THAMES WATER UTILITIES LTD

WHOLESALE WATER SPA - WATER MODELLING GROUP

Mount Pleasant Mail Centre Development Modelling Report- Additional Property Request

Final Report – March 2018

Company Confidential

Document history

Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
Rev 1.0	Additional Properties and modelling results to original April 2017 report	JR updated report		PT	PT	12/03/2018

This Modelling Study is Valid for a Period of 18 Months from the Date of Authorisation

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Executive summary

This study investigated the impact of the proposed Mount Pleasant Mail Centre development on Thames Water's Maiden Lane FMZ Network. This development will be situated across two sites on Phoenix Place and Calthorpe Street, London WC1X.

The development is in Maiden Lane DMA ZMAIDL58 which is in Pressure Management Area PMAIDL04. The Phoenix Place site will connect to a 4" CI main in Phoenix Place, while the Calthorpe Street site will connect to a 4" CI main on Calthorpe Street. Following a site diagram provided in December 2016 the Phoenix Place site connection point has been re-located to Phoenix Place. The 4" Calthorpe Street point of connection (POC) remains unchanged as this was the most appropriate POC and will not require reinforcments, whereas making a connection in Farringdon Road will require network enhancements.

The proposed development is mixed with 681 residential units and commercial properties and will be developed on two sites - Phoenix Place and Calthorpe Street – both locations being in Maiden Lane DMA ZMAIDL58. Based on a completion date in 2018, the total peak flow to be modelled at Calthorpe Street and Phoenix Place are 3.3 l/s and 3.05 l/s respectively. The sum of average daily water demand is expected to be in the region 0.19 Ml.

It has been shown that the existing network is capable of supplying adequate pressure to all areas of the ZMAIDL58 DMA under Year 2018 DYCP PD+HR demands, when the Mount Pleasant Mail Centre demands are applied.

Headloss in the model was quite high in DMA ZMAIDL58 under Year 2018 DYCP PD+HR demands. This was due to valves which were throttled as part of the calibration of the model. The condition of these valves should be investigated by Thames Water.

The current network would allow for a fire flow requirement of 25 l/s to be met.

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1. Introduction

This study investigated the impact of the proposed Mount Pleasant Mail Centre development on Thames Water's Maiden Lane FMZ Network. This development will be situated across two sites on Phoenix Place and Calthorpe Street, London WC1X.

The development is in Maiden Lane DMA ZMAIDL58 which is in Pressure Management Area PMAIDL04. The Phoenix Place site will connect to a 4" CI main in Phoenix Place, while the Calthorpe Street site will connect to a 4" CI main in Calthorpe Street.

The proposed development is mixed with 681 residential units and commercial properties and will be developed on two sites - Phoenix Place and Calthorpe Street – both locations being in Maiden Lane DMA ZMAIDL58. Based on a completion date in 2018, the total peak flow to be modelled at Calthorpe Street and Phoenix Place are 3.3 l/s and 3.05 l/s respectively. The sum of average daily water demand is expected to be in the region 0.19 Ml.

An evaluation of the net demand increase will need to be undertaken as the development sites will replace the existing demands at these sites.

1.1 FMZ Supply System

The proposed development site is located within the Maiden Lane FMZ. The Maiden Lane FMZ is located within Thames Water's North-West London Network. There are approximately 184,000 properties with a combined annual average daily demand of 102.1 Ml/d (based on AORTA data for the zone's demand values from March 2017 to March 2018). The zonal demand from AORTA for the model calibration day 6th November 2014 is 105.3 Ml/d.

The extent of the zone is from Stroud Green, B138, Wightman Road in the north to the A3212, Whitehall Road to the south and Islington, 104 Essex Road in the east to Camden B518, Gordon House Road in the west. Figure 1 shows the DMA layout of the zone, as well as the trunk mains.

