Star Land Realty UK Limited c/o LS Estates Limited

Former Barnes Hospital (Plot A), South Worple Way, SW14 8SU

Geo-environmental and Geotechnical Site Assessment

1920884 R01 (04)

RSK GEOSCIENCES

OCTOBER 2022

RSK GENERAL NOTES

Project No.: 1920884 R01 (04)

Title: Geo-environmental and Geotechnical Site Assessment: Barnes Hospital, South Worple Way, SW14 8SU

Client: Star Land Realty UK Limited c/o LS Estate Limited, 1F/128, Cheapside, London, EC2V 6BT

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Rev 00	10-01-2020	Interim
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Rev 02	22-04-2020	RBG review
Rev 03	13-08-2021	Updated architectural plans (Scott Brownrigg)
Rev 04	26-10-2022	Updated architectural plans (Scott Brownrigg)

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EXECUTIVE SUMMARY

Commissioning and purpose of assessment	RSK Environment Limited (RSK) was commissioned by Star Land Realty UK Limited c/o LS Estates Limited ('Client') to carry out a geo-environmental and geotechnical site assessment of the land at Barnes Hospital (Plot A), off South Worple Way, in North Sheen, London. The overall aim of the project was to assess land contamination sources and geotechnical constraints to the current proposed development.
Site description	The Site is located to the west of Mortlake, to the south of the Richmond line on South Worple Way. It lies adjacent to Old Mortlake Burial Ground, which forms its western boundary. A number of hospital buildings occupy the immediate area to the east with South Worple Avenue beyond, and to the south the site is bounded by the gardens to the rear of residential properties along Grosvenor Avenue.
Proposed development	Based on the updated plans prepared by Scott Brownrigg (2022), the proposed development will comprise a residential apartment block measuring three to four storeys in height with a single storey basement level car park in the western portion. A three-storey residential apartment block with an under-croft arrangement as part of the ground floor level will be situated in the eastern portion.
SI scope	The following works were completed: • Drilling of deep cable percussive boreholes; • Drilling of drive-in sampler boreholes; • Associated in-situ testing and sampling; • Laboratory analysis of soil samples; • Interpretation of data to develop a refined conceptual site model; • Generic quantitative risk assessment (GQRA) to evaluate potentially complete contaminant; • Identification of remedial strategy; • Interpretation of geotechnical data to provide preliminary recommendations with respect to foundations and infrastructure design; and • Preliminary assessment of the potential waste classification.

SI factual findings	The exploratory holes sunk during the investigation revealed that the site is underlain by a variable thickness of made ground ranging between 0.50 and 2.0 m and comprised an initial surface layer of asphalt overlying a variable proportion of anthropogenic material in a granular matrix. Localised sandy clay with frequent inclusions of gravel sized brick fragments and brick cobbles was noted locally. Beneath this, Kempton Park Gravel was noted between 4.80 and 6.30 in thickness. The stratum consisted of slightly clayey gravelly fine to coarse sand/sandy gravel. The gravel fraction consisted of subangular to rounded fine to coarse quartzite. London Clay Formation was recorded at depth and comprised firm, becoming stiff with depth medium to high strength brown clay, over stiff to very stiff, high to very high strength, closely fissured dark grey/grey silty clay. Visual or olfactory evidence of contamination was limited to localised pockets of ash/bituminous rich materials in the made ground. No evidence of organic (i.e. free phase product)/inorganic contamination was identified in soils or groundwater. The findings of the monitoring data reflect a groundwater table in the underlying granular drift deposits at elevations between approximately 2.60 m AOD in the south and 3.08 m AOD in the west.
Refined conceptual site model and geo-environmental assessment	The investigation generally confirmed the predicted ground model. In view of the unsaturated zone beneath the drift deposits, the impermeable London Clay would attenuate any dissolve phase migration of contaminants into the deeper aquifer. However, the potential contamination linkage with respect to Controlled Waters may exist within the unconfined shallow aquifer (i.e. Kempton Park Gravel). With respect to ground gas, to generate large volumes of methane and carbon dioxide, a large mass of readily degradable organic content is required. The gas generated will depend on the volume of degradable material that is present in the soil. A review of the field records observed very little degradable material with low gas generating potential within the made ground. Furthermore, the presence of volatiles was not identified following the in-situ screening using a photo-ionisation detector(<1 ppm). However, in light of the credible sources (i.e. fuel storage tanks and adjacent cemetery) recorded within the CSM, potential risk may exist beneath the site. To provide an initial assessment, the chemical results recorded to date were conservatively assessed against adopted assessment criteria. The findings identified elevated concentrations of metals and polycyclic aromatic hydrocarbons within the made ground with the potential to pose an unacceptable risk to human health (via direct contact) and plants/vegetation. Leachate tests were carried out to assess mobile contaminants and conservatively compared with freshwater Environmental Quality Standards (EQS) due to the fact that the nearby Beverley Brook represents the most viable sensitive receptor with respect to groundwater contamination. Some exceedances were recorded (namely Lead and Zinc) however large proportion of the made ground may be removed to facilitate the construction of the proposed basement.

Geotechnical assessment	The ground conditions appear suitable for the adoption of conventional spread foundation for the proposed three storey development in the eastern portion of the site. Albeit, pile foundation/raft are deemed more suitable for the development in the western portion of the site. The excavation for the basement (assumed approximately 3 m with the anticipated FFL resting at ~3 m AOD) will take the formation level within the medium dense sandy gravel/gravelly sand and close to the groundwater levels. Subsequent new construction will be accompanied by a sequence of ground movements, including swelling heave on unloading, and longer term consolidation settlement on reloading. A detailed assessment of the potential ground movements will need to be undertaken once the foundation scheme has been finalised. For preliminary road pavement design, it is recommended a sub-grade soil CBR value of 5% used. This value assumes that during construction the formation level will be carefully compacted and any soft spots removed and replaced with well-compacted granular fill. Design Sulphate Class of DS-2, may be adopted. It has been assumed that groundwater conditions are mobile. From consideration of the characteristic pH value, an Aggressive Chemical Environment for Concrete classification of AC-2 may be assumed for design purposes.
Alleviation measures	The following recommendations are made for remediation of the site to address the risks identified: • Any fuel storage tanks present should be carefully emptied (If any residual fuel/oil be encountered) and removed off site in accordance with best industry practice. • A watching brief should be maintained during removal of the slab and subsequent excavation works; • Any impacted soils should be removed with the excavations determined from soils exhibiting visual /olfactory evidence of petroleum hydrocarbon contamination; • An allowance should be made to incorporate a minimum 450 mm clean cover (including 150 mm of topsoil) over a non-woven geotextile membrane through all areas of communal soft landscaping; • All underground services placed on the site should be laid within dedicated trenches. Clean granular fill shall be used as a bedding material for all services and as backfill material for all service trenches.
The information given in this summary is necessarily incomplete and is provided for initial briefing purposes only. The summary must not be used as a substitute for the full text of the report.	

1 INTRODUCTION

1.1 Commissioning

On the instructions of Robert Bird Group (RGB), acting on behalf of Star Land Realty UK Limited c/o LS Estates Limited ('Client'), RSK Environment Limited (RSK) has undertaken a geo-environmental and geotechnical site assessment of the land at Barnes Hospital (Plot A), off South Worple Way, in North Sheen, London.

The project was carried out to an agreed brief as set out in RSK's proposal (Ref. 1920884/T01/02, dated 9th October 2019.

This report is subject to the RSK service constraints given in **Appendix A** and limitations that may be described through this document.

1.2 Objectives

The objective of the work is:

- To supplement previous phases of investigation and address any data gaps/uncertainties raised, notably associated with the potential areas of concerns identified within the initial conceptual site model;
- To prove the geological sequence and obtain data for geotechnical and geo-environmental assessment; and
- To identify the need for any additional investigation or/and preliminary remediation works to render the site suitable for its proposed use.

1.3 Scope of works

The scope of this assessment has been developed by RGB and RSK, in general accordance with relevant British Standards and authoritative technical guidance as referenced through the report. The assessment of the contamination status of the site is in line with the technical approach presented in CLR 11 Model Procedures for the Management of Land Contamination (Environment Agency, 2004) and in general accordance with BS 10175: 2011 + A2 2017 (BSI, 2017).

In addition to the above, the investigation has been designed in line with the recommendations of BS5930: 2015 Code of practice for ground investigations (BSi, 2016).

The initial scope of works for the assessment comprised the following:

- Drilling of three (3No.) cable percussive boreholes up to maximum depth of 30 m;
- Drilling of eleven (11No.) drive-in sampler boreholes up to a maximum depth of 4 m;
- Associated in-situ testing and sampling;
- Laboratory analysis of soil samples;
- Interpretation of data to develop a refined conceptual site model (CSM);

- Generic quantitative risk assessment (GQRA) to evaluate potentially complete contaminant linkages identified in the refined CSM;
- Identification of the need for further action, e.g. supplementary intrusive investigations /monitoring, remediation works or other mitigation, if any;
- Interpretation of ground conditions and geotechnical data to provide preliminary recommendations with respect to foundations and infrastructure design;
- Preliminary assessment of the potential waste classification (hazardous/non-hazardous) implications of soil arisings; and
- Preparation of this factual and interpretative report with recommendations for further works (i.e. undertake a remedial options appraisal to identify appropriate mitigation measures) and/or remediation as necessary.

1.4 Existing reports

The site has been the subject of former phases of investigation, namely:

- Ove Arup and Partners Limited (Arup), Desktop Study, 247776-00, October 2018;
- RSK, Geo-environmental Site Assessment, 1920514-R01(00), March 2019; and
- 1rst Line Defence, Detailed UXO Risk Assessment, DA8245a-00, October 2019.

RSK have relied fully upon the contents of the existing documents for the purposes of the intrusive ground investigation detailed herein. Copies of the above reports are saved under **Appendix C** and salient information is summarised in the relevant section (**Section 3**).

1.5 Limitations

The comments given in this report and the opinions expressed are based on the ground conditions encountered during the site work and on the results of tests made in the field and in the laboratory. However, there may be conditions pertaining to the site that have not been disclosed by the investigation and therefore could not be taken into account. In particular, it should be noted that there may be areas of made ground not detected due to the limited nature of the investigation or the thickness and quality of made ground across the site may be variable. In addition, groundwater levels and ground gas concentrations and flows may vary from those reported due to seasonal, or other, effects and the limitations stated in the data should be recognised.

The initial CSM is based on third party data, and whilst RSK have undertaken a critical review of the information we cannot be held liable for the quality of the data provided and cannot offer any guarantees or warranties for the completeness or accuracy of information relied upon.

Asbestos is often present in soils in discrete areas. Whilst asbestos-containing materials was not encountered during the fieldworks or supporting laboratory analysis, the history of the site indicates that asbestos may be present in soils and could be encountered during more extensive ground works.

Preliminary geotechnical recommendations are presented and these should be verified in a Geotechnical Design Report once proposed construction and structural design proposals are confirmed.

The Remediation Method Statement (RMS) contains details of the procedures to be adopted for inspection and validation of the works. However, it should be noted that responsibility for the correct implementation of the strategy lies with the Principal Contractor. **RSK cannot be held responsible for any remedial works that are carried out without the agreed procedures involving either direct supervision by RSK, or inspection and verification of the works by a representative from RSK, or if suspect materials are not notified to RSK**.

2 SITE DETAILS

2.1 Site location

Site location details are presented in **Table 1** and a site location plan is provided on **Figure 1**.

Table 1 Site location details

Site name	Barnes Hospital
Full site address and postcode	Barnes Hospital, South Worple Way, SW14 8SU
National Grid reference (centre of site)	E521203, N175677

2.2 Surrounding land uses

The Site is situated south of the River Thames in a residential area between Richmond Park and Barnes Common.

The Site is located to the west of Mortlake, to the south of the Richmond line on South Worple Way. It lies adjacent to Old Mortlake Burial Ground, which forms its western boundary. A number of hospital buildings occupy the immediate area to the east with South Worple Avenue beyond, and to the south the site is bounded by the gardens to the rear of residential properties along Grosvenor Avenue.

An extract of the 1:50,000 Ordnance Survey map showing the location of the site is included in **Figure 1**.

2.3 Site description

The Site, measuring an approximate area of 0.8 Ha, is set within the western portion of the Barnes Hospital grounds and accommodates a number of redundant buildings, which historically provided mental health facilities including an administration building, a laundry and a generator house. The remainder of the Site is occupied by hardstanding providing car parking and associated soft landscaping. Mature trees of varying height and species are noted along the southern and western boundaries. The site is relatively flat with a gentle slope from 5.8 m AOD in the southwest to 6.5 m AOD in the east.

A site layout plan is presented as **Figure 2**.

2.4 Development plans

Based on the recent plans provided by Avison Young (October 2022), the proposed development will comprise the following:

- Western portion: two residential apartment blocks measuring three to four storeys in height with a single storey interconnecting basement level car park;

- Eastern portion: three-storey residential apartment block with an under-croft arrangement as part of the ground floor level.

Current plans and sections drawings, prepared by Scott Brownrigg, are shown in **Appendix B**.

3 SUMMARY OF PRECEDING REPORTS

3.1 Arup, Phase 1 Ground Contamination Desk Study

The initial desk based review was prepared in October 2018 aimed at identifying the potential geo-environmental liabilities beneath the site and the surrounding area. The findings concluded the possibility that some shallow made ground may exist on site associated with the historic and current development. In addition, the site has been used for hospital activities for more than 50 years and some releases of contamination may have occurred during that time. The most significant potential sources of contamination was considered attributable to the former/current site operations (i.e. storage fuel oils, spills/leaks associated with the electricity sub-station, laundry, plant rooms and handling of medical waste). However, the study alluded no direct evidence of ground contamination, which in its current form of development, is very unlikely to be acting as a source of potentially on-going contamination. A number of potential off-site sources of contamination were identified (including a garage, railway track and bus station). However, none were considered to pose a direct risk to the site.

3.2 RSK, Geo-environmental Site Assessment

The desk based assessment was supplemented with an intrusive ground investigation in March 2019 to assess the potential linkages beneath the western portion of the hospital grounds (referred to as 'Plot A'). This comprised a series of shallow boreholes with associated monitoring and laboratory analysis. The report confirmed the ground conditions to comprise a variable thickness of made ground over the superficial deposits of Kempton Park Gravel. No olfactory/visual evidence of contamination was recorded and no groundwater was noted during the course of the investigation. The results from chemical analysis identified elevated concentrations of Lead (Pb) and Polycyclic Aromatic Hydrocarbon (PAH) compounds locally within the made ground. However, it was considered that any potential risk will most likely be mitigated through encapsulation or excavation as part of the enabling works.

Given the nature of the investigation completed and spatial extent of the sampling locations, data gaps and uncertainties remain, notably associated with the potential areas of concern identified within the CSM prepared by Arup. A supplementary intrusive investigation was designed by RSK and submitted to the Local Authority for approval. The purpose of the supplementary investigations was to provide sufficient additional information to enable risks to be further assessed in relation to the proposed residential development.

3.3 1st Line Defence, Detailed UXO Risk Assessment

This Report has been produced in compliance with the Construction Industry Research and Information Association (CIRIA) C681 guidelines for a detailed assessment. In summary, the site was unaffected by bombing incidents with no evidence of damage.

4 SITE INVESTIGATION STRATEGY & METHODOLOGY

4.1 Introduction

RSK carried out intrusive investigation works between 9th and 20th December 2019 and subsequent monitoring of boreholes thereafter to further investigate the potential pollutant linkages outlined in the conceptual site model (CSM). Please note the monitoring is ongoing.

4.2 Objectives

The specific objectives of the investigation were as follows:

- To establish the ground conditions underlying the site including the extent and thickness of any made ground;
- To investigate specific potential sources of contamination identified in initial CSM;
- To determine groundwater depth;
- To determine the ground gas regime underlying the site;
- To assess geotechnical properties of soils for foundation design and concrete specification; and
- To determine preliminary waste implications.

4.3 Selection of investigation methods

The techniques adopted for the investigation were chosen with consideration of the objectives and site constraints, which are described below.

Cable percussion drilling was chosen based on the targeted drill depth, requirement for in-situ geotechnical data, the opportunity to collect both disturbed and undisturbed samples and install monitoring wells. This was supplemented by shallow dynamic sampling to obtain a greater coverage of the site and to install gas monitoring wells.

Prior to conducting intrusive works, utility service plans were obtained, and buried service clearance undertaken in line with RSK's health and safety procedures. Copies of statutory service records obtained by RSK as part of the agreed scope of works are contained in **Appendix E**.

4.4 Investigation strategy

The client presented RSK with a specification prepared by RGB (ref.4427, dated August 2019) at tender stage, which was amended during the course of the investigation.

The locations of the proposed exploratory holes and techniques adopted for the investigation were detailed within the specification and chosen with consideration of the objectives discussed above.

The deep borehole was advanced using a cable percussive technique due to time constraints and requirement for in-situ geotechnical data, the opportunity to collect both disturbed and undisturbed samples and install monitoring wells. This was supplemented by a series of shallow boreholes to obtain a higher number of investigation locations, achieve a greater understanding of the contamination status of the shallow Made Ground.

All exploratory hole positions are presented on **Figure 2**.

4.5 Investigation strategy

The ground investigation was carried out using intrusive ground investigation techniques in general accordance with the recommendations of BS5930: 2015 Code of practice for ground investigations. Whilst every attempt was made to record full details of the strata encountered in the boreholes, techniques of hole formation and sampling will inevitably lead to disturbance, mixing or loss of material in some soils and rocks.

The investigation strategy involved predominately targeted boreholes located by the RGB/RSK across the site area. Boreholes located within close vicinity of potential sources of contamination (as detailed within the CSM) were selected for additional chemical analysis of relevant potential determinants.

The constraints to the investigation were as follows:

- Live, underground services present across the site area and adjacent to existing buildings dictating the locations of some exploratory hole locations;
- Palisade fencing around the existing building restricting access to some areas, however in most cases these where removed; and
- Existing buildings present across 70% of the sites surface area, including an electrical substation to present to the south.

Details of the investigation locations, installations and rationale are presented in **Table 2**.

Table 2 Summary of activities and rationale

Investigation type	No.	Designation	Rationale
Deep Boreholes by cable percussive methods	4No	BH01 to BH04	To prove the geological succession beneath the site and obtain geotechnical data for foundation design. Also, to install groundwater wells within the Kempton Park Gravel.
Shallow Boreholes by windowless sampling methods	7No.	WS201, WS203, WS205, WS207, WS208, WS209 and WS211	To prove the geological succession and targeted assessment in the vicinity of the following areas of potential concern: • Laundry house, • Generator house and diesel tank (13,600 litre); • Plant room; • Electricity sub-station; and

Investigation type	No.	Designation	Rationale
			• Work shop and potential chemical storage area.
	4No.	WS202, WS204, WS206 and WS210	To assess the upper strata in non-targeted locations for the purpose of site coverage.
Standard Penetration Tests (SPT)	64No.	WS201 to WS211, BH01 to BH04	To determine the in-situ strength of the underlying soils at regular intervals (in accordance with part 9 of BS 1377:1990 (BSI, 1990)).
Vane shear tests	5No.	WS201, WS204, WS205 and WS208.	To determine the undrained shear strength of the underlying clays without disturbance.
Falling head tests	2No.	BH01 and BH03	To assess the infiltration characteristics of the underlying granular drift deposits.
Clegg hammer impact tests	3No.	CBR1 to CBR3	To determine the strength of the sub-grade material.
PID screening	n/a	WS201 to WS202	Detection of volatile organic compounds (headspace screening with a photo-ionisation detector fitted with a 10.2 eV bulb).
Groundwater monitoring	3No. visits	BH01 to BH05	Measurement of groundwater levels within the Kempton Park Gravel.
Ground gas monitoring		WS201, WS202, WS204, WS207, WS210 and WS211	Measurement of ground gas to asses possible on-site sources and zones of permeable geology.

4.5.1 Implementation of investigation works

The exploratory holes were logged by an engineer in general accordance with the recommendations of BS 5930:2015.

The monitoring well construction and associated response zones are detailed on the exploratory hole records in **Appendix G**.

The soil sampling and analysis strategy was designed to characterise each encountered soil strata, permit an assessment of the potential contaminant linkages identified and investigate the geotechnical characteristics. In addition, samples were taken to allow for geo-environmental and geotechnical testing to be undertaken.

Soils collected for laboratory analysis were placed in a variety of containers appropriate to the anticipated testing suite required. They were dispatched to the laboratory in cool boxes under chain of custody documentation. Samples were stored in accordance with the RSK quality procedures to maintain sample integrity and preservation and to minimise the chance of cross contamination.

4.6 Monitoring programme

4.6.1 Ground gas monitoring

Three monitoring rounds have been undertaken to provide data to support refining of the CSM.

An infrared gas meter was used to measure gas flow, concentrations of carbon dioxide (CO_2), methane (CH_4) and oxygen (O_2) in percentage by volume, while hydrogen sulphide (H_2S) and carbon monoxide (CO) were recorded in parts per million.

Initial and steady state concentrations were recorded. In addition, during the first monitoring round, all wells were screened with a PID to establish if there are any interferences and cross-sensitivity of other hydrocarbons with the infrared gas meter.

The atmospheric pressure before and during monitoring, together with the weather conditions, were recorded. The monitoring included periods of rising atmospheric pressures and after rainfall. Due to time restraints on the reporting deadline, a monitoring period of low atmospheric pressure was not achieved.

All ground gas monitoring results together with the temporal conditions are contained within **Appendix G**. Equipment calibration certificates are available on request.

4.6.2 Groundwater monitoring

Alongside the ground gas monitoring, groundwater depth was recorded. The monitoring records, including dates, are shown in **Appendix G**.

4.6.3 Chemical analysis of soil samples

The soil sampling strategy was designed to characterise made ground and natural strata typically within the upper 1.0 m of the ground profile whilst also characterising deeper strata and the potential for contaminant migration from relevant sources of identified within the preliminary CSM.

The programme of chemical tests undertaken on soil samples obtained from the intrusive investigation is presented in **Table 3**

Table 3 Summary of chemical testing of soil samples

Stratum	Tests undertaken	No. of tests
Made ground	Asbestos screening and ID	12
	Heavy metals	10
	PCBs	1
	Leachable metals (9No) to BS EN 12457-1(2:1)	3
	Speciated Polycyclic Aromatic Hydrocarbons (PAH)	10
	Speciated Total Petroleum Hydrocarbons (TPH CWG)	10
	Volatile organic compound	5
	Total organic carbon (TOC)	6

Stratum	Tests undertaken	No. of tests
Kempton Park Gravel	Heavy metals	2
	Speciated Polycyclic Aromatic Hydrocarbons (PAH)	2
	Speciated Total Petroleum Hydrocarbons (TPH CWG)	2
	Total Organic Carbon	3

4.6.4 Geotechnical analysis of soils

Where appropriate disturbed, bulk and undisturbed soil samples were taken for geotechnical classification testing with the depth and nature of samples detailed within the exploratory hole records.

Where appropriate, testing was undertaken in accordance with BS 1377:1990 Method of Tests for Soils for Civil Engineering Purposes or, where superseded, by the relevant part of BS EN ISO 17892:2014 Geotechnical investigation and testing - Laboratory Testing of Soil. Tests carried out in order to classify the concrete class required on-site have been undertaken following the procedures within BRE SD1:2005.

The programme of geotechnical tests undertaken on samples obtained from the intrusive investigation is presented in **Table 4**.

Table 4 Summary of geotechnical testing undertaken

Strata	Tests undertaken	No. of tests
	Sieve analysis	12
	BRE Non pyritic geology suite	7
London Clay Formation	Moisture content %	25
	Liquid/plastic limits	25
	Unconsolidated undrained triaxial	11
	BRE pyritic geology suite	11
	Sedimentation/sieve analysis	4
	BRE pyritic geology suite	1
Made Ground	BRE pyritic geology suite	3

5 SITE INVESTIGATION FACTUAL FINDINGS

The results of the intrusive investigation undertaken are detailed below. The descriptions of the strata encountered, notes regarding visual or olfactory evidence of contamination, list of samples taken, field observations of soil and groundwater, in-situ testing and details of monitoring well installations are included on the exploratory hole records presented in **Appendix G**.

5.1 Ground conditions encountered

The exploratory holes sunk during the investigation revealed that the site is underlain by a variable thickness of made ground over the Kempton Park Gravel with the London Clay Formation encountered at depth. This appears to confirm the stratigraphical succession described within the initial conceptual model prepared by Ove Arup and Partners (Ref. 247776-00, October 2018).

For the purpose of discussion, the ground conditions are summarised in **Table 5** and the strata discussed in subsequent subsections.

Table 5 General succession of strata encountered

Stratum	Exploratory holes encountered	Depth to top of stratum m bgl	Proven thickness (m)
Made ground (i.e. fill material)	WS201 to WS211 and BH1 to BH4	0.00 (GL)	0.50 to 2.00
Kempton Park Gravel	WS1 to WS11	0.50 to 1.20	Proven to the full depth of the investigation (4.45 m)
	BH1 to BH4	1.00 to 2.00	4.8 m to 6.30
London Clay Formation	BH1 to BH4	6.80 to 7.90	Proven to the full depth of the investigation (30 m bgl)

5.1.1 Made ground

The exploratory holes encountered a variable thickness of made ground ranging between 0.50 m and 2.0 m bgl. The Made Ground was heterogeneous in nature and reference should be made to the individual records. In general, it comprised an initial surface layer of asphalt overlying a variable proportion of anthropogenic material in a granular matrix. Localised sandy clay with frequent inclusions of gravel sized brick fragments and brick cobbles was noted in BH03.

On-site PID screening of disturbed samples indicated concentrations of volatile organic compounds (VOC) <1 ppm, indicating the absence of significant VOC within the samples.

5.1.2 Kempton Park Gravel

Soils recovered as the Kempton Park Gravel were encountered beneath the made ground, predominantly characterised by slightly clayey gravelly fine to coarse sand/sandy gravel. The gravel fraction consisted of subangular to rounded fine to coarse quartzite. Cohesive portion was recorded locally above the granular horizon in the north-western/northern portion of the site (WS1, WS2, WS201, WS204, WS205 and WS208), which typically comprised firm to stiff gravelly sandy clay with occasional silt lenses.

On-site PID screening of disturbed samples indicated concentrations of volatile organic compounds (VOC) <1 ppm, indicating the absence of significant VOC within the samples.

A summary of the in-situ and laboratory test results recorded in the stratum are presented in **Table 6** and **Table 7**

Table 6 Summary of in-situ and laboratory test results for cohesive unit

Soil parameters	Min. Value	Max. Value	Reference
Moisture content (%)	14		**Appendix I**
Modified moisture content (%)	16		-
Liquid limit (%)	43		**Appendix I**
Plasticity limit (%)	21		**Appendix I**
Plasticity index (%)	22		-
Modified plasticity index (%)	19.8		-
Plasticity term	Intermediate		-
Volume change potential	Low		-
SPT 'N' values	9	22[1)]	**Appendix G**
SPT 'N60' values (E_r 58%)	9	21	
Undrained shear strength inferred from SPT 'N' values (kN/m^2) based on a stroud factor of 5	45	110	-
Undrained shear strength measured by shear vane testing (kN/m^2)	42	75	**Appendix G**
Consistency term from field description	Firm to Stiff		**Appendix G**
Strength term (based on the undrained shear strength)	Medium to High		-

[1)] High readings considered attributable to gravel content

Table 7 Summary of in-situ and laboratory test results for granular unit

Soil parameters	Min. Value	Max. Value	Reference
SPT 'N' values	18	>50	**Appendix G**
SPT 'N60' values (E_r 68%)	20	>50	
SPT 'N60' values (E_r 67%)	36	49	

Soil parameters		Min. Value	Max. Value	Reference
Density term		Medium to Very Dense		**Appendix G**
Grading (%)	Silt/clay	1	4	**Appendix I**
	Sand	15	63	**Appendix I**
	Gravel	36	84	**Appendix I**
Uniformity coefficient (Cu)		5.2	57	**Appendix I**
Coefficient of curvature (Cc)		0.13	5	**Appendix I**

5.1.3 London Clay Formation

The London Clay Formation was encountered beneath the Kempton Park Gravel and proven to a maximum depth of 30 m. The London Clay Formation typically comprised an upper weathered portion, of initially firm, becoming stiff with depth medium to high strength brown clay, over stiff to very stiff, high to very high strength, closely fissured dark grey/grey silty clay.

A summary of the in-situ and laboratory test results recorded in the stratum are presented in **Table 8**.

Table 8 Summary of in-situ and laboratory test results for London Clay Formation

Soil parameters	Min. Value	Max. Value	Reference
Moisture content (%)	23	37	**Appendix I**
Modified moisture content (%)	23	38	**Appendix I**
Liquid limit (%)	68	80	**Appendix I**
Plasticity limit (%)	27	38	**Appendix I**
Plasticity index (%)	35	48	**Appendix I**
Modified plasticity index (%)	30.6	48	**Appendix I**
Plasticity term	High to Very High		-
Volume change potential	Medium to High		-
SPT 'N' values	19	>50	**Appendix G**
SPT 'N60' values (E_r 68%)	26	>50	-
SPT 'N60' values (E_r 67%)	21	21	
Undrained shear strength inferred from SPT 'N' values (kN/m^2)* based on a stroud factor of 4.2	79.8	>210	-
Undrained shear strength measured by triaxial testing (kN/m^2)	69	204	**Appendix I**
Consistency term from field description	Firm to very stiff		**Appendix G**
Strength term (inferred from Triaxial testing)	Medium to very high		-

5.1.4 Visual/olfactory evidence of soil contamination

Visual or olfactory evidence of contamination was limited to localised pockets of ash/bituminous rich materials in the made ground. No evidence of organic (i.e. free phase product)/inorganic contamination was identified in soils or groundwater.

5.2 Groundwater

5.2.1 Groundwater encountered during intrusive works

Groundwater strikes were encountered during the intrusive investigation works as detailed on the individual cable percussive field records in **Appendix G**. Resting groundwater levels within the Kempton Park Gravel recorded between 3.90 m (1.99 m AOD) and 4.90 m (1.31 m AOD). A further strike was noted within the claystone band locally within the London Clay Formation resting at 7.5 m (-1.605 m AOD).

5.2.2 Groundwater encountered during monitoring

Field data measurements are shown in **Appendix G** and summarised in **Table 9**.

Table 9 Groundwater results during investigation

WS Location	Response zone	Elevation (m AOD)	Groundwater monitoring m (m AOD)		
			19.12.19	06.01.20	20.01.20
BH1	Kempton Park Gravel	6.28	3.67 (2.61)	3.60 (2.68)	3.58 (2.70)
BH2	Kempton Park Gravel	6.20	3.18 (3.02)	3.12 (3.08)	3.10 (3.10)
BH3	Kempton Park Gravel	5.89	3.29 (2.60)	3.21 (2.68)	3.20 (2.69)
BH4	Kempton Park Gravel	6.34	3.51 (2.83)	3.50 (2.83)	3.48 (2.85)

The findings reflect a groundwater table in the underlying granular drift deposits at elevations between approximately 2.60 m AOD in the south and 3.08 m AOD in the west. The data from the initial monitoring visits has been used to construct a piezometric contour plans and these are presented in **Figure 3**. The data indicate groundwater flow in a westerly direction.

It should be noted that groundwater levels might fluctuate for a number of reasons including seasonal variations. On-going monitoring would be required to establish both the full range of conditions and any trends in groundwater levels.

5.2.3 Visual/olfactory evidence of groundwater contamination

No visual/olfactory evidence of contamination in groundwater during well development, monitoring was recorded.

5.3 Chemical laboratory results

The soil results are presented in **Appendix H** and discussed in the relevant subsection.

5.4 Geotechnical laboratory results

The results of the geotechnical testing are presented in **Appendix I**.

5.5 Ground gas monitoring

The results of the ground gas monitoring to date, are presented in **Appendix G** and discussed in **Section 5**.

5.6 Limitations

The following data gaps have been identified during the course of the investigation:

- The cable percussive borehole (BH03) was terminated at 12.5 m due to the density of the ground conditions and groundwater ingress. An additional borehole (ref. BH4) was advanced to a maximum depth 8 m in the western portion of the site upon request of RGB; and
- Shallow refusals were recorded within drive-in sampler boreholes due to the density of the Kempton Park Gravel.

6 GEO-ENVIRONMENTAL ASSESSMENT

6.1 Refinement of initial CSM

The investigation generally confirmed the predicted ground model, which was anticipated to comprise a variable thickness of made ground overlying superficial deposits (Kempton Park Gravel) with the London Clay Formation at depth. Groundwater was recorded within the superficial deposits (3.10 m and 3.67 m bgl) with localised perched water within the London Clay Formation. No visual/olfactory evidence of significant contamination was observed, with the exception of bituminous material noted locally within the made ground.

Given the considerable thickness of unsaturated zone beneath the drift deposits, the impermeable London Clay would attenuate any dissolve phase migration of contaminants into the deeper aquifer. However, the potential contamination linkage with respect to Controlled Waters may exist within the unconfined shallow aquifer (i.e. Kempton Park Gravel).

With respect to ground gas, to generate large volumes of methane and carbon dioxide, a large mass of readily degradable organic content is required. The gas generated will depend on the volume of degradable material that is present in the soil. A review of the field records observed very little degradable material with low gas generating potential within the made ground. Furthermore, the presence of volatiles was not identified following the in-situ screening using a photo-ionisation detector(<1 ppm). However, in light of the credible sources (i.e. fuel storage tanks and adjacent cemetery) recorded within the CSM, potential risk may exist beneath the site.

6.1.1 Linkages omitted on consideration of the initial CSM

Migration of dissolve phase contaminants to wider secondary aquifer body and surface water course has not been considered, due to the following;

- The site is not located in a sensitive area with respect to controlled waters. The nearest surface water body is situated 230 m south east (Beverley Brook) flowing in a north-easterly direction (i.e. towards River Thames);
- The piezometric surface plan shows that groundwater flow is to the west and therefore it is unlikely that groundwater will provide base flow to the brook;
- No visual/olfactory evidence of contaminants (e.g. NAPLs) within the groundwater; and
- No records of surface water abstraction licences within 2000 m of the site.

The potential pollutant linkages that require further assessment and/or remediation are shown in the subsection below.

6.2 Linkages for assessment

As described in LCRM (Environment Agency, 2021), there are two stages of quantitative risk assessment (QRA), Tier 2 generic (GQRA) and Tier 3 detailed (DQRA). The GQRA comprises the comparison of soil, groundwater, soil gas and / or ground gas results with

generic assessment criteria (GAC) that are appropriate to the linkage being assessed. This comparison can be undertaken directly against the laboratory results or following statistical analysis depending upon the sampling procedure that was adopted. This assessment relates to LCRM Stage 1, Tier 2 generic quantitative risk assessment

Following the refinement of the CSM, the potentially complete contaminant linkages that require further assessment and the methodology of assessment are presented in **Table 10**.

