GD Partnership Ltd

BASEMENT IMPACT ASSESSMENT

FOR Plot B

TRANSFORMATION OF THE UGLY BROWN BUILDING

2-6 ST PANCRAS WAY, LONDON NW1 0TB

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Registration No: 4917723 [England]

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Issuing Record

Issue	Date	Description	status
Version A	22.09.17	First issue	Preliminary
Version B	27.10.17	Preliminary Ground Modelling Assessment (GMA) and further information added.	Preliminary
Version C	06.02.18	Contiguous piled wall to form perimeter retaining wall and drawings revised. Phase 2 SI specification added. Author Qualifications added. Temporary works method statement added. Ground movement monitoring strategy added Geotechnical design parameters added	Preliminary
Version D	21.12.20	Plot B, Additional basement level added. Phase 2 Site Investigation, GMA, Retaining Wall Assessment, Thames Water (TW) Asset Assessment and TW Reports together with Thames Water Mid-Level 2 condition survey and Lower Sewer along St Pancras Way survey added.	Preliminary
Version E	23.2.21	Additional information on introduction and minor amendment on clause 4.2.2.	Preliminary
Version F	11.05.21	Minor amendments on introduction and clause 2.3	Preliminary

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NON-TECHNICAL SUMMARY

NON-TECHNICAL SUMMARY	
Site Description	The site is located at 2-6 St Pancras Way in the London Borough of Camden and occupied with a concrete structure known as the Ugly Brown Building (UBB). This was originally occupied by a five-storey masonry structure called 'St Pancras Ale & Corn store', later became known as the Granary. The Regent's Canal is located to the Northeast of the site. To the Southwest of the site is St Pancras Way, with Granary Street to the Southeast beyond which lies St Pancras Hospital. The existing building 'Canal Side Studios' formerly known as 'Atlantic Metals Building' occupies the Northwest boundary of the site. The UBB is a 4-5 storey large concrete building with flat roofs and hard paving around the site boundary. Originally designed for mechanised letter sorting office, the building comprises an Administration block, Welfare block and a sorting office block. The administration block is currently a non-occupied building while the Welfare block, transformed to office space, is now occupied by Ted Baker Plc. The sorting office block is occupied by Verizon Data Centre. There are 30 no. individual trees within influence of the application area according to the Arboricultural Impact assessment issued by Aspect in April 2017. The canal wall along the north-eastern boundary was a 1.6m wide brick retaining wall with cantilevered sheet pile wall added alongside during construction of UBB. The IStructE Paper titled 'The structural Engineer Vol 63A' published during the construction of the existing Mechanised letter-sorting office building (hereafter called IStructE Paper) gives further detail. The documents are attached to Appendix 3 of this report. The middle level sewer no. 2, a part of London's historic sewer system and now part of the Thames Water Authority's system, was constructed by tunnelling across the northern part of the site. The sewer is approximately 2.12m internal diameter and is brick lined throughout, with its crown about 5.00m below the canal bed level. The administration block of UBB has been built bridging over the sewer with contiguous piles outside the easement area.
Proposed Development	The proposed redevelopment will involve the demolition of the existing building and erection of 6 new buildings ranging in height from 2 storeys to 12 storeys in height above ground and 2 basement levels comprising a mixed-use business floorspace, residential, gym, flexible retail and storage space development with associated landscaping work. The landscaping includes a new public realm plaza, retail streets, an active and engaging canal frontage, and a contextual street frontage. The new development comprises three plots A, B & C in which 'Plots A and B' will be offices and 'Plot C' will comprise 4 major buildings for mixed-use offices, gym, residential & retail spaces. The proposed basement levels at the site varies from 13.4m to 18.00m AOD while the canal water level is at 23.13m AOD and canal bed is at average 21.15m AOD. Plot A will have a Single basement at 17.2m/18.0m AOD. Plots B and C will have a double basement at 17.40m and 13.40m AOD.

