Great Ormond Street Hospital Charity

Great Ormond Street Hospital for Children NHS Foundation Trust

PLANNING STATEMENT

Southwood Courtyard Building

June 2017

Contact

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Contents

1. Introduction

Introduction

1.1 This Planning Statement relates to a full planning application dated June 2017 for the Southwood Courtyard Building, located at the Great Ormond Street Hospital for Children (referred to as GOSH, hereafter).

1.2 The Southwood Courtyard Building will occupy an external courtyard location at GOSH. Development is part of the Trust's on-going commitment to updating the Hospital's existing facilities and deliver an improved model of care into the 21st Century. Redevelopment of the wider campus is now substantially underway, with a number of buildings and associated public realm already completed, occupied or under construction. This includes: the Morgan Stanley Clinical Building, which opened in 2012; the Premier Inn Clinical Building, due to open in October 2017; and the Zayed Centre for Rare Disease in Children, due for completion end of 2018. These buildings alongside the Hospital's main buildings are shown as Figure 1 below:

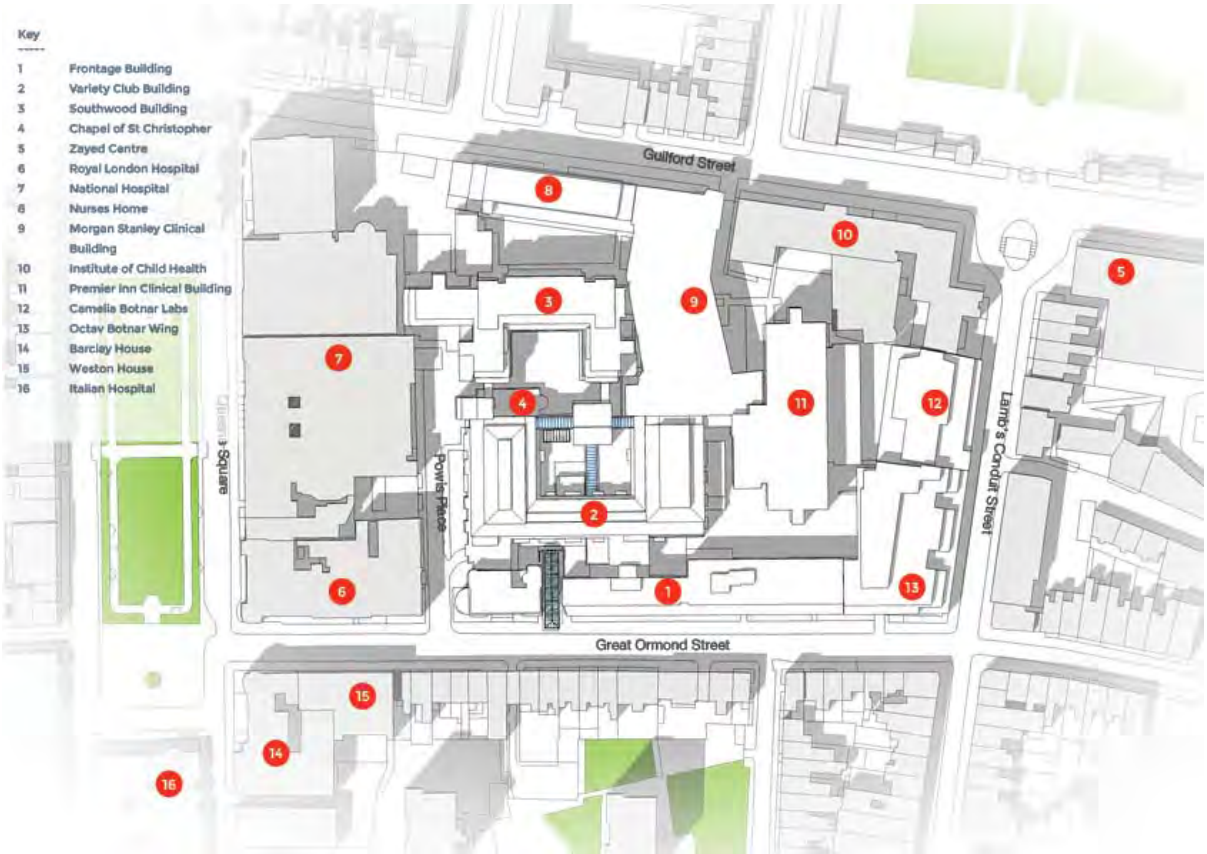

Figure 1: Map showing the location of the Morgan Stanley Clinical Building (9), Premier Inn Clinical Building (11), Zayed Centre for Children with Rare Diseases (5), as seen within the context of the hospital's main buildings

1.3 Development of the Southwood Courtyard Building comes forward as part of the Trust's next phase of works in relation to the Frontage Building, which is described in more detail under the heading Masterplanning at GOSH in Section 2 of this statement.

1.4 The detailed design has been developed with a thorough understanding of the context, townscape including the grade II* listed Chapel of St Christopher and setting of the site. Further, the proposals have been developed through an iterative process of pre-submission consultations between the Trust, the Design Team, Planning and Conservation officers at the London Borough of Camden, and Historic England. Regular user group consultations between the Design Team and clinicians, fire officers,

infection control staff, facilities management team, and estate personnel took place prior to submission. Additionally, the Hospital takes part in a range of community activities and runs a Residents' Liaison Group, which meets every eight weeks. The proposals were taken to the Liaison Group on 21st February 2017. Comments made by officers, Historic England, user groups, and representatives of the Resident's Liaison Group have been considered and incorporated into the proposal.

1.5 The Southwood Courtyard Building will occupy a location in the western part of the GOSH campus. It will be located between the Southwood Building to the north, east and west, the Variety Club Building and to a lesser extent the Paul O'Gorman Building to the south. In addition the building will be immediately adjacent to the grade II* listed Chapel of St. Christopher (Hospital Chapel). Powis Place, a privately owned road lies to the west of the site.

1.6 The location of the Southwood Courtyard Building and the Planning Application submission boundary are shown on the submitted drawing (00)002 reproduced as Figure 2, below:

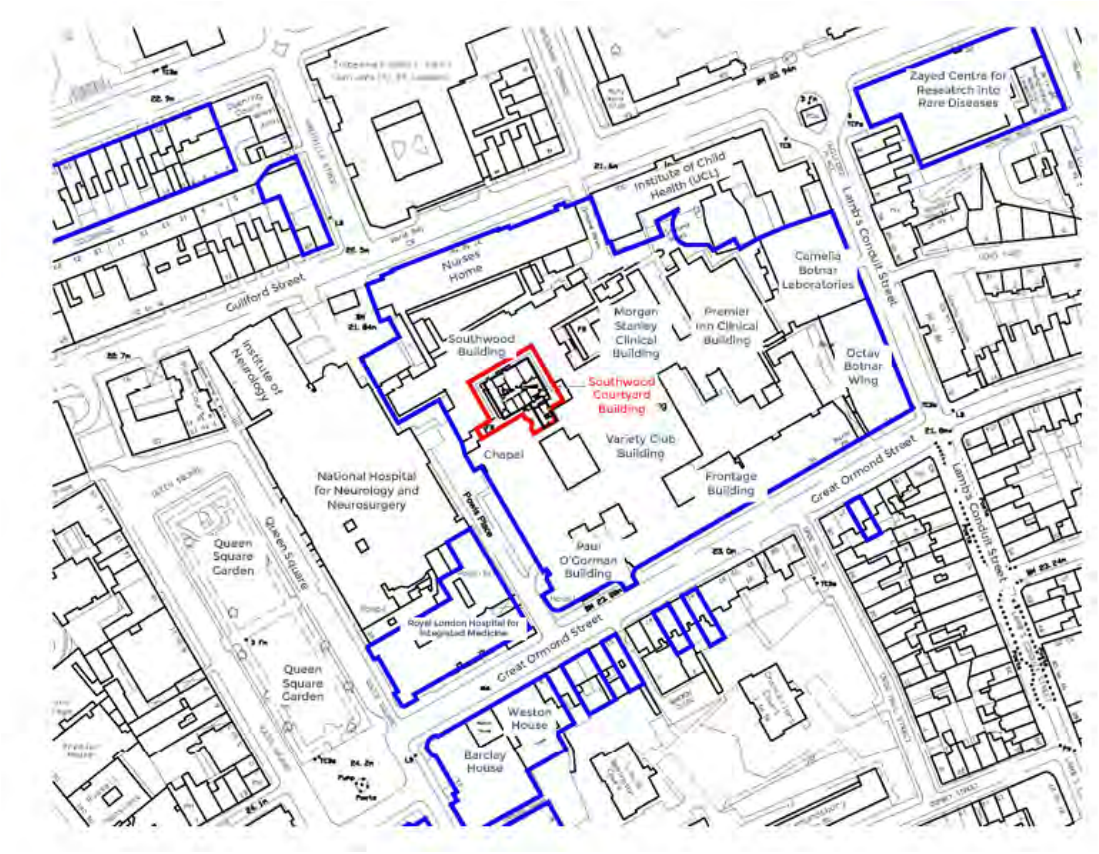

Figure 2: Location of the Southwood Courtyard Building and Planning Application submission boundary edged on red, as seen within the context of surrounding buildings.

The Proposal

1.7 The proposal is for a single building over three storeys for hospital-related uses. The hospital use will comprise: Physiotherapy and Rehabilitation Facilities and Services at Level 2; an iMRI Suite for a 3T MRI machine, operating theatre and ancillary rooms at Level 3; Plant and equipment rooms at Level 4. A total of two chiller units will be provided in a recessed area at Level 4. A green roof will be provided at roof level. Artificial lighting is proposed to the new building to raise the illumination levels outside the Chapel. The statue of St Christopher will be relocated to the south of the chapel's apse. Access will be provided via a new corridor at Level 2 connecting the new building to the Variety Club Building. Connection will be made via a new corridor linking the new building to the Variety Club Building at Levels 2 and 3. The Southwood Courtyard Building will provide a total floorspace of 998 square metres (GEA).

1.8 This Planning Statement has been prepared by BDP to assess the development proposals against planning policy. It is intended to set the scene in terms of relevant policy context and provides a description of the proposal and how it accords with the national and local planning policies. The Planning Statement is developed around themes that relate each component to its relevant policy context. This statement should be read in conjunction with all other documents submitted in support of the planning application, which include the Drawing Package, Design and Access Statement, Heritage Statement, Draft Construction Management Plan, Sunlight and Daylight Assessment, Noise and Vibration Assessment, Sustainability Statement, Ground Conditions Report and Desk Based Archaeological Assessment.

2. Background

History of Great Ormond Street for Children

2.1 Great Ormond Street Hospital opened in 1852 on the corner of Powis Place. It was the first hospital in the English-speaking world dedicated to the care of children. The Hospital was supported by many high profile benefactors and grew rapidly where in 1878, a major development provided 100 state of the art beds including an isolation ward. The next major development was the Southwood Building, opened in the 1930s, which replaced traditional long wards with smaller units, considered more nurturing for children.

2.2 In 1946 the Institute of Child Health at University College for London (UCL) was established on the Hospital site, formalising the partnership between academia and hospital. Further developments came in 1947 with the opening of the Heart Lung Unit, and in 1962 when the first paediatric heart-and-lung-bypass machine was used in the hospital. In 1994, the Variety Club Building opened, which provides an important contribution to day-to-day activities.

2.3 Since its inception more than 160 years ago, GOSH has been at the forefront of specialist paediatric care and research. Today, GOSH is an international centre of excellence for the care and treatment of children and young people, many of whom have nowhere else to go to receive the highly specialised care they need. Referrals to the Hospital's specialised services come from almost all hospitals in the UK and increasing numbers of patients from overseas.

Masterplanning at Great Ormond Street Hospital for Children

2.4 The Development Control Plan (DCP) commenced in 1985, when the vision to significantly improve the site resulted in two major projects: the Variety Club Building, opened in 1994, and the Camelia Botnar Labs, opened in 1995. In 1999 and 2005, the DCP was reviewed and updated. These review cycles were informed by the completion of Phase 1 (in 2004) and commencement of works for Phase 2 in 2007.

2.5 Phase 1 provided Weston House – a patient and family hotel on Great Ormond Street, as well as new facilities on the main hospital site and neighbouring Royal London Hospital for Integrated Medicine.

2.6 Phase 2 commenced in 2007 with the construction of the Mittal Children's Medical Centre and comprises two parts. The first part, Phase 2A is the Morgan Stanley Clinical Building, which opened in 2012; the second and final part is Phase 2B, the Premier Inn Clinical Building which is anticipated for to open later this year. The two buildings each have their own distinct ward level areas, but will link to each other.

2.7 Phase 3 of the redevelopment programme will see the creation of the Zayed Centre for Research into Rare Disease in Children, which is due for completion in 2018.

2.8 A site plan showing the redevelopment phases as mentioned above is shown in Figure 3, below.

Figure 3: Site Plan showing redevelopment phases 1, 2 and 3

2.9 In 2015, a Masterplan was prepared following an evaluation of the vision for the future of the Hospital to bring the DCP up to date in terms of current clinical needs and growth expectations. The Masterplan was drawn up following an extensive and progressive process of consultation between GOSH, the design team (at the time) and planning officers at the London Borough of Camden. Comments made by officers and representatives were considered and incorporated into the Masterplan. The Masterplan was adopted the Trust Board in February 2016.

2.10 Whilst the intention of the Masterplan is not to define the exact nature of future development, it provides an overarching vision and credible framework for future growth. The Masterplan sets out a framework to complete the redevelopment programme in two further phases over the course of 15 years up to 2030 to meet rising demand and deliver increasingly complex care. These two further phases are Phase 4 and Phase 5. Phase 4 will see the development of the southern part of the site referred to as the Frontage Building, whilst Phase 5 comprising two parts will replace the Southwood Building and Main Nurses Home buildings to the north, respectively.

2.11 The areas for potential future redevelopment are shown in Figure 4, below:

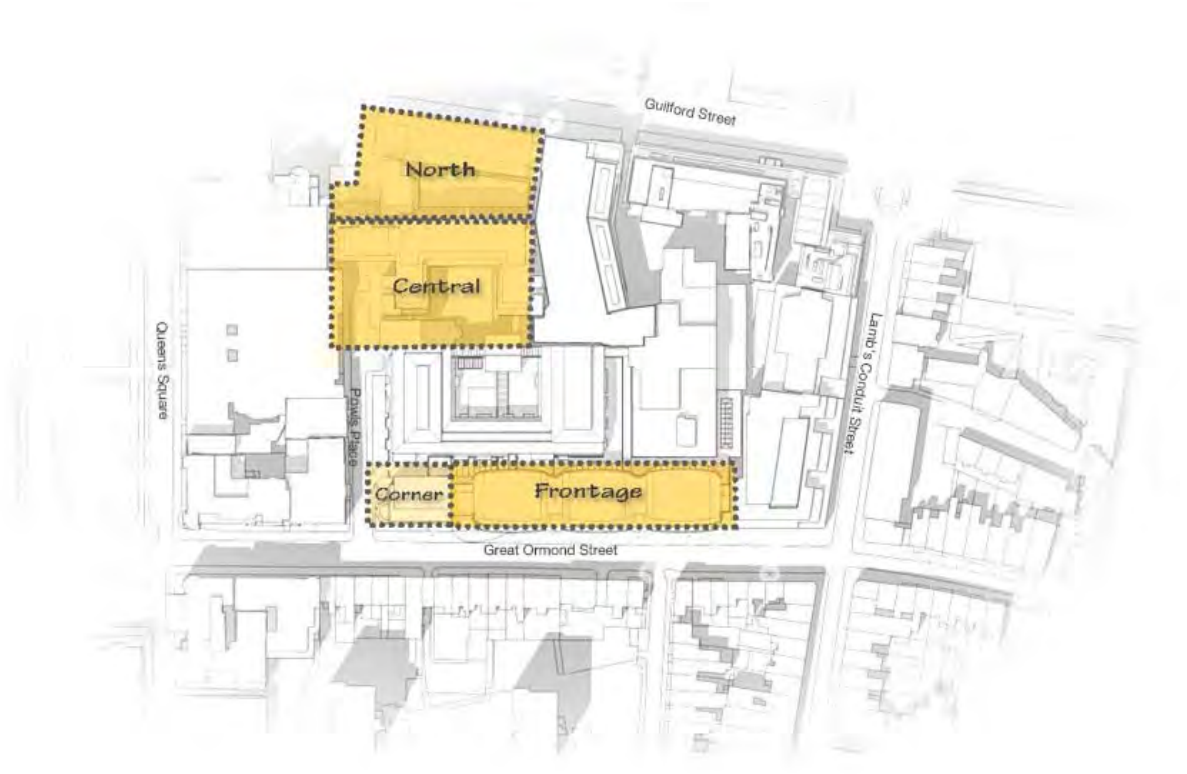

Figure 4: Site Plan showing areas for potential future redevelopment identified as the Frontage and Corner Buildings as Phase 4 and Southwood and Nurses Building as Phases 5A (Central) and 5B (North)

2.12 Phase 4 involves the demolition and redevelopment of the Frontage Building and potentially the Paul O'Gorman Building (shown as the corner building on Figure 4), to create a new south block. Once complete, Phase 4 could be a seven storey building, comprising a basement spread across three levels, allowing the Trust to move the existing clinical spaces in the Southwood Building and the Nurses Home Building in preparation to commence Phase 5.

2.13 The exact use of the space will be subject to a comprehensive briefing process, informed by ongoing clinical demand and stakeholder consultation. However, it is anticipated that the project will incorporate: clinical consulting rooms; inpatient accommodation/bed space; teaching and education spaces; an Intraoperative Magnetic Resonance Imaging (iMRI) Suite with a 3 Tesla (3T, hereafter) MRI; improved facilities management space; and a green roof. The Phase 4 project will be subject to a separate planning application for approval, with demolition anticipated to commence 2019/2020, construction from 2020 and fit-out and opening in 2023.

GOSH' Statement of Need

2.14 At the time, the 2015 Masterplan envisaged the provision of the iMRI Suite in the Phase 4 Building. However, in order for the service to keep pace with other centres and to provide the best outcomes for children, GOSH needs to establish an iMRI facility in advance of Phase 4 opening.

