



Pentavia, Mill Hill

London NW7 2ET

Flood Risk Assessment

Date: 22/03/19

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Status: Final
Date: 13/03/2019
Revision: C
Job no: 1458
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1 Introduction

1.1 Overview

This is a flood risk assessment and drainage strategy report which has been prepared by Heyne Tillett Steel on behalf of Meadow Residential LLP for the site at Pentavia Retail Park in Mill Hill, North London. The benefit of this report is to our instructing client and in support of a planning application.

The scheme proposed by Arney Fender Katsalidis architects is for low to medium rise apartment buildings (up to 15 storeys above ground) with associated retail, car parking and plant spaces. The proposed development has a total development area of 3.86ha of which approximately 2.73ha will be impermeable.

1.2 Objectives

The objective of this report is to advise interested parties in the development to the potential risk of flooding and the management of foul and surface water on the site.

1.3 Reference documents

This report has been prepared with reference to the following publications:-

- Department for Communities and Local Government (March 2012), National Planning Policy Framework
- Department for Communities and Local Government (March 2014),
- Planning Practice Guidance 'Flood Risk and Coastal Change'
- Department for Environment, Food and Rural Affairs (March 2015), Non-statutory technical standards for sustainable drainage systems
- Environment Agency (September 2013), Climate Change Allowances for Planners: Guidance to support the National Planning Policy Framework
- Environment Agency (October 2013), Delivering benefits through evidence: Rainfall runoff management for developments
- HM Government (2010), The Building Regulations (2010), Drainage and Waste Disposal, Approved Document H, The NBS, Newcastle Upon Tyne
- Wilson, Bray, Cooper (2004), Sustainable drainage systems: Hydraulic, structural and water quality advise, C609, CIRIA, London
- Woods-Ballard et al (2015), The SuDS Manual, C753, CIRIA, London

- CIRIA Report C624 Development and flood risk
- National SuDS Working Group (2004), Interim Code of Practice for Sustainable Drainage Systems,
- Institute of Hydrology (1999), Flood Estimation Handbook, Institute of Hydrology, Wallingford
- BS EN 752:2008 Drain and sewer systems outside buildings. Hydraulic design and environmental considerations
- BS 8533:2011 Assessing and managing flood risk in development – Code of Practice
- CIRIA Report C635 Designing for exceedance in urban drainage – good practice

2 The site and development proposals

2.1 Location and description of the site

The proposed development is located at Pentavia Retail Park, Watford Way, London, NW7 2ET, as shown in Figure 1.1. The National Grid Reference for the site is E521835, N191315. The site is bound by Bunn's Lane and an abandoned M1 slip road to the north, the A1 Watford Way to the east and the M1 to the south and west.

2.2 History of the site

The site is an existing retail park with associated car parking. A topographical survey of the existing site is included in Appendix A.

2.3 Proposed development

The proposed development comprises 844 residential units with associated highway infrastructure and public realm. The proposed development layout is shown in the drawings included in Appendix B.

2.4 Geology of the site and ground investigation data

From a review of the geological maps available from the British Geographical Society (BGS) there are no recorded superficial deposits across the site. The bedrock geology which underlies the site is London Clay Formation.

Infiltration techniques are unlikely to be viable due to the underlying clay geology overlaid with an average build-up of 9.8m depth of made ground.



Figure 1.1 Site Location Plan

2.5 Flood risk vulnerability

With reference to Table 2 of the Planning Practice Guidance (PPG) to the National Planning Policy Framework (NPPF), the proposed residential development would be classed as a More Vulnerable development.

An extract from Table 2 of the PPG for Flood Risk and Coastal Change is replicated here in Table 2.1 with the proposed development type highlighted.

Flood Risk Vulnerability Classification	
Vulnerability	Development Types
More Vulnerable	Hospitals.
	Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.
	Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.
	Non-residential uses for health services, nurseries and educational establishments.
	Landfill and site used for waste management facilities for hazardous waste.
	Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.

Table 2.1: Extract from Table 2 of PPG 'Flood Risk and Coastal Change'. Source: Planning Practice Guidance - 2014

3 Flood risk

3.1 Fluvial / Tidal flooding

An extract of the latest GOV.UK Flood Map for Planning (Rivers and Sea) is provided below in Figure 3.1. The approximate application site boundary is shown in red. The map indicates that the development site is located within Flood Zone 1 (Low Probability) and as such, the report considers the development to be in Flood Zone 1 and at a low risk of flooding from rivers or the sea.

Table 3.1 Extract from PPG 'Flood Risk and Coastal Change'

Flood Zone Definitions	
Flood Zone	Definition
Zone 1: Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding.
Zone 2: Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.
Zone 3a: High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding.
Zone 3b: The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency.

Source: Planning Practice Guidance – 2014

Table 3.1 below is a copy of Table 1 from Planning Practice Guidance for 'Flood Risk and Coastal Change' to the NPPF which defines Flood Zones. The proposed development, which is located within Flood Zone 1, is defined as having a less than 1 in 1,000 annual probability of river or sea flooding in any year. The LB Barnet CDA map, figure 3.3, also provides evidence of the same extent of high risk areas of surface water flooding.

3.2 Flooding from surface water

An extract of the latest GOV.UK map for surface water flooding is provided below in Figure 3.2. The approximate application site boundary is shown in red. The site is shown to be predominantly located in an area of very low (less than 1 in 1000) risk of surface water flooding in a given year. Three small areas within the site boundary, as indicated on the map below, are shown to be at low (1 in 100 to 1 in 1000) / medium (1 in 30 to 1 in 100) / high (greater than 1 in 30) risk of surface water flooding in a given year. The LB Barnet CDA map, figure 3.3, also provides evidence of the same extent of high risk areas of surface water flooding.

Two of the areas of higher surface water flood risk are isolated pockets of water, probably associated with existing low spots of the level data used for the assessment. Hence, with the proposed development, these areas of higher risk will not exist.

The final area of high risk is associated with the north-eastern corner of the site. This area of the site will comprise highway infrastructure, hence, all buildings are at very low risk. The levels of the site will be designed such that surface water flows are directed away from the proposed residential building.

Sunnyhill Park – Group2_032

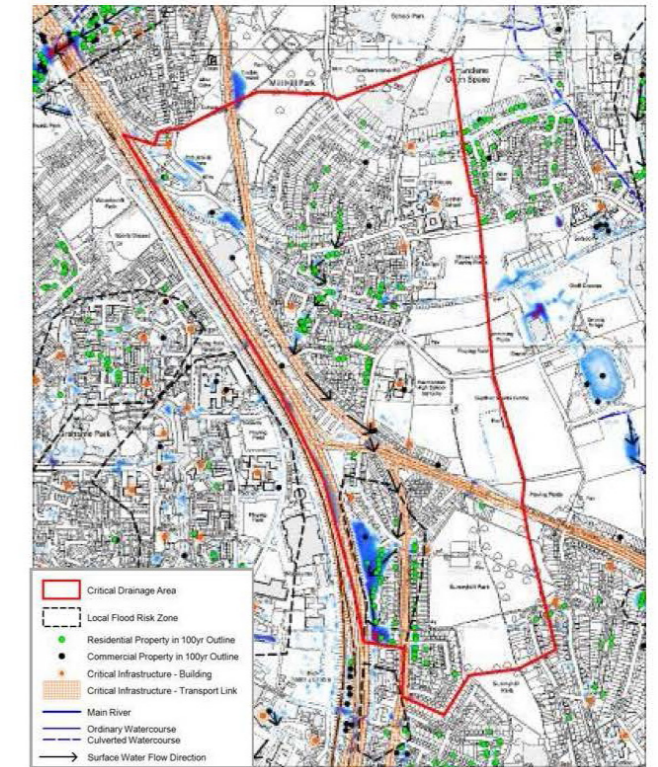


Figure 3.3 LB Barnet CDA Map Goup2_032

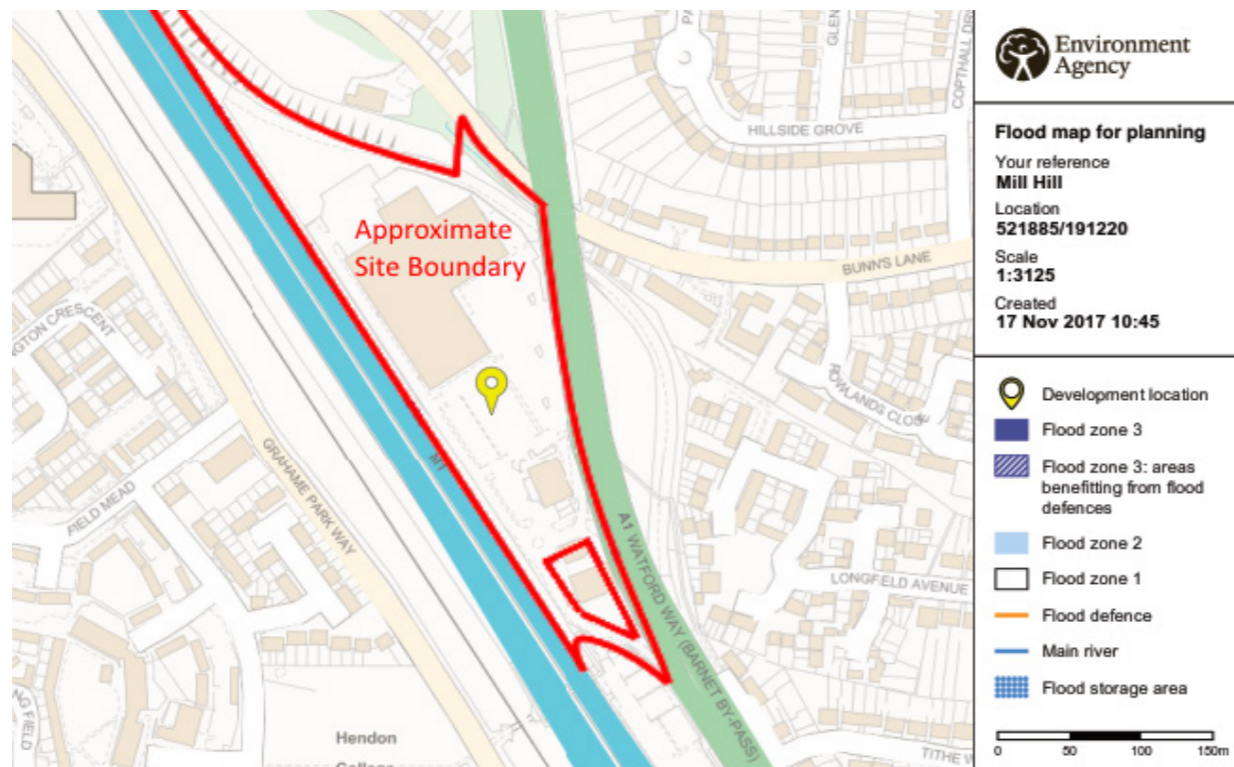


Figure 3.1 Flood Map for Planning (Rivers and Sea), Source <http://flood-map-for-planning.service.gov.uk>

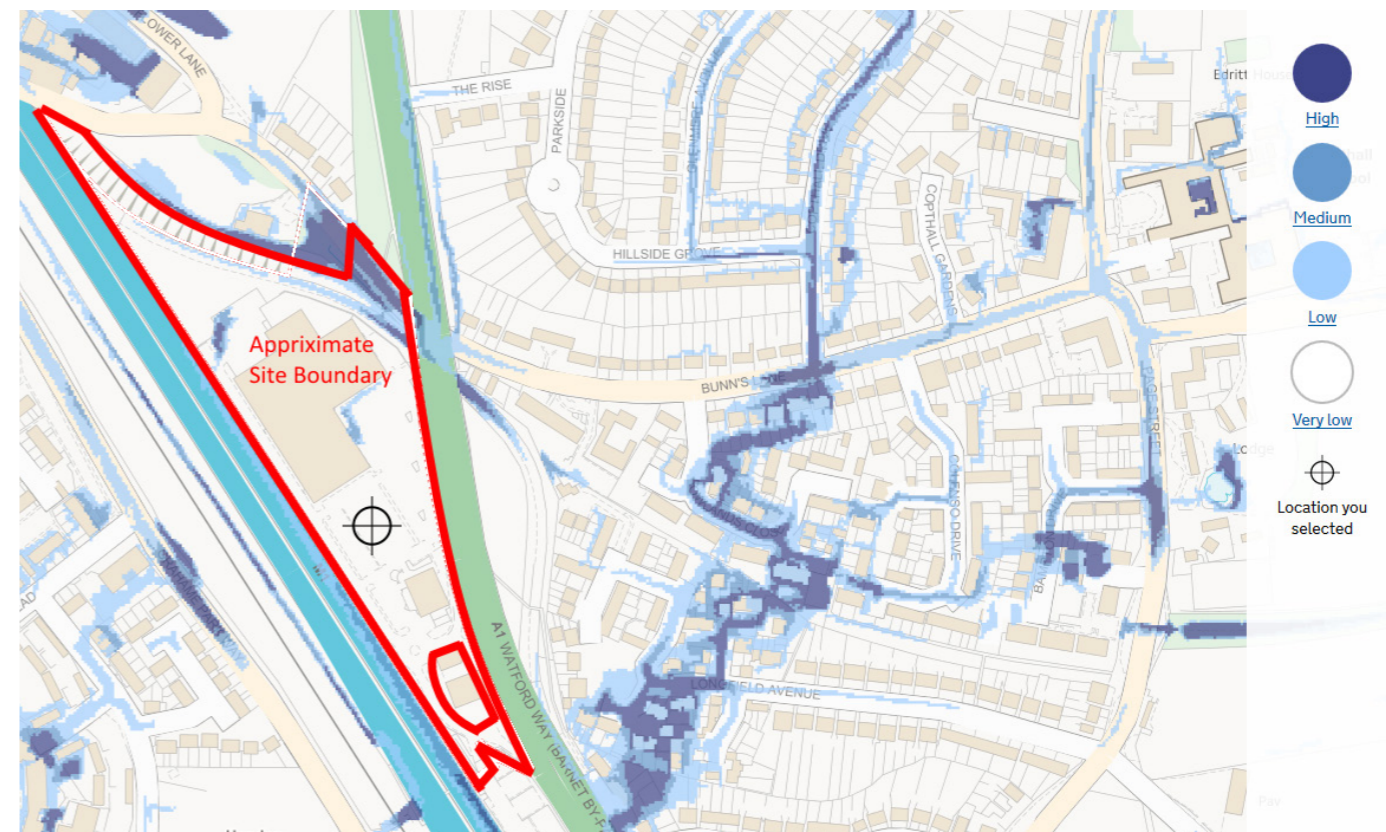


Figure 3.2 Risk of Flooding from Surface Water, Source <http://flood-map-for-planning.service.gov.uk>

3.3 Flooding from groundwater

From information provided on the Environment Agency’s website, see Figure 3.4 and Figure 3.5 below, the site does not appear to be underlain by an aquifer in the superficial deposits or in the bedrock layer. There is no evidence of any flooding on the site caused by groundwater. It is therefore considered that the probability of flooding on the site from groundwater as low.

3.4 Flooding from sewers

There are foul and surface water sewers located within the site application boundary. These sewers are assumed to be below the level of the proposed lower ground floor, approximately 10m below the existing ground level, based on TW Asset Plans and CCTV survey information. The existing sewers which cross the proposed lower ground floor extent will be either diverted or maintained along their current routes subject to TW approval. There are no records of sewer flooding within the vicinity of the proposed development. It is therefore considered the risk of flooding from sewers to be low risk for the proposed development.

3.5 Flooding from reservoirs, canals and other artificial sources

There are no nearby canals or artificial water sources that may result in flooding of this site.

An extract of the latest GOV.UK map for flood risk from reservoirs is provided below in Figure 3.6. It can be seen that the proposed development site, shown in red, is not at a risk of flooding from reservoirs.

3.6 Historic flooding

There are no records showing historic flood events within the vicinity of the site.

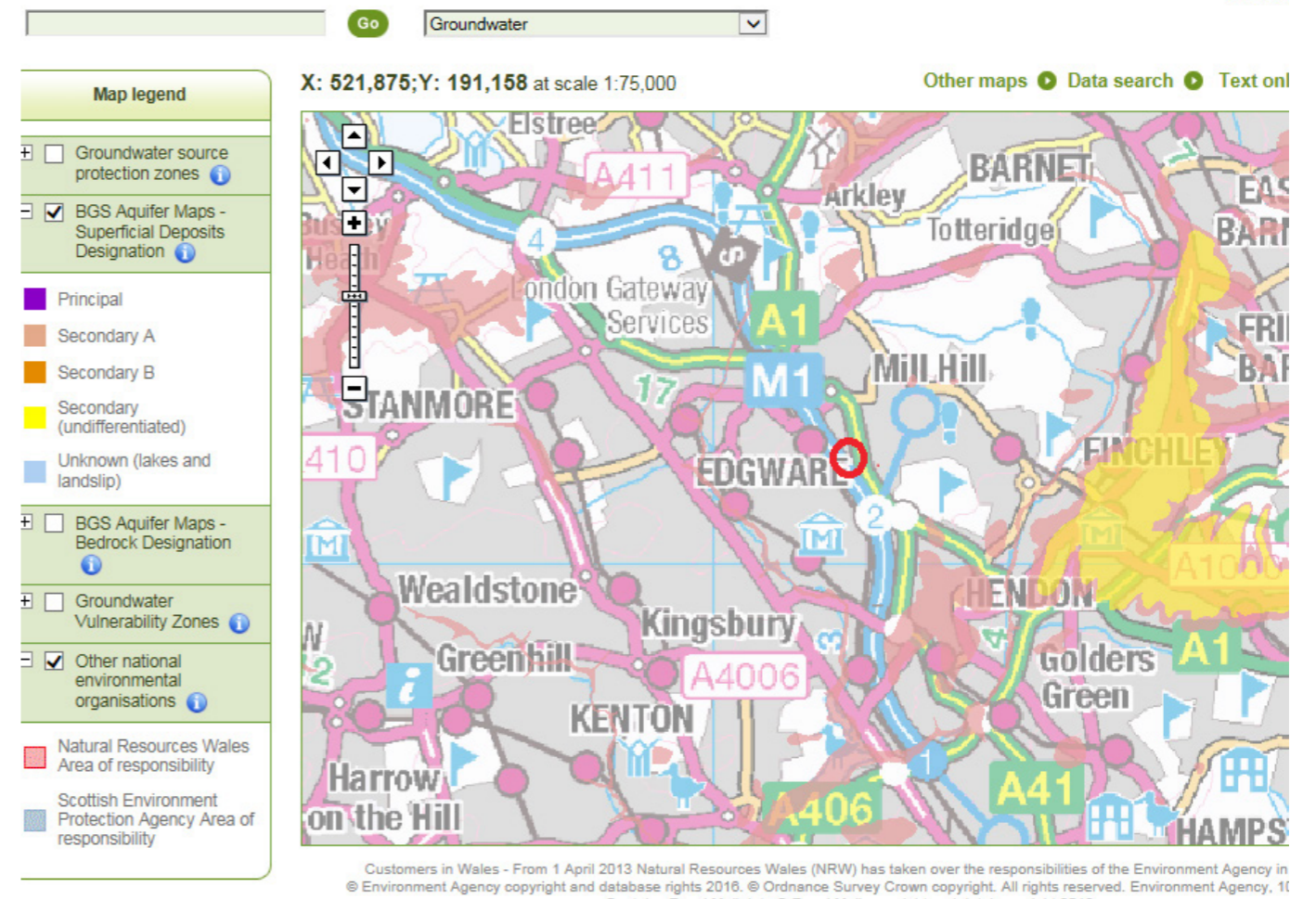


Figure 3.5 Groundwater –Superficial Designation, Source: Environment Agency website – 9th August 2016

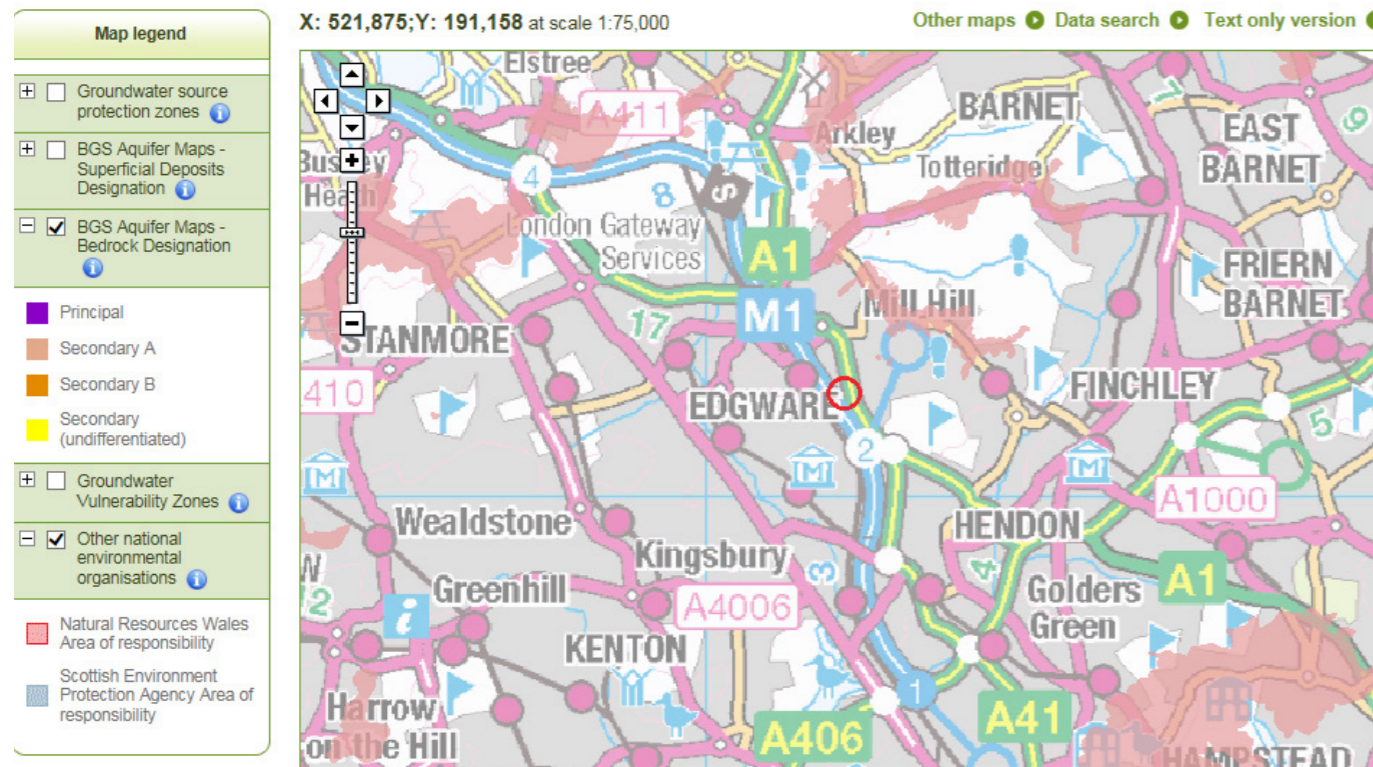


Figure 3.4 Groundwater – Bedrock Designation, Source: Environment Agency website – 9th August 2016



Figure 3.6 Risk of Flooding from Reservoirs, Source <http://flood-map-for-planning.service.gov.uk>

3.7 Flood risk vulnerability and flood zone compatibility

Based on the above assessment of the site being located within Flood Zone 1 and classified as a More Vulnerable development, and with reference to Table 3.2 below (Planning Practice Guidance for 'Flood Risk and Coastal Change' to the NPPF, Table 3), the proposed development of this site would be considered "appropriate". A copy of Table 3 is presented below highlighting the above. Neither a sequential or exception test will be required.