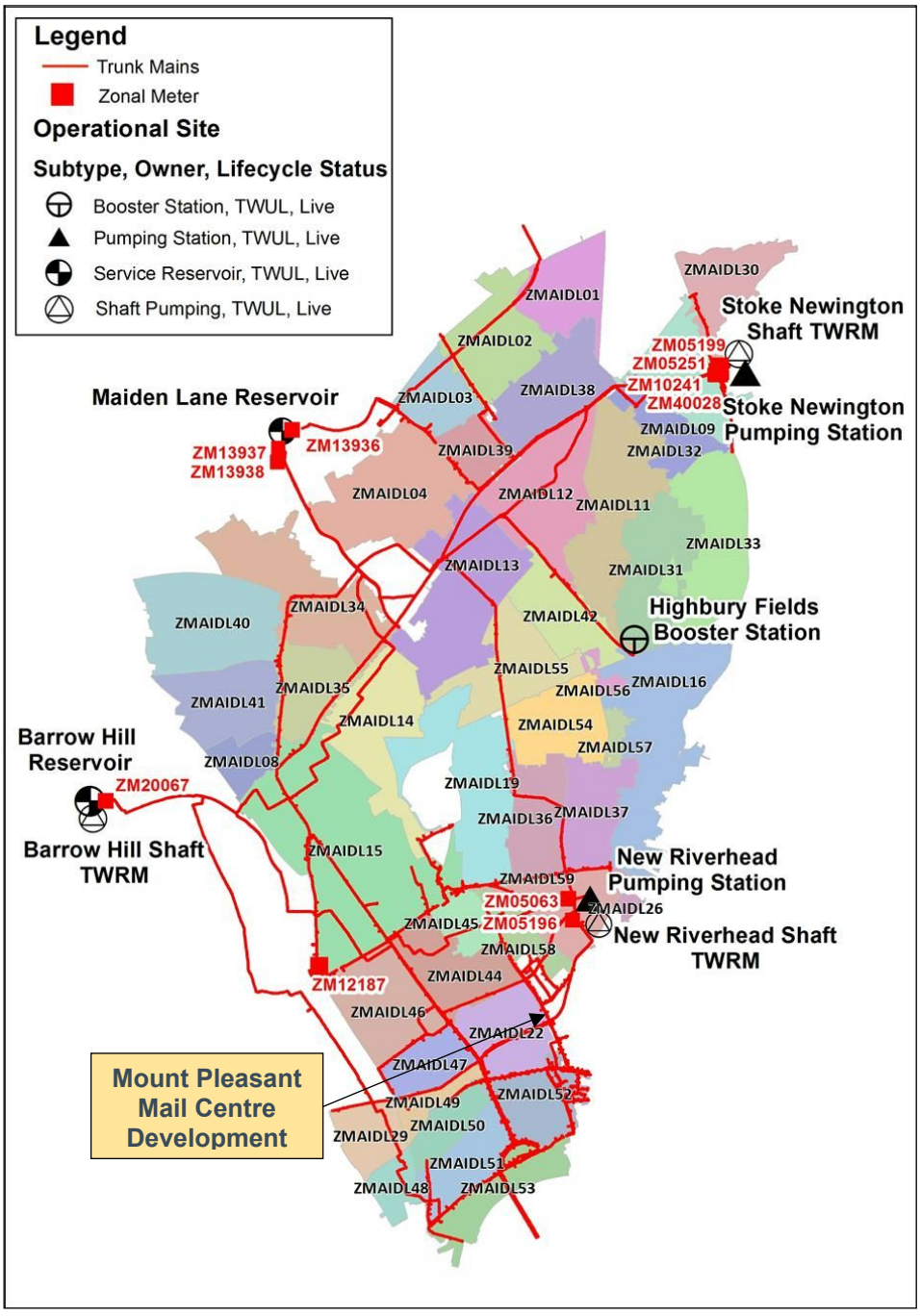

Figure 1 - The location of ZMAIDL58 in the Maiden Lane Zone

There are 45 DMAs in the Maiden Lane zone, which is supplied from three Thames Water Ring Main (TWRM) shafts: Stoke Newington Shaft, Barrow Hill Shaft and New River head Shaft. Storage and head is provided by Maiden Lane Reservoir (TWL = 70.6mAOD). There are three exports from the zone through zonal meters ZM10241, ZM12187 and ZM40028. See Table 1 for more details.