2.15 The neurosurgical department at GOSH currently undertakes surgery for 80 to 100 new paediatric brain tumours and 80 epilepsy cases every year – and this is the group of patients who could benefit from having their surgery in a theatre with MRI capability. GOSH is one of the four nationally designated Children's Epilepsy Surgery Service (CESS) centres and epilepsy numbers are projected to increase to 120 annually over the next two years. This makes it the busiest neurosurgical unit for paediatric neuro-oncology and epilepsy surgery in the UK.

2.16 Many large neurosurgical departments throughout the world have now installed IMRI, these include the large paediatric units in the United States, Europe, Australia, South America, and the major private

Asian centres, as well as Israel, China and Turkey. GOSH is the last major children's hospital in the UK to establish an IMRI facility. Recent IMRI facilities have been built at Alder Hey Children's Hospital and Sheffield Children's Hospital. Availability of IMRI will complete the Hospital's oncology and epilepsy surgery service package.

2.17 The Trust currently has five MRI scanners, none of which has intraoperative capability. GOSH's aim is to maximise the use of the 3T MRI, using it for outpatient and inpatient activity and research, as well as intraoperative patients/research subjects.

2.18 From the research undertaken by the Trust, GOSH expects the iMRI facility will be used by about 100 to 200 patients per annum and envisage that this number will slowly increase over time. From the statistical data obtained the Trust considers that from 1st January to 30th April 2017, the iMRI facility would have been used for approximately 40 patients, if it were available.

2.19 The clinical benefits of iMRI provides an assessment of a tumour resection, which can be carried out during the surgery. This method allows more precise resection with better protection of surrounding functioning brain tissue. Complete or maximal safe resection of a tumour is important as it is only in this way that the best survival and quality of life can be obtained for children and young people. Similarly, in epilepsy surgery, complete or maximal safe resection of a lesion that is causing the child's seizures leads to better seizure control.

2.20 For many tumours, any tumour inadvertently left behind needs to be removed in a second operation. Children with residual tumour before radiotherapy do not survive as long as those with no residual tumour before adjuvant treatment. iMRI allows identification of any residual tumour before the surgery is completed and therefore obviates the need for any further surgery. It is important to note that second surgeries are associated with higher surgical risks, such as infection, wound problems and new neurological deficit. They also require a much longer hospital stay. There is also a delay to starting chemotherapy and/or radiotherapy.

2.21 For some low grade tumours in very eloquent locations such as the brainstem, resection without iMRI may be suboptimal. In such cases, children would then require chemotherapy, often given for 18 months, or radiotherapy, with its known long-term complications, including vascular disease and new malignancies. iMRI optimises maximal safe tumour resection and reduces the need for adjuvant treatment.

2.22 All children undergoing surgery for brain tumours or epilepsy require MRI scans before and after surgery. Currently they have an MRI scan within 48 hours of surgery. For small children, usually under six years of age, an additional general anaesthetic is required for each scan. In iMRI, the pre and post-operative scans can be carried out just before and just after the surgery under a single anaesthetic.

2.23 Theatre and MRI scan room have been designed to be used independently. Theatres can be used by other specialities and the MRI scan room will be used for imaging day-cases, inpatients, outpatients and research. By acting as a dual purpose intraoperative and elective MRI scanner, iMRI will contribute to increasing overall scanning capacity at GOSH.

Figure 5: (left) image showing the envisaged Intraoperative MRI unit and (right) showing a typical scan

2.24 The Southwood Courtyard Building gives the Trust the opportunity to provide the IMRI suite at Level 3, co-locating it with existing operating theatres on Level 3 of the Variety Club Building. Through co-location, this provides advantages operationally, such as efficient patient flows and in reducing the space required for support accommodation, which can be shared where appropriate.

2.25 As mentioned previously, demolition of the Frontage Building is anticipated to commence in 2019/2020, subject to the approval of a formal planning application. The Physiotherapy and Rehabilitation Services provided by the Hospital is currently located in the Frontage Building, at Level 5 (third floor) and would need to be moved, prior to demolition. The Southwood Courtyard Building provides the Trust with the opportunity to relocate this clinical facility, into up-to-date modern facilities at Level 2 of the new building. This central location at ground level will benefit children and young people attending physiotherapy with direct access from the hospital's Main Entrance without taking the lift to access the facility, as they currently do. This approach also allows expansion of the Physiotherapy and Rehabilitation Facilities and Services so that the Hospital can treat a wider variety of conditions. The new physiotherapy facility will include space for GAIT assessment that is walking function, and a plaster room that are not provided in the current facility. In summary, the experience of children and families attending for physiotherapy treatment and assessment will be dramatically improved.

Alternative Locations Considered

2.26 Departmental designs are complex and are based on detailed clinical briefs, which have been produced with room-by-room schedules for each department. These have been set out by NHS guidance in Health Building Notes (HBNs) and Health Technical Memorandum (HTMs) providing recommendations for room sizes, room adjacencies and environmental requirements as well as details of specialised requirements such as air change rates, shielding and acoustic performance. Primarily, an iMRI Suite requires two large rooms, one for the operating theatre itself and one for the MRI unit, equating to 60 square metres in floorspace, for each room. In addition, the facility must connect as closely as possible to existing operating theatres, recovery and staff facilities. This is to allow scans to be carried out without the need to remove the patient from the theatre environment.

2.27 Prior to choosing the external courtyard as a location for the new building, a number of alternative locations were considered by the Trust in between 2015 to 2016, these include:

1) **Level 1 of the Octav Botnar Wing** by incorporating a new operating theatre in place of the electrical workshop;
2) **Level 1 of Phase 2B (Premier Inn Clinical Building)** by incorporating the facility within the existing 1.5T MRI room;
3) **Level 3 of the Variety Club Building** adjacent to an existing operating theatre;
4) **Level 3 of Phase 2A (Morgan Stanley Clinical Building)** adjacent to an existing operating theatre;
5) **Phase 2B (Premier Inn Clinical Building)** adjacent to the new bridge connection and the recovery area.

2.28 These locations are shown on Figure 6, below:

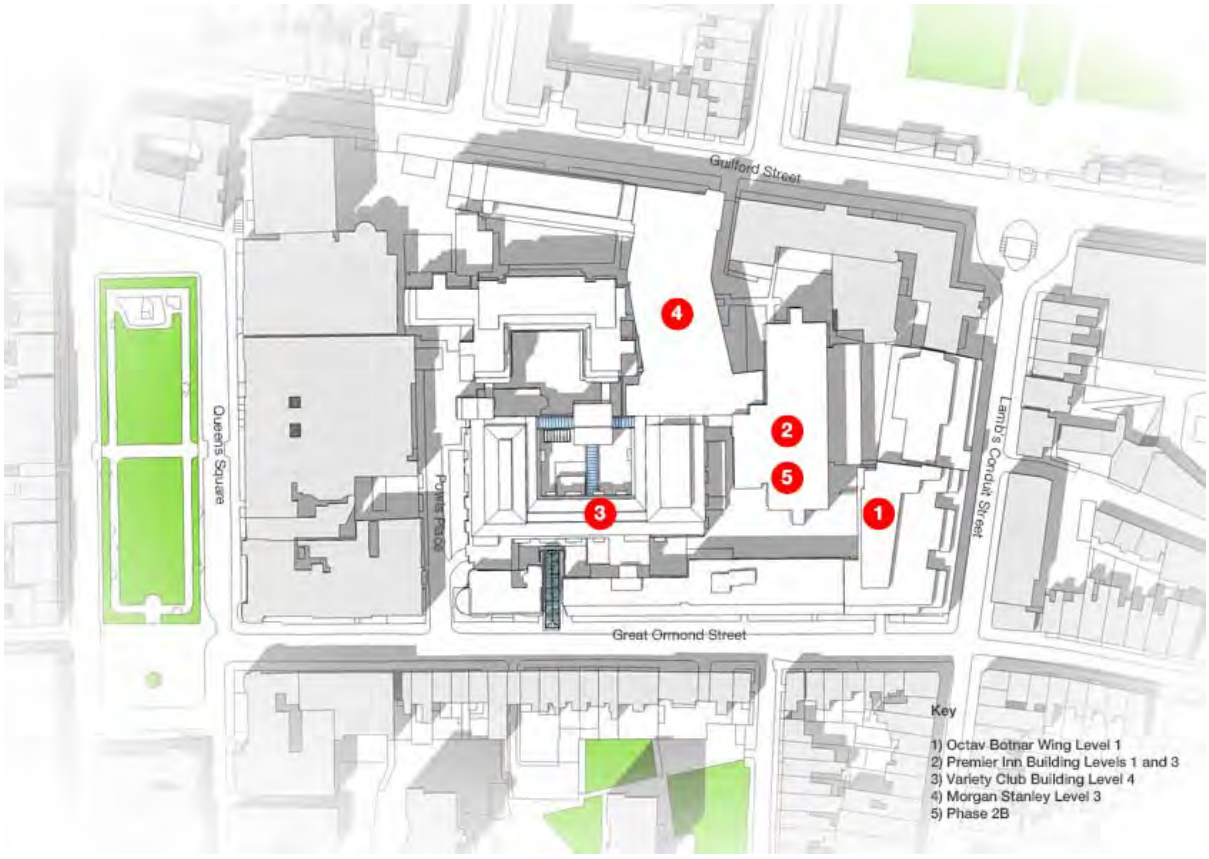

Figure 6: Diagram showing alternative locations considered as seen from the Octav Botnar Wing, Premier Inn Clinical Building, Morgan Stanley Clinical Building and Variety Club Building

2.29 In 2015, Arup reviewed and assessed the feasibility from an engineering perspective of creating an iMRI suite, based on the locations identified by the Trust. Their full report is set out in Appendix A of this Statement, however a summary of the report alongside an analysis by the Trust is set out in Schedule 1, below:

Schedule 1: Summary of Engineering Feasibility Report and Further Analysis by the Trust

Alternative Locations Considered	Analysis	Outcome
Option 1 Level 1 of the Octav Botnar Wing by incorporating a new operating theatre in place of the existing electrical workshop	The electrical workshop referred to in the report is in fact the hospital's Biomedical Engineering Department. Its entire suite of back-up stores, office accommodation and laboratories would need to be relocated in order to accommodate the iMRI suite. The floor to ceiling height of the Biomedical Engineering Department is very low, at 3 metres and a typical theatre room height needs to be 3.8 to 4 metres. The existing AHUs at this level will not have the capacity to power the iMRI suite and a new dedicated chiller unit is required. Both the AHUs and chiller unit could be located at roof level, subject to a full planning application. However, the increase in load at roof level may require the floor structure to be locally reinforced. The existing plant room at Level 0 was assessed to see if that room could accommodate additional plant and equipment. However, the room is congested, and there is no available space. Level 1 of the Octav Botnar Wing is in very close proximity to lifts and transformer rooms that are eight metres and 10 metres away, respectively. MRI machines need to be separated from large moving objects such as lifts, roads/rail, electrical transformers and switchgear, varying between 9 metres and 14 metres for transformer rooms.	Was considered **RELATIVELY FAVOURABLE** by Arup. However, due to factors such as: the requirement to relocate the Biomedical Engineering Department, resulting in the closure of the department,; the low floor-to-ceiling height of the department; the requirement for additional space for AHUs and a chiller unit possibly at roof level; and the close proximity to lifts and transformer rooms – Option 1 was not favourable. These issues were then further tested and when they were linked to the need to control vibration and the requirement to strengthen the conventional reinforced concrete slab below, it was considered not favourable. Overall: **NOT FAVOURABLE**
Option 2 Level 1 of Phase 2B Premier Inn Clinical Building	There is an existing 1.5T MRI Room, which could be increased in size to accommodate a 3T MRI and connection could be made to the theatre suite. However, there is a very low floor-to-ceiling height, at less than 3 metres. An operating theatre would typically require 3 metres in height, although some existing theatres at GOSH do have low floor-to-ceiling height. Space for AHUs and chiller units were made for the development of the PICB, but at the time of the assessment, it was not understood whether they would have the capacity to power an iMRI suite.	ARUP concluded: **FURTHER INFORMATION REQUIRED** Although there is an existing MRI room, the room is required as an isolated theatre for clinical uses. Additionally, there is no capacity for the AHUs and chiller units on the roof of the PICB to meet additional clinical activity. This was made clear in the application for the installation of four chiller units on the roof of the Variety Club Building, which was required to meet the increase in clinical activity and the opening of the

Alternative Locations Considered	Analysis	Outcome
		Premier Inn Clinical Building, later this year (2017). Overall: **NOT FAVOURABLE**
Option 3 Level 3 of the Variety Club Building – space adjacent to the existing operating theatre	The space considered is currently being used as an equipment store room and offices for doctors and sisters, and lies adjacent to the operating theatre. Floor-to-ceiling heights are approximately 3.3 metres, although the height of the room is better than options 1 and 2, this is still low as a new ventilation bulk head is required for the MRI room, which would lower the floor-to-ceiling height further. The new facility would require AHUs and chiller units to power the iMRI suite, which could possibly be located at roof level.	Arup considered Option 3 as **RELATIVELY FAVOURABLE** in structural terms, but the space that was considered is being used as a store room and offices for doctors and sisters. If these can be relocated, the space could be made available for the MRI machine itself, but space for plant and equipment required to power the suite is unavailable. However, based on a desktop study, the roof of the Variety Club Building is already congested. Further, as part of an earlier planning consent pursuant to reference 2015/5353/P, installation of a total of four chiller units at roof level is currently underway. The chiller units here, are required to meet the increase in clinical activity and the opening of the Premier Inn Clinical Building, later this year (2017). Overall: **NOT FAVOURABLE**
Option 4 Level 3 of the Morgan Stanley Building	The space selected for this option lies adjacent to an existing operating theatre, where it could be considered to create an iMRI suite. This location is directly above the staff restaurant making it unfavourable, as structural reinforcement works would be required. Typically, work would be carried out to the underside of the floor slab, with full access required from the level below, i.e. Level 2. The use of these spaces below is an important consideration for GOSH and would be disruptive for patients, visitors and staff. This location is also in close proximity to the existing lifts, which is not ideal, as MRI machines need to be separated from large moving objects such as lifts, roads/rail, electrical transformers and switchgear, varying between 9 metres and 14 metres for transformer rooms.	Arup concluded: **NOT FAVOURABLE**
Option 5 Adjacent to new bridge connection and recovery area in the Premier Inn Clinical Building	Not reviewed in detail, but makes an assumption that these locations are structurally least favourable. Further information is set out in Arup's report appended as Appendix A of this Statement.	Arup concluded: **NOT FAVOURABLE**

2.30 Overall, each of the options presented may look favourable, but on review they were not necessarily practical to progress. There were different challenges and there no clear 'best option' that came out of the review. The key common challenges were structural soffit heights, lack space for associated plant and equipment, congested services, the necessity of significant structural alterations to accommodate the weight of an MRI machine. The Engineering Feasibility is submitted as part of this application, and can be found in Appendix A of the Planning Statement.

2.31 The option of converting an existing theatre was discounted because there is no spare capacity and the size of the rooms required would require two existing theatres to be converted. Disruption within the department would not be acceptable and adjacent plant accommodation to serve the suite was unavailable.

2.32 In 2016, a further two options were considered. Option A considered a location within an existing external space between the Variety Club Building and the Frontage Building, see Figure 7, below:

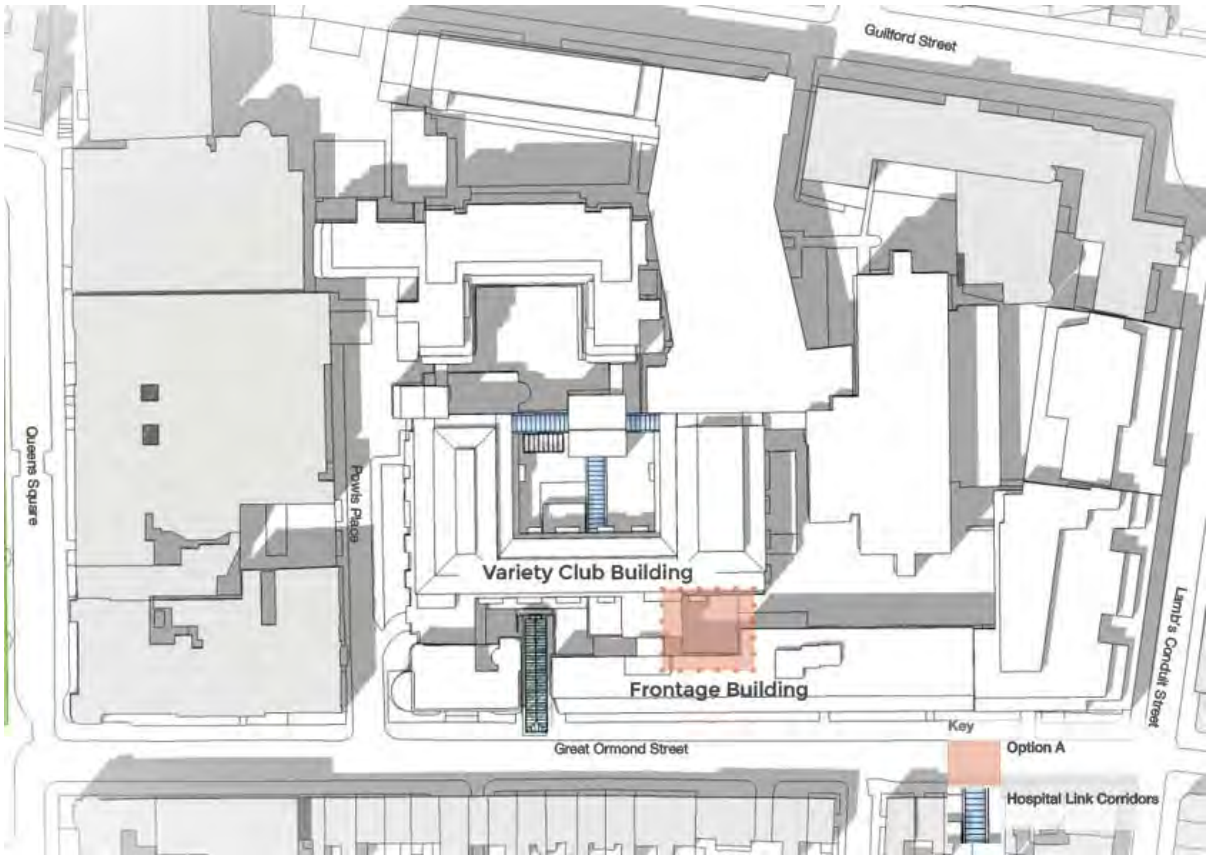

Figure 7: Option A edged in red, showing an external location as seen at Level 3 in between the Variety Club Building to the north and the Frontage Building to the south

2.33 Option A would be located in close proximity to the existing theatres on Level 3, but would require infilling an external space between the Variety Club Building and the Frontage Building to provide the new facility. A workable but tight layout was developed, but the option was discounted because it would result in the closure of existing theatre and clinical areas due to noise, dust and vibration during construction. Importantly, it would block a primary link to the operating theatres on Level 3 from the new Frontage Building to the Variety Club Building.