Table 3.2 Extract from PPG 'Flood Risk and Coastal Change'

Table 3 – Flood Risk Vulnerability and Flood Zone Compatibility					
Flood Risk Vulnerability Classification	Essential Infrastructure	Water Compatibility	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception test required	✓	✓
Zone 3a	Exception test required	✓	X	Exception test required	✓
Zone 3b	Exception test required	✓	X	X	X
✓ = Development is appropriate			X = Development should not be permitted		
Source: Planning Practice Guidance - 2014					

3.8 Flood compensation

Flood compensation measures will not be required for this site as it is located within Flood Zone 1.

3.9 Access and egress

Access and egress to and from this site in the event of flooding will be via the proposed development's access roads which will allow residents to move to higher ground.

4 Management of surface water

4.1 Existing condition

The site is currently developed as a retail park. The existing site drainage is shown in Appendix D based on collating CCTV, topographical and sub-scan surveys. There is a presence of two storage units, measuring approximately 22m x 1500mmØ and 41m x 1800mmØ, providing volumes of 38.9m³ and 104.3m³ respectively, totalling in 143.2m³ of storage. The 1800mmØ storage tank appears to be on a run shown on Thames Water Asset Plan (Appendix C), it is located between MH8202 and MH8102.

The whole site then connects via 225mmØ pipe from MH8102 to MH 8101 which lies on a TW 900mmØ sewer located along the western boundary of the site.

In line with best practice guidance, the design of drainage will assume that the site is brownfield and allowable discharge rates will be calculated in line with this assumption.

Table 4.1 Environment Agency SuDS Hierarchy Table

Rank	SuDS Technique	Flood Reduction	Pollution Reduction	Landscape & Wildlife Benefit
1	Living Roofs	✓	✓	✓
2	Basins and Ponds Construction Wetlands Balancing Ponds Detention Basins Retention Ponds	✓	✓	✓
3	Filter Strips and Swales	✓	✓	✓
4	Infiltration Devices Soakaways Infiltration trenches and basins	✓	✓	✓
5	Permeable Surfaces and filter drains Gravelled Areas Solid Paving Blocks Porous Pavers	✓	✓	
6	Tanked systems Over-sized pipes/tanks Storm-cells	✓		

The above SuDS options have been considered as part of the drainage strategy.

4.2 Sustainable Drainage (SuDS)

Sustainable Drainage Systems, known as SuDS mimic natural processes to drain surface water and encourage groundwater recharge to reduce the flow of surface water from a developed site to something akin to that of an undeveloped site. The Environment Agency SuDS hierarchy has been reproduced below:

The table below explains the reasons for and against the SuDS options.

Table 4.2 Environment Agency SuDS Hierarchy Table - Justification

Rank	SuDS Technique	Use	Comment
1	Living Roofs	✓	The proposed development benefits from 3,310m ² of green roof areas. Additionally, the ground floor podium will have green planted areas measuring 4,890m ² . This equates to approximately 8,200m ² of 'living roof'.
2	Basins and Ponds Construction Wetlands Balancing Ponds Detention Basins Retention Ponds	✓	The site is densely developed with a basement across most of its footprint. The basement formation level has been defined by a cut & fill analysis to minimise spoil disposal offsite, as well as plant movements. The only undeveloped part area is located north of the site - beyond the Bbuilding and basement boundary. This area can be split into two: (I) The steep sided embankment to connect to Bunns Lane (with pedestrian link bridge). This area is not appropriate for basins and ponds. (II) The gently sloping landscaped area between the building development and Watford Way. This area could be utilised for basins or ponds subject to detailed design consideration by architect and landscape architect. As the site slopes north to south, both areas listed above will be unable to aid with the drainage of the proposed hardstanding areas, situated downstream of the two locations. Therefore, open water features can be provided, but due to the topography of the site their effectiveness will be limited.
3	Filter Strips and Swales	✓	See comments above for Rank 2.
4	Infiltration Devices Soakaways, Infiltration trenches and basins	X	The ground conditions across the site consists varying thickness of Made Ground over London Clay to depth. These are not considered appropriate for infiltration techniques.
5	Permeable surfaces, Gravelled Areas Solid Paving Blocks Porous Pavers	✓	Permeable surfaces and filter drains are considered to help with the surface water management for this site in locations outside of the basement boundary. The feasibility for using permeable surfaces will be considered at detailed design stage.
6	Tanked systems Over-sized pipes/tanks Storm-cells	✓	Tanked systems are considered as part of the surface water management for this site in the form of a podium level 'BluRoof' and below ground geocellular storage tank.

Table 4.2 confirms that the following SuDS devices will provide an overall positive impact to the proposed development:

- Living Roofs
- Basins and Ponds (subject to detailed design)
- Infiltration Devices and Swales (subject to detailed design)
- Permeable Surfaces and Filter Drains
- Tanked Systems

4.3 Surface Water Discharge

Surface water discharge from the post-developed site can be done in various ways. The London Plan (2015) provides a list of preferred options. The London Plan (2015) states that the Mayor will, and boroughs should, seek to ensure that surface water run-off is managed as close to its source as possible in line with the drainage hierarchy. The table below sets to explain the use of SuDS to manage the surface water from a development site.

Table 4.3 The London Plan (2015) Surface Water Management Hierarchy - Justification

	Preference	Usage	Reason
1	Store rainwater for later use	✓ (subject to detailed design)	The use of rainwater for irrigation is deemed possible however this is to be advised and lead by the architect. For this particular site, this option is thought to only help with the discharge/management of surface water. The typical water demand in comparison to the volume of water accumulated during a low probability peak event would be a lower amount, therefore the excess volumes would require to be discharged and/or managed in other ways.
2	Use infiltration techniques, such as porous surfaces in non-clay areas	X	The geology of the site is described in Section 2.4 above. Infiltration techniques are unlikely due to the underlying clay geology and extensive made ground over. However, infiltration testing will be completed prior to detailed design.
3	Attenuate rainwater in ponds or open water features for gradual release	X	There is inadequate space for ponds or open water features to be used as attenuation for majority of hardstanding areas on site, as described in Table 4.2 in this report.
4	Attenuate rainwater by storing in tanks or sealed water features for gradual release.	✓	As described in Table 4.2, tanked systems are considered as part of the surface water management for this site in the form of a podium level 'BluRoof' and below ground geocellular storage tank.
5	Discharge rainwater direct to a watercourse	X	The watercourses near the development are not able to be utilised, due to the topography of the site.
6	Discharge rainwater to a surface water sewer/drain	✓	The adopted sewers within the vicinity of the site are shown on the Thames Water asset plan enclosed in Appendix C. A number of existing surface water sewers currently cross the development site, as shown on the plans enclosed in Appendix D. As part of the proposed development, the existing sewers which currently cross the development site will be diverted. These diversions will be subject to approval by Thames Water under a Section 185 agreement. Temporary diversions will likely be required during the construction of the permanent diversion works. The temporary diversions will also be subject to Thames Water approval. The proposed diversions are shown on the plans enclosed in Appendix E. Surface water from the proposed development will outfall to Thames Water's existing sewer network at manholes 7301, 8205 and one new connection as detailed on the plans enclosed in Appendix E.
7	Discharge rainwater to the combined sewer.	X	Surface water from the proposed development will drain into Thames Water's existing surface water sewer network. Therefore, draining surface water to a combined sewer will not be considered further.

Table 4.3 confirms that surface water will be managed by a combination of:

- Store rainwater for later use (subject to detailed design)
- Attenuate rainwater by storing in tanks or sealed water features for gradual release
- Discharge rainwater to the surface water sewer

5 Surface Water Drainage Strategy

Surface water discharge rates will be restricted to ensure that the rate of surface water runoff from the site does not increase as a result of the proposed development. This will be accomplished by utilising storage structures and flow control devices. The proposed drainage area plan enclosed in Appendix F identifies proposed impermeable areas considered in this report. There are two sources of storage currently considered:

- 'BluRoof' (ALUMASC, or equivalent, above ground attenuation storage) located within the podium level.
- Geocellular Storage buried below ground level.

The 'BluRoof' storage will be utilised to provide storage for the surface water runoff generated at levels above the podium level. The Geocellular storage tank will be used for flows from all other sources. In an event that the storage requirement at the podium level exceeds the capacity of the structure, a proportion of roof runoff will be diverted towards the Geocellular storage buried within the ground. To reduce the size of the buried attenuation a 'BluRoof' option (ALUMASC above ground attenuation storage) will be considered as part of the detailed design.

The proposed below ground drainage plan is enclosed in Appendix E. The drawing shows that surface water attenuation can be accommodated on the site and the method of discharge assuming that infiltration techniques are not viable. The detailed design parameters of the drainage are described in detail in Section 5.1.

5.1 Surface water drainage design and management

Proposals are to design the surface water drainage system to accommodate storms up to the 1 in 100 year event plus an allowance for climate change. The design life of a residential development is considered to be greater than 60 years. Table 5.1 below is a copy of Table 2 from the Environment Agency's guidance 'Flood risk assessments: climate change allowances' to support the NPPF, which defines climate change allowances.

For the purposes of this assessment, a worst case climate change allowance of 40% will be utilised to size the surface water attenuation requirement. Should the 40% climate change event result in surface water flooding, this will be contained within the development site and will not flood any buildings on site.

Table 5.1 Extract from 'Flood Risk Assessments: Climate Change Allowances'

Peak rainfall intensity allowance in small and urban catchments			
Allowance	'2020s' (2015 to 2039)	'2050s' (2040 to 2069)	'2080s' (2070 to 2115)
Upper end	+10%	+20%	+40%
Central	+5%	+10%	+20%

Source: Environment Agency - 2016

5.2 Existing run-off rates

The existing site is considered to be 100% impermeable, measuring an area of 3.86ha. The existing run-off rates from site have been calculated using the Modified Rational Method:

Table 5.2 Existing runoff rates

Storm Scenario	Discharge Rate
Q ₁ -15min	352.2 l/s
Q ₃₀ -15min	865.3 l/s
Q ₁₀₀ -15min	1122.8 l/s

The greenfield runoff rate (Q_{bar}) for the site have been calculated using MicroDrainage as 16.7l/s - results can be seen in Appendix G.

5.3 Proposed run-off rates

In line with the Sustainable Design and Construction Supporting Planning Guidance (2014) document and The London Plan, there is a minimum requirement to deliver 50% attenuation of site's (prior to re-development) surface water run-off at peak times and that "on previously developed sites, run-off rates should not be more than three times the calculated greenfield rate".

Based on the above and the calculated greenfield runoff, the rate which the development will be restricted to is 50.1 l/s (three times the greenfield rate), (three times the greenfield rate), for all storm duration up to and including 1 in 100-years + 40% Climate Change.

Table 5.3 Proposed runoff rates & betterment

Storm Scenario	Existing Rates	Proposed Rates	Betterment
Q ₁ -15min	352.2 l/s	50.1 l/s	86 %
Q ₃₀ -15min	865.3 l/s	50.1 l/s	94 %
Q ₁₀₀ -15min	1122.8 l/s	50.1 l/s	96 %

As can be seen, these rates provide a very significant betterment over the existing conditions.

5.4 Attenuation requirements

Surface water will discharge into the existing Thames Water sewer on the South of the site and will be attenuated to the rate calculated in the previous section. To achieve this, surface water from above the podium level will be attenuated within a 'BluRoof'. Surface water from all other hardstanding areas of the site will be attenuated within buried attenuation.

The proposed drained area plan is enclosed in Appendix F. Based on this plan and the allowable discharge rate, the storage requirement has been calculated for each storage structure separately. Full calculations are enclosed in Appendix H and I.

Each storage structure's flow will be restricted to a specific value to ensure 50.1 l/s rate is met. It is estimated that the proposed flow rates should be:

- 20.1 l/s for 'BluRoof'
- 30.0 l/s for Geocellular Storage

5.4.1 'BluRoof'

Surface water from the BluRoof will connect to the existing Thames Water sewer within the site and discharge at a rate of 20.1 l/s.

Rainfall profile	= Flood Estimation Handbook
Return Period	= 100 year
Durations	= 15 to 5000 minutes
Climate change	= 40%
Limiting flow	= 20.1 l/s
Drained area	= 17,517,500 m ²
Total Storage required	= 1,190 m ³

The podium measures approximately 8,000m², with depth of 0.2m and void ratio of 95% - it can provide approximate volume of 1,520m³, hence it will be sufficient to accommodate runoff from the roofs.

5.4.2 Geocellular storage

Surface water from the geocellular storage will connect to the existing Thames Water sewer within the site and discharge at a rate of 30.0 l/s, restricted via hydrobrake.

Rainfall profile	= Flood Estimation Handbook
Return Period	= 100 year
Durations	= 15 to 5000 minutes
Climate change	= 40%
Limiting flow	= 30.0 l/s
Drained area	= 9,800 m ²
Volume of storage required	= 510 m ³ *

* This volume may increase depending on the final capacity of the 'BluRoof' and may be revised at detailed design stage. Additionally, if deemed feasible at detailed design stage, permeable surfacing and permeable substrates may be used to provide some attenuation volume.

5.5 Existing Volume of Surface Water Runoff

The existing site is considered to be 100% impermeable, measuring an area of 3.86ha. Using MicroDrainage the total discharge volume for 6-hour storm durations are:

Table 5.4 Existing discharge volumes

Storm Scenario	Discharge Volume
Q ₁ - 360min	704 m ³
Q ₃₀ - 360min	1,555 m ³
Q ₁₀₀ - 360min	2,016 m ³

5.6 Proposed Volume of Surface Water Runoff

The proposed site is considered to have an impermeable area of 2.73ha. Using MicroDrainage the total discharge volume for 6-hour storm durations are:

Table 5.5 Proposed discharge volumes

Storm Scenario	Discharge Volume
Q ₁ - 360min	498 m ³
Q ₃₀ - 360min	1,099 m ³
Q ₁₀₀ - 360min	1,427 m ³
Q ₁₀₀ - 360min + 40% CC	1,998 m ³

An overall reduction in impermeable area due to the development will result in lower runoff volumes the for all storms up to and including the 1 in 100-year storm event plus 40% climate change.

Due to unknown infiltration rates and potential rainwater harvesting volume of storage, further reduction in runoff volumes cannot be achieved at this stage. Options to infiltrate and re-use rainwater will be explored at later stages of the design.

6 Foul water drainage strategy

6.1 Existing condition

The existing adopted sewers within the vicinity of the site are shown on the Thames Water asset plan enclosed in Appendix C.

A number of existing foul water sewers currently cross the development site, as shown on the plans enclosed in Appendix D. As part of the proposed development, the existing sewers which currently cross the development site will be diverted or maintained along their current routes subject to Thames Water approval. The proposed diversions are shown on the plans enclosed in Appendix E.

6.2 Foul water strategy

Foul water from the proposed development will outfall to the diverted foul water sewer, which ultimately connects to Thames Water's existing foul network, as detailed on the plans enclosed in Appendix E. These diversions will be subject to approval by Thames Water under a Section 185 agreement. Temporary diversions will likely be required during the construction of the permanent diversion works. The temporary diversions will also be subject to Thames Water approval.

Due to a variety of methods available for calculating foul sewer peak flow rates, different values can be determined. Overestimating developments flow rates can often lead to excessive network redundancy which is not cost or environmentally efficient. There are also additional maintenance risks associated with under capacity networks. Two methods of calculating flow rates are described below:

An estimated foul sewer peak flow was calculated using the method described in the method described in BS EN 12056. Based on typical layouts and proposed numbers of 1, 2 and 3 bedroom units, a total number of appliances connected was determined which resulted in a flow rate of 45.9 l/s. Calculations can be seen in Appendix J.

Using the method derived from Sewers for Adoption 7th Edition, a flow rate of 4,000 l/day per dwelling was used to suit the proposed development. This resulted in a proposed flow rate of 39.1 l/s.

The second method represents a more realistic value of the proposed development's peak flow rate discharging into the sewer, hence it is suggested that a flow rate of 39.1 l/s is used as the peak foul water discharge from site.

The proposed foul discharge represents a significant increase above the existing site's discharge. This increase requires approval from Thames Water. This is described in further detail in Section 7.

7 Thames Water Liaison

HTS have been in contact with Thames Water to understand the capacity of the existing foul and surface water sewer networks to accommodate the increased flows from the development.

A Pre-Development enquiry was issued to accompany a previously submitted planning application and TW Developer Services responded, via email, on the 24th March 2016. TW confirmed that there was insufficient capacity for proposed wastewater (foul). It was also requested that SuDS techniques were used to minimise surface water discharge into the local sewer network. All correspondence with Thames Water including the Pre-Development enquiry for the original planning submission can be found in Appendix K.

HTS met with TW Developer Services on 20th Sept 2016 to discuss potential diversions and build-over agreements requirements for the development in addition to the process for TW undertaking a 'Sewer Impact Survey'. A summary email of actions was issued by Jonathan Flint of HTS (20/09/16) and a response received from Fez Rafiq Sharif of TW on the 22nd Sept 2016.

Subsequently the site layout and the drainage strategy changed, and a new Pre-Development enquiry was submitted by HTS for the previous scheme which had 724 residential units and a peak flow of 33.5 l/s. A response from Thames Water (received on 04/01/2018) confirmed that the proposed foul water flows were within the network's capacity. The response from Thames Water can be found in Appendix L. For the current proposed application, a new Pre-Development (now called "Pre-Planning") enquiry will be required to determine whether the network has the capacity for the small additional increase in flow from 33.5 l/s to 39.1 l/s.

8 Maintenance

The following section captures the maintenance and operation requirements for each element of the proposed drainage design.

Before cleaning, final testing and immediately before handover the Contractor will:

- Lift covers to manholes, inspection chambers and access points. Remove mortar droppings, debris and loose wrappings.
- Thoroughly flush pipelines with water to remove silt and check for blockages. Rod pipelines between access points if there is any indication that they may be obstructed.
- Carry out a CCTV of the pipework to ensure that it is free of silt and blockages.

The End User shall then follow the "Waste Management, The Duty of Care - A Code of Practice (Revised 1996)" and shall ensure that their waste does not escape from their control and is transferred only to a registered waste carrier to be sent for recycling or disposal at a suitably licensed facility.

All waste arising from the maintenance of the drains and sewers shall be handled, stored and disposed of correctly to avoid pollution. Waste may be designated as hazardous / special waste and, as such, the End User shall ensure that they comply with the Hazardous Waste (England and Wales) Regulations 2005.

Reference shall be made to CIRIA publication C753 - The SuDS Manual by the Contractor and the End User. A suitable maintenance schedule must be developed, maintained, followed and updated as required to reflect observed performance. The following items are highlighted for guidance.

8.1 General drainage

The below ground drainage network will be designed in accordance with the requirements of the Building Regulations whilst acknowledging the need to limit the number of inspection chambers within "front of building" areas. To this end, all main runs will have rodding eyes, manholes or inspection chambers at the head of the run and at all changes of direction to provide access to rod or jet the main pipework.

Where possible, connections from stacks or gullies will be made directly to these manholes or inspection chambers to allow the connection to be rodded or jetted from the downstream end. Where this is not possible, each stack will be detailed to have an access hatch provided just above floor level to allow the connection to be rodded or jetted from the upstream end. Similarly, the gullies will have a rodding access provided within their body allowing the pipework to be rodded or jetted from the gully downstream.

Gullies and channels will be specified with silt buckets and silt trap manholes will be provided upstream of all tanks and infiltration structures to prevent the ingress of silts into the drainage network and impairing the performance of the system.

Table 8.1 General drainage maintenance schedule

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then six monthly.
	Debris removal from catchment surface (where may cause risks to performance).	As required.
Remedial Action	Repair / rehabilitation of inlets, outlets, overflows and vents.	As required.
Monitoring	Inspect / check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed.	Annually or after large storms.