Table 10 Linkages for GQRA

Potentially relevant contaminant linkage	Assessment method
Human Health	
1. Oral and dermal exposure with impacted soil by future residents ***(Linkage 1)***	Based on the recent information obtained from Avison Young, the proposal comprise a residential-led apartment block (measuring three-four storeys) with a single storey basement in the west and associated podium/communal gardens. To provide an initial assessment of the potential human health risk, the chemical results (together with the previous data collected in March 2019) have been conservatively assessed against the human health GACs (presented in **Appendix J**) under residential scenario (without home grown).
2. Inhalation exposure of future residents to asbestos fibres ***(Linkage 2)***	Due to uncertainty regarding risk (in particular appropriate toxicological criterion and soil to air relationships), no acceptable concentration of asbestos in soil exists. However, the potential for fibre release is likely to reflect the concentrations in soil, the soil type and surface cover, disturbance, the form and type of asbestos and the soil moisture content (CIRIA, C733, 2014). Qualitative assessment based on the asbestos minerals present, their form, concentration, location and the nature of the proposed development. A total of 12 samples of the near surface soil material (made ground) were screened in the laboratory for the presence of asbestos materials.
3. Inhalation exposure to soil vapours from contaminated soil ***(Linkage 3)***	In the absence of indoor inhalation data (mg/m3), the potential for volatile organic compounds in the ground (soil) has been conservatively assessed using soil chemical results against GACs (**Appendix J**) including an empirical approach to provide multiple lines of evidence to increase confidence of the assessment.
4. Exposure, explosion and asphyxiation of future residents/ground workers to carbon dioxide and methane. ***(Linkage 4)***	Gas screening values (GSV) have been calculated using maximum methane and carbon dioxide concentrations with maximum flow rates recorded at the site. The GSV have been compared with the revised Wilson and Card classification presented in BS8485.

Potentially relevant contaminant linkage	Assessment method
Vegetation	
5. Uptake of contaminants by vegetation potentially impacting plant growth (phytotoxicity) ***(Linkage 5)***	In the absence of other published GAC, the GAC have been obtained from legislation (UK and European) and guidance related to the use of sewage sludge on agricultural fields. Comparison of soil data was undertaken in accordance with Soil Code (1998) (**Appendix K**).
Potable Pipe	
6. Contaminants permeating potable water supply pipes. ***(Linkage 6)***	Comparison of chemical results against published data in general accordance with UKWIR (2010) guidance, 10/WM/03/21 (**Appendix L**). This technical guidance was introduced by UK water Industry Research to safeguard water quality by identifying suitable pipe materials to be used in potential contaminated ground.
Controlled Water (Secondary A Aquifer)	
7. Leaching of mobile contaminants potentially impacting the underlying confined aquifer (Kempton Park Gravel). ***(Linkage 7)***	Leachate analysis is not suitable for organics therefore the potential for leaching has been considered qualitatively using soil results. Comparison of leachate data against the target concentrations prescribed within **Appendix M**.

6.3 Methodology and assessment of results

The assessment has not taken into consideration the health and safety of construction workers. Risks may still be present to construction workers especially where works include the entry into excavations within the ground. Construction workers should undertake appropriate risk assessments and risks should be managed through health and safety procedures and safe systems of work.

6.3.1 Oral, dermal and inhalation exposure with impacted soil by future occupants/site users

In order to assess the soil results against the appropriate GAC, the soil results have been split into appropriate data. The datasets being considered in the assessment are:

- Data set 1 Made Ground; and
- Data set 2 Kempton Park Gravel.

As an initial assessment, all soil results in each dataset have been directly compared against the GAC for residential with home-grown produce end use.

6.3.1.1 Data set 1 – Made Ground

All made ground results have been compared with the aforementioned GAC. A soil organic matter (SOM) of 2.5% has been selected since laboratory results for total organic carbon (TOC) within the made ground range from 1.2% and 10.2%.

Assessment of the results indicates exceedances of the GAC for the contaminants shown in **Table 11**

Table 11 Data summary table – Data set 1 (Made Ground)

Determinand	No. of samples tested	GAC (mg/kg)	No of exceedances	Maximum concentration (mg/kg)	
				Value	Location / depth (m bgl)
Inorganic (Metals)					
Lead	16	200	7	380	WS1 @ 0.2[1)]
Arsenic	16	37	1	52	WS201 @ 1.00[2)]
Semi Volatile Organic Compounds (Poly-cyclic Aromatic Hydrocarbons)					
Benzo(a)anthracene	16	11	1	27.2	WS208 @ 0.2[2)]
Benzo(a)pyrene	16	5	1	18.5	WS208 @ 0.2[2)]
Benzo(b)fluoranthene	16	3.3	3	20.1	WS208 @ 0.2[2)]
Chrysene	16	22	1	29.2	WS208 @ 0.2[2)]
Dibenzo(ah)anthracene	16	0.28	3	0.62	WS2 @0.4[1)]
Total Petroleum Hydrocarbons (Aromatic Hydrocarbons)					
Aromatic >C16-C21	16	540	1	626	WS208 @ 0.20[2)]
Aromatic >C21-C35	16	1500	1	1640	WS208 @ 0.20[2)]

[1)] RSK Geo-environmental Site Assessment March 2019

[2)] RSK Supplementary Geo-environmental Site Assessment January 2020

In addition to the simple comparison of data to the adopted screening values, the CIEH document 'Guidance on Comparing Soil Contamination Data with a Critical Concentration', dated May 2008 recommends a statistical review should be conducted to demonstrate the site's 'suitability for use' with a defined level of confidence. Given the targeted nature of the investigation and the heterogenous nature of the made ground, it is not considered appropriate to conduct a statistical assessment.

On the basis of the above assessment it is considered that there are potentially significant risks associated with the soil contamination. However, there is no risk to human health via the inhalation pathway since Lead is not volatile, therefore the elevated concentrations of this determinant do not pose a risk to human health if encapsulated beneath hardstanding. With respect to the aromatic hydrocarbons, these compounds are generally associated with the higher chain hydrocarbon range and have a very low volatility. Thus, the vapour pathway is also not relevant and, similarly, not considered cause for concern if encapsulated beneath the hardstanding. Where areas of soft landscaping are proposed, further testing will be required to confirm the absence of contamination within the made ground soils. Alternatively, consideration will need to be given to incorporation of a clean capping layer to break the potential pollutant pathway.

6.3.1.2 Data set 2 – Kempton Park Gravel

All results have been compared with the aforementioned GAC. A soil organic matter (SOM) of 1% has been selected since laboratory results for total organic carbon (TOC) within the drift deposits ranged between 0.2% and 1.20%. Assessment of the results indicates that there were no exceedances of the GAC for the analytes tested.

6.3.2 Inhalation exposure of future occupants/site users to asbestos fibres

The visual inspection at the laboratory identified no materials suspected of potentially containing asbestos and the scheduled laboratory screening for asbestos found no detectable asbestos fibres within the samples of made ground.

6.3.3 Inhalation exposure to soil vapours

The following lines of evidence have been assessed in respect to the risk from VOC's:

- Chemical testing of soils largely detected concentrations of VOC below laboratory limits of detection (LOD);
- Detectable concentrations of Trimethylbenzene was recorded within WS205 (0.80 m), however, concentrations were below adopted assessment criteria value;
- Mercury and BTEX were recorded below laboratory of detection (LOD);
- No visual/olfactory evidence of volatiles (e.g. free phase product) recorded within soil and groundwater;
- The ground investigation indicated that the underlying residual made ground largely consists of inert material i.e. bituminous material, plastic, glass, clinker, flint, brick and concrete;
- Low emission rates have been recorded during the gas monitoring (<0.1 l/hr); and
- Negligible concentrations of methane and very low levels of carbon dioxide was recorded on three monitoring events.

Based on the above lines of evidence it is considered that the risk to future site users from VOC's is low.

6.3.4 Inhalation exposure, asphyxiation and explosion from ground gases

6.3.4.1 Conceptual site model

In summary, potential sources of ground gas have been identified in the initial desk study (Arup) and principally comprised made ground and the adjacent cemetery. Although, the sources of ground gas are considered to have a very low to negligible generation potential and therefore pose a very low risk to the site.

Gas primarily migrates via either pressure driven (advective) flow or via diffusive flow. In general, the predominant mechanism for migration of gases from aged landfill waste is diffusive, with no driving pressure. This is supported by the consistently negligible flow rates recorded during gas monitoring. Certain proportion of gases may remain dissolved

in groundwater, however the piezometric surface plan shows that groundwater is flowing in a westerly direction.

The anticipated development proposals will inherently introduce receptors to the site. These typically comprise future residents. Although, the main areas of risk are limited to restricted access/confined spaces. Given the proposed development, it is anticipated that a ventilated basement substructure (confirming to water proofing standards) will inherently provide suitable mitigation measures to address any potential risk.

6.3.4.2 *Assessment of data*

The risks to development from ground gases have been assessed in accordance with BS8485:2015+A1 2019, which provides guidance on ground gas (methane and carbon dioxide) characterisation and hazard assessment, as well as a framework for the prescription of protection measures within new buildings.

The process involves characterising the gas hazard from combining the qualitative assessment of risk (using the conceptual site model) with ground investigation data so that a 'characteristic situation' (CS) can be derived for the site. Characteristic situations range from CS1 to CS6, the higher the CS the higher the hazard potential. Protection measures within new buildings can be prescribed using a point scoring system, taking into consideration the CS and the proposed building type.

6.3.4.2.1 *Empirical approach for assessing low degradable content*

With respect to the low degradable organic content within the made ground as a potential source, an alternative framework can be used to characterise the ground gas regime. A significant amount of research into the relationship between the gas generation potential of soil material and the associated Total Organic Content (TOC) have been undertaken. This research has been published by CLAIRE, Reference Research Bulletin (RB) 17, November 2012 entitled 'A Pragmatic Approach to Ground Gas Risk Assessment' and recognised in BS8485:2015+A1 2019.

In total 6 No. individual TOC results were obtained from Made Ground as part of the soil chemical test analysis. These TOC results are summarised in **Table 12**.

Table 12 TOC data summary

Stratum (thickness)	No. of TOC tests	TOC range (%)	TOC geometric mean (%)
Made ground (<3m)	6	1.20 – 10.20	3.4

Consistent with the research presented in RB17, the results for the residual made ground equates to a site which is likely to be designated as conforming with Characteristic Situation (CS) 2 or 3 of the Modified Wilson and Card classification (CIRIA Report C665, Assessing Risks Posed by Hazardous Ground Gases to Buildings, 2007). However, the TOC content is considered most likely to reflect the ash/bituminous material content within the made ground much of which is generally not degradable and cannot produce carbon dioxide or methane.

6.3.4.2.2 Semi-quantitative Approach (Wilson and Card)

The empirical semi quantitative approach using gas monitoring data is based on calculations of the gas screening value (GSV). BS8485 defines the GSV as the *'flow rate (l/hr) of a specific hazardous gas representative of a site or zone, derived from assessment of borehole concentration and flow rate measurements and taking account of all other influencing factors, in accordance with a conceptual site model'.*

Once derived for both methane and carbon dioxide the GSVs are compared to the thresholds presented in Table 2 of BS8485, so that a CS can be determined for the site, or a zone. It is important to note that the GSV thresholds are guideline values and not absolute. The GSV thresholds may be exceeded in certain circumstances, if the site conceptual model indicates it is safe to do so. Similarly, consideration of additional factors such as very high concentrations of methane, should lead to consideration of the need to adopt a higher risk classification than the GSV threshold indicates.

The monitoring results are given in **Appendix G**. The steady state concentrations and flows are recorded in **Table 13**.

Table 13 Summary of ground gas results

Borehole	Number of monitoring visits	LEL (%)	Methane (%)	Carbon dioxide (%)	Oxygen (%)	Carbon monoxide (ppm)	hydrogen sulphide (ppm)	Flow rate (l/hr)	Atmospheric pressure (mbar)
WS201	3	0	<0.1	0.6-1.3	19.8-20.6	0	0	0.0	1000-1041
WS202	3	0	<0.1	0.1-0.9	19.9-21.0	2	0	0.0-0.2	1000-1041
WS204	3	0	<0.1	0.8-1.1	18.7-20.0	1	0	0.0	1000-1041
WS207	3	0	<0.1	0.1-0.2	19.7-21.1	1	0	0.0-0.1	999-1040
WS210	3	0	<0.1	0.1-1.8	20.0-20.8	0	0	0.0-0.1	999-1040
WS211	3	0	<0.1	0.2-0.3	20.0-20.7	1	0	0.0-0.1	999-1040

BS8485 suggests that the GSV should be derived by multiplying the worse credible (worst case) recorded flow value in any standpipe in that strata or zone with the maximum gas concentration in any other standpipe in that strata or zone. Further guidance is given in BS8485 section 6.3.

Based on the GSVs derived and the method for determining the CS presented within Table 2 of BS8485, the site has been characterised as CS1.

6.3.5 Uptake of contaminants by vegetation potentially inhibiting plant growth (phytotoxicity)

Table 14 Summary of soil results with respect to plant phytotoxicity effects

Determinant	Generic assessment criteria (mg/kg)				Concentrations of determinants in excess of assessment value
	pH 5.0 < 5.5	pH 5.5 < 6.0	pH 6.0 < 7.0	pH >7.0	
Zinc	200	200	200	300	None recorded
Copper	80	100	135	200	None recorded
Nickel	50	60	75	110	None recorded
Lead	300	300	300	300	WS1 at 0.20 (380 mg/kg)[1)] WS201 at 0.20 (350 mg/kg)[2)] WS211 at 0.40 (323 mg/kg)[2)]
Cadmium	3	3	3	3	None recorded
Mercury	1	1	1	1	WS1 at 0.20 (2.6 mg/kg)[1)] WS2 at 0.40 (2.0 mg/kg)[1)] WS201 at 0.20 (1.85 mg/kg)[2)] WS203 at 0.80 (1.21 mg/kg)[2)]
Note: Only compounds with assessment criteria documented within the Directive 86/278/EEC have been included, although criteria for 5 additional compounds have been presented within the 2006 CoP.					

[1)]RSK Geo-environmental Site Assessment March 2019

[2)]RSK Supplementary Geo-environmental Site Assessment January 2020

The results above indicate the potential for plant growth to be affected by the presence of contaminants within the ground. However, the made ground is not conducive to plant growth and consideration should be given to incorporating clean soil material suitable as a growing medium.

6.3.6 Impact of organic contaminants on potable water supply pipes

For initial assessment purposes, the results of the investigation have been compared with the GAC presented in **Appendix L** for this linkage, which are reproduced from *UKWIR Report 10/WM/03/21. Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites* (UKWIR, 2010).

Since water supply pipes are typically laid at a minimum depth of 750 mm below finished ground levels, sample results from depths between **0.75 m** and **1.35 m** below finished level were considered for assessing risks to water supply.

The results indicate that a relevant linkage may potentially exist associated with organic contaminants. Please note, at the time of this investigation the future routes of water supply pipes had not been established, hence the investigation and sampling strategy

may not be fully compliant with UKWIR recommendations. It is recommended that a targeted assessment be undertaken to determine the remedial measures.

6.3.7 Leaching of contaminants to the underlying Secondary A Aquifer

Leachate samples were prepared from representative soil samples of the made ground to assess mobile contaminants (metals). The results of the leachate analyses have been conservatively compared with freshwater Environmental Quality Standards (EQS) due to the fact that the nearby Beverley Brook represents the most viable sensitive receptor with respect to groundwater contamination. Those results that have been found to exceed the target concentrations are summarised in **Table 15**.

Table 15 Summary of soil leachate results with respect to controlled waters

Substance classification[1)]	Determinant	Target concentration (µg/l)	Location	Depth (m)	Concentration (µg/l)
Hazardous substance	Lead (leachable)	1.2	WS201	0.20	203
			WS203	0.80	76
Non-hazardous pollutant	Zinc (leachable)	10.9	WS201	0.20	52
			WS203	0.80	12

1) Groundwater receptor

In view of the above, exceedances are present for Lead and Zinc, suggesting that leaching of contaminants to groundwater may be occurring. However, the assessment is considered to be very conservative as the target concentration corresponds to the bio-available fraction of the metal. Bio-available metal is not the same metric as dissolved metal as only a fraction of the dissolved metal will usually be bio-available. Furthermore, a large proportion of the made ground may be removed to facilitate the construction of the basement and the proposed layout will largely comprise hardcover greatly reducing the risk of infiltration. On this basis, the pollutant linkage with respect to leachable contamination is considered a low likelihood.

6.4 Uncertainty and data confidence

The review has identified a number of data confidence issues associated with the intrusive works completed to date. Key to the assessment of the pollutant linkages, the following are highlighted:

- Spatial extent of the investigation was limited by remnant structures (i.e. redundant hospital buildings), which currently occupy a large proportion of the site;
- The nature of the made ground (i.e. fill material) is not well defined, with insufficient information to characterise the nature of the waste deposits and/or the associated waste matrix; and

- The future routes of water supply pipes had not been established, hence the investigation and sampling strategy may not be fully compliant with UKWIR recommendations.

7 PRELIMINARY WASTE ASSESSMENT

In accordance with the definition provided in the Waste Framework Directive (WFD), materials are only considered waste if 'they are discarded, intended to be discarded or required to be discarded, by the holder'. Naturally occurring soils are not considered waste if reused on the site of origin for the purposes of development. Soils such as made ground that are not of clean and natural origin (irrespective of whether they are contaminated or not) and other materials such as recycled aggregate, do not become waste until the criteria above are met. Further background information is provided in **Appendix F**.

Excavation arisings from the development may therefore be classified as waste if surplus to requirements or unsuitable for reuse. The following assessments assume the material tested is classified subsequently as waste.

RSK recommends that a Sampling Plan be prepared to support any waste classifications and hazardous waste assessments, prior to any material being excavated. Given the level of data obtained, scale of the development and heterogeneity of the site soils, the following assessment should be considered **indicative** and further assessment should be undertaken following the preparation of a waste sampling plan.

7.1 Hazardous waste assessment

Technical Guidance WM3 (EA, 2018) sets out in Appendix D requirements for waste sampling. It is a legal requirement to correctly assess and classify waste. The level of sampling should be proportionate to the volume of waste and its heterogeneity. The preliminary assessment provided below is based only upon the available sample results and may not be sufficient to adequately classify the waste.

7.1.1 Chemical contaminants

Envirolab, an RSK company, has developed a waste soils characterisation assessment tool (HASWASTE), which follows the guidance within Technical Guidance WM3. At this stage, the body of the made ground is considered as a singular unit. The analytical results have been assessed using this tool to assess the hazardous properties to support potential off-site disposal of materials in the future. Note that it is ultimately for landfills to confirm what wastes they are able to accept within the constraints of their permit. The results are presented in **Table 16**.

Table 16 Results of waste soils characterisation assessment (HASWASTE)

Sample ref/ location	Depth (m)	Soil description	Hazardous property description	Contaminant generally driving hazardous assessment	Preliminary waste assessment
WS201	0.20	Made Ground (silty sand with rare brick fragments)	-	-	Not-hazardous
WS203	0.80	Made Ground (gravelly silty sand with gravel fraction comprising brick, concrete, ceramic fragments and frequent bituminous material)	-	-	Not-hazardous
WS204	0.40	Made Ground (silty sand with rare brick fragments)	-	-	Not-hazardous
WS205	0.80	Made Ground (sandy gravel of glass, flint, bituminous material)	-	-	Not-hazardous
WS207	0.40	Made Ground (silty sandy gravel of sandstone, brick, clinker and concrete)	-	-	Not-hazardous
WS208	0.20	Made Ground (gravelly sand with the gravel fraction comprising ash, clinker, concrete, limestone, flint)	Carcinogenic HP7 & Mutagenic HP11	Total TPH (2680 mg/kg)	Hazardous
			HP8 - Corrosive	pH (13.05)	Hazardous*
WS202	0.80	Made Ground (silty sand with rare brick fragments, glass, plastic and concrete)	-	-	Not-hazardous
WS209	0.15	Made Ground (silty sandy gravel of brick, glass, ceramic and flint)	-	-	Not-hazardous
WS210	1.00	Made Ground (sandy clayey gravel of sandstone, concrete and brick with low cobble	-	-	Not-hazardous

Sample ref/ location	Depth (m)	Soil description	Hazardous property description	Contaminant generally driving hazardous assessment	Preliminary waste assessment
		content and frequent pieces of plastic).			
WS211	0.40	Made Ground (gravelly silt with frequent inclusions of brick and concrete fragments).	-	-	Not-hazardous

From the above it can be seen that majority of the samples have been identified as 'not-hazardous'. WAC testing would be required to determine whether waste might be classified as 'inert or non hazardous'.

Whilst the sample of made ground obtained from WS208 exceeded the TPH and pH hazardous threshold limits, the recorded concentrations are anticipated to relate to presence of bituminous material. As such, the hazardous classification can be downgraded.

Notwithstanding the above, it is important to note that this initial assessment given in this report is for guidance only and it is always necessary to confirm the actual classification with prospective landfill operators prior to disposal.

It is recommended that further sampling and testing should be undertaken for waste characterisation purposes.

7.1.2 Asbestos within waste soils

Technical Guidance WM3 requires that within a mixed waste the separately identifiable wastes be assessed separately.

For instance, where waste soil contains identifiable pieces of asbestos (visible to the naked eye) the asbestos should, where feasible, be separated from the soil and classified separately. This should be disposed of within a hazardous, stable non-reactive hazardous waste landfill or a special cell in a non-hazardous waste landfill.

Samples of potential asbestos containing material were collected from site and analysed for the presence of asbestos, the results of which are presented in **Appendix F**. Analysis confirmed that asbestos is not present within samples tested. Visible asbestos containing material was not identified on-site.

7.1.3 Natural soils

Uncontaminated natural soils are automatically classed as an inert waste under European Waste Category (EWC) code 17 05 04. Therefore, natural soils arisings are considered suitable for disposal at an inert landfill or a site that has a valid exemption from the Environmental Permitting (England and Wales) Regulations 2016registered with the EA.

8 PRELIMINARY REMEDIATION METHOD STATEMENT

8.1 Remedial Objectives

The aim of the remediation works is to provide a site that is suitable for its subsequent redevelopment and does not pose a risk to future site users.

8.2 Phases of Remediation

8.2.1 Introduction

The overall remediation strategy for the site may be divided into the enabling and remediation phase, i.e. those works required to produce a suitable development platform, including the removal of floor slabs and removal of contamination hotspots, and the subsequent construction phase.

The sequence of works required under both phases is outlined in the following sections.

8.2.2 Enabling and Remediation Phase

The enabling and remediation phase works will be carried out in the following sequence:

8.2.2.1 Demolition and site clearance

Prior to demolition of the existing structures, an asbestos refurbishment / demolition survey shall be undertaken to confirm the presence or absence of asbestos containing materials within all structures present on site.

Where asbestos containing materials are encountered, removal works must be undertaken by an appropriately licensed contractor such that all identified asbestos containing materials are safely removed off-site to a suitably licensed facility in advance of demolition works commencing.

Copies of the relevant survey and clearance documents, including disposal records and air monitoring/clearance results should be made available for inclusion within the site verification report.

Demolition will comprise the removal of any existing buildings, including breaking out and removal of hardstanding and below ground structures (e.g. foundations, floor slabs, and redundant services).

Any fuel storage tanks present should be carefully emptied (If any residual fuel/oil be encountered) and removed off site in accordance with best industry practice.

A watching brief should be maintained during removal of the slab and subsequent excavation works (notably beneath the potential areas of concern, as shown in **Figure 6**). It will be the responsibility of the on-site manger to ensure watching briefs are undertaken and documented. A watching brief record will consist of the following:

- Observations of contamination made during the course of development by members of site staff, contractor or visitor;

- A photographic record of the key stages of development and occurrences including contamination found during the course of the development, the formation levels of excavations, any reduced level dig/mass excavation, formation of landscaped or garden areas, etc.; and
- Examples of observations that should be recorded as part of a watching brief and included within the Discovery Strategy detailed in **Appendix O** and discussed in the relevant subsection.

Following removal of these structures, the formation levels should be periodically inspected by a suitably qualified environmental consultant. Should the assessment provide evidence of potentially significant contamination requiring remediation, modifications will be made to the remedial works and will be agreed with the Local Authority.

Stockpiles of soils for re-use at the site should be tested for its chemical suitability at a frequency of five samples per stockpile or one sample every 250 m^3, whichever is greater, for general suite of contaminants, including metals, speciated TPH determinants, speciated PAH, pH and asbestos.

Stockpiles of crushed concrete will be visually inspected for the presence of asbestos.

On completion of this element of the works, the Principal Contractor (PC) shall provide the Environmental Consultant with an accurate survey drawing showing the locations of all removed structures and any structures remaining in situ.

8.2.2.2 Hydrocarbon Impacted Areas

Hydrocarbon impacted soils (unsaturated zone) may be encountered beneath potential areas of concern (i.e. the generator house to the west and suspected tank bases to the north).

Any impacted soils should be removed with the excavations determined from soils exhibiting visual/olfactory evidence of petroleum hydrocarbon contamination. The excavations should proceed by careful removal of the upper, un-impacted parts of the made ground. This material should be stockpiled separately. Following excavation of the contaminated materials, and validation of the excavations, backfilling of the excavations should occur with clean crushed concrete or similar.

Where laboratory testing is required to verify the adequacy of remediation, those excavations shall not be backfilled until the results of the testing are obtained and approval is given by the Environmental Consultant.

All excavations should be supervised and validated by a suitably qualified engineer. Validation samples should be taken from the base and sides of the excavations, and tested at a UKAS accredited laboratory for a speciated petroleum hydrocarbon suite to demonstrate that the soil objectives presented in RSK Soil Objectives (**Appendix P**) have been met.

8.2.2.3 Disposal of soil materials & licensing

For any materials destined for off-site removal, discrete mounds should be formed and where possible, resting on hardstanding, or alternatively on impermeable membranes. A

thick gauge membrane must be placed and secured over the stockpile to prevent rainwater ingress and potential leachate migration.

During excavation care will be taken to undertake segregation of made ground and natural underlying soils as works progress so as to avoid cross contamination of the natural soils by the made ground.

All strata should be segregated visually when excavated separately. Any strata exhibiting olfactory indications of contamination will be stockpiled, analysed and classified prior to removal from site.

Prior to disposal, the PC shall ensure the waste material is assessed in accordance with the EA's 'Technical Guidance WM3' (2015).

A record shall be kept of the location of temporary stockpiles, their chemical status and nature including origin of the materials.

All hauliers transporting waste soils from site will hold a **Waste Carriers Licence**. All facilities receiving waste soils from the site will either be licensed to accept the waste that they receive or hold an exemption that allows the waste to be received without a licence.

All vehicles transporting hazardous waste soils from site will be issued with a Consignment Note. A duplicate of the Consignment note will be retained by the PC.

All waste transfer notes and consignment notes must be signed prior to the vehicle leaving site.

All documentation should be supplied to the environmental consultant for inclusion in the validation report

8.2.2.4 Material of a suspect nature

It is possible that the enabling works will encounter different conditions (e.g. presence of asbestos construction materials) from those revealed by the site investigation that may require special treatment or other alleviation measures.

Where unexpected ground conditions or potentially suspect materials are encountered, the contractor shall immediately inform the Environmental Consultant who shall then carry out an inspection as soon as is reasonably practical. During or immediately following the inspection, the Environmental Consultant shall advise the Client of any requirements for additional investigations or possible modifications to the remediation strategy. In addition, Local Authority should be consulted if any substantially different conditions are encountered or modifications to the remedial works are required.

A discovery strategy, which sets out in principle the proposed methods for identifying and managing site specific risks in the event potential land contamination is uncovered during development, is included within **Appendix O**.

8.2.3 Construction Phase

8.2.3.1 Preparation of soft landscaped area

The development scheme proposed includes soft landscaped areas. All imported soil material required for the completion of the soft landscaped areas should comply with the following requirements:

- An allowance should be made to incorporate a minimum 450 mm clean cover (including 150 mm of topsoil) over a non-woven geotextile membrane through all areas of communal and private soft landscaping respectively;
- The Principal Contractor (PC) shall provide details of the provenance of the imported material to the Environmental Consultant **before importation** and use of the material on the site;
- Representative chemical test certificate(s) from source shall be provided by the supplier to confirm suitability of use (**before importation**) and a delivery note for each consignment detailing source and volume. The certificates must correspond in both age and source to the material delivered to site;
- Additional sampling shall be undertaken by the Environmental Consultant. Representative soil samples shall be collected from a body of material into a single homogenised (composite sample) for the purpose of chemical analysis;
- All samples tested should meet the soil assessment criteria set out in **Appendix P**; and
- Prior to importation, the PC should ensure all imported topsoil comply with British Standard **BS3882:2015**.

At completion of the above works, the Environmental Consultant shall produce a verification report to confirm suitability of use. The verification process is detailed in **Section 9**.

It should be noted, that the responsibility for the correct implementation of the remediation strategy lies with the PC. However, the remedial works shall be monitored, inspected and validated by the Environmental Consultant's experienced geo-environmental engineers with part time attendance on-site dependent on the operations being undertaken.

During periods of part time supervision, it will be the PC's responsibility to provide adequate notice of any key activities that will require the attendance of the Environmental Consultant.

8.2.3.2 Potable pipes

Potentially unacceptable risks to plastic water supply pipes may exist beneath the site, however the assessment carried out to date is not fully compliant with UKWIR/local water authority. It is recommended to carry out a targeted assessment. Alternatively, consideration maybe given to adopting barrier pipes.

Notwithstanding the above, all underground services placed on the site should be laid within dedicated trenches. Clean granular fill shall be used as a bedding material for all services and as backfill material for all service trenches.

9 WORKING PRACTICE AND VERIFICATION PLAN

9.1 Health and safety of site personnel

It is the responsibility of the PC and any appointed sub-contractors to enforce an appropriate health and safety regime for all site personnel. Full details regarding the proposed working practices in connection with the remediation works shall be agreed in advance of the commencement of the works with the Planning Supervisor and if appropriate with the Environmental Health Officer at London Borough of Richmond Upon Thames.

Measures will be necessary to protect the health and safety of site workers during the site works. The contractors will be under a statutory obligation to take reasonable care to protect the health and safety of their employees. The following measures are suggested to provide a minimum level of protection.

- All ground workers on-site should be issued with protective clothing, dust masks, footwear and gloves. These should not be removed from site, and advice should be given on when and how they are to be used;
- Care should be taken to minimise the amount of dust and mud generated on-site; and
- Good practices relating to personal hygiene should be adhered to on-site, i.e. food and drink should only be consumed within designated areas on the site and smoking should be prohibited in all working areas.

Reference should also be made to the Health and Safety Executive (HSE) document “Protection of Workers and the General Public during the Development of Contaminated Land”.

Any health and safety measures noted in the Asbestos Removal Method Statement shall be adhered to.

9.2 Prevention of Pollution

9.2.1 General

The targets perceived to be potentially most at risk from pollution during the remediation of the site are the aquifer beneath the site, and workers on-site.

All contractors on-site shall adhere to environmental good practice as set out in CIRIA publication C650 (2005) and in particular those issues identified below.

9.2.2 Airborne Pollution (dust, etc.)

Care shall be taken by the contractor to minimise the amount of dust generated on-site during excavation, backfilling and trafficking. In the event that dry weather leads to excessive dust generation, exposed soils shall be damped down, but not flooded, with clean water.

The Contractor’s method statement shall include a detailed dust control plan.

9.2.3 Surface Runoff

The PC shall implement appropriate procedures to prevent surface run-off, including forming bunds around any temporary stockpiles of contaminated soils.

In addition, so far as is practicable the works should be carried out during fine weather conditions, as a heavy rainstorm would potentially mobilise the contaminants in the shallow soils currently encapsulated below hardstanding.

9.2.4 Vehicles

Wheel cleaning/washing facilities shall be provided on-site if operations are likely to result in vehicles leaving site with potentially contaminated soil/mud clinging to them. Contaminated water on-site, including water and other liquid collected from vehicle washing facilities, shall be disposed of off-site in an approved manner with full regard to current legislation and good practice.

All vehicles leaving the site shall be clear of contaminated materials other than that contained within the load container, which shall be sheeted to prevent the loss of dust and other materials.

9.2.5 Re-contamination

The programme of works and any subsequent modifications shall be designed to avoid the potential re-contamination of areas already worked, i.e. site traffic shall be routed to avoid passing from contaminated to clean areas and contaminated soils shall not be stockpiled on clean areas.

9.3 Documentation

All contaminated materials removed off-site shall be transported to an approved licensed landfill for final disposal. The main contractor shall provide a full documentary record of this operation in accordance with the Duty of Care. Copies of the landfill documents shall be provided to the Environmental Consultant for inclusion in the verification report.

9.4 Verification of Remediation

9.4.1 Cover system validation

The requirements for the validation of cover systems are outlined in NHBC Standards Chapter 4.1 ‘Land Quality – Managing Ground Conditions’. The two main aspects to consider when validating cover systems are:

a) Confirmation that the designed thickness of the material has been placed; and
b) Confirmation that the materials comprising the cover system are themselves not contaminated, i.e. suitable for residential use.

To assess the thickness of the cover layer, it will be necessary to dig through the cover layer at selected locations to verify the post-compaction thickness of topsoil and subsoil.

In addition, the topsoil and subsoil (whether imported or site derived during earthworks or the subsequent construction phase) will be chemically validated by the collection and analysis of representative soil samples by an appropriately qualified environmental consultant. The frequency of testing for any site-derived or imported materials stockpiled

for re-use should be a minimum of one sample for every 100 m^3 for the following parameters:

- Metals: arsenic, cadmium, chromium, copper, nickel, lead, mercury, selenium and zinc and pH;
- Speciated TPH CWG (split into aliphatic and aromatic carbon bands) with BTEX compounds;
- Speciated 16 No. PAH; and
- Asbestos in soil (with identification where applicable).

It is acceptable to test stockpiled topsoil/subsoil intended for use in gardens and soft landscaped areas before placement, however the cover layer thickness will still require validation at a later date.

The groundworks contractor shall provide details of the provenance of any imported soil and evidence of compliance (i.e. chemical testing certificates representative of the type and volume of material) to the Environmental Consultant whose written approval will be required **before** importation and use of the material

At the completion of the remediation works the Environmental Consultant shall undertake the following:

- Confirmation of the capping layer thickness. The thickness shall be validated by excavating a trial hole in treated areas once the cover system has been placed;
- Soil sampling and subsequent chemical analysis of capping material. The results shall be assessed against the criteria set out in **Appendix P**. Where separate subsoil and topsoil materials are present, it will be necessary to confirm the chemical quality of both of these components;
- Testing of the cover shall be conducted at a sufficient rate to provide an adequate confidence regarding the depth and quality of the material used. In accordance with NHBC guidance, site fewer than 5 plots, testing shall be undertaken in every plot;
- Provision of a verification report detailing the following:
    - The source and volume of materials imported, including test certificates provided by the supplier and approvals from London Borough of Richmond Upon Thames;
    - The results of laboratory testing carried out prior and during the works;
    - A photographic record of the trial holes with a tape or a staff clearly showing the hole depth including the placement of the geo-marker layer;
    - Locations and number of trial holes; and
    - Collation of all other relevant documents, including consignment notes.

A copy of the report shall be forwarded to the Local Authority and NHBC for approval of the remediation works.

9.4.2 Hydrocarbon impacted area validation

A verification report shall be produced by the Environmental Consultant following the completion of the remediation works. This will include the following elements:

- The extent of works that have been carried out and formation levels, including a photographic record;
- The results of the in-situ testing (PID) and validation laboratory analysis undertaken following the excavation;
- Supporting chemical test records;
- Details of the backfill material used within the resultant voids; and
- Collation of all other relevant documents, including records of waste movements and consignment notes from the licensed waste carrier.

9.4.3 Potable pipe validation

Should the above be considered (subject to any supplementary ground investigation), the Principal Contractor shall provide details of the installation, including photographic record and letter of conformity to demonstrate the works undertaken and material used are in general accordance with Thames Water. The information shall be incorporated into the verification report prepared by the Environmental Consultant.

10 GEOTECHNICAL ASSESSMENT

10.1 Proposed development

As outlined in section 2.4, the development scheme is preliminary at this stage and consideration is being given to the following options:

Eastern Portion

- A single residential apartment block (measuring up to 3 storeys in height) with an undercroft car park at ground level.