	The site would therefore be a single subterranean level in the Plot A to the North and two subterranean levels (upper and lower basements) in the Plots B and C to the South. Refer to General Arrangement drawings attached to Appendix 1 of this document.
Ground / Ground water condition	According to The IStructE Papers attached to Appendix 4, the former granary building was founded upon a concrete raft foundation that was placed directly upon London Clay by excavating approximately 6m below the canal water level. This was confirmed within nine borehole records which indicated that the hardstanding of the former granary building was underlain by approximately 20m of London Clay that is in turn underlain by clay of the 'Woolwich and Reading Beds'. The geology is also predicted from BGS bore hole records within 100m of the site which confirms the London clay is underlain by Woolwich and Reading Beds and the Thanet Sands on upper Chalk. Relevant borehole records from BGS and some neighbouring developments have been attached to Appendix 5 of for reference. There will be no historic record of perched ground water around the site. London Clay forms an impermeable layer classified as a non-aquifer (non-productive stratum). Phase II site investigation had been carried out by RSK within the plots A and B areas and the final Geoenvironmental and Geotechnical Site Investigation Report ref. 371654-01 (01) dated August 2019 has been included in Appendix 3.
Screening and Scoping	**Surface flow and flooding:** No potential impacts identified beyond the scoping stage. **Subterranean (ground water) flow**: No potential impacts identified beyond the scoping stage. **Land stability:** Potential impacts identified relate to ground movements associated with: - Retaining wall installation and ground excavation adjacent to the TW Sewer. - Elastic heave of the London Clay in the basement excavation due to relief of overburden.
Impact Assessment	The following nearby structures were identified as being potentially at risk from damaging ground movements: - The northwest site boundary retaining wall adjacent to 'Canal Side Studios'. - The Regent canal structure. - The Thames Water Sewer line beneath the site across plot A. - Culverted Fleet River running underneath the St Pancras Way. - Phased construction between Plots A, B and C. - Retaining wall along the Granary street opposite St Pancras hospital. - Adjoining buildings along the St Pancras Way.

	Structural stability of adjacent structures from heave of the basement excavation. Contiguous piled retaining wall structure will be installed around the perimeter of the site which will be designed to supports both horizontal and vertical loads and to resists/minimise movement by heave and subsidence. A numerical assessment of heave potential will be followed by monitoring of ground movement before, during and after excavation at predetermined time intervals and at strategic locations. It is expected that the horizontal and vertical ground movement will be controlled within our detail design so that the damage category of 'very slight' (Burland scale 1) applies. The historical data accumulated in the IStructE paper gives evidence of significant thickness of made ground underlying the site which was encountered while demolishing the existing brick structure, 'The Granary'. This has in turn been supported by a concrete raft at about 6m depth within the London Clay formation. The bases to the cast-iron columns of the building were formed by positioning several layers of 225 mm-thick sandstone blocks on a 4.2 m grid. Infilling above the concrete raft and around the sandstone blocks was carried out with approximately 1- 2 m of clay on which a brick sett floor was constructed. During construction of existing Ugly Brown building, it was observed that, any potential movements were significantly less than those predicted because of the significant thickness of the made ground, which has a large component of non-shrinkable granular material. Any potential effects will be investigated and mitigated as necessary during design at the detailed design stage. It is expected that the horizontal and vertical ground movement will be controlled by design so that the damage category of 'very slight' (Burland scale 1) applies. Following the results of the Phase ll Site Investigation report, we have further carried out Ground Movement and Building Damage Assessment Report ref. 371654-02 (01) which was done by RSK dated August 2020 and is included in Appendix 3.

1 INTRODUCTION

1.1 Instruction

GD Partnership Ltd. have been instructed by Reef Estates Limited to provide a Basement Impact Assessment (BIA) for the proposed development of Ugly Brown Building at 2-6 St Pancras way of the London Borough of Camden (hereafter defined as 'Site').

Application 2017/5497/P was granted full planning permission on the 17th March 2020 for the following development:

Demolition of the existing building (Class B1 and B8) and erection of 6 new buildings ranging in height from 2 storeys to 12 storeys in height above ground and 2 basement levels comprising a mixed use development of business floorspace (B1), 73 residential units (C3) (10xstudio, 29x1 bed, 27x2 bed 7x3 bed), hotel (C1), gym (D2), flexible retail (A1 - A4) and storage space (B8) development with associated landscaping work.

This permission grants consent for the use of Plot B as a nine-storey building with a single basement, which would be used as a hotel at lower levels, with office use above. The entire building was to be occupied by Ted Baker, who would operate the hotel and occupy the office space.

In the time since the permission was granted, changing economic circumstances and the Covid-19 pandemic mean that a hotel no longer represents the optimal use of the site. Furthermore, Ted Baker will no longer be retained as occupiers of the proposed building.

As a result, the applicant is now proposing a single application for the following works:

A new proposal for the Plot B and Plot C4 element of the site, which will remove the hotel, and create a building comprising flexible commercial space, offices, and ancillary storage, along with design and landscaping revisions.

