FAIRHURST

Manor Road / Richmond

Flood Risk Assessment and Drainage Strategy

Fairhurst

November 2019

1.1.11

1.1.12

Former Homebase, Manor Road, Richmond

Revised Flood Risk Assessment & Drainage Strategy

November 2019

126782-RP-C-001

FAIRHURST

CONTROL SHEET

CLIENT: **Avanton**

PROJECT TITLE: **Former Homebase, Manor Road, Richmond**

REPORT TITLE: **Revised Flood Risk Assessment & Drainage Strategy**

PROJECT REFERENCE: **126782**

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This document has been prepared in accordance with procedure OP/P02 of the *Fairhurst Quality and Environmental Management System*

Contents

1 Introduction

1.1.1 Fairhurst have been appointed by Avanton to provide engineering services for the project known as Manor Road, Richmond.

1.1.2 The proposed development site is approximately 1.842ha.

1.1.3 The proposed development is located in Flood Zone 1, meaning there is a less than 1 in 1000 year risk of flooding from rivers or seas.

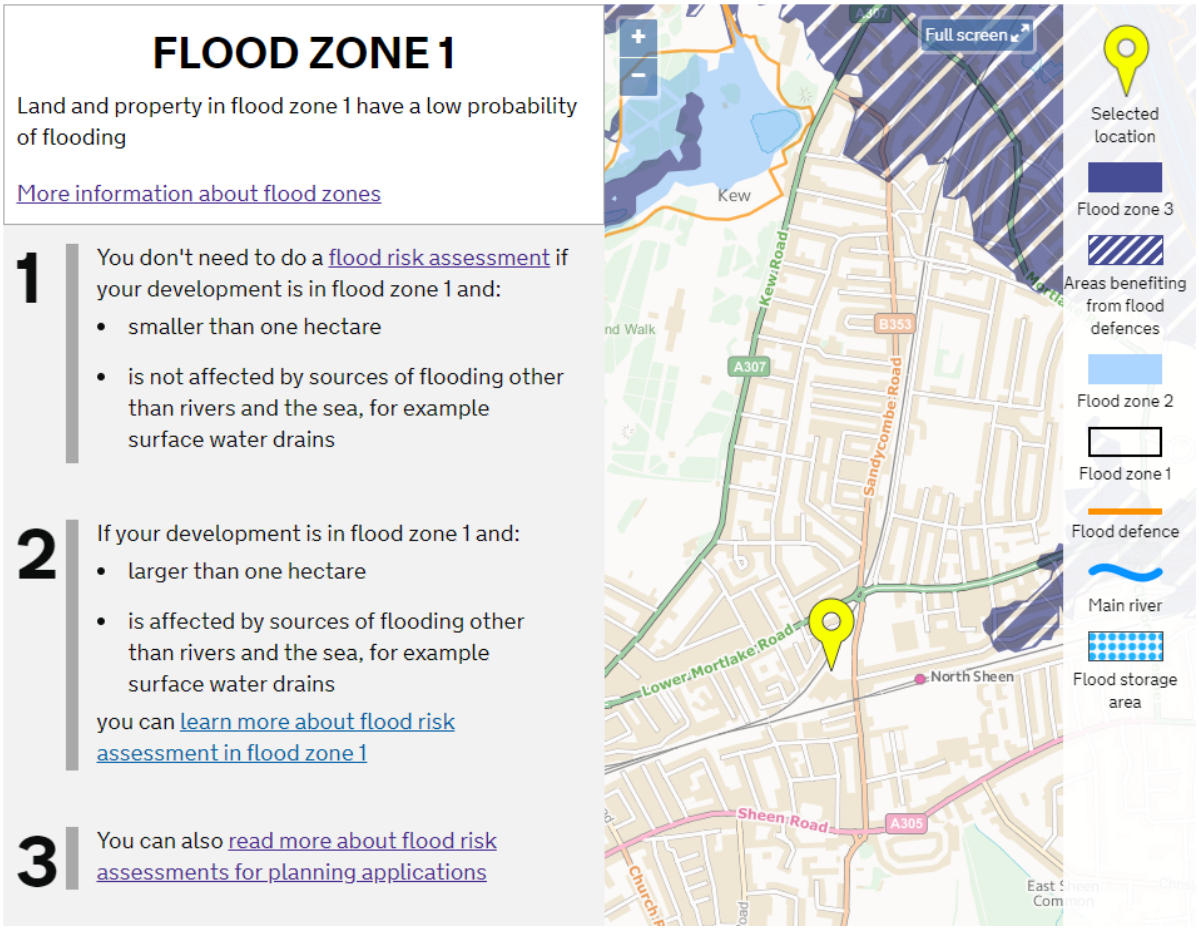


Figure 1 - Flood Risk Maps (Rivers & Seas) - Environment Agency

1.1.4 Under current Environment Agency requirements, a site of this size and Flood Zone classification requires a Flood Risk Assessment to be completed.

1.1.5 The site is located within the boundary of London Borough of Richmond upon Thames Local Planning Authority.

1.1.6 This FRA has been compiled in accordance and guidance of the Richmond Strategic Flood Risk Assessment (SFRA), National Planning Policy Framework (NPPF) and other relevant guides and reports.

1.1.7 Richmond Planning Guidance Chapter 6.2 includes a checklist of information required to accompany a planning application for Drainage and Flood Risk. A copy of this table and where information can be found is included as an appendix to this report.

1.1.8 On behalf of Avanton Richmond Development Ltd, a detailed planning application (ref. 19/0510/FUL) was submitted to the London Borough of Richmond Upon Thames (LBRuT) in February 2019 for the redevelopment of the Homebase store at 84 Manor Road, North Sheen.

1.1.9 The application was considered at LBRuT Planning Committee on 3 July 2019 and was recommended for refusal by LBRuT officers. The Planning Committee resolved that they were minded to refuse the Application in line with the officer's recommendation for six reasons relating to affordable housing; design; residential amenity; living standards; energy; and absence of a legal agreement.

1.1.10 On 29 July 2019 the Mayor issued a Direction pursuant to Article 7 of the Town and Country Planning (Mayor of London) Order 2008 and powers conferred by Section 2A of the Town and Country Planning Act (1990) that he would act as the LPA for the purposes of determining the Application.

1.1.11 Further to the Mayor's direction to take over the Planning Application for his determination, the Applicant, in consultation with the GLA and TfL, has taken the opportunity to review the scheme with the principle aim of increasing the delivery of affordable housing through additional density and addressing other issues raised in the Mayor's Stage 2 Report.

1.1.12 The Amended scheme now proposes a residential-led redevelopment of five buildings of between three and ten storeys. The development will provide 433 residential units (Class C3), flexible retail /community / office uses (Classes A1, A2, A3, D2, B1), a police facility (Use Class B1), a bus layover with driver facilities (Sui Generis Use), car and cycle parking, landscaping, public and private open spaces and other necessary enabling works.

1.1.13 The proposed changes necessitate an amendment to the Applications description of development. The revised description of development is as follows:

Demolition of existing buildings and structures and comprehensive phased residential-led redevelopment to provide residential units (Class C3), flexible retail /community / office uses (Classes A1, A2, A3, D2, B1), a police facility (Use Class B1), a bus layover with driver facilities (Sui Generis Use), provision of car and cycle parking, landscaping, public and private open spaces and all other necessary enabling works.

1.1.14 The amended scheme is referred as the 'Amended Proposed Development' and its previous iteration that was considered at LBRuT Planning Committee in 3 July 2019, is referred to as the 'Original Proposed Development'.

1.2 Scheme revision

1.2.1 The contrast between the 'Amended Proposed Development' and 'Original Proposed Development' is the proposal for additional development at the north of the site. This is outlined in Section 6 of this report.

1.2.2 The 'Amended Proposed Development' falls within the same Flood Zone as the 'Original Proposed Development' (Flood Zone 1), and the flood risk for the site has not increased from surface water or other sources.

1.2.3 It should be noted that any surface run-off from the increased development within the 'Amended Proposed Development' has been accounted for within the drainage strategy included within this report.

2 Planning policy

2.1 National planning policy framework & planning practice guidance

2.1.1 The National Planning Policy Framework (NPPF), published in 2012 and as revised in 2019 and the associated Planning Practice Guidance (PPG), published in 2014, identify flood risk as a specific material consideration in the planning process and in the allocation and release of sites for development or re-development.

2.1.2 The NPPF & PPG replaced previous guidance and policy set out in PPS 25: Development and Flood Risk, however much of the technical criteria for Flood Risk Assessments remain largely unchanged. The NPPF seeks to strengthen the co-ordination between land-use planning and development planning and the operational delivery of flood and coastal defence strategy. Through the NPPF, Local Planning Authorities will continue to use their existing powers to guide, regulate and control development in relation to flooding and flood risk. The NPPF places a presumption in favour of sustainable development whilst meeting the challenge of climate change, flooding and coastal change. In accordance with the PPG, inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk through the application of the Exception and Sequential Tests.

2.1.3 The Water Resources Act 1991 [Section 105] requires the Environment Agency to exercise general supervision over all flood defence matters, including flood plains and washlands which accommodate waters during periods of flood. In discharging their functions, the Environment Agency from time to time carries out surveys and flood studies, largely of 'main rivers' within its jurisdiction.

2.1.4 Environment Agency flood maps indicating the extents of the modelled floodplain are provided to Local Planning Authorities, to enable them to make more informed decisions when considering proposed development in flood-susceptible areas. If development is proposed in a flood-susceptible area, or in an area where there is a history of flooding, the Environment Agency, as a statutory consultee in the planning process, will generally recommend that the risk of flooding be formally assessed in accordance with the NPPF, and that a Flood Risk Assessment report is produced to support the Planning Application. The broader modelled flood extents are also indicated on the Environment Agency's Flood Zone Maps, available through their website.

2.2 Regional planning policy

London Plan (2016)

2.2.1 The London Plan (March 2016) sets out the overall strategic plan for London, setting out an integrated economic, environmental, transport and social framework for the development of London over the next 20 to 25 years. The plan contains several policies relating to development in relation to flood risk in London.

Policy 5.12 – Flood Risk Management:

2.2.2 The Mayor will work with all relevant agencies including the Environment Agency to address current and future flood issues and minimise risks in a sustainable and cost effective way.

2.2.3 Development proposals must comply with the flood risk assessment and management requirements set out in the NPPF and the associated technical Guidance on flood risk

over the lifetime of the development and have regard to measures proposed in Thames Estuary 2100 and Catchment Flood Management Plans.

a) the development will remain safe and operational under flood conditions;
b) a strategy of either safe evacuation and/or safely remaining in the building is followed under flood conditions;
c) key services including electricity, water etc. will continue to be provided under flood conditions;
d) buildings are designed for quick recovery following a flood.

2.2.4 Development adjacent to flood defences will be required to protect the integrity of existing flood defences and wherever possible should aim to be set back from the banks of watercourses and those defences to allow their management, maintenance and upgrading to be undertaken in a sustainable and cost effective way.

2.2.5 In line with the NPPF and the Technical Guidance, boroughs should, when preparing LDFs, utilise Strategic Flood Risk Assessments to identify areas where particular flood risk issues exist and develop actions and policy approaches aimed at reducing these risks, particularly through redevelopment of sites at risk of flooding and identifying specific opportunities for flood risk management measures.

Policy 5.13 – Sustainable Drainage:

2.2.6 Development should utilise sustainable urban drainage systems (SUDS) unless there are practical reasons for not doing so, and should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with the following drainage hierarchy:

a) store rainwater for later use;
b) use infiltration techniques, such as porous surfaces in non-clay areas;
c) attenuate rainwater in ponds or open water features for gradual release;
d) attenuate rainwater by storing in tanks or sealed water features for gradual release;
e) discharge rainwater direct to a watercourse;
f) discharge rainwater to a surface water sewer/drain;
g) discharge rainwater to the combined sewer.

2.2.7 Drainage should be designed and implemented in ways that deliver other policy objectives of this Plan, including water use efficiency and quality, biodiversity, amenity and recreation.

2.2.8 Within LDFs boroughs should, in line with the Flood and Water Management Act 2010, utilise Surface Water Management Plans to identify areas where there are particular surface water management issues and develop actions and policy approaches aimed at reducing these risks.

Draft London Plan (2019)

2.2.9 The 2016 London Plan is due to be revised, with a draft revision released in July 2019. Policies relating to development in relation to flood risk in London from this revision are included below.

Policy SI12 – Flood Risk Management:

2.2.10 Current and expected flood risk from all sources across London should be managed in a sustainable and cost-effective way in collaboration with the Environment Agency, the Lead Local Flood Authorities, developers and infrastructure providers.

2.2.11 Current and expected flood risk from all sources (as defined in paragraph 9.12.2) across London should be managed in a sustainable and cost-effective way in collaboration with the Environment Agency, the Lead Local Flood Authorities, developers and infrastructure providers.

Policy SI13 – Sustainable Drainage:

2.2.12 Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible. There should also be a preference for green over grey features, in line with the following drainage hierarchy:

a) rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation);
b) rainwater infiltration to ground at or close to source;
c) rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens);
d) rainwater discharge direct to a watercourse (unless not appropriate);
e) controlled rainwater discharge to a surface water sewer or drain;
f) controlled rainwater discharge to a combined sewer.

2.2.13 Development proposals should aim to get as close to greenfield run-off rates as possible depending on site conditions. The well-established drainage hierarchy set out in this policy helps to reduce the rate and volume of surface water run-off. Rainwater should be managed as close to the top of the hierarchy as possible. There should be a preference for green over grey features, and drainage by gravity over pumped systems. A blue roof is an attenuation tank at roof or podium level; the combination of a blue and green roof is particularly beneficial as the attenuated water is used to irrigate the green roof.

2.3 Local planning policy

2.3.1 As part of the new Richmond Local Development Plan adopted in July 2018, the council has developed policies to take forward the Core Strategy of the council including *A Sustainable Future.*

2.3.2 Extracts from the LDP relevant to the proposed development and flood risk / water management are given below[1];

[1] Only relevant sections of the policy are included within this report. For full policy and further information, refer directly to the original report.