Site Name	Description	Input (Mld)	Export (Mld)
New River Head	Import from TWRM Shaft	5.3	-
Stoke Newington	Import from TWRM Shaft	31.7	-
Barrow Hill	Import from TWRM Shaft	82.7	
ZM12187	Export to Barrow Hill FMZ	-	8.8
ZM10241	Export to Crouch Hill MZ	-	8.5
ZM40028	Export to Finsbury Park FMZ	-	0.3

Table 1 - Maiden Lane FMZ Inputs/Exports Year 2017-18

2. Scope of Work

This study determines the impact of the proposed Mount Pleasant Mail Centre Development on the Maiden Lane FMZ network. To achieve this, the aims were:

1. Review the current operation of the Maiden Lane FMZ all mains model (built and calibrated in 2015), including verification against telemetry data. Update the model with demand data and any operational changes.

2. Modification of the model to include the future Year 2018 DYCP PD+HR (peak day with headroom) demands without the Mount Pleasant Mail Centre development.

3. Modification of the model to include the future Year 2018 DYCP PD+HR with the Mount Pleasant Mail Centre development.

4. Identify the impact of the Mount Pleasant Mail Centre development demands on the Maiden Lane FMZ network (DYCP PD + HR demands)

5. If network improvements are required, propose potential solutions for supply to the development sites, verified with modelling results.

6. Check the network against Fire Flow demand of 25l/s.

7. Report on the findings and make recommendations for appropriate solutions, if necessary.

3. Development Site and Demand Data

3.1 Development Description

The proposed development is mixed with 681 residential units and commercial entities and will be developed on two sites - Calthorpe Street and Phoenix Place - with provisional completion in 2018. Figure 2 shows the proposed layout of the mains in blue.

The Phoenix Place site will connect to a 4" CI main in Phoenix Place, while the Calthorpe Street site will connect to a 4" CI main on Calthorpe Street. Following a site diagram provided in December 2016 (Appendix B) the Phoenix Place site connection point has been re-located to Phoenix Place. The 4" Calthorpe Street point of connection remains unchanged as this was the most appropriate POC and will not require reinforcements, whereas making a connection in Farringdon Road will require network enhancements.

The sum of average daily water demand is expected to be in the region 0.19 Ml. Storage to the sites (from information received in April 2017) is a 52 m3 storage tank at the Calthorpe site and a 28 m3 storage tank at the Phoenix Place site. An evaluation of the net demand increase will need to be undertaken as the development sites will replace the existing demands at these sites.