Amendments to the Plot C element of the site, comprising changes to the design, to align with the revised Plot B proposal, and changes to the affordable housing provision on Plot C2, increasing the provision of affordable housing to 50.8%.

A separate application was submitted in March 2021 for amendments to the Plot A element of the Site. Documents for this application have been prepared based on a scenario in which these amendments have been implemented.

The changes to the Plot C residential tenure mix will have no impact on the basement, and will therefore not be considered in this document.

1.2 Regulatory context

This assessment is designed to be compliant with guidance provided by the London Borough of Camden in their guidance document 'Camden Planning Guidance Basements (CPGB), March 2018 and its supporting study 'Camden Geological, Hydrogeological and Hydrological Study' produced for Camden by ARUP in November 2010. All the technical analysis and recommendations contained within the planning guidance are taken from this latter study, which is treated as the evidence based technical advice when Camden are assessing Basement Impact Assessments.

The document CPGB is a supporting document forming a part of supplementary planning guidance of Camden's development plan. 'Camden Local Plan' is the key document in Camden's development plan, which is the name given to the group of documents that set out the Council's planning policies.

This document will be specific to the Ugly Brown Building Project, demonstrating that the new basement to the proposed development will not cause harm to the built and natural environment, including to the local water

environment and ground conditions according to the requirement set up in Camden's Protecting Amenity Policy A5 in 'Camden Local Plan'.

Basement Impact Assessment (BIA) will be included the following stages:

- **Screening**: the identification of any matters of concern with regard to hydrogeology, hydrology or ground stability, which should be investigated.
- **Scoping:** production of a statement that defines further the matters of concern identified at the screening stage.
- **Site Investigation and Study:** undertaken to establish the baseline conditions. This can be done by utilising existing information and/or collecting new information.
- **Impact Assessment:** undertaken to determine the impact of the proposed basement on the baseline conditions, taking into account any mitigation measures proposed.
- **Review and Decision-Making:** this final stage is undertaken by Camden and consists of an audit of the information supplied and a decision on the acceptability of the impacts of the basement proposal.

The purpose of the BIA is to enable Camden Council to assess whether any predicted damage to neighbouring properties and the water environment is acceptable or can be satisfactorily ameliorated by the developer which covers the requirements as stated in Policy A5 in 'Camden Local Plan'

1.3 Background

By way of background to the current project, a Preliminary Risk Assessment (PRA) and a Flood Risk Assessment and SUDS Strategy (FRA) have been undertaken for the site. The IStructE paper produced during the construction of existing building, the then mechanised letter-sorting office, which gives immense background to the site history, has been referenced throughout the project. The report is attached with this document. A topographic survey of the site has also been carried out in February 2016 and attached to this report in Appendix 6.

A phase II site investigation has now been done and confirmed the geological, hydrogeological and hydrological information contained within this report as in Appendix 3.

Intrusive investigations and testing had also been carried out to the canal side sheet piled wall, existing contiguous piled wall along North boundary and adjacent Thames Water sewer to determine exact position, depth, integrity, durability and their design capacities. The following reports are included within the Appendix 3 and Appendix 9 and are as follow:

- RSK – Geoenvironmental and Geotechnical Site Investigation ref. 371654-01 (01) dated Aug 2019.
- RSK – Ground Movement and Building Damage Assessment Report ref. 371654-02 (01) dated Aug. 2020.
- RSK - Retaining Wall assessment – Ugly Brown Building ref. 371654-L01 (00) dated 19th. May 2020.
- RSK - Thames Water Asset Assessment Report ref. 371654-03 (03) dated Dec. 2020.
- Thames Water Survey – CCTV Survey Report to Local Sewer – St. Pancras Way dated 30/01/19 and St. Pancras Way Sewer Condition Report carried by Plowman Craven – St. Pancras Way – Mid-Level 2 Report dated 1 July 2019.

1.4 Standards and Limitations

This report is based on information available at the time of writing. This will be updated to adjust any mitigation measures following proposed intrusive investigations, testing and any other matters which may come to light during the design development.

This report may be re-considered in the light of any changes in the legislation, statutory requirement or industry practices that occur subsequent to the date of issue.

2 SITE DETAILS

2.1 Site description

The site is located at 2-6 St Pancras Way in the London Borough of Camden, at National Grid reference TQ 296837, as shown on Figure 1. The site lies within a conservation area alongside the Regent's Canal, is historically being occupied by 'The Granary', then 'the Ugly Brown Building'. The site is approximately 1.14 ha wedge-shaped piece of land between St. Pancras Way and the Regent's Canal and lies just to the north of St. Pancras Hospital. (see Figure 2).

