 to Section 4.4)

The catchment area for the VWP ground water sources has been identified and a risk assessment indicates no upstream commercial users who may pose a risk to ground water quality. There are no drinking water protected areas local to Tidworth. There are no plans to change the abstraction licence.

Planned work north of boreholes 2 and 3 related to flood alleviation as part of an improved junction of the A338 has been identified by VWP as a potential risk of local ground water contamination. This project is being closely assessed by VWP and concerns have been raised with the project team.

Pesticide and Nitrate levels continue to fall due to reduced use of contaminants by the MoD and farmers north of the VWP boreholes.

GAC is being retained and maintained as it provides good resilience to boreholes 2 and 3.

Improvements to chlorine dosing at Chalkpit have improved the reliability of this source.

The sources are now capable of providing a constant peak output of 9 MI/d for 2 weeks and so are capable of meeting extreme demand events.

2.6 Outage Assessments (Appendix 2 Section 9.1)

A combined value of 0.56 MI/d has been used in the long term supply / demand planning tables to ensure against uncertainty. This includes a combination of headroom and outage as a single figure due to the simplicity of the VWP network.

Regular communication with the MoD guards against sudden changes in strategy relating to sale of land for new development purposes.

2.7 Climate Change and Impact on Supply (Appendix 3)

The method employed by VWP aligns with best practice in terms of the selection of an appropriate climate change scenario which is then used to predict likely impact on the ground water table local to Tidworth.

Although the work completed focused on the lagoon levels at Tidworth STW's the results include a prediction of the Observation Borehole Level (OBH) which is used to monitor the availability of water at the boreholes.

The results can therefore be used to predict the probability of future events in terms of both high and low ground water events that in turn may result in drought or flood risk respectively.

VWP need to confirm that this methodology aligns with the Climate Change guidance of WRMP. This will be determined from feedback from DEFRA

regarding the general WRMP submission. An assumption has been made that this will be reviewed during Quarter 3 of 2019.

VWP should therefore be ready to modify the scenario should this prove appropriate. However, given the scale of VWP activities and the involvement in the Salisbury Hydrology Group (refer to Appendix 3 – Resilience) it is assumed that this methodology is appropriate.

Climate change is not predicted to impact on Veolia operations.

2.8 Flooding (Appendix 2 Section 3)

Potable water assets are not at risk of flooding. Refer to Appendix 2 Section 3 for further details.

Climate change modelling has indicated that there may be an increased risk of flooding local to Tidworth STW's. There has been no operational knowledge of flooding, even during the record wet year of 2001 however this situation is being monitored as part of the waste water side of the business.

2.9 The Environment (Appendix 7)

Ground water modelling is under way to consider the combined impact of MoD, Wessex Water, Southern Water and VWP (refer to Appendix 3 resilience for further details). This will cover the Water Industry National Environment Programme (WINEP) entries relating to Pilhill Brook and Nine Miles River as well as considering side effect on the River Bourne.

VWP will continue to be actively involved in the Salisbury Hydrology Group and will provide data to feed into the existing ground water model as per the plan below:

Feb 2019 – VWP to provide data for inclusion within the model

End of 2019 - The MoD will provide data and consider modifications to non-potable water abstraction at their sites.

End of 2020 - Andover reduction in abstraction by Southern Water will be analysed to determine the improvement of flow in Pilhill Brook

Summer 2021 - Wessex and MoD modelling of operational impact on Nine Miles River will be completed with deadline for full completion by **March 2022**.

Refer to Appendix 2 Section 1 for additional information concerning Ground Water Level modelling.

VWP already operate Boreholes 2 and 3 in preference to Chalkpit to minimise the impact on Nine Miles River. The current strategy favours Nine Miles River (the home of crested newts) over Pilhill Brook (which feeds a trout farm near Andover).

The Natural Environment and Rural Communities Act 2006 (NERC) forms in relation to Invasive Non Native Species (INNS) and Biodiversity will be completed by the end of February 2019. This action is included in the WRMP implementation plan (refer to Appendix 8) and Plan of Action at the end of this document.

