The Royal Brompton and Harefield NHS Foundation Trust

ROYAL BROMPTON HOSPITAL IMAGING CENTRE

S73 MINOR MATERIAL AMENDMENT TO ROYAL BROMPTON HOSPITAL CONSENTED EXTENSION (REF: PP/16/04357)

Construction Method Statement
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Construction Method Statement

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S73 MINOR MATERIAL AMENDMENT TO ROYAL BROMPTON HOSPITAL CONSENTED EXTENSION
(REF: PP/16/04357)
Construction Method Statement

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1 EXECUTIVE SUMMARY

This Construction Method Statement has been prepared by WSP on behalf of the Royal Brompton & Harefield NHS Foundation Trust (RBHT) to satisfy the Subterranean Development Supplementary Planning Document (SPD) dated April 2016 in relation to the proposals for the redevelopment of the Royal Brompton Hospital Site.

The document has been updated to align with the most recent amendments to the application PP/16/04357 which was granted planning permission in November 2017. It has been submitted to accompany a minor material amendment (under Section 73 of the Town and Country Planning Act 1990) to provide a four storey Imaging Centre, including two storeys below ground and two storeys above ground, the relocation of existing substation and associated temporary and enabling works.

This document has been prepared by WSP following the sequential approach as shown in the flow chart set out in the RBKC Subterranean Development SPD dated April 2016. Furthermore, this document sets out an approach to ensure compliance with Policy CL7(m) of the Consolidation Local Plan 2015 and that the basement will ‘be designed to safeguard the structural stability of the existing building, nearby buildings and other infrastructure including London Underground tunnels and the highway’.

Policy CL7(b) states that all basement development must ‘not comprise more than one storey. Exceptions may be made on large sites’. The Imaging Centre for the Royal Brompton Hospital requires two basement levels to house hospital accommodation and associated plant equipment in order to provide the specialist imaging facilities above ground within the available footprint and building massing.

The report addresses the key design and construction considerations in respect to the proposed development including the historic context, structural proposals and basement use, geology and hydrology, buried infrastructure and adjoining properties, construction sequencing and method and site logistics. A high level summary of these key considerations follows below.

1.1 EXISTING SITE AND BUILDINGS

The Imaging Centre development is located within the main hospital site for the Royal Brompton and Harefield Hospital on Sydney Street. The site currently comprises hospital accommodation bounded by the hospital’s Sydney Wing building to the east, to the north by Chelsea Wing, the south by Britten Street and to the west by Dovehouse Street.

The existing site comprises of:

- The Imatron building
- Staff car parking
- Britten Wing and allied buildings to the south west of the site
- Chelsea Wing (formerly Chelsea Hospital for Women)
- Vehicular access to the site is provided from Cale Street via a service ramp and from Sydney Street to the existing car park

The site is not in an Archaeological Priority area and there are no listed buildings immediately adjacent.

The site is not within a conservation area although the Chelsea Conservation Area, which incorporates St. Luke’s Church and the Chelsea Park / Carlyle Conservation Area to the west, is directly adjacent to the main hospital site.

A tree survey undertaken by Barrell Tree Consultancy in June 2016 identified Category B trees (of moderate quality and value) and their associated root protection areas on the site. Refer to the Aboricultural Assessment and Method Statement dated June 2016 for more information.
1.2 PROPOSED SCHEME

The proposed scheme comprises the demolition of the existing Imatron building to facilitate construction of an Imaging Centre alongside the existing Chelsea and Britten Wings as Phase 1 of the Royal Brompton Hospital Redevelopment.

The minor revisions to the redevelopment to which the S73 application relates include the following:

- The Imaging Centre will be constructed and operated on a stand-alone basis as phase 1 of the redevelopment
- Relocation of the existing substation to Cale Street to be undertaken by UKPN
- An additional storey for clinical accommodation above ground
- Temporary relocation of MRI scanners and support accommodation to the Sydney Wing car park.

The Imaging Centre now comprises two levels above ground along with the originally consented two levels of basement. The proposed two storey basement provides:

- Hospital accommodation including three MRI examination rooms, and
- Associated plant equipment.

There has been no increase in basement depth for the S73 minor material amendment but the gross area has increased by 36m² compared to the consented application. This is driven by a requirement for additional clinical area to support the MRI facilities. The increase in basement size does not impact on the compliance with Policy CL7(m) of the Local Plan.

1.3 STRUCTURAL PROPOSALS

The structural proposal for the Imaging Centre is to form the structure in reinforced concrete. A new steel framed link will provide a connection to the existing Sydney and Chelsea Wings. The basement will be constructed using secant piled embedded walls.

The ground floor of Britten Wing will be reconfigured to provide consulting rooms and a new shared steel framed entrance with the Imaging Centre. A temporary mobile MRI scanner will be provided on the main Sydney Wing car park alongside temporary modular units for displaced support accommodation.

1.4 ADJOINING PROPERTIES AND BELOW GROUND INFRASTRUCTURE

All buildings immediately adjacent to the proposed site are property of the Royal Brompton Hospital and Harefield NHS Trust.

There is no London Underground or Crossrail infrastructure beneath the site.

Sydney Wing
The existing Sydney Wing is a reinforced concrete framed structure over six levels with a single basement level. The building is supported by reinforced concrete pad foundations founded in the sand strata and was constructed in approximately 1988.

Britten Wing
Britten Wing is a four storey masonry clad building with a single basement level originally built in 1924 as the Nurses’ Home to the former Chelsea Hospital for Women. The structural foundations of the building are unknown at this stage and will require investigation at a later design stage, but are envisaged to be shallow pad and strip foundations.

Chelsea Wing
The Chelsea Wing is a four storey masonry clad building constructed in 1913 and has one basement level.
1.5  IMPACT ON STRUCTURAL STABILITY OF SURROUNDING PROPERTIES

At this design stage, given the proposed basement depth and record information available on the existing buildings, we would predict the damage classification for the adjacent buildings including the masonry structures to be ‘negligible to very slight’.

1.6  SUDS, GEOLOGY AND HYDROLOGY CONSIDERATIONS

WSP completed two rotary boreholes in May and June 2016 within the Sydney Wing and Dovehouse Street car parks. The ground conditions encountered were as expected, which comprised Made Ground over River Terrace Deposits underlain by London Clay. Refer to the Geotechnical report in Appendix B.

Sustainable Drainage Systems (SuDS) are proposed, as set out in detail in the Outline Surface Water and Foul Water Drainage Strategy prepared by WSP in February 2018. In summary, a surface water attenuation is proposed, by utilising a blue roof attenuation system at roof level.

1.7  CONSTRUCTION SEQUENCE AND METHODOLOGY

A detailed construction method statement will form part of the Building Contract and will outline the different procedures to be undertaken to complete the various works on site. The contractor will be required to comply with RBKC’s Considerate Constructors Scheme as well as RBKC’s Code of Construction Practice.

To facilitate the construction of the Imaging Centre, the demolition scope of works will include the existing Imatron building and glazed link to Britten Wing. An existing UKPN substation will be decommissioned and demolished to be relocated to the top of the service ramp as part of an enabling works package. An existing escape stair to Chelsea Wing will be demolished and incorporated into a new link connecting the Imaging Centre to the existing Wings.

In order to maintain HSE, LAPPC and Environmental Protection legislation effective dust and emission control measures will be put in place for every dust generating activity.

The project shall produce a dust and air quality management plan and will submit this to the local authority for comment and approval.

Increased road noise levels will occur from vehicles and plant during excavation, piling and general construction works. The impact of this will be mitigated as far as possible by implementing the following:

- Defined working hours, baffles to certain plant, local acoustic screening.
- Vehicle routing.
- Bepers, radios etc. to be silenced. Engines turned off and all measures outlined in the considerate contractors scheme.

Increased vibration levels will occur from vehicles, plant during demolition, piling and general construction works. The impact of this will be mitigated as far as possible by implementing the following:

- Phased deliveries to minimise numbers of vehicles attending site.
- Vehicle routing.
- Engines to be switched off when vehicles are idle or on site.

The excavation of the basement area will be carried out in a number of stages; temporary works will need to be installed to support the proposed secant piled retaining wall.