Policy LP 17 – Green Roofs and Walls:

Policy LP 17

Green roofs and walls

Green roofs and/or brown roofs should be incorporated into new major developments with roof plate areas of 100sqm or more where technically feasible and subject to considerations of visual impact. The aim should be to use at least 70% of any potential roof plate area as a green / brown roof.

The onus is on an applicant to provide evidence and justification if a green roof cannot be incorporated. The Council will expect a green wall to be incorporated, where appropriate, if it has been demonstrated that a green / brown roof is not feasible.

The use of green / brown roofs and green walls is encouraged and supported in smaller developments, renovations, conversions and extensions.

2.3.3 The policy notes that roof terraces are not classed as living roofs to fulfil this policy and states roofs should be minimum 70% soil / vegetation over a minimum 85mm substrate

Policy LP 21 – Flood Risk:

Policy LP 21

Flood Risk and Sustainable Drainage

A. All developments should avoid, or minimise, contributing to all sources of flooding, including fluvial, tidal, surface water, groundwater and flooding from sewers, taking account of climate change and without increasing flood risk elsewhere. Development will be guided to areas of lower risk by applying the 'Sequential Test' as set out in national policy guidance, and where necessary, the 'Exception Test' will be applied. Unacceptable developments and land uses will be refused in line with national policy and guidance, the Council's Strategic Flood Risk Assessment (SFRA) and as outlined in the table below.

In Flood Zones 2 and 3, all proposals on sites of 10 dwellings or more or 1000sqm of non-residential development or more, or on any other proposal where safe access/egress cannot be achieved, a Flood Emergency Plan must be submitted.

Where a Flood Risk Assessment is required, on-site attenuation to alleviate fluvial and/or surface water flooding over and above the Environment Agency's floodplain compensation is required where feasible.

Basements and subterranean developments

B. Basements within flood affected areas of the borough represent a particularly high risk to life, as they may be subject to very rapid inundation. Applicants will have to demonstrate that their proposal complies with the following:

Flood Zone 1	No restrictions on new or extensions to existing basements

Sustainable drainage

C. The Council will require the use of Sustainable Drainage Systems (SuDS) in all development proposals. Applicants will have to demonstrate that their proposal complies with the following:

1. A reduction in surface water discharge to greenfield run-off rates wherever feasible.
2. Where greenfield run-off rates are not feasible, this will need to be demonstrated by the applicant, and in such instances, the minimum requirement is to achieve at least a 50% attenuation of the site's surface water runoff at peak times based on the levels existing prior to the development.

Policy LP 22 – Sustainable Design and Construction:

Policy LP 22

Sustainable Design and Construction

A. Developments will be required to achieve the highest standards of sustainable design and construction to mitigate the likely effects of climate change. Applicants will be required to complete the following:

1. Development of 1 dwelling unit or more, or 100sqm or more of non-residential floor space (including extensions) will be required to complete the Sustainable Construction Checklist SPD. A completed Checklist has to be submitted as part of the planning application.
2. Development that results in a new residential dwelling, including conversions, change of use, and extensions that result in a new dwelling unit, will be required to incorporate water conservation measures to achieve maximum water consumption of 110 litres per person per day for homes (including an allowance of 5 litres or less per person per day for external water consumption).
3. New non-residential buildings over 100sqm will be required to meet BREEAM 'Excellent' standard.
4. Proposals for change of use to residential will be required to meet BREEAM Domestic Refurbishment 'Excellent' standard (where feasible).

2.3.4 A number of water saving measures and equipment may be incorporated into developments to comply with the maximum water consumption levels set out in Part A, criterion 2 above:

- There should be full use of water saving devices, water efficient fixtures and fittings.
- Rainwater and grey water recycling (water butts or more complex collection and treatment systems) can significantly reduce water consumption, particular potable water. Grey water recycling will need to be energy efficient.
- Landscaping and gardens should be designed to lower water demand.
- Sustainable Drainage Systems (SuDS), including rainwater harvesting and storage from roofs and other surfaces can significantly reduce demand for water

Policy LP 23 – Water Resources and Infrastructure:

Policy LP 23

Water Resources and Infrastructure

Water and sewerage provision

C. New major residential or major non-residential development will need to ensure that there is adequate water supply, surface water, foul drainage and sewerage treatment capacity to serve the development.

Planning permission will only be granted for developments which increase the demand for off-site service infrastructure where:

1. sufficient capacity already exists, or
2. extra capacity can be provided in time to serve the development, which will ensure that the environment and the amenities of local residents are not adversely affected.

Applicants for major developments will be required to provide evidence in the form of written confirmation as part of the planning application that capacity exists in the public sewerage and water supply network to serve their development.

Any new water supply, sewerage or waste water treatment infrastructure must be in place prior to occupation of the development. Financial contributions may be required for new developments towards the provision of, or improvements to, such infrastructure.

2.4 Strategic flood risk assessment (SFRA)

2.4.1 Local Planning Authorities are required to produce Local Development Frameworks, which are a portfolio of Local Development Documents (LDD) that collectively deliver the spatial planning strategy for the Authority area. The LDDs undergo a sustainability appraisal which assists Planning Authorities in ensuring their policies fulfil the principles of sustainability. Strategic Flood Risk Assessments (SFRAs) are used as the evidence base for planning decisions and form a component of the sustainability appraisal process. Therefore, SFRAs should be used in the review or production of LDDs.

2.4.2 To assist Local Planning Authorities in their strategic land-use planning, SFRAs should present sufficient information to enable Local Authorities to apply the Sequential Test to their proposed development sites: 'Decision-makers should use the SFRA to inform their knowledge of flooding, refine the information on the Flood Map and determine the variations in flood risk from all sources of flooding across and from their area. These should form the basis for preparing appropriate policies for flood risk management for these areas.'

2.4.3 A Strategic Flood Risk Assessment (SFRA) was carried out for London Borough of Richmond upon Thames Council in March 2016.

2.5 Sequential test

2.5.1 The Sequential Approach is detailed within the Planning Practice Guidance and aims to ensure preference is given to land within Flood Zone 1 prior to Zones 2 and 3. It also ensures that flood vulnerability of the Proposed Development is taken into consideration when locating development in Flood Zones 2 and 3.

2.5.2 Where the Sequential Approach shows that it is not possible to locate development in zones of lower flood risk due to other wider sustainability issues; it may be possible to

justify, using the Exception test, that development is still feasible by the management of flood risk.

2.6 CIRIA guidance

2.6.1 CIRIA publication 'C624 Development and Flood Risk – Guidance for the Construction Industry', defines three levels of Flood Risk Assessment which can be undertaken:

FRA Level	Description / Scope
Level 1	**Screening Study** to identify whether there are any flooding or surface water management issues related to a development site that may warrant further consideration. This should be based on readily available existing information, including the SFRA, Environment Agency Flood Map and Standing Advice. The Screening Study will ascertain whether a FRA is required.
Level 2	**Scoping Study** to be undertaken if the Level 1 FRA indicates that the site may lie within an area that is at risk of flooding or that the site may increase flood risk due to increased run-off. This Study should confirm the sources of flooding which may affect the site and should include the following: an appraisal of the availability and adequacy of existing information; a qualitative appraisal of the flood risk posed to the site, and potential impact of the development on flood risk elsewhere; an appraisal of the scope of possible measures to reduce the flood risk to acceptable levels. The Scoping Study may identify that sufficient quantitative information is already available to complete a FRA appropriate to the scale and nature of the development.
Level 3	**Detailed Study** to be undertaken if the Level 2 FRA concludes that further quantitative analysis is required to assess flood risk issues related to the development site. The Study should include: quantitative appraisal of the potential flood risk to the development; quantitative appraisal of the potential impact of development site on flood risk elsewhere; quantitative demonstration of the effectiveness of any proposed mitigation measures.

2.6.2 This Flood Risk Assessment will follow the requirements of a Level 1 Scoping Study.

3 Development description & locations

3.1 Existing surroundings description

3.1.1 The Site is located at Former Homebase Manor Road, Richmond, TW9 1YB as shown in Figure 2. The approximate coordinates at the centre of the site are 518901, 175426.

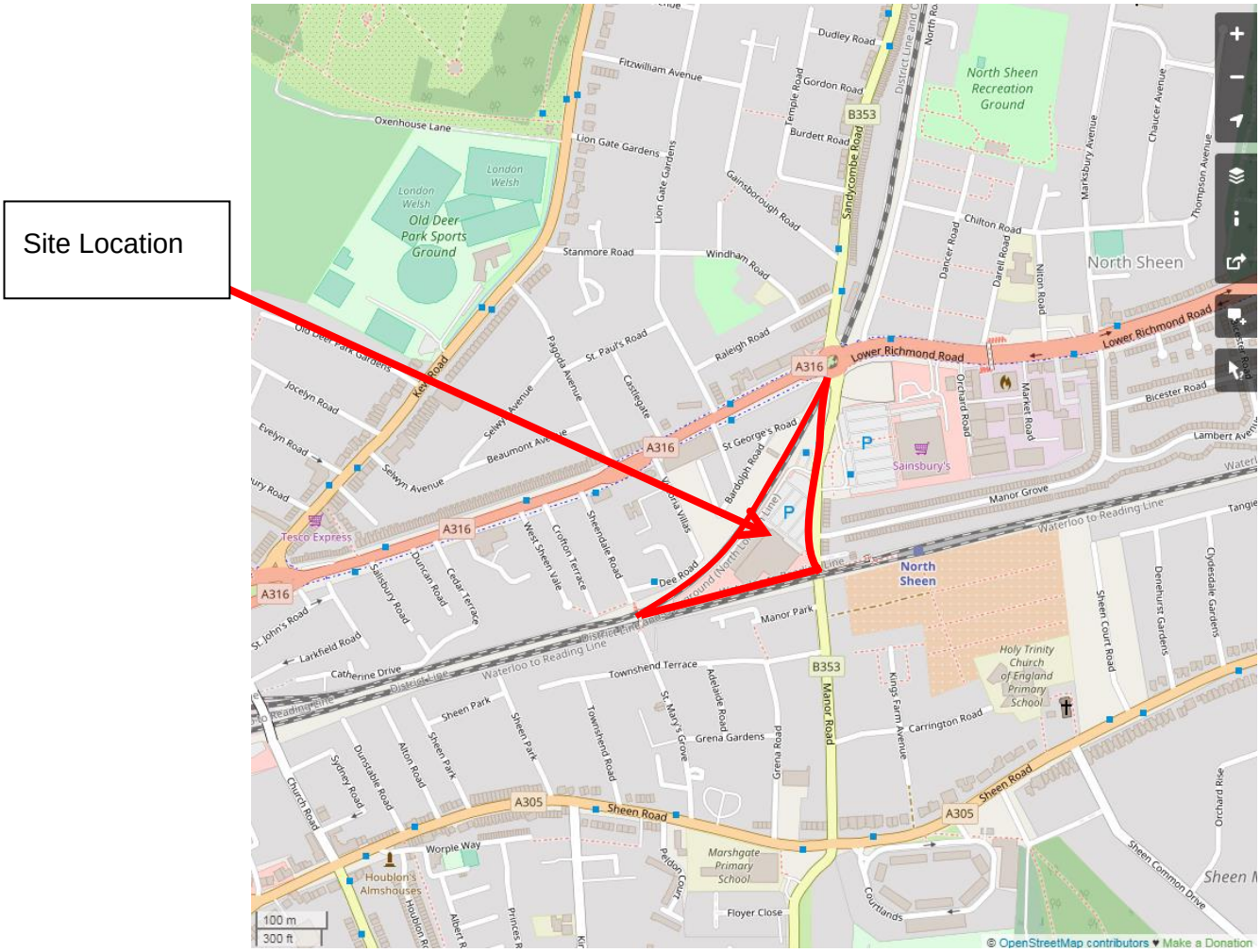


Figure 2 – Former Homebase, Manor Road, Richmond

3.1.2 The site is roughly triangular in shape and bounded to the north and south by merging railway lines and Manor Road (B353) to the east. In the north east corner of the site, Manor Road crosses the railway lines on an elevated roundabout.

3.2 Description of Existing Site

3.2.1 The total site area is 1.842ha which is almost entirely impermeable either (i) under buildings or (ii) paved parking, roads and other hardstanding areas.

3.2.2 In the pre-redevelopment layout, the site is almost fully paved with several small areas of vegetation and trees throughout the site. These can be seen on the Topographical Survey (Point2Surveys Ltd, Drawing No. LS2024/T/01-10 dated August 2018) included as an appendix to this report.

3.2.3 The Topographical Survey indicates the site to be approximately 7mAOD at the east of the site, sloping to approximately 6mAOD at the south west of the site. The south west of the site is contained by a retaining wall with the railway alongside the site at approximately 7.3mAOD.