2.34 A further option within the external courtyard to the rear of the Southwood Building and Variety Club Building was considered, as Option B, see Figure 8 below:

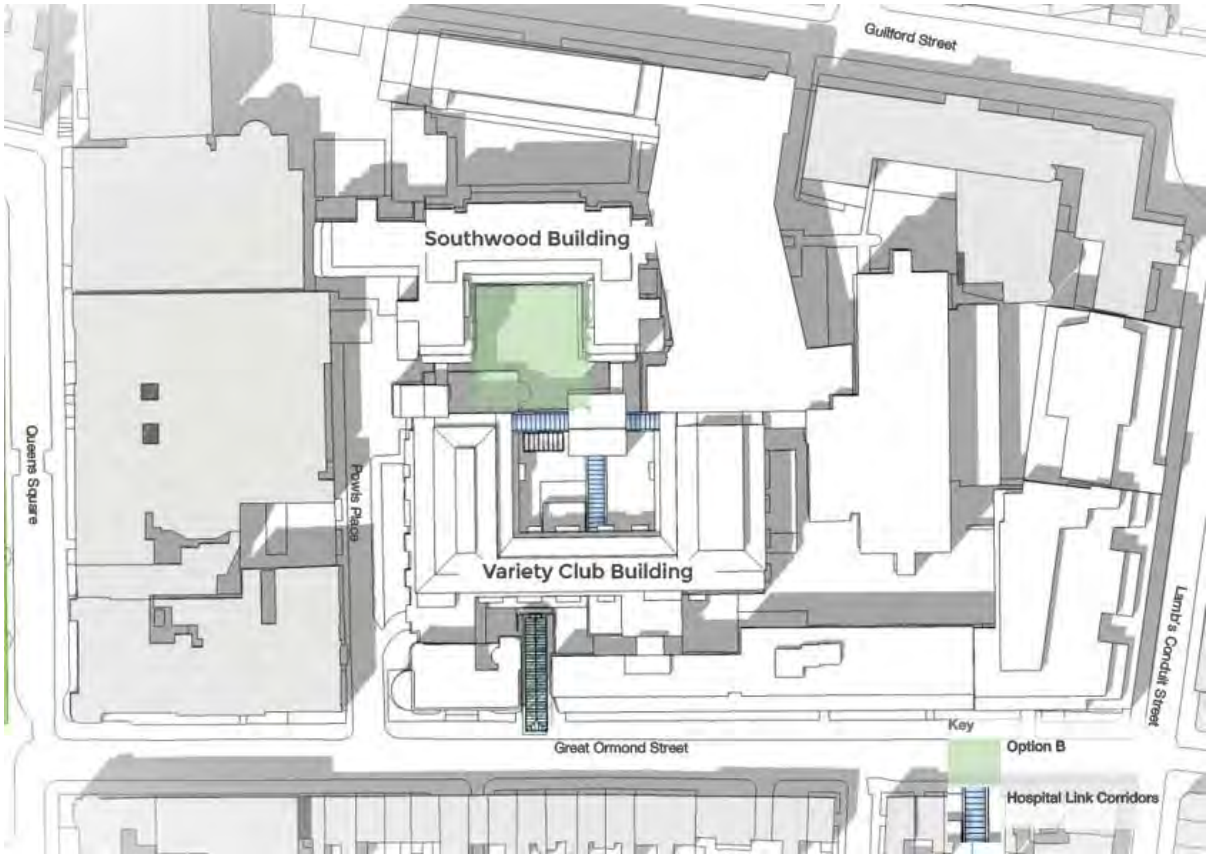

Figure 8: Option B edged in green, showing an external location as seen at Level 2 in between the Southwood Courtyard Building to the north and the Variety Club Building to the south

2.35 Option B resulted in a solution of simple connections to the main corridor of the Variety Club Building, particularly at Level 2 to the main reception area and Level 3 to the operating theatres.

2.36 Over the two year period, care has been taken to find the optimum location considering the structural, engineering and clinical requirements during the appraisal process. The appraisal and further analysis demonstrates that the courtyard location is the best solution in terms of the space that is available and connections can be made to existing corridors and operating theatres that is away from lifts and transformer rooms.

3. Format of the Planning Application

Description of Development

3.1 This planning application seeks full planning permission for the construction of a single building over three storeys for hospital-related uses. The hospital use will comprise: Physiotherapy and Rehabilitation Facilities and Services at Level 2; an iMRI Suite for a 3T MRI machine and operating theatre, with ancillary rooms at Level 3; Plant and equipment rooms at Level 4. A total of two chiller units will be provided in a recessed area at Level 4. A green roof will be provided at roof level. Artificial lighting is proposed to the new building to raise the illumination levels outside the Chapel.

3.2 The statue of St Christopher will be relocated to the south of the chapel's apse. Access will be provided via a new corridor at Level 2 connecting the new building to the Variety Club Building. Connection will be made via a new corridor linking the new building to the Variety Club Building at Levels 2 and 3.

3.3 The Southwood Courtyard Building will provide a total floorspace of 998 square metres (GEA).

3.4 The full description of the proposed development on the Planning Application form, is as follows:

Construction of a single building over three storeys for hospital-related uses at Great Ormond Street Hospital for Children.

3.5 Further details are provided in the following sections of this report, and the Design and Access Statement to accompany this Planning Application.

Scope of Planning Application

3.6 This Planning Application is accompanied by a suite of supporting documents, and has been produced by a multi-disciplinary team, led by BDP as Planning Consultant and Ansell and Bailey as the architects. The suite of documents submitted is set out in Schedule 2, below. A full set of drawings is also included as part of this application and are set out in Schedule 3, overleaf.

Schedule 2: Content of Planning Application

Ref	Document:	Prepared By:
1.	Application Form and Site Notices	BDP
2.	Drawings for Approval (see schedule 3 for full list)	Ansell and Bailey – Architects
3.	Design and Access Statement including a Statement of Engagement and GOSH's Brief for the Appointment of an Artist to design the Façade of the building. Appendix A: Photo Schedule	Ansell and Bailey, BDP and GOSH
4.	Planning Statement Appendix A: Engineering Feasibility Study (2015) prepared by Arup.	BDP and GOSH
5.	Heritage Statement	CgMS
6.	Draft Construction Management Plan	Kier Group
7.	Sunlight and Daylight, and Internal Lighting Report	Delva Patman Redler LLP and The Richard Stephen Partnership
8.	Noise and Vibration Assessment	Cole Jarman
9.	Sustainability Statement, incorporating: Energy Statement and BREEAM Pre-Assessment	Southfacing and The Richard Stephen Partnership
10.	Ground Conditions Report	Thomassons
11.	Archaeology Assessment Desk Based Assessment	CgMS

Section 3: Drawings for Approval and for Information

Drawing Title	Scale	Drawing Number	Rev.
Site Location Plan	1:1250 @ A3	16021(00)001	C
Existing Plan at Level 2	1:200 @ A3	16021(01)033	-
Drawings for Approval			
Existing North Elevation	1:200 @ A3	16021(02)012	C
Existing East Elevation	1:200 @ A3	16021(02)014	F
Existing South Elevation	1:200 @ A3	16021(02)013	F
Existing West Elevation	1:200 @ A3	16021(02)015	F
Floor Plans			
Proposed Level 2 (Ground Floor) Plan	1:100 @ A3	16021(01)002	S
Proposed Level 3 (First Floor) Plan	1:100 @ A3	16021(01)003	S
Proposed Level 4 (Second Floor) Plan	1:100 @ A3	16021(01)004	M
Proposed Level 5 (Roof) Plan	1:100 @ A3	16021(01)005	L
Proposed Level 2 (Ground Floor) showing surrounding clinical uses	1:100 @ A1	16021(01)029	H
Proposed Level 3 (First Floor) showing surrounding clinical uses	1:100 @ A1	16021(01)030	H
Proposed Level 4 (Second Floor) showing surrounding clinical uses	1:100 @ A1	16021(01)031	H
Proposed Level 5 (Third Floor) showing surrounding clinical uses	1:100 @ A1	16021(01)032	H
Elevations			
Proposed Elevation North	1:200 @ A3	16021(02)017	G
Proposed Elevation East	1:200 @ A3	16021(02)019	G
Proposed Elevation South	1:200 @ A3	16021(02)018	G
Proposed Elevation West	1:200 @ A3	16021(02)020	G
Sections			
Proposed Section 1 – North-South	As indicated	16021(03)006	F
Proposed Section 2 – North-South	As indicated	16021(03)007	F
Proposed Section 3 – East-West	As indicated	16021(03)008	F
Proposed Section 4 – East-West	As indicated	16021(03)009	E
Other			
Existing courtyard at Level 2 – Retention and Removal	1:200 @ A3	16021(01)001	H
Proposed gas bottle relocation plan at Level 1 of the Octav Botnar Wing	1:100 @ A1	16021(09)011	F
Parapet and Guarding Detail	1:10 @ A3	16021(04)009	-
Drawings for Information			
Photographic views at roof level	1:200 @ A3	16021(00)003	E
Site photographs	n/a	16021(00)005	D
Clinical uses within the Southwood Building and Variety Club Building facing onto the courtyard at Levels 1 (basement) and 2 (ground floor)	1:100 @ A1	16021(09)002	E
Clinical uses within the Southwood Building and Variety Club Building facing onto the courtyard at Levels 3 (first floor) and 4 (second floor)	1:100 @ A1	16021(09)003	F
Clinical uses within the Southwood Building and Variety Club Building facing onto the courtyard at Level 4 (third floor)	1:100 @ A1	16021(09)006	G

4. Site and Context

Great Ormond Street Hospital for Children

4.1 Great Ormond Street Hospital is the UK's largest paediatric hospital and runs its services from a campus, in Bloomsbury in the London Borough of Camden. The Main Entrance is on Great Ormond Street, to the south of the site, where patients and members of the public can access. A second entrance is located via the Octav Botnar Wing on Lamb's Conduit Street. There are eight staff entrances around the campus.

4.2 The Campus itself is bounded by Guilford Street to the north, Lamb's Conduit Street to the east, Queens Square to the west and Great Ormond Street to the south, after which the hospital is named.

4.3 The Hospital is made up of a number of linked departments and buildings, which can be accessed via the main corridors located on Level 2, running around the site, edged in light blue, shown as Figure 9, below. The external courtyard can be accessed via the Main Entrance to the hospital.

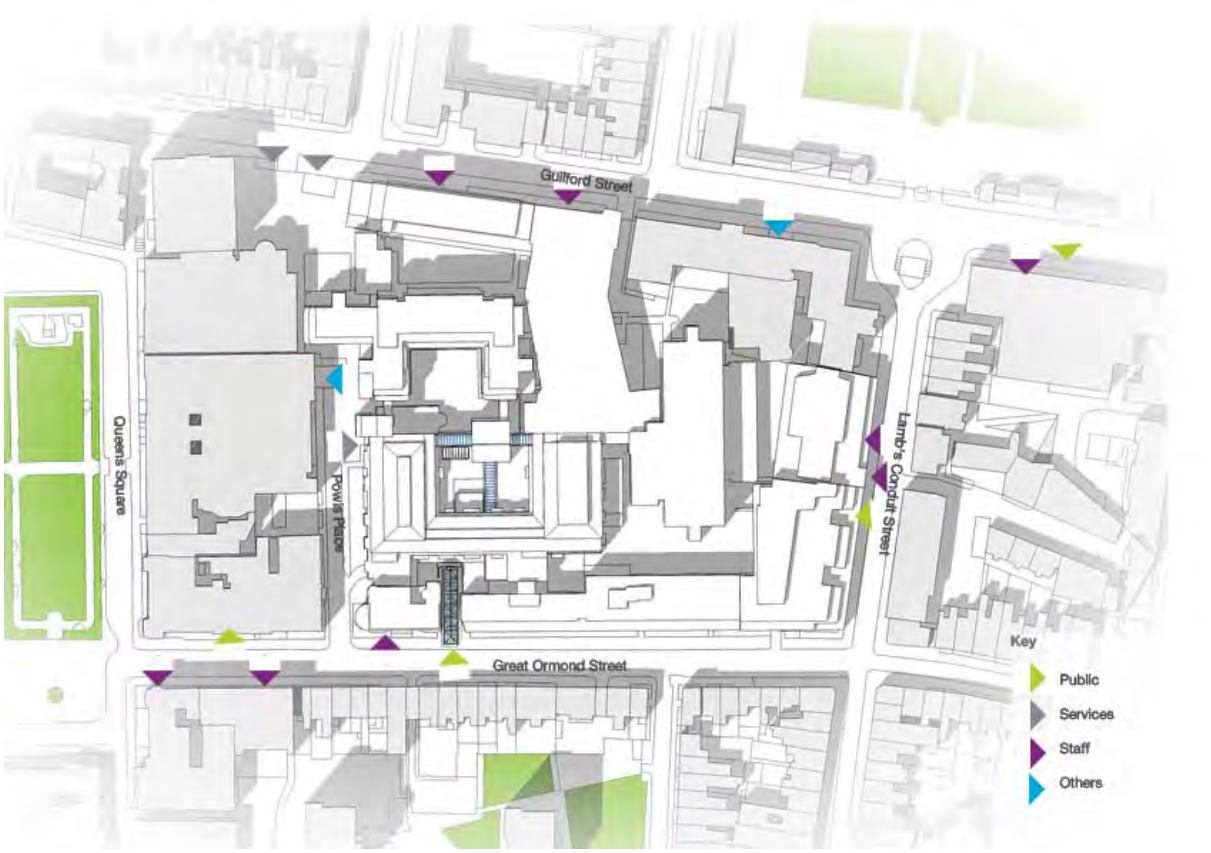

Figure 9: Plan showing the entrances for the public (in green), services (in grey), staff (in purple) and other (in blue) and internal hospital corridors, edged in light blue that links the Variety Club Building to the Frontage Building at Levels 2 and 3.

4.4 The character and appearance of the Hospital's buildings, range in age and style from late Victorian to 21st Century contemporary comprising in-patient wards, ambulatory services, emergency department, and other support departments.

Site Context

4.5 Whilst the site itself is not in a conservation area, it is bound on all sides by the Bloomsbury Conservation Area (CA). Elements of the Frontage Building fall within the CA, whilst the internal elements of the block are outside. The Hospital campus lies within the protected vista from Primrose Hill to St Paul's Cathedral.

4.6 The surrounding buildings within the CA are predominately Georgian and Victorian townhouses of between three to six storeys in height. More modern examples of infill developments exists to the north and east of the campus. Many of these buildings are listed for their historic and architectural importance, contributing to the rich and varied heritage setting.

4.7 Coram's Fields to the north-east, is a large open space occupying seven acres of children's playground, sand pits, a duck pond, café and nursery in Bloomsbury. Russell Square underground station and the Brunswick Centre to the north west; Russell Square, a large garden square to the east; and Weston House, a patient and family hotel, to the south.

The Application Site

4.8 The application site is located within an external courtyard of the hospital campus, bounded by the Southwood Building to the north, east and west; the Variety Club Building, the Paul O'Gorman Building and Powis Place are located to the south. Powis Place is a small private access road shared between GOSH and the rear of the National Hospital Building, which lies to the west, and fronts onto Queens Square.

4.9 The courtyard itself is located behind the hospital's frontage buildings on Great Ormond Street and currently occupies a single storey contractor's office that is currently disused, gas bottle storage, and redundant plant, see Figure 10, below:

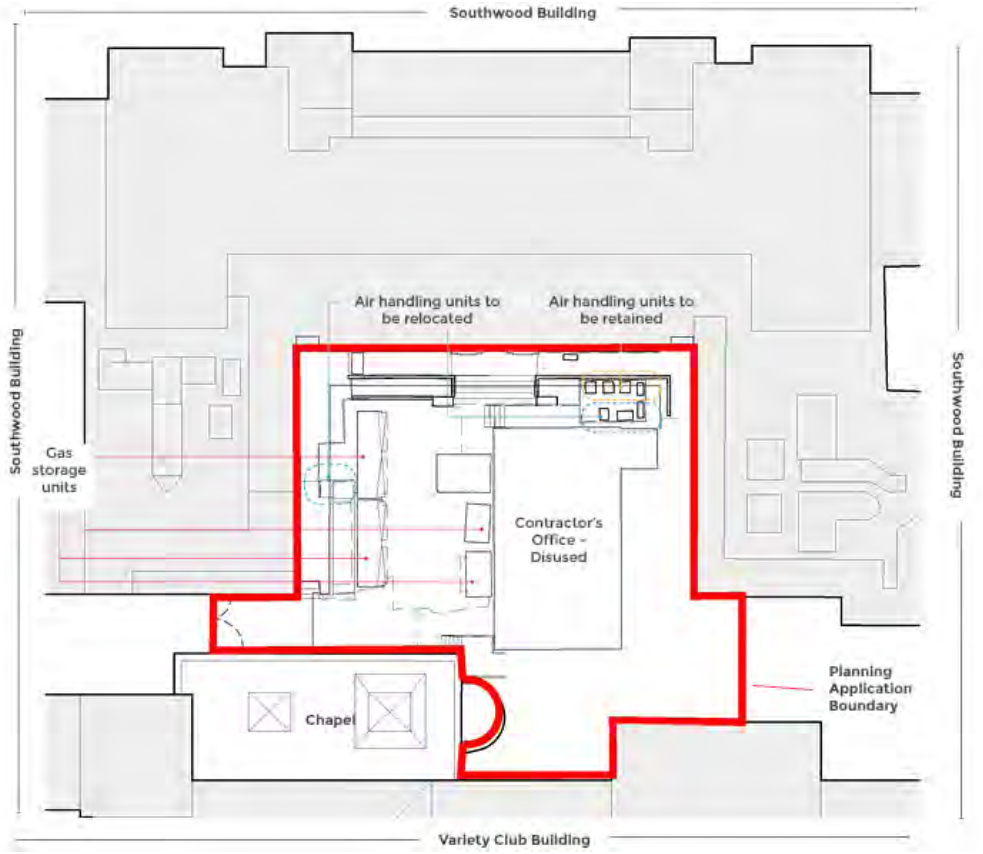

Figure 10: Plan showing the existing arrangement within the courtyard and the planning application boundary edged in red

4.10 The site itself is not statutory listed or locally listed, nor within a conservation area. However, the site lies immediately adjacent to the Chapel of St Christopher to the south. A life size statue of St Christopher currently stands to the east of the Chapel's apse.