A Water Industry Strategic Requirements (WISER) report was completed by VWP and is available with the Water Resources Management Plan (WRMP) documentation for reference.

2.10 Freeze / Thaw Risks (Appendix 2 Section 5)

During March 2018 there was a significant drop in temperature and high localised snow fall. There was no observed increase in burst mains. There was an observed increase in background leakage, but this was not significant as leakage levels did not exceed historic values and leakage rates were quickly reduced.

There was a high demand situation that occurred from 1st June to 19th June 2017 due to a valve left open supplying an armoured vehicle washing site and a burst main.

The deployable output of the boreholes was increased to 9 MI/d in response to the observed increase in demand which adds confidence in the supply and distribution system to meet high demand events.

This increase in demand was not related to the environment, however the incident helped build confidence in the peak output available at the source works.

2.11 Supply Chain Disruption (Appendix 2 Section 6 to Section 8)

VWP does not trigger the 25,000 population threshold in terms of the SEMD. However, security of operational sites is of great importance and an SEMD plan has been produced in line with best practice.

VWP are following the Network and Information Systems directive strategy with regards to essential IT systems that are associated with the provision of essential services.

The corporate IT systems are certified to ISO 27001.

VWP have the capability to cope with a loss of power supply for greater than 3 days due to power generation and reservoir storage.

The loss of the telemetry system has occurred but due to the small size of the network operations were able to manually operate the system. Chemicals are stored to guard against disruption to deliveries due to adverse weather events.

The VWP employs advanced risk assessment tools that include process and people due to its small size and possible single points of failure. Single points of failure on the network are also considered and hydraulic modelling of the network planned for Quarter 1 and 2 (Q1 and Q2) will assist in confirming risks for all network assets.

The main risk identified is to successfully balance investment in the asset management plan when compared to having to mirror Wessex and Southern tariffs (which are beyond the control of VWP). These tools and techniques are in place and continue to be developed in line with best practice (refer to Appendix 6 – Innovation for more information)

3 DEMAND

3.1 Current Demand (Appendix 5 Section 1)

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

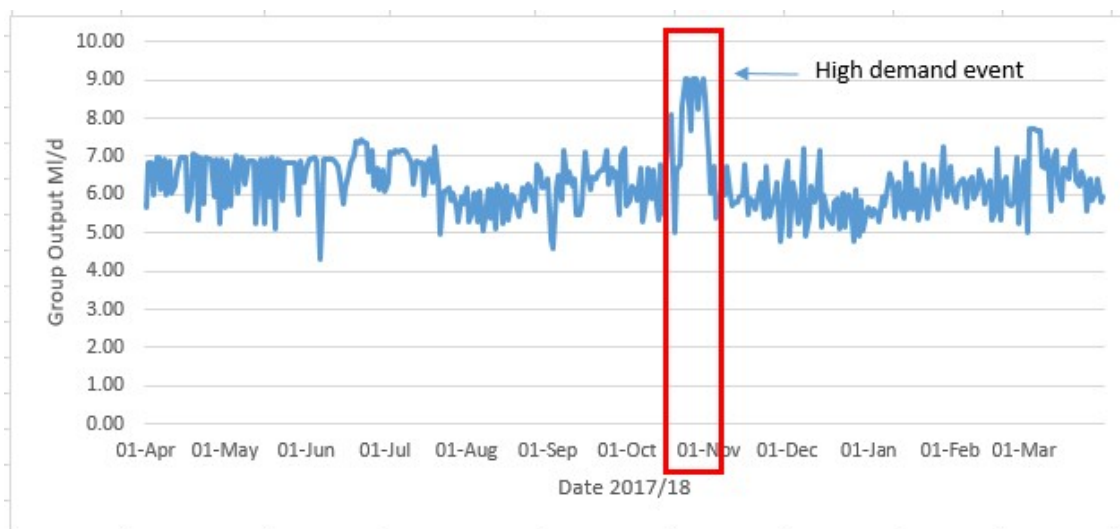
The supply situation has been stable from 2012 to 2016 with deployable output from the sources averaging approximately 5.4 MI/d.