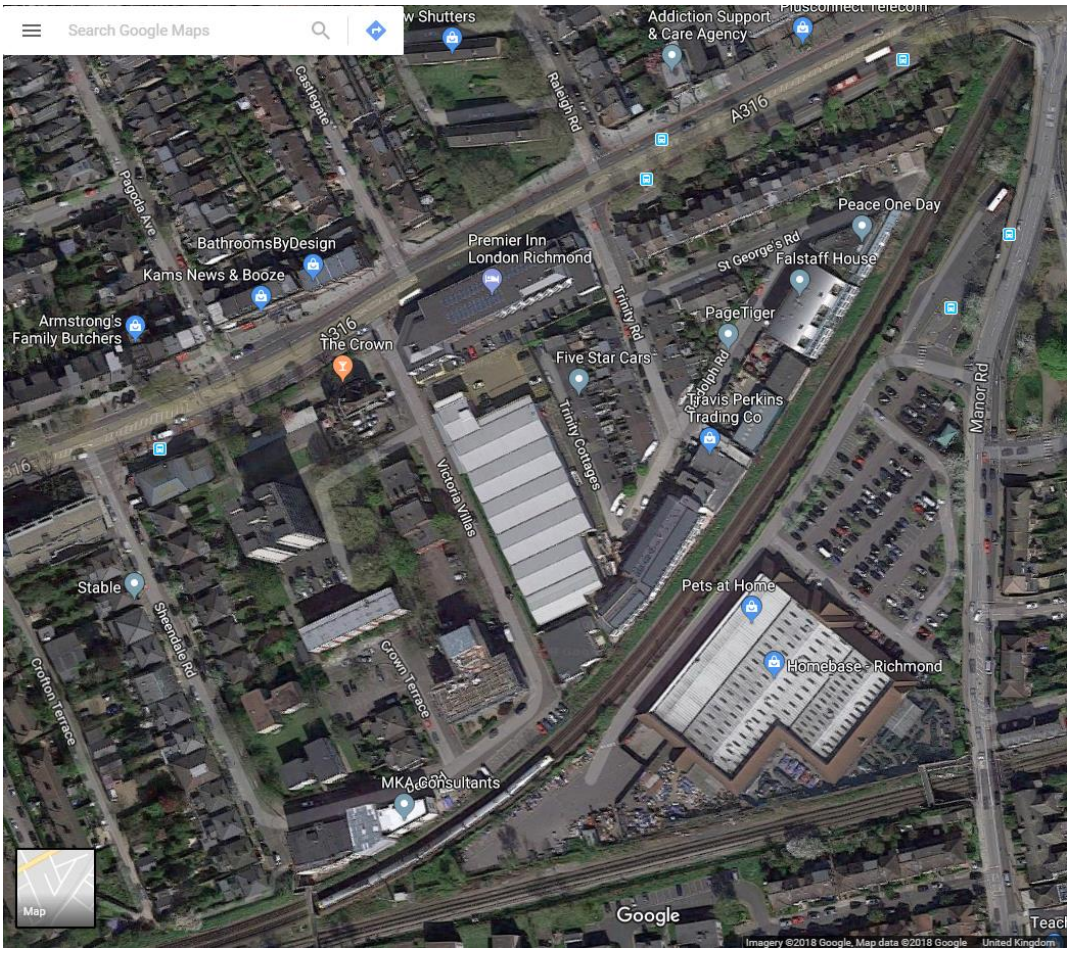


Figure 3 – Satellite imagery of the site (via Google Maps

3.3 Existing geology & groundwater protection

3.3.1 At the time of writing, no intrusive geotechnical testing had been completed however a Preliminary Geotechnical Risk Assessment (PRA) has been completed using a site walkover and desk study review of nearby boreholes.

3.3.2 Boreholes near the site identified made ground over sands and gravels underlain by clay. Groundwater was also identified in these boreholes.

3.3.3 Ground conditions can vary greatly over short distances and intrusive tests will be required to confirm the conditions of the site. These have been commissioned and results are awaited.

3.3.4 DEFRA (Department for Environment Food and Rural Affairs) publish groundwater and drinking water source protection zone maps online through Magic Map. A search on the site location identifies no protection zones with the site, see figure below.

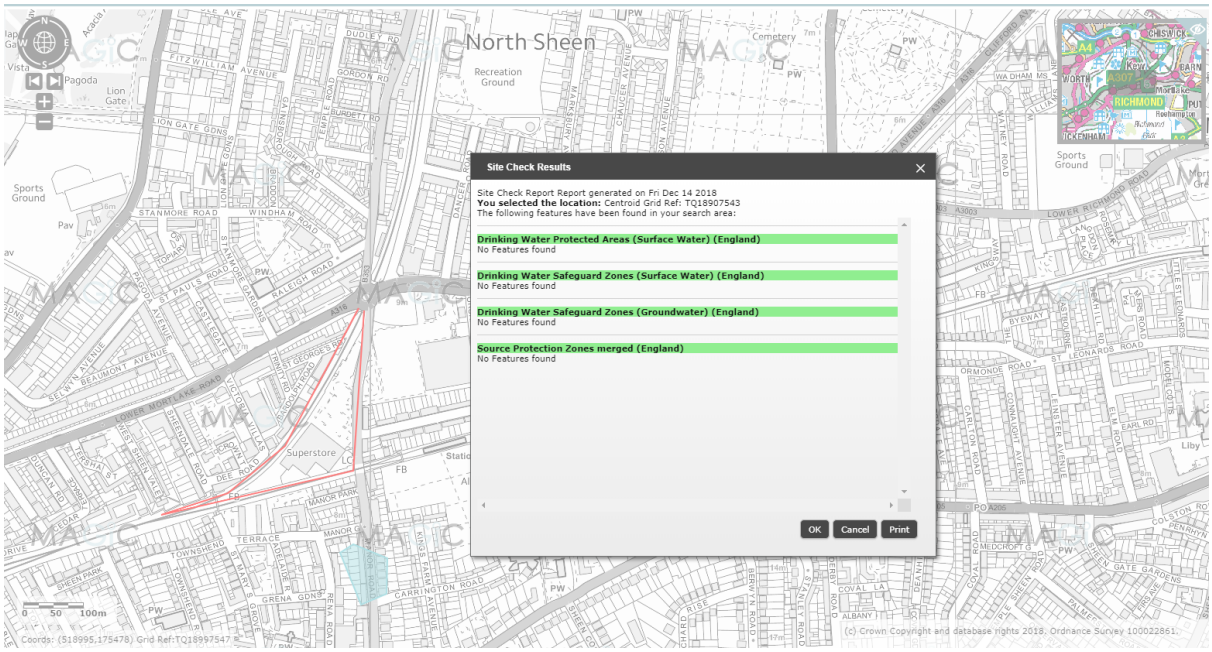


Figure 4 – Groundwater / drinking water source protection zones

3.4 Sequential Test and Exception Test

3.4.1 With reference to Table 2: '*Flood Risk Vulnerability Classification'* in NPPF Planning Practice Guidance, residential development is considered as 'more vulnerable' and Commercial properties are classed as 'Less Vulnerable' in terms of planning issues.

3.4.2 The Sequential Test should be applied to new developments located within a Flood Zone 2, 3 or functional floodplain in order to steer them to areas with a lower risk of flooding. As the proposed development site is located in a Flood Zone 1 (Low Probability of flooding) the Sequential Test is not required.

4 Definition of flood hazard

4.1 Flooding from Rivers

4.1.1 River flooding that occurs when a watercourse cannot cope with the water draining into it from the surrounding land. This can happen, for example, when heavy rain falls on an already waterlogged catchment.

4.1.2 The site is located south of a bend in the River Thames, with the closest point being approximately 1.6km to the east. Environment Agency mapping shows that neither it nor other watercourses pose any significant flood risk to the site.

4.2 Flooding from Sewers (Surface Water Flooding)

4.2.1 Sewer flooding that occurs when sewers are overwhelmed by heavy rainfall or when they become blocked. The likelihood of flooding depends on the capacity of the local sewerage system and the type of sewer (combined or separate) in the local area. Land and property can be flooded with water contaminated with raw sewage as a result. Rivers can also become polluted by sewer overflows. It is difficult to predict and pinpoint; much more so than river or coastal flooding.

4.2.2 The EA Surface Water flood maps identify the potential depths, velocities and hazard rating of surface water flooding during a 30, 100 & 1000 year probability storm events.

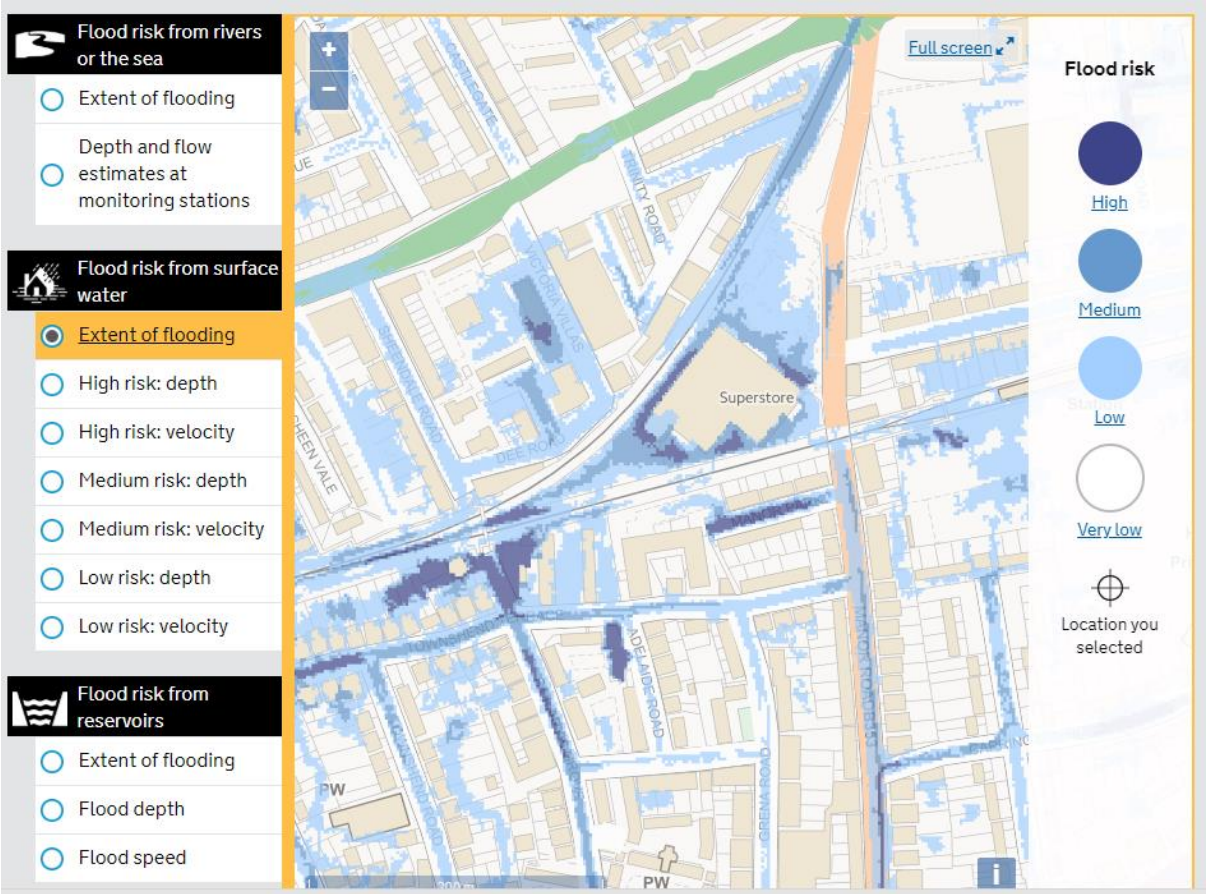


Figure 5 – Flood Risk Maps (Surface Water) - Environment Agency

4.3 Flooding from Groundwater

4.3.1 Flooding from groundwater is defined by BGS as:

"the emergence of groundwater at the ground surface away from perennial river valleys or the rising of groundwater into man-made ground under conditions where the 'normal' range of groundwater levels and groundwater flows is exceeded."

4.3.2 Groundwater modelling is required on site to ascertain the risk of flooding from groundwater.

4.4 Flooding from Artificial Sources

4.4.1 Flooding from artificial sources can be defined as a failure of man-made infrastructure or human intervention that causes flooding. Consideration should be given to features such as reservoirs, canals and lakes where water is retained above natural ground level.

5 Probability of flooding

5.1 Probability of Flooding from Rivers

5.1.1 In accordance with the Environment Agency's indicative flood map, the site is located in Flood Zone 1, which has less than 0.1% annual probability of fluvial flooding (equivalent of 1 in 1000 year return period).

5.1.2 The site is outside of the influence of the Thames Flood defences which are designed to protect against a greater than 1 in 1000 year return period. Therefore there is negligible risk that flooding may occur during extreme future flood events in a breach scenario.

5.2 Probability of Flooding from Sewers / Surface Water

5.2.1 The Environment Agency produces flood risk maps to show the risk of flooding from surface water / sewers (Figure 5 above). These show the site to be at risk of flooding from surface water.

5.2.2 It should be noted that the EA maps are caveated with the guidance note

due to the difficulty in surface water flooding prediction, maps report property information for the highest risk within 20m of the site

5.2.3 More accurate information relating to the specific flooding of individual properties by surface water due to sewer surcharge is held by Thames Water.

5.2.4 A search request for this site returned no evidence of surface water flooding of the site due to surcharging events on record. A copy of this search result is contained within the appendices.

5.2.5 Based on this more accurate flooding information, the site is assessed as not at risk of surface water flooding from surcharging sewers.

5.2.6 Properties are at risk of foul water flooding in areas of combined foul and surface water. The local area is served by separate foul and surface water sewers. The site is therefore deemed not to be at risk of flooding of foul water.

5.3 Probability of Flooding from Groundwater

5.3.1 Two BGS borehole records situated in the vicinity of the site (see Figure 6 below) recorded groundwater levels at 3m below ground level (TQ17NE436) and 1.5m below ground level (TQ17NE62). This indicates that the site could be at risk of flooding from groundwater. Groundwater monitoring should be undertaken to confirm groundwater levels on the site in order to more fully assess the risk.