4.11 The Chapel is listed grade II* in recognition of its historical and architectural interest. The Chapel underwent changes in the early 1980s when it was moved to its current location during the redevelopment of the hospital site. The changes were external mainly. It is accessed through the hospital's corridor at Level 2 of the Variety Club Building.

Relevant Planning History

4.12 The application site and its surrounding buildings have had a number of planning permissions with the most recent schemes including:

Full Planning Permission – Reference 2015/5353/P for the installation of a total of four chiller units at roof level of the Variety Club Building (East and West Roofs) with associated screening and pipework. Granted on 24/03/2016.

Subsequent approval of details included:

Reference 2016/3934/P for Details of Construction Management Plan pursuant to Condition no. 5. Granted on 06/09/2016

Reference PP-06120679 installation details of the external noise level emitted from plant/ machinery/ equipment and mitigation measures pursuant to Condition no. 4. Submitted 02/06/2017

Full Planning Permission – Reference 2007/4116/P Demolition of nurses' home annex, Barrie Wing and Southwood A wing and redevelopment of demolished areas for new hospital clinical building and the partial demolition (top four storeys) and refurbishment of the cardiac wing and construction of an associated 7-storey extension. Granted on 27/11/2007.

Full Planning Permission – Reference 2005/1963/P for the installation of one services unit mounted on three trailers and two associated air conditioning units within the Southwood Courtyard for a limited period. Granted on 10/08/2005.

Subsequent approval of detail included:

Reference 2006/2278/P for the variation of to extend the permitted temporary period for an additional 3 years pursuant to planning permission 2005/1963/P). Granted on 12/07/2006.

Reference 2010/5729/P for the Variation of condition 1 pursuant to planning permission (ref. 2006/2278/P). Granted 18/01/2011.

Full Planning Permission – Reference PSX0004609R3 for the erection of a new building comprising sub-basement, basement and five upper floors plus plant (Class C2) on the site of the Charles West building for clinical use by Great Ormond Street Hospital. Granted on 01/02/2001.

Conservation Area Consent – Reference CSX0004069 Conservation Area Consent granted for the demolition of Charles West Building fronting Lamb's Conduit Street and two bays of Great Ormond Street building on Great Ormond Street. Granted on 01/02/2001.

5. The Proposed Development

5.1 The proposed development comprises the removal of the existing single storey contractor's office, the air conditioning units and gas bottle storage for the construction of a three storey building for hospital floorspace.

5.2 The hospital use will comprise: Physiotherapy and Rehabilitation Facilities and Services at Level 2; an iMRI Suite for a 3T MRI machine and an operating theatre, with ancillary rooms at Level 3; Plant and equipment rooms at Level 4. A total of two chiller units will be provided in a recessed area at Level 4. A green roof will be provided at roof level.

5.3 The proposed building would be a steel framed structure with piled foundations. The envelope would be insulated with metal panels with printed fabric screen panels above first floor level. The screen panels have the ability to have any printed image desirable. They allow light to penetrate while providing a degree of privacy. Kalwall panels are proposed on two sides of the building to backlight the Chapel's stained glass. Artificial lighting is proposed to the new building to raise the illumination levels outside the Chapel.

5.4 The statue of St Christopher will be relocated to the south of the chapel's apse.

5.5 Access will be provided via a new corridor at Level 2 connecting the new building to the Variety Club Building. Connection will be made via a new corridor linking the new building to the Variety Club Building at Levels 2 and 3.

5.6 The Southwood Courtyard Building will provide a total floorspace of 998 square metres (GEA).

Use and Amount

5.7 The proposed use of the Southwood Courtyard Building is consistent with the rest of the Hospital that is Use Class C2. The building will provide 998 square metres (GEA) of floorspace. The use of the proposal is in line with the prevailing land use, and sits within the context of the Hospital's buildings.

Layout and Scale

5.8 The new building is designed to link via the hospital's existing corridor. At Level 2 the corridor will connect to the main reception area and at Level 3 to the operating theatres and recovery area of the Variety Club Building.

5.9 Physiotherapy and rehabilitation services and facilities will be located on Level 2 consisting of a small gym, consultation and examination rooms and a GAIT room with a walking track for assessments, which all accord with the standards set out HBN.

5.10 An iMRI suite comprising a total of two rooms for a 3T MRI machine and operating theatre, and preparation and anaesthetic rooms will be located on Level 3.

5.11 The engineering and plant equipment that will supply the Southwood Courtyard Building will be located on Level 4. This room will be largely enclosed for a number of reasons. In particular, equipment for the MRI unit and theatre is highly serviced and requires much of the control gear to be internal. GOSH aims to avoid unscreened plant on roofs particularly where the roofs are overlooked by neighbouring buildings. Plant sound attenuation is better controlled in an enclosure.

5.12 A green roof will be provided at roof level and will provide the necessary ecological benefits for BREEAM assessment. Further detail on BREEAM is set out in the accompanying Sustainability Statement.

5.13 The green roof will provide an area of 258 square metres for a mixture of sedum planting. The planting mix will be developed to provide habitat for fauna through low nutrient planting. The substrate depth will exceed 80mm to ensure suitable depth for planting.

5.14 As part of the development proposal the statue of St Christopher will be relocated to the south of the apse, where it will be appreciated better by the general public from the corridor at Level 2 in the Variety Club Building and from the Southwood Courtyard Building.

Access

5.15 Access will be made via a new corridor linking directly with Level 2 the main reception area and Level 3 where existing operating theatres, recovery and staff facilities are located within the Variety Club Building.

Servicing

5.16 Servicing will be made via main hospital.

Cycle Parking

5.17 A total of eight cycle spaces will be provided in accordance with guidance.

Sustainability

5.18 A BREEAM New Construction 2014 assessment has been undertaken for Pre-Assessment stage and indicates a clear pathway to achieving a rating of 'Excellent' with a score of 72.7%. This is possible despite restrictions on the site and stringent clinical requirements as; the scheme is able to connect to the existing hospital energy network, the works will include clearing of contamination (asbestos), there will be improved water retention and there will be a net gain in biodiversity on site due to the addition of a new green roof.

5.19 In summary, sustainability considerations have been addressed at all stages of the design development, these include:

- A predicted total regulated CO_2e savings over Part L 2013 Building Regulations baseline of 52.9%;
- Potential savings from energy demand reduction 'Be Lean' is 37.8% through optimised building design and use of high performing construction materials, while still meeting stringent heating, cooling and hot water requirements for clinical facilities;
- The potential to 'Be Clean' is 15.1% through connection to the hospital's existing energy network, a combined heat and power (CHP/TRIGEN) that was installed at GOSH in 2011;
- Provision of a total of eight cycle parking spaces;
- Optimised design includes use of 20% opaque translucent KalWall system on Level 2 and connecting corridors which ensures privacy while maximising use of natural light;
- Optimised u-values of walls, doors and windows, air permeability and hence building leakage and daylight factors developed in line with Building Regulations Part L 2013;
- All timber used on site and for construction materials will be from an independently verified sustainable source such as Forest Stewardship Council (FSC) or Programme for the Endorsement of Forest Certification (PEFC);
- Improvements to the overall biodiversity and water retention capacity of the courtyard through the installation of a green roof representing a net gain in ecological assets;
- The green roof, and the low number of windows, will help to provide passive assistance to managing heat gains, and reduce overheating in summer, i.e. urban heat island effect;
- Low flow sanitary fittings are proposed throughout and a Building Management System (BMS) will be provided which will include capability to monitor water utilisation, leaks etc; and
- Construction waste will be minimised, the contractor will be required to produce a Site Waste Management Plan and waste will be sorted on site.

5.20 As mentioned above, the Southwood Courtyard Building will require plant, equipment and a total of two chiller units to run the facilities envisaged. Further details on noise impact is provided in the submitted Noise Impact Assessment.

5.21 An Energy Statement has been prepared by the Richard Stephens Partnership and further details can be found within the submitted Sustainability Statement.

5.22 The proposals have been developed through an iterative process of pre-submission consultations between the Trust, the Design Team, Planning and Conservation officers at the London Borough of Camden, and Historic England. User group consultations between the Design Team and users took place over an 18 month period, prior to submission. Additionally, the Hospital takes part in a range of

community activities and runs a Residents' Liaison Group, which meets every eight weeks. The proposals were taken to the Liaison Group on 21st February 2017. A Statement of Engagement is provided within Section 6 of the Design and Access Statement, which summarises the comments made by officers, Historic England, user groups, and representatives from the Resident's Liaison Group and explains how they have been considered and incorporated into the proposal. A summary of that statement is provided in next section of this statement.

6. Summary of Engagement

6.1 A statement of engagement setting out the consultation that has been undertaken in support of the proposed Southwood Courtyard Building is set out in Section 6 of the Design and Access Statement. It summarises the feedback received and explains how the scheme has responded to the feedback. A summary of that statement is set out below.

Stakeholder Consultation

6.2 Pre-application consultation took place with a range of stakeholders since the design process began. Key stakeholders consulted include:

- London borough of Camden;
- Historic England;
- Hospital's Chaplain;
- GOSH NHS Trust and User Groups; and
- Resident's Liaison Group.

London Borough of Camden

6.3 The first meeting was held with the London Borough of Camden on 30th November 2016 between members from the Trust, the Design Team and the Council's Planning and Conservation Officers. The meeting, established the principles to guide the design of the proposals.

6.4 Following this, a second meeting between the Trust and the Design Team was held with the London Borough of Camden and Historic England on 7th April 2017, where a range of topics including the planning process, design and surrounding amenity were discussed. Feedback was gathered and the scope of the planning application was confirmed.

6.5 A summary of officer's feedback is set out in the Design and Access Statement.

Historic England

6.6 Prior to the submission of this planning application, the Trust and the Design Team consulted with Historic England. Overall, Historic England supported the principle of the proposal, and acknowledged the benefits that a new iMRI facility will provide for the hospital. However, their concern was on the potential impact the proposed building would have on the quality of light through the chapel's stained glass windows. Consequently more information regarding the proposed methods of mitigation were requested.

Summary

6.7 The consultation process has served two important purposes. Firstly, to inform stakeholders and the local community of the development process; and secondly, to allow stakeholders and the local community to feed their aspirations into the design proposals as they are developed.

6.8 The Trust and the Design Team have adopted a proactive approach to listening to people's aspirations and given consideration to all aspects of the proposal. This has included making modifications to the design and expanding the scope of technical assessments to ensure that stakeholder views are fully considered. Many changes to the scheme have been made specifically to accommodate the views of the stakeholders.

7. Planning Policy Assessment

7.1 This section of the Planning Statement firstly provides an overview of the adopted policy framework that applies to development. Secondly, it discusses the most pertinent planning issues in the context of the policy framework.

Status of planning policy in the London borough of Camden

7.2 There are three tiers of planning policy relevant to the proposed development, these are:

- The National Planning Policy Framework (NPPF) (2012);
- National Planning Practice Guidance (NPPG) (2014);
- Minor Alterations to the London Plan (MALP) consolidated with alterations since 2011 (2016);
- London Borough of Camden's Local Development Framework, which comprises:
  - Core Strategy 2010-2025 adopted (November 2010); and
  - Development Policies 2010-2025 adopted (November 2010).

7.3 The London Borough of Camden submitted their Draft Local Plan for examination in 2016. Following the issue of the Inspector's suggested amendments, the Council consulted on the Main Modifications to the Local Plan from 30th January to 13th March 2017. The Draft Local Plan has therefore been afforded limited weight due to its status as emerging policy and draft policies relevant to the proposed development are considered.

7.4 There are also a number of Supplementary Planning Documents (SPDs) and Guidelines (SPGs) which have been considered as part of this policy review. These include:

- Bloomsbury Conservation Area Appraisal and Management Strategy (April 2011);
- CPG 1 Design (September 2014);
- CPG 3 Sustainability (September 2013); and
- CPG 6 Amenity (September 2011).

7.5 The following matters are considered in detail within the remainder of this Chapter:

- Principle of Development;
- Design Considerations;
- Below Ground Archaeology;
- Noise and Vibration;
- Sustainability and Energy Considerations;
- Cycle Provision; and
- Construction, Phasing and Decant.

Principle of Development

7.6 Health and wellbeing are key components of achieving sustainable development as highlighted in the NPPF (paragraph 171 of the NPPF), it recognises that '*Local planning authorities should work with public health leads and health organisations to understand and take account of the health status and needs of the local population including expected future changes, and any information about relevant barriers to improving health and well-being.*

7.7 As well as maintaining the adequacy of healthcare services in the context of a growing population in Camden, policies in the Core Strategy, and policies in the emerging Local Plan all support development that create a healthy environment whilst not contributing to negative health outcomes. In particular, Policy CS16 seeks to improve the health and wellbeing in Camden, by *'supporting the provision of new or improved health facilities to consolidate and modernise its facilities'* (Part C) and

'supporting the borough's concentration of centres of medical excellence and their contribution to health-related research, clinical expertise, employment and training provision' (Part D). Similarly, Draft policy C1 of the emerging Local Plan *support the provision of new or improved health facilities, in line with Camden's Clinical Commissioning Group and NHS England requirements*.

7.8 The driver for the proposals is firstly the requirement for an iMRI Suite in advance of Phase 4 opening to keep pace with other centres worldwide and across the UK and provide the best outcomes for children. Secondly, is the requirement to relocate the outdated Physiotherapy and Rehabilitation services and facilities currently at Level 5 of the Frontage Building in advance of the redevelopment of Phase 4. This strategic need has been identified in the Trust's 2015 Masterplan. The Trust's Statement of Need, as outlined in Section 2 of this report provides further information on this aspect of the application.

7.9 The proposed land use and redevelopment of the site for improved hospital services and facilities accords with Policy CS16 of the Core Strategy and draft policy C1 of the emerging Local Plan, which support the provision of new or improved health facilities.

7.10 When assessing the proposal against relevant policies and when considering the existing land use within the Hospital Campus, the principle of development for hospital use meets the requirements set out in the adopted and emerging policies. The principle of development is therefore considered acceptable in land use terms and importantly in accordance with local planning policies.

Assessment of Alternative Sites

7.11 Departmental designs are complex and are based on detailed clinical briefs, which have been produced with room-by-room schedules for each department. These have been set out by NHS guidance in Health Building Notes (HBNs) and Health Technical Memorandum (HTMs) providing recommendations for room sizes, room adjacencies and environmental requirements as well as details of specialised requirements such as air change rates, shielding and acoustic performance. Primarily, an iMRI Suite requires two large rooms, one for the operating theatre itself and one for the MRI unit, equating to 60 square metres in floorspace, for each room. In addition, the facility must connect as closely as possible to existing operating theatres, recovery and staff facilities, which are located on Level 3 across the Hospital Campus.

7.12 A detailed assessment of alternative sites is set out in Section 2 of this statement and the engineering feasibility study prepared by Arup on behalf of the Trust is set out in Appendix A. The key common challenges were low ceiling height, suitable plant locations, congested services and a wide range of different structural solutions.

7.13 As a result of these suggestions and directions made over the years, the decision to pursue the courtyard site for a new building was made. The decision for a new building to accommodate an iMRI Suite and provide an update to date Physiotherapy and Rehabilitation services and facilities, has been made with other locations within the hospital campus discounted.

Community Benefit

7.14 Policy CS16 seeks to improve health and well-being in Camden, particularly by: *supporting NHS Camden in its goal to reduce health inequalities by targeting measures to improve health in the areas with poorest health* (part a); *protecting existing health facilities* (part b) *support the provision of new or improved health facilities* (part c) and *recognise and support the borough's concentration of centres of medical excellence and their contribution to health-related research, clinical expertise, employment and training provision* (part d). Similarly, draft policy C1, seeks to ensure that development in Camden considers local issues relating to health and wellbeing at an early stage of the planning process in order to positively improve outcomes for the people who live, work and visit the borough. In particular the Council will: *support the provision of new or improved health facilities, in line with Camden's Clinical Commissioning Group and NHS England requirements* (part d) a*nd protect existing health facilities in line with Policy C2 – Community facilities* (part e).

7.15 The proposal is important to ensure the long-term success of the Hospital, particularly to meet the current and predicted demand, deliver increasingly complex care and offer a better patient experience.

Overall, the key benefits for children and young people undergoing surgery using iMRI as a result of development include:

- Reduced requirement for additional pre-operative or post-operative MRI scans, often under general anaesthetic, during their hospital stay;
- The ability to monitor the extent of surgical resection during the procedure and update pre-operative imaging;
- Immediate quality control; and
- Significant reduction in the number of revisional surgical procedures for brain tumours and epilepsy surgery, with their associated resource and quality of care implications.