Note:

During construction surface water runoff should be prevented from entering the Geocellular storage structure.

8.2 Maintenance Strategy

The drainage system will be designed to minimise maintenance requirements and a full maintenance scheme will be established for those elements not being offered for adoption. The various areas will be maintained as set out in Table 8.1.

Table 8.1 Maintenance Areas – Surface Water

Maintenance Areas – Surface Water	
Aspect	Maintainer
Private Drains / Sewers	Freeholder
SuDS – Private	Freeholder
SuDS – Communal	SuDS Adoption Authority / Management Company / Freeholder
Adopted Sewers	Thames Water

In accordance with CIRIA C625 it is recommended that a private SuDS maintenance agreement is agreed as a simple contract between the property owner/tenant (customer) and the maintenance provider (the maintainer). It is mainly to facilitate continuing maintenance of the SuDS that are in private ownership. The maintenance requirements are in accordance with the CIRIA C753 SuDS Manual 2015. The following Drainage / SuDS measures are proposed within the development.

8.3 Inlets, Outlets and Inspection Chambers:

Table 8.2 Maintenance of inlets, outlets and inspection chambers.

Maintenance Period	Maintenance Task	Frequency
Occasional maintenance	Inspect surface structures removing obstructions and silt as necessary. Check there is no physical damage. Remove vegetation 1m min. surround to structures and keep hard aprons free from silt and debris.	Monthly or as required
	Remove cover and inspect ensuring water is flowing freely and that the exit route for water is unobstructed. Remove debris and silt. Undertake inspection after leaf fall in autumn.	Annually

8.4 Geocellular Storage Tank

The geocellular attenuation to be installed & maintained in line with the manufacturer's recommendations.

8.5 BluRoof

The BluRoof attenuation to be installed & maintained in line with the manufacturer's recommendations.

8.6 HydroBrake (Flow Control)

Following installation of the Hydro-Brake® Flow Control it is vitally important that any extraneous material i.e. Building materials are removed from the unit and the chamber.

After the system is made live, and assuming that the chamber design is satisfactory, it is recommended that each unit be inspected monthly for three months and thereafter at six monthly intervals with hose down if required.

If problems are experienced please do not hesitate to contact the company (Hydro International) so that an investigation may be made.

Contact: enquiries@hydro-int.com (+44 (0)118 933 1325)

9 Conclusion

The proposed development at Pentavia Retail Park, Watford Way, will comprise of 844 residential units with associated highway infrastructure and public open space.

The proposed drainage strategy will utilise surface water attenuation to allow for discharge at a rate of 50.1 l/s to accommodate a 1 in 100 year event plus an allowance of 40% for climate change.

There will be two main storage types, 'BluRoof' located at podium level and the Geocellular storage buried beneath the ground. Each storage will discharge by gravity, independently into the existing Thames Water sewer with combined flow from both not exceeding 50.1 l/s.

The podium level 'BluRoof' will require an approximate capacity of 1,190m³ and the Geocellular tank will provide additional 510m³ of storage. These ratios and combined method of storage and combined method of storage may change, but a combined volume of 1,700m³ will be provided for an impermeable area of 27,300m² for the whole site.

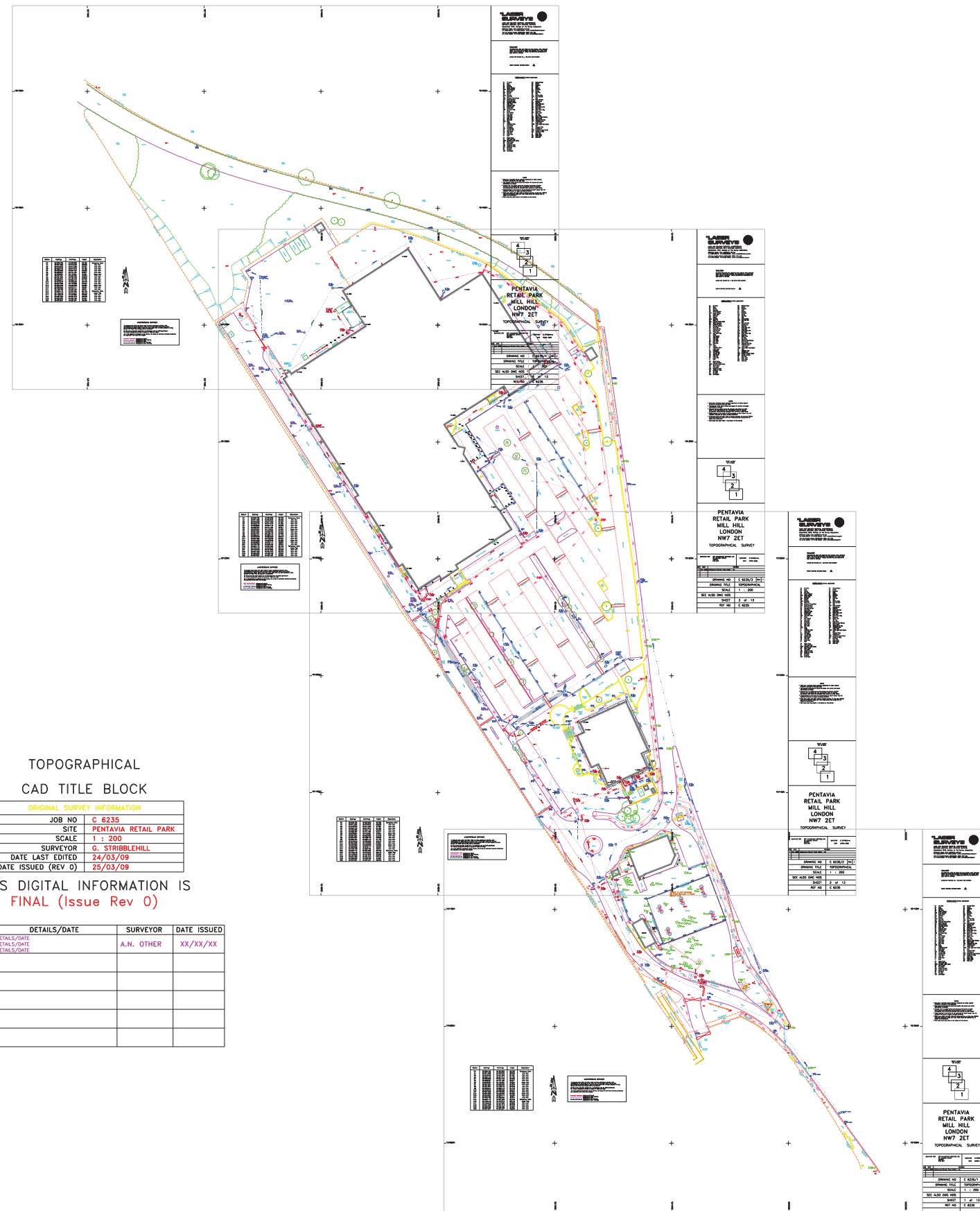
Volume of surface water runoff from the development will decrease, as the overall impermeable area of the site will be reduced as a result this development.

Foul water from the proposed development will outfall to the adopted foul water sewer as the existing condition. Previously the proposed foul water discharge rate was 33.50 l/s. A pre-development enquiry was submitted and Thames Water confirmed sufficient capacity for the development within the existing network (Appendix L). The small increase in proposed flow from 33.5 – 39.1 l/s will require a new pre-planning enquiry application to Thames Water to confirm there is sufficient capacity in their network.

The surface water drainage from this site, post development, is such that the surface water will be managed within the site boundary, thus complying with the Planning Practice Guidance for 'Flood Risk and Climate Change' to the NPPF. Based on the above, providing the above strategies are adopted the developed site will not contribute further to flood risk thus satisfying the principles of the NPPF.

Appendix A

Topographic Survey



TOPOGRAPHICAL
CAD TITLE BLOCK

ORIGINAL SURVEY INFORMATION			
JOB NO	C 6235		
SITE	PENTAVIA RETAIL PARK		
SCALE	1 : 200		
SURVEYOR	G. STRIBBLEHILL		
DATE LAST EDITED	24/03/09		
DATE ISSUED (REV 0)	25/03/09		

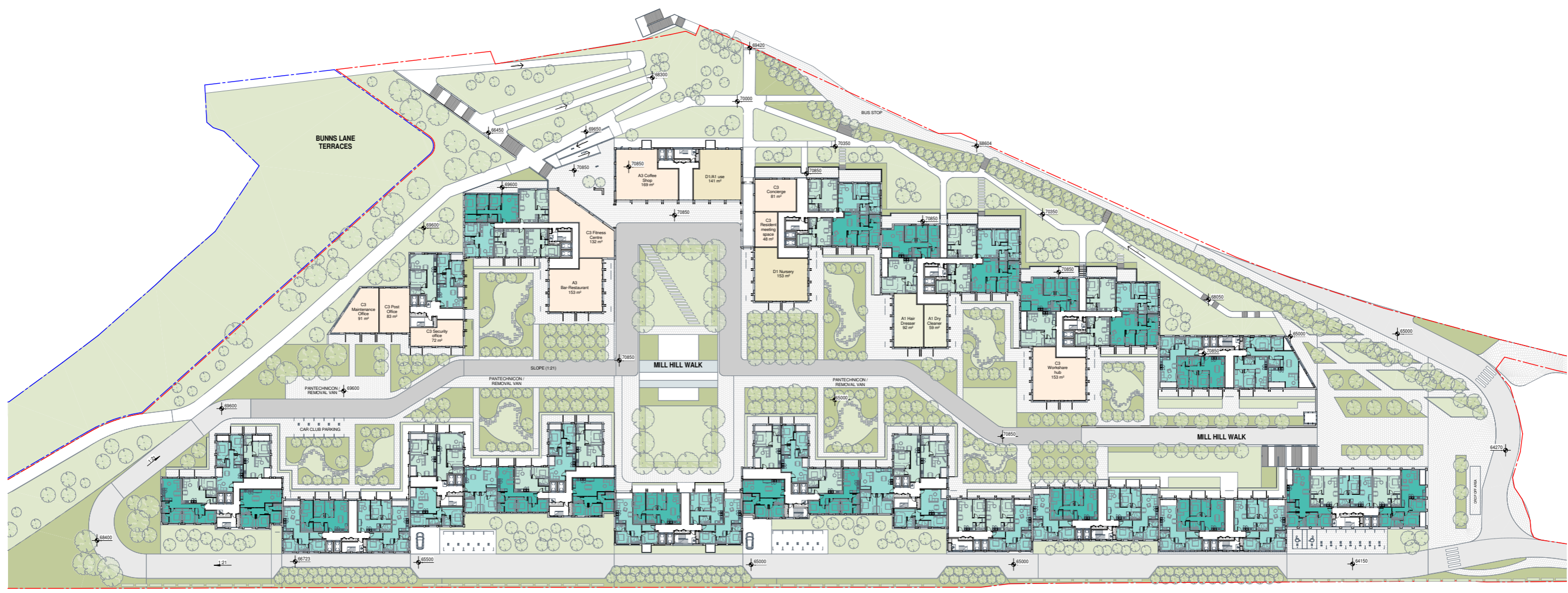
THIS DIGITAL INFORMATION IS
FINAL (Issue Rev 0)

REV NO	DETAILS/DATE	SURVEYOR	DATE ISSUED
REVISION 1	DETAILS/DATE DETAILS/DATE	A.N. OTHER	XX/XX/XX
REVISION 2			
REVISION 3			
REVISION 4			
REVISION 5			
REVISION 6			

Appendix B

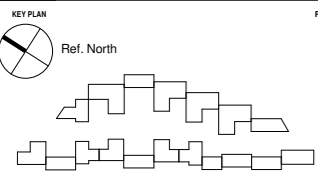
Proposed Site Plan

- Legend**
- 1 Bed
 - 2 Bed
 - 3 Bed
 - C3 Ancillary
 - A1 Class Order
 - A3-A4 Class Order
 - D1 Class Order

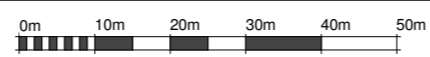


M1 MOTORWAY

LEVELS ARE SUBJECT TO CHANGE



REV	DATE	DESCRIPTION
P1	01.02.19	For information



SITE BOUNDARY ———
APPLICATION BOUNDARY ———

NOTES
Check and verify all dimensions prior to commencement of work.
This drawing shall be read in conjunction with all other contract documents including those by other consultants, and including specifications.
Seek clarification of inconsistencies/ conflicts.
Figured dimensions shall take precedence to scaled dimensions.

DRAWN	CHECKED	JOB NO.
MMR	JC	44032

This drawing is COPYRIGHT and shall remain the property of ARNEY FENDER KATSALIDIS

CLIENT
Meadow Residential

PROJECT
Mill Hill - London

ARCHITECTS:
AFK ARCHITECTURE + INTERIORS
44-46 SCRUTTON STREET, LEVEL 1
LONDON, EC2A 4HN, UNITED KINGDOM

CLIENT:
MEADOW RESIDENTIAL
FIRST FLOOR, 50 GREAT
MARLBOROUGH STREET, LONDON,
W1F 2AE

STRUCTURAL ENGINEER:
JES
2 PEAR TREE COURT, LONDON,
EC1P 3DS

MECHANICAL / ELECTRICAL ENGINEER:
CHAPMAN BROS
SAFFRON HOUSE, 8-10 KIRBY STREET,
LONDON, EC1N 8TS.

LANDSCAPE ARCHITECT:
OUTSIDE
THE SCOTTHOUSE, 27 FERRY
ROAD, TESSINGTON, TW11 8NN.

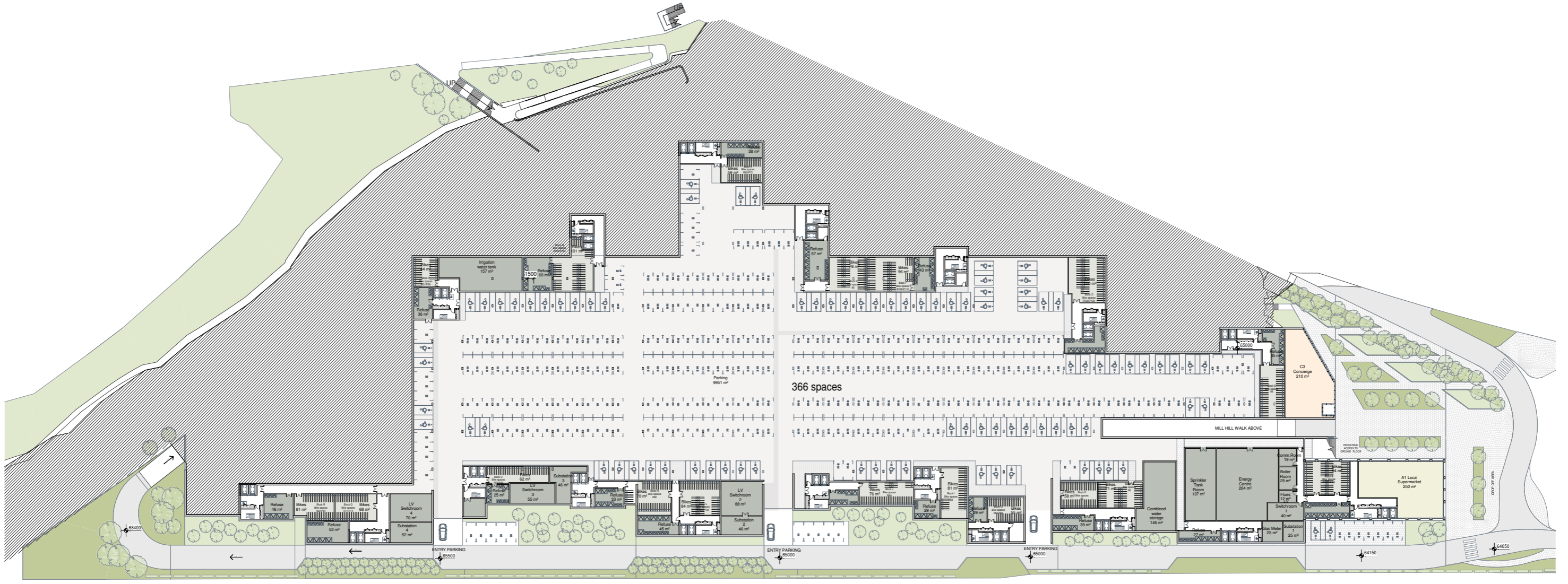
Arney Fender Katsalidis

DRAWING TITLE
GA_LEVEL 00_OVERALL PLAN

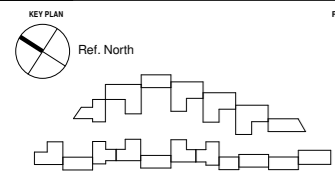
SCALE
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REVISION / DRAWING NO.
P1 | PLANNING

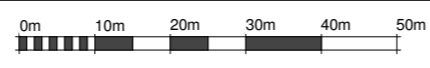
A10-00-01



STRUCTURE TO BE COORDINATED



REV	DATE	DESCRIPTION
P1	01.02.19	For information



NOTES
 Check and verify all dimensions prior to commencement of work.
 This drawing shall be read in conjunction with all other contract documents including those by other consultants, and including specifications.
 Seek clarification of inconsistencies/ conflicts.
 Figured dimensions shall take precedence to scaled dimensions.

DRAWN	CHECKED	JOB NO.
MMR	JC	44032

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CLIENT
 Meadow Residential

PROJECT
 Mill Hill - London

ARCHITECTS:
 822 ARCHITECTURE + INTERIORS
 44-46 SCRUTTON STREET, LEVEL 1
 LONDON, EC2A 4HN, UNITED KINGDOM

CLIENT:
 MEADOW RESIDENTIAL
 FIRST FLOOR 50 GREAT
 MARLBOROUGH STREET, LONDON,
 W1F 7JZ

DRAWING TITLE
 GA_LEVEL LG_OVERALL PLAN

STRUCTURAL ENGINEER:
 IES
 2 FEAR TREE COURT, LONDON,
 EC1P 3DB

MECHANICAL / ELECTRICAL ENGINEER:
 CHAPMAN BOSS
 SAFFRON HOUSE, 6-10 KIRBY STREET,
 LONDON, EC1N 8TS

LANDSCAPE ARCHITECT:
 OUTSPACE
 THE SCOTHOUSE, 27 FERRY
 ROAD, TESTONTON, TW11 8NL

Arney Fender Katsalidis

SCALE
 1 : 500@ A1

REVISION / DRAWING No.
 P1 | PLANNING

A10-LG-01

Appendix C

Thames Water Asset Plans

Asset Location Search



Atkins Telecoms
BRISTOL
BS32 4RZ

Search address supplied Pentavia Retail Park, Watford Way, LONDON
NW7 2ET

Your reference LM 42894

Our reference ALS/ALS Standard/2015_3219919

Search date 17 December 2015

You are now able to order your Asset Location Search requests online by visiting
www.thameswater-propertysearches.co.uk



Asset Location Search



Search address supplied: Pentavia Retail Park, Watford Way, LONDON, NW7 2ET

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

This search provides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0845 070 9148, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Email: searches@thameswater.co.uk

Web: www.thameswater-propertysearches.co.uk

Asset Location Search



Waste Water Services

Please provide a copy extract from the public sewer map.

The following quartiles have been printed as they fall within Thames' sewerage area:

TQ2191SE
TQ2190NE
TQ2291NW
TQ2290NW
TQ2191NE
TQ2291SW

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an 'as constructed' record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

Asset Location Search



The following quartiles have been printed as they fall within Thames' water area:

TQ2191SE
TQ2290NW
TQ2291SW

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0800 316 9800. The Customer Centre can also arrange for a full flow and pressure test to be carried out for a fee.

The following quartiles have not been printed as they contain no assets:

TQ2190NE

The following quartiles have not been printed as they are out of Thames' water catchment area. For details of the assets requested please contact the water company indicated below:

TQ2291NW Affinity Water
TQ2191NE Affinity Water

Affinity Water Ltd
Tamblin Way
Hatfield
AL10 9EZ

Tel: 0845 7823333

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Payment for this Search

A charge will be added to your suppliers account.