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.



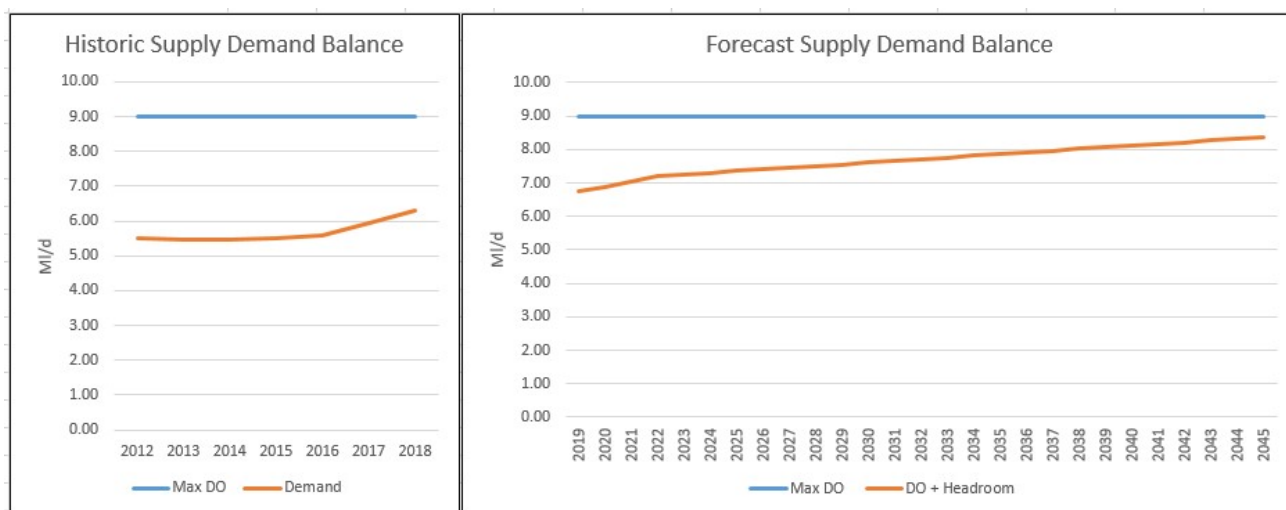
3.2 Demand Forecast (Appendix 5 Section 5)

As part of the WRMP VWP are required to produce a planning table that predicts a realistic growth in demand up until 2045.

The planning table is provided as an excel spreadsheet entitled 'Planning Table'. The planning table has been designed to mimic the annual WRMP supply / demand table to ease comparison of actual demand to forecast.

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).

The graph below indicates the predicted growth in demand compared to the 9 MI/d capability of the sources.