7.16 The Southwood Courtyard Building will bring significant clinical and healthcare benefits which are exclusive to patients, visitors and staff. It will also have a range of wider public benefits, including:

- Lower rates of mortality as a result of better critical care facilities, which will benefit the regional community;
- New employment opportunities during construction and residually through job creation;
- Improved research and development opportunities using the 3T MRI for outpatient and inpatient activity and research, as well as intraoperative patients/research subjects, which will produce economic benefits; and
- Generation of secondary spending in the local economy, e.g. local shops.

7.17 Overall, the community benefits noted above will contribute substantially to the local economy, but more importantly to children's and young people's quality of life.

Design Considerations

Location

7.18 The external courtyard location is considered to offer the best solution in terms of limiting the visual impacts on the surrounding area and taking into account the technical requirements of the scheme. The majority of the site comprises previously developed land, the use of hard standing areas, an existing single storey contractor's office and gas bottle storage facilities. Given that the nature of development is for hospital-related uses, development is therefore considered appropriate.

7.19 The proposed development seeks to optimise existing adjacencies and is focused on connecting via the Hospital's existing corridors to reduce travel distances and provide greater connectivity for patients, visitors and staff between the Variety Club Building and the new Southwood Courtyard Building.

Appearance

7.20 High quality design is a core planning principle within the NPPF (paragraph 17). The NNPPF confirms the importance of placed by the Government on the design of the built environment; good design is a key aspect of sustainable development (NPPF paragraph 56). NPPF paragraphs 57, 58 and 61 refer to key strands of design including quality, inclusivity, sense of place, local character, safe and accessible environments, and the integration of new development into the natural, built and historic environment. It expects applicants to work closely with those directly affected by their proposals; those that can demonstrate this in developing the design of the new development should be looked on more favourably (NPPF paragraph 66).

7.21 There are a number of policies within the adopted Local Plan and emerging Local Plan, which require high quality design and for development to respond appropriately to its context/local character, these include policies CS1, DP24, DP22 and DP26, which are consistent with the NPPF.

7.22 To achieve these objectives, the design is predicated on the built form to be high quality in terms of functionality and deliverability, and through the appearance, character and identity of the scheme. The

Design and Access Statement explains how the scheme responds to the context in terms of layout, scale, and massing to achieve a design solution that is appropriate to the surrounding area. The potential impacts of the Southwood Courtyard Building upon the patients, visitors and staff have been at the core of the design evolution. Examples of how this is achieved, include:

- The siting of the Southwood Courtyard Building to maximise existing adjacencies in terms of operability of existing and future hospital related functions;
- Responding to surrounding spaces in terms of layout, from and appearance of development;
- Providing additional cycle spaces and facilities; and
- Providing a green roof, which accords with the wider hospital's green space strategy that enhances the overall legibility and sensory experience of the physical environment.

7.23 At Level 2 of the new building, Kalwall translucent panels are used to backlight the stained glass windows of the neighbouring Chapel provide an illuminated base to the new building. Between Levels 3 to 5, a printed screen cladding on fabric is proposed which will wrap around all four sides of the building.

7.24 The Arts Programme at GOSH (GOSH Arts) commission art and design for hospital buildings and run a participatory programme of engaging art activities and experiences for children, young people, their families and staff. They work with artists across a wide variety of art forms including high profile cultural partners such as galleries and museums to inspire creativity and learning, to provide unique opportunities that reflect the diversity of GOSH patients, visitors and staff. GOSH Arts is integrated with the hospital's Redevelopment Directorate to create new hospital environments that inspire the imagination of visitors and make clinical spaces feel less intimidating.

7.25 As part developing detailed design for the façade of the building, GOSH is in the process of commissioning an artist to create a design for the cladding that will enhance the appearance of the building, particularly when it is viewed and glimpsed from the Main Entrance and surrounding courtyard building. A workshop with children, young people, families and staff at the hospital will be held to inform the design of the artwork for the cladding. It is anticipated that the artist will be appointed in December 2017, with a workshop to be held in February 2018, design and development between March to April 2018, with a final design anticipated in May 2018.

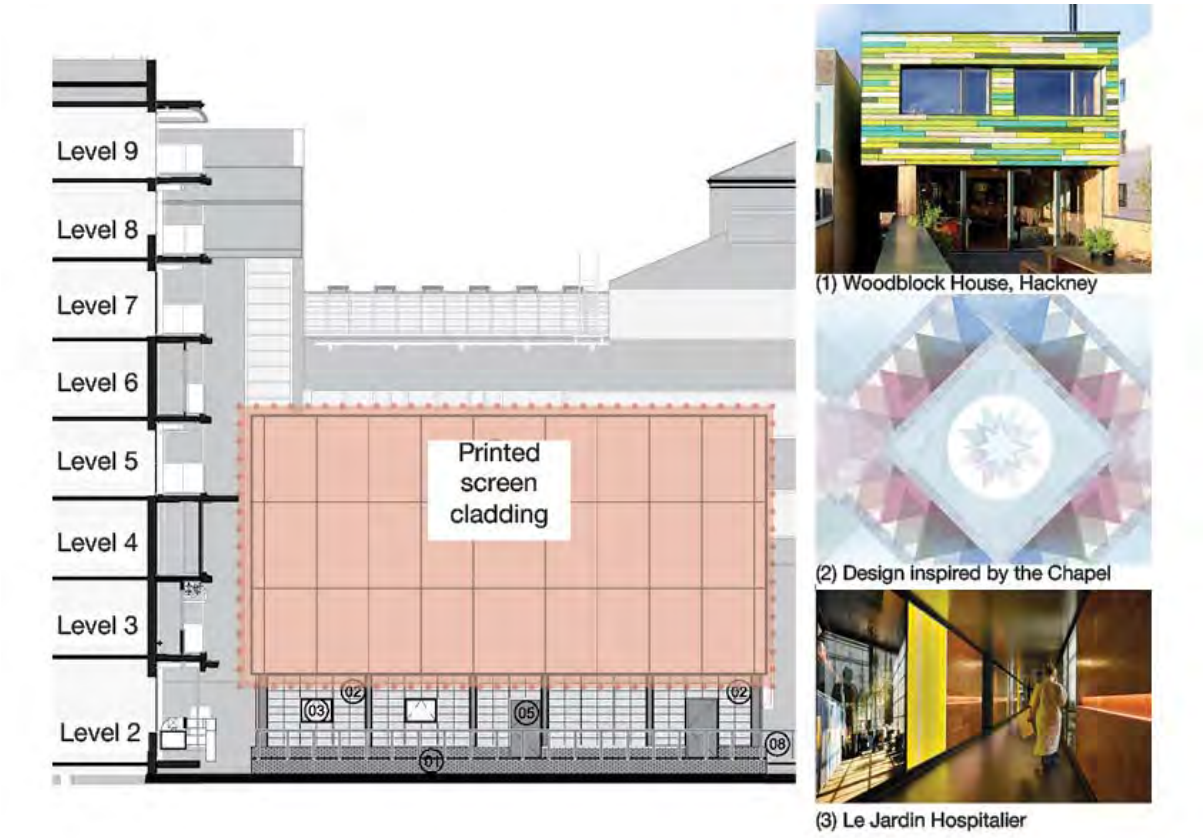

Figure 11: (Left) North Elevation showing the printed screen cladding panel as seen from the courtyard and (right) examples of printed cladding from GOSH Arts shortlist of Artists

7.26 Figure 11, as shown above shows examples of printed cladding on the north elevation. A shortlist of artists and examples of printed exterior cladding used elsewhere, are set out in the Design and Access Statement and further details on the artwork for the cladding will be submitted by the Trust as a separate application for approval of detail.

Sunlight and Daylight

7.27 The design and layout of new buildings must enable sufficient sunlight and daylight to penetrate into and between new buildings, whilst ensuring that adjoining properties are protected from unacceptable overshadowing. Policy DP26 of Camden's Development policies requires development to protect the quality of life of occupiers and neighbours by providing a good level of amenity by considering sunlight, day light and artificial light levels. Given that the proposed development is concealed within the Hospital's existing buildings, sunlight and daylight of nearby residential properties remain unaffected.

7.28 The new Southwood Courtyard Building will be constructed within an external courtyard of the Hospital Campus, and due to its height and relationship with the surrounding buildings the new building could have an impact on outlook and provision of light for staff and patients within the Southwood Building and the Variety Club Building. Detailed sections, plans and drawings are submitted showing the surrounding buildings and the uses related.

7.29 A Preliminary Daylight Report is submitted as part of the Planning Application. The report sets out a baseline assessment using the Vertical Sky Component (VSC), No Sky Line (daylight distribution) and the Average Daylight Factor (ADF) for daylight analysis, and the Annual Probable Sunlight Hours (APSH) provided by the Building Research Establishment (BRE).

7.30 Overall, the existing light levels within the Southwood Building are principally affected by a combination of the relatively tight enclosed courtyard space, as well as the presence of the external balconies/fire escape walkways, which substantially inhibit the access to natural light into this building. With restriction to the access of natural light the current light levels are zero, and when in use the rooms are

constantly lit by electrical lighting rather than the reliance on natural light levels. The baseline analysis in the Daylight Report demonstrates the existing VSC levels to be below 10% and in many cases are below 1% or zero.

7.31 Existing visual outlook for patients, visitors and staff of the Southwood Building facing the external courtyard is heavily restricted by angles of view, balconies and mesh coverings combined with a high proportion of windows being obscured with frosted film. Drawings submitted for approval and a schedule of photos is appended in the Design and Access Statement provide further details of the surrounding departments and the extent of blank, obscured and clear glazing. Those rooms that do have a view of the courtyard currently overlook a service yard with gas bottle containers, plant and the flat roof of a temporary building.

7.32 As part of the proposed scheme, a number of opportunities to enhance the daylight to the neighbouring buildings have been considered. On the south and west facades of the new building, Kalwall translucent panels are used to backlight the stained glass windows of the neighbouring Chapel. The translucent Kalwall panels create a two storey 'light box' and provide an illuminated base to the new building providing the perception of better light levels into those poorly lit rooms at Levels 2, 3 and to some extent to Level 4 of the Southwood Building, as a result of the diffuse light emitting from the new building when lit from the inside.

7.33 It is clear that the proposed Southwood Courtyard Building will reduce the access to natural light to the neighbouring windows of the Southwood Building where there is access to daylight, but in reality the levels of actual quantum of change is very small and barely noticeable. As outlined in the Preliminary Daylight Report submitted, the actual real change is 2.45% VSC points. Moreover, as the healthcare and medical use of the rooms currently is dependent on the use of electrical light rather than natural light, it is considered unlikely that the actual beneficial use of the rooms will experience any material effect. Importantly, it should be noted in this assessment that the BRE guidelines used to interpret the VSC and ADF results are guidance and not an instrument of planning policy. Furthermore, it is specifically noted in the guidance that the results should not be used rigidly to dictate development and that it may be more appropriate to adopt a flexible approach. This is considered particularly pertinent in the case of the Southwood Courtyard Building proposal given the site constraints, particularly the constrained nature of the surrounding area.

7.34 In summary, whilst the proposal does have an impact on the amount of daylight received by adjacent rooms, it is important to note that the use of the rooms is dependent on the use of electrical light rather than natural light, and this must be balanced against the need to ensure a fully functional hospital building and the related benefits that this will provide. Therefore, the development can be considered to be in accordance with Policy CS14 of Camden's Core Strategy and Policies DP24 and 25 of the Camden's Development Policies 2010-2025, and draft policy D2 of the emerging Local Plan.

7.35 Drawings are included in the application which show the uses of each room of the Southwood Building. They indicate whether the windows are currently infilled, obscured or have clear fenestration at level 2, 3, 4 and 5. These drawings are submitted for information as part of the Drawing Package.

Scale

7.36 In relation to the scale of development, the Core Strategy requires development to respect the importance of human-scale and should not unduly harm the residential amenity, the environment or transport infrastructure. Generally, development should be appropriate for their surrounding in terms of scale and context. The Southwood Courtyard Building is designed to respect the existing scale and proportions of the Southwood Building to the north, east and west, and the Variety Club and the hospital's Chapel to the south. As shown in the Drawing Package and described in the Design and Access Statement, the Southwood Courtyard Building has been designed to respect the existing buildings being lower in height and massing, and in line with the existing floor levels, to provide improved horizontal accessibility. For example, the corridor proposed as part of the Southwood Courtyard Building, links directly with Level 2, the main reception area and Level 3 where existing operating theatres, recovery and staff facilities are located within the Variety Club Building.

7.37 The proposed scheme is concealed within the Hospital's buildings. Both the Southwood Building and the Variety Club Building are seven storeys in height. Given that the height of the new Southwood

Courtyard Building is significantly lower, i.e. at three storeys, the roof line of the new building will not be visible at street level.

7.38 Whilst every effort has been made to locate plant and equipment internally to supply the new building with ventilation and cooling, some external plant has been required. A total of two chiller units will be located in a recessed area on Level 4 and are sited behind an enclosure. The enclosure is open to the sky and will be visible from Levels 5 to 9 from the Southwood Building and Variety Club Building. However, the rest of the roof level will provide a total area of 258 square metres for a mixture of sedum planting, which will provide an improved outlook for patients and users of the Southwood Building. Further details are set out below, under the heading Green Roof.

Heritage

7.39 The NPPF states that in determining applications, local planning authorities should require an applicant to describe the significance of any heritage asset affected including a contribution made by their setting.

7.40 As mentioned above, a Heritage Statement is submitted as part of this Planning Application and made an assessment of proximate heritage assets affected. The analysis revealed that the site is not within a conservation area nor does it contain statutory listed buildings or locally listed. However, it lies very close to the Grade II* listed Chapel of St. Christopher; the Hospital's Chapel.

7.41 The assessment established that the development proposals are considered to cause no harm to the significance of the Grade II* listed Chapel of St. Christopher. As such, the development proposals are considered to be in accordance with Section 66 of the Planning (Listed Buildings and Conservation Areas) Act 1990 and with the policies of the NPPF. They can also be considered to be in accordance with Policy CS14 of the Camden Core Strategy 2010-2025, and Policies DP24 and DP 25 of the Camden Development Policies 2010-2025, and draft policy D2 of the emerging Local Plan.

Impact within the Chapel of St Christopher

7.42 The significance of the Chapel of St Christopher lies mainly in the high aesthetic value of the Chapel's interior, particularly the stained glass crafted by Clayton and Bell. The exterior has no architectural articulation, besides the stained glass windows and apse, and is considered to contribute very little to the chapel's significance.

7.43 As mentioned previously, the setting of the Chapel lost its original setting when it was moved in the 1980s. Its present setting is within the courtyard, which is surrounded by a contractor's office, gas bottles and storage facilities. This setting is not considered to contribute to the Chapel's significance. However, the natural daylight that penetrates the Chapel's stained glass windows helps to make these legible from the interior space. The new building will be built close to the Chapel and may block or reduce the natural light that penetrates the Chapel's stained glass windows, which may harm the Chapel's significance.

7.44 In response, the façade of new building will be designed by a Kalwall panel system on all sides that face the Chapel and are shown in the submitted Drawing Package, but indicated in Figure 12, below:

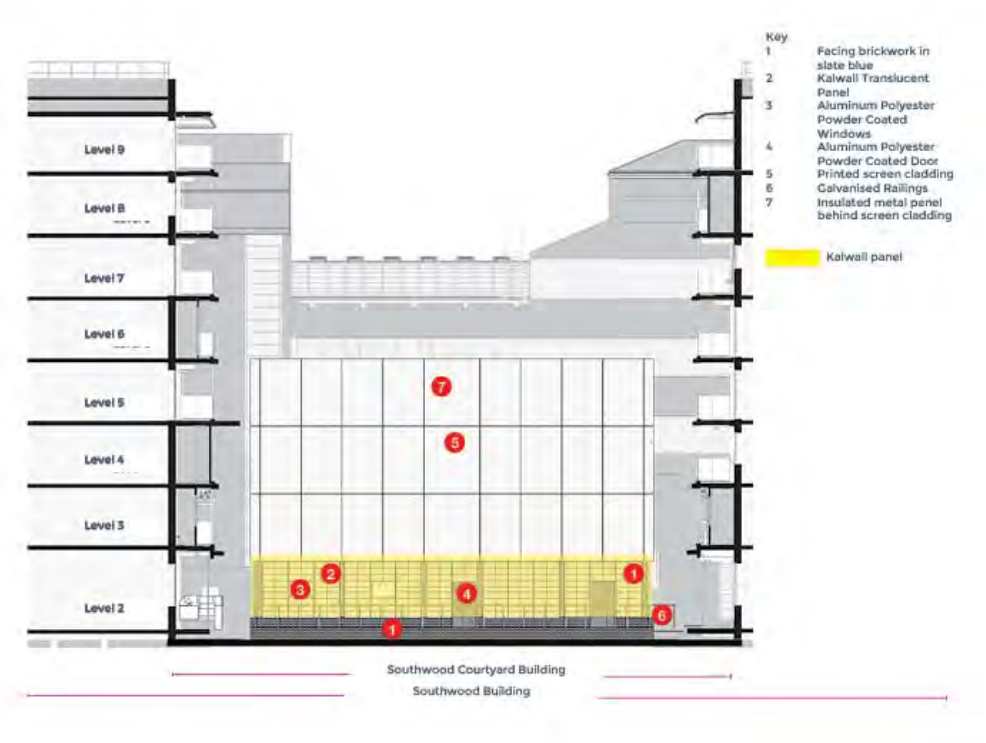

Figure 12: North elevation of the Southwood Courtyard Building showing the location of the Kalwall Panels edged in yellow within the context of the Southwood Building and Variety Club Building

7.45 The hospital environment is artificially illuminated twenty-four hours a day, seven days a week. In order to maintain the consistency of the lighting and ensure that that light continues to penetrate the Chapel's stained glass windows, preserving their legibility and significance, the proposed Kalwall system will emit light towards the Chapel at all times of the day.