All temporary works shall be designed by a qualified structural engineer to the relevant British Standards and/or Eurocodes and shall be independently checked in accordance with the requirements set out by the statutory authorities, where required. The sequence of propping for the basement will generally follow the sequence shown in Section 9.
1.8 SITE LOGISTICS

From the outset, the phasing and site logistics have been planned to ensure minimal disruption to the operation of the hospital during the demolition and reconstruction works. In particular, key pedestrian routes between the Wings have been considered and the service ramp will remain operational throughout the construction period. A detailed programme will be developed with the main contractor and detailed in the CMS.

The site is surrounded by residential properties so all construction activities are to be contained within the site boundary wherever possible. The proposed construction vehicle access route will be from Dovehouse Street via Fulham Road. This avoids the residential area of Cale Street.

A Construction Management Plan will be developed by the main contractor once appointed. This is a condition that has been imposed on the original planning permission. The area available for construction activity is limited on the small site, with the basement footprint extending out to the edge of the site boundary. To avoid complicated construction and phasing, it is likely that an on street loading and unloading arrangement will be implemented for construction vehicles. Figure 1 indicates the site boundary and potential construction access.

Figure 1 – Site boundary and construction access for the Imaging Centre

1.9 CONCLUSION

In consideration of the design issues summarised above, this report demonstrates that the proposed scheme will not adversely impact the structural stability of any nearby existing buildings or infrastructure. The Royal Brompton Hospital Imaging Centre development proposals for the S73 minor material amendment therefore comply with Policy CL7(m) of the Consolidation Local Plan 2015.
2 INTRODUCTION

WSP have been commissioned by Royal Brompton and Harefield NHS Foundation Trust to provide a Construction Method Statement in connection with the proposal to demolish the Imatron building to facilitate the construction of a new Imaging Centre, as Phase 1 of the Royal Brompton Hospital Redevelopment. The development will comprise of a two storey building with two basement levels, the formation of a new entrance with the adjacent Britten Wing, and new landscaping. This document supports a minor material amendment (Section 73) application for the scheme.
3 EXISTING SITE

3.1 HISTORIC ENVIRONMENT

The Imaging Centre development is located within the main hospital site for the Royal Brompton and Harefield Hospital on Sydney Street. The site currently comprises hospital accommodation bounded by the hospital’s Sydney Wing building to the east, to the north by Chelsea Wing, the south by Britten Street and to the west by Dovehouse Street. The wider area surrounding the site is predominantly residential with proximity to a number of green spaces including Chelsea Common and St Luke’s Gardens.

The existing site comprises:
- The Imatron building
- Staff car parking
- A UKPN substation
- Britten Wing and allied buildings to the south west of the site
- Chelsea Wing, formerly Chelsea Hospital for Women
- Vehicular access to the site is provided from Cale Street via a service ramp and from Sydney Street to the existing car park. Ambulance parking is provided at the main south entrance to Sydney Wing. The two vehicle accesses are joined via the service yard at the lowered level 1 of the existing development.

The demolition of the existing staff car park, Imatron building and UKPN substation will allow for the development of a new Imaging Centre for the Royal Brompton Hospital to provide improved inpatient facilities with enhanced diagnostic imaging services.

The site is not in an Archaeological Priority area and there are no listed buildings immediately adjacent. The site is not within a conservation area, although the Chelsea Conservation Area, which incorporates St. Luke’s Church and the Chelsea Park / Carlyle Conservation Area to the west, is directly adjacent to the main hospital site.
A tree survey undertaken by Barrell Tree Consultancy in June 2016 identified Category B trees (of moderate quality and value) and their associated root protection areas on the site. The Aboricultural Assessment and Method Statement dated June 2016 includes an analysis of how trees will be affected by the development and an arboricultural method statement describing how retained trees will be protected and managed during the development activity.

Typical site geology comprises Made Ground over Kempton Park Gravels overlying London Clay at depth. A ground investigation has confirmed that the ground water is perched on top of the clay, lying within the gravel layer. Refer to Section 8 within this report for more details.

The topography of the site consists of a gradual fall in existing ground levels from the north of the site at Cale Street towards the south of the site and Britten Street; with northern levels at approximately 7.9m AOD and southern levels at 7.8m AOD.

No watercourses are in proximity to the site, with the nearest being the River Thames over 500m south. For more information on the surface water and groundwater regimes, refer to Section 8 of this report.

The basement has the potential to displace the groundwater present within the Upper Aquifer and affect conveyance of groundwater directly beneath the site. Although considered unlikely to be significant, this may have an impact on surrounding groundwater flow and levels within the vicinity of the site, which will be studied in detailed design.

Further assessment may be required at detailed design stage to determine the significance of these potential impacts.

### 3.2 BUILDING LOCATION

The building is situated in London SW3 and is bounded on four sides by:

- Britten Wing and Britten Street to the south
- Sydney Wing to the east
- Dovehouse Street to the west
- Chelsea Wing to the north

![Figure 3 – Site location](image-url)
Sydney Wing – looking South

Dovehouse Street – looking east

Service ramp – looking north

Dovehouse Street – looking north
EXISTING BUILDINGS

The area to be developed on the Imaging Centre site currently consists of a single storey Imatron building, a UKPN substation and a staff car parking area. Vehicular access to the main hospital is provided from Cale Street via a service ramp adjacent to the Imaging Centre site and from Sydney Street to the existing main car park. Ambulance parking is provided at the main south entrance to Sydney Wing. The two vehicle accesses are joined via the service yard at the lowered level 1 of the existing development. Figure 4 shows the existing buildings on the main hospital site and the extent of demolition.

The surrounding area is generally residential with the green space of St. Luke’s Gardens in close proximity to the east of the site. The Grade II listed gardens and associated Grade I listed church overlook the existing Sydney Wing.

A key constraint to the development is to maintain the uninterrupted operation of the hospital throughout the works to site, including the vehicle service ramp.

Figure 4 - Existing buildings and extent of demolition

The proposed Imaging Centre development site is bounded by Britten Wing to the south, a four storey masonry clad building with a single basement level originally built in 1924 as a Nurses’ Home. To the north of the development site is Chelsea Wing, formerly Chelsea Hospital for Women, a four storey masonry clad building constructed in 1913 with one basement level.

The structural foundations of both buildings will be investigated at the next design stage, but are envisaged to be shallow pad and strip foundations. Minor alterations to both buildings will be undertaken as part of the redevelopment proposals but the Wings will generally remain operational throughout the construction of the Imaging Centre.

The existing Imatron building to be demolished is a single storey timber framed structure constructed in 1973 that accommodates offices and a MRI scanner. During the demolition and reconstruction works this MRI scanner and support accommodation will be relocated in temporary accommodation alongside an existing mobile MRI on the Sydney Wing car park. Both scanners will remain in operation until the completion of the Imaging Centre and installation of the replacement MRIs.
5 PROPOSED SCHEME

5.1 OVERVIEW

The proposed scheme is a minor material amendment (under Section 73 of the Town and Country Planning Act 1990) to planning permission PP/16/04357 to provide a four storey Imaging Centre, including two storeys below ground and two storeys above ground, the relocation of existing substation and associated temporary and enabling works.

The Imaging Centre will consist of two levels of basement, one accommodating plant and the other an Imaging department with MRI scanners. Two levels above ground will consist of specialist clinical accommodation. A link will be provided to connect the new building to the existing Sydney and Chelsea Wings via the existing pedestrian bridge.

The ground floor of Britten Wing will be reconfigured to provide consulting rooms. A new shared entrance will be constructed to connect the Imaging Centre and Britten Wing. A temporary mobile MRI scanner will be provided on the main Sydney Wing car park alongside temporary modular units for displaced support accommodation.

5.2 BASEMENT USE

The proposed two storey basement of the Imaging Centre provides:

- Hospital accommodation including three MRI examination rooms and clinical support, and
- Plant equipment serving the Imaging Centre building.

The lower ground level of the Imaging Centre will have a floor to ceiling height of 4.03m to allow for service routes and the MRI equipment. The basement level will have a height of 5.0m to accommodate plant equipment.