Figure 6 – BGS Borehole locations - BGS

5.4 Probability of Flooding from Artificial sources

5.4.1 The EA maps (7) show a low / no probability of flooding occurring from artificial sources.

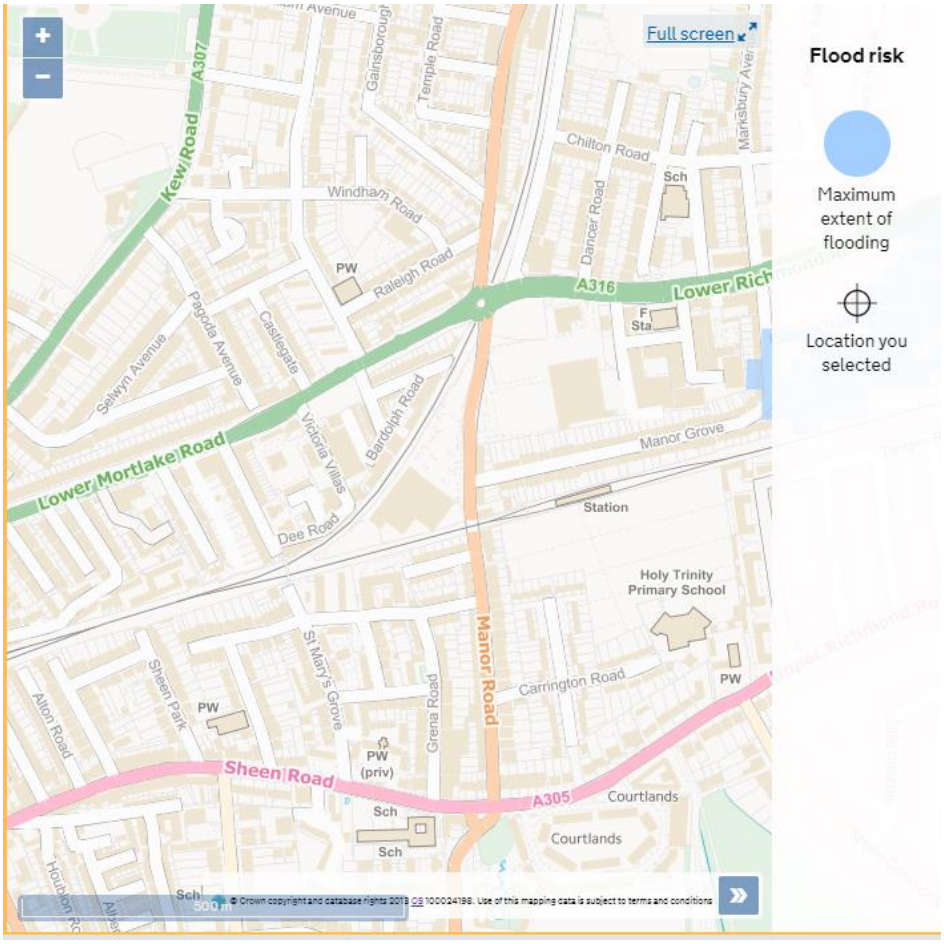


Figure 7 - Flood Risk Maps (Artificial Sources) - Environment Agency

6 Development proposal

6.1.1 The proposed development plans are included as an appendix to this report.

6.1.2 The development proposals include 5No. blocks of mixed commercial and residential units.

6.1.3 It is also proposed to construct a bus layover and associated facilities, in addition to a police facility, at the north of the site.

6.1.4 The proposed external layout includes small islands of soft landscaping and trees of a similar total size to the landscaped islands in the pre-development state.

7 Flood risk mitigation measures

7.1 Groundwater flooding

7.1.1 The proposal to drain the site via infiltration devices as per the predevelopment condition will provide a betterment on the exiting situation as 0.52ha of the site will be blue roof where water will be stored and the run-off limited to 1.5 l/s per building meaning that the development will not increase the risk of groundwater flooding.

7.1.2 To mitigate against potential groundwater flooding an exceedance route has been identified which routes water away from the buildings and road and into low spots

around the edge of the site, leaving a safe route of exit for residents. Please refer to Fairhurst drawing 126782-C-4000 which is included as an appendix to this report.

7.2 Surface Water flooding

7.2.1 As discussed in previous sections, it is policy in Richmond for developments to, where possible, reduce the flood risk to the local area and reduce peak runoff rates to greenfield rates (where feasible) using Sustainable Drainage Measures (SuDS).

7.2.2 The proposed development site is currently brownfield land. A utility and drainage survey identified a series of ring soakaways in the existing site car park which it is believed all the surface water in the site discharges through. No surface water connection to the Thame Water sewer was identified during any of the site investigations completed to date.

7.2.3 The site is split into (i) buildings with roofscapes (approx. 0.69ha) and (ii) ground level landscaping (approx. 1.0ha).

7.2.4 In line with LBRuT policy, green/blue roofs should be incorporated at roof level. Due to the build-up of the soil, this reduces runoff leaving the roof. Smart controls and additional storage can be provided at roof level to limit the roof run-off.

7.2.5 The proposed development includes large areas of hardstanding (approx. 0.62ha). Where possible, these will be constructed of a porous material and with a permeable lined porous subbase. This will allow rainfall to infiltrate to the natural environment.

7.2.6 As the site currently drains via infiltration, it is assumed the local geology is suitable for infiltration drainage. Infiltration tests in accordance with BRE365 have been commissioned and the results are awaited to confirm this and the infiltration rate for design.

7.3 Climate change

7.3.1 An allowance within the drainage network should be made to accommodate climate change.

7.3.2 The Environment Agency (EA) publishes tables of anticipated climate change based on river basin districts for different design life lengths.

River basin district	Allowance category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Thames	Upper end	25%	35%	70%
	Higher central	15%	25%	35%
	Central	10%	15%	25%

Figure 8 - Peak river flow allowances by river basin district (use 1961 to 1990 baseline), source: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances, Aug 2018

7.3.3 The proposed development lies within the Thames district and the upper end allowance for the 2050's should be applied.

7.3.4 Based on the table above and current guidance, this advises an allowance of 35%. This allowance has been reflected in any surface water calculations.

8 Surface Water Drainage

8.1 Existing private drainage

8.1.1 The existing site contains surface and foul water drainage serving the existing retail store (to be demolished as part of the proposed works).

8.1.2 A topographical and drainage survey (see appendices) shows the drainage network including conveyance features and soakaways. Due to the scale of the proposed development, it is not anticipated that any of the existing drainage within the site will be suitable for reuse. This includes the existing soakaways that cannot remain in their current location within the proposed development.

8.2 Existing surface water runoff

8.2.1 The current site is brownfield land with negligible soft landscaping.

8.2.2 The existing surface water runoff rates have been calculated using the Wallingford Procedure for various return periods. The results are summarised in the table below and the full calculations are included as an appendix to this report. For comparison, the site greenfield equivalent rates are also given.

Return Period	Greenfield Rates		Brownfield Rates
	Runoff / ha (l/s)	Runoff (site) (l/s)	Runoff (site) (l/s)
1yr	2.4	6.7	252.5
30yr	6.4	18.2	594.7
100yr	8.9	25.2	753.6

8.3 Proposed surface water runoff

8.3.1 It is proposed to drain the site using infiltration devices on the site, as per the predevelopment condition, subject to confirmation of suitable infiltration rates.

Greenfield Runoff

8.3.2 Pending the infiltration results, the site has also been assessed to consider the possibility of a connection to the public sewer network for the case of unfavourable infiltration results being reported.

8.3.3 The site has been assessed using *Quick Storage Estimates* in MicroDrainage software to estimate the required volumes to attenuate the site to existing greenfield runoff rates for various storm return periods.

8.3.4 Further to the *Quick Storage Estimates*, a *Source Control* calculation has been carried out for each of the proposed tanks. The MicroDrainage Source Control calculations are included as an appendix to this report.

8.3.5 The estimated volume for the 100yr + 35% climate change storm is shown in the table below as the maximum attenuation that would be required to match greenfield runoff. The MicroDrainage calculations are included as an appendix to this report.

Return Period	Flow Limit (l/s)	Volume (m^3)
100yr + 35% Climate Change	25.2	962

8.3.6 It is anticipated that this would be attenuated using a combination of above ground blue / green roofs and below ground tanks. Complex flow controls would be used to flow match different storm return periods.

8.4 Sustainable Drainage Systems (SuDS)

8.4.1 Sustainable Drainage Systems (SuDS) aim to reduce runoff rates by mimicking the natural environment and discharge routes.

8.4.2 The SuDS Manual (CIRIA C753) provides guidance on the different types of SuDS components and how they can be used.

8.4.3 The table below summarises the SuDS components as listed in the SuDS manual and indicates their suitability for use on the proposed development.

SuDS Feature	Description		Suitability / comment
Rainwater harvesting	Rainwater harvesting is the collection, storage, treatment (where necessary) of rainwater runoff from roofs and other impermeable areas for reuse within the site. In addition to reducing volume runoff from the site, they can reduce the water demand of the site delivering climate resilience and sustainability benefits		Although not proposed, this is suitable for irrigation and external uses within the site, subject to requirements of the landscape architect. Building constraints do not allow for dual potable and non-potable water supply pipes to units within the buildings. Suitable treatment should be used in accordance with specialist guidance.
Green/Blue roofs	Green/Blue roofs are areas of living vegetation included on the roofscape of buildings. They can be either extensive or intensive and accessible or non-accessible. The plant and soil reduces the rate of discharge extending the time between rainwater falling on the roof and reaching the rainwater outlet / drain.		This is suitable for use in the development and have been proposed for the site. Extensive sedum roofs are suitable for non-accessible roof areas. Intensive landscaped roofs are suitable for amenity areas on podiums / select roofs.

SuDS Feature	Description		Suitability / comment
	They also provide ecological and visual benefits.		
Infiltration systems	Infiltration systems hold water and allow it to percolate back into the ground as it would naturally in permeable areas. These can either be traditional shallow soakaways or deep bore soakaways. Their suitability depends on the soil permeability. Due to the effect of water on structural stability, these need to be sited sufficient distances from buildings / foundations. These can reduce volume runoff from sites and contribute to recharging groundwater		This is proposed for the site pending results of infiltration tests.
Proprietary treatment systems	Proprietary treatment systems are manufactured products to remove specified pollutants from runoff. These can reduce downstream maintenance requirements and provide additional benefit, if required, by receiving watercourses / discharge locations.		Catchpits will be included to reduce silt build up within pipes and drainage components. There is no special protection to the discharge destination and therefore additional treatment (on discharge) is not required.
Filter strips	Filter strips are uniformly graded gently sloping strips of grass or vegetation to treat runoff by slowing down flows, promoting sedimentation and infiltration.		These are suited for large open spaces and therefore not suitable for use on the proposed development.
Filter drains	Filter drains are shallow trenches filled with gravel to attenuate, treat and convey surface water runoff. They can convey / attenuate only or, depending on site conditions, allow infiltration direct to the ground.		The proposed landscaping plan does not include areas of gravel paths / surfacing.
Swales	Swales are shallow flat bottomed channels to convey, infiltrate (where possible) and treat surface water runoff. They can enhance site design and provide biodiversity enhancements. They are often used to drain roads, paths or car parks. Swales can replace traditional pipes as a means to convey flows and used as part of a SuDS train of elements.		Swales are most suitable along roads with large verges or car parks surrounded with vegetation. They are not suitable for use on the proposed development.
Bioretention systems	Bioretention systems including rain gardens are shallow landscaped depressions to treat and store runoff using engineered soils and vegetation. They provide amenity and visual benefit alongside additional climate benefits. They are usually used for containing / managing frequent storm events.		These require areas of open space suitable for frequent flooding / surface water storage. These are not suitable for use with the intensity of the proposed development.

SuDS Feature	Description		Suitability / comment
Trees	Trees help protect the environment in a number of ways including reducing runoff rates through interception of rain water in their canopies, and promoting infiltration in permeable / soft landscaping as well as the visual benefit they provide to the area.		Trees are proposed to be included within soft landscaped areas of the development.
Pervious pavements	Pervious pavements provide pavement surfaces suitable for pedestrian / trafficked applications whilst allowing runoff to permeate through their structure. This provides filtration benefit to treat runoff. Pervious pavements can be used to collect, treat and convey flow only, or if site condition permit, allow infiltration to the ground direct from their base.		These may be suitable within the development subject to detailed design. Site conditions are not suitable for full infiltration however these can facilitate partial infiltration. Additional benefits to the development of pervious pavements will be to convey flows – reduce the number of drains and pipes required, and attenuation - reducing the size of underground storage tanks required.
Attenuation storage tanks	Attenuation storage tanks temporarily hold back water for gradual release or reuse at a controlled rate to reduce the peak runoff rate. These can be in the form of above ground tanks (blueroofs), below ground geocellular / concrete tanks or oversized pipes.		The sedum greenroofs / landscaped greenroofs are proposed to include podium storage crates to attenuate water at roof level. Below ground tanks for storage / infiltration is proposed to increase available storage as required and discharge surface water.
Detention basins	Detention basins are landscaped depressions which are normally dry except for during and immediately after storm events. These attenuate flows through controls on the outfalls to store rainwater upstream in networks providing treatment and amenity benefits. With careful design, these can be used for leisure / amenity uses during normal / dry periods.		These are suitable for large open spaces. These are not suitable for use with the intensity of the proposed development.
Ponds & wetlands	These are similar to detention basins, however they are designed to have a permanent level of water within them to provide biodiversity and amenity benefits.		These are suitable for large open spaces. These are not suitable for use with the intensity of the proposed development.
Red – Not suitable; Orange – May be suitable; Green - Suitable			

8.5 Drainage hierarchy

8.5.1 In accordance with the Flood Risk and Sustainable Drainage policy LP 21, the development should follow the drainage hierarchy.

8.5.2 The table below summarises the hierarchy and how the proposed drainage strategy complies with the drainage hierarchy.

Stage		Suitability / comment
Store rainwater for later use		This may be suitable for some attenuated water subject to landscape architect requirements. This is not considered to be a viable solution for the main discharge due to the volumes of water required for irrigation.
Use infiltration techniques such as porous surfaces		This is proposed for the site pending infiltration test results.
Attenuate rain water in ponds or open surface features		The intensity of the proposed development is not suitable for open water features
Attenuate rainwater by storage in sealed features or tanks		Attenuation (above and below ground) is proposed on the development.
Discharge direct to a water course		There are no water courses within the development that can be used for discharge.
Discharge to a surface water sewer		This may be required subject to infiltration test results. A hybrid solution with infiltration tanks and an overflow connection to the sewer may be required depending on the infiltration rates at the site.
Discharge to a combined sewer		Not required
Discharge to a foul water sewer		Not required.
Red – Not suitable; Orange – possible discharge location; Green – Discharge location		

8.6 Proposed drainage layout

8.6.1 The proposed drainage strategy has been developed in accordance with the relevant policy and guidelines as set out in the Flood Risk Assessment.

8.6.2 The proposed drainage strategy is shown on Fairhurst drawing 126782-C-4000 and is included as an appendix to this report.

8.6.3 The drainage strategy includes blue / green roofs to attenuate roof drainage at source. Low flow orifices are available which can restrict roof run off to low flow rates. Using these will minimise the volume of below ground attenuation required.