Asset Location Search



Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, budget estimates, diversions, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

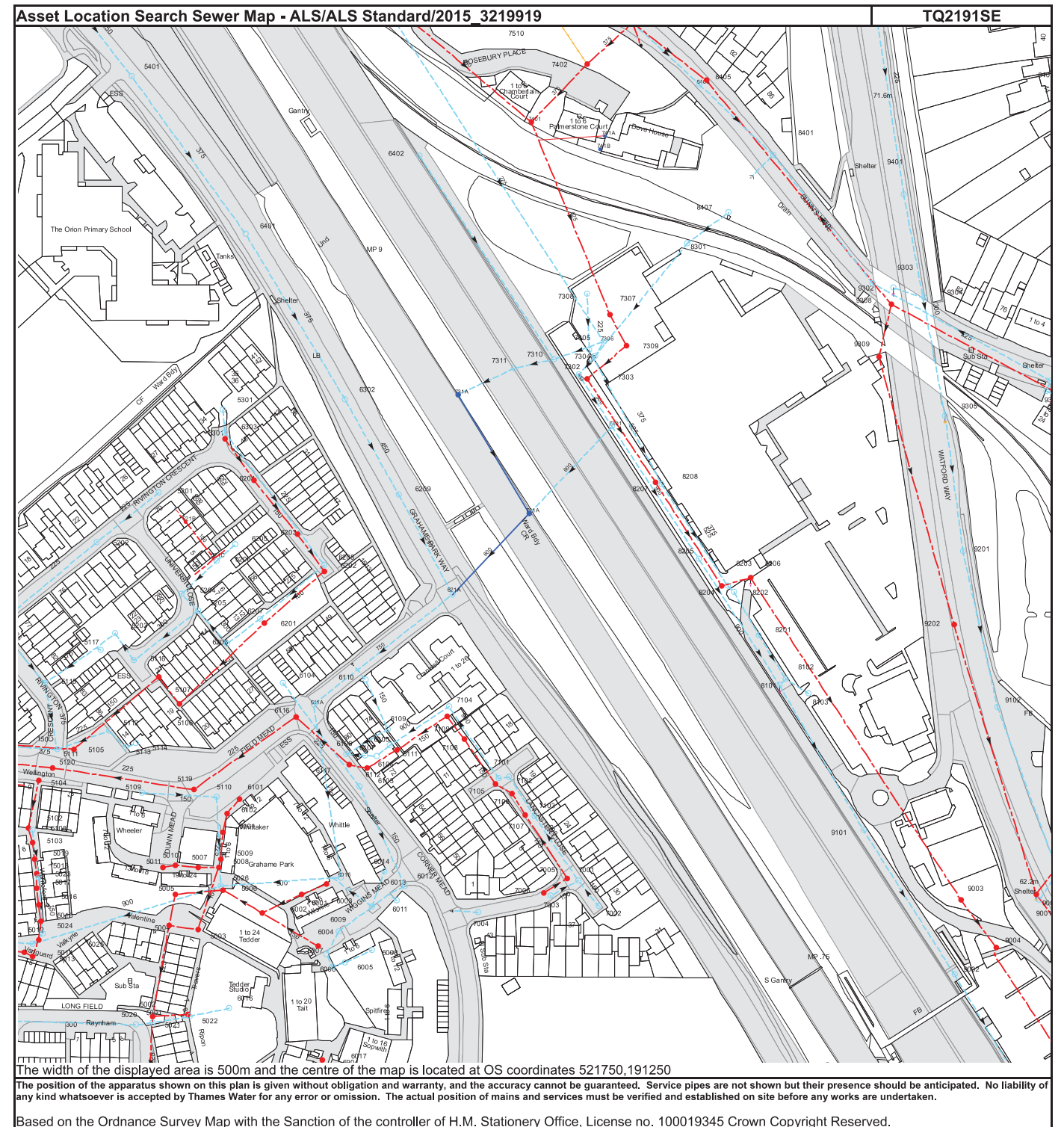
Tel: 0845 850 2777
Email: developer.services@thameswater.co.uk

Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0845 850 2777
Email: developer.services@thameswater.co.uk



NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
5401	60.17	57.12
6401	59.07	56.49
5112	54.97	53.28
5203	55.69	53.08
5113	54.97	53.47
5116	55.35	53.25
5114	54.98	53.55
5107	55.48	52.86
5201	57.47	55.69
5106	55.33	53.07
5204	56.3	54.67
521B	n/a	n/a
5205	56.36	53.58
521C	n/a	n/a
5206	.01	n/a
5301	58.58	57.64
6301	58.05	55.99
6303	58.09	56.43
6206	56.08	53.76
6205	56.99	55.68
6204	57.56	55.39
6207	56.44	54.02
6201	56.62	53.78
6104	55.62	54.75
6116	55.76	52.11
6203	56.8	54.58
611A	n/a	n/a
6202	56.4	54.13
6208	56.41	54.51
5104	53.42	52.22
5120	53.65	51.18
5111	53.72	52.44
5105	54.16	52.15
5115	54.64	52.68
5117	55.26	54.02
5202	56.72	55.04
5014	52.06	50.4
5102	52.86	51.94
5103	52.82	51.87
5013	52.07	50.45
5025	51.78	n/a
5108	52.79	51.83
5019	52.77	51.72
5017	52.78	51.57
5018	52.78	51.64
5016	52.78	51.43
5012	51.78	51.07
5023	52.78	51.47
5015	52.74	51.33
5024	51.82	50.22
5020	51.59	49.02
5109	54.48	52.29
5021	51.82	49.71
5002	51.93	50.28
5011	52.8	51.3
5004	52.11	50.61
5010	52.8	51.24
5005	52.96	50.66
5001	52.12	50.41
5022	52	50.07
5119	54.63	51.68
5003	52.15	50.74
5007	52.73	51.07
5110	54.18	52.08
5008	52.75	50.97
5026	52.75	49.53
5009	52.78	51.04
5006	52.9	50.92
5101	52.77	51.22
6102	53.29	51.31
6016	51.85	50.32
6101	53.41	51.4
6001	52.67	51.14
9001	.01	n/a
9005	n/a	n/a
8207	66.03	55.84
8208	65.98	63.58
8301	n/a	n/a
8406	n/a	n/a
8405	n/a	n/a
8407	n/a	n/a
8401	64.65	59.81
9302	62.08	60.23
9309	n/a	n/a
9308	n/a	n/a
9303	62.58	61.17
9401	.01	n/a
9304	62.8	61.33
9305	n/a	n/a
9306	64.6	62.44
9307	64.87	62.39

Manhole Reference	Manhole Cover Level	Manhole Invert Level
7101	56.51	53.24
7102	56.47	53.27
6112	55.13	52.3
6117	56.3	52.42
6106	55.46	52.92
6107	55.47	52.41
6108	55.21	50.88
6111	55.48	52.52
6105	55.72	53.08
7108	56.5	52.91
6109	55.79	51.14
7109	56.17	52.9
9102	n/a	n/a
7104	56.15	53.32
8103	64.65	61.88
8101	64.8	53.94
6110	56.37	51.43
8102	64.73	n/a
8201	65.15	62.05
9202	n/a	n/a
621A	n/a	n/a
8202	65.47	62.86
8203	65.51	63.03
8204	65.51	55.35
8206	66.25	55.24
8205	65.7	54.64
9201	n/a	n/a
6302	58.03	55.74
6209	57.46	55.13
6402	n/a	n/a
731A	n/a	n/a
7311	n/a	n/a
721A	n/a	n/a
7401	62.15	58.6
7310	n/a	n/a
7302	n/a	56.28
7308	66.27	64.64
7402	63.59	59.22
7303	66.4	56.33
7305	66.47	64.43
7304	66.66	n/a
741B	n/a	n/a
7306	66.61	n/a
741A	n/a	n/a
7307	68.3	56.73
7301	66.24	55.27
7309	66.75	56.53
6006	52.76	51.46
6005	52.69	51.55
6007	52.71	51.34
6008	52.81	51.7
9004	n/a	n/a
6004	52.44	51.38
6009	52.77	51.01
7004	54.03	52.19
6013	53.41	50.66
7002	56.07	54.61
6011	53.55	52.43
9003	n/a	n/a
7003	56.07	54.59
6002	52.75	51.42
7006	56.05	53.81
6012	53.81	51.55
6003	52.73	51.59
7001	56.26	53.42
7005	56.31	53.7
6015	52.83	49.57
6014	53.66	51.72
9101	n/a	n/a
7103	56.58	53.3
7107	56.94	53.77
7106	56.43	53.39
6103	55	52.55
7105	56.49	53.17
6017	52.17	51.18
9002	n/a	n/a

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 521750,190750
 The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.
 Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
591A	n/a	n/a
5902	51.46	50.05
6917	52.72	51.04
5910	50.82	49.29
5915	50.83	49.43
5817	50.93	47.08
5916	50.79	48.04
5914	50.83	48.14
5808	50.85	48.17
5912	50.79	49.78
5913	50.81	49.62
5803	50.88	47.48
5917	.01	n/a
5802	50.99	47.98
5807	51.09	48.57
5801	51.46	48.39
5911	51.42	50.23
5909	51.41	49.69
5806	51.4	49.03
5805	52	49.75
5815	52.07	49.12
5814	52.06	49.37
5816	52.09	48.7
5813	52.06	49.4
5812	52.05	49.45
5811	52.07	49.49
5810	52.08	49.52
5809	52.09	49.62
5901	52.01	50.01
5908	52.07	49.62
5906	52.08	49.75
5905	52.08	49.84
5904	52.1	49.87
5907	52.1	49.71
5903	52.12	49.97
5804	52.01	49.41
6918	51.99	50.33
6914	51.91	50.12
6806	52.42	50.27
6807	52.1	49.25
6805	52.37	50.35
6808	52.23	49.78
6813	52.49	50.34
6804	52.42	50.42
6913	51.9	49.82
6915	52.64	50.87
6916	52.41	51.36
6815	52.52	49.96
6812	52.8	50.38
6912	52.78	50.14
6732	52.43	50.33
6719	51.6	48.46
6730	52.43	50.16
6717	52.56	49.56
6736	51.73	48.77
6608	50.86	47.74
6643	49.94	48.05
6605	49.93	47.28
6743	.01	n/a
6635	50.63	48.5
6716	52.39	49.74
6609	50.91	48.16
6735	51.45	49.23
6715	52.39	49.74
6642	49.88	48.24
6733	52.43	50.01
6604	49.88	47.36
6714	52.46	50.19
6601	50.29	48.46
6603	50.29	48.23
6745	52.13	50.31
6640	50.29	48.69
6637	50.32	49.12
6734	52.4	50.08
6610	50.91	48.6
6641	49.86	48.31
6638	50.27	48.87
5608	51.01	n/a
571A	n/a	n/a
5604	51.01	46.49
5609	49.2	46.02
5701	.01	n/a
5607	50.57	45.49
5601	50.61	44.91
5703	51	45.97
5506	n/a	n/a
5606	50.56	48.32
5702	50.97	48.18
5605	49.78	46.69
5603	51.21	47.16
5602	51.36	46.08

Manhole Reference	Manhole Cover Level	Manhole Invert Level
6636	50.83	47.88
6801	52.44	50.42
6644	49.84	47.8
6607	48.87	46.84
6606	49.09	47.1
6737	52.29	49
6718	52.53	48.88
6630	50.59	46.45
6629	50.86	46.81
5504	51.26	46.87
5507	n/a	n/a
5501	50.75	46.44
5502	50.65	46.18
5503	50.6	47.89
6509	50.13	47.42
6508	49.73	46.95
6506	49.67	47.96
6507	49.66	47.56
6503	50.29	49.27
6504	49.98	48.86
651G	n/a	n/a
761C	n/a	n/a
761D	n/a	n/a
7609	50.97	49
7605	50.98	48.39
761A	n/a	n/a
7701	52.35	50.55
761B	n/a	n/a
861C	n/a	n/a
861F	n/a	n/a
861D	n/a	n/a
861E	n/a	n/a
861A	n/a	n/a
8709	52.4	51.31
8701	54.75	49.84
861B	n/a	n/a
8707	52.2	49.97
8601	51.43	49.12
651A	n/a	n/a
6624	50.22	48.9
6502	50.77	46.57
6625	50.26	48.98
7503	49.98	47.46
7611	50.54	49.11
7505	50.2	47.42
7502	50.18	47.74
7504	50.12	48.46
7501	50.07	48.23
8502	50.1	47.88
8505	50.24	47.58
8504	50.1	48.06
8501	50	48.04
851A	n/a	n/a
8503	50.31	48.87
7604	51.01	n/a
7610	50.82	49.25
6619	51.03	48.32
7603	51.02	48.52
7601	51.01	48.55
7612	51.05	48.81
7602	51.2	49.1
7608	51.41	47.02
6648	51.01	49.05
7613	51.06	48.87
761E	n/a	n/a
761F	n/a	n/a
7615	51.79	47.58
7614	51.92	49.39
7607	51.94	47.42
7616	52.8	n/a
7606	52.85	47.58
6741	51.8	50.27
8703	53.48	51.36
6703	51.81	49.97
6702	51.79	50.01
9701	54.18	50.56
8702	53.54	51.87
6802	51.75	50.11
6803	51.78	50.17
9803	53.52	50.62
6809	51.82	50.51
6810	52.81	48.47
9802	54.57	51.21
9801	54.69	52.73
6814	52.49	50.01
6910	52.15	50.21
6911	52.74	50.14
6909	52.8	50.99
6908	52.33	50.63
6907	52.43	51.54
6906	52.5	51.45
6919	.01	n/a
6905	52.6	50.73

Manhole Reference	Manhole Cover Level	Manhole Invert Level
6901	52.65	50.7
6902	53.45	51.93
6904	52.57	51.61
6725	51.8	48.12
6740	51.79	48.33
6739	51.78	48.47
6724	51.81	48.14
6709	51.7	49.02
6723	51.81	48.14
6738	51.73	48.52
6708	51.75	49.27
6722	51.79	48.22
6721	51.79	48.39
8706	53.42	50.69
6720	51.74	48.41
8711	.01	n/a
8708	54.25	51.74
8705	52.05	51.33
8710	54.81	50.2
6707	51.76	49.32
6706	51.73	49.37
8704	55.05	50.96
6742	51.74	50.09
6705	51.7	49.66
6744	50.49	49.97
8713	53.84	51.03
9703	53.58	50.7
8712	53.54	51.38
6704	51.8	49.9
9702	53.95	51.57
651F	n/a	n/a
651E	n/a	n/a
651D	n/a	n/a
6611	50.91	48.68
6615	49.83	47.55
6505	49.84	48.1
6612	50.91	48.89
6613	50.93	n/a
6616	50.83	47.77
6513	n/a	n/a
6501	50.52	n/a
6614	50.89	49.17
6622	50.39	48.23
6623	50.12	48.43
651C	n/a	n/a
651B	n/a	n/a
6650	50.11	48.32
6602	50.23	48.39
6639	50.18	48.83
6634	51	48.41
6645	49.81	48.49
6726	51.74	47.99
6727	51.74	47.95
6731	51.69	50.45
6728	51.74	47.86
6729	51.73	47.72
6701	51.8	47.67
6633	51.37	48.48
6628	51.62	47.47
6646	50.84	48.66
6632	51.75	48.7
6647	49.75	48.79
6710	51.76	48.89
6631	51.72	49.52
6711	51.77	48.82
6712	51.77	48.81
6627	51.78	48.57
6713	51.81	48.74
6617	50.49	49.08
6626	51.78	48.7
6618	49.75	48.79
6621	49.98	48.1
6649	50.05	48.51
6620	50.48	48.25

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The width of the displayed area is 500m and the centre of the map is located at OS coordinates 522250,191750
 The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

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Manhole Reference	Manhole Cover Level	Manhole Invert Level
3501	.01	n/a
3502	n/a	n/a
3604	.01	n/a
3603	85.28	n/a
3601	86.14	83.37
3602	.01	n/a
4503	73.91	71.91
4504	.01	n/a
4501	77.11	75.01
4502	.01	n/a
461A	n/a	n/a
4601	84.61	n/a
4602	84.77	78.55
1501	75.61	73.21
0603	83.28	79.7
2601	74.73	71.4
0604	83.33	79.39
2602	74.94	n/a
2604	75.31	n/a
2603	75.45	n/a
2606	78.18	76.04
0602	82.08	80.22
2605	78.31	75.71
0601	82.08	79.87
261B	79	77.77
261E	79	76.65
261A	80	78.68
261D	80	77.63
1602	80.64	78.79
1601	80.81	78.56
361B	81.3	78.82
361A	81.3	80.13
3703	82.91	79.77
3702	82.9	81.08
2705	83.22	81.24
1704	82.63	80.72
1703	82.69	80.49
2704	85.59	82.76
1702	84.17	82.43
1701	84.25	81.85
251A	n/a	n/a
251B	n/a	n/a
251C	n/a	n/a
1503	74.19	71.94
1504	74.28	72.22
2501	69.81	67.52
2502	69.76	67.81
1502	75.2	72.89
1505	75.27	73.18
1506	75.63	73.53
1903	85.2	84.78
1902	85.45	83.34
1901	85.53	82.03
1802	85.84	83.88
1801	85.8	83.2
2702	86.73	84.23
2701	86.74	83.56
0502	81.9	79.61
0501	81.96	79.28

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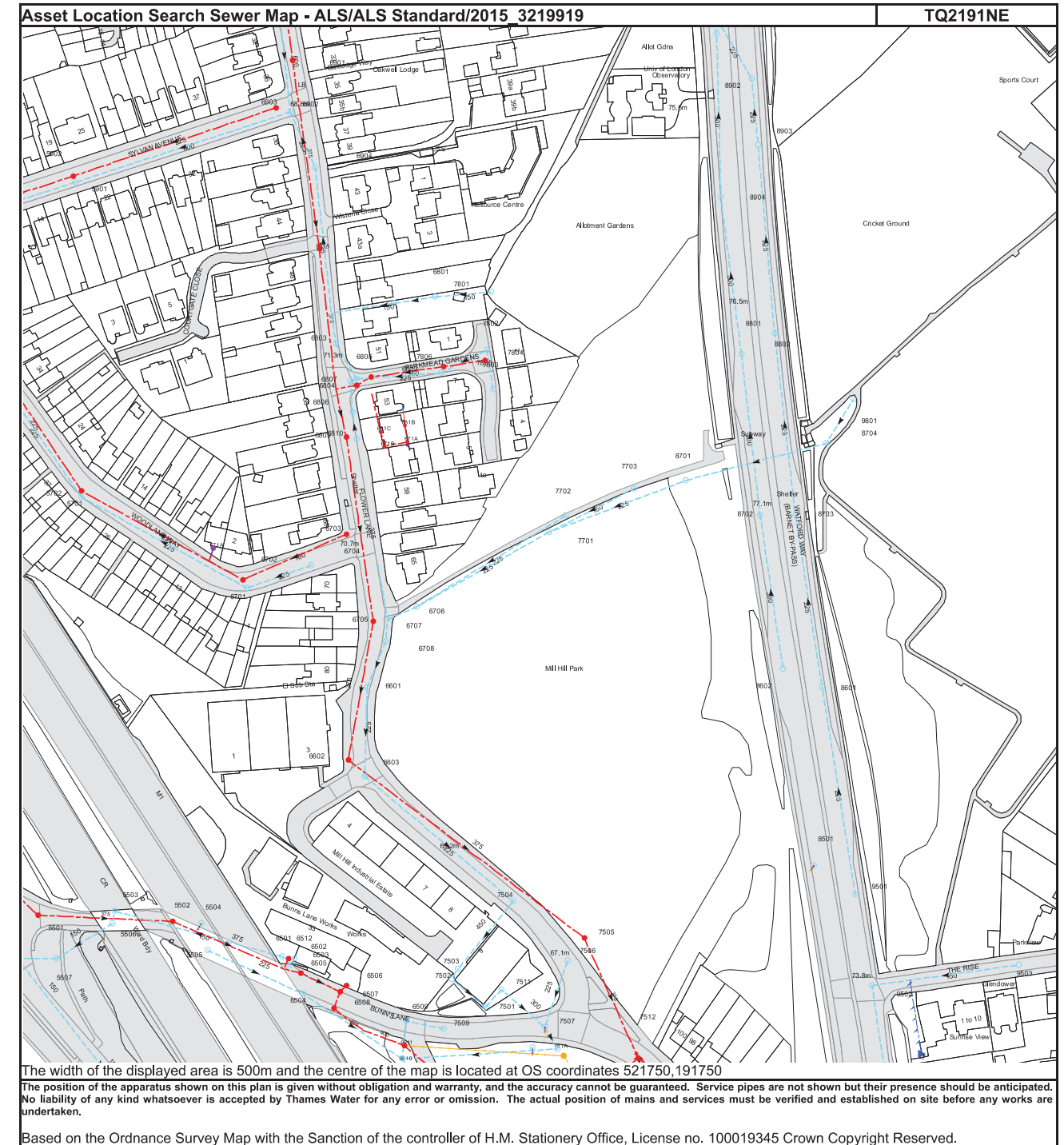
The width of the displayed area is 500m and the centre of the map is located at OS coordinates 522250,190750
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Manhole Reference	Manhole Cover Level	Manhole Invert Level
451H	n/a	n/a
451I	n/a	n/a
451F	n/a	n/a
451G	n/a	n/a
4504	53.63	51.79
4505	53.77	52.62
4501	53.77	52.94
4506	55.51	53.87
4502	55.61	53.49
451E	n/a	n/a
451C	n/a	n/a
451D	n/a	n/a
451A	n/a	n/a
451B	n/a	n/a
4507	57.69	54.08
4508	58.25	57.21
4503	56.12	53.55
4603	58.5	57.18
4604	58.01	56.26
4605	58.1	56.37
4601	57.83	55.44
4602	56.76	54.61
461B	n/a	n/a
4606	56.21	54.74
461A	n/a	n/a
361D	n/a	n/a
361C	n/a	n/a
3602	.01	n/a
3604	.01	n/a
3603	.01	n/a
3601	50.08	47.36
3606	54.06	52.31
3607	54.59	52.59
3615	n/a	n/a
3614	n/a	n/a
3613	n/a	n/a
361B	n/a	n/a
3612	n/a	n/a
3619	n/a	n/a
361A	n/a	n/a
3617	n/a	n/a
3501	.01	n/a
3620	n/a	n/a
4609	n/a	n/a
4510	53.47	51.94
4607	n/a	n/a
4608	n/a	n/a
3904	65.69	63.18
3902	65.88	62.76
291F	n/a	n/a
3906	65.17	62.47
3903	65.17	61.75
2904	65.32	62.1
2901	65.31	61.55
3901	67.78	66.39
3905	67.8	66.43
291B	n/a	n/a
291E	n/a	n/a
291D	n/a	n/a
291C	n/a	n/a
1905	58.89	56.97
1901	57.54	54.99
1802	57.53	n/a
1904	59.98	58
1902	59.96	57.38
291A	n/a	n/a
2905	62.07	60
2902	62.13	59.42
2903	59.16	56.39
2801	59.16	56.86
3706	55.16	53.43
3703	55.69	53.02
3707	55.68	53.6
1701	.01	n/a
2704	55.51	53.92
3704	55.68	53.74
3709	55.7	54.06
2702	55.52	53.49
2701	55.79	54.75
2703	55.75	54.79
3708	56.19	53.7
1702	56.37	n/a
3801	56.52	53.4
1805	56.12	54.08
2802	n/a	n/a
0802	.01	n/a
2812	58.08	57.04
0801	.01	n/a
1807	.01	n/a
2809	58.57	56.99
1804	57.11	55.15