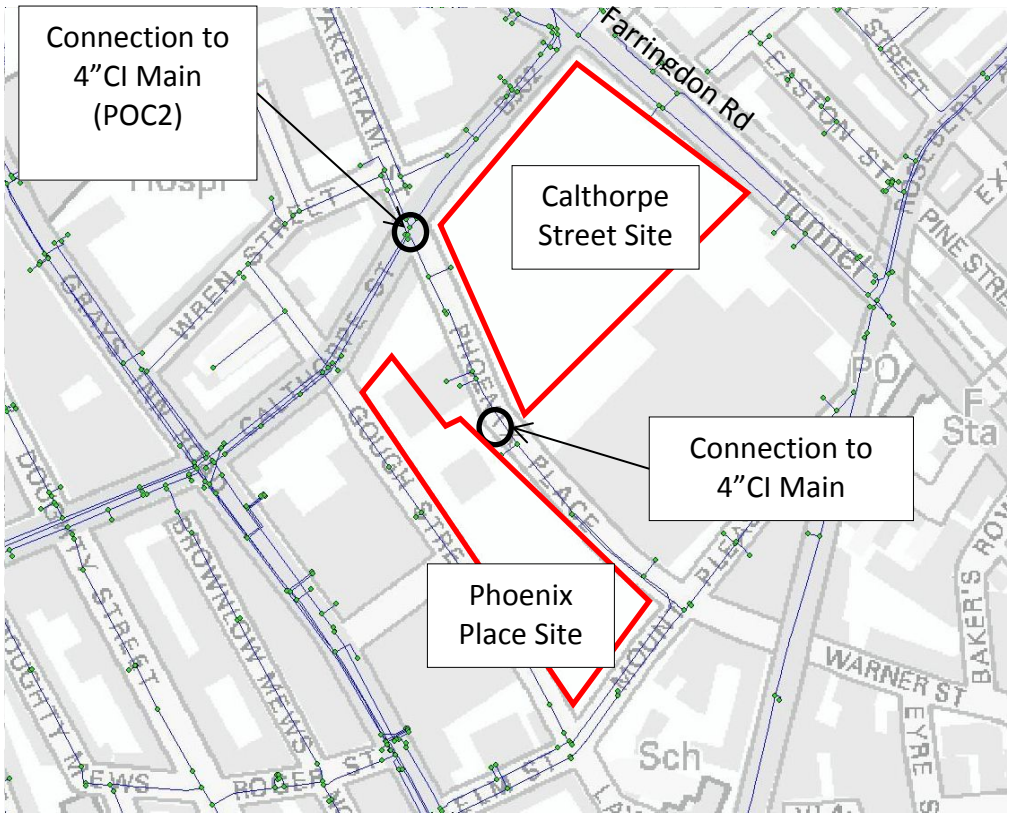

Figure 2 - Development Site Locations

4. Supply and Demand Data

4.1 Proposed Development Demand Data

Based on the 2018 completion date this completion date, the provisional development demands to be modelled at Calthorpe Street and Phoenix Place are detailed in Table 2. A fire flow of 25 l/s will have to be met at these sites.

	Calthorpe Street	Phoenix Place
Peak Morning (l/s)	3.3 l/s	3.05 l/s
POC	6" in Farringdon Road	4" in Gough Road
Fire Flow	25l/s on 18" CI main in Calthorpe Street	25l/s on 4" CI main in Gough Street

Table 2 - Development Site Demands

Using the Confidence Grade/ Demand Forecast Model provided by TW, the peaking factor and peak day normalised profile for a DYCP Peak Day in 2018 was obtained and shows that the zonal demand is 117.7 Mld. This should indicate the ability of the solutions to accommodate the development demand when the development is completed.

4.2 FMZ Demand Data

FMZ demands are based on the Water Resource Management 2014 corporate demand forecast data. Table 3 shows the DYAA and PD demands used in the model.

FMZ Name	DYAA (2020-21), Mld	DYCP PD + HR (Year 2020-21), Mld
Maiden Lane	94.9	113.7

Table 3 - Maiden Lane FMZ Demand

Fire flow demands have been estimated based on the limited information available and the Water UK document ''Water for Firefighting'' (Jan 2007 3rd edition) which contains guidelines regarding expected firefighting flow rates. Based on these guidelines the required firefighting flow has been taken as 25l/s for the development.

The WN05 standard states that for the instantaneous peak hour demand with the fire supply incorporated, the design shall take into account hydrant losses to ensure positive pressure at the fire hydrant, and minimum residual pressure in the mains of preferably 7.0m. For a fire flow of 25l/s from a single hydrant, this equates to approximately 15m.

5. Working Model

The ZMAIDL all mains model *'ZMAIDL_CAL_November2014.mxd '(*calibrated in 2015) was provided by TWUL in InfoWater format and this was used for modelling the Mount Pleasant Mail Centre Development. This model had a calibration date in November 2014, therefore some updates were made to the model.

5.1 Demand Profiles update

Maiden Lane FMZ demand profiles were updated from the Confidence Grade Model (CGM) provided by TW. Table 4 shows the details of Peak profiles taken from the CGM.

FMZ Name	FMZ Code	Data Source	Peak Week Date	Peak Day Date	Demand profile update method
Maiden Lane	ZMAIDL	CGM v10.9	27/05/2011	25/05/2011	Type 1, 2 and 9 Profile Updated

Table 4 - Demand profiles update in working model

There are two large developments, situated in the Maiden Lane Zone, planned for construction. These have been added to the model for this study and have a combined demand of 12.15 Mld.

	Kings Cross Inset	Regis Road
Development Demand (Mld)	11.63	0.52
Address	London N1C 4AH	Regis Road, London NW5 3EW
DMA	ZMAIDL00 (Trunk Main)	ZMAIDL40
Nodes applied on	7571731, 7911602	1230765

Table 5 - Other Developments Planned in the Zone

5.2 Changes to Model Controls

A new district meter has been installed for the DMA ZMAIDL58. To mimic this update in the model, a DBV (Model ID 7074641) in Grays Inn Road has been opened.

6. Modelling Scenarios

The hydraulic analysis to assess the impact of the proposed Mount Pleasant Mail Centre development was carried out by beginning with the working model and assessing the impact of different demand scenarios.

A summary of the modelled scenarios is given in Table 6.