8.6.4 Below ground infiltration and attenuation tanks are proposed to attenuate and discharge surface water.

Infiltration

8.6.5 The Geotechnical Preliminary Risk Assessment (included in appendix) states;

Soakaways may be feasible within the granular Kempton Park Gravel Formation; however, given the potential for contamination identified, further risk assessments

may be required to ensure that these do not result in increased mobilisation of potential contamination. Furthermore, BGS borehole logs have identified a groundwater table from c.1.5m bgl and the shallow depth to groundwater may preclude the use of soakaway drainage.(Report Fairhurst 126782-R1)

8.6.6 This was written prior to the receipt of the survey showing the current site draining to soakaways.

8.6.7 Based on the current site drainage regime and the geotechnical conclusions, it is determined the site may be suitable for infiltration drainage. Pending the result of the site specific testing, infiltration rates have been assumed based on conservative estimates for the anticipated soil conditions.

Soil condition	Typical Infiltration Rate Range (m/hr)
Gravel	0.1 - 1
Sands	0.1 – 100

8.6.8 For the preliminary drainage strategy, a conservative rate of 0.5m/hr has been used.

8.6.9 A simple drainage network has been modelled in MicroDrainage simulating blue / green roofs restricted to a cumulative total of 5.0l/s (0.65ha) and 0.53ha of hard landscaping area direct to the infiltration tank.

8.6.10 The site is bounded by Network Rail land who typically require any infiltration devices to be minimum of 10m from their land boundary. Based on this and the site layout, there is nominally 315m^2 of space available for infiltration.

8.6.11 The tank size should be confirmed following the results of the infiltration tests.

8.6.12 As part of the infiltration tests, groundwater monitoring should also be completed to confirm there is a minimum of 1.0m below the base of the infiltration device and the maximum groundwater level.

Connection to the Public Water Sewer / Overflow

8.6.13 If the infiltration results prove unsuitable for infiltration discharge, a new connection may be required to the Thames Water sewer.

8.6.14 Dependant on the infiltration rates, this may be for all discharge (limited to greenfield rate) or partial discharge as an overflow.

The table below shows the volume of attenuation required on site if the site is to solely discharge to Thames Water sewers at greenfield rates.

Return Period	Flow Limit (l/s)	Volume (m^3)
100yr + 35% Climate Change	25.2	962

8.6.15 A preplanning application has been submitted to Thames Water to confirm capacity in the network should this be required. Thames Water have advised that as the site currently drains via infiltration, they will not fully assess the site for a sewer connection prior to completion of infiltration tests.

8.6.16 Thames Water have indicated if infiltration drainage is not possible, they may consider a new connection restricted to the lower of greenfield runoff rate and 5l/s subject to Lead Local Flood Authority agreement.

8.6.17 A copy of Thames Water's response to the preplanning enquiry is included in the appendix to this report.

8.7 Drainage Form

8.7.1 London Borough of Richmond upon Thames has developed a drainage assessment form for developers to complete.

8.7.2 A completed copy of this form is included in Appendix A.8

9 Foul Water Drainage

9.1 Existing drainage

9.1.1 The existing site is served by a network of private drains and connects to the Thames Water foul sewer as shown on the surveys in the south east corner of the site.

9.2 Proposed drainage

9.2.1 Due to the extents and type of the proposed development, the existing drainage network within the site will not be suitable for reuse due to the layout of the pipes / proposed buildings.

9.2.2 It is proposed to maintain the existing connection between the final private manhole and the Thames Water sewer and connect the proposed site via this existing connection.

9.2.3 Due to the scale of the development, there will be an increase in peak foul flow from the site. A preplanning application has been submitted to Thames Water to confirm capacity in the network. Thames Water have confirmed there is currently capacity in the network for the proposed foul water requirements.

9.2.4 A copy of the Thames Water's response is included in the appendices of this report.

10 Drainage maintenance

10.1.1 As with all engineering systems, SuDS networks require a maintenance regime to be established and followed to ensure it acts as designed.

10.1.2 The SuDS Manual, CIRIA C753 provides guidance on the general maintenance requirements for different SuDS elements.

10.1.3 Typical drainage maintenance schedules are included as an appendix to this report. These should be updated as required during detailed design to reflect the constructed drainage system's requirements.

11 Conclusions

11.1.1 The proposed development is 1.842ha in Flood Zone 1.

11.1.2 The existing site drains to soakaways and does not connect to the surface water sewers.

11.1.3 A surface water drainage strategy using blue / green roofs and attenuation / infiltration tanks is proposed to manage surface water on the site including an allowance for climate change.

11.1.4 A detailed drainage design based on the strategy and comments in this report should be developed. By implementing these measures, surface water will be managed on site and not increase downstream flood risk.

11.1.5 By implementing these measures, surface water flood risk has been managed and the site is deemed to be not at risk of surface water flooding.

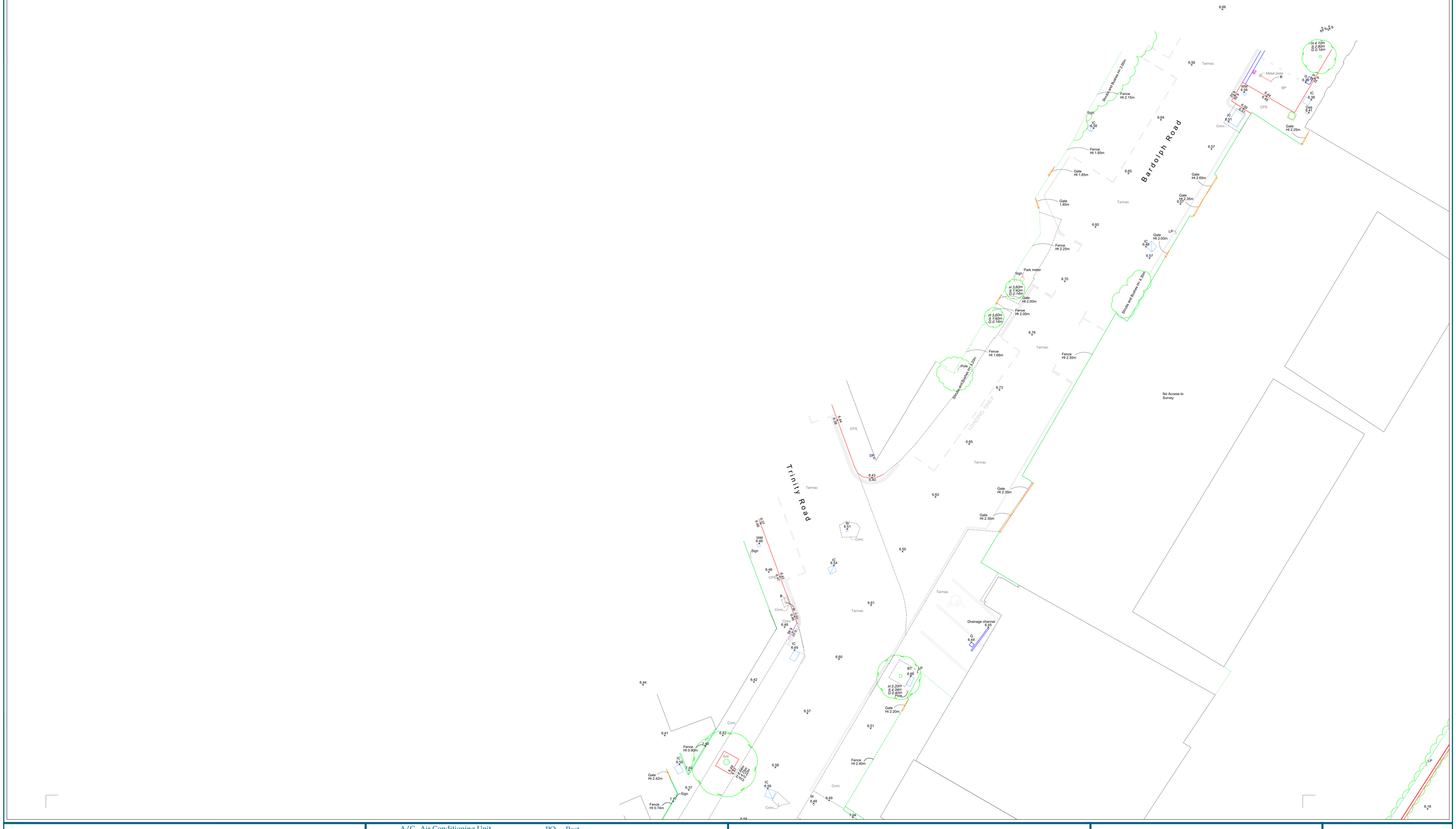
11.1.6 Flood routing and indicative areas of flooding have been identified along the western and southern boundary of the site which leave a safe route of exit for residents onto the road along the eastern boundary of the site should groundwater flooding occur.

11.1.7 A connection to Thames Water sewers may be required for surface water if unsuitable infiltration results are recorded on the site.

11.1.8 A foul water drainage strategy will be developed using the existing connection from the site to the public sewer network.

A.1 Surveys

- Topographical survey
- Utility Survey
- Drainage CCTV Survey



Sources:

Levels are related to Ordnance Survey Datum via GPS Observations

Survey location is related to Ordnance Survey Grid via GPS Observations.

All information contained in this drawing (including digital data) should be checked and verified prior to any fabrication or construction.

Stations:

STN01 - 518899.719, 175472.891, 6.147
STN02 - 518970.579, 175484.687, 6.586
STN03 - 518969.606, 175528.346, 6.724

Key:

A/C	Air Conditioning Unit
B	Bollard
BP	Brick Paving
BT	BT Inspection Cover
CATV	Cable Television Inspection Cover
CPS	Concrete Paving Slab
DK	Dropped Kerb
DP	Down Pipe
EL	Eaves Level
FH	Fire Hydrant
G	Gully
GP	Gate Post
IC	Inspection Cover
ILB	Illuminated Bollard
IRS	Illuminated Road Sign
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WM	Water Meter

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Project: Homebase, Richmond

Title: Topographic Survey
Sheet 1

Drawn By: SB

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Date: August 2018

Dwg No: **LS2024/T/01**

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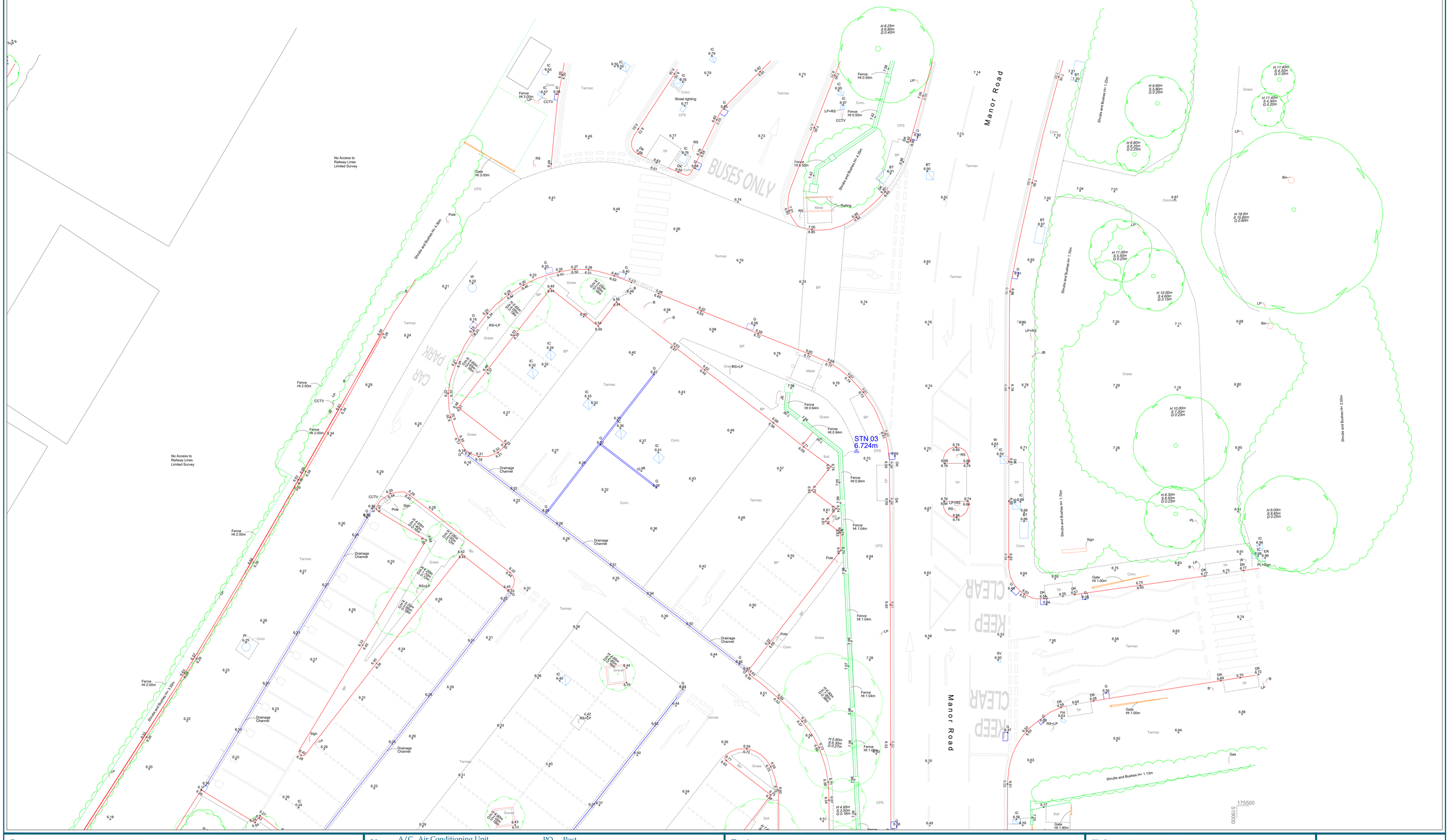