There has been no increase in basement depth for the S73 minor material amendment but the gross area has increased by 36m² compared to the consented application. This is driven by a requirement for additional clinical area to support the MRI facilities. The increase in basement size does not impact on the compliance with Policy CL7(m) of the Local Plan.

5.3 STRUCTURAL PROPOSALS

SUPERSTRUCTURE

It is proposed that the Imaging Centre building structure is formed in reinforced concrete. The slabs will be supported on reinforced concrete columns which in turn will be supported on a piled raft foundation, subject to a ground investigation and detailed geotechnical assessment. A transfer structure is required at ground floor level to accommodate a step in the building line above ground.

A new steel framed link will provide a connection to the existing Sydney and Chelsea Wings at first floor level. An existing escape stair tower to Chelsea Wing will be demolished and re-provided with the construction of the new link with minimal alterations to the existing structural framing.

The new shared entrance to Britten Wing and Imaging Centre will be a single storey steel framed structure supported on shallow foundations. For connectivity, a new glazed link corridor will be constructed within the Britten Wing courtyard. This will also be a lightweight steel frame construction supported on shallow foundations.

BASEMENT CONSTRUCTION

The basement walls will be constructed using a hard/soft secant piled embedded wall. Expected pile diameters are 750mm (tbc in detailed design).
The suspended floors to the basement of the Imaging Centre will be constructed in reinforced concrete which will span on to a reinforced concrete column grid, supported on the piled raft foundation at basement level.

The proposed basement construction will be carefully considered in respect to:

1. Ground heave and associated movements – tension piles are expected to be required. This will require a detailed geotechnical assessment.

2. Ground water and hydrostatic pressure - waterproofing systems need to be considered with appropriate environment grades assigned for the basement areas. Temporary and permanent embedded walls shall be constructed in such a way as to ensure the groundwater is cut off and not drained. In detailed design, the option of introducing a drainage layer below the raft foundation will be considered, should the combined uplift forces prove difficult to accommodate.

3. Significant temporary works will be required to support the new embedded piled retaining walls as the excavation is carried out in order to limit ground movements and minimise disturbance on the boundary of the site and to buried adjacent infrastructure.

4. Movement monitoring of boundaries and party walls will be specified with an appropriate emergency preparedness plan implemented with set trigger levels corresponding to various levels of action (e.g. stop work immediately etc.)

5. Large openings in the basement slabs will require props or buttresses to limit lateral movements.

FOUNDATIONS

The proposal is to support the majority of the development on a deep raft foundation solution, subject to geotechnical detailed assessment and receipt of a site specific ground investigation. Tension and bearing piles will be required to resist out of balance uplift forces.

Perimeter secant piled walls will also be load bearing where the building columns are located on top of the capping beams and at locations where suspended slabs and beams are supported.

5.4 TREES AND LANDSCAPING

A minimum of 1m of soil shall be allowed for designated mature planting and trees along the Dovehouse Street elevation. This shall be accommodated within the design of the ground floor slab. Elsewhere, a shallow grass build up has been allowed for in general landscaped areas. Note that there are no existing trees or landscaping within the site.

5.5 ENVIRONMENTAL AND SUSTAINABILITY

Sustainable Development is the achievement of a better quality of life through the efficient use of resources, which realise continued social progress while maintaining stable economic growth and caring for the environment.

Sustainability issues are addressed in the Imaging Centre development through the consideration of the relevant sustainability policies in the Royal Borough of Kensington and Chelsea’s Plan, which has led to the incorporation of the key design features discussed in this section of the document.

The key design features include:

- During the design development, significant consideration has been given to how the building fabric will respond to its environment in order that the energy consumption of the building is reduced as far as possible through passive means.

- The building fabric will be designed to significantly exceed the limiting fabric requirements of Part L2A (2013) of the Building Regulations wherever possible.
Efficient building services plant, including high efficiency air handling plant with heat recovery and low specific fan power will be specified where feasible.

All spaces will include 100% low energy lighting and maximised use of LED and low energy fixtures.

Efficient gas fired boilers and air cooled chillers to supply heating and cooling to the Imaging Centre.

Roof mounted photovoltaic panels will be installed to provide on-site electricity generation.

A Construction Site Waste Management Plan shall be implemented, which includes procedures and targets for the reduction of waste and ensuring waste is reused, recycled or diverted from landfill.

Monitoring of energy and water use and transport of materials to and from site during construction, as to inform more sustainable practices.

Specification/procurement of materials with a low environmental impact.

Materials are to be responsibly sourced and in particular all timber shall be procured in accordance with UK Government’s Timber Procurement Policy.

Measures shall be implemented on site during demolition and construction to prevent air and water pollution.

Water meters will be installed to help monitor and reduce operational water use.

Water efficient fittings are proposed for the toilet facilities.

Incorporation of sustainable urban drainage (SuDS) to reduce the surface water discharge rate to the drainage system by 50% compared to the current scenario.
6  ADJOINING PROPERTIES AND BELOW GROUND INFRASTRUCTURE

6.1  ADJOINING PROPERTIES

All buildings immediately adjacent to the proposed site are property of the Royal Brompton Hospital and Harefield NHS Trust.

There is no London Underground or cross rail infrastructure beneath the site.

Sydney Wing
The existing Sydney Wing is a reinforced concrete framed structure over six levels with a single basement level. The building is supported by reinforced concrete pad foundations founded in the sand strata and was constructed in approximately 1988.

Britten Wing
Britten Wing is a four storey masonry clad building with a single basement level originally built in 1924 as the Nurses’ Home to the former Chelsea Hospital for Women. The structural foundations of the building are unknown at this stage and will require investigation at a later design stage, but are envisaged to be shallow pad and strip foundations.

Chelsea Wing
The Chelsea Wing is a four storey masonry clad building constructed in 1913 and has one basement level.

6.2  BELOW GROUND SERVICES

Some services diversions will be required to facilitate the works. Most notably, the HV cable running beneath the proposed development site from the UKPN substation located adjacent to Chelsea Wing. The cable supplies the hospital buildings and residential properties on Dovehouse Street. In order to construct the Imaging Centre the substation and cable will be decommissioned and re-provided by UKPN at the top of the service ramp on Cale Street.
7 GROUND MOVEMENT AND DAMAGE CLASSIFICATION

The excavation of the ground to form the new basement will be carried out in a controlled manner with extensive temporary works designed to retain the ground around the excavation perimeter. This will ensure that foundations to adjacent buildings will not be undermined. It may be necessary to underpin existing foundation directly adjacent to the work. This will be reviewed in detail following intrusive site investigations to confirm the exact nature and depth of the existing building foundations.

Excavation of the ground within the new basement area may also generate movement of the deep soil strata leading to localised settlement of the shallower ground adjacent to the excavation. A detailed intrusive site investigation will be carried out in the next design stage to confirm the ground conditions at depth. This additional information on the soil strata will allow a detailed assessment of ground movement to be carried out and the predicted damage classification for the adjacent structures to be calculated. If required after this assessment, measures to reduce ground movement will be considered together with any strengthening works to adjacent properties.

At this stage, the detailed intrusive site investigation has not been carried out to avoid disruption to patients and staff at the hospital. This is due to be undertaken at the beginning of the next stage to inform the detailed design.

At this stage in the design, given the proposed basement depth and record information available on the adjacent buildings, we would predict the damage classification for the adjacent buildings including the masonry structures to be ‘negligible to very slight’.
GEOLOGY AND HYDROLOGY CONSIDERATIONS

8.1 GEOLOGY AND BOREHOLE DATA

WSP completed two boreholes (using rotary drilling) to a depth of 7.7 and 9.0 m below ground level (bgl), respectively, on 27th May 2016 (BH601) and 1st June 2016 (BH602). The investigation was commissioned to establish the ground conditions including the geological strata and the presence of the Upper Aquifer. Results are summarised in Table 1 below. Refer to SI factual report in Appendix B.

Table 1 - Summary of encountered ground conditions (extract from WSP 2016 SI factual report)

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<td>Lightly brown and black clayey gravelly sand.</td>
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<td>Kempton Park Gravels</td>
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<td>Light brown gravelly SAND becoming sandy gravel with depth.</td>
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<td>London Clay Formation</td>
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<td>Bluish grey silty CLAY.</td>
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Both boreholes were installed with standpipes and groundwater was monitored on two occasions. The results are provided in Table 2. Borehole BH601 relates to the Imaging Centre site in particular.