Western Portion

- Two residential apartment blocks (measuring up to 3-4 storeys in height) with a single storey interconnecting basement level.

No specific information relating to the structural design or maximum imposed loads by the proposed building has been provided.

BS EN 1997-1 defines three different Geotechnical Categories that structures may fall into, which are summarised as follows:

- Category 1: Small and relatively simple structures for which it is possible to ensure that the fundamental requirements will be satisfied on the basis of experience and qualitative geotechnical investigations; with negligible risk;
- Category 2: Conventional types of structure and foundation with no exceptional risk or difficult ground or loading conditions; and
- Category 3: Structures or part of structures, which fall outside limits of Geotechnical Categories 1 and 2. Examples include very large or unusual structures; structures involving abnormal risks, or unusual or exceptionally difficult ground or loading conditions; structures in highly seismic areas; structures in areas of probable site instability or persistent ground movements that require separate investigation or special measures.

Different regimes for each category are adopted for inspection of the construction works, quality control, checking the exposed ground and groundwater conditions and performance of the works in relation to the design assumptions.

Based on the information provided above on the proposed development and in view of the anticipated ground conditions, a Geotechnical Category of 2 has been assumed for the purposes of assessment. This should be reviewed at all stages of the investigation and revised where necessary.

For Categories 2, measurements of the ground properties should be conducted, and additional ground investigations may be needed. Monitoring of performance in relation to the sequence of construction is required with measurements of displacements and appropriate ongoing analyses.

10.2 Key geotechnical hazards/development constraints

A summary of commonly occurring geotechnical hazards is given in **Table 17** together with an assessment of whether the site may be affected by each of the stated hazards.

Table 17 Summary of main potential geotechnical hazards that may affect site

Hazard category (excluding contamination issues)	Hazard status based on investigation findings and proposed development			Engineering considerations if hazard affects site
	Found to be present on site	Could be present but not found	Unlikely to be present and/or affect site	
Sudden lateral changes in ground conditions	✔	The variable composition and thickness of made ground and heterogeneity of the drift deposits (Kempton Park Gravel).		Likely to affect ground engineering and foundation design and construction
Shrinkable clay soils	✔	Low volume change potential (associated with the cohesive portion of the Kempton Park Gravel) and Medium to High (associated with the London Clay Formation), although the latter is unlikely to have effect due to its depth		Design to NHBC Standards Chapter 4 or similar
Highly compressible and low bearing capacity soils			✔	Likely to affect ground engineering and foundation design and construction
Silt-rich soils susceptible to loss of strength in wet conditions	✔	Variable silt content in the cohesive portion of the Kempton Park Gravel and inherent nature of the London Clay Formation.		Likely to affect ground engineering and foundation design and construction
Running sand at and below water table		✔	Could be present for excavation in granular soils below groundwater table	Likely to affect ground engineering and foundation design and construction
Karstic dissolution features (including 'swallow holes' in Chalk terrain)			✔	May affect ground engineering and foundation design and construction – refer to Section 4.1.2
Evaporite dissolution features and/or subsidence			✔	May affect ground engineering and foundation design and construction

Hazard category (excluding contamination issues)	Hazard status based on investigation findings and proposed development			Engineering considerations if hazard affects site
	Found to be present on site	Could be present but not found	Unlikely to be present and/or affect site	
Ground subject to or at risk from landslides			✔	Likely to require special stabilisation measures
Ground subject to peri-glacial valley cambering with gulls possibly present			✔	Likely to affect ground engineering and foundation design and construction
Ground subject to or at risk from coastal or river erosion			✔	Likely to require special protection/stabilisation measures
High groundwater table (including waterlogged ground)	✔	Groundwater recorded within the Kempton Park Gravel ranging between 3.10 and 3.67 m bgl.		May affect temporary and permanent works
Rising groundwater table due to diminishing abstraction in urban area	Relevant to exceptional structures (CIRIA Special Publication 69). The site does not lie within critical areas in which foundations and basements are at risk.			May affect deep foundations, basements and tunnels.
Underground mining			✔	Likely to require special stabilisation measures
Existing sub-structures (e.g. tunnels, foundations, basements, and adjacent sub-structures)	✔	Foundations to existing structures.		Likely to affect ground engineering and foundation design and construction
Filled and made ground (including embankments, infilled ponds and quarries)	✔	Made ground with variable thickness across the Site.		Likely to affect ground engineering and foundation design and construction
Adverse ground chemistry (including expansive slags and weathering of sulphides to sulphates)	✔	Geological strata most likely to have substantial sulphate concentrations within the London Clay Formation. This is further discussed in the sub-sections below.		May affect ground engineering and foundation design and construction
Note: Seismicity is not included in the above table as this is not normally a design consideration in the UK.				

10.3 Foundations

10.3.1 Foundation options

The ground conditions beneath the footprints of the proposed blocks derived from the two phases of investigative works reveal a variable depth of made ground, overlying interbedded superficial deposits of Kempton Park Gravel, typically characterised by firm gravelly sandy clay and medium dense to very dense locally clayey sandy gravel. The solid geology comprised the London Clay Formation of firm weathered silty clay, grading into stiff to very stiff dark grey/blueish grey silty clay. Groundwater levels recorded during the monitoring show resting levels within the Kempton Park Gravel, at a depth of between 3.10 and 3.67 m bgl. Groundwater strike were recorded was further recorded locally within claystone band in the London Clay Formation.

Given the presence of competent granular Kempton Park Gravel deposits at relatively shallow depths (0.50 m to 2.00 m below ground level) it is considered that traditional spread footings may be suitable in the eastern portion. Foundation excavations will, however, be locally relatively deep and may require further deepening due to any ground disturbance caused during the removal of remnant sub structures associated with the existing buildings on-site. Therefore, whilst recommendations for the design and construction of spread foundation is provided in **Section 10.3.2**, it is recommended that further investigations be conducted to provide greater confidence that traditional spread foundations will prove viable given the likely requirement to locally deepen and support foundation excavations. Alternatively, prior treatment, such as vibro-compaction/replacement may prove a more cost effective solution to enable the adoption of spread foundations or recourse to pile foundations. It is recommended that advice be sought from a ground improvement specialist to confirm suitability of the ground conditions for treatment and achievable bearing capacities.

With reference to western portion, piles are deemed the most suitable foundation option for the proposed development however, a rafted foundation can also be considered. The excavation for the basement (assumed approximately 3 m with the anticipated FFL resting at ~3 m AOD) will take the formation level within the medium dense sandy gravel/gravelly sand and close to the groundwater levels. Subsequent new construction will be accompanied by a sequence of ground movements, including swelling heave on unloading, and longer term consolidation settlement on reloading. The amounts of each component of movement will depend upon a number of factors, construction timetable and ultimate loadings. A detailed assessment of the potential ground movements will need to be undertaken once the foundation scheme has been finalised.

10.3.2 Spread foundations

It is envisaged that spread foundations founded within the Kempton Gravel Member at a minimum depth of 1.00 m below the existing ground level or at least 0.2 m into the medium dense gravels may be appropriate for this option. Design Approach 1 - Combination 2 results are summarised in **Table 18**.

Table 18 Comparison of ULS design resistance and SLS design pressures

Foundation Dimensions				DA1-C2 Design Resistance (kN/m²)	SLS (25 mm Settlement) (kN/m²)
Width (m)	Length (m)	Depth (m)	Area (m²)		
Strip/Trench Fill Foundations					
1.00	10.00	1.00	10.00	420	282
1.50	10.00		15.00	565	216
2.00	10.00		20.00	595	180
1.00	10.00	1.50	10.00	706	289
1.50	10.00		15.00	737	223
2.00	10.00		20.00	767	186
1.00	10.00	2.00	10.00	876	296
1.50	10.00		15.00	908	230
2.00	10.00		20.00	938	193
Pad Foundations					
1.50	1.50	1.00	2.25	523	328
2.00	2.00		4.00	546	271
3.00	3.00		9.00	570	233
1.50	1.50	1.50	2.25	702	335
2.00	2.00		4.00	726	277
3.00	3.00		9.00	750	240
1.50	1.50	2.00	2.25	882	341
2.00	2.00		4.00	906	284
3.00	3.00		9.00	929	247
Notes: Depth refers to depth below ground level or m bgl					

Consideration may need to be given to some form of excavation stabilisation/support as pumping from open sumps in non-cohesive soils can result in instability and general loosening of the soils at the base of the excavation.

10.3.3 Basement raft

Based on the soil profile indicated above and the anticipated formation level of the proposed basement (3 m below the existing ground level), the basement raft would be constructed within the medium dense, sandy gravel and locally firm sandy, gravelly clay (Kempton Park Gravel).

A net safe bearing pressure of 250 kN/m^2 (safety factor F_s=3.0) has been calculated for a raft foundation, however, pressures of this magnitude are likely to result in appreciable

settlements. It will be necessary to check that the associated settlements are acceptable to the proposed structure and surrounding buildings.

The groundwater level beneath the site was recorded at the highest level of approximately 3.10 mbgl, i.e. below, but close to the anticipated basement formation level. Therefore, it would be prudent to allow for a potential for higher levels to occur at some point in the future and associated hydrostatic uplift pressures acting on the raft.

The proposed methods for basement construction should effectively produce a cut-off around the perimeter of the excavation, and therefore dewatering will not be required during the construction. Furthermore, suitable support to the excavation should be provided by the installation of the proposed sheet/secant/contiguous piles around the perimeter.

The basement structure will need to incorporate suitable waterproofing measures and reference should be made to BS 8102:2009 'Code of practice for protection of below ground structures against water from the ground' for further guidance.

10.3.4 Piled foundations

Recommendations for the design and construction of pile foundations in relation to the ground conditions are set out in **Table 19**.

Table 19 Design and construction of piled foundations

Design/construction considerations	Design/construction recommendations
Pile type	The construction of both bored and 'cfa' piles is considered technically feasible at this site
Possible constraints on choice of pile type	Given the close proximity of the site to other properties, it is considered that the use of driven piles may not be acceptable due to the vibration, noise and heave associated with pile driving. Driven piles are also likely to reach premature set in the 'dense' sands and gravels of the Kempton Park Gravel.
Temporary casing	Given the presence of groundwater within the Kempton Park Gravel, and the claystone bands in the London Clay Formation, bored piles will require temporary casing throughout their depth. Alternatively, the use of continuous-flight-auger (CFA) injected bored piles or driven piles usually overcomes this issue Groundwater adopted at 1.00 m bgl for preliminary design purposes
Man-made obstructions	The presence of buried sub-structures or other obstructions within made ground may lead to some difficulty during piling. Where buried obstructions are encountered, it will be necessary to either relocate the pile(s) or make allowance for removing the obstruction
Hard strata	An allowance should be made for the presence of 'rock' bands (claystone) within the London Clay Formation. Claystone bands were recorded locally within BH02 (13.70 m) and BH03 (12.20 m)

Design/construction considerations	Design/construction recommendations	
Limitations afforded by ground	For the purpose of assessing preliminary pile capacities the made ground/Kempton Park Gravel (cohesive portion) have been presumed not to contribute to the load-carrying capacity for the piles for the first approximately 3 m bgl. At this time, no negative skin friction has been considered	
Pile Design Parameters (bored piles)		
Kempton Park Gravel (granular)	Angle of internal friction (φ) based on average SPT 'N' value of 34	37
	Shaft friction factor (k_s.tan δ)	0.60
London Clay Formation	Undrained shear strength c_u (kN/m^2) for London Clay Formation	80 + 8.26z kN/m2 where z = depth
	Adhesion factor α	0.5
	End bearing factor (N_c)	9
General parameters	SLS check –factor on shaft friction	1.2
	Model factor (γ_{Rd})	1.4
	Maximum limiting shaft friction (kN/m^2)	140
Special precautions relating to bored pile shafts and bases	Bored pile concrete should be cast as soon after completion of boring as possible and in any event the same day as boring Prior to casting the base of the pile bore should be clean, otherwise a reduced safe working load will be required. Similarly, if the pile bore is left open the shaft walls may relax/soften, leading to a reduced safe working load	

The design resistance has been calculated in accordance with BS EN 1997-1 and the UK National Annex, using partial resistance factors for bored piles, given in **Table 20**.

Table 20 Partial resistance factors (γ_R)

Resistance	Set	
	DA1 C1	DA1 C2[1)]
Base - γ_b	1.0	2.0
Shaft (compression) - γ_s	1.0	1.6
Total (compression) - γ_t	1.0	2.0

[1)] no serviceability verification

The design procedure for piles varies considerably, depending on the proposed type of pile. However, for illustrative purposes **Table 19** give likely working pile loads (in compression) for traditional bored, cast-in-situ concrete piles of various diameters and lengths, based on the design parameters given in **Table 21**.

Table 21 Illustration of typical compressive design resistances for bored cast-in-situ piles

Compression												
Typical Design resistance for DA1 – Combinations C1 & C2 (kN)												
Depth of toe below ground (mbgl)	Pile diameter											
	300 mm			450 mm			600 mm			750 mm		
	C1	C2	SLS	C1	C2	SLS	C1	C2	SLS	C1	C2	SLS
10	228	137	152	375	222	229	545	318	305	737	426	382
12	307	185	212	500	298	319	720	423	425	965	562	532
14	398	241	282	643	385	423	918	543	564	1223	717	705
16	501	305	361	803	483	542	1139	678	722	1509	890	903
18	616	375	450	980	591	675	1383	826	900	1824	1081	1125
20	741	453	548	1175	711	822	1651	990	1097	2168	1289	1371
22	879	538	656	1387	841	984	1941	1167	1313	2541	1517	1641

From the above, it can be seen that pile loads are limited by the Combination 2 design resistances or serviceability limit state and the smaller of the two adopted.

It should be stressed that the above capacities do not take into consideration limiting concrete stress (to be verified by a separate load case as defined in EC2) nor pile group effects, the latter of which is more pronounced for a large number of closely spaced piles.

Notwithstanding the above, it is recommended that the detailed advice of a specialist-piling contractor be sought as to the most suitable type of pile for the prevailing ground conditions and as to their lengths and diameters to support the required design loads.

It should be stressed that the above capacities do not take into consideration pile group of piled raft effects which is more pronounced for a large number of closely spaced piles.

The presence of water-bearing strata may dictate the pile length, its type and the construction methods adopted. The ground investigation undertaken to date was limited and further investigations may be required to fully characterise the ground conditions.

10.4 Retaining wall design parameters

In order to facilitate the basement excavation, it will be necessary to construct an embedded retaining wall around the external basement perimeter. On the basis of the ground investigation information obtained to date, the following soil parameters in **Table 22** are recommended for retaining wall design purposes.

Table 22 Retaining wall design parameters

Soil type	N Value / Undrained Shear Strength c_u (kN/m²)	Unit weight -γ_k (kN/m³)	Short Term Characteristics		Long Term Characteristics	
			C_U (kN/m²)	ϕ (°)	c' (kN/m³)	ϕ' (°)
Made Ground (granular)	N = 9 to 32	18	0	30	0	30
Kempton Park Gravel (cohesive)	Cu = 42 to 75[2)]	19	42 to 75	0	0	25[1)]
Kempton Park Gravel (granular)	N = 18 to >50	20.0 (moist) 22.0 (saturated)	N/A	37	0	37
London Clay Formation	80 + 8.26z	20.0	80 + 8.26z	0	2[1)]	25[1)]

[1)] assumed parameters based on previous experience and in absence of site specific data

[2)] based on hand vane results

In order to prevent damage to adjacent structures, the design of the retaining wall and basement excavation must address the risk of excessive deformation of the wall. Bracing, both in the temporary and permanent condition will therefore be required, to ensure that the horizontal and vertical soil movement around and below the excavation remain within acceptable levels.

10.5 Roads and hardstanding

In the 1.0 m to 1.5 m below the proposed finished ground level the exploratory holes have revealed a soil profile comprising made ground over Kempton Park Gravel. The potentially poorest sub-grade material within this profile is the made ground.

In pavement design terms, the groundwater conditions are anticipated to comprise a low water-table, i.e. at least 1 m below the pavement formation level. The results of in-situ testing are summarised in **Table 23**.

Table 23 Summary of CBR values derived from in-situ Clegg Hammer tests

Test location	Depth (mbgl)	Material type	Minimum CBR value
CBR1	0.45	Made Ground (granular)	17%[1)]
CBR2	0.45	Made Ground (granular)	10%[1)]
CBR3	0.45	Made Ground (granular)	10%[1)]

1) High readings considered attributable to gravel content

For preliminary road pavement design, it is recommended a sub-grade soil CBR value of 5% used. This value assumes that during construction the formation level will be carefully compacted and any soft spots removed and replaced with well-compacted granular fill.

It is recommended that in situ plate bearing tests are completed on the final formation to confirm the final design CBR value.

The sub-grade soils can be regarded as non-frost-susceptible (PI <15%), based upon the criteria given in Appendix 1 of TRRL (1970) Report Road Note 29. When the sub-grade is frost-susceptible the thickness of sub-base must be sufficient to give a total thickness of non-frost-susceptible pavement construction over the soil of not less than 450 mm.

10.6 Chemical attack on buried concrete

This assessment of the potential for chemical attack on buried concrete is based on current BRE guidance. The desk study and site walkover indicate that, for the purposes of this assessment of the aggressive chemical environment, the site should be considered as a site where disturbance of pyrite bearing ground could result in additional sulphate. A summary of the results is presented below.

Table 24 Pyritic geology chemical tests (London Clay)

Test location	Depth	pH	Water soluble sulphate (2:1) mg/l	Acid soluble sulphate %w/w	Total Sulphur %w/w	Total potential sulphate %	Oxidisable Sulphides %
BH02	9	8.61	120	0.1	0.44	1.32	1.22
BH02	12	8.34	11	0.2	7.38	22.14	21.94
BH02	15	8.73	56	0.07	0.34	1.02	0.95
BH02	18	8.94	66	0.06	0.3	0.9	0.84
BH04	8	8.76	66	0.05	0.17	0.51	0.46
BH01	10.5	8.86	39	0.08	0.38	1.14	1.06
BH01	13.5	8.71	92	0.1	0.48	1.44	1.34
BH01	16.5	8.41	308	0.16	0.41	1.23	1.07
BH01	19.5	8.43	174	0.12	0.36	1.08	0.96
BH01	25.5	8.49	184	0.2	5.32	15.96	15.76
BH03	7.5	8.28	150	0.14	0.45	1.35	1.21
BH03	10.5	8.74	68	0.07	0.42	1.26	1.19

Table 25 Non-Pyritic geology chemical tests (Kempton Park Gravel)

Test location	Depth	pH	Water soluble sulphate (2:1) mg/l
BH02	6	8.45	<10
BH04	1.5	8.15	15
BH04	3.5	8.5	<10
BH04	5.5	8.29	<10

Test location	Depth	pH	Water soluble sulphate (2:1) mg/l
BH02	6	8.45	<10
BH04	1.5	8.15	15
BH01	2	8.42	<10
bh01	7	8.11	<10
BH03	5	8.17	<10

Table 26 Non-Pyritic geology chemical tests (Made Ground)

Test location	Depth	pH	Water soluble sulphate (2:1) mg/l
BH02	1.2	8.08	<10
BH04	0.5	7.92	<10
BH03	1.2	8.09	11

"Characteristic value" is the highest or mean of the two highest results if more than 5 readings from one area are available. For the purpose of this assessment, we have taken the highest result (308 mg/l) as a characteristic value. As this value is below the limiting value of 3.0 g/l consideration of magnesium is not required.

Based on Table C2 in the BRE guidance, Result one for Design Sulphate Class for the site is DS-1.

Although for the purposes of this assessment the site has been classified as brownfield, the pH is nowhere less than the limiting value of 5.5. The third assessment of Design Sulphate Class specific to brownfield sites is therefore not required in this case.

Due to the possible presence of sulphides in weathered London Clay, a calculation was made using the measured concentrations of Total Sulphur and Acid Soluble Sulphate content of the amount of Oxidisable Sulphide present. A maximum Oxidisable Sulphide content of 21.94% was calculated. Since this value is greater than 0.3% a Total Potential Sulphate (TPS) concentration of 22.14% has been calculated, which results in a Design Sulphate Class of DS-5. However, the classification is based on the assumption that significantly disturbed clays will come into contact with buried concrete. As such, concrete in pyritic ground which is initially low in soluble sulfate does not have to be designed to withstand a high potential Sulfate Class unless it is exposed to ground which has been 'disturbed' to the extent that contained pyrite might oxidise and the resultant sulfate ions reach the concrete.

Furthermore, the sulfate classification based on total potential sulfate is highly conservative as not all the pyrite in soil will be oxidised and only a part will be taken into solution.

In view of the above and assuming the adoption of pile foundation, Design Sulphate Class of DS-1, may be adopted. It has been assumed that groundwater conditions are mobile. From consideration of the characteristic pH value, an Aggressive Chemical Environment for Concrete classification of AC-1 may be assumed for design purposes. However,

should the proposals include the reuse of significantly disturbed clay (pile arisings, etc.) on site concrete structures, Design Sulphate Class of DS-5 and Aggressive Chemical Environment for Concrete classification of AC-5 should be adopted.

With respect to non-pyritic ground conditions (i.e. Kempton Park Gravel), consideration may be given to DS-1.

Please note, the above is preliminary and the data should be re-assessed once the development scheme and foundation type has been finalised.

10.7 Infiltration drainage

Falling head tests were performed in BH2 and BH3 to provide a preliminary assessment on the infiltration characteristics of the underlying soils. The results of which are summarised in **Table 27** below and shown in **Appendix G**.

Table 27 Summary of borehole soakaway results

Test location	Depth of test section (m)	Infiltration rate (m/s)	Strata
BH2	1.7-2.7	$4.0E10^{-6}$	Kempton Park Gravel
BH3	3-4	$1.46E10^{-4}$	Kempton Park Gravel

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FIGURES

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Client: LS ESTATES LIMITED

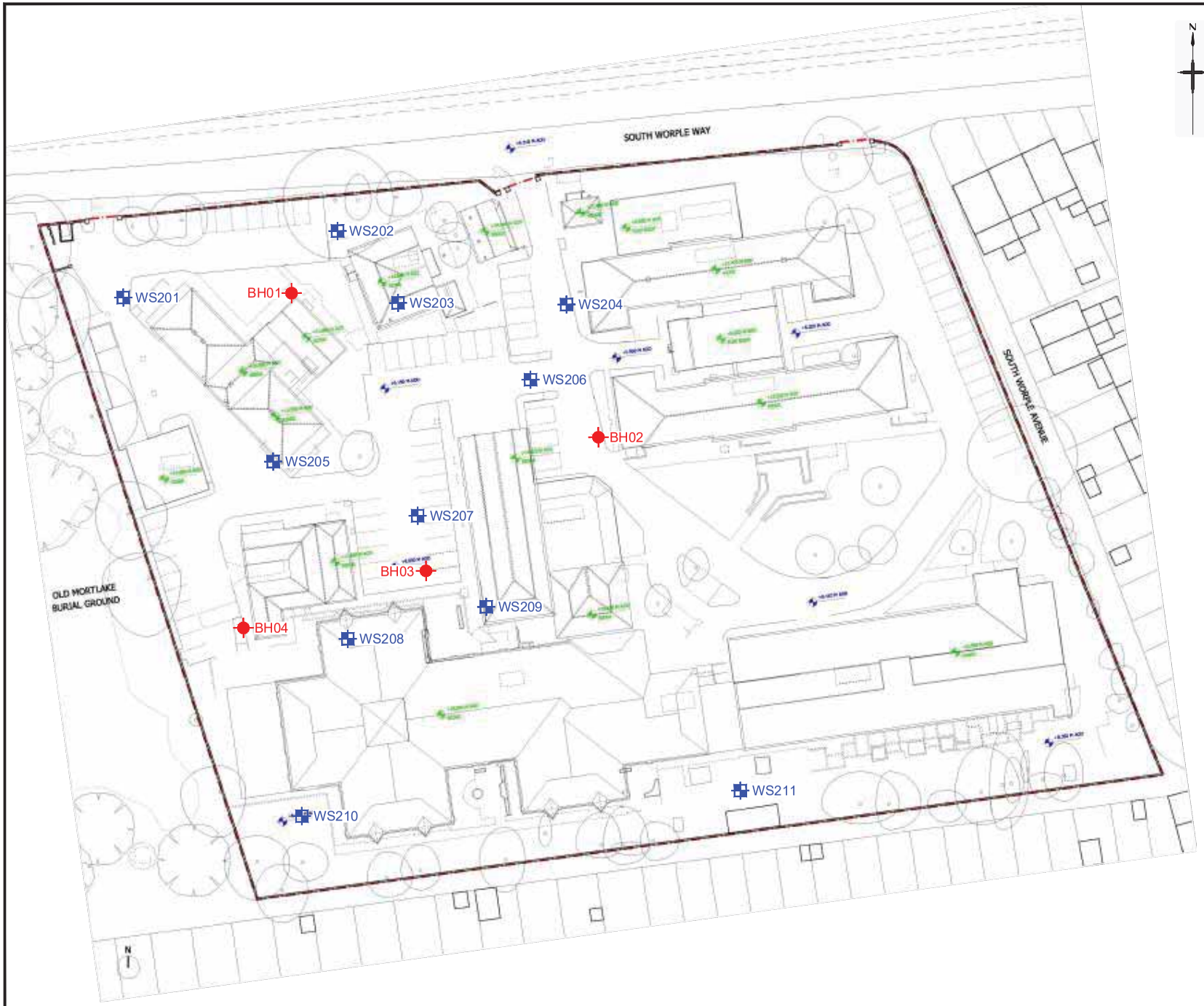
Project Title: BARNES HOSPITAL
PLOT A

Drawing Title: SITE LOCATION PLAN

Rev	Drawn	Date	Checked	Date	Approved	Date
01	SAY	20.01.20	HA	20.01.20	ZH	20.01.20

Dimensions	Scale	Original Size
m	1:25,000	A4

Project Number	Drawing File	Drawing Number
1920884 - R01 (00)	1920884 - SLP.dwg	FIGURE 1



LEGEND

- Site Boundary
- Borehole Location
- Window Sample Location

Rev.	Date	Amendment	Drawn	Chkd.	Appd.

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BARNES HOSPITAL
PLOT A

Drawing Title

SITE LAYOUT AND EXPLORATORY HOLE LOCATION PLAN

Drawn	Date	Checked	Date	Approved	Date
SAY	20.01.20	HA	20.01.20	ZH	20.01.20

Scale	Orig Size	Dimensions
1:600	A3	Metres

Project No.	Drawing File
1920884 (R01-00)	1920884 (R01-00) Fig 2.dwg

Drawing No.	Rev.
FIGURE 2	P1

Scale 1 : 600

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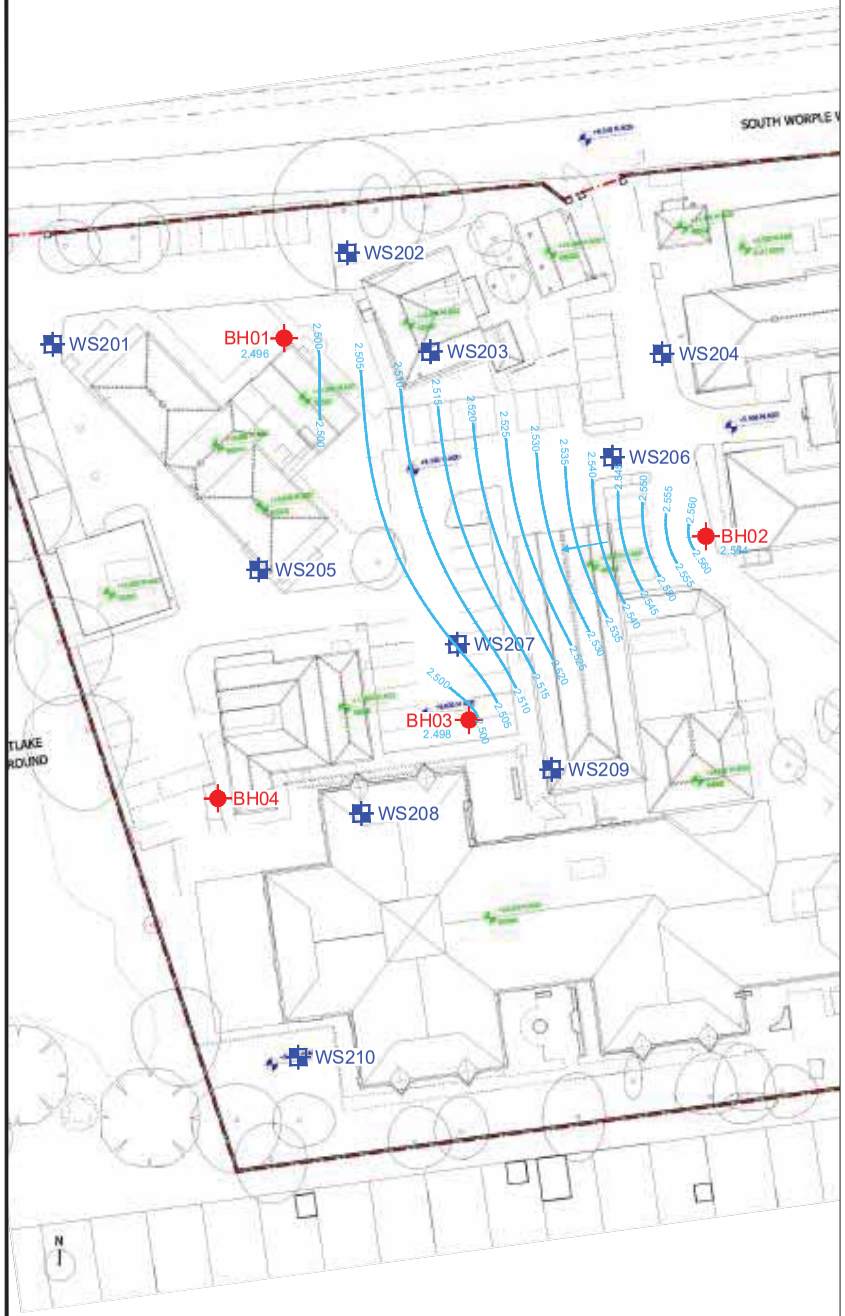

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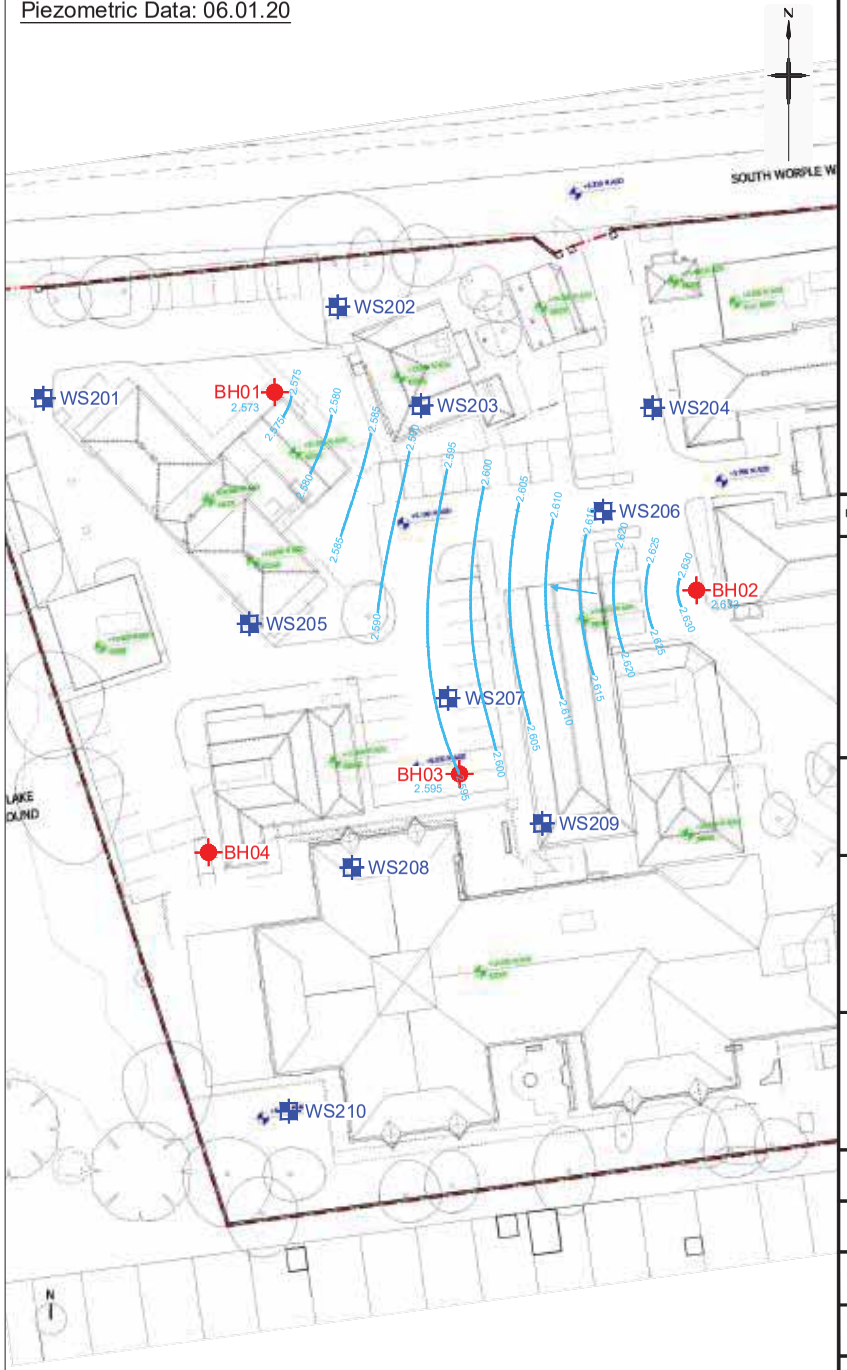

LEGEND

- Site Boundary
- Borehole Location
- Window Sample Location
- 6.943 Groundwater Level (mAOD)
- 7.05 Groundwater Contour (mAOD)
- Groundwater Flow Direction

Rev.	Date	Amendment	Drawn	Chkd.	Appd.