Figure 1: Location of Proposed Development Site

Historically, the ground sloped from east to west with a fall of approximate 3 m towards the River Fleet which is now culverted and lies to the west of St. Pancras Way towards the College Street. The location of the culverted river is shown in Figure 3.

The Regent's Canal runs along the northeast boundary of the site. To the southwest of the site is St Pancras Way, with Granary Street to the southeast beyond which lies St Pancras Hospital. The existing building, 'Canal Side Studios' makes the northwest boundary of the site.

The Middle Level Sewer no. 2, a part of London's historic sewer system, now part of the Thames Water Authority's system, has been constructed by tunnelling under the northern part of the site. The sewer is 2.12m in diameter and is brick lined throughout, with its crown about 5.0m below the canal bed level. The existing building has been built bridging over the sewer with contiguous piles outside the easement area.

Figure 2: Ariel Photograph of site

The canal wall along the north-eastern boundary is a substantial 720mm wide brick wall construction with cantilevered sheet pile wall added alongside during construction of existing UBB in 1985. It was mentioned that there is a brick retaining wall along the south-east boundary.

The current site conditions may slightly vary from those in this report especially on There is an existing RC retaining wall along the canal behind the old brick retaining wall that will require further investigation during pre-construction stage to determine and confirm its position and construction.

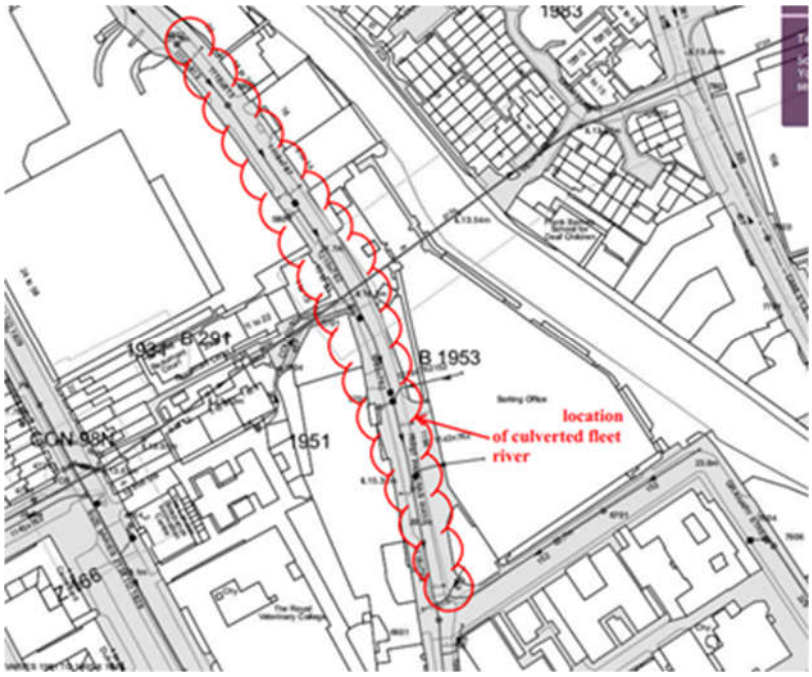


Figure 3: Location of culverted Fleet river. Refer to Appendix 9.

2.2 Proposed Development

The proposed redevelopment will involve the demolition of the existing building and erection of 6 new buildings ranging in height from 2storeys to 12 storeys in height above ground and two basement levels comprising a mixed-use business floorspace, residential, gym, flexible retail and storage space development with associated landscaping works. The landscaping includes a new public realm plaza, retail streets, an active and engaging canal frontage, and a contextual street frontage as shown in drawing D2477 L.100 attached to Appendix 6. The development has been named as 'Plots A and B' for offices and Plot C1 for mixed use of offices & residential and Plot C2 & C3 mainly offices. Plot A will be built in place of existing administration building, Plot B which is currently the existing Ted Baker Building will be re-build as offices and Plot C will occupy existing Verizon digital building as marked up in figure 4.