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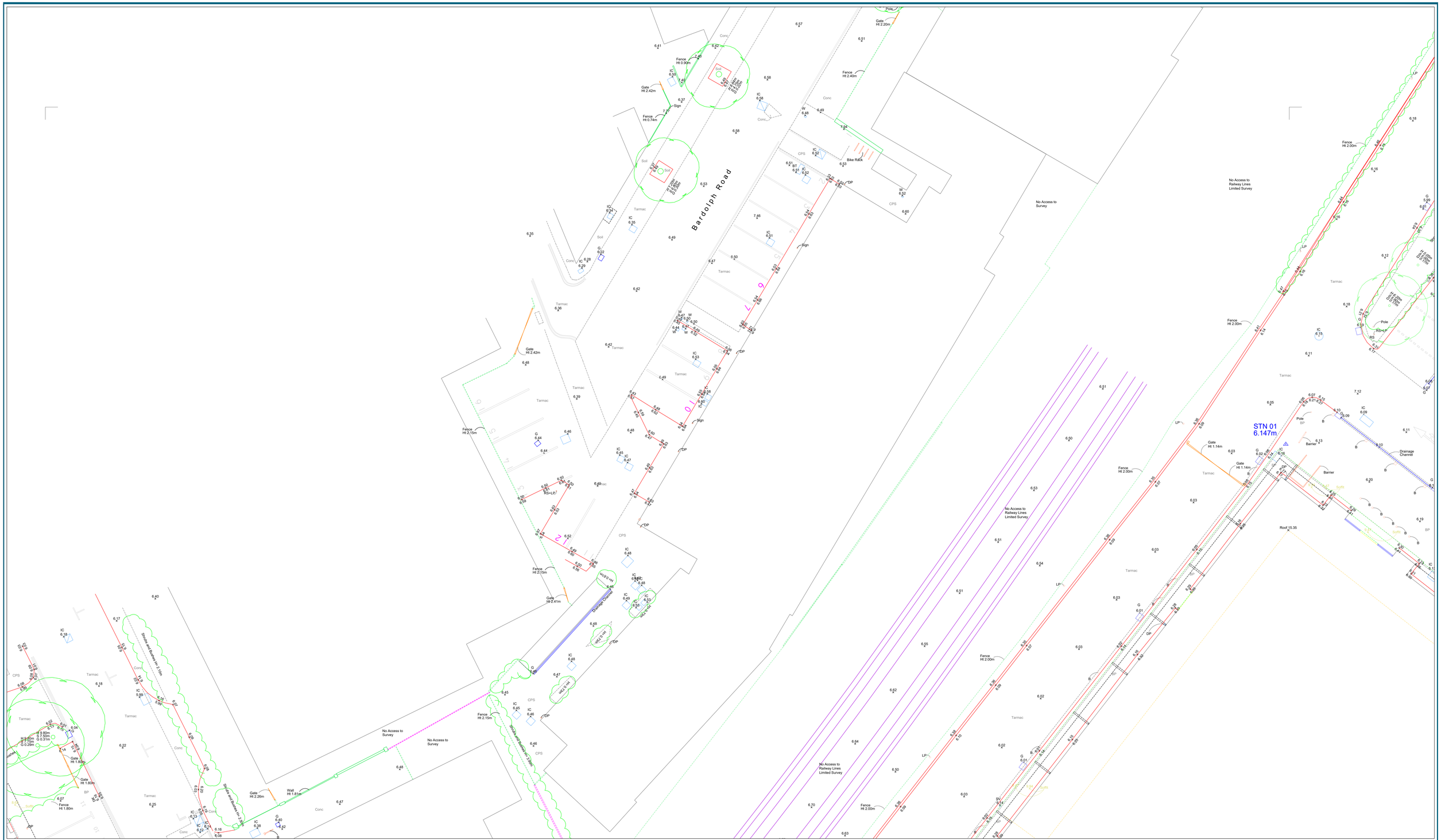

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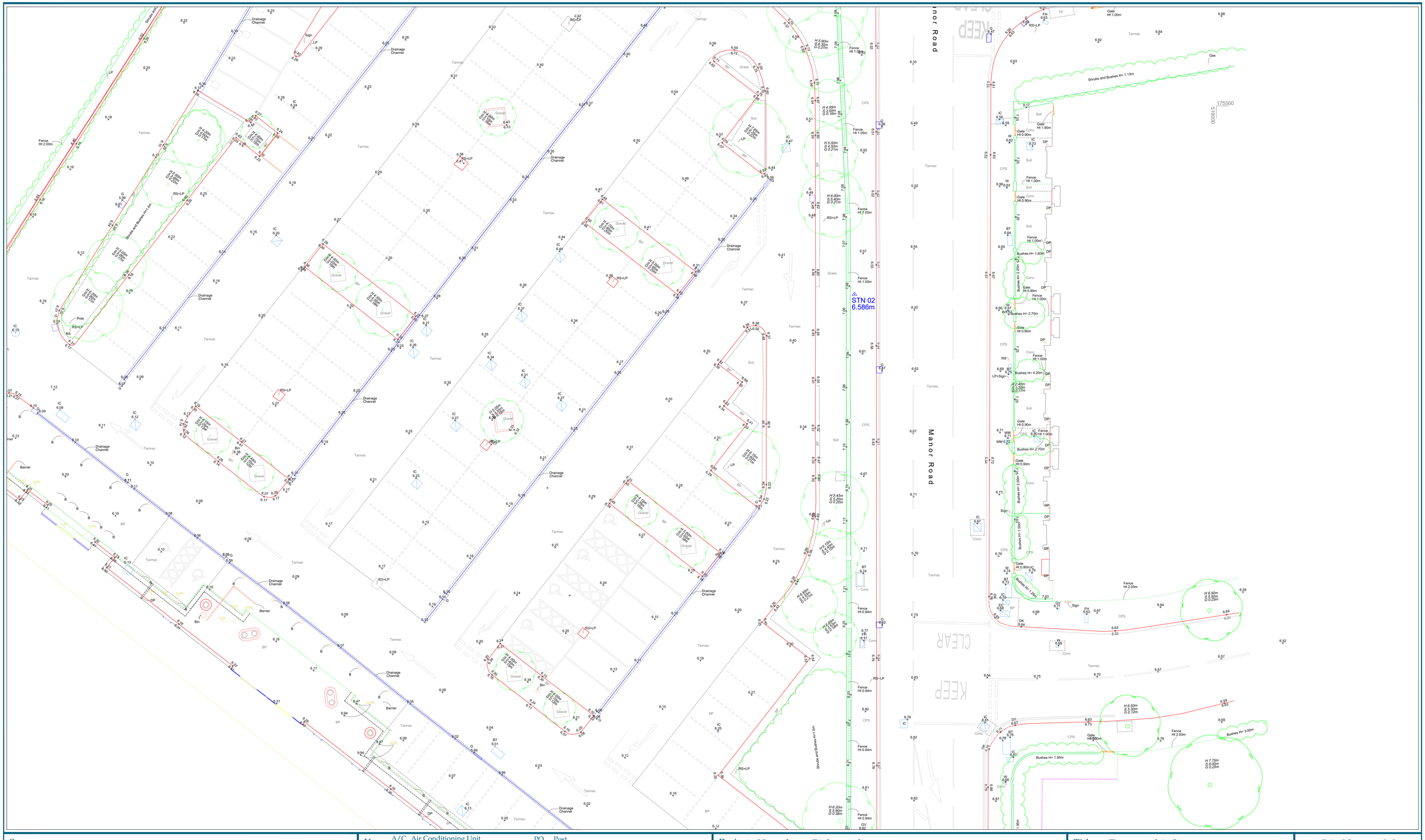

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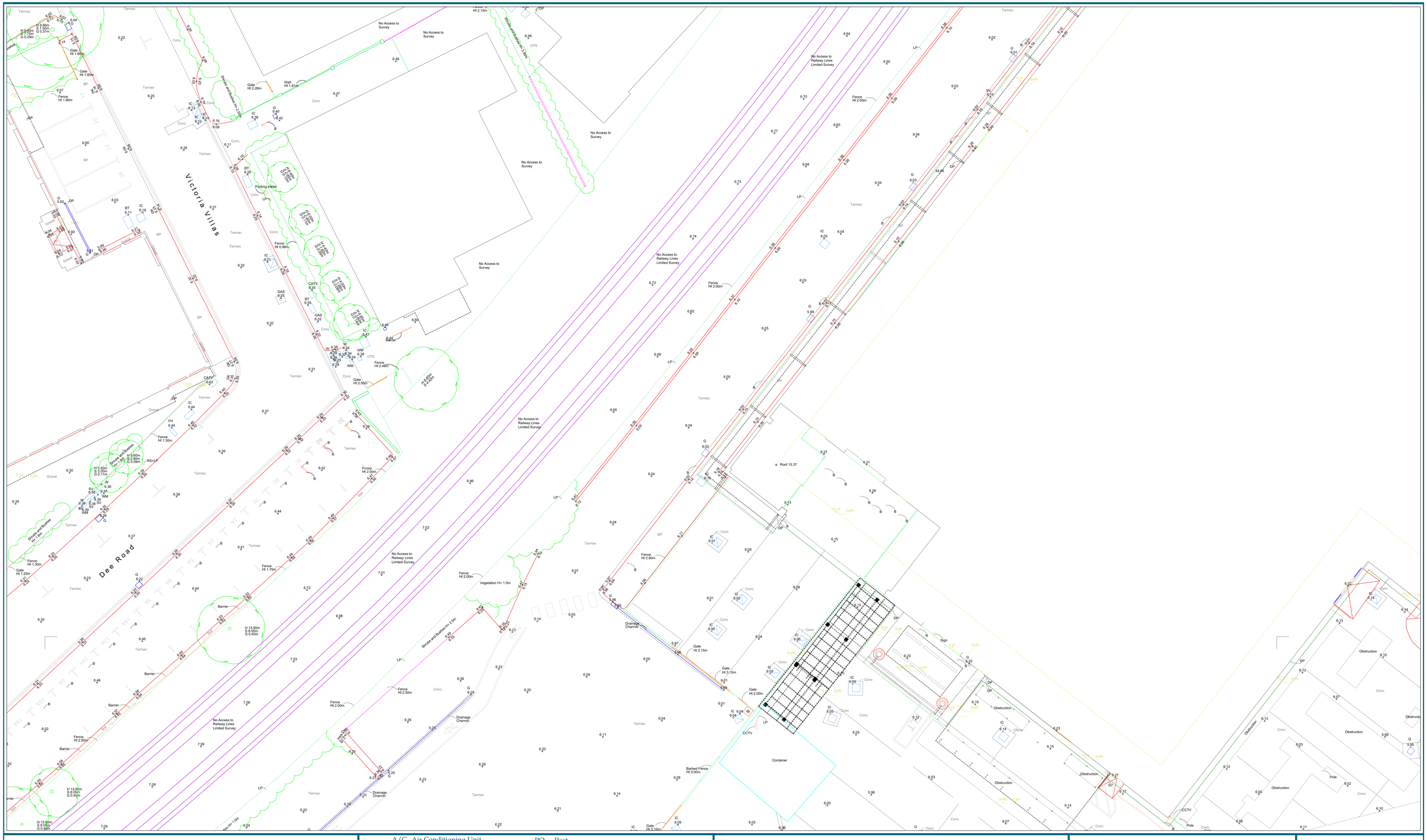

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BP	Brick Paving
BT	BT Inspection Cover
CATV	Cable Television Inspection Cover
CPS	Concrete Paving Slab
DK	Dropped Kerb
DP	Down Pipe
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FH	Fire Hydrant
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IC	Inspection Cover
ILB	Illuminated Bollard
IRS	Illuminated Road Sign
JB	Junction Box
LP	Lamp Post
MH	Man Hole Cover
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PO	Post
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SRFC	Surface Change
S/O	Smoke Outlet
SV	Stop Valve
TCB	Telephone Call Box
TP	TacCPS Paving
W	Water Inspection Cover
WM	Water Meter

	S1	S2
	S3	S4
S5	S6	S7
S8	S9	S10

Project: Homebase, Richmond

Title: Topographic Survey
Sheet 6

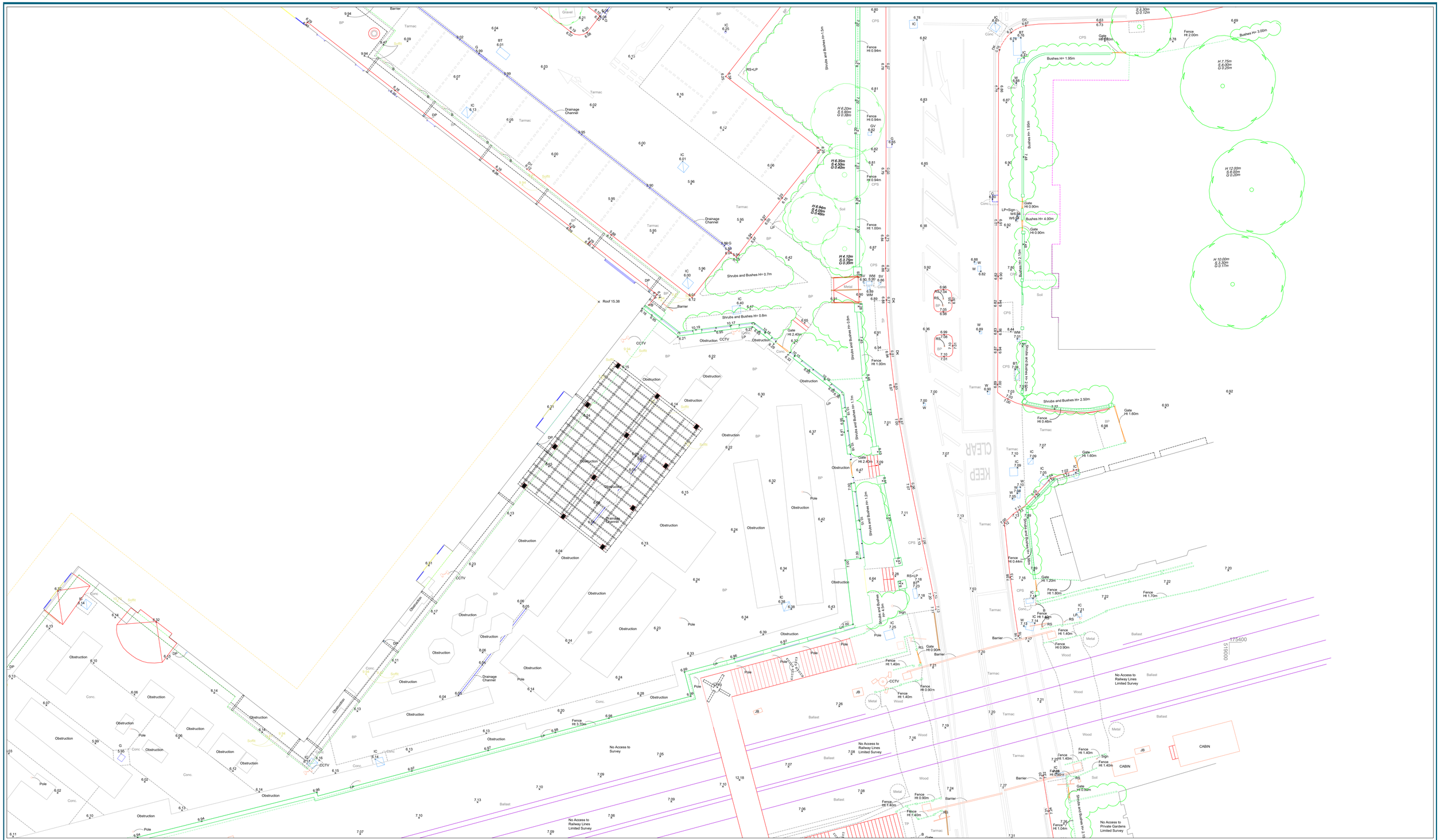
Point 2 Surveyors Ltd,
3rd Floor,
17 Slingsby Place,
London WC2E 9AB,
0207 836 5828
www.point2surveyors.com

Drawn By: SB

Scale: 1:100 @ A0

Date: August 2018

Dwg No: **LS2024/T/06**



Sources:

Levels are related to Ordnance Survey Datum via GPS Observations

Survey location is related to Ordnance Survey Grid via GPS Observations.