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BARNES HOSPITAL
PLOT A

Drawing Title

GROUNDWATER
PIEZOMETER PLAN

Drawn	Date	Checked	Date	Approved	Date
SAY	20.01.20	HA	20.01.20	ZH	20.01.20

Scale	Orig Size	Dimensions
1:600	A3	Metres

Project No.	Drawing File
1920884 (R01-00)	1920884 (R01-00) Fig 3.dwg

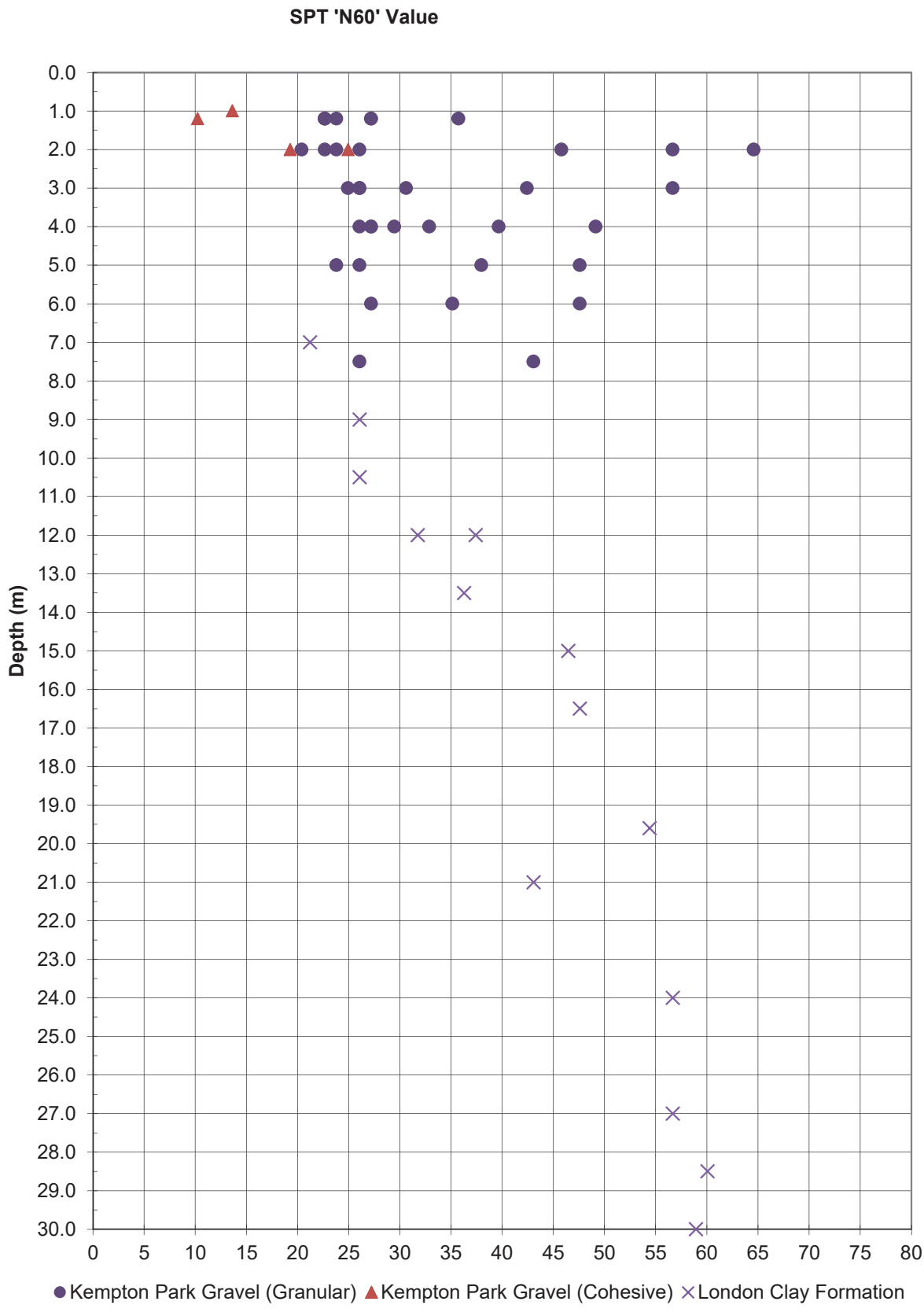
Drawing No.	Rev.
FIGURE 3	P1

Scale 1 : 600

0 8 16 24 32 40m

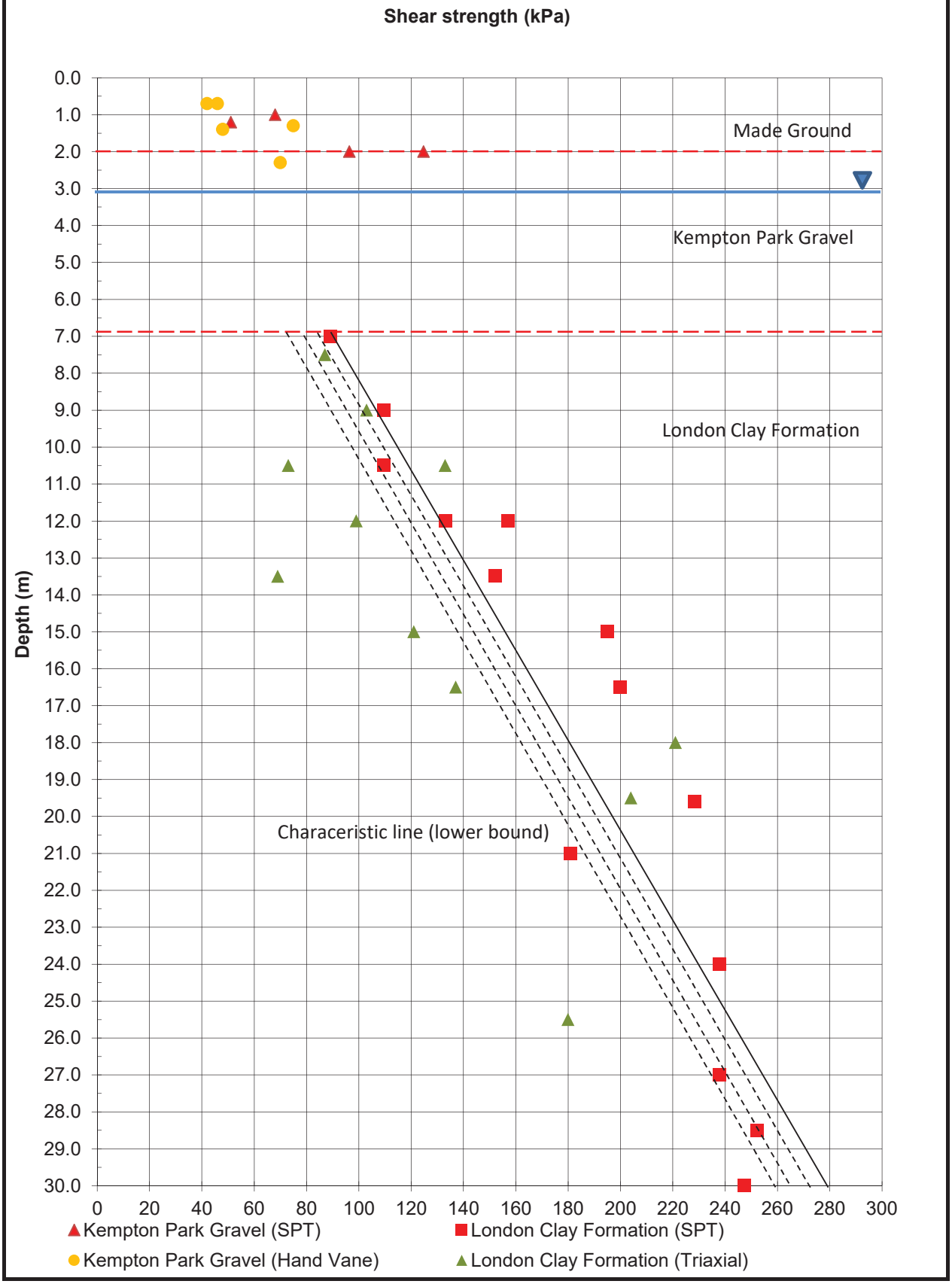
SPT 'N60' Value vs Depth (m)

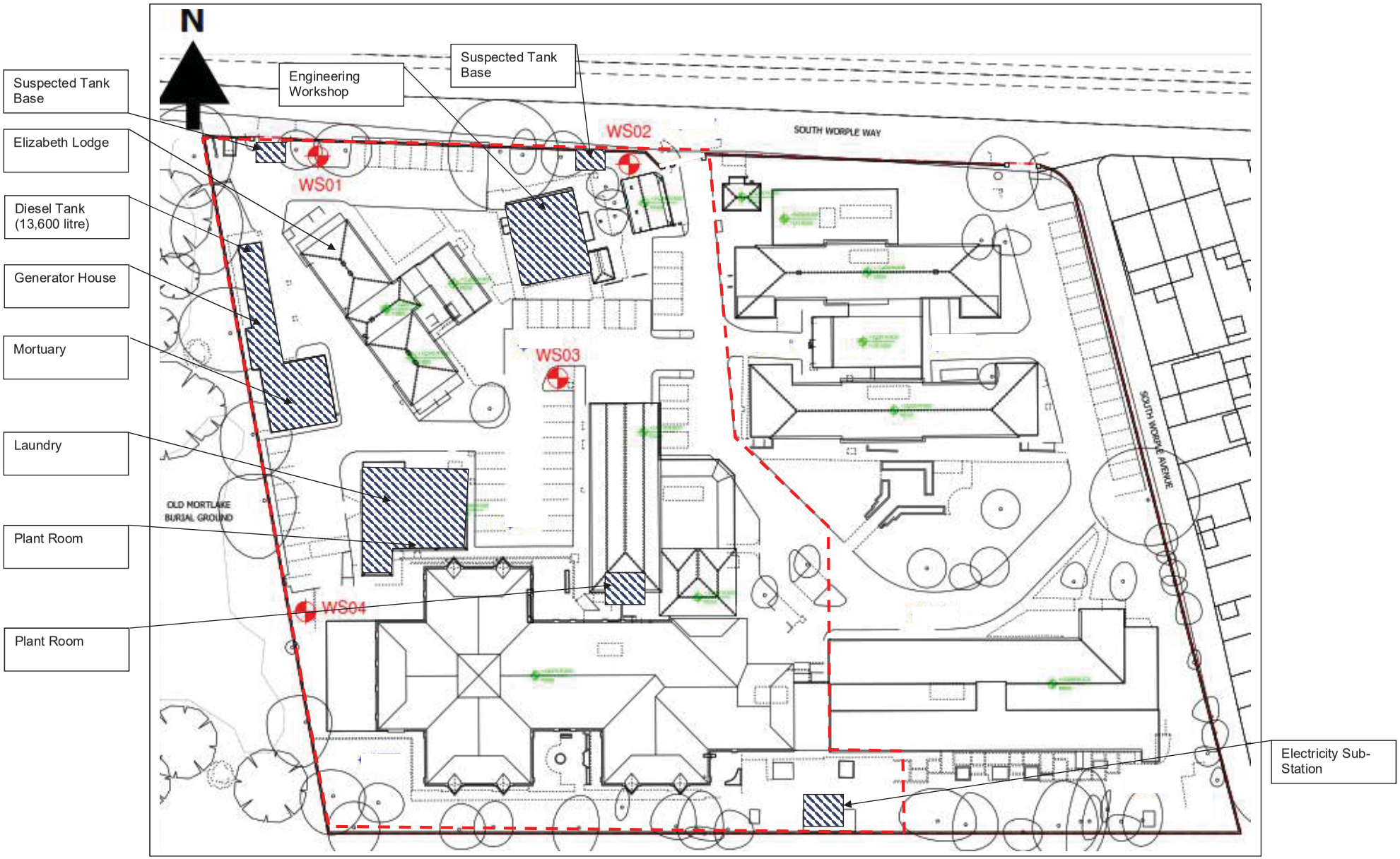
Site:	Client:	Job Number:	1920884
Barnes Hospital (Plot A)	Star Land UK Ltd c/o LS Estates Ltd	Figure:	4



Shear Strength vs Depth (m)

Site:	Client:	Job Number:	1920884
Barnes Hospital (Plot A)	Star Land UK Ltd c/o LS Estates Ltd	Figure:	5





RSK	**POTENTIAL AREAS OF CONCERN**	Client:	Star Land Realty UK Ltd c/o LS Estates Ltd	Figure No:	6
		Site:	Barnes Hospital (Plot A)	Job No:	1920884
		Scale:	NTS	Source:	RSK

APPENDIX A
SERVICE CONSTRAINTS

1. This report and the site investigation carried out in connection with the report (together the "Services") were compiled and carried out by RSK Environment Limited (RSK) for Star Land UK Ltd c/o LS Estates Ltd (the "Client") in accordance with the terms of a contract [RSK Environment Standard Terms and Conditions] between RSK and the Client. The Services were performed by RSK with the reasonable skill and care ordinarily exercised by an environmental consultant at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the Client.
2. Other than that, expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.
3. Unless otherwise agreed in writing, the Services were performed by RSK exclusively for the purposes of the Client. RSK is not aware of any interest of or reliance by any party other than the Client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. **Any such party would be well advised to seek independent advice from a competent environmental consultant and/or lawyer.**
4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK 's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date of this report, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.
5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the Client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between RSK and the client.
6. The observations and conclusions described in this report are based solely upon the Services which were provided pursuant to the agreement between the Client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off the site of asbestos, invasive plants, electromagnetic fields, lead paint, heavy metals, radon gas or other radioactive or hazardous materials, unless specifically identified in the Services.
7. The Services are based upon RSK's observations of existing physical conditions at the Site gained from a visual inspection of the site together with RSK's interpretation of information, including documentation, obtained from third parties and from the Client on the history and usage of the site, unless specifically identified in the Services or accreditation system (such as UKAS ISO 17020:2012 clause 7.1.6):

    a. The Services were based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely.

    b. The Services were limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the visual inspection.

    c. The Services did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services.

    RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and

including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the Client and RSK.

8. The intrusive environmental site investigation aspects of the Services are a limited sampling of the site at pre-determined locations based on the known historic / operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the properties of the materials adjacent and local conditions, together with the position of any current structures and underground utilities and facilities, and natural and other activities on site. In addition, chemical analysis was carried out for a limited number of parameters (as stipulated in the scope between the client and RSK, based on an understanding of the available operational and historical information) and it should not be inferred that other chemical species are not present.

9. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (intrusive and sample locations etc) annotated on site plans are not drawn to scale but are centred over the approximate location. Such features should not be used for setting out and should be considered indicative only.

10. The comments given in this report and the opinions expressed are based on the ground conditions encountered during the site work and on the results of tests made in the field and in the laboratory. However, there may be conditions pertaining to the site that have not been disclosed by the investigation and therefore could not be taken into account. In particular, it should be noted that there may be areas of made ground not detected due to the limited nature of the investigation or the thickness and quality of made ground across the site may be variable. In addition, groundwater levels and ground gas concentrations and flows, may vary from those reported due to seasonal, or other, effects and the limitations stated in the data should be recognised.

11. Asbestos is often observed to be present in soils in discrete areas. Whilst asbestos-containing materials may have been locally encountered during the fieldworks or supporting laboratory analysis, the history of brownfield and demolition sites indicates that asbestos fibres may be present more widely in soils and aggregates, which could be encountered during more extensive ground works.

12. Unless stated otherwise, only preliminary geotechnical recommendations are presented in this report and these should be verified in a Geotechnical Design Report, once proposed construction and structural design proposals are confirmed.

APPENDIX B
DEVELOPMENT DRAWINGS

Figured dimensions only are to be taken from this drawing. All dimensions are to be checked on site before any work is put in hand.

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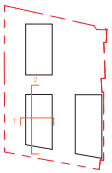

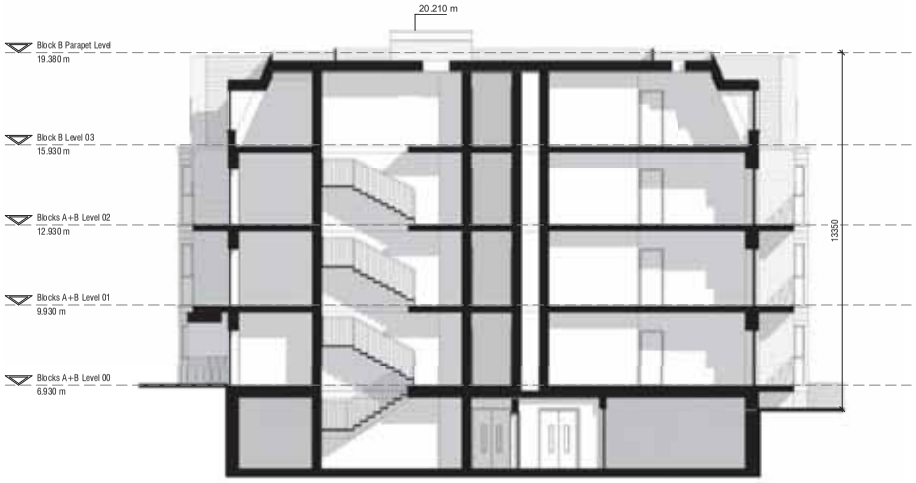

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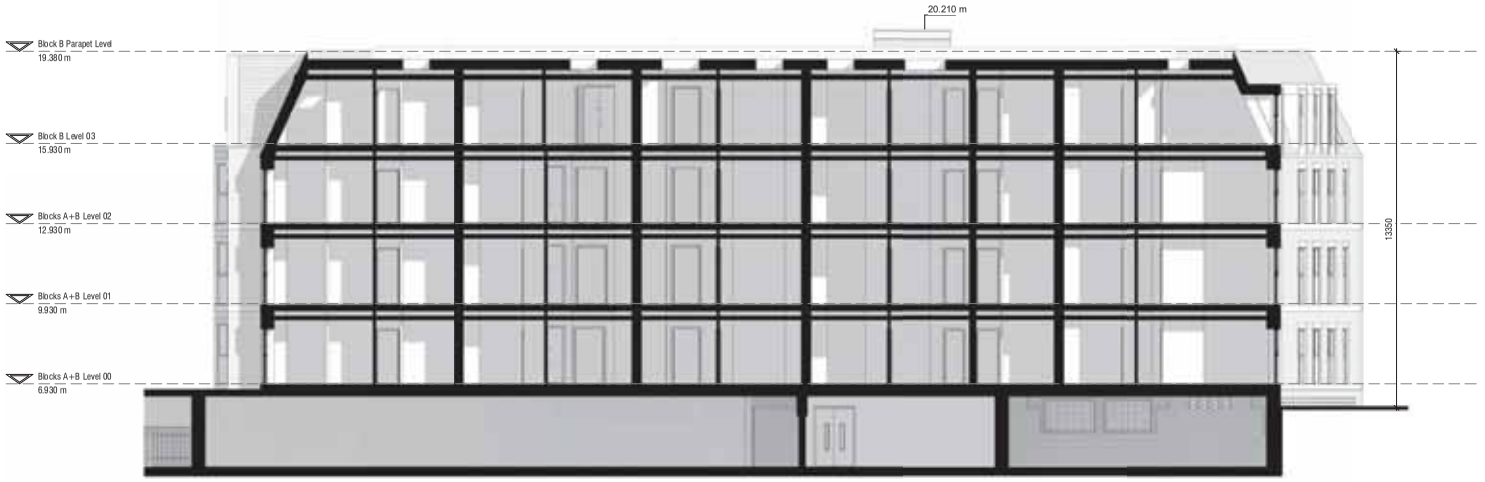

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3	For Planning Submission	31/05/2022	FS	OM
2	For Planning Submission	12/08/2021	FS	OM
1	For Information	30/07/2021	FS	OM

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Client's Name
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Job Title
Barnes Hospital Site

Drawing Title
Block B Sections

Scale
As indicated @A1

SBR Project No.
18387

SBR Project No. | Originator | Volume | Level | Type | Role | Number
18387-SBR-BB-XX-DR-A-85102

Suitability Code | Status | Rev
S4 - FOR STAGE APPROVAL | 4

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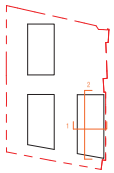

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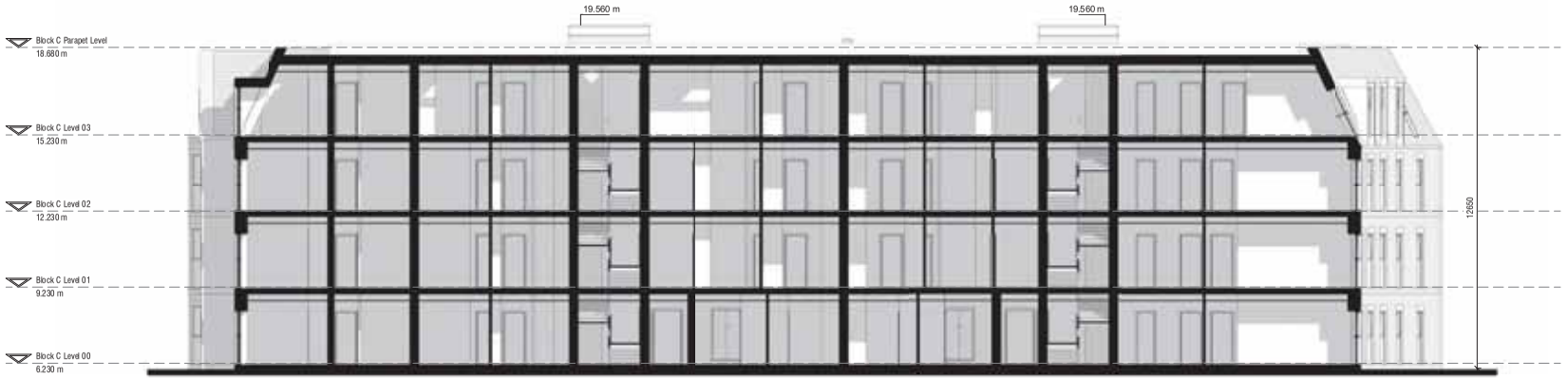

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3	For Planning Submission	31/05/2022	FS	OM
2	For Planning Submission	12/08/2021	FS	OM
1	For Information	30/07/2021	FS	OM

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Drawing Title
Block C Sections

Scale
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SBR Project No.
18387

SBR Project No. Originator Volume Level Type Role Number
18387-SBR-BC-XX-DR-A-85103

Suitability Code Status
S4 - FOR STAGE APPROVAL

Rev
4

Figured dimensions only are to be taken from this drawing. All dimensions are to be checked on site before any work is put in hand.

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19	For Planning Submission	31/05/2022	FS	OM
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17	For Planning Submission	20/01/2022	FS	OM
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15	For Planning Submission	17/08/2021	FS	OM
14	For Planning Submission	13/08/2021	FS	OM
13	For Planning Submission	12/08/2021	FS	OM
12	Update Desing Freeze	23/07/2021	FS	OM
11	Draft Planning Submission	09/07/2021	FS	OM
10	For Information	05/07/2021	FS	OM
9	For Information	23/06/2021	FS	OM
8	For Information	04/06/2021	FS	OM
7	For information	12/05/2021	FS	OM
6	For Information	10/05/2021	FS	OM
5	For Information	25/03/2021	FS	OM
4	Pre-App 2 Issue	25/02/2021	FS	OM
3	Building position update	08/02/2021	FS	OM
2	For Information	28/01/2021	FS	OM
1	For Information	14/01/2021	FS	OM

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Job Title
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Drawing Title
Proposed Site Plan

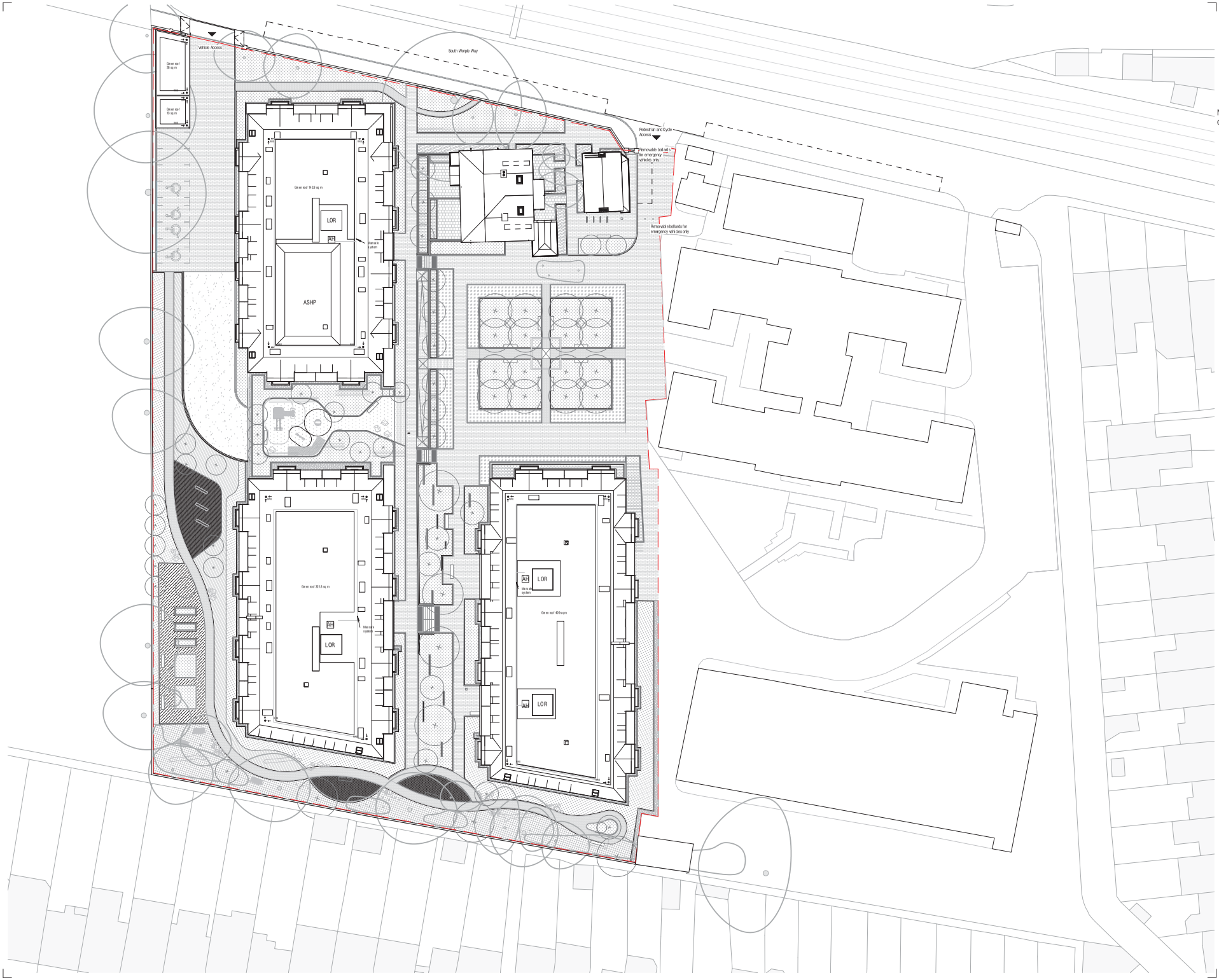
Scale
1 : 250 @A1

SBR Project No.
18387

SBR Project No. | Originator | Volume | Level | Type | Role | Number
18387-SBR- ZZ- 00-DR-A-80101

Suitability Code | Status
S4 - FOR STAGE APPROVAL

Rev
21



Figured dimensions only are to be taken from this drawing. All dimensions are to be checked on site before any work is put in hand.

metres 5 10 15 20 25

SCALE BAR: 1:250

NOTE: Top level roof and dormers are subject to design devlopment and facade coordination

Revision	Description	Date	Drawn	Checked
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12	For Planning Submission	14/09/2022	FS	OM
11	For Planning Submission	31/05/2022	FS	OM
10	For Planning Submission	04/02/2022	FS	OM
9	For Planning Submission	12/11/2021	FS	OM
8	For Planning Submission	13/08/2021	FS	OM
7	For Planning Submission	12/08/2021	FS	OM
6	Update Desing Freeze	23/07/2021	FS	OM
5	Draft Planning Submission	09/07/2021	FS	OM
4	For Information	05/07/2021	FS	OM
3	For Information	23/06/2021	FS	OM
2	For Information	04/06/2021	FS	OM
1	For Information	15/04/2021	FS	OM

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Client's Name
Star Land Realty UK Ltd.

Job Title
Barnes Hospital Site

Drawing Title
Proposed Site Roof Plan

Scale
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SBR Project No.
18387

SBR Project No. Originator Volume Level Type Role Number
18387-SBR- ZZ- 00-DR-A-80103

Suitability Code Status
S4 - FOR STAGE APPROVAL

Rev
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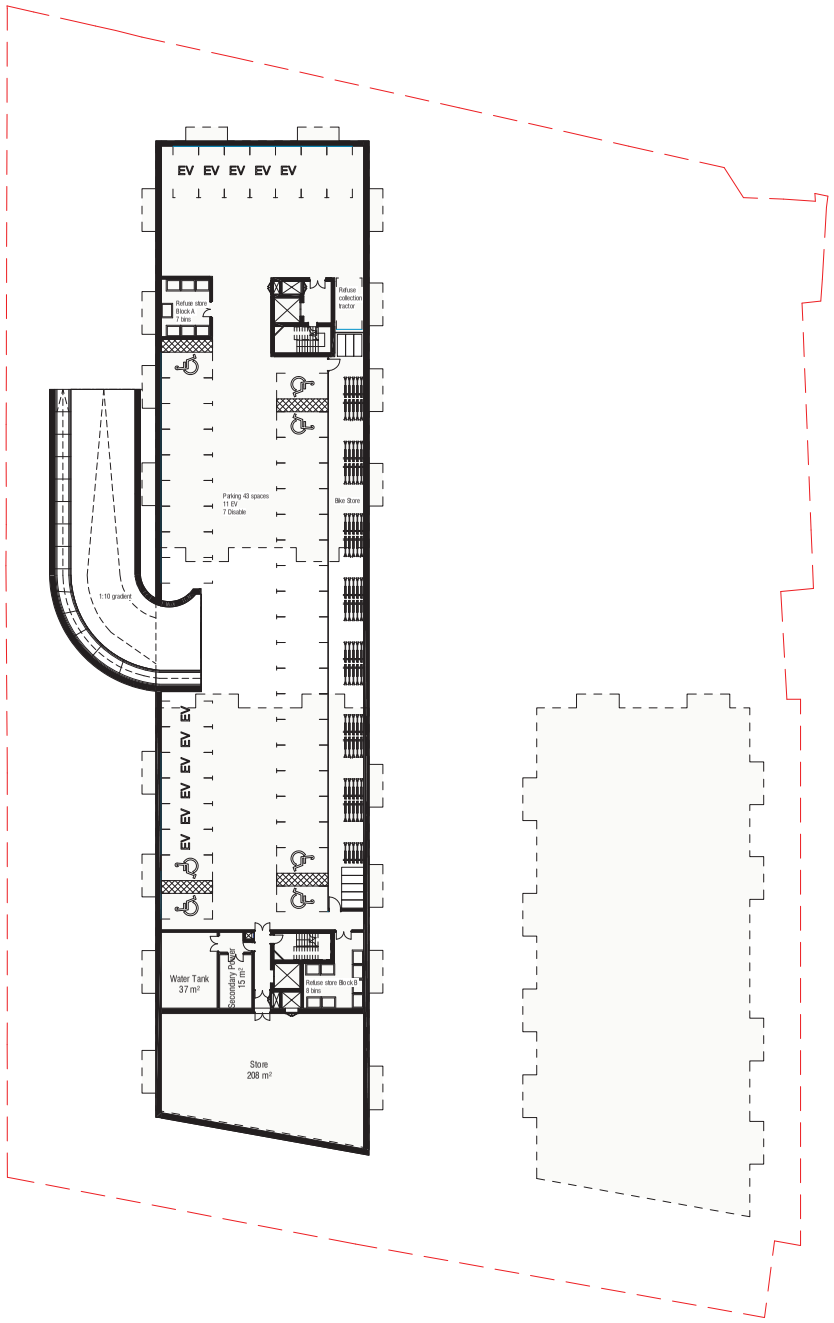

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14	For Planning Submission	12/11/2021	FS	OM
13	For Planning Submission	12/08/2021	FS	OM
12	Update Desing Freeze	23/07/2021	FS	OM
11	Draft Planning Submission	09/07/2021	FS	OM
10	For Information	05/07/2021	FS	OM
9	For Information	23/06/2021	FS	OM
8	For Information	04/06/2021	FS	OM
7	For information	12/05/2021	FS	OM
6	For Information	10/05/2021	FS	OM
5	For Information	25/03/2021	FS	OM
4	Pre-App 2 Issue	25/02/2021	FS	OM
3	Building position update	08/02/2021	FS	OM
2	For Information	28/01/2021	FS	OM
1	For Information	14/01/2021	FS	OM

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Client's Name
Star Land Realty UK Ltd.

Job Title
Barnes Hospital Site

Drawing Title
Basement Plan

Scale
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SBR Project No.
18387

SBR Project No. | Originator | Volume | Level | Type | Role | Number
18387-SBR- ZZ- B1- DR- A- 80102

Suitability Code | Status | Rev
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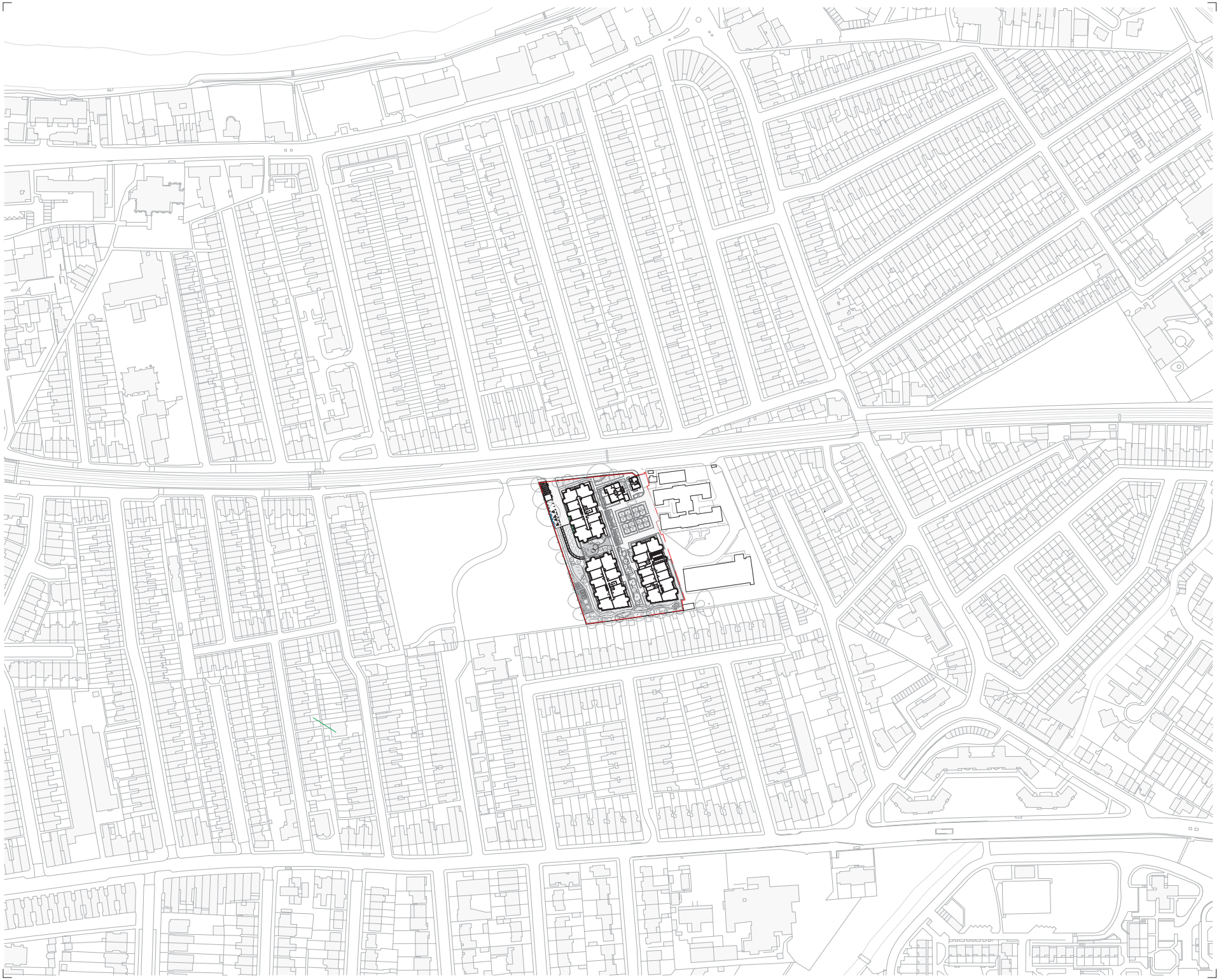

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5	For Planning Submission	12/11/2021	FS	OM
4	For Planning Submission	12/08/2021	FS	OM
3	Update Desing Freeze	23/07/2021	FS	OM
2	Draft Planning Submission	09/07/2021	FS	OM
1	Pre-App 2 Issue	25/02/2021	FS	OM

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Client's Name
Star Land Realty UK Ltd.