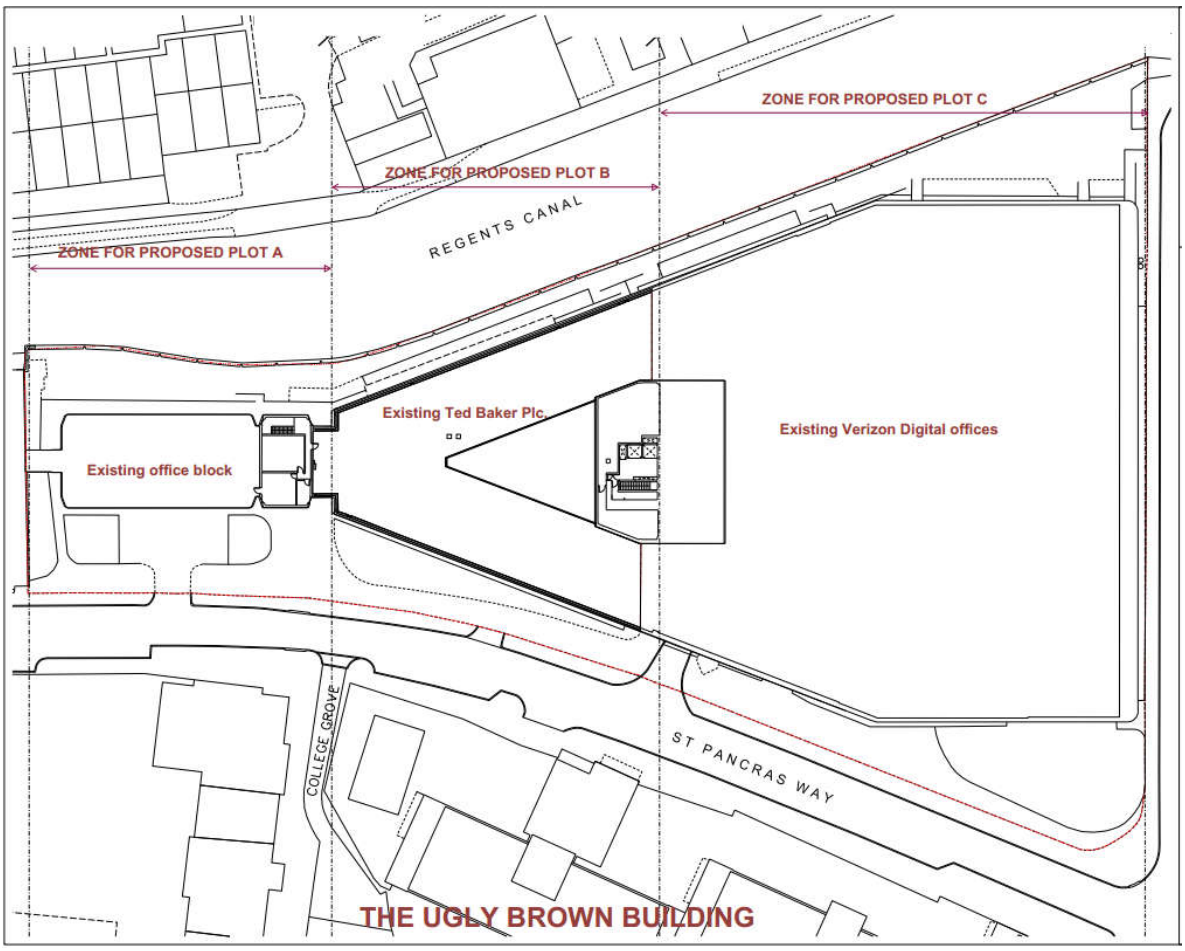


Figure 4: Existing Site - The Ugly Brown Building

The proposed basement level at the site varies from 13.4m to 18.00m AOD while the canal water level is at 23.13m AOD and canal Bed is at 21.15m AOD. Plot A will have single basement with basement level at 17.2/18.0m AOD while Plots B and C will have two basements with lower basement level proposed to be at 13.4m AOD. Appendix 1 gives General Arrangement of site plans and sections illustrating the proposed development.

The site would therefore be a single subterranean level in the Plot A to the North and two subterranean levels (upper & lower basements) in the Plots B and C to the South.

In the temporary case, a propped perimeter contiguous piled wall is proposed to support the basement excavation, inside which the basement box will be constructed from reinforced concrete, with reinforced

concrete slabs at basement and lower ground floor levels, forming propping in the permanent condition. It is proposed to support the structure on piled foundations.