All information contained in this drawing (including digital data) should be checked and verified prior to any fabrication or construction.

Stations:

STN01 - 518899.719, 175472.891, 6.147
STN02 - 518970.579, 175484.687, 6.586
STN03 - 518969.606, 175528.346, 6.724

Key:

A/C	Air Conditioning Unit
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	S1	S2
	S3	S4
S5	S6	S7
S8	S9	S10

Project: Homebase, Richmond

Title: Topographic Survey
Sheet 7

Point 2 Surveyors Ltd,
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17 Slingsby Place,
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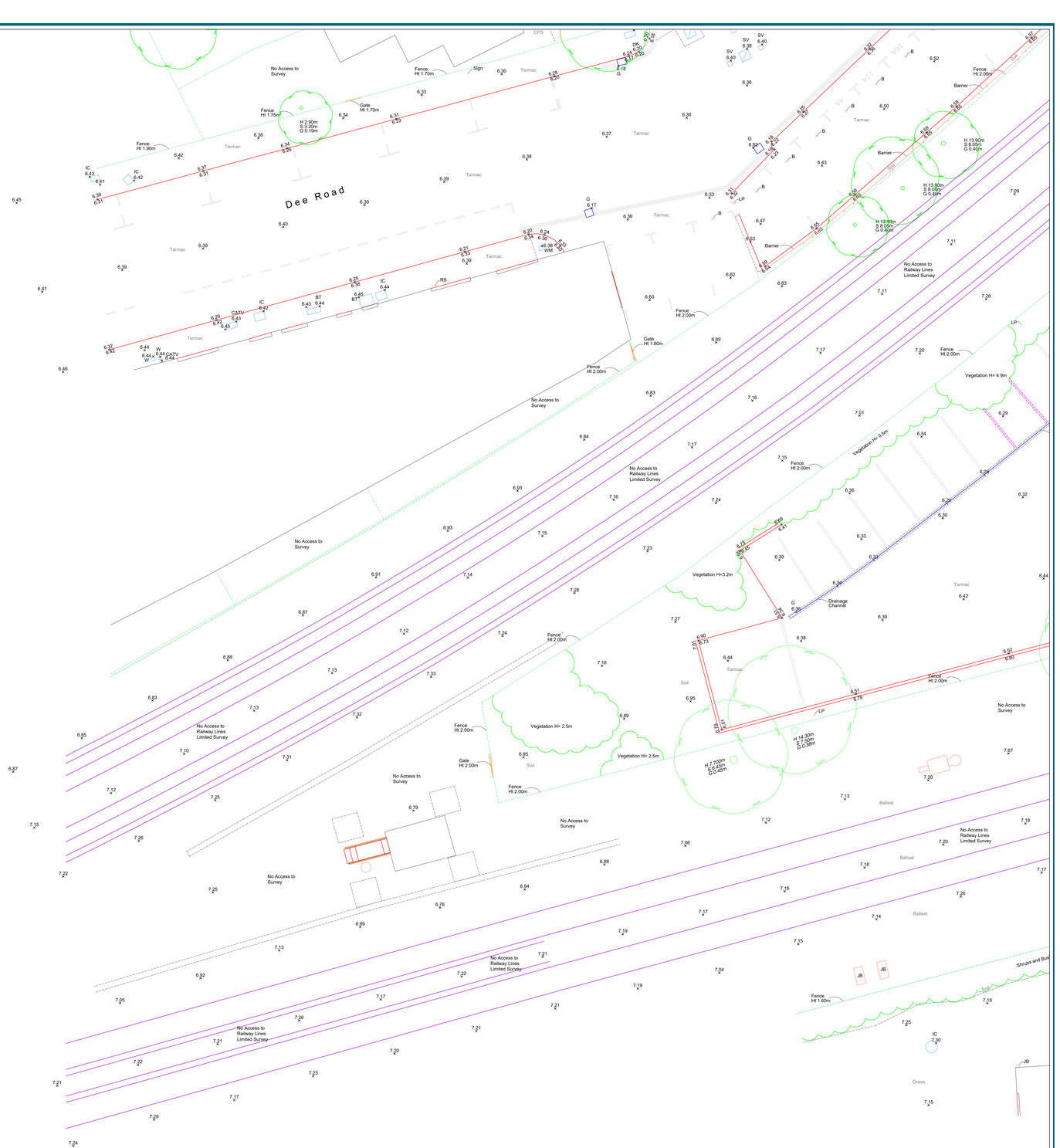
Drawn By: SB

Scale: 1:100 @ A0

Date: August 2018

Dwg No: **LS2024/T/07**



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	S1	S2
	S3	S4
S5	S6	S7
S8	S9	S10

Project: Homebase, Richmond

Title: Topographic Survey
Sheet 8

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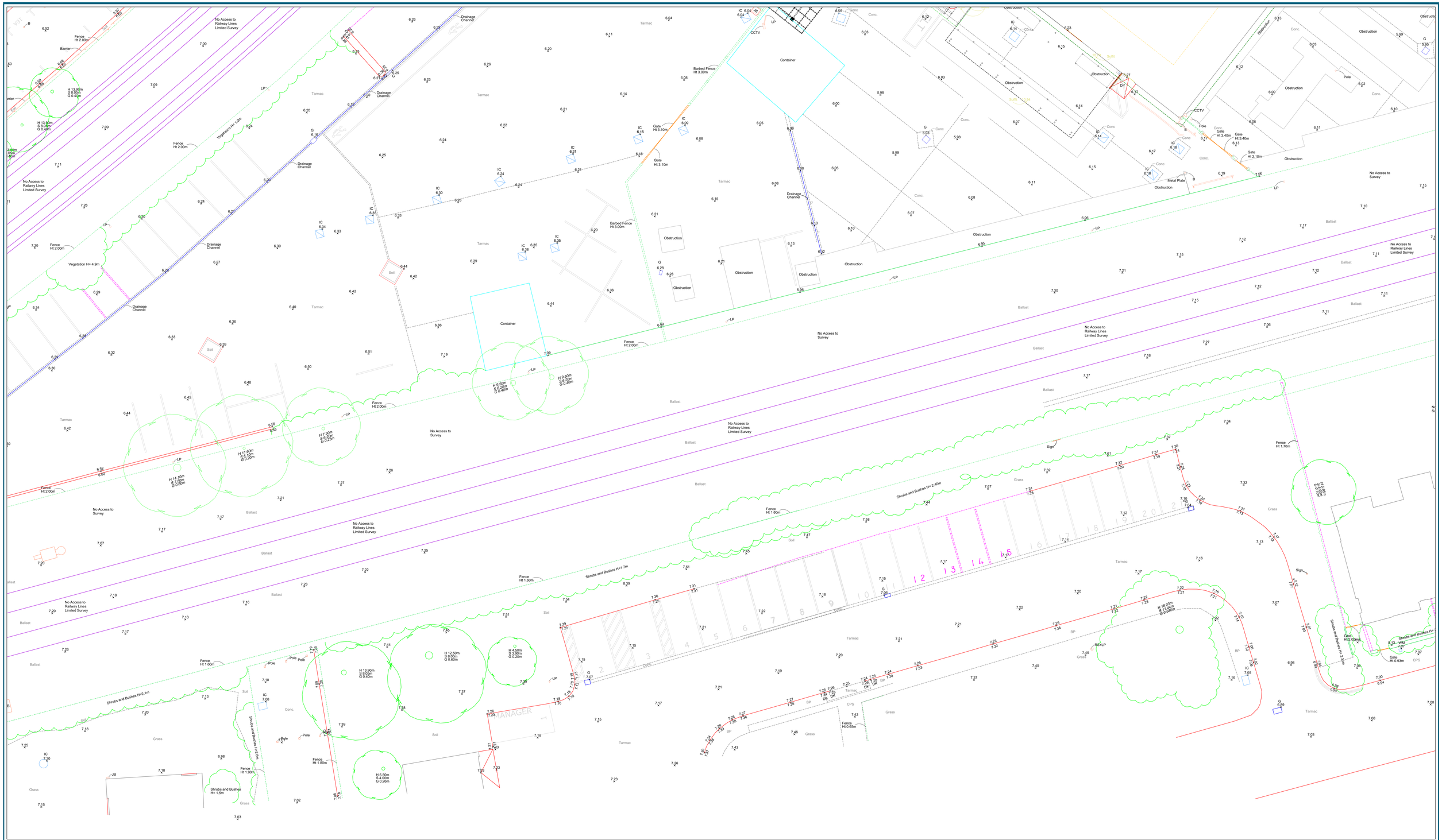
Drawn By: SB

Scale: 1:100 @ A0

Date: August 2018

Dwg No: **LS2024/T/08**



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	S1	S2
	S3	S4
S5	S6	S7
S8	S9	S10

Project: Homebase, Richmond

Title: Topographic Survey
Sheet 9

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Drawn By: SB

Scale: 1:100 @ A0

Date: August 2018

Dwg No: **LS2024/T/09**

Sources:

Levels are related to Ordnance Survey Datum via GPS Observations

Survey location is related to Ordnance Survey Grid via GPS Observations.

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Indicative

	S1	S2
	S3	S4
S5	S6	S7
S8	S9	S10

Project: Homebase, Richmond

Title: Topographic Survey Sheet 10

Drawn By: SB

Scale: 1:100 @ A0

Date: August 2018

Dwg No: LS2024/T/10

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17 Slingsby Place,
London WC2E 9AB,
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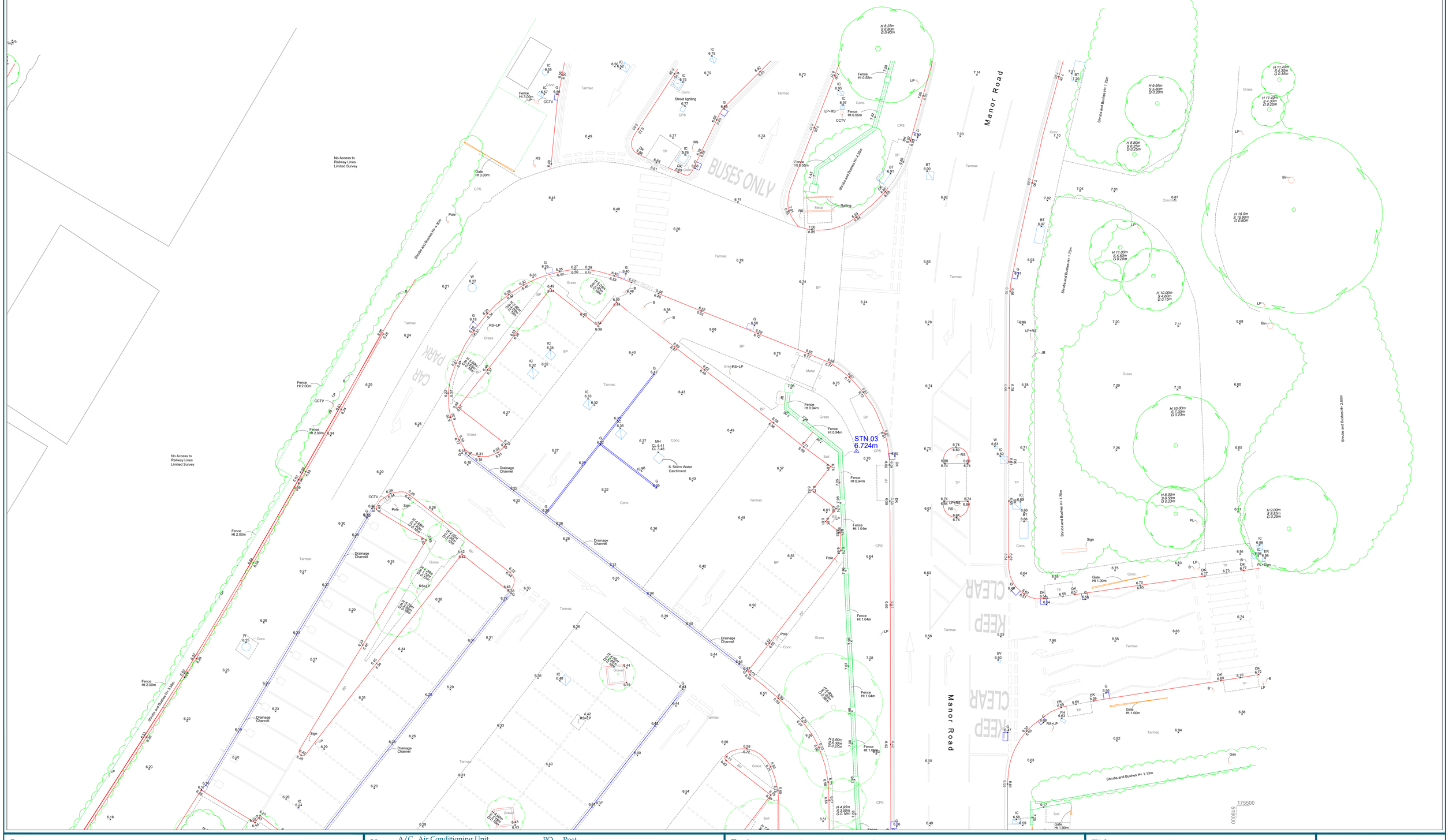