Job Title
Barnes Hospital Site

Drawing Title
Site Location Plan

Scale
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SBR Project No.
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Suitability Code Status
S4 - FOR STAGE APPROVAL

Rev
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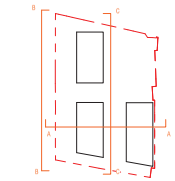

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2 **Site Section B**
1 : 500

3 **Site Section C**
1 : 500

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4	Update Desing Freeze	23/07/2021	FS	OM
3	Draft Planning Submission	09/07/2021	FS	OM
2	Building position update	08/02/2021	FS	OM
1	For Information	14/01/2021	FS	OM

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Client's Name
Star Land Realty UK Ltd.

Job Title
Barnes Hospital Site

Drawing Title
Site Sections

Scale
As indicated @A1

SBR Project No.
18387

SBR Project No. | Originator | Volume | Level | Type | Role | Number
18387-SBR- ZZ-XX-DR-A-85001

Suitability Code | Status | Rev
S4 - FOR STAGE APPROVAL | **7**

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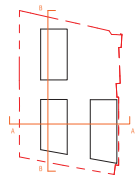

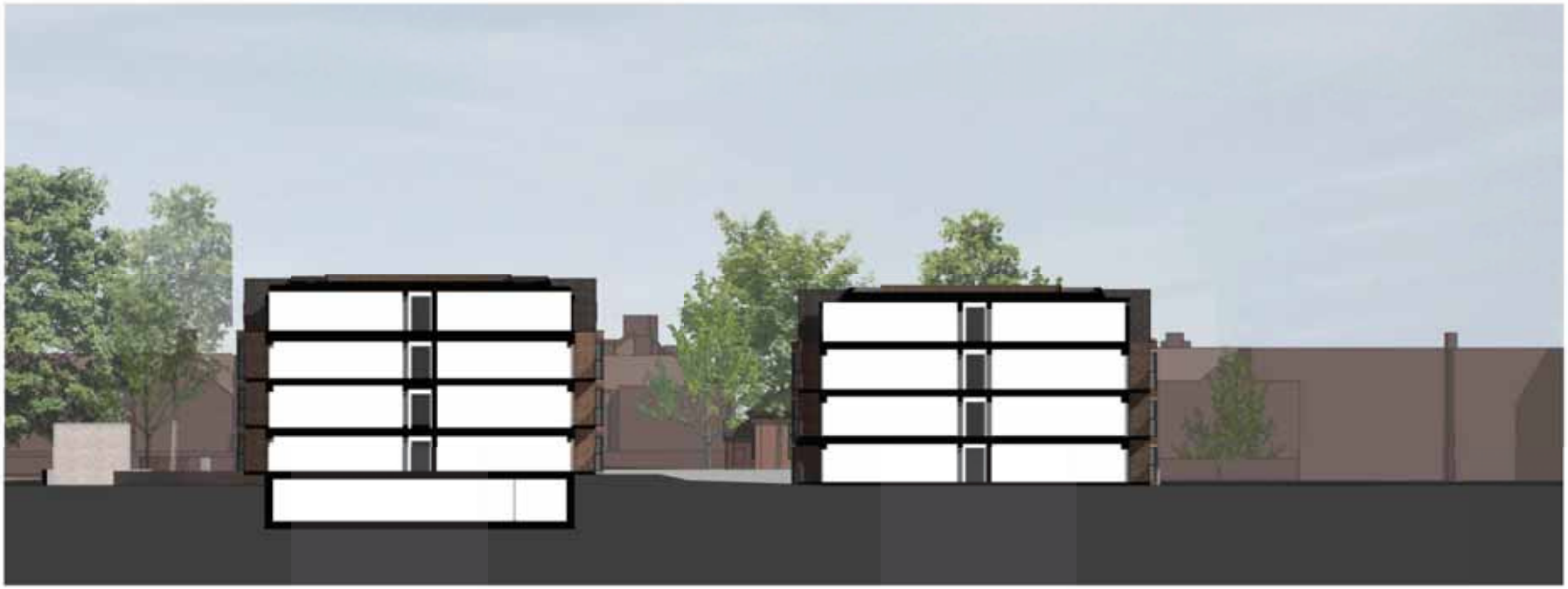

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6	For Planning Submission	14/09/2022	FS	OM
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3	Update Desing Freeze	23/07/2021	FS	OM
2	Draft Planning Submission	09/07/2021	FS	OM
1	For Information	15/04/2021	FS	OM

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Client's Name
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Job Title
Barnes Hospital Site

Drawing Title
Site Sections

Scale
As indicated @A1

SBR Project No.
18387

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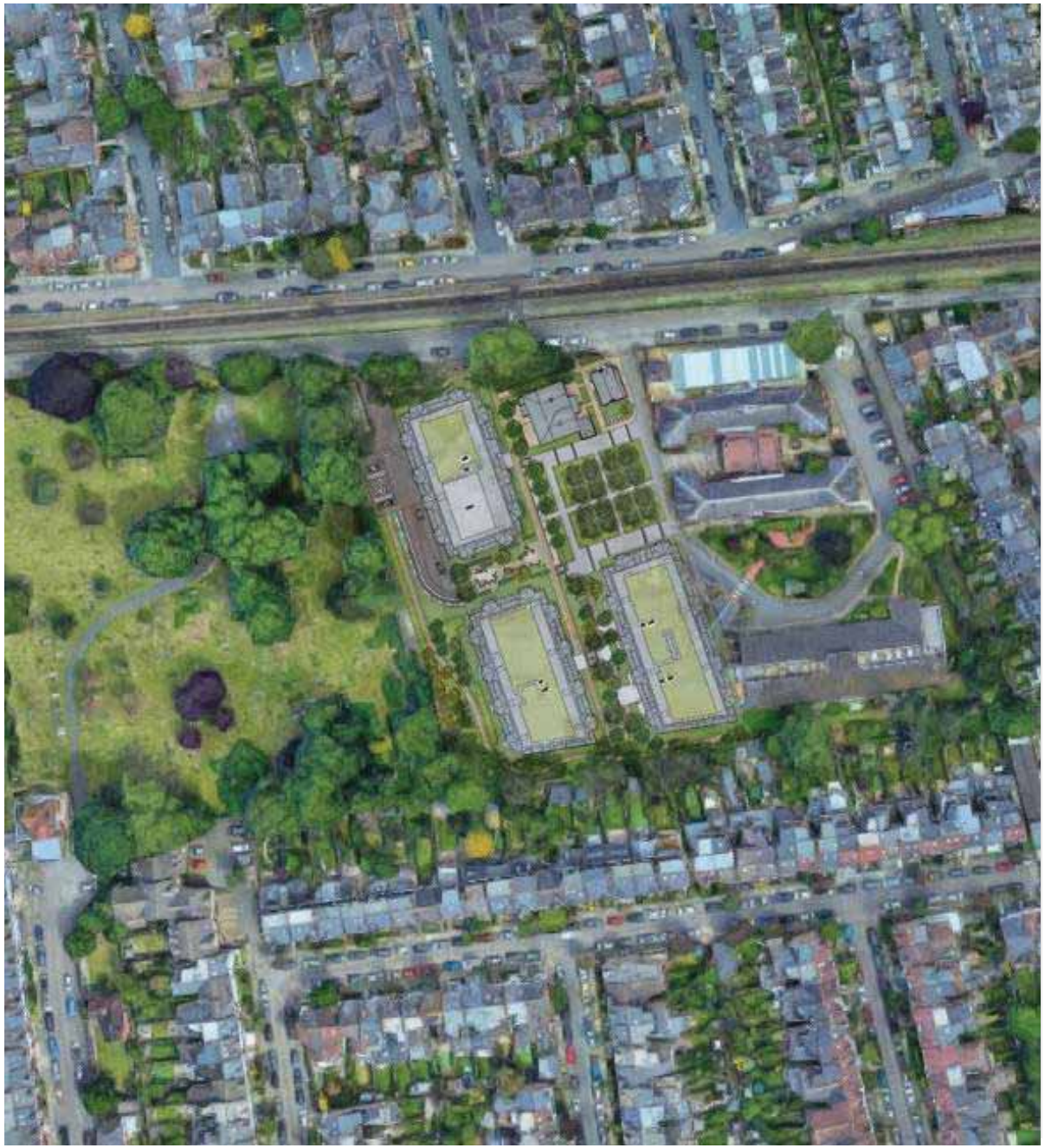
18387-SBR- ZZ-XX-DR-A-85002

Suitability Code Status
S4 - FOR STAGE APPROVAL

Rev
6



SCOTT BROWNRIGG

BARNES HOSPITAL RESIDENTIAL PLOT

DESIGN AND ACCESS STATEMENT
12 OCTOBER 2022

PREPARED FOR
STAR LAND REALTY LTD
REVISION 8

N:\Projects\18387

This report has been prepared for the sole benefit, use and information of Star Land Realty Ltd for the purposes set out in the report or instructions commissioning it. This report, together with further reports accompanying this application relate to the present situation and may be subject to supplementary information as discussions progress with the local authority.

Revision	Description	Issued by	Date	Checked
01	Draft 1	OM	**09/07/21**	RMcC
02	Draft 2	OM	**22/07/21**	RMcC
03	Draft 3	OM	**30/07/21**	RMcC
04	Planning	OM	**12/08/21**	RMcC
05	Planning	OM	**15/11/21**	RMcC
06	Planning	OM	**30/06/22**	RMcC
07	Planning	OM	**16/09/22**	RMcC
08	Planning	OM	**12/10/22**	RMcC

Approved	Richard McCarthy
Signature	
Date	12/10/2022

SCOTT BROWNRIGG

CONTENTS

1.0

INTRODUCTION

1.0

1.1 INTRODUCTION

This Design and Access Statement is prepared as part of the planning application submission in relation to the residential plot of the Barnes Hospital Site which received planning approval under the Outline Planning Permission (ref. 18/3642/OUT). This proposal seeks to optimise the site for residential use, in line with adopted and emerging policy.

The proposed development seeks to increase the height of Blocks B and C by an additional storey which reflects the height of the existing buildings on site while considering impact to neighbours and the surrounding context. The internal cores and building envelopes have been rationalised to reflect the low rise nature of the buildings and improve communal access control and reduce ongoing management charges. These changes result in an uplift of 26 additional residential units, bringing the total to 109 (including BTM's). In line with the Outline Planning Permission, 22% of the total residential units are proposed as affordable units, subject to viability.

1.2 PRE-APPLICATION PROCESS SUMMARY

We have undertaken a proactive and collaborative approach to engagement and entered into a Planning Performance Agreement (PPA) with the Council. As part of this process, a number of formal meetings and design workshops took place:

1. Pre-application Meeting 1, 5th November 2020 – introduced the proposals and the principle of a standalone application for the residential site. The initial scheme proposals included a single storey increase in height to Blocks A and B above the OPP parameters.

2. Pre-application Meeting 2, 4th March 2021 – the second meeting included the Council's Conservation Officer alongside the Case Officer and outlined the design development since the first meeting, in particular proposed increase in the height of Block C in line with that proposed for Blocks A and B.

3. Design Workshop 1, 30th April 2021 – a design workshop with the Case Officer, Conservation Officer and the Urban Design Officer whereby the proposals from the 2nd pre-app meeting were presented and discussed in detail.

4. Design Workshop 2, 19th May 2021 – a follow-up design workshop whereby the updated design (incorporating reduced massing to Block A) was discussed, with an additional focus on the detailed design elements of the scheme including elevation treatments, brick types, roofscape, gable ends and dormer windows.

5. Pre-application Meeting 3, 28th June 2021 – third meeting with Officers, including attendance from the Council's Affordable Housing and Planning Obligations/CIL teams, focussing on wider planning considerations including affordable housing, viability and accessibility.

At each stage of the pre-application process the design team sought to respond to comments raised and further refine the scheme accordingly.

The details of pre-application process are covered in the Design Evolution Section and also in Planning Statement by Avison Young. Below is the summary of pre-application meetings feedback.

The feedback confirmed that the principle of optimising residential use is supported, subject to design, residential quality, environmental and amenity testing and heritage.

The type of application (full standalone) was considered acceptable on the basis that a holistic approach to the redevelopment of the wider site, in terms of land use, could be maintained as required by the site's allocation and through adopting design principals founded by the Outline Consent. Additionally further consideration/information was requested regarding the demolition of buildings on the boundary of the SEN, including the impact on any conditions/obligations triggered upon demolition within the original planning permission.

1.3 THE PROJECT TEAM

Client - Star Land Realty UK Ltd

Development Manager - LS Estates Ltd

Project Manager & Employers Agent - Beadmans

Cost Consultant - Beadmans

Architect - Scott Brownrigg

Landscape Architect - Exterior Architecture

Planning Consultant - Avison Young

Building Services Engineer - Flatt Consulting

Structural & Civils Engineer - Robert Bird Group

Traffic & Highways - Motion

Arboriculture Consultant - Crown Tree Consultancy

1.4 LAND OWNERS AND DEVELOPMENT MANAGERS

Star Land Realty UK Ltd, is a 50:50 joint venture between Aurum Investments Ltd and Lee Kim Tah Holdings Ltd, both from Singapore.

The company with the assistance of LS Estates as Development Managers have purchased from the NHS Trust in March 2019 the Residential Plot of the Barnes Hospital site.

Aurum Investments is a subsidiary of Woh Hup Holdings, a successful privately owned construction company operating from Singapore with a 2,500 workforce and turnover of over £1bn. Aurum looks to invest in start ups and human centric proptechs with a focus to empower change and facilitate growth for business, professionals, individuals and its investments.

Lee Kim Tah is a property investment and development group with real estate investments across the globe including Singapore, UK, Germany, India, China, Indonesia and Australia.

Both company's owners have known and worked in partnership for many years and have several co investments in the UK including residential developments in Little Venice (45 units), Maida Vale (12 units), St John's Wood (165 units), Newmarket (21 units) and Basingstoke (120 units). They have further ambitions for residential development in the UK and wish to build a strong and reputable brand. The Barnes Hospital site offers the opportunity to provide quality housing that will satisfy their intentions.

LS Estates are a real estate company based in central London, who have been working with Woh Hup and Lee Kim Tah for over 4 years. The Directors, Mark Swetman and Duncan Trench have extensive experience of developing commercial and residential real estate in the UK, Ireland and Europe, delivering over 15million sf of real estate while working at Hammerson, Hines, Development Securities and U+I PLC. LS Estates share the objective of their client to make Barnes Hospital an exemplar project, with a focus on quality and an agenda for an environmentally responsible and sustainable development.

All parties have shown their intentions by appointing a highly professional and experienced consultant team to deliver the project and maintain the integrity of the planning consent

List of UK Projects

One Warrington Gardens, Little Venice, London W9

Residential development comprising 38 apartments, 3 penthouses, 4 marionettes, communal gardens and a basement car park. Completed in 1995.

One Morshead Road, Maida Vale, London W9

Character residential development comprising 12 two and three bedroom apartments. Completed in 1996.

Templar Court and Squire Gardens, St John's Wood Road, London NW8

Residential development comprising 34 apartments, 9 townhouses, central landscaped courtyard and basement car park. Completed in 1997.

The Pavilion Apartments, St John's Wood, London NW8

Residential development comprising 122 apartments, penthouses and a basement car park. Completed in 2000.

West Smithfield, London EC1

Refurbishment development consisting of offices and A3 space. Completed in 2001.

Meadowcroft, Newmarket

Residential development comprising 17 apartments and 4 townhouses. Completed in 2003.

The Grove, Newmarket

Completed in 2005.

Aurum Green, Chineham, Hampshire, RG24
New residential development comprising of 78 2-5 bedroom homes.

1.5 ARCHITECT - SCOTT BROWNRIGG

Scott Brownrigg is a collaborative international design practice specialising in architecture, masterplanning, urbanism and interior design.
We enrich lives through the built environment.

“We believe that the actions of every member of staff can make a positive difference to the environment and that every project is an opportunity to protect and enrich the environment to create a better world.”

“We are signatories of the Architects Declare movement, and the RIBA 2030 Climate Challenge and are one of few architects to have signed up to the UN Global Compact. These commitments inform our environmental objectives and targets.”

Kidderpore Avenue, Hampstead, London Borough of Camden (Winner of the ‘Best Conversion’ in Evening Standard New Homes Awards’ & winner of the ‘Silver Award for the Best Renovation’ category at the What House Awards)

Vista, Battersea, London Borough of Wandsworth (Commmedned for Sunday Times British Homes Award)

Cambium, Southfields, London Borough of Wandsworth (Shortlisted for ‘Resi Development of the Year’ Award & ‘Sunday Times British Homes’ Award)

The Woods, Wobum, Bedforshire (Winner of ENES for Energy Efficiency)

2.0

SITE CONTEXT

2.1 SITE

The site comprises a number of red-brick buildings ranging in date from 1889-1999, some of which are identified as Buildings of Townscape Merit by the London Borough of Richmond. The more recent buildings on the site are of no architectural merit.

The site is not located within a Conservation Area. It lies adjacent to the Queen's Road, Mortlake Conservation Area which was designated in 1982 and subsequently extended in 1998. The east boundary of the conservation area, which follows the line of the cemetery wall, forms the western boundary of the site.

No local views are identified within the Conservation Area Guide. However, views from and across the cemetery that is adjacent to the Site are likely to be affected by the proposed development, which have been taken into consideration.

There are no statutorily listed buildings on the site, or within 250m of the site boundary. The nearest locally listed building to the site are those on Lodge Avenue to the west and No. 3-24 on North Worple Way to the north of the site.

The OPP granted approval for the demolition of all the buildings on-site with the exception of two of the BTMs; 'The Entrance Lodge' and 'The Recreation Hall'.

2.2 SURROUNDING CONTEXT

The houses surrounding the site are characteristic of late nineteenth and early twentieth century domestic suburban development in London. These houses have a certain picturesque value when taken together, whilst not making particular contributions to the significance of the Conservation Area as individual buildings. Mortlake Old Burial Ground has lost its setting as a semi-rural landscape and has been surrounded by residential and hospital development for in excess of 100 years. Therefore, its setting is decidedly semi-urban in character.

Barnes Hospital Site in Red, Queen's Road Mortlake Conservation Area in Yellow

View of houses backing onto South Worple Avenue

View of houses on South Worple Way facing East

General view of site

Images from Squire and Partners Outline Planning Application document

BUILDINGS OF TOWNSCAPE MERIT (BTM'S)

BTMs to be Retained

1

2

Buildings of Townscape Merit on Site

1. *Entrance Lodge*
2. *Recreation Hall*
3. *Gatehouse*
4. *Fleming Ward*
5. *Beatrice Ward*
6. *Administration Building*
7. *Laundry Building*
8. *A Elizabeth Lodge*

Images from Squire and Partners Outline Planning Application document

SITE CONTEXT & CONSERVATION AREA

Existing buildinga re indicated on the diagram below. As noted previously BTM's A,B,C are retained.

Towards the east of the site lies Queen's road (Mortlake) Conservation Area.

Refer to Townscape and Heritage section for more details.

Key

A	Recreation Hall
B	Entrance Lodge
C	Gatehouse
D	Fleming Ward
E	Beatrice Ward
F	Administration Building
G	Laundry
H	Elizabeth Lodge

Queen's Road [Mortlake] Conservation Area 35

Site

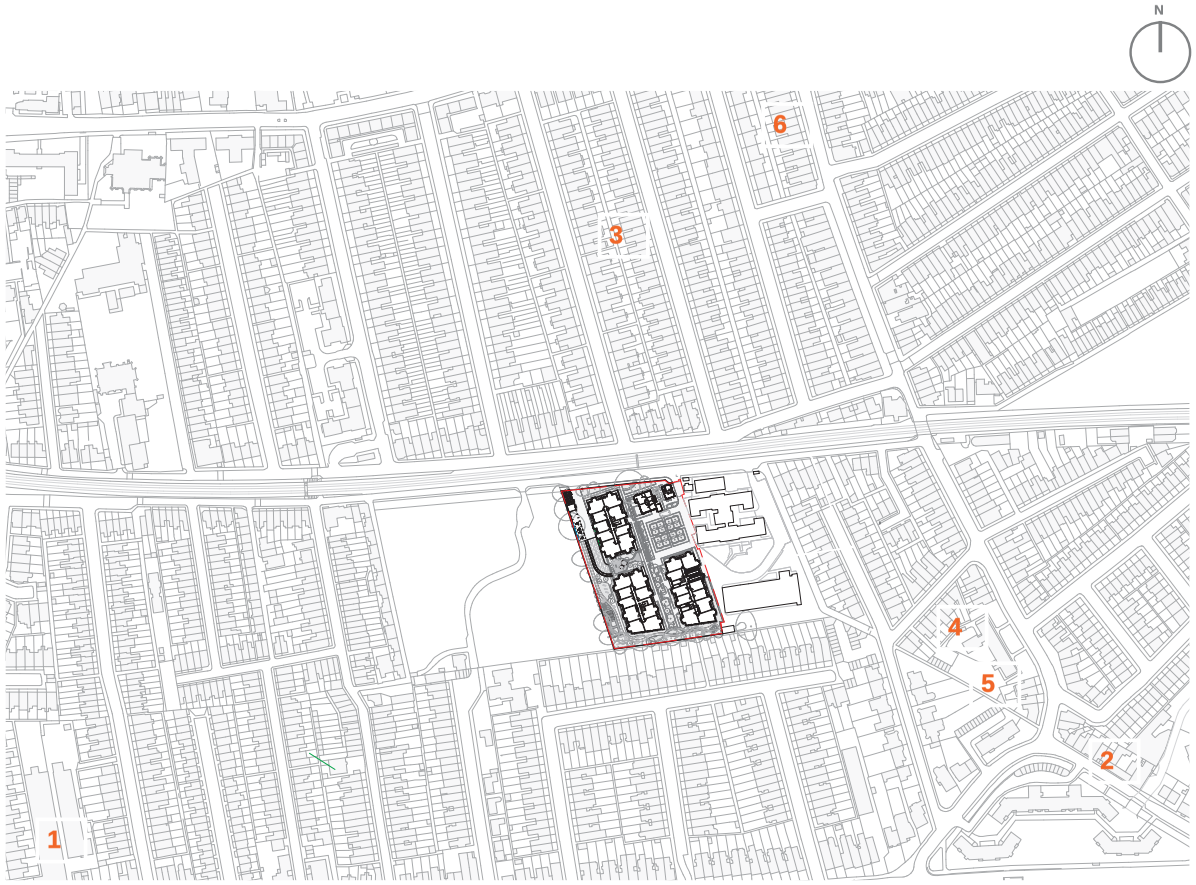
Images from Squire and Partners Outline Planning Application document

EXISTING & SURROUNDING BUILDING HEIGHT

The existing buildings on site range between 5 to 13.5m with the height rising towards the south boundary. The surrounding buildings height ranges between 6.5- 12m, whilst there are some individual buildig of over 13m.

Existing buildings of 4 storey are indicated on the next page.

EXISTING NEARBY 4 STOREY DEVELOPMENTS



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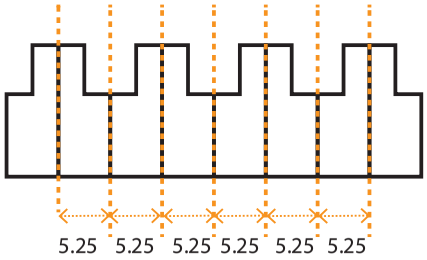
6

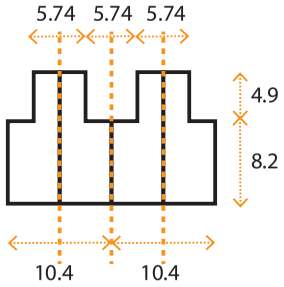
2.3 LOCAL ARCHITECTURE TYPOLOGIES & CHARACTERISTICS

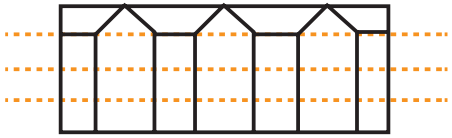
The existing buildings in the conservation area and along Fitzgerald Avenue provide the inspiration to experiment with the potential volume and form of the proposals. This section identifies a selection of typical building forms, details and materials that can be found in the surrounding context, which help give the site its scale and character.

This proposal looks to draw inspiration from these vernacular details while adhering closely to the guidelines set in the design code, to ultimately enhance the site character.

Building Proportions







Materials and Details

Gables - Mono Pitch

Windows and Bays

Images from Squire and Partners Outline Planning Application document

3.0

PLANNING HISTORY AND OPP

3.1 PLANNING HISTORY

In November 2017, CPMG (Architects) submitted a pre-planning application proposal which provided a replacement health centre [Use Class D1] of approx. 2,835 sqm and 76 residential units - mix of 1, 2, 3 and 4 bed units, with an outlined area for a school use.

In November 2018 Squire and Partners submitted an Outline Planning Application for the South West London and St George's Mental Health NHS Trust for a mixed used scheme comprising of a Health Hub [use class D1], a Special Educational Needs [SEN] school [use class D1] and residential accommodation [use class C3], in addition to extensive landscaping.

The Outline Planning Permission (OPP) Reference No. 18/3642/OUT was approved on 14 September 2020.

The OPP granted approval for a three-part phased development of the site: (1) the residential part, (2) the SEN School and (3) the health centre. This pre-application relates to the residential part only which occupies the western half of the site totalling 7,993 sqm. The OPP approves the development of up to 80 residential units with associated car and cycle parking within three blocks of two and three storeys.

There are two sets of 'Control Documents' approved. These are:

1. The 'Parameter Plans'; and
2. The 'Design Code'.

Previous Scheme Proposed by CPMG Architects Nov 2017

Pre-application by Squire and Partners May 2018

Outline Application by Squire and Partners Nov 2018

Images from Squire and Partners Outline Planning Application document

3.2 SUMMARY OF THE KEY DETAILS OF THE PARAMETER PLANS

Land Use

- Site Area: approx. 14,350 sq. m / 1.4 ha / 3.5 acres

Proposed Use: A mixed use scheme consisting of;

- Health Hub [Use Class D1] (0.3 ha)
- SEN School [Use Class D1] (0.3 ha)
- Residential Accommodation [Use Class C3] (0.8 ha)

Health Hub

- Total GIA: up to 2,500 sqm
- Car parking: up to 26 no. bays [inc. 4 no. Accessible]
- Cycle bays: up to 27 no. [inc. 17 Short Stay]

SEN School

- Total GIA: up to 2,402 sqm
- Car Parking: up to 11 no. bays
- Cycle bays: up to 26 no. bays [inc. 18 no. short stay]

Residential Accommodation New Build

- Total NIA: up to 5,570 sqm 59,955 sq.ft
- Total GIA: up to 6,918 sqm 74,465 sq.ft
- No. of Blocks: up to 3 no.
- Car parking: up to 44 no. bays [Ratio of 0.53 per unit, inc. 10% accessible]
- Cycle Storage: up to 153 no. [inc. 2 no. short-stay provision at ground level]
- Approx. No. Flats: up to 80 no.

Residential Accommodation Existing

- Retaining 3 of the Buildings Of Townscape Merit [BTM]
- Recreation Hall [GIA: 138 sq.m] - for residential use, up to 2 units
- Entrance Lodge [GIA: 82 sq.m] - for residential use, up to 1 unit

OUTLINE PLANNING APPLICATION - PROPOSED PLOT USES

Images from Squire and Partners Outline Planning Application document

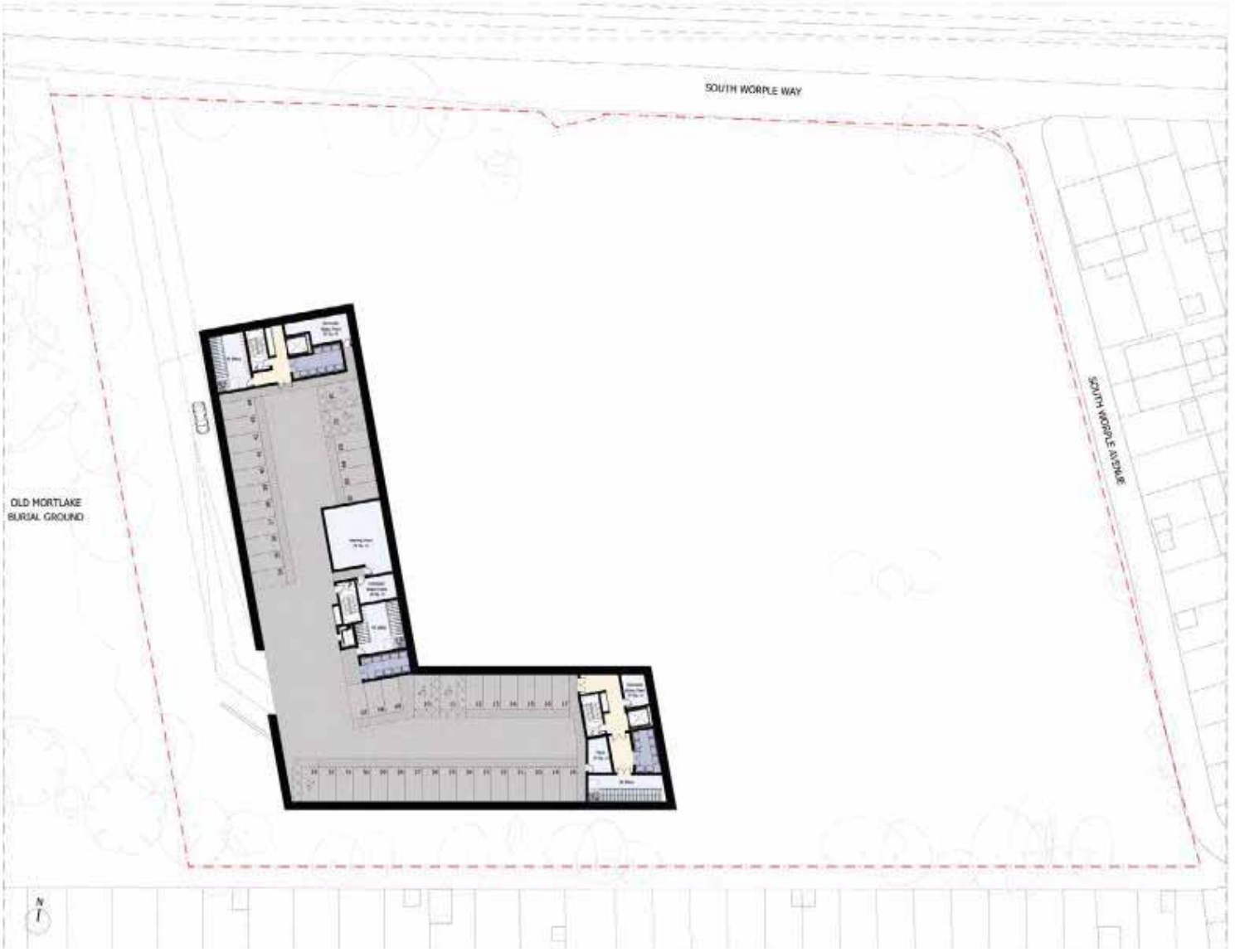
OUTLINE PLANNING APPLICATION - APPROVED HEIGHTS

Images from Squire and Partners Outline Planning Application document

OUTLINE PLANNING APPLICATION - CONSENTED MASTERPLAN

Images from Squire and Partners Outline Planning Application document

OUTLINE PLANNING APPLICATION - PARKING



Images from Squire and Partners Outline Planning Application document

3.3 OPP INDICATIVE SCHEDULE OF AREAS

Proposed New Build Residential Blocks Unit Areas
[excluding retained BTMs - Entrance Lodge & Recreation Hall]

Block A:

Floor	Unit No.	NIA [sq. m]	Unit Type
Ground Floor	1	70	2B 4P
	2	95	3B 6P
	3	54	1B 2P
	4	73	2B 4P
	5	86	3B 5P
	6	70	2B 4P
	7	62	1B 2P
	8	62	1B 2P
First Floor	9	73	2B 4P
	10	51	1B 2P
	11	70	2B 4P
	12	86	3B 5P
	13	62	2B 3P
	14	77	2B 4P
	15	94	3B 5P
	16	77	2B 4P
	17	55	1B 2P
Second Floor	18	86	3B 5P
	19	88	3B 5P
	20	50	1B 2P
	21	50	1B 2P
	22	51	1B 2P
	23	67	1B 2P
	24	76	2B 4P
Total	24	1685	

Block B:

Floor	Unit No.	NIA [sq. m]	Unit Type
Ground Floor	1	70	2B 4P
	2	87	3B 5P
	3	72	2B 4P
	4	72	2B 4P
	5	87	3B 5P
	6	53	1B 2P
	7	50	1B 2P
	8	51	1B 2P
	9	50	1B 2P
First Floor	10	88	3B 5P
	11	70	2B 4P
	12	84	2B 4P
	13	84	2B 4P
	14	87	3B 5P
	15	76	2B 4P
	16	50	1B 2P
	17	51	1B 2P
	18	61	2B 3P
Second Floor	19	73	2B 4P
	20	54	1B 2P
	21	77	2B 4P
	22	70	2B 4P
	23	71	2B 4P
	24	77	2B 4P
	25	55	1B 2P
	26	74	2B 4P
Total	26	1794	

Block C:

Floor	Unit No.	NIA [sq. m]	Unit Type
Ground Floor	1	74	2B 4P
	2	53	1B 2P
	3	52	1B 2P
	4	51	1B 2P
	5	70	2B 4P
	6	99	3B 6P
	7	74	2B 4P
	8	74	2B 4P
	9	52	1B 2P
	10	97	3B 6P
First Floor	11	90	3B 5P
	12	73	2B 4P
	13	55	1B 2P
	14	52	1B 2P
	15	75	2B 4P
	16	55	1B 2P
	17	56	1B 2P
	18	96	2B 4P
	19	93	2B 4P
	20	97	3B 6P
Second Floor	21	66	2B 3P
	22	54	1B 2P
	23	55	1B 2P
	24	56	1B 2P
	25	68	2B 3P
	26	99	2B 4P
	27	54	1B 2P
	28	53	1B 2P
	29	72	2B 4P
	30	76	2B 4P
Total	30	2091	

Proposed New Build Residential Blocks

	No. of Units	NIA [sq. m]	GIA [sq. m]	GEA [sq. m]
Total	80	5570	6918	7516

Residential Basement Car Park

	GIA [sq. m]	GEA [sq. m]
Total	1894	2163

This aligns with the agreed **new build** residential unit mix:

1B2P - 30no. (37%)
2B3P - 4no. (5%)
2B4P - 32no. (40%)
3B5P - 10no. (13%)
3B6P - 4no. (5%)

3.4 SUMMARY OF THE KEY ARCHITECTURAL REQUIREMENTS OF THE DESIGN CODE

Height

- The top floor of the residential blocks shall be combined with a pitched roof to avoid a separate roof storey giving additional height to residential buildings consisting of three storeys of accommodation.
- The eaves heights will vary to create playful elevations and must not exceed a maximum height of 6m, not including brick balustrades.
- The top floor of the residential blocks shall be designed to include gables and dormer windows to improve the internal efficiency and to limit areas of restricted head height.

Scale

- The top floor of the residential blocks shall be combined with a pitched roof to the scale found in local residential architecture and the existing site.
- Projecting bay windows on the first and second storeys shall be consistent with the design and scale of similar design features found in local residential architecture and the existing site.
- Gables shall be designed to the scale of similar design features found in local residential architecture and the existing site.
- The building plane shall not exceed a maximum of 8m of a single continuous surface before introducing projecting or receding detail.