7.46 Prior to submitting the planning application the design team consulted with Historic England. Overall, Historic England did not consider the Chapel's existing setting contributed to its significance, and provided their support towards the principle of developing the courtyard to provide much needed facilities for the hospital. However, their concern was in relation to the close proximity of the proposed Southwood Courtyard Building to the apse and the potential this brings for a reduction in light in the Chapel. As mentioned, the stained glass in the apse is relatively well-lit considering the location of its courtyard setting. A change in the amount and quality of light could harm the ability to appreciate the stained glass through diminishing luminosity, and in turn affect the character and atmosphere of the Chapel.

7.47 In addition to the Kalwall system proposed, three additional elements of artificial lighting to raise the illumination levels outside the Chapel are proposed. These include:

1) Using the internal corridor lighting on Levels 2 and 3 of the new building to shine through an opaque wall-cladding system. This lighting element will be controlled via a timeswitch to ensure that it is energised at all times when the Chapel is available for occupation.

2) To further enhance the bright surface of the Kalwall, a continuous strip of linear LED luminaires will be installed at high level and at low level to shine down and up along the length of wall facing the Chapel. This will contribute to the Chapel's 'light box' effect, the light will also spill through the Kalwall into the internal corridor areas. These LED luminaires will also be timeswitch controlled, but on a different timer.

3) The final new lighting element will be some in-ground mini-LED spotlights that will be aimed up onto the back of each stained glass panel so that some light will be directed through the glass and into the Chapel to "lift" the eastern end in the same way that natural daylight would. These spotlights will also be controlled via a timeswitch but, on a different timer.

7.48 The light that passes through the Kalwall surfaces will be designed in accordance with the Trust's requirements for the internal lighting scheme i.e. 200 lux and the energy needed to maintain these lights will be expended to illuminate the corridors irrespective of whether or not the Chapel interior levels need to be improved. It is expected that the natural hours of occupation will be from 6:00 a.m. to 9:00 p.m.

7.49 Through the use of three different lighting elements, there will be a potential for varying the illumination levels in a simple way to replicate the natural rise and fall of light during a 24-hour cycle of the day. By, switching on the corridor lights in the morning, followed by the up/down linear LEDs an hour later, then the floodlights, the natural rhythm of the day can be followed by having the brightest appearance in the middle of the day. During the evening, a similar shutdown sequence could be followed. Other timing sequences could also be explored if they were considered to be a positive influence on the end result.

7.50 With the methods described above, we believe we have mitigated the Historic England's concerns and that there will be no detriment impact to the internal appearance of the Chapel. It may be possible to enhance the space by raising the illumination levels by a small degree. The ultimate objective would be to perceive a sunny day outside the Chapel and this can be achieved by using artificial sources of light.

7.51 Further to Historic England's feedback the Trust has continued to engage with the Chaplain on a weekly basis to ensure the proposals are appropriate for the Chapel's needs and requirements.

7.52 In summary, the development proposals are considered to cause no harm to the Chapel's significance and the additional methods proposed for artificial sources of light will have no detrimental impact to the internal appearance of the Chapel. Therefore, the development is considered to be in accordance with Policy CS14 of Camden's Core Strategy and Policies DP24 and 25 of the Camden's Development Policies 2010-2025, and draft policy D2 of the emerging Local Plan.

St Christopher Statue

7.53 As part of the proposed development, the statue of St Christopher, which currently stands to the east of the Chapel's apse, will be relocated to the south of the apse. At this new position it would be appreciated better by the general public from the hospital corridor at Level 2 in the Variety Club Building and from the new Southwood Courtyard Building. Therefore, the development is considered to be in accordance with Policy CS14 of Camden's Core Strategy and Policy DP25 of the Camden's Development Policies 2010-2025, and draft policy D2 of the emerging Local Plan.

Below Ground Archaeology

7.54 Draft Policy D2 provides guidance on the importance of below ground archaeology. In particular it states that: *the Council will protect remains of archaeological importance by ensuring acceptable measures are taken to preserve them and their setting, including physical preservation, where appropriate.*

7.55 In order to assess the archaeological significance of the site, a desk-based assessment has been undertaken by CgMS and submitted as part of this Planning Application, which finds that the site is located within an Archaeological Priority Area as designated by the London Borough of Camden. The site is considered likely to have a potential for Post-Medieval defensive features at depth within the site. There is a low potential within the site for all other periods of activity.

7.56 The construction of hospital buildings on the site during the late 19th century is considered likely to have had a localised severe negative impact on below ground archaeological deposits due to the cutting of foundations and services.

7.57 The subsequent demolition of the late 19th century building, followed by the construction of further buildings on and immediately adjacent to the site during the 20th century is considered likely to have

had a further cumulative severe widespread negative impact on below ground archaeological deposits due to landscaping, and the cutting of foundations and services.

7.58 During the late 20th century the location of the site was utilised to provide support infrastructure, including a tower crane, for extensive redevelopment work on the hospital complex. This work is considered likely to have had a further cumulative severe widespread negative impact on below ground archaeological deposits due to the instillation of a tower crane base.

7.59 Due to the archaeological potential and known constraints within the site, the Trust proposes that further details for archaeological investigation are submitted for approval including the implementation of a programme of archaeological monitoring of ground works during construction.

Noise and Vibration

7.60 The NPPF states that new development should be prevented from both contributing to or being adversely affected by unacceptable levels of noise pollution (paragraph 109). Whilst Paragraph 123 refers to the need to avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development.

7.61 Camden's Noise Policy is set out in DP26 of the Development Policies Plan (2012), and as draft policy A4 in the emerging Local Plan (2017), which recognises that noise and vibration can have a major effect on amenity and health, and quality of life. As a requirement, the Council will only grant permission for plant or machinery if it can be operated without cause harm to amenity and does not exceed their noise thresholds. In this instance, no greater than 10 dB below the representative background noise level during the day, evening and night time periods.

7.62 As part of the new building, a total of two air handling units (AHU) and two chiller units are required. Manufacturers' data for the AHUs and the chiller units can be found in the Noise Assessment submitted as part of this Planning Application. The AHUs will be located internally on Level 4. However, air conditioning units will located in a recessed area at Level 4 and will be 2.5 metres below the green roof.

7.63 The Noise Assessment, was prepared by Cole Jarman considered the closest and most exposed noise sensitive receptor associated with the hospital and the nearest noise sensitive residential property to the proposed plant. These being the nearest ward at the Southwood Building and resident properties on Great Ormond Street, respectively.

7.64 With the noise mitigation measures recommended which include: high performance acoustic enclosures for the chiller units and the positioning of the AHUs internally it is considered the proposals are consistent with DP26 of the Development Policies Plan (2012), and draft policy A4 in the emerging Local Plan (2017).

Sustainability and Energy Considerations

7.65 Sustainability and sustainable forms of development are enshrined throughout the NPPF. Reducing greenhouse gas emissions, minimising the impacts of climate change and delivering of renewable and low carbon technology are central to the three strands of sustainable development (NPPF paragraph 93). It states that new development should comply with the adopted Local Plan policies on local requirements for decentralised energy supply (unless it is demonstrated to be unfeasible or unviable) and should take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption (NPPF paragraph 96).

7.66 Paragraph 97 of the NPPF supports measures to increase the use and supply of renewable and low carbon energy including the identification of opportunities where development can draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers. The NPPF promotes the creation of sustainable communities, with appropriate facilities/services/infrastructure.

7.67 There are a number of local policies in the Core Strategy and Development Management Plan, and draft Local Plan, which relate to sustainable development, including climate change and renewable energy. These include: CS13, DP22 and draft policy CC1. The policies are focused on the need to

protect resources and, through the location, design, materials, orientation and form of new development, make the most efficient use of existing utilities; provide any necessary infrastructure/use technological measures which supports sustainable forms of construction; utilise decentralised, renewable or low carbon forms of energy; and be responsive to climate change.

Energy

7.68 Policy CS13 sets out Camden's position in tackling climate change through promoting higher environmental standards. Part C of the policy encourages all development meet the he highest feasible environmental standards that are financially viable during construction and occupation by: minimising carbon emissions from the redevelopment, construction and occupation of buildings by implementing, in order, all of the elements of the following energy hierarchy: ensuring developments use less energy; making use of energy from efficient sources, such as the King's Cross, Gower Street; Bloomsbury and proposed Euston Road decentralised energy networks; and generating renewable energy on-site. This policy intention is followed through in draft policy CC1 requiring require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy: Be lean… for design to use less energy; Be clean… to supply energy efficiently; and Be Green… to use renewable energy.

7.69 An overall emissions reduction of 52.9% (against the Part L 2013 Building Regulations baseline) is identified in the Energy Assessment submitted as part of the Sustainability Statement for this Planning Application. The scheme is not proposing to carry out dynamic thermal modelling, or future climate change projections as the constrained nature of the site are considered to make negligible difference to the energy calculations.

7.70 Further details on the Energy Hierarchy are set out in the Energy Statement. A summary is set out below:

Be Lean to for Design to use Less Energy

7.71 Overall, the energy savings through 'Be Lean' are 37.8% against the Part L 2013 Building Regulations baseline.

Be Clean by Supplying Energy Efficiently

7.72 Overall the energy savings through "Be Clean" are 15.1% against the Part L 2013 Building Regulations baseline.

Be Green… to use renewable energy

7.73 The incorporation of any roof-mounted solar technology is restricted as the work consists of infill developments between taller existing buildings that will overshadow and limit efficiency. It is therefore considered that solar thermal or PV are not feasible due to limited capacity of the available roof area.

7.74 There are also restrictions on ground-works due to the infill nature of the development and constrained site. Excavation may impact the structural integrity of the surrounding existing building stock and there are restrictions due to the neighbouring Chapel. As such, there will be very little available space for installation of effective geothermal technology such as ground source heat pumps (GSHP).

7.75 Air source heat pumps (ASHPs / VRV/VRF) are not considered suitable as within the restrictions of the courtyard the technology the energy contribution will be unpredictable and overall insignificant. All levels will be full fresh air with heating and cooling by LTHW and chilled water respectively. The condensing units will either be accommodated within the chiller enclosure already allowed for within the plans, or at courtyard level.

7.76 The energy savings through "green" are therefore 0%.

7.77 Overall the TOTAL savings are 52.9% against the Part L 2013 Building Regulations baseline. This exceeds the emissions reduction target of 40% as outlined in the London Plan Policy 5.2 and Camden Planning Guidance CPG3; and is optimal within the constraints of the site and clinical requirements. It is therefore considered the proposals are consistent with CS13 of the Core Strategy (2012), and draft policy CC1 in the emerging Local Plan (2017).

Sustainable Use of Materials

7.78 All building materials and their thermal properties will be assessed against the BRE Green Guide, with the aspiration of achieving A or A+ rated build-ups. All timber used on site and for construction materials will be from an independently verified sustainable source such as Forest Stewardship Council (FSC) or Programme for the Endorsement of Forest Certification (PEFC). Where feasible, other materials will seek to be sourced from responsible suppliers ideally with BES6001 certification.

Sustainability Assessment Tools

7.79 The proposal falls under the category of 'non-domestic development of 500 square metres of floorspace or above' and would be expected to achieve 'excellent' in BREEAM assessments, as required by Policy DP22 and draft policy CC2. Further, Camden Planning Guidance 9 requires the submission of a pre-assessment report at Planning Application Stage.

7.80 A BREEAM New Construction 2014 assessment has been undertaken for Pre-Assessment stage and indicates a clear pathway to achieving a rating of **'Excellent'** with a score of 72.7%. This is possible despite restrictions on the site and stringent clinical requirements as; the scheme is able to connect to the existing hospital energy network, the works will include clearing of contamination (asbestos), there will be improved water retention and there will be a net gain in biodiversity on site due to the addition of a new green roof. The proposal is considered to be in accordance with Policy DP22 of the Camden Development Polices 2010-2025, and draft policy CC2 of the emerging Local Plan.

Green Roof and Biodiversity

7.81 The requirement for schemes to incorporate green or brown roofs, and green walls, wherever suitable is set out in Policy DP22 (Part B) and draft policy CC2 (part c). An area of 258 square metres is proposed for a green roof for a mixture of sedum planting to provide a net gain in biodiversity on site. Further details on the planting mix is contained in the Design and Access Statement.

7.82 Details of its construction and the materials used, including a section at a scale of 1:20 and planting details are provided in the Drawing Package with reference to drawing number: 16021(04)009.

7.83 With the inclusion of a green roof, the proposal is considered to be in accordance with Policy DP22 of the Camden Development Polices 2010-2025, and draft policy CC2 of the emerging Local Plan.

Flooding

7.84 Policy CS13 sets out Camden's approach to tackling climate change which includes reducing our water consumption and reducing the risk of surface water flooding. Policy DP23 contributes towards the implementation of Policy CS13 by seeking to reduce water consumption and limit the amount of waste water entering the combined storm water and sewer network.

7.85 The impermeable surface area will not increase as a result of the new development, and therefore run-off rates are not expected to change. New drainage systems will connect to the existing sewer network. The site lies within Environment Agency Flood Zone 1 and therefore is not considered at risk of fluvial flooding. The biodiverse roof areas will provide some attenuation through the hydraulic capacity of the substrate.

7.86 The proposal is considered to be in accordance with Policy DP23 of the Camden Development Policies 2010-2025, and draft policy CC3 of the emerging Local Plan.

Water Efficiency

7.87 Water management will be optimised. Low flow sanitary fittings are proposed throughout and in addition to extensive metering, a Building Management System (BMS) will be provided which will include capability to monitor water utilisation, leaks etc. through use of 'out of normal range' alarms. The green roof will rely on precipitation. Rainwater or greywater harvesting is not feasible due to site constraints.

7.88 The proposal is considered to be in accordance with Policy DP23 of the Camden Development Policies 2010-2025, and draft policy CC3 of the emerging Local Plan.

Cycle Provision

7.89 Policy CS11 sets out the Council's position to promote sustainable travel. Part H of that policy requires development to improve facilities for cyclists, including increasing the availability of cycle parking. Policy DP17 sets out the requirement for development to include high quality cycle parking.

7.90 A total of eight cycle parking spaces will be provided in the form of four Sheffield Stands. The provision will be designed in accordance with Camden's CPG on Transport. Full details, including elevations, dimensions, plans and manufacturers details will be submitted for approval of detail.

7.91 Subject to the detail to be provided, the proposal is considered to be in accordance with Policy CS11 of the Core Strategy and DP23 of the Camden Development Policies 2010-2025, and draft policy T1 of the emerging Local Plan.

Construction, Phasing and Decant

7.92 The Southwood Courtyard Building will comprise a single building over three storeys connecting at Levels 2 and 3 into the Variety Club Building. The existing single storey contractor's office will be removed and gas bottle storage will be relocated to Level 1 of the Variety Club Building.

7.93 Development of the Southwood Courtyard Building is primarily linked to the two further phases as part of the GOSH's redevelopment programme with Phase 4 i.e. the Frontage Building anticipated to commence demolition in 2019/2020, and the new building under construction from 2020. As part of the Frontage Building coming forward the existing Physiotherapy and Rehabilitation Services from Level 5 of the Frontage Building, and the much needed iMRI Facility will be located in a new building within the courtyard.

7.94 Construction of the Southwood Courtyard Building is anticipated to commence towards the end of 2017. Fit out of the iMRI Suite and relocation of the Physiotherapy and Rehabilitation services and facilities are anticipated around 2019, with the proposed building opening thereafter. A draft programme is included in the draft Construction Management Plan, submitted as part of this Planning Application.

7.95 Upon completion of Phase 4, facilities and services from the Southwood Courtyard Building will be transferred to the new Frontage Building or the Variety Club Building in late 2024. Whilst the Frontage Building will be subject to a separate planning application and have its own construction programme the Trust will continue liaise with the London Borough of Camden on the anticipated timing for the transfer of services and facilities from the Southwood Courtyard Building to the Variety Club Building and the Frontage Building. The wider redevelopment will be completed by 2030.

7.96 A draft programme for the construction of the Southwood Courtyard Building is provided in the draft Construction Management Plan (CMP) showing an indicative timescale for development and the key stages and interrelationships of the development.

7.97 In order to take account of the construction impact of the proposal and protect the amenity of surrounding occupiers, the draft CMP details the methods that will be employed by the Main Contractor to minimise the potential negative impacts associated with construction.

8. Planning Obligations and Draft Heads of Terms

8.1 In addition to the provision of planning benefits directly generated by the proposed development, the Trust will continue to work with the London Borough of Camden to agree appropriate planning obligations to mitigate the impacts of the proposed development.

Draft S106 Heads of Terms

8.2 The following draft S106 heads of terms has been prepared and informed by pre-application discussions with officers at the London Borough of Camden:

- Highways improvement of the junction at Great Ormond Street and Powis Place;
- Construction Management Plan; and
- Review Mechanism prior to the transfer of the services and facilities within the Southwood Courtyard Building to the Phase 4 Frontage Building.

8.3 Following the submission of this planning application, the Trust will continue to engage with the Council on the planning obligations required to mitigate the effects of the proposed development. The negotiation of Heads of Terms will have regards to the site specific constraints and considerations of the site, the statutory tests for planning obligations contained in Regulation 122 of the Community Infrastructure Levy (CIL) Regulations shall determine the overall viability of the proposed development.

Mayoral or Camden CIL

8.4 The proposal will not be liable for Mayoral CIL or for the London Borough of Camden's Community Infrastructure Levy as development used for the provision of any medical or health services are exempt from charge.

9. Conclusion

9.1 Great Ormond Street Hospital (GOSH) for Children NHS Foundation Trust has identified that in order to continue to offer a 'world class' centre for tertiary paediatric neurosciences and neurosurgery, it needs to provide an Intraoperative Magnetic Resonance Imaging (IMRI) facility with a 3 Tesla (3T) MRI on the main hospital site. The Southwood Courtyard Building provides the Trust with dedicated clinical facilities for the IMRI facility at Level 3 and Physiotherapy and Rehabilitation Facilities and Services located at Level 2.

9.2 The Physiotherapy and Rehabilitation Services treats children and young people with a variety of conditions. The department is currently located in Frontage Building at Level 5 (i.e. third floor). Relocating this clinical facility gives the Trust the opportunity to decant the current 'dated' Physiotherapy and Rehabilitation Services into up-to-date modern facilities at Level 2 of the Southwood Courtyard. This central location at the ground level will benefit children and young people attending physiotherapy with direct access from the hospital main entrance without taking the lift to access the facility (as they currently do). It also allows expansion of the Hospital's Physiotherapy facilities so that they can treat a wider variety of conditions. The new facility will include space for GAIT assessment and a plaster room that are not provided in the current department. In summary, the experience of children and families attending for physiotherapy treatment and assessment will be dramatically improved.