Table 2 - Groundwater monitoring summary

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The above soil and hydrogeology profile confirms assumptions made to date and also confirms that the Upper Aquifer is present in the gravels layer on top of the clay.

Further detailed site investigation works will be undertaken for the Imaging Centre development to confirm the ground conditions. This will include deep boreholes to identify the ground conditions at depth and trial pits to establish the depth of foundations to adjacent buildings. This will provide design parameters for the next phase of works. The proposed basement will require monitoring of the groundwater level over a long period.
8.2 HYDROLOGY AND FLOODING

OVERVIEW
In terms of groundwater flooding, groundwater is present beneath the site at depths of between 1.986 to 2.109 mAOD, within the river terrace gravels (RTGs). The final level of the basement to the Imaging Centre will be -1.500 mAOD to be founded within the London Clay and therefore will potentially displace the groundwater present within the Upper Aquifer and affect conveyance of groundwater directly beneath the site. Although considered unlikely to be significant, this may have an impact on surrounding groundwater flow and levels within the vicinity of the site. Further assessment may be required at detailed design stage to determine the significance of these potential impacts.

GROUNDWATER FLOODING
The RBKC’s Strategic Flood Risk Assessment (SFRA) states that there are several groundwater flooding records identified within the RBKC boundary, with the majority of incidents recorded located within Notting Hill and South Kensington areas of the Borough. Figure 7 within the SFRA shows no groundwater flooding incidents at the site; however groundwater flooding incidents have been recorded 600m north-west of the site, towards Sloane Square.

Both Figure 14 of the SFRA and Figure 5 of the Surface Water Management Plan (SWMP) (which appear to be the same map) show that the site is within an area susceptible to groundwater flooding.

OFF-SITE IMPACT
In terms of groundwater flooding, groundwater is present beneath the site at depths of between 1.986 to 2.109 mAOD, within the RTGs. The final level of the basement to the Imaging Centre will be -1.500mAOD to be founded within the London Clay and therefore will potentially displace the groundwater present within the Upper Aquifer and affect conveyance of groundwater directly beneath the site. Although considered unlikely to be significant, this may have an impact on surrounding groundwater flow and levels within the vicinity of the site. Further assessment may be required at detailed design stage to determine the significance of these potential impacts.

SUSTAINABLE DRAINAGE SYSTEM PROPOSALS
A sustainable drainage system is proposed, as set out in detail in the Outline Surface Water and Foul Water Drainage Strategy prepared by WSP in February 2018. In summary, the development proposals include the use of SuDS in the form of surface water attenuation in a blue/green roof system. This strategy will facilitate a reduction in surface water runoff rates both in terms of volume and discharge rates.

The development proposes to use a blue/green roof on top of the Imaging Centre overlooked by Dovehouse Street residents. This system provides temporary surface water attenuation on the building’s flat roof and gradually releases this at a low flow rate. The integration of a green roof cover provides benefits in terms of biodiversity and visual impact.

The attenuated water will be restricted by incorporating a flow controlled device (i.e. pump) to allow for a gradual release. There is no practical nearby watercourse to allow for a surface water discharge and infiltration to the ground is limited due the limited permeable layers within the area. As a result, the attenuated surface water will discharge to the public sewer.

The surface water discharge rates from the proposed development will reduce compared to the existing buildings as a consequence of the proposed surface water attenuation. The proposed discharge will be at a minimum 50% less than the existing runoff rate to ensure the sustainable management of surface water runoff in line with best practice. Full details of how this will be achieved are included within the Outline Surface Water and Foul Water Drainage Strategy report.

It is confirmed that the proposed SuDS system will be retained throughout the lifetime of the development.
8.3 GROUND CONTAMINATION

A geo-environmental desk study has been undertaken which outlines the possible sources of contamination on the site. The report identified a low to medium risk of possible pollutants being present. Refer to the Geo-environmental Desk Study prepared by WSP in April 2018 for more information.

A site investigation compliant with BS10175 and Generic Quantitative Risk Assessment will be undertaken post planning in line with CLR11. This will include sampling and testing of soil samples which will provide a full profile of the soil conditions across the site.

8.4 DESIGN APPROACH

BASEMENT RETAINING WALLS

The basement shall be designed using appropriate soil parameters determined from a detailed site ground investigation. The retaining embedded pile retaining walls shall be designed to resist the lateral earth pressure derived from this study and the reinforced concrete lining walls designed to resist the hydrostatic pressure, assumed to be at 1m below existing ground level. The piled retaining wall design shall be considered in both the temporary and permanent condition, taking due account of lateral prop positions in the respective cases.

RAFT FOUNDATION

The raft foundation shall be designed to resist combinations of the building dead and imposed loads, the upward heave forces created through the unloading of the clay and the hydrostatic pressure. The calculation of the heave forces will be determined through detailed analysis of the raft and soil interaction. Appropriate soil stiffnesses shall be selected based on the site specific soil data and according to the duration of load being considered. Where required, tension piles shall be used to resist the combination of hydrostatic and heave pressure on the raft where the counteracting weight of the building is insufficient.
9 CONSTRUCTION SEQUENCING AND METHODOLOGY

9.1 OUTLINE SEQUENCE OF DEMOLITION AND CONSTRUCTION

A more developed construction method statement (CMS) will form part of the Building Contract and will outline the different procedures to be undertaken to complete the various works on site. The contractor will be required to comply with RBKC’s Considerate Constructors Scheme as well as RBKC’s Code of Construction Practice.

The sequence of demolition, excavation, temporary works and construction of permanent works is shown in the sequence sketches below.

Figure 5 - Sequence 1 – Demolish existing

Figure 6 – Sequence 2 – Remove/divert existing buried services and begin piling
Figure 7 – Sequence 3 – Install capping beam and begin basement dig, installing temporary propping in stages

Figure 8 – Sequence 4 – Install basement bottom up, removing temporary props as each floor is constructed
9.2 DEMOLITION AND CONTROL OF DUST, NOISE AND VIBRATION

DEMOLITION

The demolition scope of works includes the Imatron building, once vacated, the glazed link to Britten Wing and the existing substation. An existing escape stair to Chelsea Wing will be demolished and incorporated into the new link connecting the Imaging Centre to the existing Wings.

A Demolition & Asbestos survey will be carried out prior to any construction works starting. A full dilapidation survey will be undertaken of surrounding properties and highways; this will include all street furniture, adjacent buildings and a CCTV survey of the drainage.

Any asbestos containing materials that have been identified will be disposed of properly. The contractor will employ all appropriate procedures and adopt all necessary precautions for any asbestos not picked up in the report. Existing services will be isolated and capped off to carry out the works safely.

Before the works can commence the contractor’s final demolition method statement will need to be submitted and agreed. In particular mitigation measures will need to be detailed for the containment and minimisation of noise, dust and vibration.

DUST AND POLLUTION

In order to maintain HSE, LAPPC and Environmental Protection legislation an effective dust and emission control measures should be put in place for every dust generating activity.

The project shall produce a dust and air quality management plan and will submit the same to the local authority for comment and approval. This plan will detail the work methods and the controls to be employed for all relevant site activities. This plan will also consider the use of water suppression, dealing with demolition arising’s, encapsulation of areas, scaffolding and general site waste management.

The plan will set out commitments to reducing CO₂ emissions and controlling PM10 and NOx emissions from plant and vehicles. The following steps should be followed:

- Monitoring techniques for particulate matter PM10 (dust) throughout the course of the project, normally requiring a series of sensors located around the project and also recording wind speed and direction.
Setting of trigger action levels for PM10 emissions along with an agreed management action plan throughout the demolition and construction phases of the project.

Response processes including communication to the Council on breach of the set trigger level.

Corrective action process to be established following any breach or agreed improvement measure.

Air monitoring will be undertaken on regular intervals and will be analysed to ensure that the air quality of the surrounding area is not being detrimentally affected by our construction works. Air monitoring will not be just related to dust but will also check for PM10 and NOx emissions as well as the levels of CO₂ created by site based activates.