Massing

- The residential blocks shall be designed with projecting gables of no less than 0.5m [except south facing elevations of Blocks B and C and reduced depths of projecting gables on west facing elevations of Blocks A and B] of varying depths to add variety and articulation.
- Separation between residential massing blocks should not be less than a minimum 13.5m. Where distances between building lines is below 13.5m, facing bay windows must be offset in their alignment to maximise separation and facing windows shall only serve non habitable rooms
- Between Blocks B and C, there shall be a minimum of 13.5m distance between bay windows, a minimum of 15.3m between projecting gables and a minimum of 17m between main facing elevations.
- The southern building line of residential Blocks B and C shall be not less than 20m from the rear building line of dwellings fronting Grosvenor Avenue as well as a minimum of 8.25m from the southern boundary to allow enough clearance for tree preservation and amenity space for the residential blocks.

Build form and Character

- Elevations should also be carefully considered relative to their orientation in terms of sunlight and in terms of overlooking issues.
- Particular sensitivity should be given to the elevations addressing Grosvenor Avenue, reducing impression of mass through roof design and form.
- Each residential block shall integrate a combination of pitched roofs [with a maximum pitch of 65° to respond to the design and scale found in the surrounding area and the existing site] and flat roofs which integrate wild flowers or brown roofs where possible in order to support local biodiversity as well as photovoltaic panels and roof lights.
- There must be no dormer windows or gables to the southern elevations of Blocks B and C facing Grosvenor Avenue. The residential blocks shall be designed with dormer windows of varying sizes to add variety and articulation to the massing set modestly in the roof space, not appearing overly dominant.
- The dormer windows must be smaller in width than the windows below and generally to be centred on windows in storeys below.

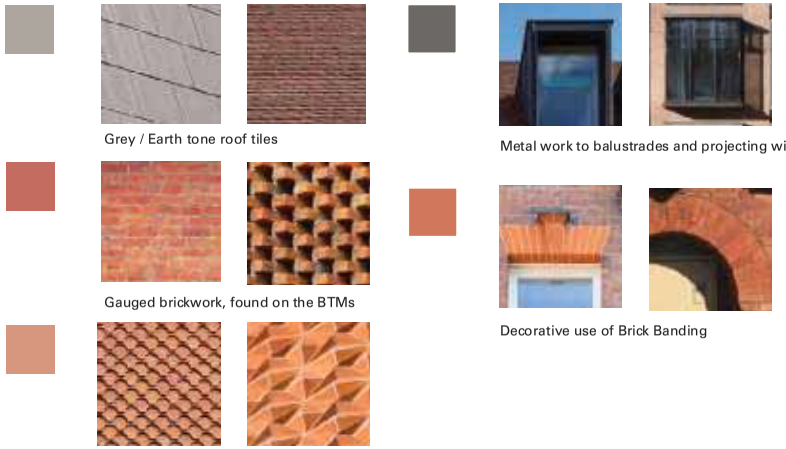
Materials

- The primary finish to the residential blocks will be good quality brickwork, flush pointed.
- Copings and string-courses are to be of York or Portland stone.
- Windows, doors and projecting bay windows are to be of painted metal with mullions, transoms and casements or of hardwood timber with painted metal secondary type mullions, transoms and casements.
- The architectural housings of dormer windows are to be clad and flashed in lead or zinc.
- Windows to dormers are to be as windows, doors and projecting bay windows, above.
- Roofs are to be of good quality red clay or slate tiles and flashed in lead or zinc.
- Glazing to windows is to be low-iron glass with no green caste.
- Any window frame sitting in a brick wall should be recessed by a minimum of 100mm.
- Juliet balconies and balustrades are to be of painted steel with no visible fixings.
- Rain water pipes, hoppers, gutters and all ancillary components are to be of painted metal.

Illustrative Western Elevation of Block A

Illustrative Western Elevation of Block B

Typical Facade - Material Palette



Grey / Earth tone roof tiles

Metal work to balustrades and projecting wi

Gauged brickwork, found on the BTMs

Decorative use of Brick Banding

Images from Squire and Partners Outline Planning Application document

3.5 SUMMARY OF THE KEY LANDSCAPING AND EXTERNAL AMENITY REQUIREMENTS OF THE DESIGN CODE

Landscaping Strategy

- The residential buildings will be arranged around a Garden Square at ground level which will be publicly accessible.
- The residential blocks shall be softened on all sides [except that abutting the western vehicular ramp and restricted distance between Block C and the SEN School boundary] by at least 2m of soft landscaping before meeting the public realm for provision private external amenity space.
- The perimeter of the residential use BTMs, and residential Blocks A, B and C, as well as between Blocks A and B and between B and C could be used to provide private external amenity space. Details of delineation between publicly accessible portions of external amenity space and private residential external amenity space to be agreed by the LPA.
- There shall be no control gates at the entrance of the residential development.
- Amenity space for the residential units shall be provided within the communal gardens.
- Based on a minimum provision of 5 sq. m per flat plus an additional 1 sq.m per additional occupant, a total of 534 sq. m is required for residential amenity space.
- Provision will be made within this communal amenity space for on-site play area in accordance with London Plan standards [10 sq. m/child unless justified to satisfaction of the LPA].
- The Garden Square shall be an area of not less than 1200 sq. m.
- Planting and pathways to the Garden Square will be designed to avoid overly delineated separation.
- The landscape treatment of the external amenity spaces between the residential blocks will be designed to be consistent with and subordinate to the Garden Square.
- Communal gardening should be encouraged to be incorporated where feasible.

Boundary

- Boundary treatment between the various uses on the site should be discrete with paths and soft landscaping defining the boundary between the Health Hub and residential plots.
- Any boundary fences and walls should be softened through the use of climbing plants.

Walls and Gates

- The existing brick perimeter wall shall be retained and repaired where necessary, using sympathetic materials, including matching bricks and lime mortar.
- The gateposts and decorative iron gate of the central entranceway on the north flank of the site shall be repaired where necessary, using sympathetic materials, including matching bricks and lime mortar.
- The decorative iron gates of the north-west and north-east entrances will be demounted, restored and re-used as part of a detailed site landscape design.

Planting

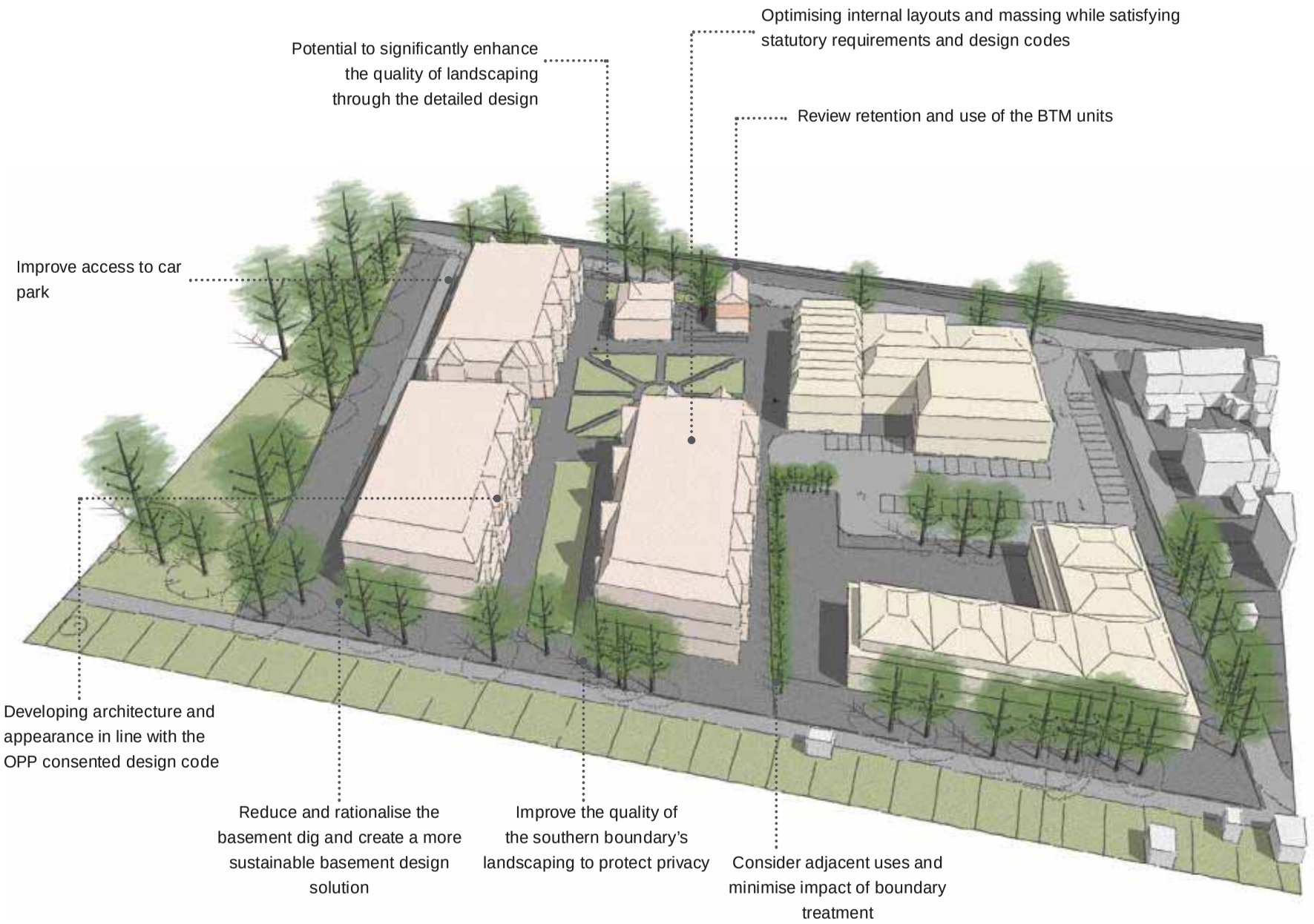
- A minimum area of 4,000 sq.m of the site(total) should be soft landscape with a combination of trees, mass planting, and lawn areas.
- The detailed landscape design should establish a coherent site-wide approach across the garden square, Health Hub and SEN School via the consistent use of materials, lighting and planting.
- Trees should be planted to provide a light canopy over part of the space to provide a sense of enclosure and intimacy, without any undue restriction of sunlight into the garden square.
- A mix of evergreen and deciduous species should be used to ensure visual richness and cover throughout the year.
- A combination of native and locally adapted plants and exotics can be used, with a preference for the former and drought resistant plants to improve biodiversity and sustainability.
- Any additional trees and shrubs will be of a greater scale within the Garden Square element of the proposed landscape and of a subordinate scale within the landscape treatment of the external amenity spaces between the residential blocks.

Materials, Furniture and Lighting

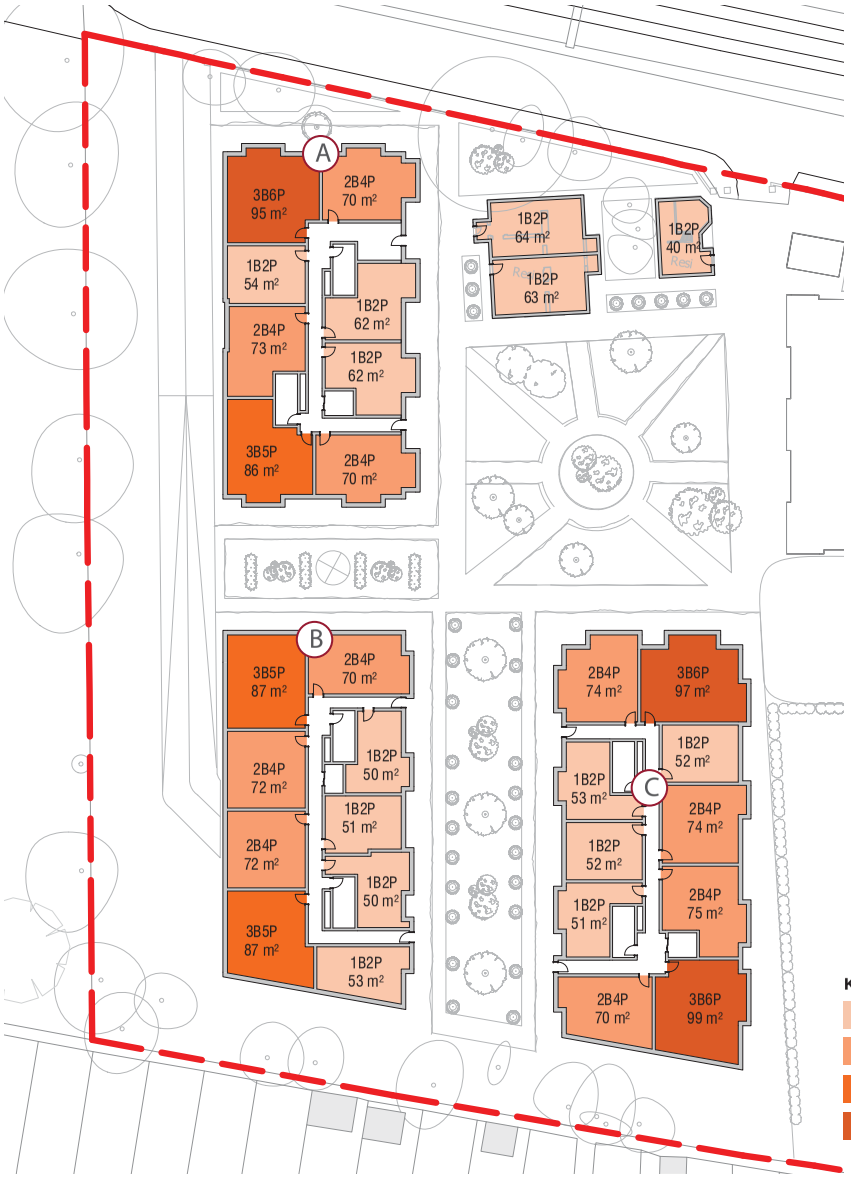
- A simple restrained palette of complimentary materials should be used, taking into account comfort and needs of all users. Materials should be robust and hard wearing and durable.
- Seating should be integrated into the design and layout across the site, taking best advantage of the sunpath.
- High level lighting should be avoided to limit disturbing the existing ecology, i.e. a general preference for down-lighting and no up-lighting to buildings. All lighting shall not exceed a maximum height of 1.2m.

Images from Squire and Partners Outline Planning Application document

3.6 OPP MASTERPLAN REVIEW



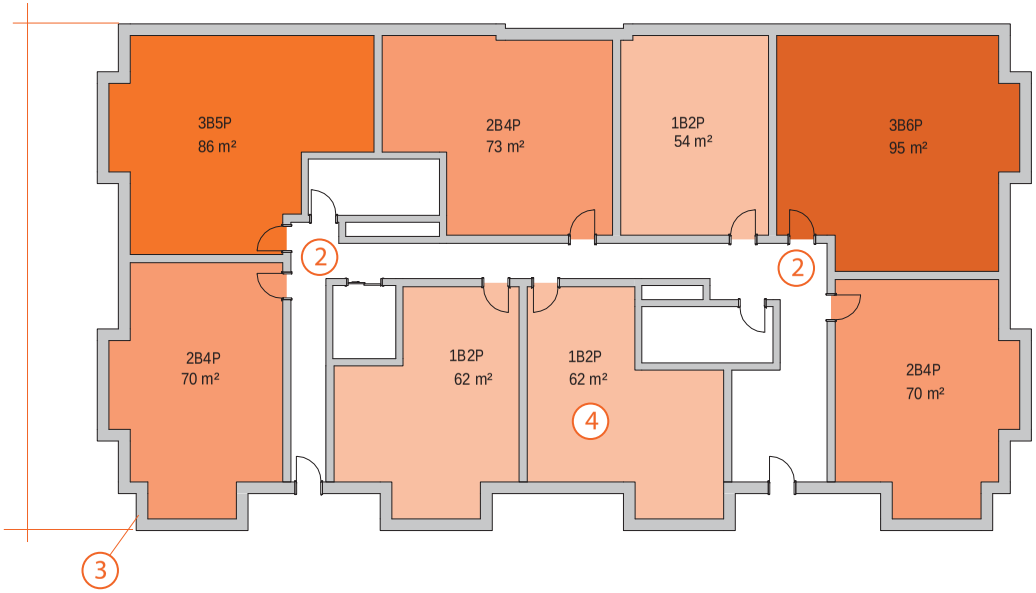
OPP BUILDING LAYOUT REVIEW



Outline Planning Application - Proposed Areas and Mix

Level	Apartment No.				Areas (sqm)		
	1 Bed	2 Bed	3 Bed	Total	GEA	GIA	NIA
Level 0	11	10	6	27	2,574	2,370	1,860
Level 1	8	14	6	28	2,574	2,370	2,038
Level 2	11	12	2	25	2,368	2,178	1,672
Totals	30	36	14	80	7,516	6,918	5,570
Mix	38%	45%	18%				

Outline Planning Application - Proposed Block Layout



Key Points:

1. 80 newbuild units + 3 BTM refurbished units;
2. Inefficient core/ circulation spaces - single core solution better for security, management and maintenance;
3. Envelope rationalisation - consider buildability and residential scale by creating repeatable facade modules, while adhering to the design code;
4. Oversized unit areas (up to 24%) - the optimisation of sites is fully supported by the Mayor of London, who considers that oversized units should generally only be 10-15% over the standards.

4.0

COMMUNITY CONSULTATION

4.1 BARNES HOSPITAL CONSULTATION SUMMARY

In consulting the local community about the plans for the residential portion of Barnes Hospital, the intention has been to inform stakeholders about the scheme, involve them in the development of the detailed proposals and identify areas where stakeholder feedback could be incorporated.

There have been two phases to the consultation process. The first has been the Listening Phase. JBP Associates undertook an audit of the area around Barnes Hospital to identify local community groups and interested parties. Meetings were held with stakeholders discuss any existing concerns about the proposed redevelopment of the Hospital site. This feedback was used by the project team during the detailed design work and resulted in a number of changes to the proposals to ensure they better aligned with local wants and needs.

The second phase was the Consulting Phase. This entailed the re-engagement with stakeholders to present the outline proposals and involve them as the scheme was developed to planning submission. A consultation website hosted presentation material and provided opportunities for the community to comment on the process and proposals, and make contact with the project team to either learn more about the scheme in general, or attend sessions focusing on specific issues like transport, or construction. The website was promoted by newsletter to approximately 1000 addresses.

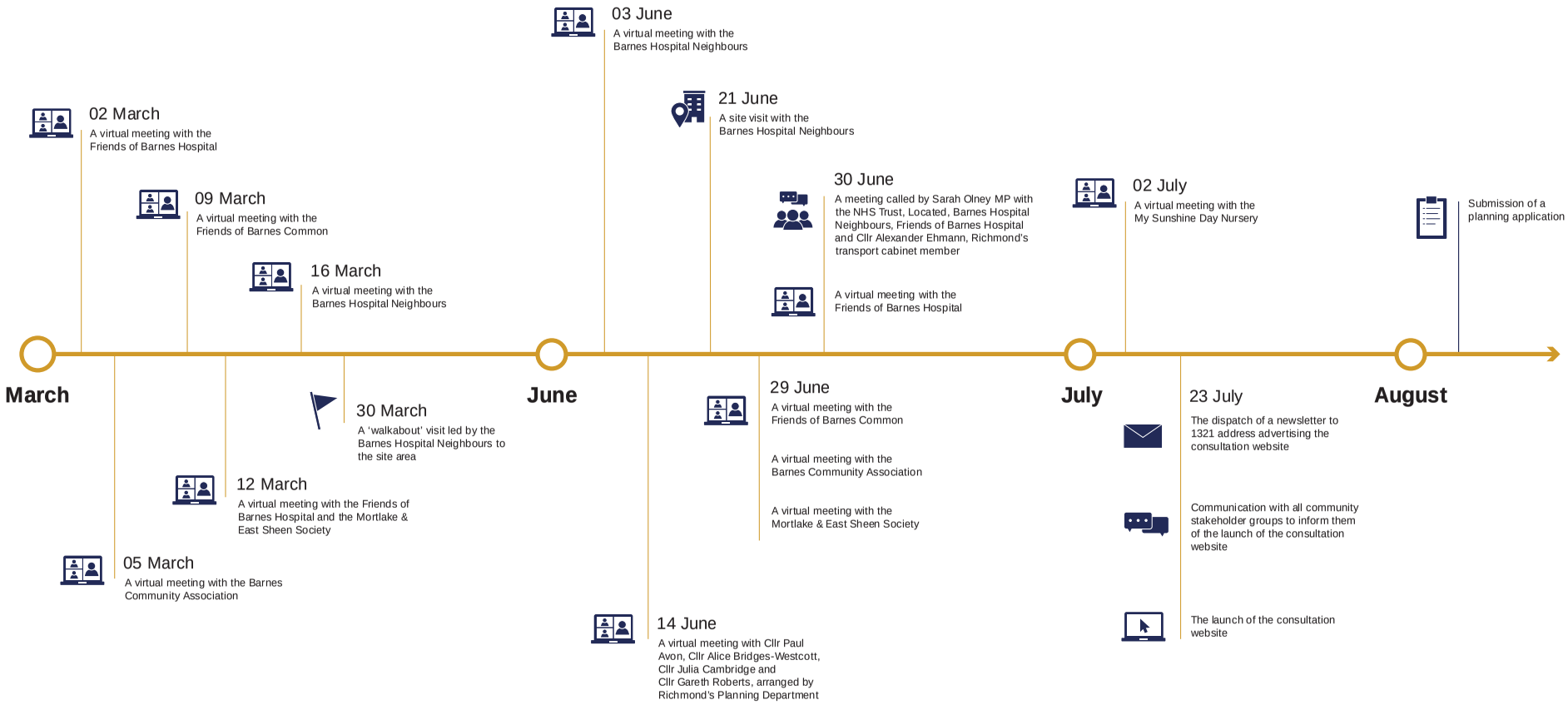
In addition to the above there were monthly meetings with the neighbours, the SEN school developer and the NHS Trust to co-ordinate thoughts on designs and share feedback from interested parties.

For more information, please see the Statement of Community Involvement submitted with the application.

The following table outlines the activities that were undertaken to support community involvement in the planning application for the redevelopment of the residential plot at Barnes Hospital.

Date	Activity
2 March 2021	A virtual meeting with the Friends of Barnes Hospital
5 March 2021	A virtual meeting with the Barnes Community Association
9 March 2021	A virtual meeting with the Friends of Barnes Common
12 March 2021	A virtual meeting with the Friends of Barnes Hospital and the Mortlake & East Sheen Society
16 March 2021	A virtual meeting with the Barnes Hospital Neighbours
30 March 2021	A 'walkabout' visit led by the Barnes Hospital Neighbours to the site area
3 June 2021	A virtual meeting with the Barnes Hospital Neighbours
14 June 2021	A virtual meeting with Cllr Paul Avon, Cllr Alice Bridges-Westcott, Cllr Julia Cambridge and Cllr Gareth Roberts, arranged by Richmond's officers
21 June 2021	A site visit with the Barnes Hospital Neighbours
29 June 2021	A virtual meeting with the Friends of Barnes Common
29 June 201	A virtual meeting with the Barnes Community Association
29 June 2021	A virtual meeting with the Mortlake & East Sheen Society
30 June 2021	A meeting called by Sarah Olney MP with the NHS Trust, Located, Barnes Hospital Neighbours, Friends of Barnes Hospital and Cllr Alexander Ehmann, Richmond's transport cabinet member
30 June 2021	A virtual meeting with the Friends of Barnes Hospital
2 July 2021	A virtual meeting with the My Sunshine Day Nursery
23 July 2021	The dispatch of a newsletter to 1321 addresses advertising the website
23 July 2021	Communication with all community stakeholder groups to inform them of the launch of the consultation website
23 July 2021	The launch of the consultation website
Ongoing	Correspondence with local residents and businesses
Ongoing	Monthly liaison meetings with NHS Trust and the team developing the medical and school site

2021 Timeline



5.0

DESIGN EVOLUTION

5.1 PRE APPLICATION NO.1 PROPOSED MASTERPLAN SUMMARY

Pre-application Meeting 1, 5th November 2020

We introduced the proposals and the principle of a standalone application for the residential site. The initial scheme proposals included a single storey increase in height to Blocks A and B above the OPP parameters.

SUMMARY OF KEY CHANGES AND BENEFITS:

Key Development Points:

- Additional storey added to Blocks A&B
- 25 additional apartments proposed while keeping the same tenure mix as the OPP
- Optimised internal efficiency through the rationalisation of cores and circulation spaces
- Improved lobby area and corridor layout
- Whilst some floor plates include a core to unit ratio of nine units per core rather than eight, as the cores are generally naturally lit and ventilated. Furthermore, given the limited number of storeys, there are also a limited number of households sharing the same communal spaces.
- Units meet the London Housing Design Guide area standards
- Block C contains 24 affordable units with a separate entrance of which 19 are social rent, 5 are shared ownership
- Undercroft and disabled surface parking with 47 spaces in total (addition of 3 spaces to consented scheme). Car parking ratio of 45% without accommodating further parking

5.2 PRE-APPLICATION MEETING NO.1 FEEDBACK RESPONSE

The principle of optimising the development was broadly supported, however further work was encouraged to ensure that the resultant scheme maximised public benefits (in particular an uplift in affordable housing) and did not create unacceptable impacts on nearby residents, heritage assets and the amenity of future occupants.

The summary of comments and the responses including additional design information is listed below:

Height Scale and Massing

- **Additional Height & Associated Heritage/ Townscape Impact** - the increase in height will result in an additional impact on the CA.
- **Impact on BTMs** – the proposals should preserve, and where possible enhance, the significance, character and setting of BTMs.
- **Height of Block A** - the impact on the Recreation Hall to be considered further given the proximity and single storey nature of this building and should preserve, and where possible enhance, its significance, character and setting of BTMs.
- **Height of Block B** – whilst Block B will broadly match the height of the tallest building on site, the massing at roof level is greater at 3rd floor level. It is recommended the scale and bulk is revised to allow for a more sensitive massing reflective to the existing building and designations of the adjacent cemetery, or otherwise further information will need to be provided (detailed drawings, townscape views, and an updated Heritage Statement)to fully assess this impact.
- **Height of Block C** – this block is far less prominent and could be increased in height instead of Block A or in addition to the other two blocks and would have the benefit of increasing affordable housing delivery, subject to viability considerations.
- **Impact on Cemetery** - the additional height of Blocks A and B will result in an increase in scale and mass adjacent to the western boundary, increasing the visual impact and limiting the views into and out of the OOLTI.
- **Undercroft** – cross sections, including potential impacts on the landscaping and site environment should be considered to ensure the buildings are not isolated from the surrounding gardens.
- **Massing** – it is important that the mass of the blocks is broken down through a high quality design, detailing and use of materials. Excessive standardisation should be avoided.
- **Materials** – the materiality appears to show red brick which reflects the retained BTMs on the site, albeit the visuals show a yellow brick which is considered less appropriate.

Landscaping, Playspace & Amenity Space

- **Playspace & Amenity Space** - It is essential the minimum area requirements for soft landscaping and the central communal area are provided, given the increase in density resulting from increased residential units.

Transport, Parking & Servicing

- **Parking Survey** - a new Parking Survey will be required and carried out in accordance with the Council's supplementary planning guidance.

Affordable Housing

- Affordable Rent Category 3 dwellings to be built out as fully accessible where LBR has nomination rights, and any shared ownership/ intermediate rent and private Category 3 dwellings to be built as adaptable.

5.3 PRE APPLICATION NO.2 PROPOSED MASTERPLAN SUMMARY

Note: SEN School and Health centre are shown indicatively

Pre-application Meeting 2, 4th March 2021

The second meeting included the Council's Conservation Officer alongside the Case Officer and outlined the design development since the first meeting, in particular proposed increase in the height of Block C in line with that proposed for Blocks A and B.

SUMMARY OF KEY CHANGES AND BENEFITS:

Scale and Massing

- Additional storey added to block C to match existing building height
- Comprehensive townscape assessment has been carried out
- Increased distance between Block A and the BTMs
- The scale of the proposal has been considered through massing, sections and elevations in relation to the surrounding existing and proposed context.
- Block B&C have been moved away from boundary for fire access and maintenance

Masterplan and Access Strategy

- Reduction in basement dig to improve site ecology and construction reduce construction traffic and export of soil from site
- Undercroft and surface parking with 54 spaces in total (addition of 7 spaces). Car parking ratio of 0.48.
- Removal of the basement from block C
- Secure cycle storage providing 194 spaces (addition of 53 spaces)
- Improvements to basement layout and vehicular access thought the site including emergency services.

Residential Quality

- 8 additional units proposed in Block C
- Block C Refuse and cycle stores following discussions at the first pre-app accessed at ground level. Surface parking provided for residents.
- Block C contains all of the scheme's affordable units with the exact quantum to be determined following feedback from registered providers and viability assessments
- Entrances to Block C are proposed to be of equal design quality and area both accessed from the linear garden.
- Providing a residential amenity/ work spaces and a post room/ concierge at the entrance to the site

- Improvements to construction and servicing strategies through a strategic sustainability analysis
- Introduction of air sourced heat pump to reduce energy consumption and improve the ESG of the development
- Introduction of sprinklers over code to improve safety

Architecture and Materiality

- Height impact of Block A has been considered and mitigated through updates to the roof and gable design. Its impact on South Worple way, as well as its relationship with the BTMs and the cemetery have been considered through a comprehensive townscape assessment, as well as facade design.
- Variation of architectural details and features through the facade design
- Material palette has been updated to complement the existing context

Landscaping

- Developed landscaping plan with improvements to play space provisions
- Emergency access has been considered throughout the masterplan
- Proposals to improve the ecology of the site through the introduction of an eco-zone with sanctuaries proposed for bats, bees and other insects
- Creation of natural pockets of play, and reflection moments to encourage a sense of community throughout the site.

5.4 PRE-APPLICATION MEETING NO.2 FEEDBACK RESPONSE

Architecture & Massing

Block A

Review building height to minimise the impact to surrounding townscape, CA and setting of the BTMs.

Blocks B & C

Review roof appearance and in particular points below:

Roof - In some of the views, the appearance of top floor is boxy in appearance.

Eaves line – review in line with design code, relationship between the roof and lower floors.

Dormers – look at reducing the number in line with design code, particularly on sensitive elvations

Review size of dormers – reduce further – shouldn't be full size double doors with Juliette balcony

Review distance between Blocks B and C with regards to OPP

Appearance/Materiality

Materiality - Introduce a variation across blocks, with each block to have its own distinct design. Suggest variation in design between the three buildings to break up 'monolithic design'.

Test introduction of different brick tones on blocks, while Block A remaining red with a brick course running through the building of a different brick tone.

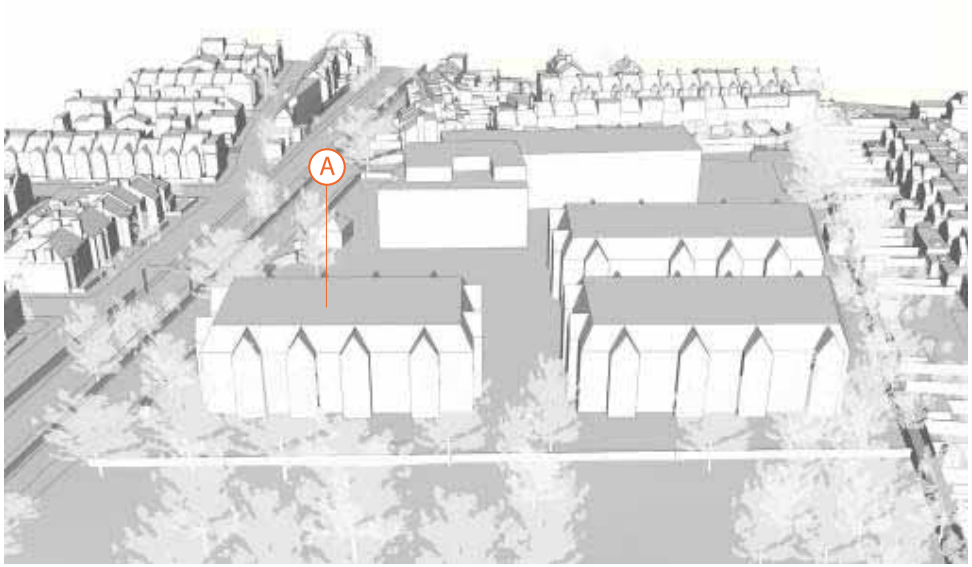
Roof – natural slate would be more sympathetic. In view from S Warple Way – the red brick appears similar to the roof which gives a more dominant appearance for the building

Dormers – in lead or zinc.

Metal work – removing some of the juliette balconies and replacing with smaller openings to minimise metal work

5.5 BLOCK A MASSING OPTIONS

Following the council comment different options were explored in relation to Block A height. The options are presented on this page. The three storey option was adopted for future development.



Block A - 4 storey option

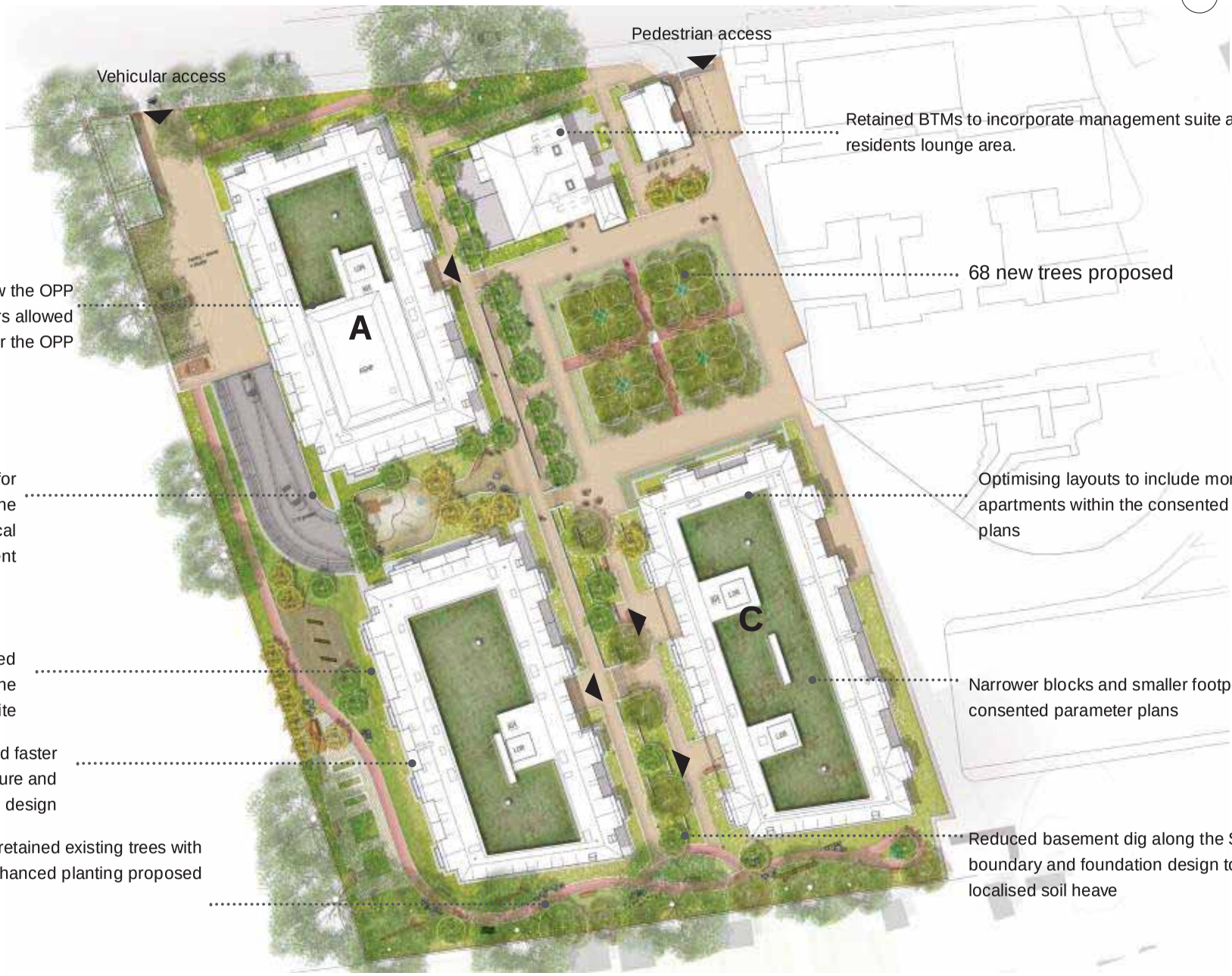
Block A - 3 storey option

Block A - Stepped Option

6.0

PROPOSED MASTERPLAN

6.1 PROPOSED MASTERPLAN SUMMARY



6.2 QUANTUM OF DEVELOPMENT

Planning Consented Residential Site (Squire and Partners)

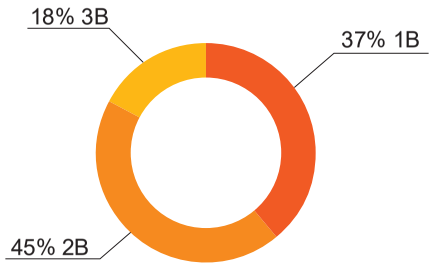
80
Number of Units (New build)

62
Private

18
Affordable

3
BTM Units

Mix of Units



140
Cycle Storage

44
Parking Spaces

Proposal

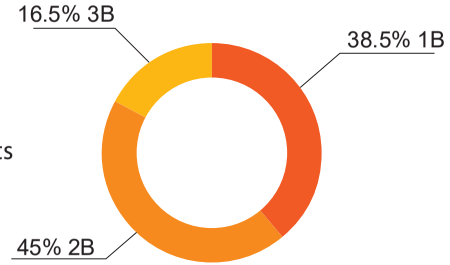
106
Number of Units (New build)

85
Private

24
Affordable

3
BTM Units

Mix of Units



197
Cycle Storage

50
Parking Spaces

6.3 SEPARATION DISTANCES

Proposed separation distance between Blocks B&C is 15.7m wich is in line and greater than the parameter plan separation distance of 15.3m.