Manhole Reference	Manhole Cover Level	Manhole Invert Level
3803	59.51	57.36
1803	56.76	54.73
3802	59.9	57.07
2807	58.9	56.96
1801	56.94	53.1
2803	58.9	56.63
0601	53.25	51.91
0503	52.46	50.01
0501	53.04	51.25
0502	52.73	50.73
2705	55.29	53.48
2505	n/a	n/a
2506	n/a	n/a
2502	52.85	52.1
2504	52.67	51.93
2501	52.83	50.6
2503	52.6	51.77
2602	.01	n/a
3608	53.47	52.01
3702	54.82	52.71
3611	53.99	50.59
3701	n/a	n/a
3705	54.79	n/a
3610	54.27	52.53
3609	54.25	52.64
3605	54.22	50.56
0913	58.21	n/a
0908	58.43	n/a
0907	58.58	n/a
0912	57.39	n/a
0914	57.8	n/a
0901	58.13	54.84
0906	58.28	56.31
0902	58.32	54.75
0909	57.88	55.98
0903	57.99	54.59
0910	57.94	55.8
0904	57.9	54.41
0905	57.63	54.34
0911	57.86	55.68
1903	58.87	56.35

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The width of the displayed area is 500m and the centre of the map is located at OS coordinates 521750.191750. The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken. Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

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Manhole Reference	Manhole Cover Level	Manhole Invert Level
5501	60.9	60.02
5507	59.28	n/a
5701	68.59	65.41
5702	68.53	66.01
5506	60.53	60.03
5503	60.83	n/a
5502	60.83	n/a
5504	61.05	60.28
5505	61.02	58.43
571A	n/a	n/a
6701	69.08	66.81
6702	69.04	67.28
6501	61.64	59.39
6512	61.78	60.03
6503	61.86	59.68
6502	61.82	n/a
6505	61.97	59.72
6504	62.32	58.08
6704	70.13	68.26
6508	63.18	59.48
681A	70.24	63.64
5902	68.21	65.37
5901	68.21	64.77
6904	68.91	67.19
6903	68.52	66.18
6902	68.45	65.54
6901	68.49	63.94
7703	73.98	71.68
8701	.01	n/a
8901	76.05	74.3
8904	76.53	74.68
8802	76.92	75.02
8902	76.13	n/a
8903	76.25	74.5
8702	77.41	76.01
8801	76.65	n/a
8703	75.14	73.51
8704	.01	n/a
9801	.01	n/a
6509	64.66	63.49
7501	65.08	61.05
6507	62.6	59.66
7511	63.25	60.98
6506	62.83	n/a
9502	73.59	71.68
7502	62.27	61.11
7503	62.34	61.17
9503	79.64	n/a
7506	66.04	64.33
7505	66.51	62.02
7504	65.32	62.02
9501	74.76	72.82
8501	75.14	73.25
6603	65.72	63.78
6602	66.05	62.49
6601	68.07	n/a
8601	77.18	n/a
8602	77.41	76.01
6708	69.55	67.53
6705	69.97	62.72
6707	69.98	68.04
6706	.01	n/a
6703	70.76	69.96
7701	72.4	71.21
6803	71.03	69.43
6809	71.05	63.06
6805	71.12	70.2
6806	71.07	n/a
6807	71.14	63.8
6804	71.11	69.55
6810	70.96	n/a
6812	71.13	69.03
681C	n/a	n/a
671B	n/a	n/a
681D	n/a	n/a
681B	n/a	n/a
671A	n/a	n/a
6801	70.86	70.34
7806	71.16	69.72
7805	71.19	69.28
7804	71.39	69.55
7802	71.32	69.88
7801	.01	n/a
7803	71.49	70.18
7702	72.66	69.83
6510	61.81	56.83
6511	65.43	59.31
7509	65.09	63.75
7510	.01	n/a
7507	64.81	62.33
751A	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
7512	64.171	59.231
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Asset Location Search Sewer Map - ALS/ALS Standard/2015 3219919 TQ2291SW



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 522250,191250
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Manhole Reference	Manhole Cover Level	Manhole Invert Level
3307	68.41	66.4
3301	68.82	63.33
3302	68.98	65.94
3306	68.91	66.57
3403	71.13	70.43
3401	71.02	69.92
4402	71.11	69.73
4404	71.23	70.3
4407	.01	n/a
4401	72.09	69.5
4406	.01	n/a
4403	70.87	64.27
4405	70.97	n/a
4303	69.93	64.64
2311	65.6	63.75
3303	68.43	65.87
141A	n/a	n/a
0401	77.83	75.44
0406	77.9	75.8
1401	73.05	69.99
1402	73.33	70.54
1403	72.9	70.14
2403	67.38	65.13
2404	67.55	65.42
0412	n/a	n/a
0407	79.34	77.05
2402	69.47	67.22
3402	69.42	67.5
0411	81.13	78.9
2401	70.4	68.12
2405	70.39	68.36
4102	68.8	66.1
4201	68.33	65.74
4205	68.28	67.27
4218	n/a	n/a
4219	n/a	n/a
4217	n/a	n/a
4206	68.35	67.09
4207	68.27	67.01
4213	68.3	65.5
4204	68.68	65.32
4209	68.82	67.95
4210	69.12	68.01
4306	.01	n/a
4304	69.87	68.7
4305	70.4	68.95
431B	n/a	n/a
431A	n/a	n/a
4004	68.91	n/a
4005	68.91	66.83
4006	69.37	67.86
4007	69.42	67.44
4001	69.15	67.79
4008	69.31	68.62
4002	69.33	68.33
4107	67.6	62.54
4101	68.38	66.52
4106	67.75	64.29
3105	n/a	n/a
3109	n/a	60.96
3104	n/a	65
3110	n/a	61.9
3214	66.97	65.24
3111	n/a	62.69
3207	67.57	65.78
3204	68.29	66.84
3203	67.65	66.43
3205	67.92	66.56
3310	68.41	66.6
3201	67.93	66.4
3206	67.84	66.26
3202	67.99	66.43
4214	68.2	66.76
4307	69.09	67.48
4308	69.11	67.76
4211	68.27	66
4105	68	64.37
4104	68.15	65.98
4208	68.25	66.97
4302	69.74	n/a
4103	68.99	67.88
4216	68.31	66.89
4301	69.04	67.65
4212	68.41	65.82
4202	68.64	67.1
4003	69.31	67.99
3002	68.7	66.62
3001	68.65	66.16
3101	67.43	62.34
2103	63.9	62.06
2101	62.97	59.81

Manhole Reference	Manhole Cover Level	Manhole Invert Level
2104	63.14	61.86
2107	n/a	n/a
2111	n/a	n/a
3106	n/a	n/a
3108	n/a	n/a
2108	n/a	n/a
2109	n/a	n/a
2106	62.08	61.45
2112	n/a	n/a
2110	n/a	n/a
2113	n/a	n/a
2102	62.32	60.06
3107	n/a	n/a
2105	62.35	60.67
1102	62.46	60.18
1217	62.52	60.53
2203	62.78	61.4
2207	.01	n/a
2208	.01	n/a
3211	n/a	n/a
1209	62.9	59.74
1204	63	61.44
2211	n/a	n/a
2210	n/a	n/a
3213	n/a	n/a
2204	64.19	62.47
2202	63.92	61.48
2201	64.01	62.27
3212	n/a	n/a
3210	n/a	n/a
2205	64.67	63.42
1216	64.39	61.91
2206	64.97	62.39
2209	n/a	n/a
2312	n/a	n/a
231A	n/a	n/a
1303	64.94	62.63
2306	64.91	63.28
2310	64.82	63.63
2314	64.84	62.64
2313	n/a	n/a
2304	65.38	59.84
2302	66.95	65.6
2301	67.2	63.28
2308	66.22	64.44
2305	64.91	n/a
2309	64.93	63
231D	n/a	n/a
2303	67.14	n/a
231C	n/a	n/a
3304	68.08	66.56
231B	n/a	n/a
1104	n/a	n/a
1103	n/a	n/a
1101	61.2	58.69
2001	62.88	60.37
2002	62.98	60.87
0201	63.32	62.01
0304	65.34	62.88
0202	63.59	61.62
0303	65.97	64.1
0203	64.41	61.51
0204	64.5	62.69
1211	63.33	60.93
1221	63.36	61.56
1202	63.2	61.51
1307	65.87	62.05
1212	63.15	60.75
1220	63.86	61.72
1304	65.38	63.27
1213	63.91	62.37
1205	61.15	59.55
1210	62.9	60.23
1305	65.83	63.99
1203	62.95	60.85
1301	65.74	61.05
1206	62.79	59.65
1208	62.77	59.7
1214	63.61	62.71
1201	62.71	60.54
1207	62.61	60.15
131A	n/a	n/a
131B	n/a	n/a
1215	64.19	61.58
0008	n/a	n/a
0103	n/a	n/a
0004	58.52	n/a
0005	58.51	56.03
0003	58.6	56.83
0002	58.51	n/a
0001	58.5	55.85
0006	58.62	56.97
0102	.01	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
0101	59.04	57.81
9301	64.25	62.19
0403	80.84	78.28
0409	80.86	78.74
0402	81.41	78.9
0302	65.45	61.6
0301	65.34	60.52
0410	81.4	79.21
0405	78.11	75.75
0408	80.47	78.39
0305	65	62.64
0404	81.21	78.77

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.



ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

- Foul:** A sewer designed to convey waste water from domestic and industrial sources to a treatment works.
- Surface Water:** A sewer designed to convey surface water (e.g., rain water from roofs, yards and car parks) to rivers or watercourses.
- Combined:** A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.
- Trunk Surface Water**
- Trunk Foul**
- Storm Relief**
- Trunk Combined**
- Vent Pipe**
- Bio-solids (Sludge)**
- Proposed Thames Surface Water Sewer**
- Proposed Thames Water Foul Sewer**
- Gallery**
- Foul Rising Main**
- Surface Water Rising Main**
- Combined Rising Main**
- Sludge Rising Main**
- Proposed Thames Water Rising Main**
- Vacuum**

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

- Air Valve
- Dam Chase
- Fitting
- Meter
- Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

- Control Valve
- Drop Pipe
- Ancillary
- Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol. Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

- Outfall
- Undefined End
- Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

- Public/Private Pumping Station
- Change of characteristic indicator (C.O.C.I.)
- Invert Level
- Summit

Areas

Lines denoting areas of underground surveys, etc.

- Agreement
- Operational Site
- Chamber
- Tunnel
- Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

- Foul Sewer
- Surface Water Sewer
- Combined Sewer
- Gully
- Converted Watercourse
- Proposed
- Abandoned Sewer

- Notes:**
- All levels associated with the plans are to Ordnance Datum Newlyn.
 - All measurements on the plans are metric.
 - Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.
 - Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
 - 'na' or '0' on a manhole level indicates that data is unavailable.

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 521750,191250

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

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The width of the displayed area is 500m and the centre of the map is located at OS coordinates 522250,190750
 The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.
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The width of the displayed area is 500m and the centre of the map is located at OS coordinates 522250,191250
 The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.
 Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.



ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

- 4"** **Distribution Main:** The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.
- 16"** **Trunk Main:** A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.
- 3" SUPPLY** **Supply Main:** A supply main indicates that the water main is used as a supply for a single property or group of properties.
- 3" FIRE** **Fire Main:** Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.
- 3" METERED** **Metered Pipe:** A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.
- Transmission Tunnel:** A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.
- Proposed Main:** A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

Other Water Pipes (Not Operated or Maintained by Thames Water)

- Other Water Company Main:** Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.
- Private Main:** Indicates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

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1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
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8. A charge may be made at the discretion of the company for increased administration costs.

A copy of Thames Water's standard terms and conditions are available from the Commercial Billing Team (cashoperations@thameswater.co.uk).

We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0800 316 9800

If you are unhappy with our service you can speak to your original goods or customer service provider. If you are not satisfied with the response, your complaint will be reviewed by the Customer Services Director. You can write to him at: Thames Water Utilities Ltd. PO Box 492, Swindon, SN38 8TU.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to Consumer Council for Water on 0121 345 1000 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.

Ways to pay your bill

Credit Card	BACS Payment	Telephone Banking	Cheque
Call 0845 070 9148 quoting your invoice number starting CBA or ADS.	Account number 90478703 Sort code 60-00-01 A remittance advice must be sent to: Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW. or email ps.billing@thameswater.co.uk	By calling your bank and quoting: Account number 90478703 Sort code 60-00-01 and your invoice number	Made payable to ' Thames Water Utilities Ltd ' Write your Thames Water account number on the back. Send to: Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW or by DX to 151280 Slough 13

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Search Code

IMPORTANT CONSUMER PROTECTION INFORMATION

This search has been produced by Thames Water Property Searches, Clearwater Court, Vastern Road, Reading RG1 8DB, which is registered with the Property Codes Compliance Board (PCCB) as a subscriber to the Search Code. The PCCB independently monitors how registered search firms maintain compliance with the Code.

The Search Code:

- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in property search reports undertaken by subscribers on residential and commercial property within the United Kingdom
- sets out minimum standards which firms compiling and selling search reports have to meet
- promotes the best practise and quality standards within the industry for the benefit of consumers and property professionals
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.

By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

The Code's core principles

Firms which subscribe to the Search Code will:

- display the Search Code logo prominently on their search reports
- act with integrity and carry out work with due skill, care and diligence
- at all times maintain adequate and appropriate insurance to protect consumers
- conduct business in an honest, fair and professional manner
- handle complaints speedily and fairly
- ensure that products and services comply with industry registration rules and standards and relevant laws
- monitor their compliance with the Code

Complaints

If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm's final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). The Ombudsman can award compensation of up to £5,000 to you if he finds that you have suffered actual loss as a result of your search provider failing to keep to the Code.

Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

TPOs Contact Details

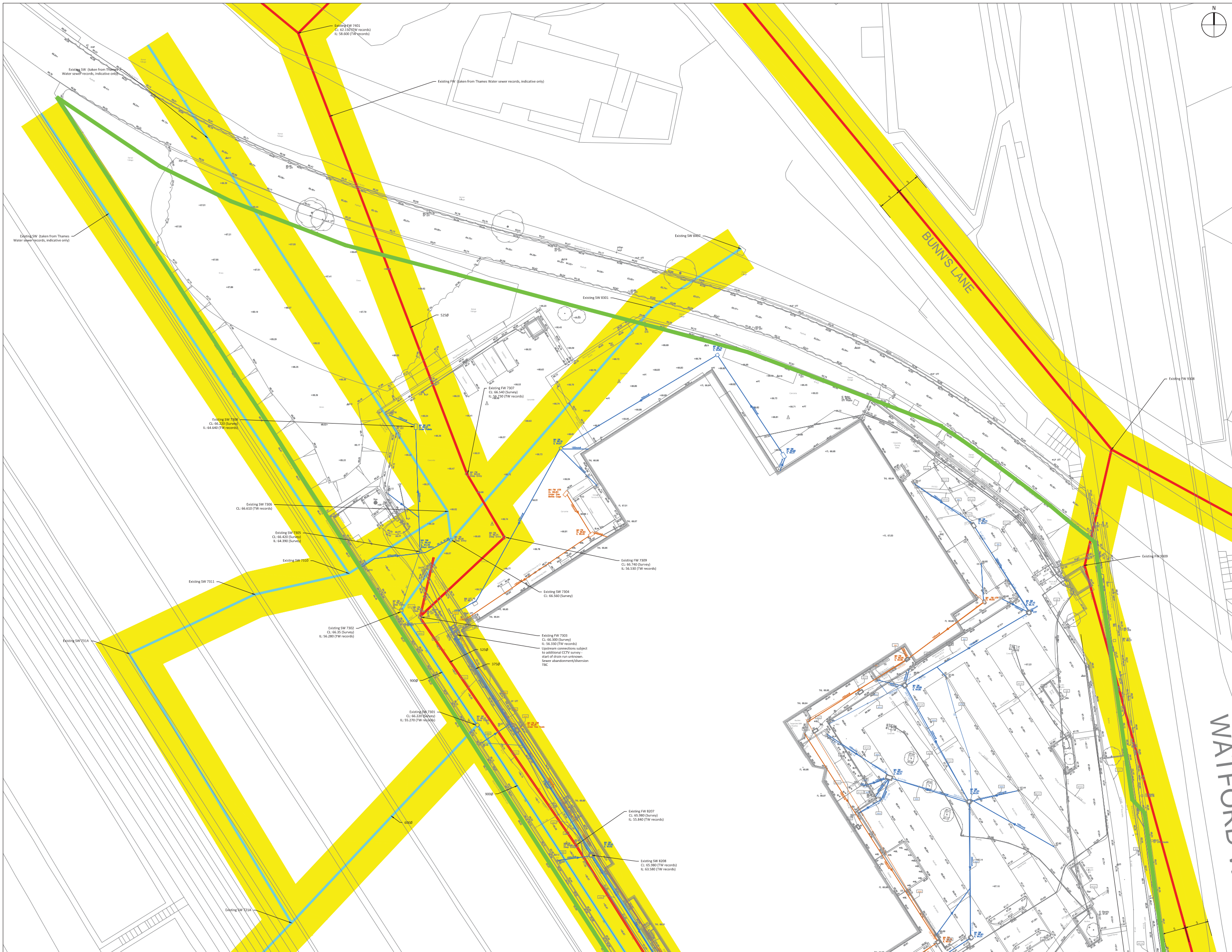
The Property Ombudsman scheme
Milford House
43-55 Milford Street
Salisbury
Wiltshire SP1 2BP
Tel: 01722 333306
Fax: 01722 332296
Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk

PLEASE ASK YOUR SEARCH PROVIDER IF YOU WOULD LIKE A COPY OF THE SEARCH CODE

Appendix D

Existing Below Ground Drainage



100mm @ A0 50mm @ A3

- This Drawing is to be read in conjunction with all relevant Architect's Engineer's and specialists' drawings and specifications.
- Do not scale from this drawing in either paper or digital form. Use written dimensions only. To check drawing has been printed to the intended scale the above bar should be 100mm long @A1 or 50mm long @ A3.

- KEY**
- Existing Public SW sewer (indicative only, taken from Thames Water records & surveys)
 - Existing Public FW sewer (indicative only, taken from Thames Water records & surveys)
 - Existing SW sewer (indicative only, taken from surveys)
 - Existing FW sewer (indicative only, taken from surveys)
 - Existing assumed 10m public sewer easement, as stipulated by Table 2.1 in Sewers for Adoption 6th Edition.
 - Site boundary taken from Heyne Tillet Steel drawing "1038_SITE"

WATFORD ROAD

P5	30.08.16	GL	CM	UPDATED PRELIMINARY ISSUE
P4	05.08.16	CM	TH	UPDATED PRELIMINARY ISSUE
P3	29.07.16	CM	TH	UPDATED PRELIMINARY ISSUE
P2	27.07.16	CM	TH	UPDATED PRELIMINARY ISSUE
P1	05.07.16	CM	TH	PRELIMINARY ISSUE

Rev | Date | By | Eng | Amendments

HEYNE TILLET STEEL STRUCTURAL ENGINEERS
hts.uk.com

Job Name
Mill Hill
Pentavia Retail Park
NW7 2ET
Drawing Title
Existing Below Ground Drainage
Part 1



100mm @ A0 (50mm @ A3)



- This Drawing is to be read in conjunction with all relevant Architect's Engineer's and specialists' drawings and specifications.
- Do not scale from this drawing in either paper or digital form. Use written dimensions only. To check drawing has been printed to the intended scale the above bar should be 100mm long @A1 or 50mm long @ A3.