2.3 The proposed detailed sequence of work:

1. Detailed design up to stage 3 for Plot A have been done and Basement Construction Plan for this plot has been approved.
2. Phase ll Geo-Environmental and Geotechnical Site Investigation Report had been done for Plots A and B including GMA, Retaining Wall and Thames Water Assessment Reports as in Appendix 3. Please note that further Site Investigations will be required when Plot C is to be developed.
3. It is assumed that Plot A building would be under construction or have been constructed.
4. RSK – Ground Movement and Building Damage Assessment Report ref. 371654-02 (01) dated Aug. 2020 may need to be revised to take into account of the double basement that is now proposed within plot B.
5. Carry out detail design for the Plot B. It is expected that the horizontal and vertical ground movement will be controlled during detail design so that the damage category of 'very slight' (Burland scale 1) applies.
6. Precondition surveys for all the surrounding structures to be carried out including TW sewers (TBC by TW as condition survey had already been done) and installing monitoring stations to adjoining properties. Monitoring the adjoining structures are to be maintained throughout the demolition and construction works to the agreed triggered level. All construction works will be stopped when triggered level is reached and investigate the cause of it and provide the necessary remediation works where required before commencing further works.
7. Carefully demolish existing plot B down to ground floor. Where it is attached to plot C, interface will be stabilised by temporary modification works and alterations as necessary.
8. Remove plot B existing ground floor slab including RC ground beams and pile caps.
9. Carry out further site investigations to determine the lower existing RC retaining wall that provide the footpath along the canal and the diameter, reinforcement, depth, durability and capacity of the existing piles for possible re-use where required.
10. Install contiguous piled walls along the canal side to form the canal boundary then the boundary between plots B and C and progress along the St Pancras Way according to the detailed specialist design.
11. The contiguous piled wall that would be/have been Installed between plots A and B would form as the divisional wall.
12. Install the bearing piles and carryout construction works following the detail design procedure.
13. Carry out basement excavation in accordance with the design methodology. Temporary propping / waling beams will be installed as required by detail design methodology
14. Movements will be monitored before, during and after excavation at predetermined time intervals dictated by the detailed design.
15. Carry out construction of basement walls, basements and ground floor slabs and super structure to be followed by detail design procedure.
16. Following the same procedure, plot C will be demolished and required alterations & modifications will be carried out in order to complete the new interface between Plot B & C.

17. Install the perimeter contiguous piled walls and bearing piles and carry out construction of basements and super structure following detail design.

2.4 The Subterranean Construction Method statement:

Some of the issues that affect the sequence of works on this project are:

- The integrity of the adjacent Regent Canal, Thames Water sewer across Block A and culverted Fleet River running underneath St. Pancras Way.
- The integrity of the adjoining buildings including phased construction of the new buildings.
- The stability of adjacent roads.
- Forming sensible access onto the site to minimise disruption to the neighbouring residents.
- Providing a safe working environment.

The undertaking of such projects is specialist work and GDP will be involved in the selection of an appropriate Contractor who will need the relevant expertise and experience for this type of project. Drawings illustrating the sequence of basement construction and temporary works are included in Appendix 2.

Noise & Vibration

The Contractor shall undertake the works in such a way as to minimise noise, dust and vibration when working in order to protect the amenities of the nearby buildings and infrastructure.

The breaking out of existing structure shall be carried out by saw cutting or shearing where possible to minimise vibration to the adjacent properties and associated construction noise. All demolition and excavation work will be undertaken in a carefully controlled sequence, taking into account the requirement to minimise vibration and noise, and stability of adjacent structures.

2.4.1 Site set up

- Erect a fully enclosed painted plywood site hoarding along all boundary walls, this should not impede on the neighbouring properties or roads.
- The services within the site should be identified and isolated as necessary. All below ground obstructions should also be removed to allow the works to progress.

2.4.2 Construction of Basements

1. Install monitoring systems, to be located strategically around and the adjoining buildings including within the existing TW sewers and any other structures that are required to be monitored.
2. The exact positions of the existing Thames Water sewer and the existing culverted Fleet River had been established including the conditions of these sewers as the report in the Appendix 9.
3. Prior to any works adjacent to the canal, review RSK report on the Retaining Wall Assessment - UBB Report 371654-L01 (00) 19th. May 2020 for the stability of the existing canal steel sheet piled wall and provide any temporary works required to ensure its stability is maintained throughout the construction. Refer to section S(SK)-GA 53B for a typical section through canal edge for Plot B.
4. New contiguous piled wall along the canal structure will be designed and installed by piling specialist and checked to withstand water pressure/ surcharge from the canal and other surrounding design loadings.