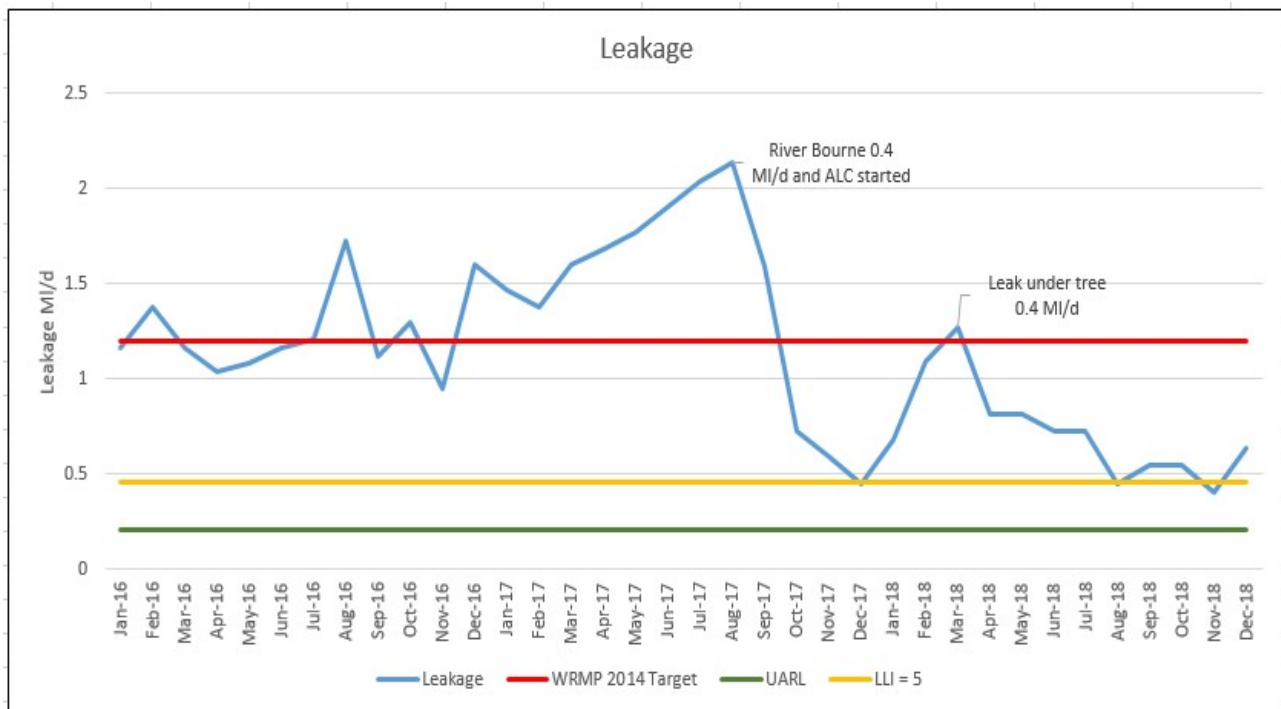
3.3 Metering and Water Efficiency (Appendix 5 Section 2.2)

Meter coverage is currently at approximately 80% and is set to increase to 85% as more new houses are constructed.

The weighted average PCC is 112 litres / property / day which is less than the target of 118 litres / property / day set by OFWAT 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 MI/d. (refer to Appendix 4 – Customer Demand Management for further information).

3.4 Leakage (Appendix 1)



3.4.1 Leakage Performance

The active leakage control response from August 2017 onwards has reduced leakage to an average of 0.72 MI/d during 2018 and compares favourably to the WRMP 2014 aspirational target of 1.2 MI/d.

This reduction when compared to the WRMP 2014 leakage of 1.65 MI/d is a leakage reduction of 58% (more than halved) and one can argue that this already meets the desired reduction in leakage of 15% by 2025 and 50% by 2050.

Current leakage levels now stand at 15.5% compared to leakage of 42.7% in 2012. This observation is supported by the fact that internal consumption (Deployable Output minus Leckford Bridge export) in 2012 was 3.86 MI/d and has only increased to 4.5 MI/d in 2018.

The reduction in leakage levels has helped offset much of the growth in demand due to the new developments in the area.

3.4.2 Benchmarking of Performance

Although there has been a dramatic improvement in performance due to the active leakage control strategy it is still useful to benchmark against internationally recognised performance standards.

The Infrastructure Leakage Index (ILI) for VWP is 3.48 and this indicates a good performance (B on an A to D scale) with no urgent action required although the situation should continue to be monitored carefully.

Using the Veolia Corporate Linear Leakage Index then VWP is rated as 'borderline' with a LLI of 7.95. In order to move to a satisfactory score (LLI = 5) would require a future leakage level of 0.46 MI/d.

The metric of leakage per connection point gives a value of 226 litres / connection per day which is almost double that of the UK Water Industry norm. However, this is due to the unique nature of the VWP network having many multi-occupancy MoD barracks. Therefore ILI and LLI are a more appropriate benchmark.

3.4.3 Options for reducing leakage further

Total impact on leakage for operational activities has been calculated to be 10 m³/d = 0.01 MI/d. Operational use is small when considered over the year. Work will continue to firm up on these initial calculations by using the output of a hydraulic model that is planned for construction and calibration during 2019.