- KEY**
- Existing Public SW sewer (indicative only, taken from Thames Water records & surveys)
 - Existing Public FW sewer (indicative only, taken from Thames Water records & surveys)
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 - Existing assumed 10m public sewer easement, as stipulated by Table 2.1 in Sewers for Adoption 6th Edition.
 - Site boundary taken from Heyne Tillet Steel drawing "1038_SITE"

P5	30.08.16	GL	CM	UPDATED PRELIMINARY ISSUE
P4	05.08.16	CM	TH	UPDATED PRELIMINARY ISSUE
P3	29.07.16	CM	TH	UPDATED PRELIMINARY ISSUE
P2	27.07.16	CM	TH	UPDATED PRELIMINARY ISSUE
P1	25.07.16	CM	TH	PRELIMINARY ISSUE

Rev | Date | By | Eng | Amendments

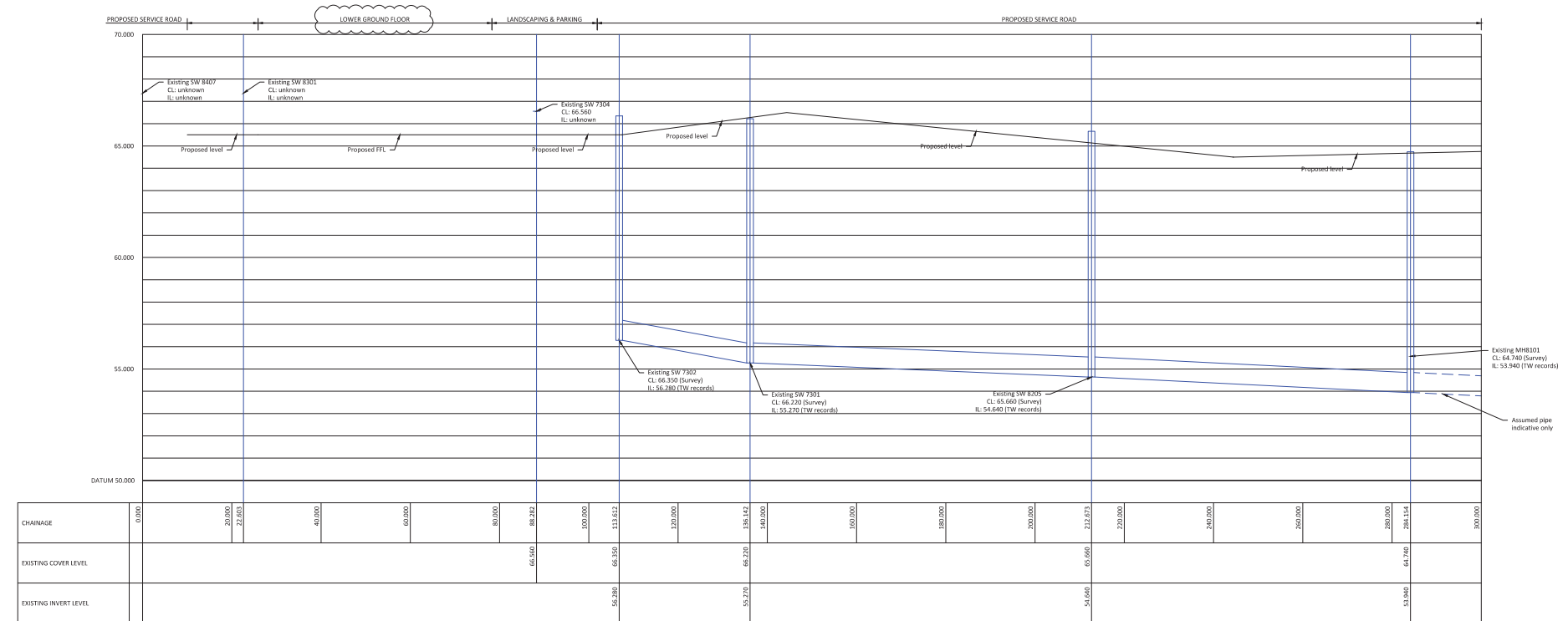
HEYNE TILLET STEEL STRUCTURAL ENGINEERS
hts.uk.com

Job Name
Mill Hill
Pentavia Retail Park
NW7 2ET
Drawing Title
Existing Below Ground Drainage
Part 2

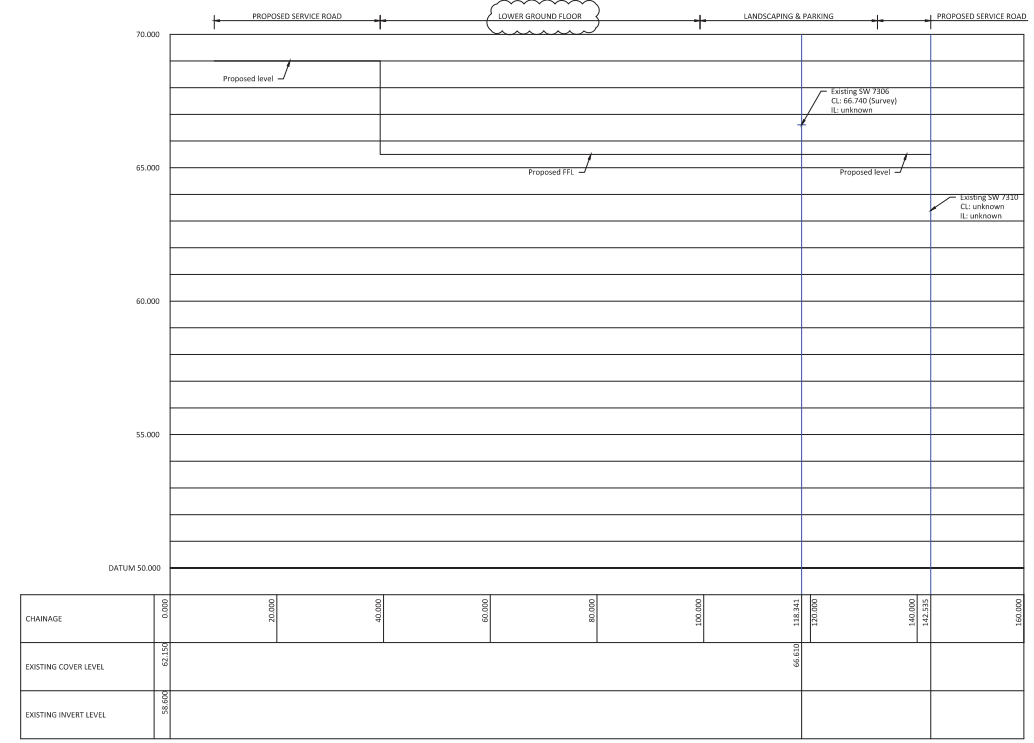


100mm @ A0 50mm @ A3

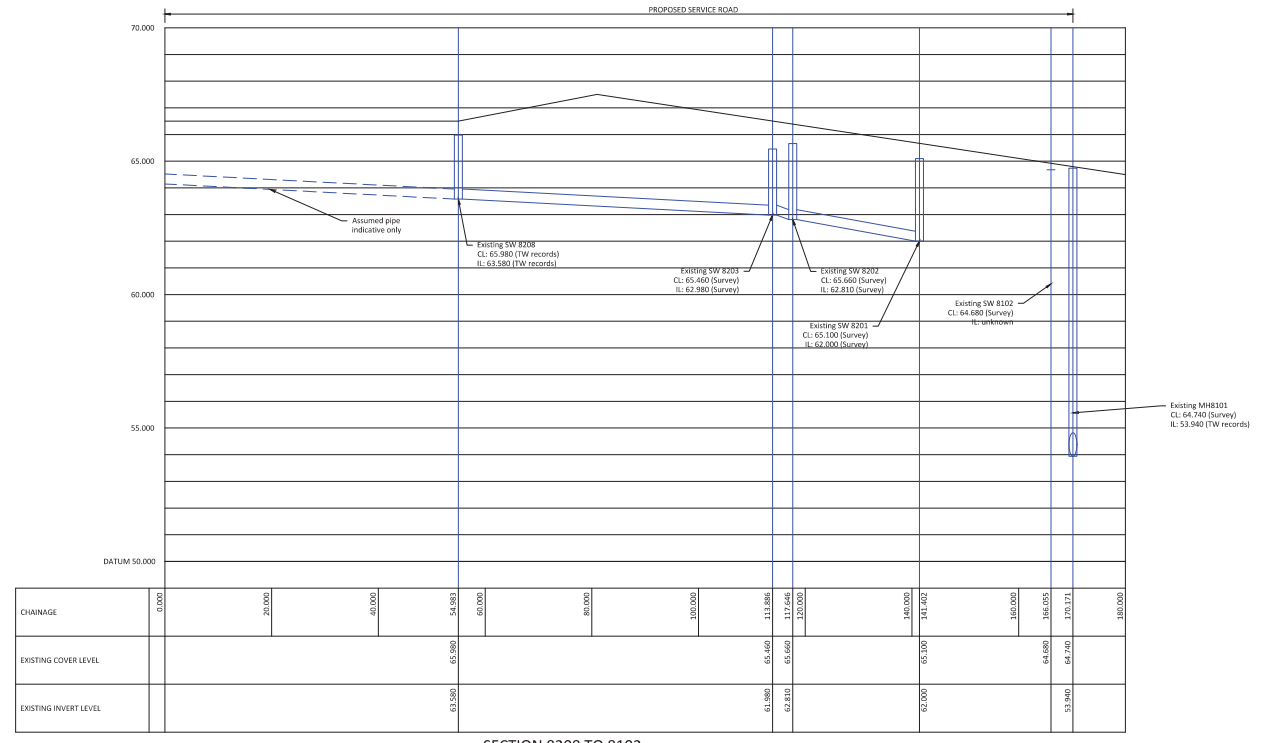
1. This Drawing is to be read in conjunction with all relevant Architect's Engineer's and specialists' drawings and specifications.
2. Do not scale from this drawing in either paper or digital form. Use written dimensions only. To check drawing has been printed to the intended scale the above bar should be 100mm long @A1 or 50mm long @ A3.
3. Site layout positioned via Ordnance Survey overlay due to insufficient Topographical Survey reference data.



SECTION 8407 TO 8101
Vertical Scale: 1:100
Horizontal Scale: 1:500



SECTION 7306 TO 7310
Vertical Scale: 1:100
Horizontal Scale: 1:500



SECTION 8208 TO 8102
Vertical Scale: 1:100
Horizontal Scale: 1:500

Rev	Date	By	Eng	Amendments
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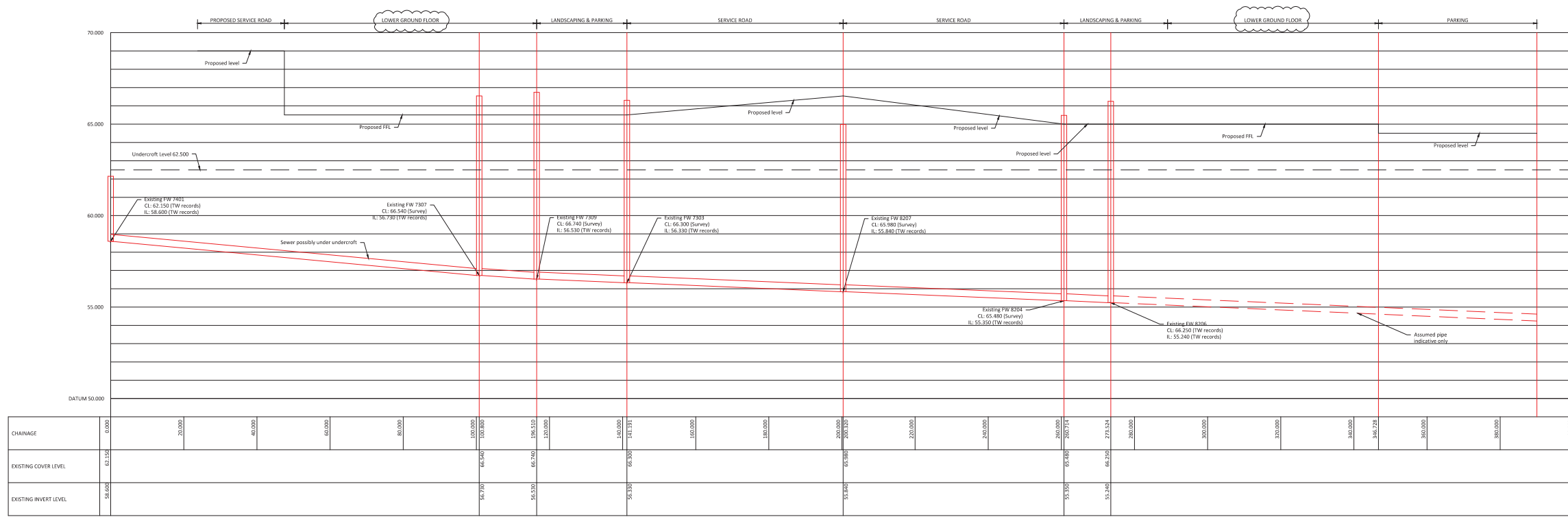


Job Name
Mill Hill
Pentavia Retail Park
NW7 2ET
Drawing Title
Existing Long Sections
Part 1



100mm @ A0 (50mm @ A3)

1. This Drawing is to be read in conjunction with all relevant Architect's Engineer's and specialists' drawings and specifications.
2. Do not scale from this drawing in either paper or digital form. Use written dimensions only. To check drawing has been printed to the intended scale the above bar should be 100mm long @A1 or 50mm long @ A3.
3. Site layout positioned via Ordnance Survey overlay due to insufficient Topographical Survey reference data.



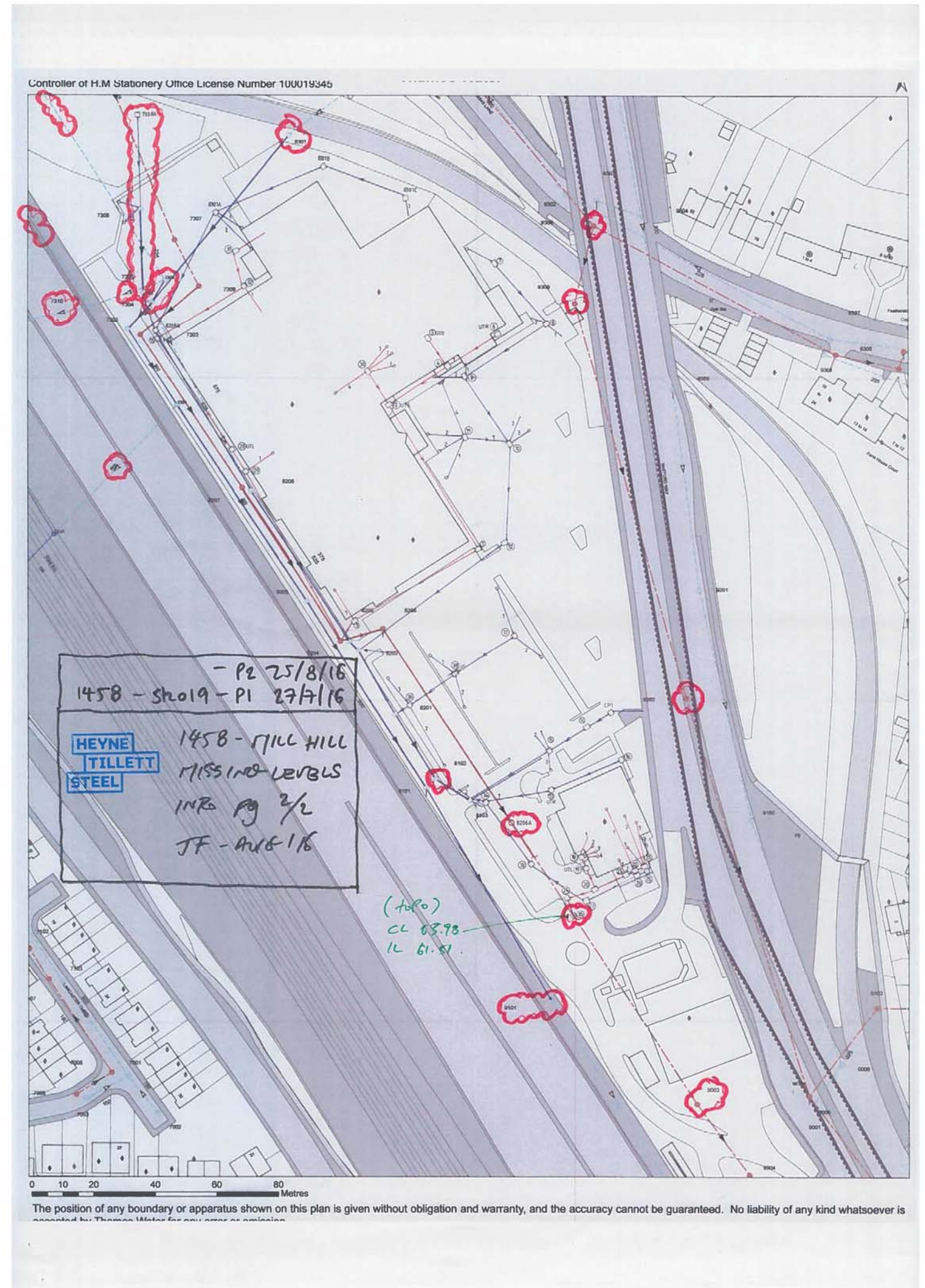
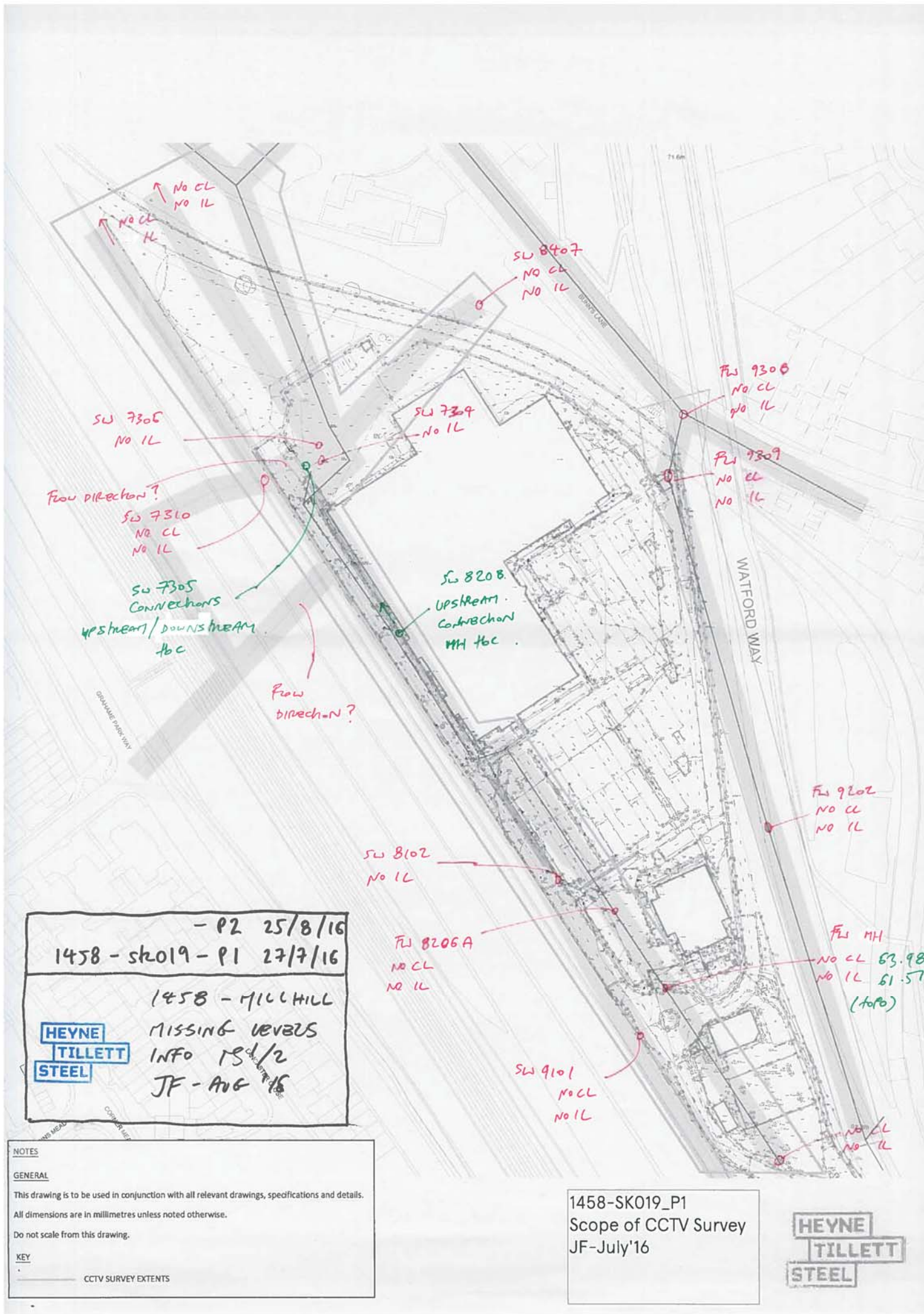
SECTION 7401 TO 8206
 Vertical Scale: 1:100
 Horizontal Scale: 1:500

CHAINAGE	0+000	20+000	40+000	60+000	80+000	100+000	116+315	127+000	142+000	141+151	160+000	180+000	200+000	220+000	240+000	260+000	267+171	277+324	280+000	300+000	320+000	340+000	346+728	360+000	380+000	400+000	
EXISTING COVER LEVEL	61.150					64.430	67.780		68.300							65.130	66.230										
EXISTING INVERT LEVEL	58.600					56.730	56.530		56.330							55.350	55.140										

P1	20.08.16	GL	CM	PRELIMINARY ISSUE
Rev	Date	By	Eng	Amendments



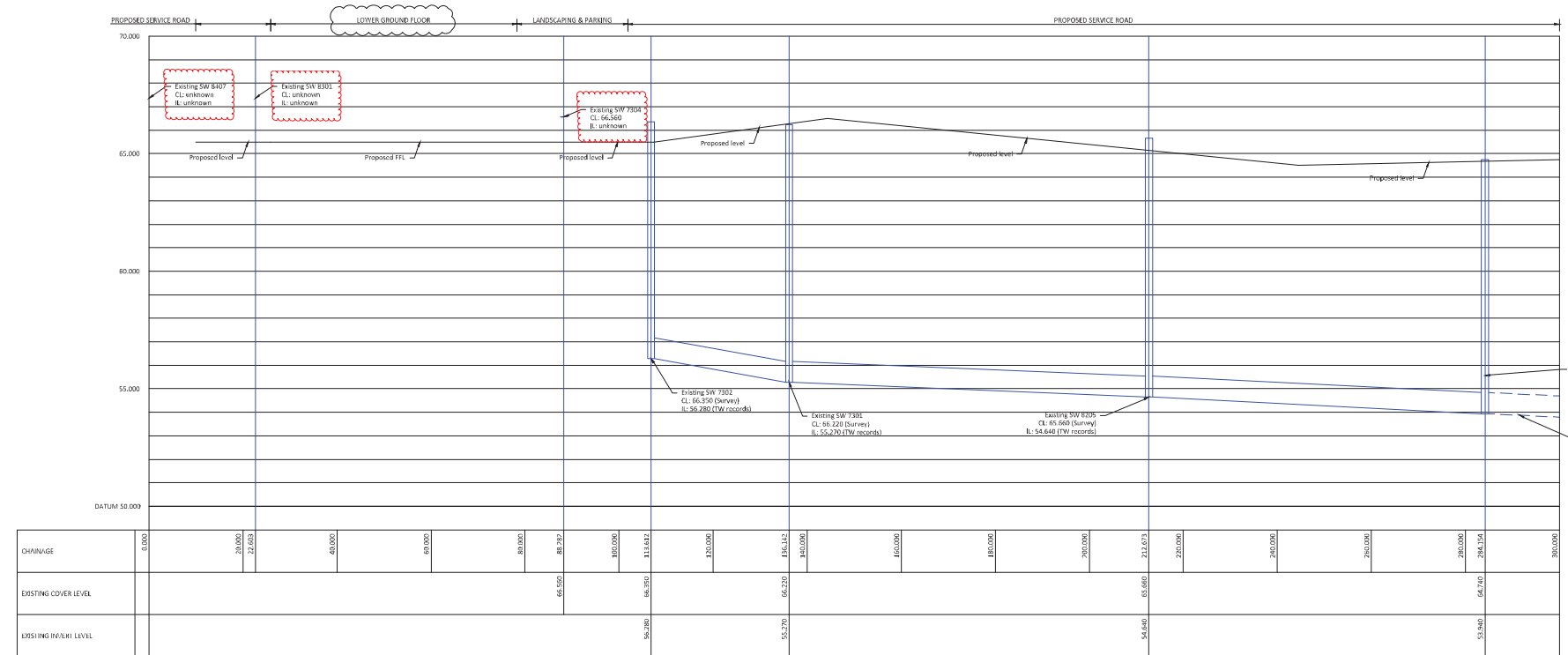
Job Name
 Mill Hill
 Pentavia Retail Park
 NW7 2ET
 Drawing Title
 Existing Long Sections
 Part 2