5. Complete the installation of new contiguous piled wall around perimeter of basement Plot B as plan S(SK)-GA-50 C including RC capping beams and the installation of any additional monitoring systems within the piles and on top of the new RC capping beams.
6. Provide temporary supports as shown on the drawings S(SK)-TW-60 B, S(SK)-TW-61 B attached to Appendix 2.
7. Carefully excavate the ground to the required basement formation level and construct pile caps and basement slab.
8. The results of the monitoring systems are continuously monitored during the construction of the new basements and compare these with the predicted analysis data. Actions will be taken if any of the results deviates from the anticipated results.
9. Construction of basement for Plot C will be followed in a similar manner during relevant construction phase. For preliminary pile layout refer to drawings GA 100 B and for temporary works refer to S(SK)-TW-110 A & S(SK)-TW-111 A.

2.5 Ground / Groundwater Conditions

2.5.1 Topography

Site topographical survey was carried out by Clugston Survey Services in February 2016. The site generally slopes towards St Pancras Way with an average 3m fall. The ground levels vary between 20.4m AOD at the southernmost corner of the site and 23.6 AOD along the edge of the canal at the North-eastern boundary. The ground level increases north along St Pancras Way ranging from 20.4 m to 21.9 m AOD and rises more steeply east along Granary Street from 20.4 m to 23.6 m AOD. Drawings 3948/10/001 & 002 attached to Appendix 6.

2.5.2 British Geological Survey Data

The published 1:10,000 scale BGS maps (Extracted pages from Camden Geological, Hydrogeological and Hydrological Study attached to Appendix 7) evidenced the Site belongs to area of London Clay Formation.
Phase ll SI had been done for Plots A and B, please refer to RSK- Geoenvironmental and Geotechnical Assessment SI Report 371654-01 (01) Aug 2019 in Appendix 3.
Phase II Site Investigations will be required for plot C.

2.5.3 Hydrology & Hydrogeology

The nearest surface water is the Regent's Canal located adjacent the Northeast boundary of the site. According to the IStructE paper the canal edge is lined with a sheet steel wall and sealed back into existing brick retaining wall at each end. Given the sheet pile will act as a barrier and the low permeability of the underlying London Clay, the site is not considered sensitive with respect to surface water. Proposed basement development will have a completely impermeable barrier along the canal to mitigate any associated risks to the development.

Phase ll SI had been done for Plots A and B, please refer to RSK- Geoenvironmental and Geotechnical Assessment SI Report 371654-01 (01) Aug 2019 in Appendix 3

2.5.4 Site Specific Intrusive Investigation Data

Phase ll SI had been done for Plots A and B, please refer to RSK- Geoenvironmental and Geotechnical Assessment SI Report 371654-01 (01) Aug 2019 in Appendix 3

Further site investigations, intrusive surveys and testing to be carried out are explained in section 5 of this document.

3 STAGE 1 - SCREENING

This section of the report provides information for the purpose of screening in accordance with CPG4 and addresses all questions raised within the relevant sections of that document. Tables summarising the screening flowcharts are shown as Tables 1 to 3. In accordance with procedure set out in Camden Planning Guidance Basements (CPGB), March 2018, where a 'yes' or 'unknown' response is returned, the potential issue is taken to the scoping stage in Section 4.

Table 1 – Surface flow and flooding Screening

	Question	Answer	Evidence / Comment
1.	Is the site within the catchment of the pond chains in Hampstead Heath?	No	The site lies 3.0km southeast of the nearest Hampstead Heath drainage catchment, will therefore not impact any catchments.
2.	As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing?	No	The proposed development will have a large provision of biodiverse roofs (green/Brown Roofs) resulting in significantly reduced hard roof area and providing a multitude of other benefits. These will be drained to the canal by gravity at a controlled discharge rate subject to confirmation of ongoing liaison with the Canal & River Trust. The areas not covered by biodiverse roofs and the remaining areas at ground level will be attenuated within ground floor / basement underground storage and will be drained to sewer network at a permitted rate by the Thames Water. Currently the site drainage is conveyed to the existing sewer system without sustainable urban drainage system. Therefore, surface water flow routes will not be materially changed, but improved surface water management system will significantly help to eliminate any associated risks of flooding.
3.	Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	Yes	See section 4.1.1 (scoping)
4.	Will the proposed basement result in changes to the profile of the inflows	No	Page 23 of Geological, Hydrogeological and Hydrological study & Guidance for subterranean development in