Proposed separation distance between Blocks A&B is 15.64m wich is greater than the parameter plan separation distance of 13.5m.

Proposed separation distance between Block A and BTM is 10.37m wich is greater than the parameter plan separation distance of 9.15m.

The following considerations have been taken to maximise separation distances and improve privacy between habitable rooms:

Staggering of gables with bay windows on long elevations.

Ensuring that there are no living rooms facing bedrooms where separation distances fall below 13.9

Reducing the number and sizes of windows to the Southern boundaries of Blocks B&C

Parameter plans - Max. general building footprint

Parameter plans - Max. bay projections

OPP consented dimensions

Proposed dimensions

6.4 SOUTHERN BOUNDARY

The number and sizes of windows along the Southern facades of Blocks B&C have been reduced to improve privacy between the proposed units and the residential terraced houses along Grosvenor Avenue.

Windows to living spaces along the Southern facade are secondary windows required to meet daylight requirements to supplement the primary windows that relate to the focal seating areas in these rooms.

- Existing boundary wall is maintained.
- The provision of windows on the South facade has been kept to a minimum.
- Rooms facing the South are primarily bedrooms
- Where a living space faces the South, the window to this space will be a smaller secondary source of light.
- Mature trees along the Southern boundary will be retained and will provide a good level screening from all levels proposed in the scheme
- The eco-walk at the Southern boundary of the site will create a green buffer between the proposed residential blocks and the neighbouring properties. The eco-walk will include additional trees and planting.

7.0

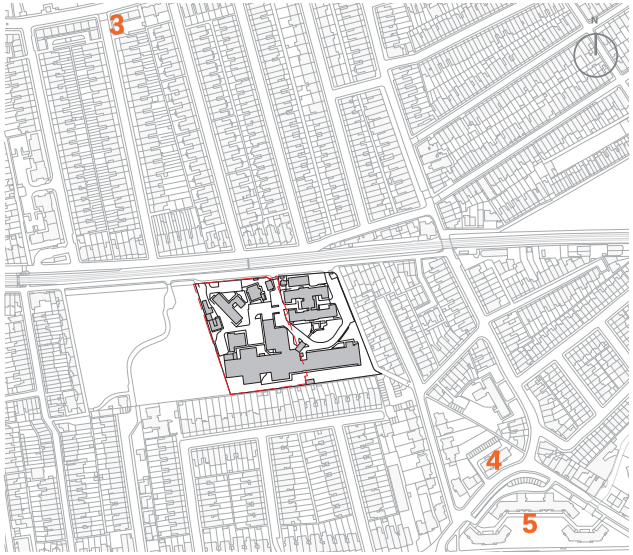
SCALE AND MASSING

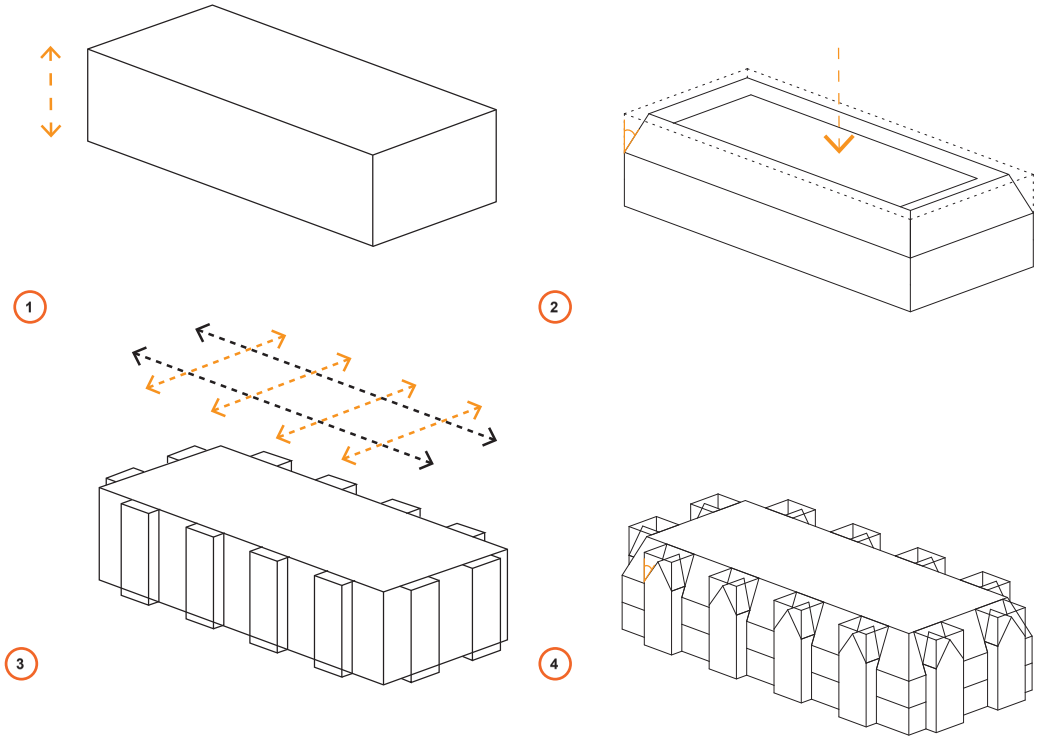
7.1 SCALE & MASSING

The overall scale of the blocks respects the principles set out in the Design code and Parameter plans.

The proposal seeks to break down the block mass to relate to the general residential scale of the context by introducing projecting bays of a more similar scale to the gables of the surrounding buildings.

The images below demonstrate examples of other 4-storey residential developments within a 300m radius from the site.





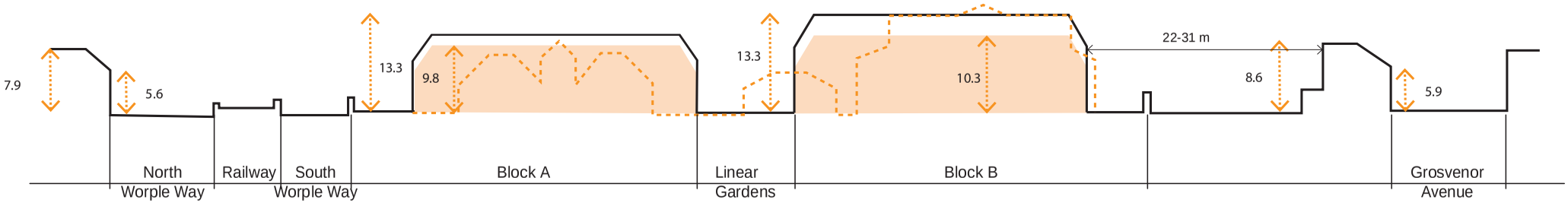
Building Mass study

4

5

3

COMPARISON BETWEEN THE EXISTING, PLANNING CONSENTED AND PROPOSAL HEIGHT



Proposed Masterplan Section

Design code parameter height

Existing buildings' outline

PROPOSED MASSING IN CONTEXT

IMPACT STUDY OF ASHP ON BLOCK A

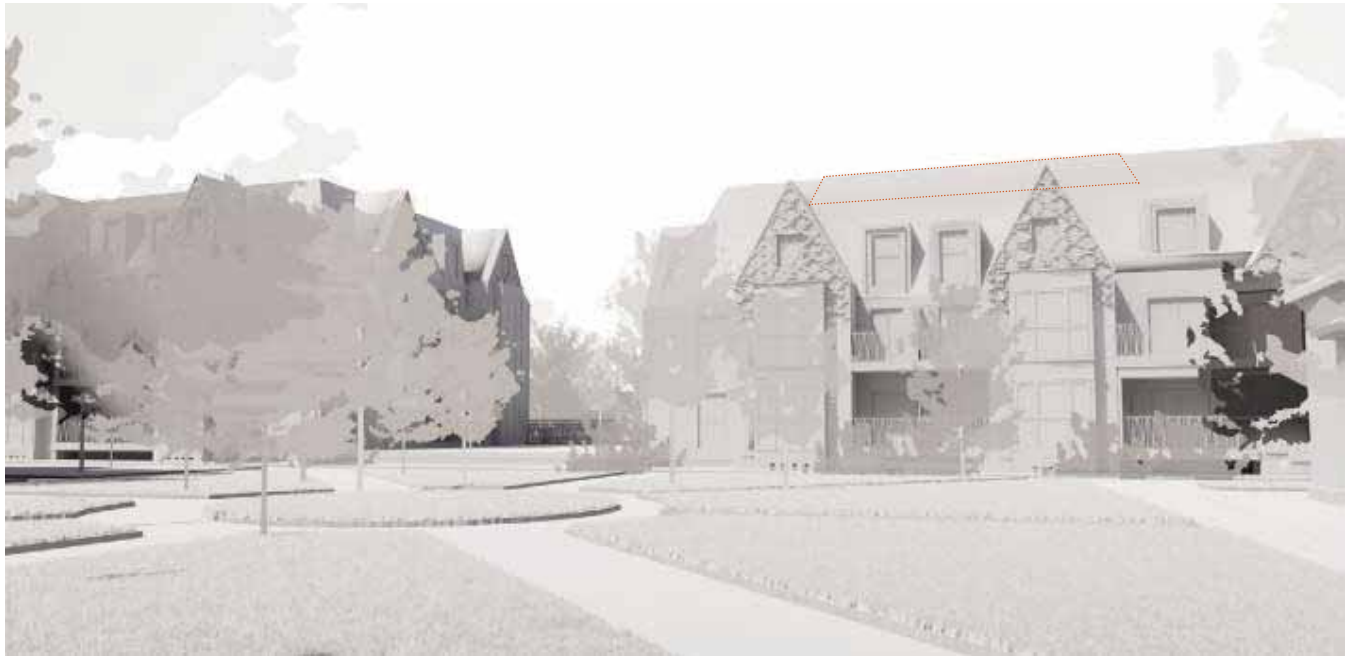
As a part of the massing study we looked at the impact of air source heat pump located to the top of Block A.

The Air Source Heat Pump enclosure is 3m height with acoustic attenuators and is set back from the main facade of Block A, so that it is not visible from ground level as seen in the adjacent views.

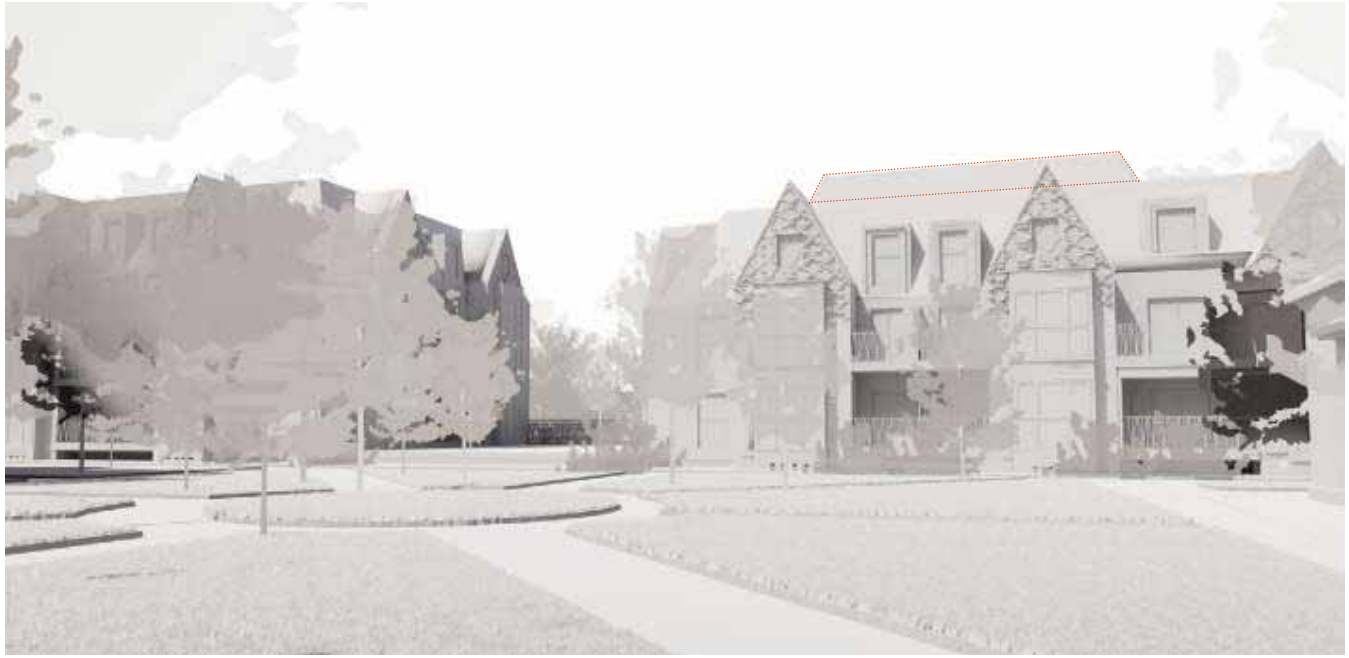
During the design review with LBRUT asked Scott Brwonrigg to explore option with lower roof. On the second image it can be seen the option with lower roof, where ASHP is more visible.

For more information refer to Energy Strategy section.

ASHP enclosure



Proposed option to screen ASHP



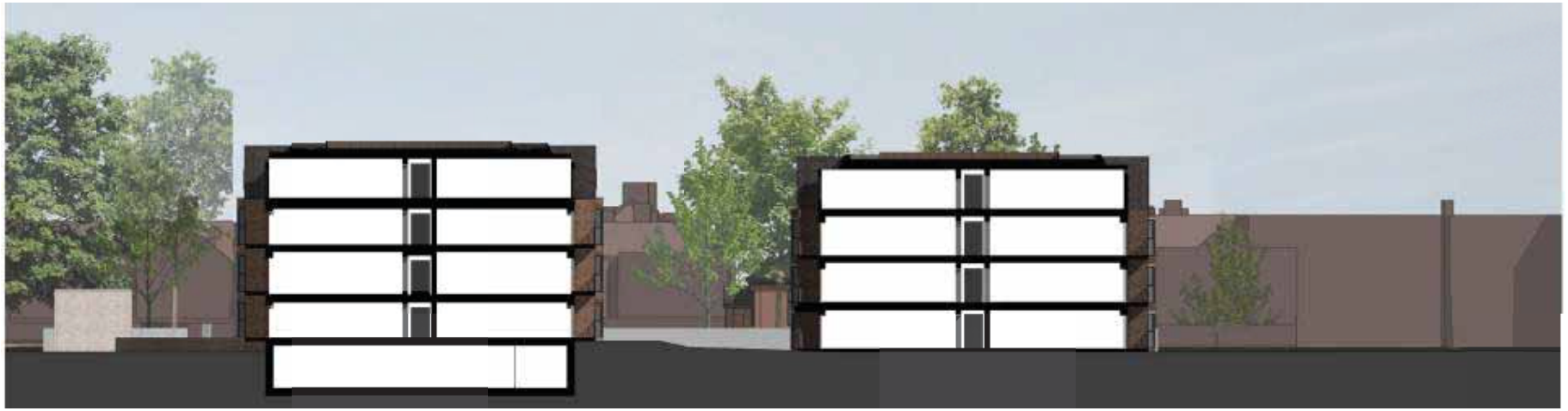
Alternative option with lower roof

MASSING VIEWS

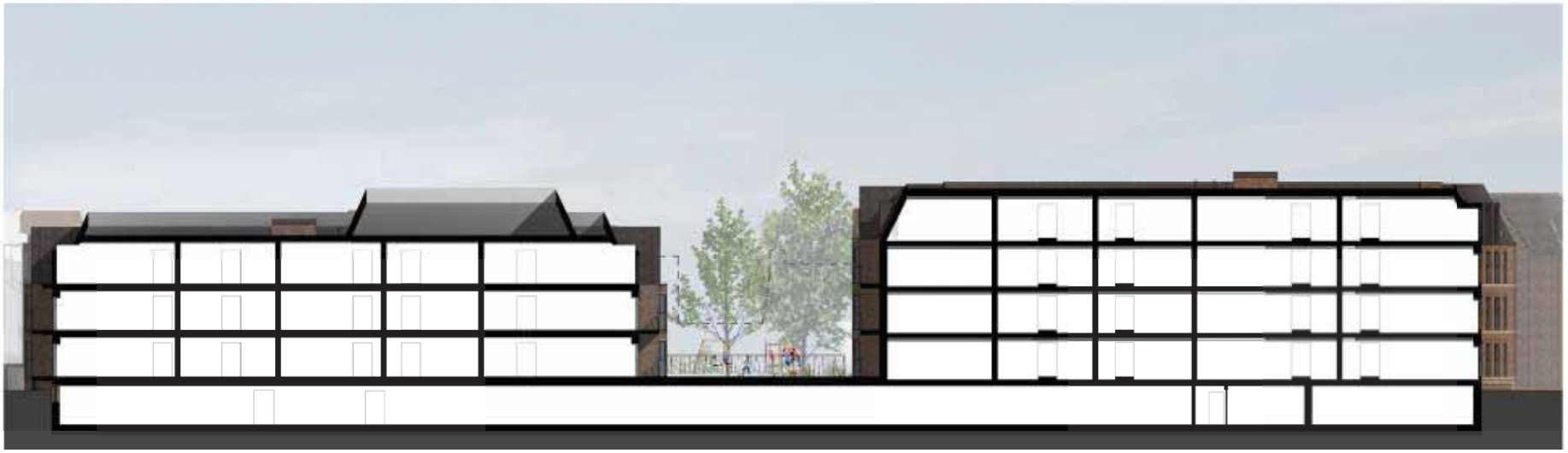
Proposed option to screen ASHP

Alternative option with lower roof

SITE SECTIONS



Cross Section through Blocks B&C



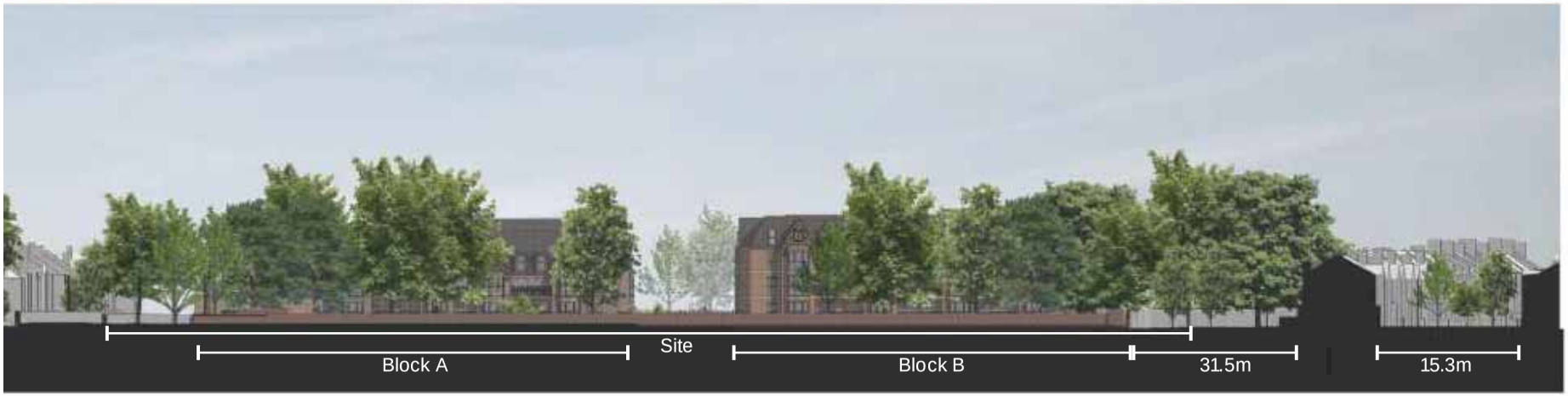
Section through Blocks A & B

SITE ELEVATIONS WITH CONTEXT

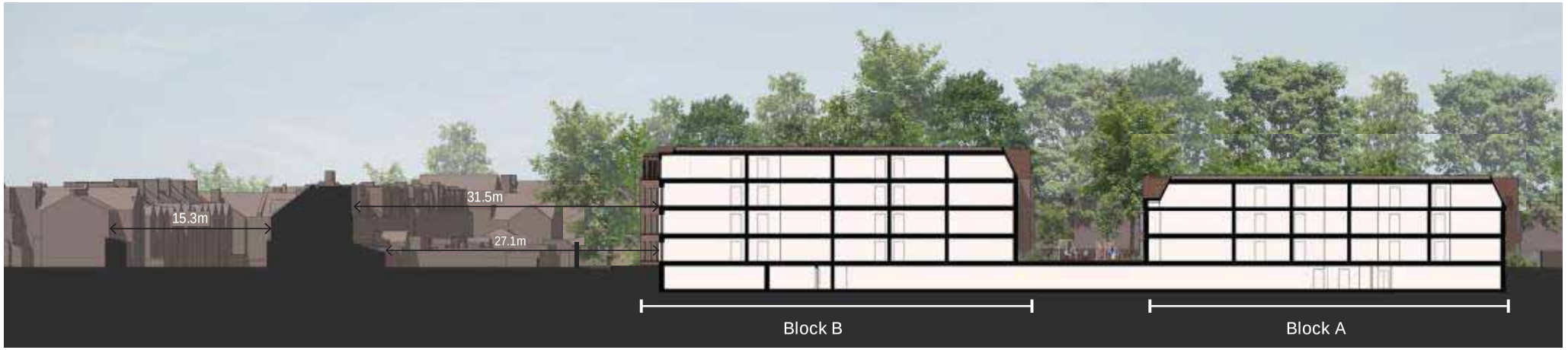
Context elevation view across the site towards Block A

Context elevation view from the cemetery

SITE SECTIONS WITH CONTEXT



Site section through cemetery



Site section through Blocks A & B

8.0

TOWNSCAPE & HERITAGE

8.1 TOWNSCAPE ANALYSIS

This section provides a summary of Townscape Analysis & Views.

For more information, please see the Montagu Evans statement submitted with the application.

Scott Brownrigg have worked closely with Montagu Evans during design development and as part of the pre-application process to understand the impacts on heritage and townscape. Montagu Evans have prepared a Heritage and Townscape Statement which is submitted with the application and provides a full assessment of the impacts in light of the relevant legislation and policy. Montagu Evans also used VU.CITY to test the proposals, and selected model shots are reproduced in this section. The model shots compare the consented OPP scheme and the current proposals for ease of comparison.

8.2 TOWNSCAPE VIEWS

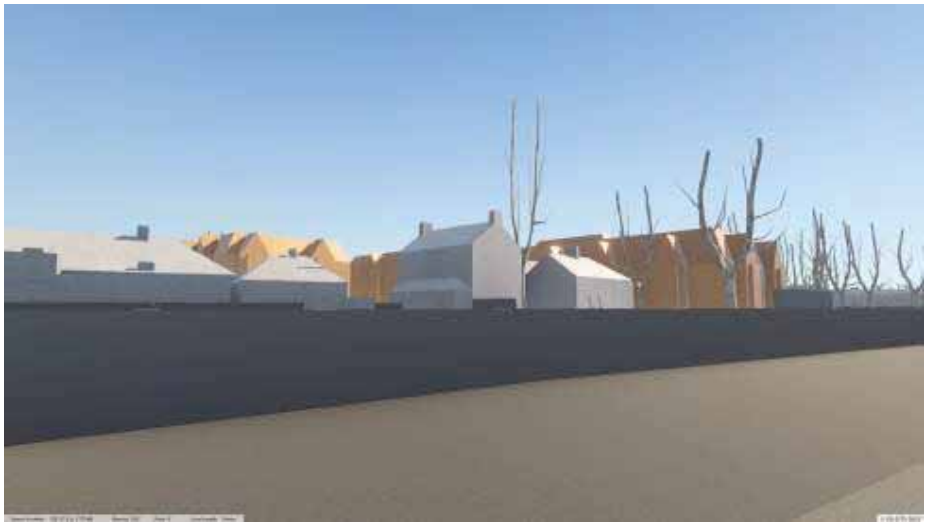
Key

A	Recreation Hall
B	Entrance Lodge
C	Gatehouse
D	Fleming Ward
E	Beatrice Ward
F	Administration Building
G	Laundry
H	Elizabeth Lodge

Queen's Road [Mortlake] Conservation Area 35

Site

Existing Context (Photo)



Proposed Massing Vu City Model

OPP Consented Massing Vu City Model

Proposed Massing Vu City Model (trees)

View 1 Junction of North Worple Way and Second Avenue

In this view Blocks B and C appear to the left of the Entrance Lodge and Block A to the right. The visualisation demonstrates that there is no material difference in the appearance of the massing as between the permitted and proposed schemes in terms of Blocks B and C. It is noted that two dimensional images are unable to fully represent depth of field appreciated by the human eye. These buildings will be understood in the backdrop of the Entrance Lodge, which will maintain its presence in the townscape. The architecture of these buildings is in line with the Design Code and is subject to further design. There could be revisions, for example, to the gables to make the roofscape of the new block less expressive. Block A is screened by the mature trees at the site boundary. The photograph of the view shows how these trees from a dense backdrop to the Entrance Lodge, even in winter.

Existing Context (Photo)

Proposed Massing Vu City Model

OPP Consented Massing Vu City Model

Proposed Massing Vu City Model (trees)

View 2 Old Mortlake Burial Ground

View 2 and 3 show how the proposals will appear from the Old Mortlake Burial Ground, which provide the clearest views from the Queens Road (Mortlake) CA. The slight increase scale and massing is not likely to be noticeable to a casual observer because of the extent of mature trees. The permitted scheme was not found to cause any harm to the CA. We do not consider that the introduction of additional floor to Blocks A and B would result in harm, as the principle of a modern residential development in the setting of the CA is established and there would not be any increase in enclosure or visibility, given the mature trees.

Existing Context (Photo)

Proposed Massing Vu City Model

OPP Consented Massing Vu City Model

Proposed Massing Vu City Model (trees)

View 3 South Entrance to the Old Mortlake Burial Ground

See analysis for view 2. It is noted that the majority of Blocks B and C are occluded by interposing residential development in this view.

Existing Context (Photo)

Proposed Massing Vu City Model

OPP Consented Massing Vu City Model

Proposed Massing Vu City Model (trees)

View 4 Cowley Road

Blocks B and C will not appear in this view. Block A will appear to the right where the road terminates with the Entrance Lodge and Recreation Hall to the left. The separation between the BTMs and Block A will be maintained. The additional height would not change the assessment of an acceptable townscape impact in this view. Block A will not appear taller than the development in the foreground and will introduce a residential development of architectural quality into the view.

Existing Context (Photo)

Proposed Massing Vu City Model

OPP Consented Massing Vu City Model

Proposed Massing Vu City Model (trees)

View 5 Junction between North Worple Way and Ashleigh Road

In this view the proposals will be screened by the trees. The photograph was taken in winter conditions, on the 22nd March 2021. This view demonstrates there will be no impact on the Cowley Road CA.

Existing Context (Photo)

Proposed Massing Vu City Model

OPP Consented Massing Vu City Model

Proposed Massing Vu City Model (trees)

View 6 South Worple Way

9.0

MASTERPLAN & ACCESS STRATEGY

9.1 PEDESTRIAN ACCESS STRATEGY

The main pedestrian access to the site is located on the Northern site boundary from South Worple Way. Pedestrians can access the site from Mortlake Railway Station at Sheen Lane via South Worpole way. Additionally, there are pedestrian link bridges crossing the railway tracks to the North of the site to help facilitate pedestrian access towards the site.

The development landscape will create pedestrian routes within the site with access through the shared landscape gardens to be available for residents.

Pedestrian access to the residential buildings will be provided from the main routes in the landscape.

Key Points:

- Primary pedestrian entrance to the site is adjacent to the BTMs
- The entrance lodge will include a concierge, post room and residential amenity space to welcome residents at the site entrance and facilitate management of site services and deliveries.
- Residential cores all have ground level access via an entrance lobby facing the central courtyards/ linear gardens
- Residential Entrances are clearly marked by a feature entrance portal
- Block C entrances have been developed and proposed to be of equal design quality, both being accessed from the linear gardens.

9.2 VEHICULAR ACCESS & PARKING

The primary vehicular access for residents is located along the Western boundary of the site. The vehicular entrance leads to a two-way ramp which connects to the undercroft residential car park under blocks A&B.