Scenario	Demand Scenario	Mount Pleasant Demand, (Mld)	Other Known Proposed Developments in ZMAIDL, (Mld)	Zonal Demand (Mld)
1	Base Model: 2014 Calibration day Demand	-	-	106.02
2	DYCP PD+HR 2018 Model	-	12.15	129.89
3	DYCP PD+HR 2018 Model + Mount Pleasant Mail Centre Development	0.19	12.15	130.08
4	Fire Flows Assessment Model: Year 2018 DYCP PD+HR + Mount Pleasant Mail Centre Development + Fire Flows at Calthorpe Street	0.19	12.15	130.08 Mld + Fire Flow of 25 l/s
5	Fire Flows Assessment Model: Year 2018 DYCP PD+HR + Mount Pleasant Mail Centre Development + Fire Flows at Mount Pleasant Street	0.19	12.15	130.08 Mld + Fire Flow of 25 l/s

Table 6 - Modelled Scenarios

7. Modelling Results

The working model indicates that the Peak Instantaneous Demand (PID) normally occurs at 07:00am in the morning. The results for each scenario have therefore been compared at this time of day. The existing demands within the development area have been removed in the model. The location of these points and the minimum pressures they receive for the various demand scenarios and solutions are presented in Figure 3.

- Point A is the Calthorpe Street POC (Node ID 1453224)
- Point B is the revised Phoenix Place POC (Node ID 1450927)
- Point C is the opened DBV, which supplies ZMAIDL58 (Node ID 1450927)
- Point D is near DM10127, which also supplies ZMAIDL58 (Node ID 1790955)
- Point E is near CPP2396 at Cubitt Street (Node ID 1720022)
- Point F is the hydrant in Calthorpe Street tested for fire supply for Calthorpe Street site (GIS 1785240, Fire hydrant 733
- Point F is the hydrant in Gough Street tested for fire supply for Phoenix Place site (GIS 1719926, Fire hydrant 751)