Reported PCC for 2017/18 was 112 l/h/d so this would reduce to 106 l/h/d due to USPL inclusion in the reporting process. This adjustment will be included in future Annual Review WRMP tables and in the planning tables produced as part of WRMP 2019.

However, this adjustment is after the customer meter and will not have an impact on reported leakage, but this does indicate that VWP are already meeting the regulatory customer efficiency target of 118 l/h/d. This may be due to many of the houses being relatively new and so careful assessment will continue to ensure that the current efficiency does not drift from the long term regulatory target.

Mains renewal schemes would not appear to be effective as much of the network is relatively new (laid since 1998).

To reduce current leakage of 0.72 MI/d for 2018 to the 0.46 MI/d to achieve the LLI of 5 then an additional 4 leaks would need to be located and repaired per month. Recent performance is 25 repairs in 6 months, approximately 4 per month and so the current leakage detection and repair strategy would need to double in effectiveness. This could involve 4 full time employees dedicated to leakage detection and this would not seem to be cost effective given the size of the network.

Reducing the pressure by 10 m average for the day, using pressure control method 3 to automatically respond to a fire flow scenario and so meet Crown Fire Fighting standards when a fire occurs then a 21% reduction would reduce leakage by 0.15 MI/d.

Therefore a combination of 0.01 MI/d to take into account realistic operational water use together with 0.15 MI/d reduction due to advanced flow modulated pressure control could reduce leakage from 0.72 MI/d to 0.56 MI/d (assuming existing performance continues) and would come close to achieving the Veolia Corporate objective LLI of 5.

3.4.4 Reporting of leakage

By constantly assessing leakage and the impact of repairing burst mains it is possible to identify the impact of leaks that take many months to repair due to being in a difficult location (such as in the grounds of an ammunition store, under a tree or river). These individual leaks would have a significant impact on performance which is beyond VWP ability to control. It is possible therefore to identify and set aside such leakage during the regulatory reporting process.

There are a total of 5 months that have been identified over the last 3 years where a leak of 0.4 MI/d was known to exist but could not be accessed for repair due to its location. The likely average leakage value over the 3 years that could be attributed to such an event is 0.06 MI/d, not excessive but still worthy of note given the relatively small size of the VWP network.

3.5 Climate Change and Demand Growth (Appendix 5 Section 5)

Studies predict that demand across VWP region in 25 years will be higher than it is today. Demand predictions in the planning table have been increased to reflect this. (Refer to Appendix 5 Section 5)

Demand is likely to increase as a direct result of climate change. UKCP09 predictions for VWP region predict a net increase in temperature across the year. As historical data shows, temperature increases have a direct relation to demand due to changes in water usage.

Climate change, potentially leading to longer and hotter summer periods, will also drive more frequent and higher peak seasonal demands. This is confirmed by the key findings of UKCP09 projections, which have indicated that warming will be likely and more intensified in the summer months. Increases in temperature are directly linked with increases in demand with all water companies experiencing higher demand peaks in the summer months.

Although the MoD usage does not show an overall peak in summer demand, the additional civilian customers from new developments and the effects of climate change means VWP will have to plan for higher summer peaks going forward.

3.6 Greenhouse Gas Emissions

The energy required to produce and distribute water through the Tidworth network is approximately 170,000 kWh per year. Using a conversion of 0.527 kg CO₂ / kWh the total CO₂ emissions appear to be approximately 90,000 kg of CO₂.

Energy use going forward will be monitored and will form part of future WRMP commentaries.