Sources:

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S1
S2
S3

Project: Homebase, Richmond

Title: Topographic Survey - Services
Sheet 1

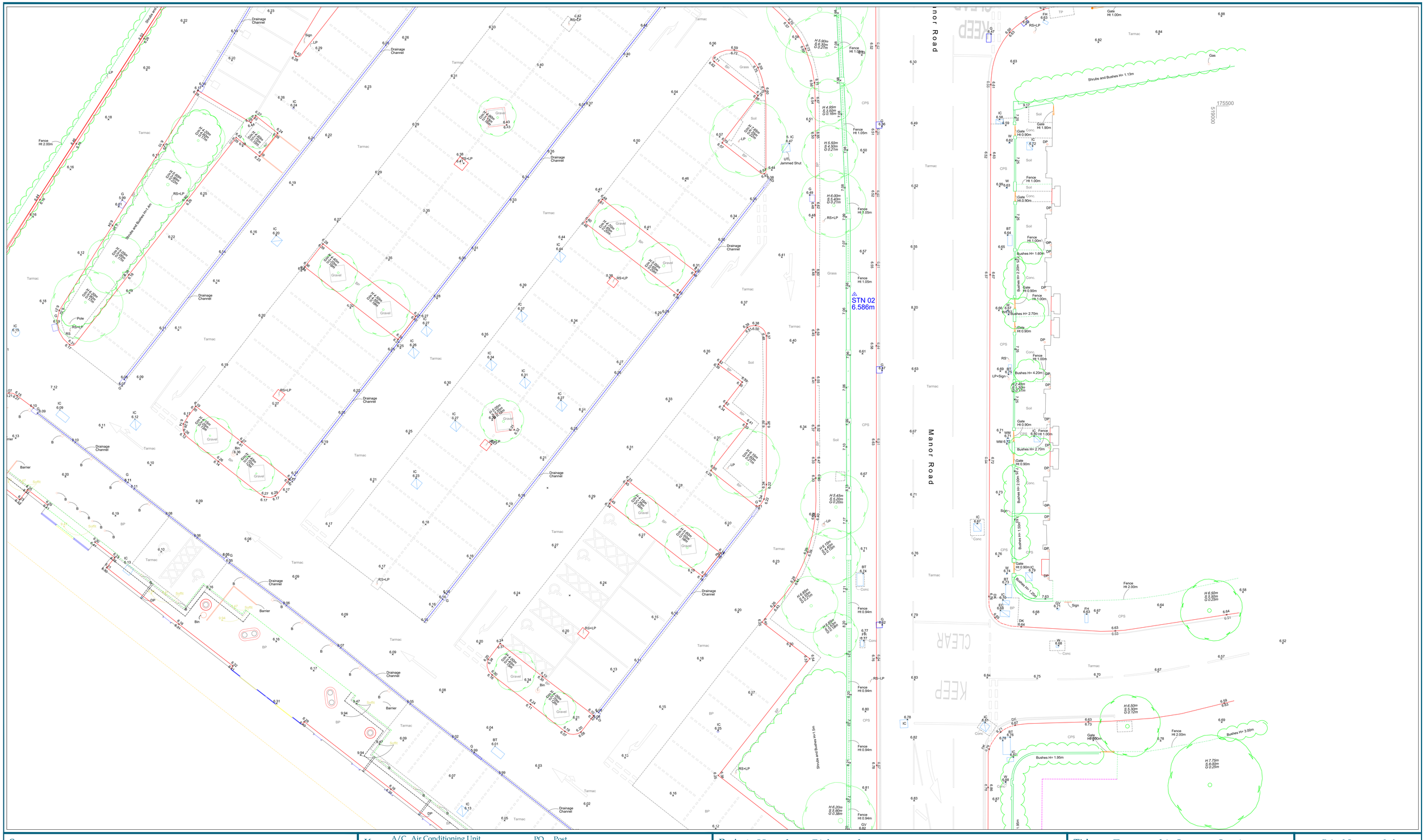
Point 2 Surveyors Ltd,
3rd Floor,
17 Slingsby Place,
London WC2E 9AB,
0207 836 5828
www.point2surveyors.com

Drawn By: SB

Scale: 1:100 @ A0

Date: August 2018

Dwg No: **LS2024/T_S/01**



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S1
S2
S3

Project: Homebase, Richmond

Title: Topographic Survey - Services
Sheet 2

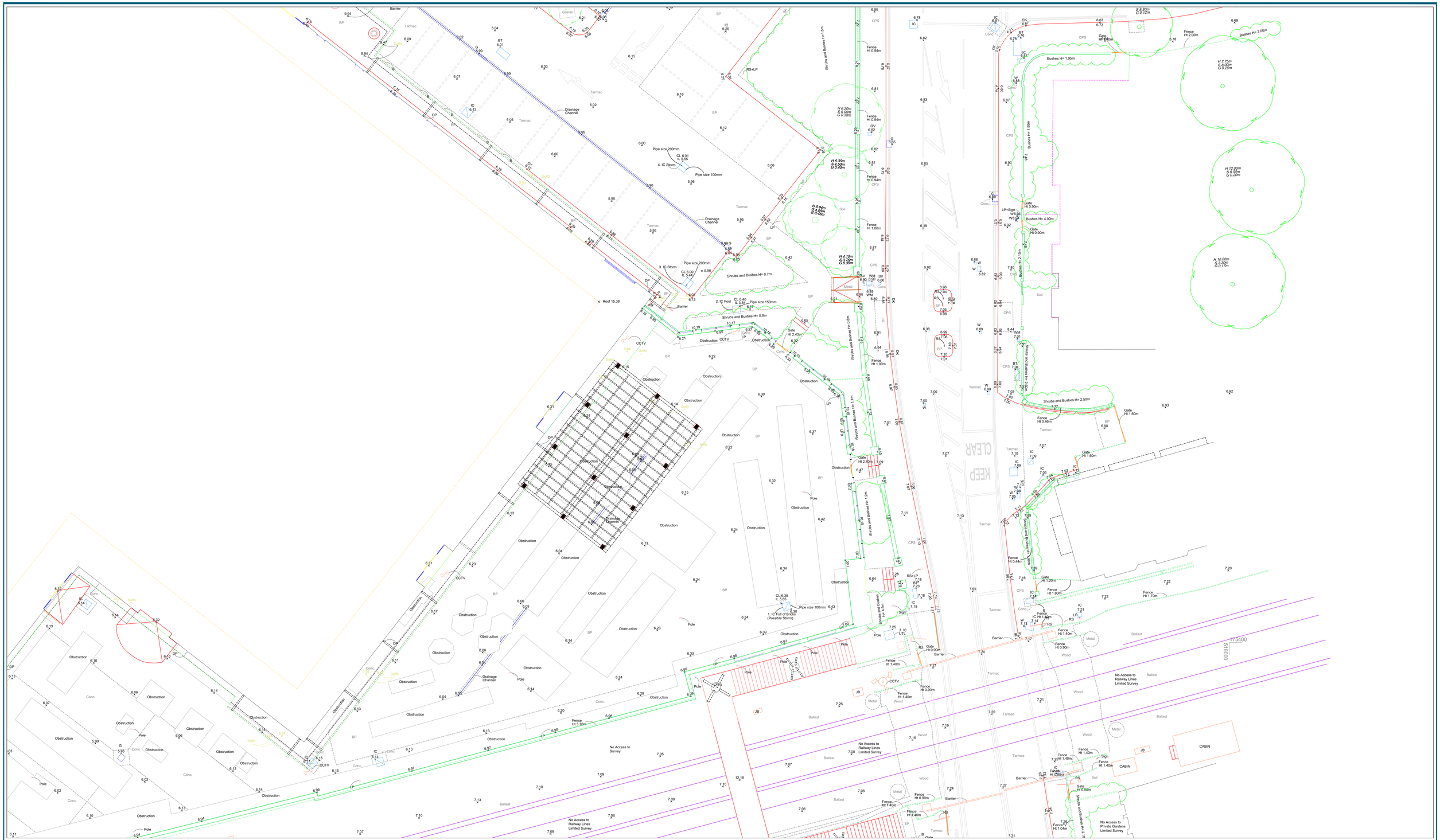
Point 2 Surveyors Ltd,
3rd Floor,
17 Slingsby Place,
London WC2E 9AB,
0207 836 5828
www.point2surveyors.com

Drawn By: SB

Scale: 1:100 @ A0

Date: August 2018

Dwg No: **LS2024/T_S/02**



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S1
S2
S3

Project: Homebase, Richmond

Title: Topographic Survey - Services
Sheet 3

Point 2 Surveyors Ltd,
3rd Floor,
17 Slingsby Place,
London WC2E 9AB,
0207 836 5828
www.point2surveyors.com

Drawn By: SB

Scale: 1:100 @ A0

Date: August 2018

Dwg No: **LS2024/T_S/03**

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Topographical Survey Key

AV Air Valve	BM Bench Mark
FH Fire Hydrant	Borehole
ST Stop Tap	Trial Pit
TAP Tap	CATV Cable TV Cover
WM Water Meter	C Cable TV Supply
SV Stop Valve	Sign Sign
WO Wash Out	TS Traffic Signals Cover
WV Water Valve	MH Circular Manhole
W Water Cover	MH Square Manhole
D/G Drain/Gully	MH Triangular Manhole
KO Kerb Outlet	Chamber Extents
TP Telecoms Cover	THR Threshold Level
T	Col Column
CCTV Camera	G Gas Valve
Mail Post Box	RE Rodding Eye
LP Light	M Marker Post
LP Lamp Post	Bus Bus Stop
TL Traffic Light	Bol Bollard
EP Electricity Pole	TP Telegraph Pole
ER Earth Rod	TO Trapped Outlet
E Electric Cover	BD Back Drop
IC Inspection Cover	

Sub Surface Key

BT Cable
CATV Cable
Coms Cable
Coms Power
Traffic Signal Cable
Electric Cable
Electric LVCable
Electric HVCable
Gas Pipe
Unidentified Service
Water Main
Foul Sewer
Combined Sewer
Private Sewer
Pumped Sewer
Surface Sewer
Rising Main
Trade Effluent
GPR Anomaly
Service Duct
Survey Extents
Chamber Extents
Fibre Optic
CCTV Cables

D1.00 Depth (m)	TOF Top Of Fence
UTT Unable To Trace	TOH Top Of Hedge
EOT End of Trace / Signal Lost	TOW Top Of Wall
EOS End of Sonde	DOC Depth Of Cover
S:A Drainage Survey Abandoned	DOB Depth Of Bottom
AR Assumed Route	P.T Poor Trace
TFR Taken From Records	N.V.P No Visible Pipe
UTR Unable To Raise	N.V.V No Visible Valve
UTL Unable To Lift	E.D Empty Duct
UTM Unable To Measure	RWP Rain Water Pipe
UTTF Unable To Trace Further	BLKD Blocked
M.A.R Man Access Required	M.U.D Multiple Ducts
CL Cover Level	M.U.C Multiple Cables
IL Invert Level	CR Cable Rise
U:S Underside Soffit	AB Above Ground
	DC Drainage Channel

Letters correspond with CCTV report and indicate pipe references.

Disclaimer

Service details have been added to a previous survey unless otherwise stated. All services shown on this plan have been surveyed using approved detectors and the connections between manholes (if not traced) are assumed to be direct.

Should the background or topographical information for the survey area be based on an Ordnance Survey tile we are not liable for any loss that may arise due to a lack of accuracy in that digital data.

Location accuracy is determined by referring to manufacturer's guidelines for the equipment used. In ideal conditions the accuracies for the underground utilities located and mapped are +/-10% of the depth. Whilst this technique has proven to be successful, it is not 100% reliable and is affected by ground conditions. The depths obtained are for the centre of the conductor and do not necessarily the depth to a duct or pipe.

Although all reasonable effort is made during site detection, the completeness of the underground services information cannot be guaranteed. An electric current will flow along the path of least resistance. This means that when a current is induced into a feature it will 'jump' to adjacent features if they offer a better conducting pathway. It is possible, therefore, that features that are detected by connecting to one type of apparatus may not in fact be that type of utility. The identification of apparatus cannot be assumed to be totally accurate. It should be noted that the technique is limited to detecting features that either generate an electromagnetic field, such as power cables, or around which an electromagnetic field can be induced, such as some water pipes and some communications cables, and it cannot therefore be guaranteed to reveal the exact routes of all buried services or to detect their presence.

Service information can also be shown on the drawings taken from statutory undertakers record plans. This information is shown for the sake of completeness and Subscan UDS Ltd can take no responsibility for the positional accuracy of such information as this may be digitised directly from service plans provided. Information shown as stat plan information may duplicate traced routes but may be offset due to the inaccuracy of the service records from which the information has been digitised.

Notes:

1. Drawing to be read in conjunction with Subscan CCTV Survey report 19857, CCTV and all associated video footage.
2. Drainage information added by Subscan that was not previously displayed on the topographical survey has been drawn in indicative positions only.

Layout

A0:P1

Approximate Direction of North

NORTH

GRID / DATUM

Utility information overlaid onto previous topographical survey LS2024:T provided by Fairhurst.

REV	DATE	DRAWN	DESCRIPTION	CHECKED

SUBSCAN
www.subscan.com Tel: 0844 499 5220

CLIENT
Fairhurst

SITE
Former Homebase
Manor Road
Richmond, TW9 1YB

DRAWING TITLE
CCTV Drainage Investigation Survey

DRAWING REF (LAYOUT TAB)	SCALE: A0
19857 (A0:P1)	1:200
PROJECT REF	REV
19857	Ø

SURVEYED	JM:PW	DRAWN	AS
CHECKED	RJ	DATE	02.11.18

A.2 Geotechnical Reports

- Geo-Environmental and Geotechnical Preliminary Risk Assessment, Ref 126782-R1