100mm @ A0 (50mm @ A3)

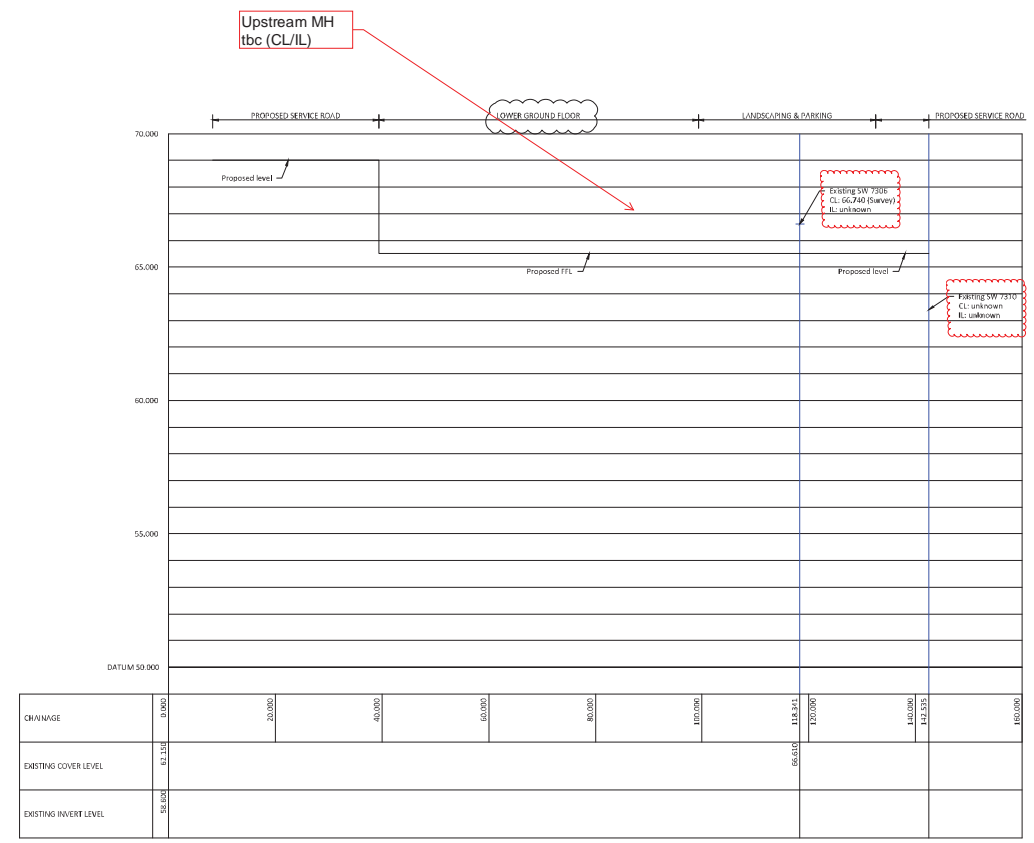
- This Drawing is to be read in conjunction with all relevant Architect's Engineer's and specialist's drawings and specifications.
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- Site layout positioned via Ordnance Survey overlay due to insufficient Topographical Survey reference data.



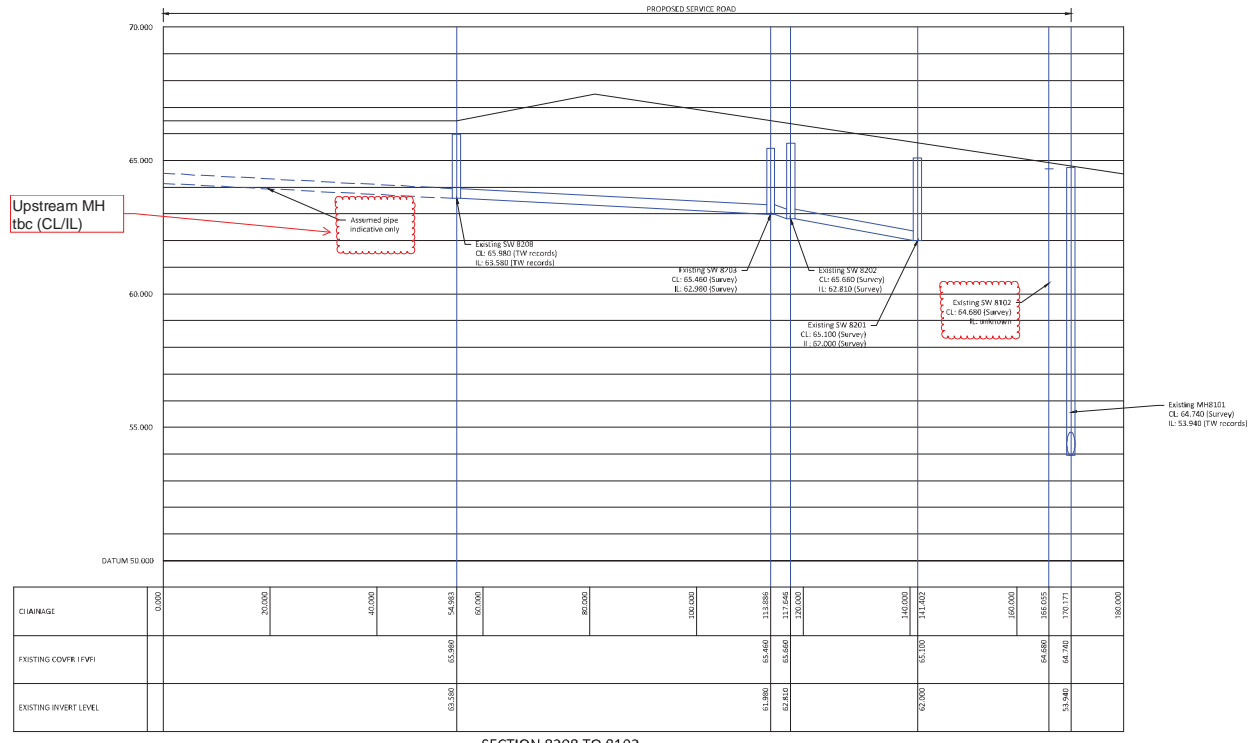
SECTION 8407 TO 8101
Vertical Scale: 1:100
Horizontal Scale: 1:500

Downstream MH tbc (CL/L)

Additional CCTV survey information required



SECTION 7306 TO 7310
Vertical Scale: 1:100
Horizontal Scale: 1:500



SECTION 8208 TO 8102
Vertical Scale: 1:100
Horizontal Scale: 1:500

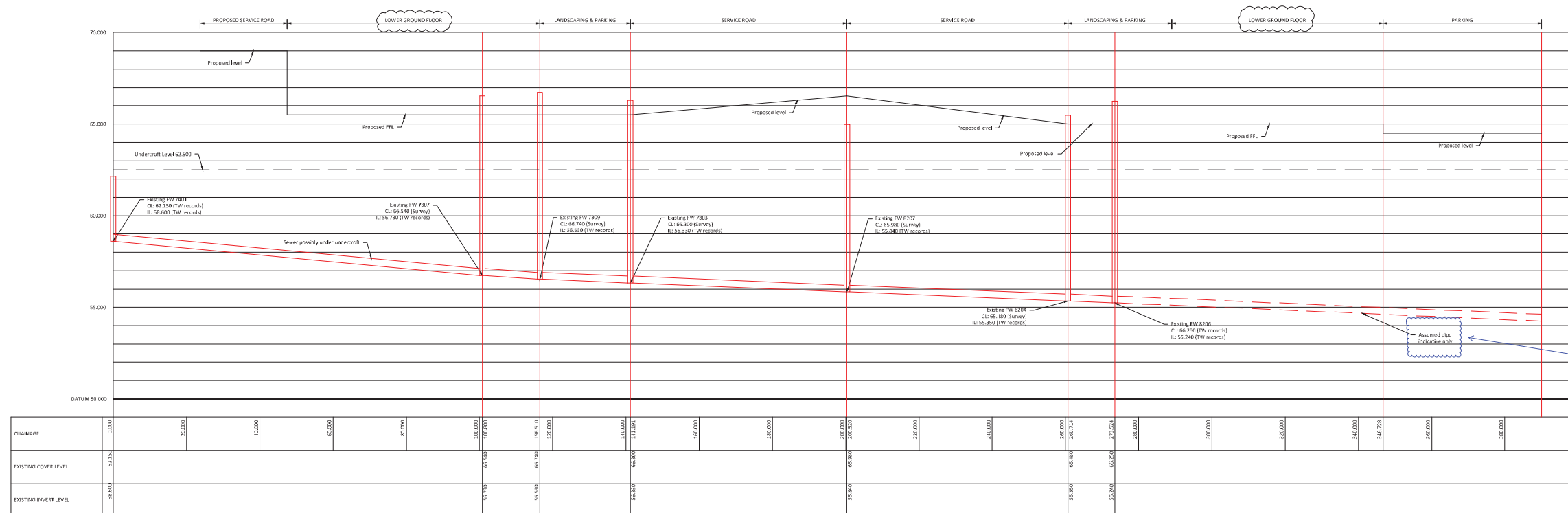
P1	01.08.16	GL	CM	PRELIMINARY ISSUE
Rev	Date	By	Eng	Amendments

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Job Name
Mill Hill
Pentavia Retail Park
NW7 2ET
Drawing Title
Existing Long Sections
Part 1



1. This Drawing is to be read in conjunction with all relevant Architect's Engineer's and specialist's drawings and specifications.
2. Do not scale from this drawing in either paper or digital form. Use written dimensions only. To check drawing has been printed to the intended scale the above bar should be 100mm long @A1 or 50mm long @ A3.
3. Site layout positioned via Ordnance Survey overlay due to insufficient Topographical Survey reference data.



Downstream MH tbc (CL/IL)

CHAINAGE	0+000	20+000	40+000	60+000	80+000	100+000	120+000	140+000	160+000	180+000	200+000	220+000	240+000	260+000	280+000	300+000	320+000	340+000	360+000	380+000	400+000	
EXISTING COVER LEVEL	62.134					66.540	66.740	66.300	66.740	66.300	65.980	65.980	65.980	65.480	65.480	66.250	66.250	66.250	66.250	66.250	66.250	66.250
EXISTING HAVERT LEVEL	58.800					58.730	59.330	59.330	59.330	59.330	59.330	59.330	59.330	59.330	59.330	59.330	59.330	59.330	59.330	59.330	59.330	59.330

SECTION 7401 TO 8206
Vertical Scale: 1:100
Horizontal Scale: 1:500

Additional CCTV survey information required

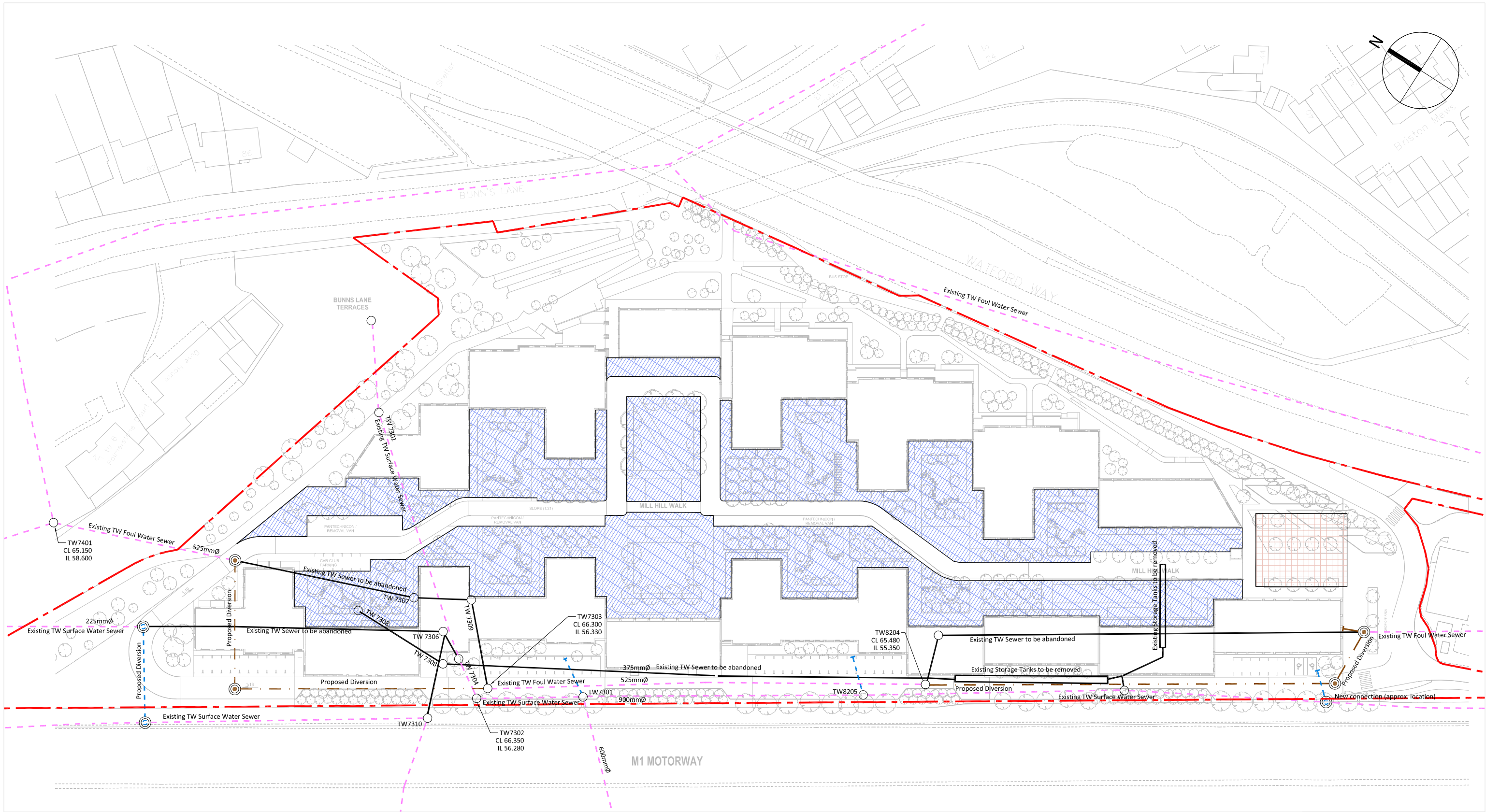
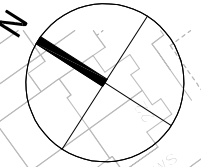
P1	01.08.16	GL	CM	PRELIMINARY ISSUE
Rev	Date	By	Eng	Amendments



Job Name
Mill Hill
Pentavia Retail Park
NW7 2ET
Drawing Title
Existing Long Sections
Part 2

Appendix E

Proposed Below Ground Drainage



100mm @ A1 (50mm @ A3)

- NOTES**
- This Drawing is to be read in conjunction with all relevant Architect's Engineer's and specialists' drawings and specifications.
 - Do not scale from this drawing in either paper or digital form. Use written dimensions only. To check drawing has been printed to the intended scale the above bar should be 100mm long @A1 or 50mm long @ A3.
 - All existing drainage is based on Thames Water Sewer Records

PROPOSED ATTENUATION

COLOUR:	REPRESENTS:	AREA:	REQ VOLUME:
	BLUE ROOF AT PODIUM LEVEL	8,000 m ²	1,190 m ³
	GEOCELLULAR STORAGE	500 m ²	510 m ³

- LEGEND:**
- Proposed SW drain run
 - Proposed FW drain run
 - Existing Public sewer
 - Drain run to be abandoned

- Proposed SW Manhole
- Proposed FW Manhole
- Existing Manhole

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Job Name
Mill Hill
NW7 2ET

Drawing Title
Drainage Strategy
Proposed Drainage Layout

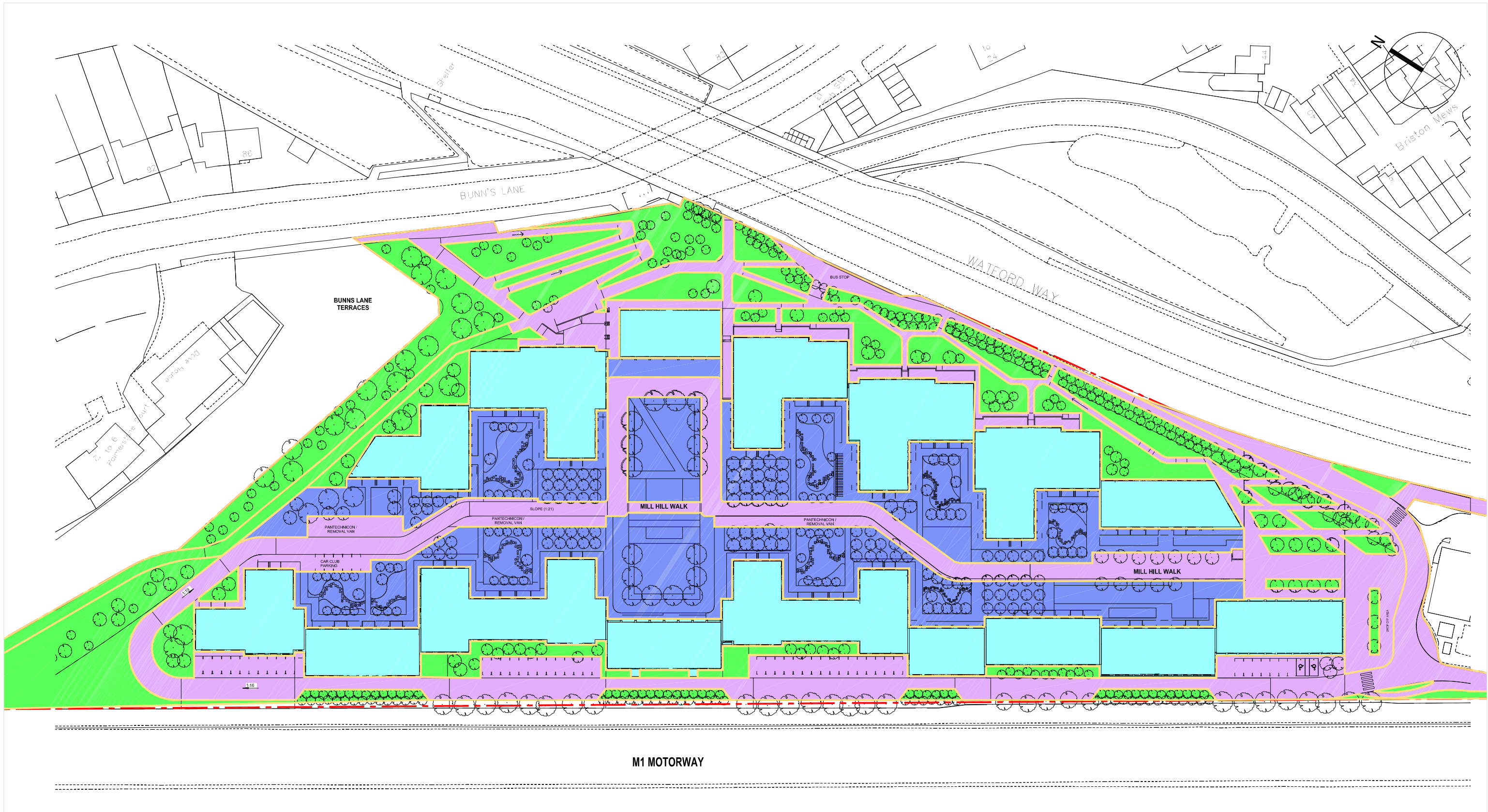
Rev	Date	By	Eng	Amendments
P3	07.06.18	KG	KG	Updated Layout
P2	21.11.17	KG	KG	Updated Layout
P1	03.11.17	KG	KG	First Issue

Purpose of Issue Preliminary Scale at A1 1:500

Drawing No. 1458/DR010 Rev. P3

Appendix F

Proposed Drained Area Plan



- 100mm @ A1 (50mm @ A3)
- NOTES**
- This Drawing is to be read in conjunction with all relevant Architect's Engineer's and specialists' drawings and specifications.
 - Do not scale from this drawing in either paper or digital form. Use written dimensions only. To check drawing has been printed to the intended scale the above bar should be 100mm long @A1 or 50mm long @ A3.