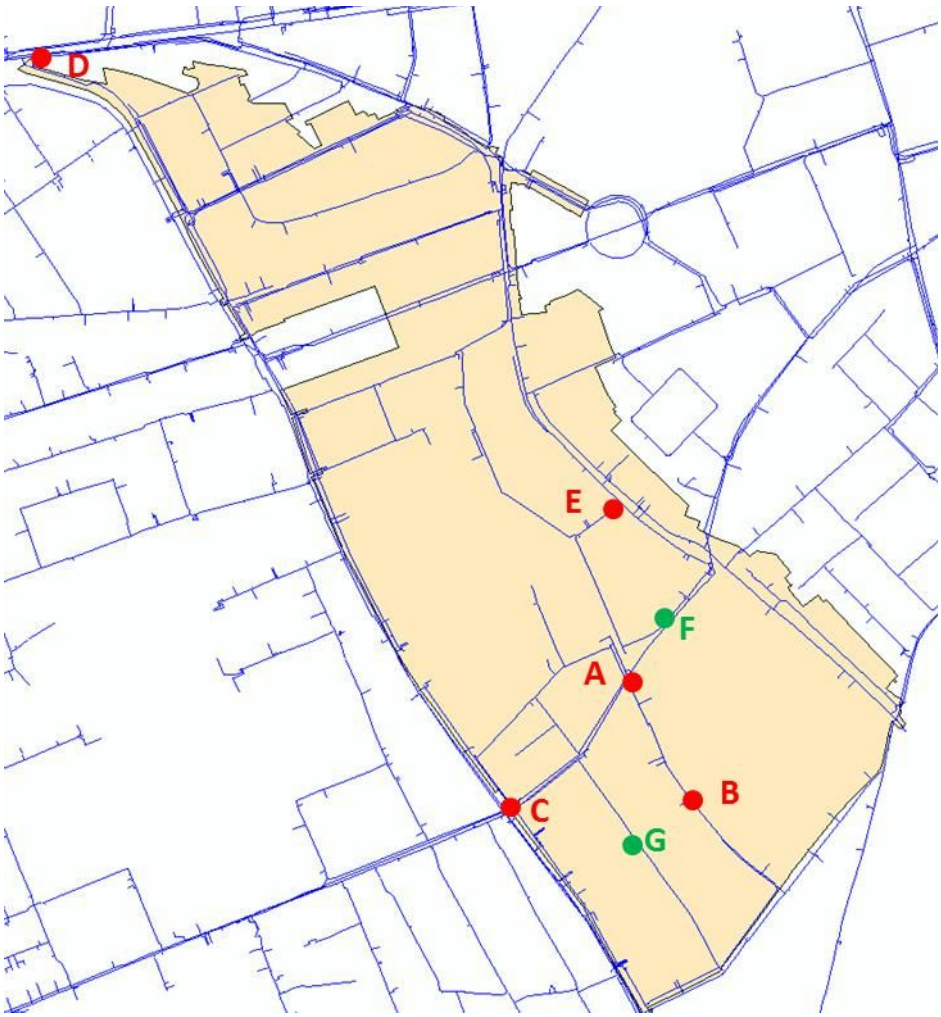

Figure 3 - Points of interest in the network

Table 7 details the pressures at peak demand time that are experienced at the points of interest in the model, for various scenarios. It can be seen that in Scenario 1, where the 2014 demands are in place

from the calibrated model, that adequate pressures of between 34.3m and 39m are experienced at all locations. When 2018 DYCP PD + HR demands are used in Scenario 2, the pressure at points A, B and C reduces by 1.7m.

At points D and E however, the pressure reduction is 3.7m and 12.4m respectively. These larger pressure drops are caused by throttled valves (highlighted by green squares in Figure 3) which were introduced as calibration actions as part of the Maiden Lane FMZ model build. Headloss is further compounded by the increased demand of 2018 DYCP PD + HR – an additional 23.9 Mld.

The addition of the Mount Pleasant Mail Centre can be seen to have little significance on the pressures at these points. Pressure reductions, at the points of connection, are all less than 1.0m when comparing Scenarios 2 and 3.

Table 4 represent the pressures at peak demand at all the Scenarios.

Scenario	Demand Scenario	Pressures at Peak Demand Time (m)				
		A	B	C	D	E
1	2014	34.6	38.4	34.3	37.4	36.4
2	2018 DYCP PD + HR	33.1	36.7	32.7	33.7	24.0
3	2018 DYCP PD + HR with Mount Pleasant Demands	32.2	35.8	32.6	33.6	24.0

Table 7 - Network Performance for each Scenario

8. Fire Flows

Modelling results indicated that fire flows of 25l/s under Year 2018 DYCP PD+HR demands are achievable, if applied at either of the locations indicated on the trunk mains which run near to the site.

Scenario	Demand Scenario	Location	Fire Flow Required (l/s)	Residual Pressure Required (m)	Residual Pressure Available (m)
4	2018 with Mount Pleasant Demands	25l/s on 18” CI main in Calthorpe Street (Node 1785240) (FH 733)	25	15	33.4
5	2018 with Mount Pleasant Demands	25l/s on 4” CI main in Gough Street (Node 1719926 FH 751)	25	15	24.3

Table 5 - Fire Flow Analysis

9. Conclusion and Recommendations

It has been shown that the existing network is capable of supplying adequate pressure to all areas of the ZMAIDL58 DMA under Year 2018 DYCP PD+HR demands, when the Mount Pleasant Mail Centre demands are applied.

Headloss in the model was quite high in some areas under Year 2018 DYCP PD+HR demands. This was due to valves which were throttled as part of the calibration of the model. The condition of these valves should be investigated by Thames Water.

The current network would allow for a fire flow requirement of 25 l/s to be met.

Appendices

Appendix A Glossary of Terms

BS	Booster Station
CI	Cast Iron
DBV	District Boundary Valve
DM	District Meter
DMA	District Metering Area
DYAA	Dry Year Annual Average
DYCP	Dry Year Critical Period
DYCP PD + HR	Dry Year Critical Period Peak Day plus Headroom
FMZ	Flow Monitoring Zone
ID	Internal Diameter
l/s	Litres per second
m	Metres
Ml/d	Mega Litres per day
PID	Peak Instantaneous Demand
PMA	Pressure Management Area
POC	Point Of Connection
PRV	Pressure Reducing Valve
PS	Pumping Station
SR	Service Reservoir
TW	Thames Water
VSD	Variable Speed Drive
WBS	Water Booster Station

Appendix B Site Diagram from December 2017