At this preliminary stage we envisage the following dust suppression techniques will take place on the Royal Brompton Hospital Imaging Centre scheme:

- Any scaffold erected to the external elevations will be fully wrapped in monarflex or debris netting to contain the construction activities.

- In order to reduce the CO₂ emissions, no construction vehicles or plant will be left to idle. If it is not being used it will be turned off. This includes all delivery vehicles.

- Adoption of ‘green fleet management practices’ to set out ways to reduce CO₂ emissions along with a monitoring process to record savings made.

- Water will be used to suppress the dust generally and specifically where demolition, cutting and breaking of concrete is being carried out.

- All skips and wagons containing waste will be securely covered and water ‘misted’ as appropriate.

- Trained and responsible management will be maintained on site at all times during working hours.

Dust monitoring will be carried out at regular intervals, increasing in frequency during works that will inherently generate dust (e.g. demolition and reinforced concrete works). If the levels of dust particles in the air are deemed unacceptable action will be taken and measures to avoid, reduce and/or suppress any dust will be evaluated and implemented. At the boundary to the site specific risk assessments will be carried out in relation to dust emissions and where practical dust screening measures will be placed at the boundary. We note the proximity of the fully operational hospital where specific measures will be put in place through liaison with the Trust.

9.3 NOISE AND VIBRATION

Increased road noise levels will occur from vehicles and plant during excavation, piling and general construction works (e.g. from the use of air compressors and diamond cutters). It is anticipated that the contractor will enter into a Section 61 Agreement with RBKC following liaison with the local community. The impact of this will be mitigated as far as possible by implementing the following:

- Defined working hours, baffles to certain plant, local acoustic screening.

- Vehicle routing.

- Beepers, radios etc. to be silenced. Engines turned off and all measures outlined in the considerate contractors scheme.

Increased vibration levels will occur from vehicles, plant during demolition, piling and general construction works. The impact of this will be mitigated as far as possible by implementing the following:

- Phased deliveries to minimise numbers of vehicles attending site.

- Vehicle routing.

- Engines to be switched off when vehicles are idle or on site.
SITE ENABLING

- Erection of hoarding / temporary barriers / control measures and signage to prevent unauthorised access, where required.
- Identification and protection / termination of any live services, including the decommissioning of the UKPN substation to be re-provided elsewhere within the main hospital site.
- Installation of temporary services as required to suit the works.
- Construction of temporary modular units for the replacement MRI and staff accommodation on the main car park.
- Decanting of staff and clinical services.
- Erection of fully monaflexed scaffold in accordance with design.
- Establishment of fire routing: fire-fighting equipment and emergency lighting in accordance with separately issued Fire and Emergency procedures and too include evacuation procedures.
- Structural investigations and floor load testing to determine the weight of material allowable for the floor by floor demolition, or to identify any need for back propping.
- Erection of temporary welfare facilities that includes toilets, changing room, canteen and office to suit the demolition activities.

9.4 BASEMENT TEMPORARY WORKS AND PERMANENT SUPPORT SOLUTION

EXCAVATION TO FORM BASEMENT

The excavation of the basement area will be carried out in a number of stages; temporary works will need to be installed to support the retaining wall that is proposed to be installed as a secant piled wall. The ground and existing conditions are to be fully investigated to ascertain the potential movement and reactions to the excavation and construction of the new basement.

As the basement is constructed the new structure will prop the perimeter retaining wall and allow the temporary propping to be removed leaving a stable basement retaining structure in the permanent condition.

The construction sequence for the basement will generally follow the sequence below once the demolition is completed (note exact levels are subject to change);

- Installation of the secant piled retaining wall from ground level c+7.98mOD.
- Initial reduced level dig to the underside of the ground floor capping beam c+7.35mOD.
- Construction of the capping beam.
- Installation of high level props at c+7.65mOD progressively as excavation is reduced.
- Excavation to reduced level c+2.55mOD.
- Install props at c+3.05mOD.
- Excavation of basement down to c-2.25mOD to enable basement raft at B2 to be constructed.

EMBEDDED SECANT PILE RETAINING WALLS TO BASEMENT

Secant piled walls are a series of interlocking male and female piles that are cast either in a rotary or continuous flight auger (CFA) method. Female piles are not reinforced whereas the male piles are reinforced with the principle that the male piles are bored between the un-reinforced female piles. The interlocking piles of a secant piled wall form the closed structure to the basement and act as a barrier in water bearing soil. Where large depths of basement are to be formed it may well be necessary to use a cased CFA rig, these are known as Cased Secant Piles (CSP). Guide walls will need to be cast at the outset to assist with the setting out and locating of the pile casing/ auger.
As a proportion of the secant piling is installed and tests results on the strength/integrity are approved the capping beam can be installed to stabilise each of the piles.

The excavation to the lower levels can progress as soon as the temporary props are in place to the new retaining wall. It is expected that a regime of monitoring will need to be agreed to ensure that movement of existing structures is within acceptable levels.

TEMPORARY WORKS

The retaining walls will need to be propped as the excavation progresses and it is envisaged that the propping design will take a number of forms. All temporary works shall be designed by a qualified structural engineer to the relevant British Standards and/or Eurocodes and shall be independently checked in accordance with the requirements set out by the statutory authorities, where required (e.g. Thames Water). The sequence of propping for the basement will generally follow the sequence below.

1. **Stage 1.** As the secant piles are completed with capping beam cast and the integrity/test results are approved and accepted by the temporary works engineer, the excavation can commence.

2. **Stage 2.** To facilitate the first level of lateral props being installed an initial excavation will take place to bring the dig down to a level c1.0m below the soffit of the ground floor slab. The secant piles will be designed to enable this level of excavation to be achieved with the capping beam acting as a waling structure.
3. **Stage 3.** Props will be installed at a level to ensure that the top of the new secant wall can be braced and supported to restrict movement to acceptable levels. The props will be installed at a level c0.5m below the soffit of the ground floor slab. If it is necessary to support the lateral props mid span this will be carried out by installing temporary piles/ plunge columns as required.

4. **Stage 4.** Once the temporary works engineer has approved and released the approval to dig, excavation will commence down to a level c1.0m below the soffit of the lower ground floor to enable the next level of props to be installed.

5. **Stage 5.** Props will be installed at a level c0.5m below the soffit of the lower ground floor as the excavation is progressed.
6. **Stage 6.** Final excavation stage to the soffit level of the basement raft. Access to the reduced level will need to be carefully planned to ensure the maximum volumes can be excavated day by day. In order to complete the excavation platforms will need to be erected to take vehicles off the road and sit a large excavator to remove the ramp.

7. **Stage 7.** Cast basement slab (B2). The Basement slab provides the propping to the secant wall at basement level. Concrete will be pumped from the upper levels and/or skipped to the slab and columns utilising the tower cranes.

8. **Stage 8.** Cast basement slab (B1). As the core walls and columns are cast to the B2 level basement formwork and falsework can be prepared ready for the next concrete slab at level B1.
9. **Stage 9.** Removal of props once the B1 slab is cast.

10. **Stage 10.** Cast ground floor slab. As the core walls and columns are cast to the B1 level basement formwork and falsework can be prepared ready for the next concrete slab at level GF.

11. **Stage 11.** Removal of the ground level lateral prop.
10 SITE LOGISTICS

10.1 CONSIDERATIONS

The phasing and site logistics have been planned to ensure minimal disruption to the operation of the hospital during the demolition and reconstruction works. In particular, key pedestrian routes between the Wings have been considered and the service ramp will remain operational throughout the construction period. A detailed programme will be developed with the main contractor and detailed in the CMS.

In establishing a logistics strategy we are taking into account the following local conditions:

- Local occupants including offices, hotels, residential and other amenities,
- Requirements of the Royal Borough of Kensington and Chelsea,
- Other construction projects,
- Local traffic conditions,
- Noise and dust control.

10.2 ROAD ACCESS

The proposed construction vehicle access route will be from Dovehouse Street via Fulham Road. This avoids the residential area of Cale Street. Refer to sketches in Appendix C showing the wider road network and the local road network.