4 SUPPLY / DEMAND BALANCE (Appendix 5)

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

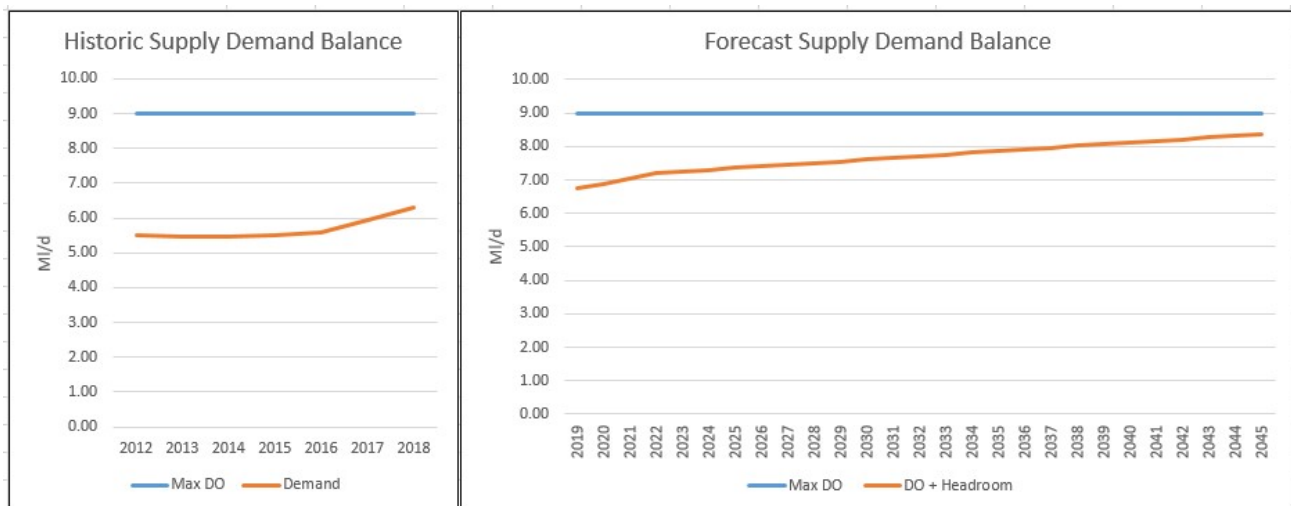
- Comparing leakage to target on a monthly basis as per the existing reporting process
- Comparing number of new connections to the network against forecast on a monthly basis as per the existing reporting process
- Comparing the WRMP supply / demand balance in October of each year with the Planning Table to ensure that the network develops as per prediction

4.1 Target Headroom (Appendix 2 Section 9.2)

A combined value (Headroom plus Outage) of 0.56 Ml/d has been used in the long term supply / demand planning tables to ensure against uncertainty. This has been included in the planning table.

Regular communication with the MoD guards against sudden changes in strategy relating to sale of land for new development purposes.

4.2 Baseline Supply / Demand Balance (Appendix 5)



Supply exceeds demand until 2045. Refer to the Planning Table for further details of the breakdown of the supply / demand balance.

4.3 Resilience (Appendix 5)

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.

The deployable output of BH2 and BH3 will be investigated as improving their output will reduce outage and the increased reliability will reduce the need for headroom.

Further as part of SEMD consideration is being given to the installation of a cross connection that will remove single points of failure on the network.

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.

5 SUPPLY / DEMAND OPTIONS

5.1 Option Identification

5.1.1 Leakage Control (Appendix 1)

The outcome of the leakage analysis has been fed into the WRMP 2019 planning table and will be included in future WRMP Annual Review tables.

VWP will consider the flow modulated pressure control option by submitting a business case in Q1 of 2019 with a potential trial at the largest of the 3 sites before the end of 2019. Should this prove successful then this would be expanded to the remaining 2 sites during 2020 realising a 0.15 MI/d leakage reduction.

VWP will aim to maintain leakage rates of 0.72 MI/d and achieve a reduction of 0.07 MI/d due to reporting operational use and exceptional leakage with an option of 0.15 MI/d reduction due to flow modulated pressure management (if business case is proven during 2019).

Operational use of water and User Supply Pipe Leakage (USPL) will be included in the WRMP annual return.

This would appear to meet the regulatory requirements of a 15% reduction in leakage by 2025 and a 50% reduction in leakage by 2050 as well as reducing LLI to 5 to meet Veolia Corporate aspirations and potentially move ILI category A – Excellent.

The metric of leakage per connection point will not be used to measure performance due to the unique nature of the VWP network which includes multi-occupancy MoD barracks that are embedded within the regulated network.