HATCHES	COLOUR:	REPRESENTS:	AREA:
	Blue	BLUE ROOF AT PODIUM LEVEL	8,000 m ²
	Cyan	AREAS ABOVE PODIUM LEVEL	9,500 m ²
	Purple	HARD-STANDING AREAS BELOW PODIUM LEVEL	9,800 m ²
	Green	SOFT LANDSCAPING	11,300 m ²

Rev	Date	By	Eng	Amendments
P3	07.06.18	KG	KG	Updated Layout
P2	21.11.17	KG	KG	Updated Layout
P1	03.11.17	KG	KG	First Issue

Appendix G

Greenfield Calculations

4 Pear Tree Court
London
EC1R 0DS



Date 01/06/2018 10:36 Designed by KGyba
File Checked by

XP Solutions Source Control 2017.1.2

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	3.860	Urban	0.000
SAAR (mm)	692	Region Number	Region 6

Results 1/s

QBAR Rural	16.7
QBAR Urban	16.7
Q100 years	53.4
Q1 year	14.2
Q30 years	37.9
Q100 years	53.4

Appendix H

Attenuation Calculations Geocellular Storage

Design Rainfall

CC Allowance = 40 %

From Wallingford Procedure, Volume 3 - Maps
Rainfall Depths (M5 - 60minutes)

M5_60 = 21.0 mm

from BRE Digest 365, fig. 1

rainfall ratio r = 0.450

Design Storm Return Period,

P = 100 years

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	8.3 mm	1.867	21.6 mm	259 mm/hr
10	11.7 mm	1.936	31.6 mm	190 mm/hr
15	13.7 mm	1.969	37.9 mm	151 mm/hr
30	17.3 mm	2.008	48.7 mm	97 mm/hr
60	21.0 mm	2.026	59.6 mm	60 mm/hr
120	24.9 mm	2.011	70.0 mm	35 mm/hr
240	29.1 mm	1.977	80.6 mm	20 mm/hr
360	31.8 mm	1.956	87.1 mm	15 mm/hr
600	35.5 mm	1.926	95.8 mm	10 mm/hr
1440	42.8 mm	1.868	111.9 mm	5 mm/hr
5000	55.5 mm	1.776	138.0 mm	2 mm/hr

Infiltration Rate m/s (OR Outlet Flow Rate l/s)
 Impermeable Area m² ie m³/hr
 Width m Gravel Pit or Trench Soakaway
 Depth m
 Min Length (optional) m Gravel free volume

D	Length req	Inflow	Outflow	Storage	t _{s50} (hrs)	Storage Prov
5	158.13	157.8	7.5	150.2	0.83	150.2
10	226.87	230.6	15.1	215.5	1.19	215.5
15	267.08	276.3	22.6	253.7	1.40	253.7
30	326.74	355.6	45.2	310.4	1.72	310.4
60	362.59	434.8	90.4	344.5	1.91	344.5
120	348.00	511.3	180.7	330.6	1.83	330.6
240	238.94	588.4	361.4	227.0	1.26	227.0
360	98.86	636.1	542.2	93.9	0.52	93.9
600	0.00	699.3	903.6	0.0	0.00	0.0
1440	0.00	816.6	2168.6	0.0	0.00	0.0
5000	0.00	1007.7	7530.0	0.0	0.00	0.0

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

Provide storage pit, 362.75 m x 1 m x 1 m deep

Minimum Free Volume = 95%

370 Rounded volume

Actual Volume = 362.8m³

(Note that the depth is measured below the inlet pipe invert)

Appendix I

Attenuation Calculations Blu Roof

Design Rainfall

CC Allowance = 40 %

From Wallingford Procedure, Volume 3 - Maps
Rainfall Depths (M5 - 60minutes)

M5_60 = 21.0 mm

from BRE Digest 365, fig. 1

rainfall ratio r = 0.450

Design Storm Return Period,

P = 100 years

D mins	M5_D	Z2	R = MP_D	Rainfall Intensity
5	8.3 mm	1.867	21.6 mm	259 mm/hr
10	11.7 mm	1.936	31.6 mm	190 mm/hr
15	13.7 mm	1.969	37.9 mm	151 mm/hr
30	17.3 mm	2.008	48.7 mm	97 mm/hr
60	21.0 mm	2.026	59.6 mm	60 mm/hr
120	24.9 mm	2.011	70.0 mm	35 mm/hr
240	29.1 mm	1.977	80.6 mm	20 mm/hr
360	31.8 mm	1.956	87.1 mm	15 mm/hr
600	35.5 mm	1.926	95.8 mm	10 mm/hr
1440	42.8 mm	1.868	111.9 mm	5 mm/hr
5000	55.5 mm	1.776	138.0 mm	2 mm/hr

Infiltration Rate m/s (OR Outlet Flow Rate l/s)
 Impermeable Area m² ie m³/hr
 Width m Gravel Pit or Trench Soakaway
 Depth m
 Min Length (optional) m Gravel free volume

D	Length req	Inflow	Outflow	Storage	t _{s50} (hrs)	Storage Prov
5	467.92	475.4	7.5	467.9	2.60	467.9
10	679.91	694.9	15.0	679.9	3.78	679.9
15	810.23	832.7	22.5	810.2	4.50	810.2
30	1026.62	1071.6	45.0	1026.6	5.70	1026.6
60	1220.42	1310.4	90.0	1220.4	6.78	1220.4
120	1360.96	1541.0	180.0	1361.0	7.56	1361.0
240	1413.37	1773.4	360.0	1413.4	7.85	1413.4
360	1376.95	1917.0	540.0	1377.0	7.65	1377.0
600	1207.35	2107.4	900.0	1207.4	6.71	1207.4
1440	301.05	2461.0	2160.0	301.0	1.67	301.0
5000	0.00	3037.0	7500.0	0.0	0.00	0.0

Time until system can cope with additional influx of 50% design storage volume < 24 hrs ~ OK

0

Minimum Free Volume = 100%

1420 Rounded volume

Actual Volume = 1413.5m³

(Note that the depth is measured below the inlet pipe invert)

Appendix J

Foul Water Discharge Calculations



Project: **Mill Hill**
 Address: **Pentavia Retail Park**
Proposed Foul Water

Project No: **1458**
 Date: **12/03/19**
 Calcs by: **AGH**
 Page No: **4**

1 Bed Unit	Per unit	286
Toilets	1	286
Bath	0	0
Shower	1	286
Sink	1	286
Kitchen Sink	1	286
Washing Machine	1	286
Dishwasher	1	286

2 Bed Unit	Per unit	435
Toilets	2	870
Bath	2	870
Shower	0	0
Sink	2	870
Kitchen Sink	1	435
Washing Machine	1	435
Dishwasher	1	435

3 Bed Unit	Per unit	123
Toilets	2	246
Bath	2	246
Shower	0	0
Sink	2	246
Kitchen Sink	1	123
Washing Machine	1	123
Dishwasher	1	123

TOTAL	
Toilets	1402
Bath	1116
Shower	286
Sink	1402
Kitchen Sink	844
Washing Machine	844
Dishwasher	844

- Development Type:-
- Dwelling, guesthouse, office (intermittent use)
 - Hospital, School, Restaurant, Hotel (frequent use)
 - Toilets and/or shower open to the public (congested use)
 - Laboratory buildings (special use)

Appliance	No.	Discharge Units per Appliance	Total Units
Washbasin	1402	0.6	841.2
Shower	286	0.6	171.6
Urinal	0	0.8	0
Bath	1116	1.3	1450.8
Kitchen Sink	844	1.3	1097.2
Dishwasher	844	0.8	675.2
Household Washing Machine	844	0.8	675.2
Commercial Washing Machine	0	1.5	0
WCs	1402	2.5	3505
Floor Drains	0	2	0

Total Discharge Units for Site 8416.2

Therefore, total flow from site = 45.87 l/s

Appendix K

Thames Water Correspondence

Mark Goodbrand

From: DEVELOPER.SERVICES@THAMESWATER.CO.UK
Sent: 24 March 2016 11:31
To: Charlie Rudd
Subject: IRef:1013738640 REF: DS6014185 PDEV NW7 2ET Watford Way

Follow Up Flag: Follow up
Flag Status: Flagged

Dear Mr Rudd,

Thank you for your pre development application concerning the above mentioned site.

Following initial investigation, Thames Water has identified an inability of the existing wastewater infrastructure to accommodate the needs of this application. Should the Local Planning Authority look to approve the application, Thames Water would like the following 'Grampian Style' condition imposed. We would advise you to apply for an S185 application to upgrade the existing foul water network to accommodate your site proposals.

Further to this, development shall not commence until a drainage strategy detailing any on and/or off site drainage works, has been submitted to and approved by, the local planning authority in consultation with the sewerage undertaker. No discharge of foul or surface water from the site shall be accepted into the public system until the drainage works referred to in the strategy have been completed. Reason: The development may lead to sewage flooding; to ensure that sufficient capacity is made available to cope with the new development; and in order to avoid adverse environmental impact upon the community.

Regarding surface water specifically, our preferred option would be for all surface water to be disposed of on site using SUDs as per policy 5.13 of the London plan. The London plan Policy 5.13 identifies a hierarchy of drainage options for surface water drainage and as such we would expect the development proposal to follow this. Policy 5.13: The Mayor will, and boroughs should, seek to ensure that surface water run-off is managed as close to its source as possible in line with the following drainage hierarchy: >Store rainwater for later use >Use infiltration techniques, such as porous surfaces in non-clay areas >Attenuate rainwater in ponds or open water features for gradual release to a watercourse >Attenuate rainwater by storing in tanks or sealed water features for gradual release to a watercourse >Discharge rainwater direct to a watercourse >Discharge rainwater to a surface water drain >Discharge rainwater to the combined/surface water sewer.

The use of sustainable urban drainage systems should be promoted for development unless there are practical reasons for not doing so. Such reasons may include the local ground conditions or density of development. In such cases, the developer should seek to manage as much run-off as possible on site and explore sustainable methods of managing the remainder as close as possible to the site. The Mayor will encourage multi agency collaboration (GLA Group, Environment Agency, Thames Water) to identify sustainable solutions to strategic surface water and combined sewer drainage flooding/overflows.

Please aim to achieve greenfield run off from the site through incorporating rainwater harvesting and sustainable drainage. Should the Local Planning Authority consider the above recommendation is inappropriate or are unable to include it in the decision notice, it is important that the Local Planning Authority liaises with Thames Water Development Control Department (telephone 0203 577 9998) prior to the Planning Application approval.

We would expect you to demonstrate what measures you will undertake to minimise groundwater discharges into the public sewer. Groundwater discharges typically result from construction site dewatering, deep excavations, basement infiltration, borehole installation, testing and site remediation. Any discharge

made without a permit is deemed illegal and may result in prosecution under the provisions of the Water Industry Act 1991. Should the Local Planning Authority be minded to approve the planning application, Thames Water would like the following informative attached to the planning permission: "A Groundwater Risk Management Permit from Thames Water will be required for discharging groundwater into a public sewer. Any discharge made without a permit is deemed illegal and may result in prosecution under the provisions of the Water Industry Act 1991. We would expect you to demonstrate what measures will be undertaken to minimise groundwater discharges into the public sewer. Permit enquiries should be directed to Thames Water's Risk Management Team by telephoning 02035779483 or by emailing wwriskmanagement@thameswater.co.uk. Application forms should be completed on line via www.thameswater.co.uk/wastewaterquality."

I trust the above is useful, and will help point you in the right direction.

Best regards

Shaun Picart

Thames Water - Development Engineer

0800 009 3921

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Mark Goodbrand

From: Jonathan Flint
Sent: 23 September 2016 16:36
To: Mark Goodbrand
Subject: RE: Mill Hill - Thames Water meeting

Jonathan Flint

HEYNE TILLET STEEL

4 Pear Tree Court, T: 020 7870 8050
London, EC1R 0DS M: 079 6244 7500

hts.uk.com

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Registered Office: 4 Pear Tree Court, London EC1R 0DS

From: Fez RafiqSharif [mailto:Fez.RafiqSharif@thameswater.co.uk]
Sent: 22 September 2016 10:26
To: Jonathan Flint <JFlint@hts.uk.com>
Cc: Che-Yung Man <Che-Yung.Man@jppuk.net>; Toby Heath <Toby.Heath@jppuk.net>; Mark Goodbrand <MGoodbrand@hts.uk.com>
Subject: RE: Mill Hill - Thames Water meeting [Filed 23 Sep 2016 16:34]

Jonathan,

I have spoken to the modelling team and asset planners and with respect to the surface water flows, and they have stated that a sewer impact study would NOT be required for the Surface Water discharge as long as you can provide evidence that you have followed Policy 5.13 of the London Plan

As discussed in the meeting, if you are looking to divert the Surface water sewers that are passing through your site such that flows will now discharge to a separate network, then a model assessment will be required to determine the impact on the receiving network. I've attached a sketch of a possible diversion arrangement for the foul and surface water sewers to the west of the site, however as discussed in the meeting the foul sewer to the east of the site requires further clarification.

If you are happy, I will request a fee proposal from our design partners for the modelling of foul flows only, including for the diversion of the foul sewers similar to that shown in the attached sketch. Hopefully, by the time the fee proposal is submitted, paid by yourselves and is ready to commence, you should have received the survey data and finalised your preferred diversion arrangements.

Kind regards

Fez

From: Fez RafiqSharif
Sent: 20 September 2016 17:50
To: 'Jonathan Flint'
Cc: Che-Yung Man; Toby Heath; Mark Goodbrand
Subject: RE: Mill Hill - Thames Water meeting

Hi Jonathan,

We will require the sewer survey data to ensure it is a true representation of what is on site. This will enable us to run the baseline model and then initiate the solution assessment. We can commence the initial works (i.e. request a

copy of the model, undertake a review and identify any risks within the model) ahead of the survey data being provided, however the payment identified within the fee proposal will be required to commence this stage. Please note, once payment is made, it typically takes a minimum of 2 weeks for the monies to be credited, a PO to be raised and the design team to commence.

Kind regards

Fez

From: Jonathan Flint [mailto:JFlint@hts.uk.com]
Sent: 20 September 2016 16:58
To: Fez RafiqSharif
Cc: Che-Yung Man; Toby Heath; Mark Goodbrand
Subject: Mill Hill - Thames Water meeting

Hi Fez,

Thanks for meeting with us today (also thanks to Simon for joining).

A brief summary of the actions is provided below;

- The original TW adoptions engineer who dealt with our predevelopment enquiry was Shaun Picart (see response email attached) – TW to liaise with Shaun regarding work previously done on the project
- There is additional CCTV information required (particularly around the site boundary) to confirm line and levels of the existing network. This is required prior to TW starting the sewer impact assessment - HTS to organise and arrange CCTV asap (we will hopefully return the survey report within 2wks)
Fez, based on the detailed information issued to TW to date can the assessment be started any sooner?
- A fee proposal for the sewer impact assessment will be prepared by TW and issued to HTS before the end of w/c 26th September
- Based on the fact that some elements of TW sewer diversion is likely HTS will make a section 185 application which includes the proposed m² areas of commercial space and number of residential units – HTS to do by end of this week

Let us know if you have any comments/queries.

Jonathan Flint

HEYNE TILLET STEEL

4 Pear Tree Court, T: 020 7870 8050
London, EC1R 0DS M: 079 6244 7500

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Appendix L

Thames Water Pre-development Approval

Karol Gyba

From: DEVELOPER.SERVICES@THAMESWATER.CO.UK
Sent: 09 January 2018 16:23
To: Karol Gyba
Subject: RE: RE: IRef:1015582427 DS4043953:PDEV:NW7 2ET:Pentavia Retail P

Categories: Important Info - to come back to

Dear Karl,

Thank you very much for your email.

The existing Foul sewer network does have sufficient capacity to accommodate the new proposed foul water discharge from the proposed development.

Kind Regards,

Laura Vega

Developer Services – Adoptions Data Analyst
laura.vegasobrin@thameswater.co.uk
Helpdesk 0800 009 3921
Clearwater Court, Vastern Road, Reading, RG1 8DB

Original Text

From: KGyba@hts.uk.com
To: DEVELOPER.SERVICES@THAMESWATER.CO.UK
CC:
Sent: 05.01.18 12:03:02
Subject: RE: IRef:1015582427 DS4043953:PDEV:NW7 2ET:Pentavia Retail P

Dear Laura,

Thank you very much for the response and for the phone call today,

As I mentioned, there is an additional 2,033m² of retail proposed for the site, the foul water contribution shouldn't increase much because of it (approximately 0.2 l/s), could you confirm that it is still OK?

I will follow up with surface water strategy once we hear back from planning.

Kind regards,

Karol Gyba

HEYNE TILLET STEEL
4 Pear Tree Court, T: 020 7870 8050
London, EC1R 0DS
hts.uk.com

From: DEVELOPER.SERVICES@THAMESWATER.CO.UK [mailto:DEVELOPER.SERVICES@THAMESWATER.CO.UK]
Sent: 04 January 2018 16:25

To: Karol Gyba <KGyba@hts.uk.com>

Subject: IRef:1015582427 DS4043953:PDEV:NW7 2ET:Pentavia Retail P

Dear Karol,

Please find attached the letter which includes Thames Water's response for the above referenced site address.

Please be note the details approved assuming that the surface water drainage strategy for this development sufficiently follows policy 5.13 of the London Plan.

Typically greenfield run off rates of 5l/s/ha should be aimed for using the drainage hierarchy.

The hierarchy lists the preference for surface water disposal as follows;

Store Rainwater for later use,

Use infiltration techniques, such as porous surfaces in non-clay areas,

Attenuate rainwater in ponds or open water features for gradual release,

Discharge rainwater direct to a watercourse,

Discharge rainwater direct to a surface water sewer/drain,

Discharge rainwater to the combined sewer.

Thank you very much.

Kind Regards,

Laura Vega

Developer Services – Adoptions Data Analyst
laura.vegasobrin@thameswater.co.uk
Helpdesk 0800 009 3921
Clearwater Court, Vastern Road, Reading, RG1 8DB

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Mr Karol Gyba
Heyne Tillet Steel
4 Pear Tree Court
London
EC1R 0DS



Your account number
DS4043953



Developer.services@thameswater.co.uk



0800 009 3921

Mon – Fri 9am-5pm,

04/01/2018

Pre Development Enquiry

Site Address: Pentavia Retail Park, Watford Way Barnet NW7 2ET

Existing site: Homebase foul water discharging by gravity into between MH7303 and MH8206, Existing SW run off for 1 in 1: 212.58 l/s; 1 in 10: 419.75 l/s; 1 in 30: 519.04 l/s; 1 in 100: 679.04 l/s discharging by gravity into between MH7308 and MH8101

Proposed Development: New 410 houses and 322 flats foul water discharging by gravity into between MH8206 and MH9003, Proposed SW run off 47.7 l/s for all events discharging by gravity into between MH7302 and MH9101

Dear Karol,

I write in relation to the Pre-Development application submitted, we have completed the assessment of the foul water flows and surface water run-off based on the information submitted in your application with the purpose of assessing sewer capacity within the existing Thames Water sewer network.

Foul Water

From the information you have provided, we can confirm that the existing foul sewer network does have sufficient capacity to accommodate the proposed foul water discharge from the proposed development.

Surface Water

Please note that discharging surface water to the public sewer network should only be considered after all other methods of disposal have been investigated and proven to not be viable. In accordance with the Building Act 2000 Clause H3.3, positive connection to a public sewer will only be consented when it can be demonstrated that the hierarchy of disposal methods have been examined and proven to be impracticable. The disposal hierarchy being: 1st Soakaways; 2nd Watercourses; 3rd Sewers.

Only when it can be proven that soakage into the ground or a connection into the adjacent watercourse is not possible would we consider a restricted discharge into the public surface water sewer network.

We would encourage techniques such as green roofs and/or permeable paving that restricts surface water discharge from your site.

When redeveloping an existing site, policy 5.13 of the London Plan and Policy 3.4 of the Supplementary Planning Guidance (Sustainable Design and Construction) states that every attempt should be made to use flow attenuation and SUDS/storage to reduce the surface water discharge from the site as much as possible.

If they are consulted as part of any planning application, Thames Water Planning team would ask to see why it is not practicable to attenuate the flows to Greenfield run-off rates i.e. 5l/s/hectare of the total site area or if the site is less than hectare in size then the flows should be reduced by 95% of existing flows. Should the policy above be followed, we would envisage no capacity concerns with regards to surface water for this site.

Please note that the Local Planning authority may comment on surface water discharge under the planning process.

Please Note

All connection requests are subject to a full Section 106 (Water Industry Act 1991) application before the Company can confirm approval to the connection itself. Please also note that capacity in the public sewerage system cannot be reserved.

The discharge of non-domestic effluent is not permitted until a valid trade effluent consent has been issued by Thames Water. If anything other than domestic sewage is discharged into the public sewers without the above agreement an offence is committed and the applicant will be liable to the penalties contained in Section 109(1) (WIA 1991).

Applicants should contact Trade Effluent prior to seeking a connection approval, to discuss trade effluent consent and conditions of discharge. A Trade Effluent reference number should be obtained and included in the relevant box of the attached application form. The address for Trade Effluent is - Thames Water Utilities Limited, Waste Water Quality, Crossness Sewage Treatment Works, Belvedere Road, Abbeywood, London SE2 9AQ. Alternatively you can telephone them on 020 8507 4321.

The views expressed by Thames Water in this letter are in response to this pre development enquiry at this time and do not represent our final views on any future planning applications made in relation to this site.

Yours sincerely,

Laura Vega
Developer Services