10.3 SITE ACCESS

A Construction Management Plan will be developed by the main contractor once appointed. The area available for construction activity is limited on the small site, with the basement footprint extending out to the edge of the site boundary. To avoid complicated construction and phasing, it is likely that an on street loading and unloading arrangement will be implemented for construction vehicles. Refer to Appendix C for a sketch indicating potential construction access.
LIMITATIONS OF STUDY PARAMETERS

An appropriate approach has been taken in determining the basement construction proposal, based upon desk study appraisal and some preliminary design studies and analyses.

When considering this report, it must be recognised that a site specific detailed ground investigation and a detailed inspection of the neighbouring properties has yet to be undertaken to obtain sufficient information that will be necessary for a detailed assessment and final design for the proposed development.

A project specific ground investigation and adjacent buildings surveys will be undertaken prior to finalisation of details of the substructure and basement structural elements, construction techniques, sequence, and temporary works.

Ground investigation and adjacent properties surveys will include, but not be limited to, the following:

- Trial pits to determine boundary footing levels, projections, materials, and general construction.
- Surveys to determine boundary wall thicknesses, construction and basement and floor levels.
- Surveys to determine the construction and the condition of the utility companies’ equipment.
- Surveys and investigations to determine the structural conditions.
- Deep geotechnical boreholes for soil strata levels, in situ soil testing, ground water monitoring, and samples.
- Laboratory testing of soil to obtain strength and stiffness properties, and chemistry/contamination.
12 SUMMARY AND CONCLUSIONS

The S73 outlines the following changes to the consented development:

- The Imaging Centre will be constructed and operated on a stand-alone basis as phase 1 of the Royal Brompton Hospital Redevelopment
- Relocation of the existing substation to Cale Street by UKPN
- An additional storey for clinical accommodation above ground
- Temporary relocation of MRI scanners and support accommodation to the Sydney Wing car park
- The building has been designed to allow for the future modification of the access ramp to allow phase 2 of the consented scheme to be constructed.

The amendments do not require an increase in the basement depth and require a minor increase in size from the consented scheme and will not adversely impact the structural stability of any nearby existing buildings or infrastructure.

The S73 minor material amendments to the Royal Brompton Hospital consented redevelopment therefore comply with Policy CL7(m) of the Consolidation Local Plan 2015.
Appendix A

STRUCTURAL GENERAL ARRANGEMENT DRAWINGS
NOTES:
1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL
ARCHITECTS, ENGINEERS AND SPECIALIST DRAWINGS ALONG WITH
ALL RELEVANT SPECIFICATIONS.
2. FOR GENERAL NOTES, REFER TO DRAWING PROJ-WSP-00-XX-DR-
S-0001.

KEY TO HEALTH & SAFETY SYMBOLS

WARNING
INDICATES A RESIDUAL RISK AS A WARNING.

INFORMATION
INDICATES A RESIDUAL RISK FOR INFORMATION.

PROHIBITIVE
INDICATES A RESIDUAL RISK REQUIRING A PROHIBITIVE ACTION.

COMPULSORY
INDICATES A RESIDUAL RISK REQUIRING A COMPULSORY ACTION.

DRAWING STATUS:

CLIENT:
ARCHITECT:
PROJECT:
TITLE:
CHECKED: APPROVED:
PROJECT NUMBER: DATE:
DRAWING No: REV:
SCALE @ A1:

RROYAL BROMPTON & HAREFIELD NHS FOUNDATION TRUST

RBH REDEVELOPMENT
IMAGING CENTRE
BASEMENT B1 LEVEL
GENERAL ARRANGEMENT

DRAWING CREATED IN REVIT. 23/03/2018 17:57:06

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INTRODUCTION

WSP | Parsons Brinckerhoff undertook a site investigation on behalf of Royal Brompton and Harefield NHS Trust (the Client) at Royal Brompton Hospital, London, SW3 (the Site) in order to support the planning application.

WSP | Parsons Brinckerhoff understands the proposed redevelopment of Royal Brompton Hospital includes construction of an extension to the Sydney Wing and development of an Imaging Centre. The extension will also comprise a two level basement (with an underlying attenuation tank).

London Borough of Kensington and Chelsea adopted planning policy (CL7) on basements in January 2015. Subsequently, draft guidance was produced, which culminated in the adoption of the “Basements Supplementary Planning Document” (SPD) on 14 April 2016. This guidance requires a Construction Method Statement to be provided as part of the pre-planning work. Section 5, B.2.2 states the following:

“A site investigation should be undertaken to establish the ground conditions including the geological strata and the presence of the Upper Aquifer. It is particularly important to distinguish between sites where the subsoil is clay and those where it is sand or gravel. The site investigation should be undertaken using boreholes on the application site. Variations in ground conditions can occur within close proximity therefore the borehole investigation may need to be undertaken at various locations spread across the site.”

Considering this new guidance and following discussions with the London Borough of Kensington and Chelsea planning team, WSP | Parsons Brinckerhoff understand that a site investigation is required to confirm ground conditions and groundwater levels beneath the Site, prior to submission of the planning application.

SITE APPRECIATION

WSP | Parsons Brinckerhoff completed a revised Phase 1 geo-environmental desk study in June 2016. A summary of relevant findings are presented below in Table 1, which has informed our proposed scope for a site investigation.

<table>
<thead>
<tr>
<th>Table 1 - Summary of Available Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SITE DETAILS</strong></td>
</tr>
<tr>
<td><strong>Site Address</strong></td>
</tr>
<tr>
<td><strong>Grid Reference</strong></td>
</tr>
<tr>
<td><strong>Area</strong></td>
</tr>
<tr>
<td><strong>Current Use and Description</strong></td>
</tr>
</tbody>
</table>
SITE DETAILS

accommodation running between Sydney Street to the east, Dovehouse Street to the west, Cale Street to the north and Britten Street to the south.

New buildings (with basements) are proposed within two areas and are the subject of this investigation; the eastern area is currently used as a car park for the Sydney Wing and is access via Sydney Street; the western area is currently comprised of the northern section of the Britten Wing and a car park accessed via Dovehouse Street. An electrical substation is present within the car parking area.

Ground Cover and Access

The majority of the Site is covered by hard standing and building cover with occasional landscaped areas and is flat and level.

OBJECTIVES

The objectives were the completion of a site investigation including the installation of boreholes, monitoring of groundwater to confirm the presence and depth to the Upper Aquifer in order to support the planning application.

It should be noted that the aims of this site investigation were limited to informing the Construction Method Statement only to allow compliance with the SPD. This investigation is not be adequate to discharge any future planning conditions relating to contaminated land nor will it be sufficient to inform geotechnical design of the proposed development.

INTRUSIVE WORKS

WSP | Parsons Brinckerhoff completed two boreholes (using rotary drilling) to a depth of 7.7 and 9.0 m below ground level (bgl), respectively, on 27th May 2016 (BH601) and 1st June 2016 (BH602). The boreholes were installed for the purposes of groundwater monitoring with the response zones (between 4.7 to 8.5 m bgl) within the Kempton Park Gravels on the interface with the London Clay in order to confirm the depth of the Upper Aquifer. One borehole was progressed within each of the Site cark parking areas.

A borehole location plan is appended to this report.

GROUND CONDITIONS

DESK STUDY

A site investigation was completed by WSP | Parsons Brinckerhoff in 2010 as part of a wider investigation. One borehole was progressed within the Sydney Wing car park to a maximum depth of 8.75 m bgl and recorded the following geological sequence and anticipated depth and thickness:

- Made Ground: 0.0 to 2.6 m below ground level (m bgl)
- Kempton Park Gravel: 2.6 to 7.8 m bgl
- London Clay Formation: 7.8 to >8.75 m bgl (Unproven)

The Kempton Park Gravels are classified as a Secondary ‘A’ aquifer. The London Clay Formation is classified as Unproductive Strata.

From the previous site investigation data, groundwater was anticipated to be at a depth of approximately 5.5m bgl, within the base of the Kempton Park Gravels, resting on the London Clay Formation, which is effectively impermeable.