Key Points:

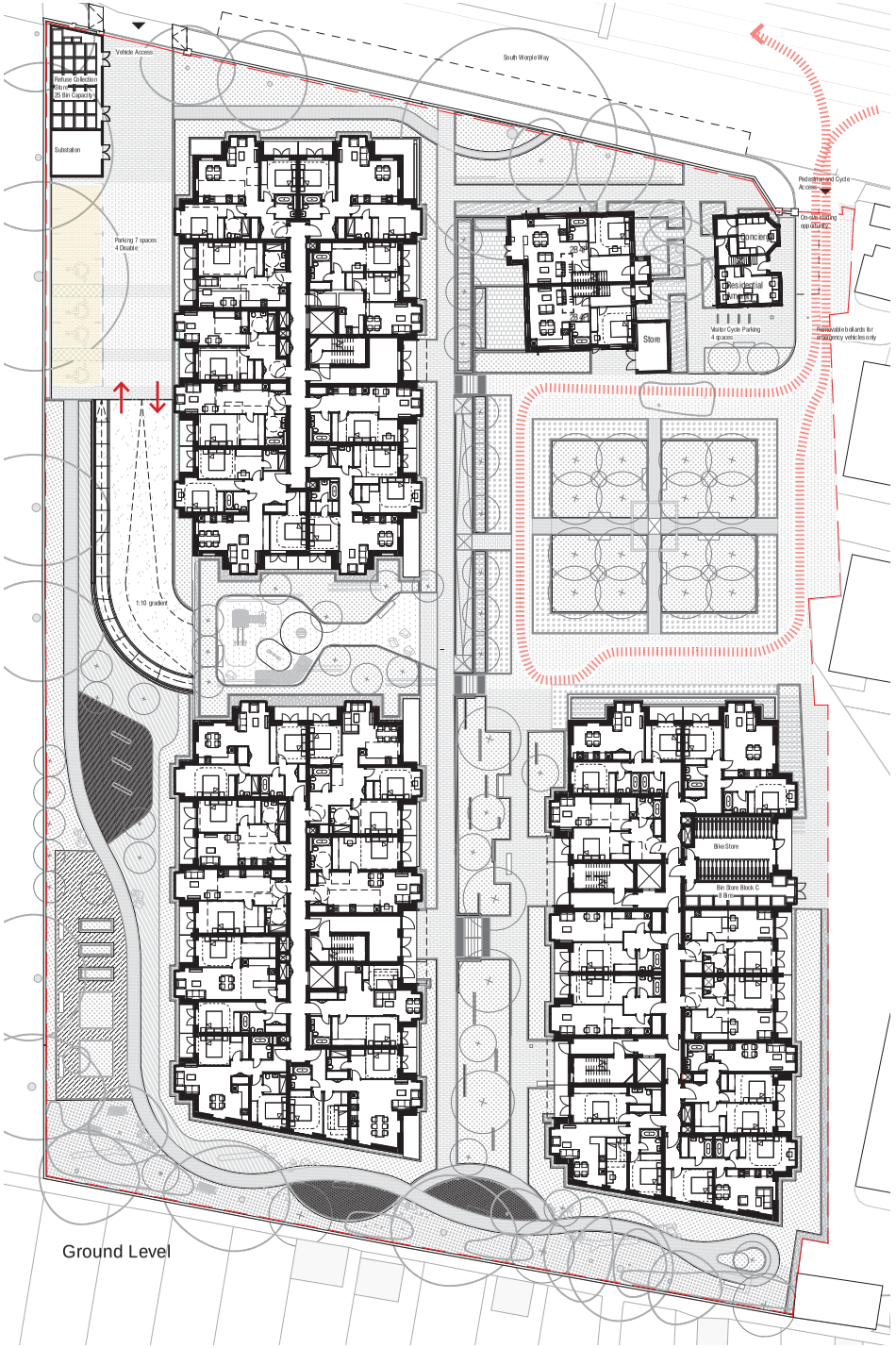
- A total of 50 parking spaces are proposed throughout the scheme
- 43 undercroft parking bays and 7 surface parking
- Disabled parking: total of 11 disabled bays; 7 in the undercroft and 4 on the ground surface
- 20% EV parking bays (11 spaces)
- Refuse collection and servicing can be accommodated on site to minimise traffic impact on South Worple Way
- The ramp with have a segregated path alongside it with shallow steps and a bicycle track to enable cyclists and pedestrians to safely access the undercroft from this location.
- The existing vehicular access has been maintained at the North of the site to allow for refuse collection and disabled car park access to block C.
- An emergency route has been considered in the design of the landscape layout

Key:

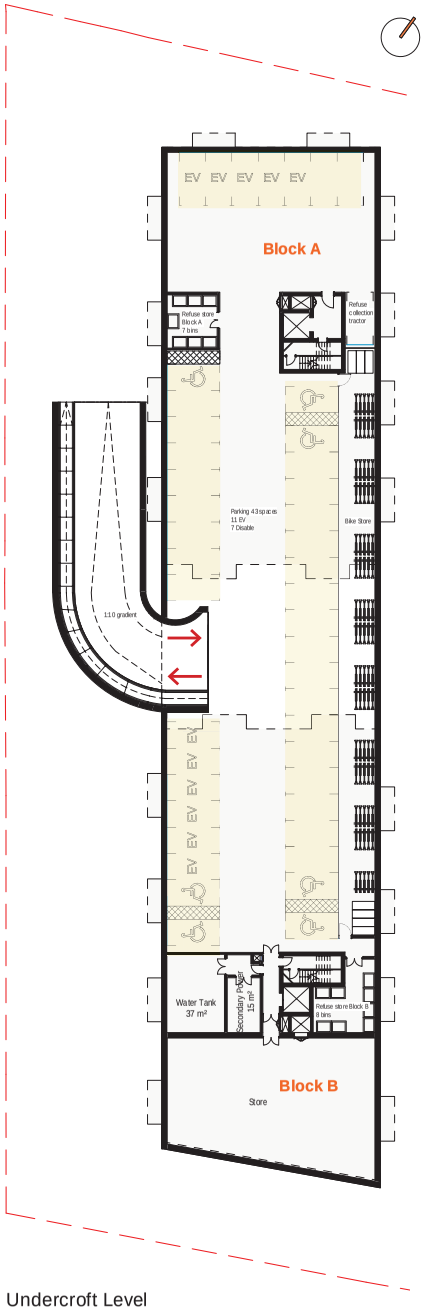
Parking

Vehicular Access

Emergency Access Route



Ground Level



Undercroft Level

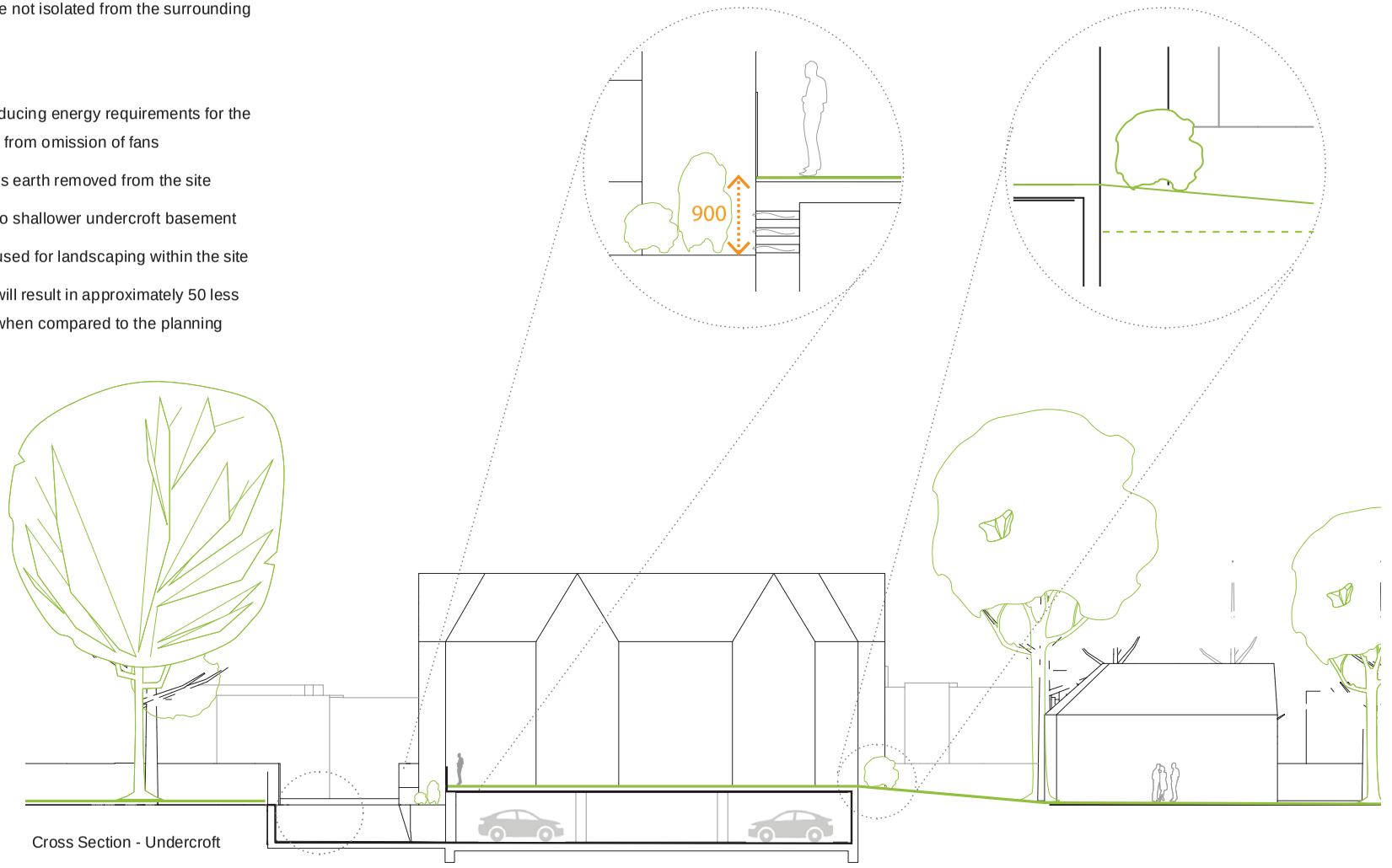
UNDERCROFT PARKING

The undercroft parking raises block A&B by 900mm above ground level. This provides the benefit of reducing site excavation, increasing privacy to ground floor units and allowing for natural ventilation to the car park.

The soil from the car park excavation will be used on the surface to create gentle slopes connecting the blocks seamlessly with the rest of the landscape to ensure the buildings are not isolated from the surrounding gardens.

Key Points:

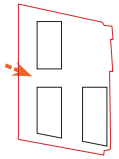
- Naturally ventilated basement reducing energy requirements for the development with reduced noise from omission of fans
- More sustainable design with less earth removed from the site
- Reduction in basement dig due to shallower undercroft basement
- 50% of the undercroft soil to be used for landscaping within the site
- Reduced basement dig volume will result in approximately 50 less vehicular load movements than when compared to the planning consented scheme.



Cross Section - Undercroft

SCOTT BROWNRIGG

CGI VIEW



9.3 CYCLE STORAGE STRATEGY

Paths and routes around the park are be provided for cycle use. Shared cycle/ pedestrian paths are a minimum 3.5m wide, with signage to guide shared use. The primary entrance for cyclist will be via the central access point to the site.

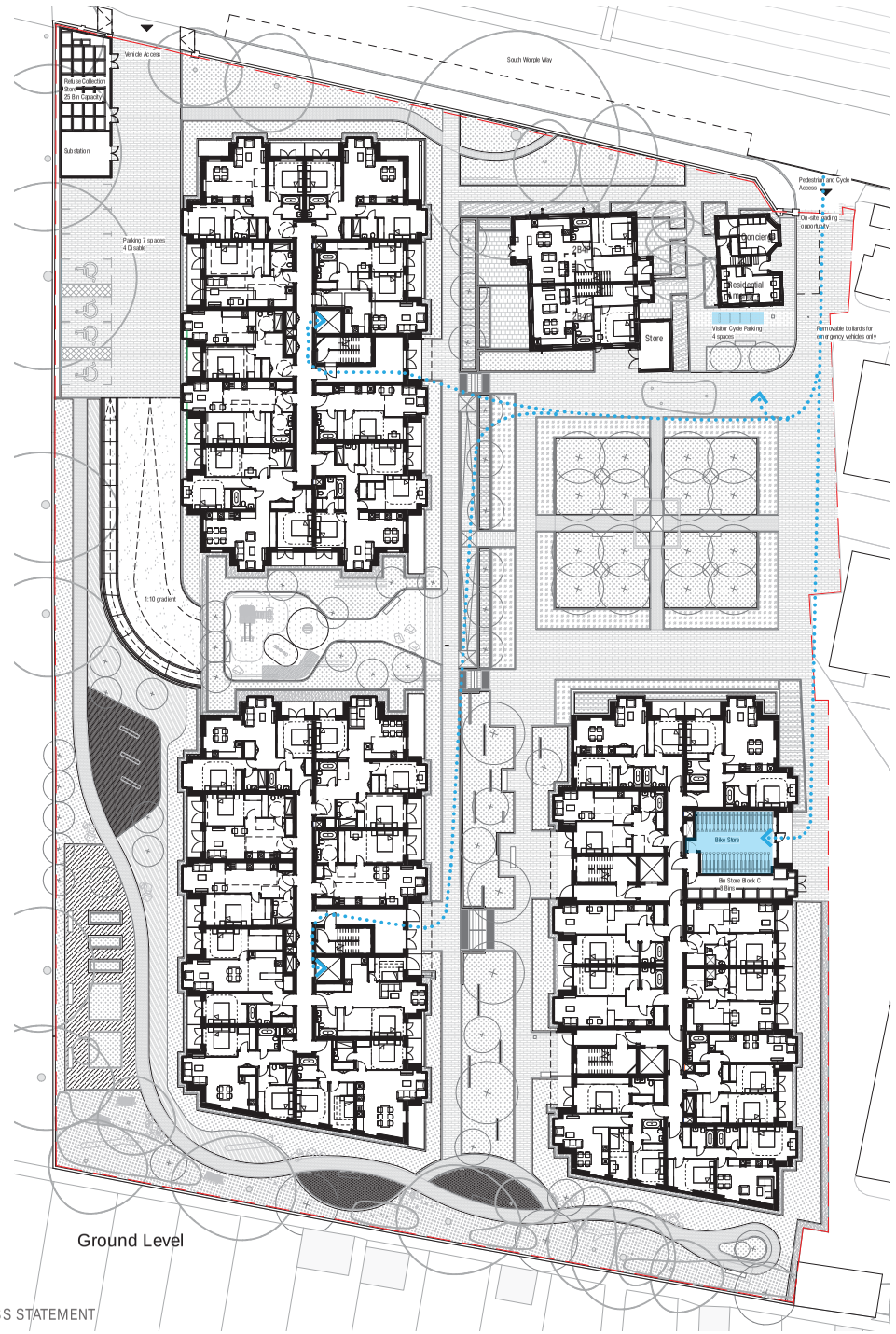
Key Points:

- Blocks A&B have a shared cycle storage in the undercroft holding 121 spaces for both blocks, including 8 cargo bike spaces.
- Block A&B residents can access the undercroft cycle store via the residential lift cores.
- Alternatively, the undercroft cycle store can be accessed via the shallow steps and bicycle track alongside the ramp.
- Block C residents will have a cycle store at ground level which can be accessed directly from the building exterior. This holds 76 parking spaces including a cargo bike space.
- Sheffield stands (4 cycle capacity) are provided externally for short stay cycle parking and integrated within the landscape. These are located close to the pedestrian entrance for ease of access navigation.
- Larger cargo bay stands are provided to accommodate a wider range of cyclists and encourage alternative means of transport.

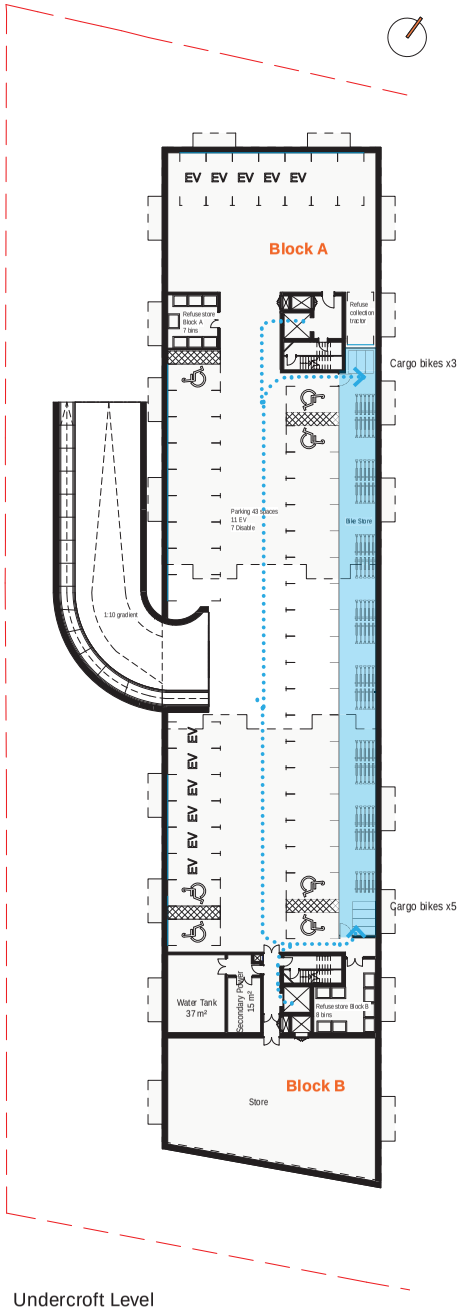
Key:

Cycle Store

Cycle access



Ground Level



Undercroft Level

9.4 REFUSE & SERVICING STRATEGY

The residential waste stores for each block can be accessed directly from the residential core at basement level for blocks A&B and ground level for block C. The internal storage areas will enable residents to segregate their waste into refuse and recyclables, and store them temporarily.

Key Points:

- Waste from Blocks A&B will be collected in stages from each one of the residential bin stores via a waste car travelling up the car ramp, and transported to the waste collection point adjacent to the vehiclar access point to the North-West of the site.
- Waste from the Block C communal refuse store, as well as the residential units in the BTMs, will be transported to a waste collection store held there for collection from the vehiclar access point to the North-West of the site.
- Waste from BTM's will be collected from the waste collection point as above.
- Space has been allocated within the undercroft to park a refuse collection tractor/vehicle.

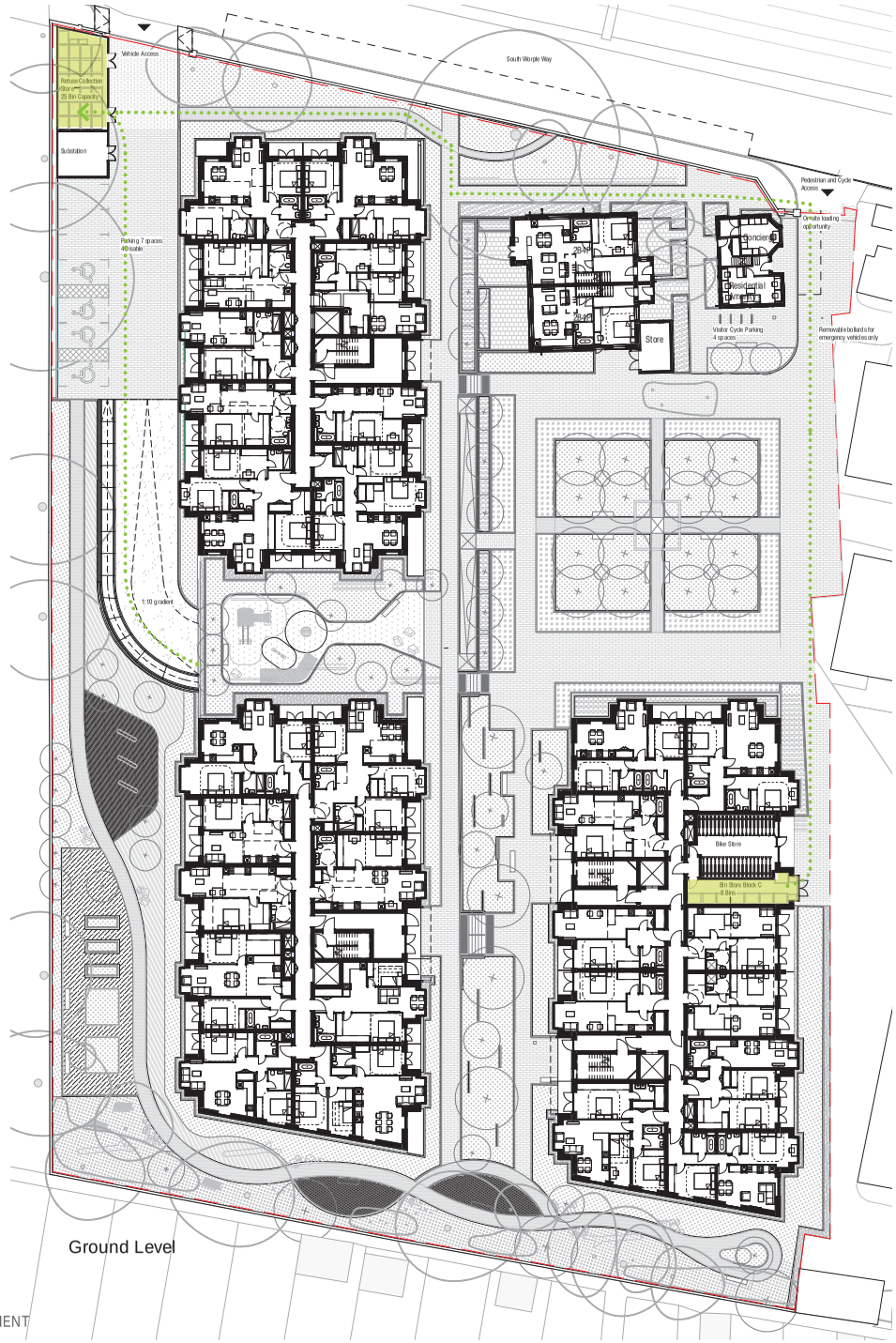
Servicing & deliveries are enabled from the temporary parking bay off South Worple Way adjaicent to the Entrance Lodge where there is a concierge service as well as post room for deliveries and parcels.

Emergency vehicles can access via central entrance in a similar way as Fire tender using the route via Orchard garden.

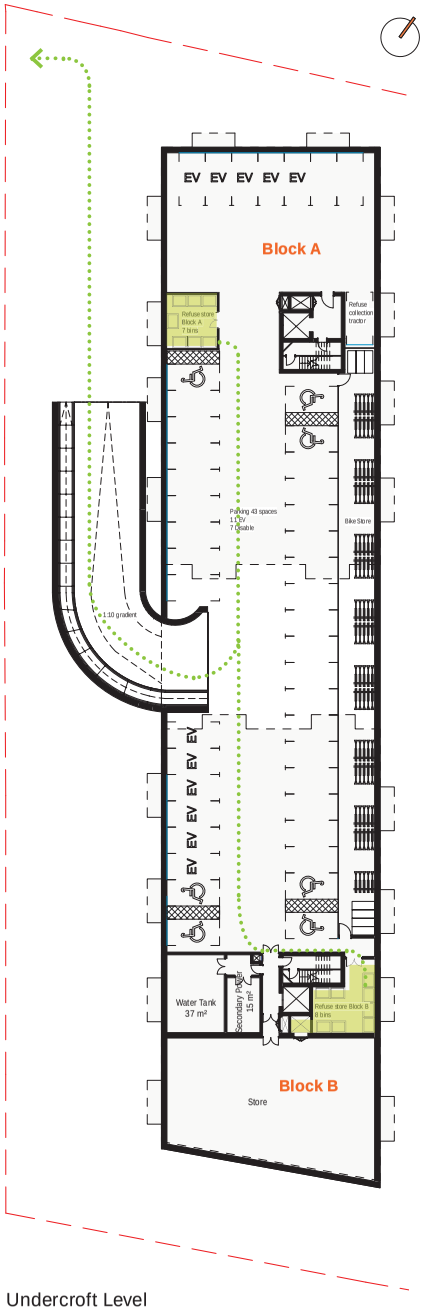
Key:

Refuse Store

Refuse collection



Ground Level



Undercroft Level

10.0

LANDSCAPE PROPOSAL

10.1 LANDSCAPE VISION & APPROACH

This section provides a summary of key Landscape design principles.
For more information, please see the Exterior Architecture document and drawings submitted with the application.

Three key pillars

Ecology to Define Spatial Types

Messy Ecosystems, Orderly Frames

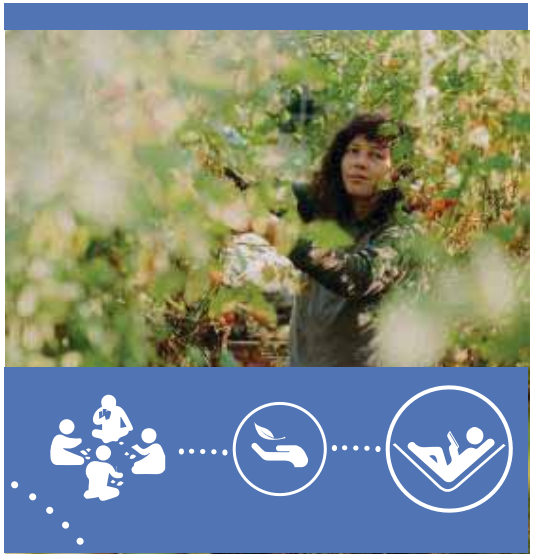
- incorporate meaningful, lush planting within structured forms
- planting to be ecologically focused and more 'wild', while maintained within orderly spaces

Prioritise Ecological Interventions

- productive planting to be incorporated within the entire scheme such as orchard trees, fruiting and flowering shrubs, sensory planting including herbs and scented flowers such as lavender

Foster a Connection with Ecology

- seating and play areas to be nestled within planting to encourage biophilia



Spaces that Create Moments & Memories

Promote a Sense of Discovery

- encourage a sense of discovery through designing a sequence of spaces
- create smooth and interesting transitions from one space to the next
- promote biophilia; a connection of people to their natural surroundings

Create Spaces with Distinct Sense of Place

- emphasis on creating strong sense of character for each space
- create moments and cues for users to stop, enjoy, connect and create memories in the landscape

Interactive & Engaging Landscapes

Focus on Community

- build spaces that help strengthen the sense of community within the development
- play areas for everyone to discover
- flexible seating areas to allow users to gather and socialise

Encourage interaction with nature

- the site aims to be an ecological oasis, a green escape from the urban environment
- create opportunities for users to interact with ecology through grow gardens, natural play areas, and seating nestled into planting

10.2 CHARACTER AREAS

Design Approach & Character Areas

Design Approach

ExA have developed the landscape brief in direct response to:

- Existing site constraints and opportunities. These are diverse with the main considerations being, but not limited to; people movement; equality in accessibility; micro-climate; above and below ground infrastructure; and emergency access and egress;
- Creating a modern neighbourhood - Taking an approach to place making which aims to cater to the diversity of the local resident. This has involved scripting spaces for a variety of curated uses such as relaxation, play, and socialising
- Maintaining a focus on a progressive and dynamic living space that can enhance the experience of urban living, by allowing the opportunity for socialisation within a green and verdant setting; and
- Placing importance on pedestrian comfort levels, navigation and ease of flow, through provision of a clear and uncluttered pedestrian spaces

Character Areas

5 Character areas have been identified for the Barnes Hospital development:

ORCHARD GARDEN

space to gather / reflective / verdant / inclusive / orchard planting / colourful, textured planting / movement / seating areas nestled into planting / commemorative

PLAY GARDEN

playful / immersive / tree planting / seating areas / exciting / explorative / soft / natural / green / sense of discovery

LONG BORDER GARDEN

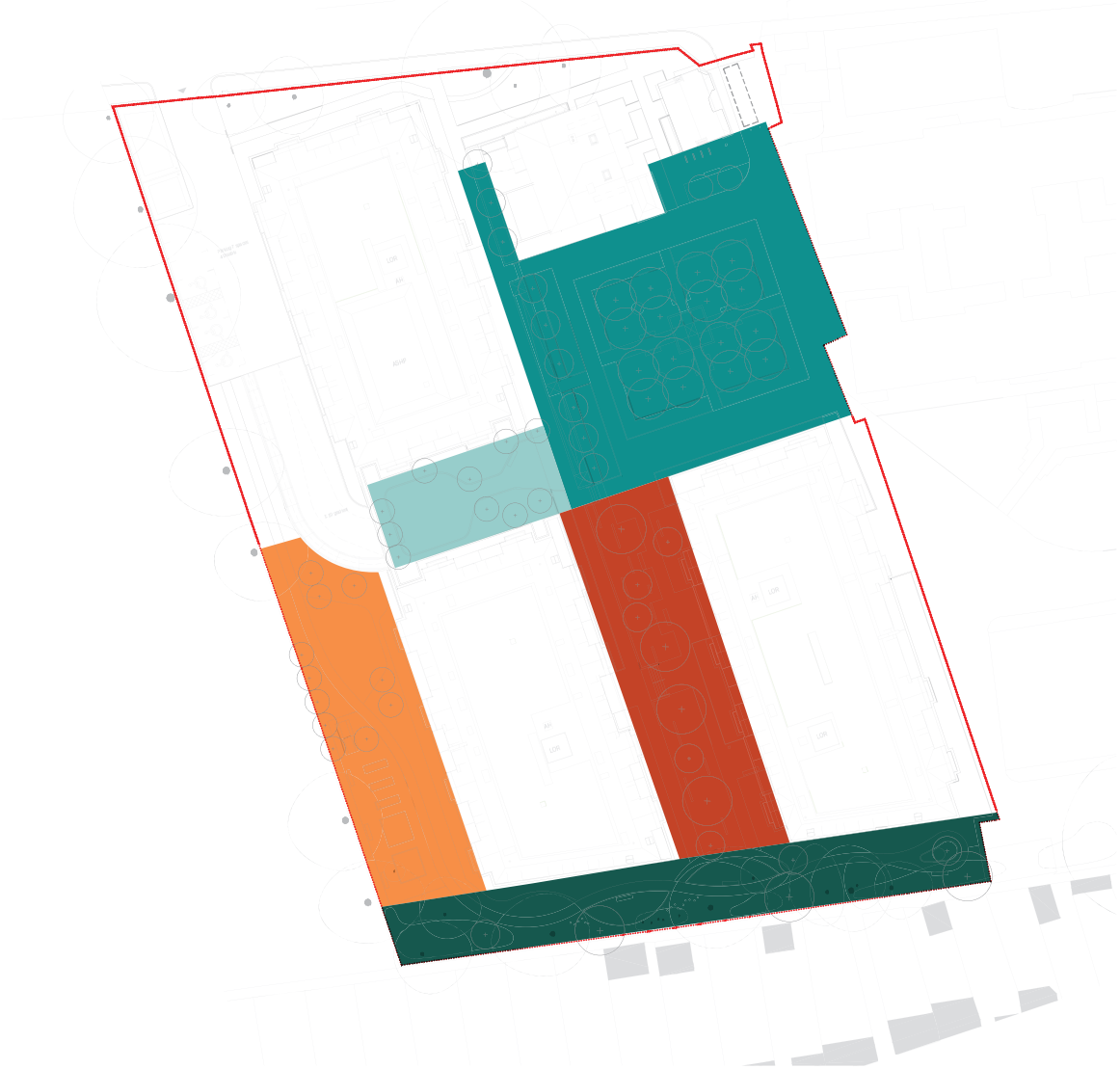
space to meet / pedestrian footpaths / tree planting / informal integrated seating areas / space to rest / directional

GROW GARDENS

productive / social / explorative / interactive / fun / space to sit / space to learn / playful / tree planting

ECO WALK

high ecological value / sense of discovery / biophilia / verdant / immersive / playful / nature trail / secret footpaths / green buffer



EXTERIOR ARCHITECTURE

Proposed Play Provision

The following page displays the proposed play strategy, including only 0-11 play provision on site, and providing 12+ off site through a financial contribution. We believe this strategy results in the highest quality play spaces and maintains the ecological integrity of the existing site.

Play strategy Diagram for 0-11 only on site

KEY

0 - 5 Years (Nature trail character)

- very light touch play elements such as boulders, balance and stepping logs nestled within planting which double as ecologcal features and habitats

5 - 11 Years (Prescrptive, Educational & Community Focussed)

- sculptural play elements such as climbing walls, tunnels , slides and play huts, coupled with more educational and explorative play within the grow

ded

m^2

m^2

m^2

12+ - offsite contribution to allow for the site to retain its quiet character, and maintain biodiversity, as was the case for the outline planning permission.

Space requirements based on GLA benchmark standard.

EXTERIOR ARCHITECTURE

10.3 MASTERPLAN

Landscape Masterplan

Ground Floor

1. Pedestrian/ cyclist emergency vehicle access
2. Community centre and Cycle stands
3. Hedge and buffer planting to private residences
4. Orchard Garden
5. Entrance gardens (Main pedestrian access)
6. Play Garden
7. Long Border Gardens
8. Eco-Walk with nature trail
9. Grow Garden
10. Vehicular access (parking entrance)
11. Bin Storage
12. Parking bays

EXTERIOR ARCHITECTURE

Orchard Garden

1. Orchard planting
2. Grasscrete with wildflower planting
3. Fire engine access route
4. Compliant sloped access to Block A and play garden
5. Commemorative plaque location
6. Seating nestled within planting

The Orchard Garden is a community anchor within the development where residents will want to meet, rest, and relax. The Orchard tree planting will be sensitive to the existing site context, and will be at the heart of the character design, incorporating seating areas immersed within planting.

Character Area Objectives:

- reflective bird baths surrounded by productive, orchard tree planting
- seating opportunities for solo users and groups nestled within planting
- colourful, inviting planting with native, evergreen, and pollinator species
- ecological interventions such as reflective bird baths and biodiverse planting


Wildflower meadow


Reclaimed brick path


Fruit Trees


Etched natural stone plaque


Reflective bird bath


Orchard trees

EXTERIOR ARCHITECTURE

Play Garden

1. Playable Log Tunnel
2. Willow Tunnel
3. Wobble disk
4. Small see-saw
5. Combination play hut

The Play Garden provides inclusive, green, and immersive play opportunities that fit seamlessly into the already verdant landscape. The aim is to create a sense of discovery and exploration is at the heart of this character area.

Character Area Objectives:

- natural play elements such as willow tunnels, balance elements, playable logs
- robust, natural materials
- play elements and seating immersed in lush planting
- space to run, climb, play and imagine


Wobbble disk


Playable log tunnel


Willow tunnel


Small see-saw


Combination play hut

Long Border Garden

1. Biodiverse planting
2. Seating pockets to rest and relax
3. Steps between Blocks B & C
4. Immersive tree planting
5. Retaining plinths (reclaimed brick from site)

The Long Border Garden provides a functional space to allow for pedestrian circulation and also allows for spaces along the journey to stop, meet, rest, think, relax and socialise. The immersive tree planting and verdant planting typology makes this garden an inviting place to rest.

Character Area Objectives:

- high ecological value with textured planting of native, evergreen and pollinator species
- immersive tree planting
- opportunities to sit, rest, relax within the verdant environment
- create sense of movement through planting


Movement through planting


Seating pockets


A verdant journey


Lush view from adjacent units


Immersive planting


Shade-tolerant planting

EXTERIOR ARCHITECTURE

Grow Garden

1. Raised and in-ground planting beds
2. Seating pockets for residents
3. Path flowing between productive planting
4. Play totems
5. Residents outdoor dining area

The Grow Garden is a productive community garden space for residents to meet, explore, learn and play. Creating a playful and fun space to enjoy productive planting will be the driving force behind the layout of this character area.

Character Area Objectives:

- productive planting such as fruiting and flowering trees and shrubs, herbs, and planting to stimulate all the senses.
- seating areas for residents to gather and enjoy
- opportunities to hold small events and evening use
- informal climbing play opportunities


Fruiting plants


Seasonal vegetable gardens


Herb Garden


Seating areas around and between beds


Raised and in-ground beds


Play totems

Eco Walk

1. Biodiverse planting all along the path
2. Seating immersed in planting
3. Natural trail elements
4. Meandering path

Creating an inviting and green link with high ecological value and sense of discovery. Incorporating a nature trail and immersive board walks adds to the sense of exploration in this space.

Character Area Objectives:

- biodiverse planting with seasonal interest
- incorporation of ecological interventions such as bird boxes, bird baths, insect hotels, squirrel ropes
- footpaths immersed in dense planting
- nature trail explorative elements nestled into planting
- character area to function as a wildlife corridor, connecting to the wider green infrastructure network


Catering for birds


Pollinator-friendly planting


Bird boxes


Insect hotels


Nature trail elements


Natural seating/ explorative play elements


Reclaimed brick footpath

Movement and Access

Pedestrians and Cyclists

- Primary pedestrian movement
- Secondary pedestrian movement
- Pedestrian priority zone
- Cycle route
- Cycle storage / stands
- Stepped access
- Ramped access
- Removable bollards
- Building entrance (public)
- Building entrance (communal)
- Building entrance (private)

Streetscape and Servicing

- Existing vehicle access
- Proposed vehicle access
- Service and emergency vehicle access only
- Vehicle entrance
- Car park/ Loading bay / drop off zone

Pedestrians and Cyclists

Main pedestrian access is from S Worple Way through a straight path connecting to all three building blocks, as well as providing access to the Orchard Garden and Play Garden. A secondary entrance on north-east corner takes pedestrians to the low rise buildings located on that corner and passing through the orchard and Border Garden, connects to the Eco Walk and Grow Garden.

Main cycle entrance is located on north-east corner of the site, which connects to the guest cycle stands by the community building as well as the cycle storage at back of Block C.

Streetscape and Servicing

The main vehicular access is provided from north-west corner of the site, directing vehicles to the parking below the buildings and the blue-badge parking spaces along western boundary.

An emergency vehicle access is also provided from eastern side of the north boundary, passing around the Orchard to provide access to all building blocks.

EXTERIOR ARCHITECTURE

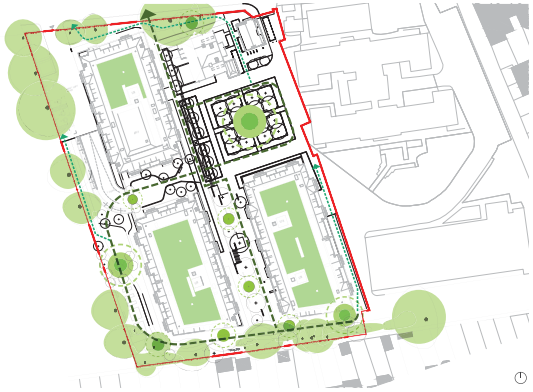
Green and Blue Infrastructure

Green Infrastructure

The green infrastructure approach to the site includes tree planting, shrub planting, ecological planting, hedgerows and biodiverse roofs.

The proposed tree planning will strengthen the GI network and the other greening features will help diversify local ecology. This will also create a biodiversity net gain for the site.

An orchard garden with fruit trees and wildflower planting as well as a 'Grow Garden' with allotments planted and managed by the residents, a grove of fruit trees and groundcover edible beds createthe two anchor green spaces on site.



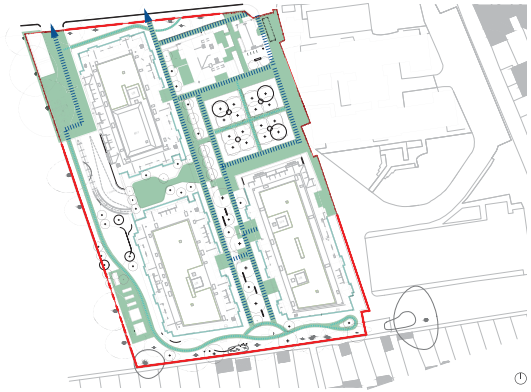
Green Infrastructure

- Existing green assets
- Primary green link
- Secondary green link
- Anchor green space
- Pocket green space
- Intensive biodiverse roof

Blue Infrastructure

The proposed drainage strategy integrates features of a Sustainable Drainage system (SuDS) into the open spaces of the site. Surface water is collected through gullies and permeable surfaces on the ground floor.

The permeable planted areas of the site and the large areas of biodiverse roofs help to reduce storm water run-off rates.



Blue Infrastructure

- Primary blue infrastructure link
- Secondary blue infrastructure link
- Fall direction
- Permeable hard landscape surfaces