9.3 The Southwood Courtyard Building also gives the Trust the opportunity to provide the much needed iMRI suite at Level 3. The suite will be co-located with existing operating theatres and recovery areas currently provided at Level 3 of the Variety Club Building. This co-location provides advantages operationally, such as efficient patient flows and use of staffing resources and in reducing the space requirement for some support accommodation which can be shared where appropriate. For example, recovery areas, offices for consultants and staff amenities will not be required, as these are all provided in the adjacent Variety Club Building.

9.4 Overall, the redevelopment will provide the Trust with the much needed iMRI suite and will replace the outdated physiotherapy and rehabilitation services and facilities at Level 5 of the Frontage Building, with new facilities within a modern building. Overall, the redevelopment will have a range of clinical and public benefits.

9.5 As part of the pre-submission consultation process, the Trust has responded to feedback received from key stakeholders including the representatives from the Resident Liaison Group, user groups (including clinicians, fire officers, infection control staff, facilities management team and estate personnel), officers at the London Borough of Camden and representatives at Historic England to ensure that their opinions and feedback are included as part of the scheme design. Many of the changes made to the scheme have been made specifically to accommodate the views of the stakeholders.

9.6 The Southwood Courtyard Building proposal will also meet the aspirations set out in planning policy to provide improved hospital services and facilities. In addition, the Planning Statement highlights a number of other significant benefits, including:

- Reduced requirement for additional pre-operative or post-operative MRI scans, often under general anaesthetic, during their hospital stay;
- The ability to monitor the extent of surgical resection during the procedure and update pre-operative imaging;
- Immediate quality control;
- Significant reduction in the number of revisional surgical procedures for brain tumours and epilepsy surgery, with their associated resource and quality of care implications.
- Lower rates of mortality as a result of better critical care facilities, which will benefit the regional community;
- New employment opportunities during construction and residually through job creation;

- Improved research and development opportunities using the 3T MRI for outpatient and inpatient activity and research, as well as intraoperative patients/research subjects, which will produce economic benefits; and
- Generation of secondary spending in the local economy, e.g. local shops.

9.7 As one of the best known providers of children's health care, nationally and internationally, it is imperative that the Hospital continues to improve its facilities by firstly replacing outdated facilities and services and secondly provide the space for new facilities to offer a 'world class' centre for tertiary paediatric neurosciences and neurosurgery.

9.8 There is clear support for the continuing improvement to London's hospitals both in the London Plan and Camden's Local Plan. A number of issues were discussed with the London Borough of Camden and Historic England, and resolved prior to this submission.

9.9 The Southwood Courtyard Building proposal will provide a range of benefits for the children and young people of Camden and London, for years to come. The Trust firmly believes that the scheme is appropriate in terms of land use, design, sustainability, and its impact on the neighbouring occupiers, including its relationship with the Chapel. All of these issues have been assessed in this Planning Statement, and it is considered that the development complies with planning policy, we therefore believe that planning permission should be granted.

Appendix A

Great Ormond Street Hospital
Intra-operative MRI
Engineering Feasibility Report

GOSH/IMRI/01

Issue | 2 October 2015

Job number 245008

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ARUP

Document Verification

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			Prepared by	Checked by	Approved by
		Name	Ryan Dunne; Malcolm Turpin	Mike Booth	Mike Booth
		Signature			
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		Name	Ryan Dunne; Malcolm Turpin	Mike Booth	Mike Booth
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Contents

1 Executive Summary

Arup have been asked to review the feasibility of creating an intraoperative MRI (iMRI) Suite in the GOSH estate. The iMRI would require a 3T MRI examination room with direct access to an operating theatre, to allow for scans to be carried out without removing the patient from the theatre environment.

The Trust had selected some specific locations where the iMRI could be feasible, having already reviewed these locations as part of an earlier feasibility process. Arup were asked to look at these options again and carryout a fresh assessment of their engineering feasibility. We were also asked to propose any of our own ideas for possible locations and to review general areas in the level 3 theatre department.

The scope of our assessment is formally limited to structural, mechanical, electrical and public health engineering. We have however made additional comments on other aspects of the feasibility where we think it will be useful.

The first part of this report reviews the engineering requirements of the iMRI. The different location options are then reviewed.

Overall each of the options presents different challenges and there was no clear 'best option' that came out of our review. The key common challenges are low ceiling height, suitable plant locations, congested services and a wide range of different structural solutions. We have not found any engineering issues for any of the options which makes us think they would be unfeasible, although further detailed design and investigation may reveal such issues. We have however found key compromises and potentially significant difficulties which make some options less favourable than others. Each of the options reviewed are summarised below:

Level 1 OBW (Option A2), desktop study and site survey completed - This option is complex due to existing services and relocation of a number of different spaces. The entire iMRI theatre suite would need to be provided as new (rather than an MRI to an existing theatre or vice versa) and new dedicated cooling and ventilation plant would therefore be required. There have not been any aspects of the services which are considered unfeasible although there are some key actions for further investigation including MRI proximity to lifts and transformer room, and locations of AHU and chiller plant. **The Key compromise** with this option is on ceiling height in the iMRI which would have to be considerably lower than optimum and down to 2.8m in the centre of the theatre and 2.4m in a large perimeter bulkhead. Architectural and clinical user input is required to assess how this affects the feasibility.

Structurally this option looks relatively favourable, based on a desktop study of structural plans, but it would need modification to enhance vibration and loading performance. The structure is a conventional reinforced concrete slab which could be stiffened and strengthened from the plant room below.

Level 1 Phase 2b (Option C), desktop study and site survey completed - This option is relatively simple from a services point of view with easy access to a

large riser in the new Phase 2b development and an existing quench route. The space for AHU and cooling plant on the roof requires further investigation. **The key compromise** with this option is also ceiling height in the theatre which is even worse than the option above, down to 2.75m in the centre of the theatre and 2.35m in a large perimeter bulkhead. Architectural and clinical user input is required to assess how this affects the feasibility.

Structurally there is limited information available; further information including structural surveys would be required to verify the structure. This option has been previously assessed by WSP, and we assume that the conclusions of their study still apply.

Level 3 VCB Theatres, desktop study only – This option is has an improved clear height, relative to the options described above, of 3.3m and connects to an existing operating theatre. The available space of new ventilation plant, cooling plant and quench pipe require further review if this option was to be taken forward.

Structurally this option is relatively favourable. It is expected that the steel frame/ composite floor construction could be significantly stiffened and strengthened with access from the waiting room area below. The impact of the steel structure on the magnetic field of the MRI machine will need further review.

Level 3 MSB, Phase 2b, Adjacent to new bridge construction, desktop study only - Structurally this is not such a favourable option. The post tensioned slab may be reasonably stiff already but is very difficult to strengthen further. The location directly above the main hospital staff restaurant would make carrying out structural remedial works below a challenge. This option has not been reviewed from a services perspective due to these structural issues. However from first inspection its close proximity to lift shafts would be of concern and require further review.

Level 3 PICB, Phase 2b, Adjacent to new bridge construction, desktop study only - Structurally this is one of the least favourable options. The existing ribbed slab construction maybe difficult to strengthen. This option has not been reviewed from a services perspective due to these structural issues.

Level 3 PICB, Phase 2b, Recovery area, desktop study only - Structurally this is one of the least favourable options. The 250mm reinforced concrete flat slab is expected to be relatively responsive and may not be suitable for MRI even after extensive modification. This option has not been reviewed from a services perspective due to these structural issues.

Next Steps - Next steps and ongoing work is reviewed at the end of this report. The main recommendation is to review these options from architectural and user perspective to reduce down the options and allow for more in depth engineering investigations.

2 Engineering Requirements of the iMRI

The iMRI requires a 3T MRI examination room with direct access to an operating theatre. A photo of an existing iMRI suite is shown below:

2.1 Services Requirements of the iMRI

The MRI Machine in the Examination room and associated plant in the Equipment room will have airside and waterside cooling requirements. The Examination room temperature and relative humidity also needs to be closely controlled. These requirements vary between manufacturers but examples of the typical requirements from two manufacturer are shown in the table below, with key design implications highlighted:

Parameter	Philips Achieva 3T	Siemens Magnetom 3T	Key Design Implications/ Comments
Physical Dimensions	206 x 200 x 167 (HxWxD,cm)	250 x 230 x 317 (HxWxL,cm)	
Weight	5830 kg	8300 kg	
Electrical Load	400/3/50, 88kVA, 125A	400/3/50, 140kVA, 160A	
Equipment Cooling Load (waterside to the MRI Equipment room)	40kW	63kW	**1a. Dedicated duty/ standby cooling plant required** **OR 1b. new connection to an existing central cooling system**
Quench Pipe	400mm with 75mm insulation	No information	**2. Route to safe discharge location required**
Examination Room – Temperature	20-24°C	18-22°C	
Examination Room – RH	40-60%	40-60%	**3.Humidification required**
Examination Room – Heat to Air	2kW	3kW	
Examination Room – Ventilation	Min 5acph or 500m³/h Positive pressure (for normal MRI install)	10 acph (for normal MRI install)	**4. iMRI will need more than this, assume 25ac/hr and 25pa**
Examination Room – Emergency Venting	20acph in case of low O2 levels	No information	
Computer Room – Temperature	15-24°C	18-24°C	
Computer Room – RH	30-70%	40-80%	
Computer Room – Heat to Air	12kW	12kW	
Control Room – Temperature	18-24°C	15-30°C	
Control Room – RH	40-60%	40-80%	
Control Room – Heat to Air	**0.5kW**	**2kW**	

2.2 Structural Requirements of the iMRI

The 3T MRI machines have typical structural requirements as follows:

Vibration criteria: VC-C (note less stringent criteria may apply depending on manufacturer and characteristics of structure)

Machine weight: not > 75kN

Room allowances (inc shielding):

Super-Imposed Dead Load - 2.5kN/m2

Imposed load - 9.0 kN/m² - allowing for weight of machine + shielding applied as a uniformly distributed load (point loadings also to be checked)

2.3 Key Design Implications

Picking up from a general understanding of the iMRI requirements and the data in the table in Section 2.1 and listed in Section 2.2 the following features of the iMRI are key to the feasibility assessment

1. **a. Dedicated duty/ standby cooling plant required -** This will need to be located in an external compound. It will need to be duty/ standby to ensure that chiller failure does not result in MRI critically overheating and a helium quench occurring. The chillers will need associated water treatment, expansion and pressurisation plant, although these can be included as hydronic units in the chillers themselves. Duty/ standby pumps will also be required.

   b. New connection to an existing central cooling system – If existing central cooling systems had spare capacity then a plate heat exchanger separated connection could be used to provide cooling to the MRI equipment. The resilience of the central cooling system would need to be considered to ensure it had sufficient redundancy. The new circuit would need associated water treatment, expansion and pressurisation plant and Duty/ standby pumps.

2. **Helium quench pipe –** This will need to be routed to a safe location outside of the building. The discharge location will need to be 3m clear of any occupants or building openings (doors/ windows) below and 6m clear above. Assume diameter 500mm external after insulation.

3. **Humidification and temperature control –** The MRI examination room requires close control of the environment, usually this would require local heating and cooling coils in the ductwork and local humidification plant. However if this space is served off a new dedicated AHU (discussed under the options below) then these can all be incorporated into the AHU.

4. **High air change rates -** The iMRI examination room will effectively become an extension of the operating theatre environment and we therefore think it should be treated as a sterile space. GOSH Infection control input would be useful on this topic. Assuming that we have a

theatre air change rate and pressure regime the quantity of air required will be considerably higher than for a normal MRI. If for example a typical MRI would require 350l/s (ventilated to 10ac/hr, 45m² in area, 2.8m high), then the iMRI space of the same size would require 875l/s

5. **MRI separation from large moving ferrous objects –** separation from lifts and roads/ rail, electrical transformers and switchgear. The exact distance vary between manufacturers but anywhere within 9m (14m for transformers) would warrant further investigation.

6. **Separation of the MRI and the Operating Theatre spaces –** The interconnection of the MRI space and an operating theatre creates issues for when they want to be used as separate spaces. If the door between the spaces is closed then noise and air will still transfer between the two spaces.

    a. **Noise Transfer –** the noise generated by the MRI could disturb the surgery staff in the operating theatre

    b. **Air leakage –** we would propose that the MRI and the theatre are operated at the same pressure, however when the doors into the MRI space are open the pressure will drop, resulting in air leakage and pressure drop in the theatre as well. This could cause air flows from relatively dirtier parts of the operating theatre suite to flow into the theatre.

    c. **RF Shielding –** The MRI examination room would need to be completely shielded from the operating theatre to avoid electromagnetic interference

        - **A lobby solution -** The simplest solution to both of the issues above is a lobby between operating theatre and the MRI. This would to help separate the pressure relationship between the two spaces and provide acoustic attenuation. This will however take up additional space.

        - **A High Specification Door Solution -** An alternative would be to have a very well-sealed and acoustically attenuated, RF shielded door between the MRI and the theatre. We have investigated and ETS-Lindgren manufacturer a pneumatically sealed door and we are seeking specification data from them to help asses if this would be a suitable solution.

7. **High Imposed Structural load**

    The load imposed by the weight of the MRI is higher than a hospital floor slab would typically be designed for. A typical hospital design may be in the range 3-5kN/m² whereas the MRI installation is approximately 9 kN/m². This increase in load would require the floor structure to be locally reinforced and therefore this should be expected in all of the locations which are reviewed in this report unless they already have MRI imaging plant installed, or have been designed for storage loads.

8. Stringent Vibration Criteria

The MRI machines typically specify a VC-C Criteria for vibration, although the value to be achieved may depend on the vibration characteristics of the floor under consideration. This is considerably more onerous than a typical hospital floor plate structure would be designed for.

This requirement would generally be more onerous to achieve than the structural load requirement listed as item 7 above.

Unlike the load requirement this is a performance criteria and MRI manufacturers will be able to advise on the implications on MRI image quality if greater structural vibrations are to be experienced.

As a result of these structural criteria a typical new build structure would be expected to consist of the following:

- 450mm RC slab with approx. 6m x 6m structural grid

  OR

- 450mm PT flat slab with approx. 8.5m x 8.5m structural grid

3 Building Services Feasibility of Each Option

The following options have been selected for review:

1. Level 1 OBW (Option A2)
2. Level 1 Phase 2b (Option C)
3. Level 3 VCB Theatres
4. Level 3 MSB, Phase 2b, Adjacent to new bridge construction
5. Level 3 PICB, Phase 2b, Adjacent to new bridge construction
6. Level 3 PICB, Phase 2b, Recovery area

The choice of these options has been made through discussions with the Redevelopment team.

3.1 Feasibility of Level 1 OBW (Option A2)

The level 1 Octav Botnar Wing (OBW) has been highlighted as one of the potential locations for the iMRI in the previous studies. This option, previously referred to as Option A2 would include a new operating theatre in place of the electrical workshop and the new linked MRI in the recovery area, with the recovery being relocated to the theatre staff rest room. The sketch below shows this option as it was previously developed:

Arup have carried out a site survey and a desktop study of drawings and schematics and the following key observations have been made regarding the feasibility of this option:

1. **Clear Height for New Theatre** – The clear height in the existing electrical workshop (and the majority of the L1 OBW floor is very low at 3.05m from floor finish to soffit. A typical theatre clear height would be 3.8m - 4.0m (3m high ceiling with 800mm-1000mm ceiling void). The existing theatres at the front of the level 1 OBW have a local thinning of the slab above to help improve clear height but still required a large perimeter ductwork bulkhead inside the theatre.

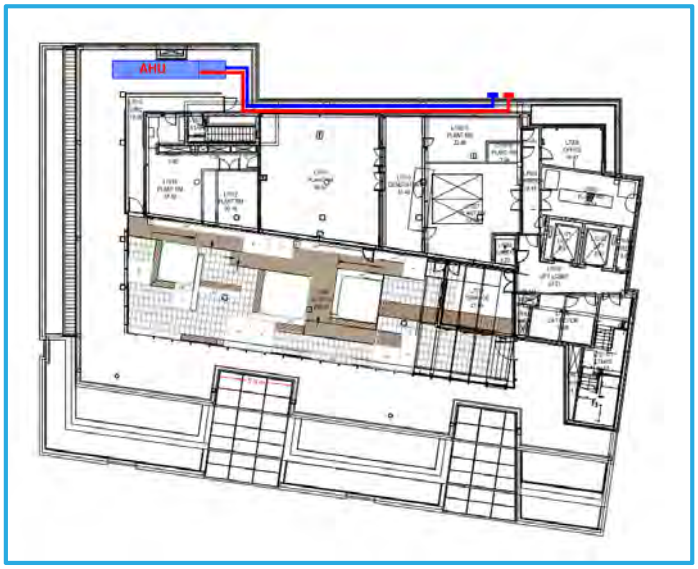
KEY COMPROMISE – The low theatre clear height would be a key compromise with this option. We expect that a height of 2.8m would be maximum that could be achieved and a perimeter bulkhead for supply ductwork would be required and we expect this would be at about 2.4m clear height. The feasibility of these clear heights would need to be discussed with healthcare architects and the users to see if it undermined the operational

2. **New iMRI Suite (Operating Theatre/ MRI) AHU required –** It is recommended that the new operating theatre and linked MRI are both served off a new common AHU for the following reasons:

- The existing AHUs will not have capacity for the new iMRI suite which will require approximately 3m³/s of fresh air
- The iMRI Suite will have a pressure relationship and this will be easier to commission and maintain if they are served from the same AHU.
- They both need reasonably close control of temperature. The MRI in particular needs humidification and it is considered easier to locate this in a new AHU than in ductwork in the ceiling void local to the space.