SITE INVESTIGATION

Ground conditions encountered during the site investigation are summarised in Table 2 below and concur with the 2010 site investigation and geological mapping.
Table 2 - Summary of Encountered Ground Conditions

<table>
<thead>
<tr>
<th>STRATUM</th>
<th>DEPTH TO BASE (M BGL)</th>
<th>THICKNESS (M)</th>
<th>TYPICAL DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt/Brick Paving</td>
<td>0.05 to 0.07</td>
<td>0.05 to 0.07</td>
<td>Tarmac cover</td>
</tr>
<tr>
<td>Made Ground</td>
<td>2.20 to 3.00</td>
<td>2.15 to 2.93</td>
<td>Light brown and black clayey gravelly sand.</td>
</tr>
<tr>
<td>Kempton Park Gravels</td>
<td>7.40 to 8.20</td>
<td>4.40 to 6.00</td>
<td>Light brown gravelly SAND becoming sandy gravel with depth.</td>
</tr>
<tr>
<td>London Clay Formation</td>
<td>Not proven (&gt;9.00)</td>
<td>Not proven (&gt;0.80)</td>
<td>Bluish grey silty CLAY.</td>
</tr>
</tbody>
</table>

The borehole logs are appended to this report.

GROUNDWATER MONITORING

BH601 and BH602 were installed with standpipes with response zones within the Kempton Park Gravels. Groundwater was monitored on two occasions on 2nd and 8th June 2016. Results are provided in Table 3 below:

Table 3 – Groundwater Monitoring Summary

<table>
<thead>
<tr>
<th>BOREHOLE</th>
<th>DEPTH TO GROUNDWATER (M BGL)</th>
<th>DEPTH TO BASE (M BGL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2nd June</td>
<td>8th June</td>
</tr>
<tr>
<td>BH601</td>
<td>5.85</td>
<td>5.84</td>
</tr>
<tr>
<td>BH602</td>
<td>5.84</td>
<td>5.86</td>
</tr>
</tbody>
</table>

Groundwater was recorded beneath the site at a depth of approximately 5.8m bgl, equivalent to a level of approximately 2.1 mAOD, at the interface of the Kempton Park Gravels and London Clay. The final levels of the basement to the Sydney Street extension (relating to BH602) and Imaging block (relating to BH601) are understood to be -0.875 and -0.720 mAOD respectively to be founded within the London Clay and therefore will potentially displace the groundwater present within the Upper Aquifer and affect conveyance of groundwater directly beneath the site. Although considered unlikely to be significant, this may have an impact on surrounding groundwater flow and levels within the vicinity of the site. Further assessment may be required at detailed design stage to determine the significance of these potential impacts.

Yours sincerely,

Roisin Lindsay
Senior Environmental Consultant

Appended

- Limitations
- Borehole Location Plan
- Borehole Logs
General Limitations

Limitations for WSP Land Restoration and Ground Engineering Division

General

WSP has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed and outlined in the body of the report. Unless explicitly agreed otherwise, in writing, this report has been prepared under WSP Standard Terms and Conditions, as included within our proposal to the Client.

Project specific appointment documents may be agreed on a project by project basis, at our discretion. A charge may be levied for both the time to review and finalise appointments documents and also for associated changes to the appointment terms. WSP reserve the right to amend the fee should any changes to the appointment terms create an increase risk to WSP.

The report needs to be considered in the light of the WSP proposal and associated limitations of scope. The report needs to be read in full and isolated sections cannot be used without full reference to other elements of the report. The report is only valid for its originally intended purpose as set out in either our report or the proposal.

Phase 1 Geo Environmental Preliminary Risk Assessments

The works undertaken to prepare this report comprise a study of available and easily documented information from a variety of sources (including the Client), together with (where appropriate) a brief walk over inspection of the Site and correspondence with relevant authorities and other interested parties. Due to the short timescales associated with these projects responses may not have been received from all parties. It is not standard, due to the timescales, to visit archives and local libraries as part of these works. WSP cannot be held responsible for any disclosures that are provided post production of our report and will not automatically update our report.

The opinions given in this report have been dictated by the finite data on which they are based and are relevant only for the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in this report, WSP reserves the right to review such information and, if warranted, to modify the opinions accordingly.

It should be noted that any risks identified in this report are perceived risks based on the information reviewed. Actual risks can only be assessed following intrusive investigations of the Site.

Intrusive Investigation Reports

The investigation has been undertaken to provide information concerning the type and degree of contamination present at the Site in order to allow a generic risk assessment to be undertaken or identification of the soil properties to allow for geotechnical development constraints to be identified.

The objectives of the investigation are limited to establishing the risks associated with potential contamination sources with the potential to cause harm to human health, building materials, the environment (including adjacent land), or controlled waters. For geotechnical investigations the purpose is to broadly identify the development constraints associated with the physical property of the soils underlying the site.

The amount of exploratory work, soil property and chemical testing undertaken has necessarily been restricted by various factors which may include accessibility, the presence of services; existing buildings; current site usage or short timescales. The exploratory holes completed assess only a
small percentage of the area in relation to the overall size of the Site, and as such can only provide a
general indication of conditions. The number of sampling points and the methods of sampling and
testing do not preclude the possible existence of localised "hotspots" of contamination where
concentrations may be significantly higher than those actually encountered or ground conditions that
vary from those identified. In addition, there may be exceptional ground conditions elsewhere on the
site which have not been disclosed by this investigation and which have therefore not been taken into
account in this report. For example these include spatial variations in soil properties; the varying
thickness and physical nature of the strata identified and changes in groundwater levels or flow rates.

The inspection; testing and monitoring records relate specifically to the investigation points and the
timeframe that the works were undertaken. They will also be limited by the techniques employed.
WSP has interpreted between these points based upon assumptions to develop our interpretation and
conclusions. The assumption made in forming our conclusions is that the ground and groundwater
conditions (both chemically and physically) are the same as have been encountered during the works
undertaken at the specific points of investigation.

On 1st April 2010, BS EN 1997-1:2004 (Eurocode 7: Geotechnical Design – Part 1) became the
mandatory baseline standard for geotechnical ground investigations.

In terms of geotechnical design for foundations, slopes, retaining walls and earthworks, EC7 sets
guidance on design procedures including specific guidance on the numbers and spacings of
boreholes for geotechnical design, there are limits to methods of ground investigation and the quality
of data obtained and there are also prescriptive methods of assessing soil strengths and methods of
design. Unless otherwise explicitly stated, the work has not been undertaken in accordance with
EC7. A standard geotechnical interpretative report will not meet the requirements of the
Geotechnical Design Report (GDR) under Eurocode 7. A GDR can strictly only be prepared following
confirmation of all structural loads and serviceability requirements. The design process requires close
co-operation between the geotechnical engineer and the structural engineer and is iterative. Where a
GDR is prepared using preliminary or assumed loadings and/or serviceability limits it should only be
considered as an interim report and should not be relied upon for the procurement or construction of
the works it describes. A GDR will be a standalone specifically entitled report.

During any build programme WSP should be consulted if alternative ground conditions are
encountered. It assumes during any site works that the contractor will use their best endeavours to
manage and control groundwater and other unforeseen ground conditions. WSP will not be liable for
actions taken prior to consultation.

The scope of the investigation was selected on the basis of the specific development and land use
scenario proposed by the Client and may be inappropriate to another form of development or scheme.
If the development layout was not known at the time of the investigation the report findings may need
revisiting once the development layout is confirmed.

The risk assessment and opinions provided are based on currently available guidance relating to
acceptable contamination concentrations; no liability can be accepted for the retrospective effects of
any future changes or amendments to these values. Specific assumptions associated with the WSP
risk assessment process have been outlined within the body or associated appendix of the report.

Additional investigations may be required in order to satisfy relevant planning conditions or to resolve
any engineering and environmental issues.

If costs have been included in relation to additional site works, and / or site remediation works these
must be considered as indicative only and must, be confirmed by a qualified quantity surveyor.

The following report titles (or combination) may cover this category of work: geo environmental site
investigation; geotechnical assessment; GIR (Ground Investigation reports); preliminary
environmental and geotechnical risk assessment; geotechnical risk register.