5.1.2 Demand Management and Customer Engagement (Appendix 4)

VWP actively communicates with the main stakeholders, but there is room for improvement in regards to engagement of regulated customers and Forest Drive Estate.

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.

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.

New developments will continue to be constructed with water efficiency in mind. VWP have a dedicated New Development Manager who directly communicates with the developers to help ensure that best practice is followed.

The existing customer engagement improvement project continues so that a marketing strategy is developed including implementation of a link from the VWP webpage to CCWater meter consumption calculator

VWP will continue to track development of smart AMR metering being developed by Veolia Corporate (refer to Appendix 6 – Innovation for further details).

5.1.3 Innovation (Appendix 6)

The model construction and calibration proceed during 2019 as per existing plans

Power BI continue to be developed in line with existing project programme

Consideration be given to implementation of PLaN during model field testing – this will involve the throttling of valves into District Meter Areas (DMA's) at night whilst data loggers are on hydrants (already planned as part of model calibration).

Pressure management proceed as per the original leakage strategy (refer to Appendix 1 - Leakage) thus helping prevent the reoccurrence of leaks on the network

Smart AMR technology is monitored near Paris so that new technology can be implemented to fully realise the potential of the AMR system

Auditing of Local Management Systems proceed as per the audit programme during 2019 to 2021.

5.2 Plan of Action

The following plan of action has been developed to deliver the various elements of the WRMP.

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
1	Flow modulation business case	-																				
2	Trial site Flow Modulation	1																				
3	Additional Sites	2																				
4	Report Operational Use	-																				
5	Report USPL	-																				
6	Ground Water Data to Model	-																				
7	MoD Data added to GW Model	6																				
8	Southern Water GW Analysis	7																				
9	Wessex and MoD Analysis	8																				
10	GW modelling for all complete	9																				
11	Drought Management Plan	-																				
12	Climate Change Methodology	-																				
13	Customer Engagement	-																				
14	Smart AMR Corporate R&D	-																				
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																					
21	Model Construction	-																				
22	Leakage Detection (Plan)	21																				
23	Power BI Development	-																				
24	NERC Environmental Audit	-																				

6 CONCLUSION

Investigatory work completed at BH2 and BH3 plus the improvement of treatment at Chalkpit indicates that the sources are now capable of meeting growth in demand.

The current strategy of running BH2 and BH3 at higher volumes and minimizing the use of Chalkpit continues to minimize the impact on Nine Mile River.

The Leckford Bridge agreement is approaching renewal (in 2022) and consideration regarding options to abandon the agreement, maintain the agreement or increase the transfer (given major capital investment required to allow BH2 and BH3 to pump to peak license flow rates of 4 MI/d each). The assumption is that the transfer agreement will be renewed with similar terms and conditions. A target of end of 2020 has been set for a new agreement between VWP and Wessex to be agreed at corporate level.

Resilience of supply to Leckford Bridge will be maintained with evidence provided by a 'LB 2.75 Table' assuming Wessex will require a take of 2.74 MI/d (in line with Wessex WRMP). This will be achieved by reduction on a litre by litre basis as per the existing Leckford Bridge agreement (the current preferred option on return on investment as it is free), but the solution is to reduce headroom and outage by increasing the output available from BH2 and BH3 is being actively investigated as an alternative as is reducing leakage by using advanced flow modulated pressure control.

Further as part of the VWP Security and Emergency Measures Directive (SEMD) consideration is being given to an emergency backup connection that will enhance security of supply to the entire network including Leckford Bridge.

Environment Agency catchment modelling studies show that the Winter Bourne and Pilhill Brook are only marginally affected by abstraction at BH2 and BH3, potentially affecting its dry season length and reach. The requirement of a more detailed study needs to be assessed during the next 5 year investment plan.

The VWP drought management plan is due for review at the end of 2020 and the classification of drought and probability of such an event will be revisited as part of that activity.

A series of improvements have been proposed. These will be investigated with decisions and improvements added to the Water Resources Management Plan technical appendices. This WRMP will remain unaltered over the next 5 years with an annual commentary being provided to communicate progress and any significant changes to the Appendices.