Possible new theatre AHU locations for L1 OBW option include:

Roof level above – suitable space found (from initial visual inspection), ducts would need to be routed externally down to L1 but looks feasible

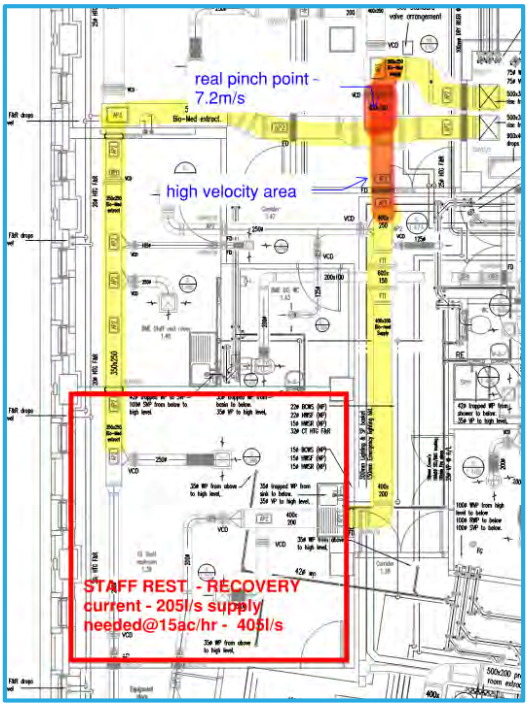


This option would need to be assessed for any planning implications associated with rooftop plant.

Above the medical gas manifold room in the courtyard behind OBW – The roof of this structure would most likely have to be reinforced to the support the weight of the new plant and the visual impact and location of ventilation discharges would have to be checked for impact on the new Phase 2b development.

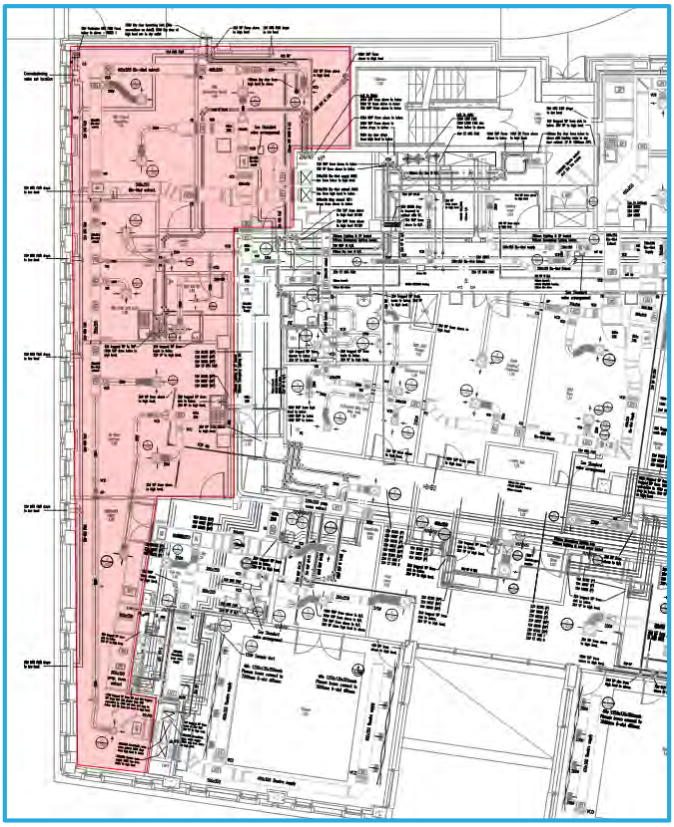
Within the existing L0 plant room – NOT FEASIBLE. The existing plant room has been visited and no suitable feasible solution has been found. The plant room is congested already and a there is no free riser space to route ducts to level 1.

3. **Corridor Ductwork Modifications –** The existing ventilation system serving most of the L1 OBW spaces is AHU 02. The relocation of the recovery space would increase the air flow volumes on one of the existing ventilation branches and require some increases to ductwork size in already very congested ceiling void spaces, as shown below:

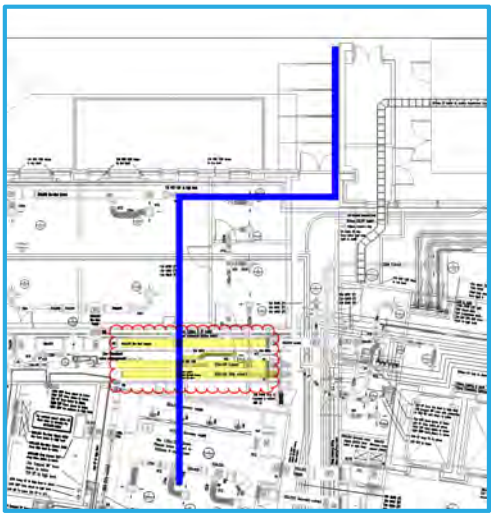


We think these changes are feasible (although difficult) and would only be required in corridor and store room spaces.

To carry out these works it is likely that the above branch of the ventilation system would need to be shut down for a short period of time to allow for the modifications. The rooms served by this ventilation branch are highlighted below and do not appear to be critical spaces but further investigation would be required if this option was pursued further.



4. **Quench pipe Route –** The quench pipe will need to route from the MRI to a safe discharge point. It is recommended that the quench line is routed to the external courtyard rather than attempting to route through a riser as there is limited riser space available. The Key pinch point will be crossing the main corridor as highlighted below:



5. **New dedicated MRI cooling system expected –** We don't believe the existing cooling system has any spare capacity (needs final confirmation) or redundancy and would therefore not be suitable to serve the new MRI. Therefore we think a new dedicated duty/ standby chiller installation would be required with associated pumps and pressurisation units. These chiller would be relatively small and could be located adjacent to either of the proposed new AHU locations (Level 7 roof or above gas manifold room).

6. **MRI Proximity to Lifts and Transformer rooms -** The proposed MRI location is within 8m in the z-plane to a main bank of lifts. It is also within approximately 10m of the transformer on the level below. Both of these are close enough to warrant further investigation to ensure that electromagnetic interference will not adversely affect the MRI images.

3.2 Feasibility of Level 1 Phase 2b (Option C)

Level 1 of phase 2b has been highlighted as a possible location for the iMRI suite. There is an existing 1.5T MRI room which would need to increase in size to house a 3T MRI. This space would connect to a new build space where the adjoining theatre suite would be located. These spaces are shown below:

After a visit to the Phase 2b building site a key issue was identified of very low clear height. We have 3m only from floor to soffit before any floor finishes, a photo of this shell and core space is shown below:

An operating theatre would typically be 3m clear height although GOSH have compromised on this on other existing theatres.

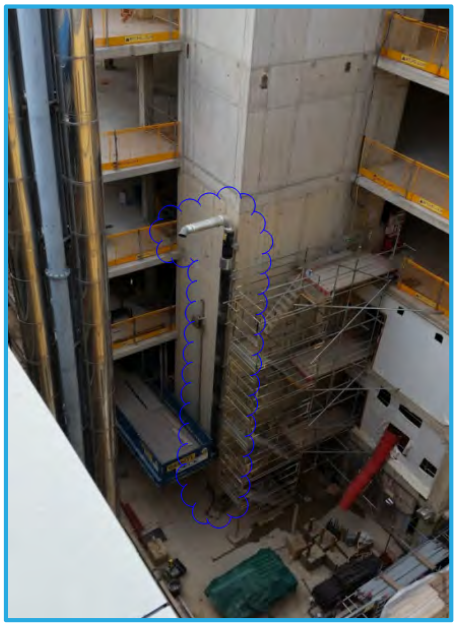
KEY COMPROMISE - This option looks almost unworkable without big compromises in clear height, we would estimate of 2.75m maximum centre of theatre, 2.35m under perimeter bulkheads. This is similar but a little worse than the Level 1 OBW option above and would require the same architectural and clinical user appraisal to assess feasibility.

Given this space is shell and core and on the perimeter of the building there are fewer other services issues in this option than for the Level 1 OBW option. Some further feasibility comments are made below:

7. Riser and Plant Space – As part of the new Phase 2b development there is a large new riser adjacent to the proposed operating theatre suite space which could be used to run ductwork to the roof top plant room.

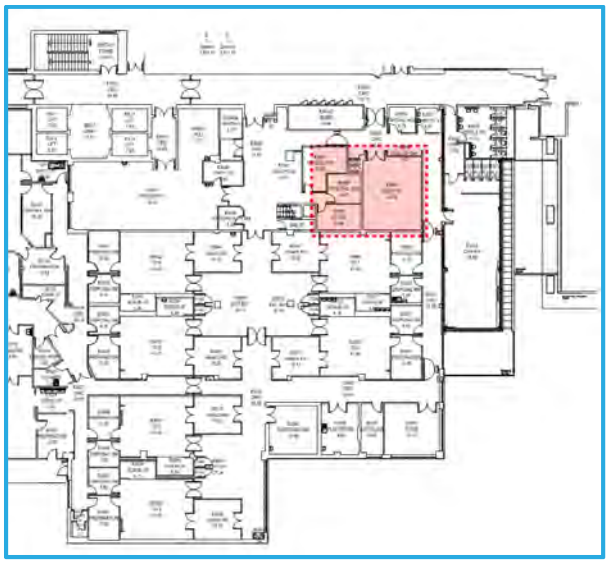
   The space for new AHU and cooling plant on the roof has not been reviewed would require further investigation if plans could be provided.

8. Quench line – there is an existing quench line route serving the MRI and this could be reused or replaced as necessary. This is shown below:



3.3 Feasibility of Level 3 VCB

Arup were asked to explore the feasibility of an option in this area. In the absence of any input from architects we selected a space adjacent to an existing operating theatre where an MRI could be added to create an iMRI suite. This area is shown below:



We have carried out a desktop study and have not inspected this area or lifted ceiling tiles. The following key observations have been made:

1. **Clear Height -** The height from the finished floor to the underside of the structure above is approximately 3300mm. the structure is a steel so there is also some additional space between the steel beams. This is still less than the 3800-4000mm that is typically required above an operating theatre but is a considerable improvement on the clear height found in the OBW and level PICB Phase 2b options described above. This option would connect into an existing operating theatre where a ventilation bulkhead is already in place and would not require any changes. The new MRI space would require a new ventilation bulkhead, very similar to that found in the operating theatre.

2. **Plant Locations –** Although we have not carried out a site survey the space for new AHU (if required) and new MRI cooling looks like it would be hard to locate. The aerial photo below shows how congested the existing roof space is:

One possible option could be to utilise the courtyard garden space in some way although the loss of garden area and natural light to rooms would need careful review.

3. **Quench line** – The quench may be able run up to the level above and across to the courtyard garden where it could route to roof level and discharge safely. This would require site investigation to identify if a suitable route could be found.

This option has only been reviewed at a high level, if it was to be taken on and reviewed in more detail the following activities would be useful:

1. Site survey and inspection of ceiling void
2. Further review of available plant space
3. Review of schematic and riser details to understand if a new AHU would be required (expect that this will be the case)

3.4 Feasibility of Level 3 MSB Phase 2a

Arup were asked to explore the feasibility of an option in this area. In the absence of any input from architects we selected a space adjacent to an existing operating theatre where an MRI could be added to create an iMRI suite. This area is shown below:

This is option has not been reviewed in detail. The location of this area directly above the staff restaurant is likely to make it unfavourable as the structural reinforcement works would be very disruptive in that area (discussed in Section 4.). Also the proximity of the new MRI to existing lifts would be a concern and would require closer examination.

3.5 Feasibility of PICB Phase 2b – 2 location options

Arup were asked to explore the feasibility of options in this area. In the absence of any input from architects we looked at two different possible location:

1. Adjacent to new bridge connection
2. Recovery area

These two locations are shown below:

These is option have not been reviewed in detail from a services perspective. They are assumed to be structurally least favourable (discussed in Section 4.).

3.6 Typical services diversion approach

GOSH have asked what the likely services downtime would be associated with carrying out any of these options. This is something that would be reviewed in detail as part of any more detailed design process. In general it is unlikely that the installation would result in long term shut down of any essential services to the surrounding areas.

If main water services (heating/ cooling/ domestic water etc.) were required to be relocated then the new pipework route could be installed first and then connected to existing during a planned (hopefully out of hours) switch over.

Local ventilation services may have to be shut down for longer periods if ductwork modifications are required although shorter sections may be able to be replaced out of hours to minimise disruption.

4 Structural Option Feasibility Review

The Structural assessment has been based on a desktop study of record drawings provided by GOSH.

Arup have been asked to review a wide range of options and each option consists of a different type of existing structural solution. As a result the structural assessment that has been carried is high level. It gives an initial assessment of each option and provides some brief descriptions of the type of modifications that might be needed in order to make the structure more suitable for the installation of the iMRI suite.

The aim of this assessment is to help provide some initial direction, allowing the number of options to be reduced and then examined in more detail as part of a further structural appraisal.

The Structural assessment is described in the form of a table to allow for easier comparison between the options.

For some of the options, key information such as the size of structural elements has not been available for Arup to review. Where this is the case it has been noted in the table.

Each of the options includes a statement of relative favourability, these are colour coded as follows:

- **Relatively Favourable-**
- **Relatively less Favourable-**
- **Less Favourable/ Potential significant difficulties**

It is important to emphasise that these statements are only based on a high level assessment and further investigation and design work may well prove them to be adjusted.

The *Less Favourable* options are those where structural strengthening work would be the most difficult (and therefore time consuming) or where it is considered that the final result of strengthening may not meet the loading and vibration requirements of the iMRI suite.

Typically structural reinforcement work would be carried out to the underside of the slab, with full access required from the level below the proposed location. The use of these spaces below is therefore an important consideration for GOSH when reviewing these options. It is likely to be necessary to strip out services from these spaces in order to provide access to the structure.

The structural reinforcement may not only be required directly under the iMRI suite but may also be required along the MRI machine entry route. This would require further investigation to understand the weight of the largest MRI machine section and the existing loading of the structure along the entry route.

Arup Structural Assessment

Option	Description	Information available	Info Required for further Appraisal	Structural form	Initial Assessment	Potential for modification
A2 OBW L1	MRI located GL 20-22, G-J (approx.)	3S47908/1B/003 - Upper Ground Floor drawing (Level 2)	Reinforcement design for columns and slabs local to intended installation	300mm RC slab (FFL 23.445) - span of local panel 4.825m x 8.5m(approx.); large opening adjacent to intended location	**Relatively Favourable-** Structure unlikely to be able to meet MRI manufacturer vibration criteria without modification Design: SDL - 2.5 kN/m2 Imposed Load - assume general area 3.0 + 1.0 kN/m2 = 4.0 m2;	It should be possible to stiffen/ strengthen conventional reinforced concrete The solution will depend on the span and quantity of reinforcement provided. Potential solutions include creation of downstand beams, use of frp composite strengthening. At this location could additional columns be added for single storey of structure below?
C L1 VCB PICB	MRI located	2102-1 shows form of construction for building but not for intended area Drawing DDN210 (within WSP report)South does not show the relevant structure clearly	2102-2	Local structure understood to be on area of Ground level slab; short span slab spanning between pile caps.	**FURTHER INFORMATION REQUIRED** No further information available at this stage. Assume WSP report applies	-

Option	Description	Information available	Info Required for further Appraisal	Structural form	Initial Assessment	Potential for modification
VCB	a) Proposed location is in area shown as atrium void; this must have subsequently been in-filled b) GL 3-4, M+-P	7039/1/C/01	a) Atrium infill details required b) Beam Schedule required	a. Unknown b. Steel frame with composite floor slab; beam sizes unknown	**Relatively Favourable-** Steel frame/ composite floor construction is unlikely to have sufficient strength and stiffness to support the MRI suite; however, it may be possible to carry out significant strengthening to improve the situation. *Care with magnet iso-centre clear dimensions*	Steel construction can in many cases be strengthened/ stiffened significantly with the additional of new beam elements, and the welding of steel plates on to existing beams.
MSB Phase 2a	MRI in location of former TC opening	S/2831		300mm PT slab (SSL +27.335) - span of local panel approx. 6m x 6.7m; former opening for tower crane within panel chosen as potential MRI location	**Relatively less Favourable-** Typically PT construction can improve vibration performance by maximising the effective stiffness of the concrete section. In this particular bay this effect will be reduced by the former opening for tower crane within panel chosen as potential MRI location. Structure unlikely to be able to meet MRI manufacturer vibration criteria without modification Design: SDL - 1.85 kN/m2 Imposed Load - assume general area 3.0 + 1.0 kN/m2 = 4.0 m2;	PT slab generally expected to offer stiffest (lowest vibration) environment. However this could be very difficult to strength to carry increased loading, and also difficult to add stiffness.

Option	Description	Information available	Info Required for further Appraisal	Structural form	Initial Assessment	Potential for modification
PICB Phase 2b	Adjacent to new bridge connection	S-2103-2	Information on the pre-existing structure	The pre-existing structure is a ribbed slab construction - is this a correct reading of the drawings?	**Less Favourable/ Potential significant difficulties** Further information is required for fuller assessment	The pre-existing ribbed slab system may be difficult to stiffen / strengthen
PICB Phase 2b	Encompassing 250mm flat slab	S-2103-2	Reinforcement design for columns and slabs local to intended installation Loading information required	250mm reinforced concrete flat slab on varying grid; max span ~7m	**Less Favourable/ Potential significant difficulties** Slab relatively responsive, and may not be suitable for MRI even after extensive modification	It should be possible to stiffen/ strengthen conventional reinforced concrete. The solution will depend on the span and quantity of reinforcement provided. Potential solutions include creation of downstand beams, use of frp composite strengthening.

5 Key Next Steps and Ongoing Work

The following Key next steps and ongoing work are recommended:

1. Reduce down the number of options so that a more detailed review can be carried out.
2. Consult with a clinical architect and the clinical users about the issues regarding low ceiling heights.
3. Discuss iMRI requirements with MRI equipment manufacturers – we have contacts already and want to discuss issues such as lobby separation, air change rates and pressures to support our initial assumptions.
4. Seek further specification of high performance MRI to theatre door.
5. Seek Infection control input on the sterile iMRI environment.
6. Review proximity to the lifts and transformers in Level 1 OBW Option.