**Detailed Quantitative Risk Assessments and Remedial Strategy Reports**

These reports either use primary data or build upon previous report versions and associated notes.
The scope of the investigation; further testing and monitoring and associated risk assessments were
selected on the basis of the specific development and land use scenario proposed by the Client and
may not be appropriate to another form of development or scheme layout. The risk assessment and
opinions provided are based on currently available approaches in the generation of Site Specific
Assessment Criteria relating to contamination concentrations and are not considered to represent a
risk in a specific land use scenario to a specific receptor. No liability can be accepted for the retrospective effects of any future changes or amendments to these values, associated models or associated guidance.

The outputs of the Detailed Quantitative Risk Assessments are based upon WSP manipulation of standard risk assessment models. Models are simulations based on the available data set and should not be used as predictions.

Where a remediation strategy is proposed, this is based on our interpretation of the risk assessment criteria and is specific to a particular location and a particular intended land use and configuration / layout. Prior to adoption they will need discussing and agreeing with the Regulatory Authorities prior to adoption on site. The regulatory discussion and engagement process may result in an alternative interpretation being determined and agreed. The process and timescales associated with the Regulatory Authority engagement are not within the control of WSP. All costs and programmes presented as a result of this process should be validated by a quantity surveyor and should be presumed to be indicative.

**Monitoring (including Remediation Monitoring reports)**

These reports are factual in nature and comprise monitoring, normally groundwater and ground gas and data provided by contractors as part of an earthworks or remedial works.

The data is presented and will be compared with assessment criteria.

**Asbestos in soils**

Unless explicitly included for in our proposal, our investigation does not include for a formal asbestos assessment and the inspection for asbestos, either as asbestos containing materials (ACMs) lying on the surface or as ACMs and/or as loose asbestos fibres within made ground/stockpiles is excluded. Our report will include only the factual reporting of any laboratory asbestos soil screening results, if completed. These results should be treated cautiously and should not be relied upon to provide detailed and representative information on the delineation, type and extent of bulk ACMs and/or trace loose asbestos fibres within the soil matrix at the site.

Where we indicate in our proposal that we will consider asbestos we will undertake screening of representative soil samples for the presences / absence of loose asbestos fibres. If these are found a further and more detailed specific investigation into asbestos in soils will need to be undertaken, which will include asbestos quantification testing. These investigations are associated with more rigorous monitoring of asbestos and health and safety provisions.
# Rotary Drillhole Log

**Project:** Royal Brompton Hospital  
**Client:** Royal Brompton and Harefield NHS Trust  
**Hole No.:** BH601  
**Date:** 27-05-16

### Run Details

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>SPT 'N' Fracture Spacing</th>
<th>Rock Test Result (MPa)</th>
<th>Water Depth</th>
<th>Elev. (m)</th>
<th>Depth (Thickness)</th>
<th>Discontinuities</th>
<th>Detail</th>
<th>Description</th>
<th>Main</th>
<th>Legend</th>
<th>Geology</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ASPHALT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.63</td>
<td></td>
<td></td>
<td></td>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
<td>Black brown slightly clayey sandy fine to coarse subangular to angular GRAVEL of asphalt, concrete (MADE GROUND)</td>
<td>GMG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.73</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ooligolithic brown slightly clayey gravelly fine to coarse SAND with occasional cobbles of brick</td>
<td>GMG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.63</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Light brown slightly gravelly fine and medium SAND, gravel is fine to coarse subangular to rounded of flint. (KEMPTON PARK GRAVELS)</td>
<td>GMG</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Strata

- **Light brown medium and coarse SAND and fine to coarse subangular to rounded GRAVEL of flint. (KEMPTON PARK GRAVELS)**
- **Bluish grey silty CLAY, (LONDON CLAY)**

### Boring Progress

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Depth</th>
<th>Casing Dpt</th>
<th>Core Dia. (mm)</th>
<th>Water Strike</th>
<th>From</th>
<th>To</th>
<th>Type</th>
<th>Return</th>
<th>Depth Casing</th>
<th>Casing Dia</th>
</tr>
</thead>
</table>

### Chiselling

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>Hours</th>
<th>Tool</th>
<th>From</th>
<th>To</th>
</tr>
</thead>
</table>

### General Remarks

- Hole progressed using open hole techniques and terminated at 9 m BGL at prescribed depth.
- No visible or olfactory evidence of contamination.
- No groundwater strikes observed, however noted to be damp from 1.1 m BGL.

**Scale:** 1:62.5  
**Notes:** All dimensions in metres. Logs should be read in accordance with the provided Key. Descriptions are based on visual and manual identification.
### Rotary Drillhole Log

**Project:** Royal Brompton Hospital  
**Client:** Royal Brompton and Harefield NHS Trust  
**Contractor/Driller:** Environmental Sampling Ltd  
**Logged By:** Roisin Lindsay  
**Co-Ordinates:**
- Easting: 527151.415  
- Northing: 178259.846  
**Ground Level:** 7.949

### Run Details

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>TCR</th>
<th>SPT 'N' Fracture Spacing</th>
<th>Rock Test Result (MPa)</th>
<th>Water Depth</th>
<th>Elev. (m)</th>
<th>Depth (Thick cross)</th>
<th>Discontinuities</th>
<th>Detail</th>
<th>Description</th>
<th>Main</th>
<th>Legend</th>
<th>Geology</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.988</td>
<td>0.07</td>
<td>(0.53)</td>
<td></td>
<td></td>
<td>7.952</td>
<td>(0.60)</td>
<td></td>
<td></td>
<td>CONCRETE, Brick paving</td>
<td></td>
<td></td>
<td>GMG</td>
</tr>
<tr>
<td>7.355</td>
<td>0.60</td>
<td>(2.40)</td>
<td></td>
<td></td>
<td>4.950</td>
<td>3.00</td>
<td></td>
<td></td>
<td>Light brown gravelly fine to coarse SAND, Gravel is fine and medium angular to subangular of brick and flint, (MADE GROUND)</td>
<td></td>
<td></td>
<td>GMG</td>
</tr>
<tr>
<td>4.950</td>
<td>3.00</td>
<td>(2.00)</td>
<td></td>
<td></td>
<td>2.950</td>
<td>5.00</td>
<td></td>
<td></td>
<td>Light brown gravelly clayey fine to coarse SAND, Gravel is fine to coarse subangular to rounded of flint, (KEMPTON PARK GRAVELS)</td>
<td></td>
<td></td>
<td>KPGR</td>
</tr>
<tr>
<td>2.950</td>
<td>5.00</td>
<td>(0.80)</td>
<td></td>
<td></td>
<td>2.150</td>
<td>6.80</td>
<td></td>
<td></td>
<td>Light brown gravelly clayey fine to coarse SAND, Gravel is fine to coarse subangular to rounded of flint, (KEMPTON PARK GRAVELS)</td>
<td></td>
<td></td>
<td>KPGR</td>
</tr>
<tr>
<td>2.150</td>
<td>6.80</td>
<td>(0.80)</td>
<td></td>
<td></td>
<td>1.900</td>
<td></td>
<td></td>
<td></td>
<td>Light brown very sandy fine to coarse subangular to rounded GRAVEL of flint, (KEMPTON PARK GRAVELS)</td>
<td></td>
<td></td>
<td>KPGR</td>
</tr>
<tr>
<td>1.900</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.550</td>
<td>7.40</td>
<td></td>
<td></td>
<td>Blush grey silty CLAY, (LONDON CLAY)</td>
<td></td>
<td></td>
<td>LC</td>
</tr>
<tr>
<td>0.550</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.250</td>
<td>7.70</td>
<td></td>
<td></td>
<td>Blush grey silty CLAY, (LONDON CLAY)</td>
<td></td>
<td></td>
<td>LC</td>
</tr>
</tbody>
</table>

### Boring Progress

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Depth</th>
<th>Casing Dpt</th>
<th>Core Dia. (mm)</th>
<th>Water Strike</th>
</tr>
</thead>
</table>

### Rotary Flush

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>Hours</th>
<th>Tool</th>
<th>From</th>
<th>To</th>
</tr>
</thead>
</table>

**General Remarks:**
- Hole progressed using open hole techniques and terminated at 7.77mbgl at prescribed depth.  
- No visual or olfactory evidence of contamination.  
- Groundwater strike at 5.6mbgl.

**Notes:** All dimensions in metres, Logs should be read in accordance with the provided key. Descriptions are based on visual and manual identification.