	(instantaneous and long term) of surface water being received by adjacent properties or downstream watercourses?		Camden (reference 213923) prepared by Arup for Camden Council states: 'The Regent's Canal runs east to west through the Borough between Regent's Park, Camden Town and King's Cross. In general canals are considered to pose a low flood risk as they have limited surface water inputs; they are not natural drainage channels fed by surface runoff but subject instead to controlled inflows to maintain the water level.' Given the general impermeability of London Clay and that the canal is a man-made structure with controlled inflows, it is considered that there will be no hydraulic continuity (surface water or groundwater flow) between the canal and the surroundings. Surface water within the site will be discharged to the canal and the Thames sewer network via biodiverse roof and below ground attenuation systems at a controlled discharge rate. Therefore, the basement will have no impact in relation to surface water flow to adjacent properties and nearby water course.
5.	Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No	As noted in 4. above, there will be no impact on surface water flow in and around the basement area due to impermeability of the underlying strata. Surface water within the site will be discharged to the canal and the Thames sewer network via biodiverse roof and below ground attenuation systems at a controlled discharge rate. Therefore, there will be no impact on quality of the surface water being received due to the basement.
6.	Is the site in an area known to be at risk from surface water flooding, such as South Hampstead, West Hampstead, Gospel Oak and King's Cross, or is it at risk from flooding, for example because the proposed basement is below static water level of a nearby surface water feature?	No	The latest online Environment Agency Flood Zone maps indicate that the site lies in Flood Zone 1 and is therefore considered to be at 'very low' risk of flooding from rivers or the sea. Proposed basement is below the adjacent canal water level. However, as described for item 4 above, there will be a low risk of flooding from the Regent's Canal. The basement will also be designed waterproofed to grade 3 level of protection (table 2 of BS 8102) via a cavity drain system to mitigate against any residual risk of water ingress to the basement from the surrounding soils.

Table 2 – subterranean (ground water) Screening

	Question	Answer	Evidence / Comment
1a.	Is the site located directly above an aquifer?	No	The existing site is underlain by 2m-5m of made ground underlain by approximately 20m of London Clay formation. London Clay forms an impermeable layer classified as a non-aquifer (non-productive stratum). The geology is confirmed by 1. BGS recorded boreholes approximately within a 100m radius of the site (refer to table 3.1 of PRA attached). 2. The bedrock geology underlying the site shown on the BGS online maps consists of London Clay Formation. No superficial deposits are shown in the area. (page extracted from Camden Geological, Hydrogeological and Hydrological Study attached to the Appendix 6). 3. Environment Agency Aquifer Designation based on BGS Mapping also shows the site is located on unproductive strata. (page extracted from Camden Geological, Hydrogeological and Hydrological Study attached to the Appendix 6). 4. Phase ll SI had been done for Plots A and B, please refer to RSK- Geoenvironmental and Geotechnical Assessment SI Report 371654-01 (01) Aug 2019 in Appendix 3 5. IStructE paper for 'The Granary site – design and construction of a mechanised letter-sorting office' published in 1985. (attached as Appendix 3)
1b.	Will the proposed basement extend beneath the water table surface?	No	BGS recorded boreholes, approximately within a 100m radius of the site, indicates there will be no ground water encountered (refer to table 3.1 of PRA). Perched water may be encountered locally within the made ground (TBC by phase II site investigation), ponding on top of the immediate London Clay. This does not constitute a water table. Within a few meters of the ground surface the London clay can assumed to be saturated, i.e. all available pore space within the clay filled with water. Porosity within this material is so low that it does not maintain significant volumes of water and is described as 'unproductive'. In this case water recorded within the London Clay records pore water pressure and the concept of a 'ground water table' does not apply.

			Therefore, the proposed development does not penetrate any water tables that might affect ground water levels or flows. Phase ll SI had been done for Plots A and B, please refer to RSK- Geoenvironmental and Geotechnical Assessment SI Report 371654-01 (01) Aug 2019 in Appendix 3.
2.	Is the site within 100m of water course, well (used /disused), or potential spring line?	yes	See section 4.2.1 (scoping)
3.	Is the site within the catchment of the pond chains on Hampstead Heath?	No	The Site lies 3.3km southeast of the nearest Hampstead Heath drainage catchment will therefore not impact any catchments.
4.	Will the proposed basement development result in a change in the proportion of hard surfaced /paved areas?	yes	See section 4.2.2 (scoping)
5.	As part of site drainage, will more surface water (e.g. rainfall and run- off) than at present be discharged to the ground (e.g. via soakaways and / or SUDS)?	No	The new development is proposed to have biodiverse roofs with attenuation and the surface water will be discharged to the canal under controlled discharge rate to be agreed by the Canal & River Trust. The areas not covered by biodiverse roofs and the remaining areas at ground level will be attenuated within ground floor / basement underground storage and will be drained to the sewer network at a permitted rate by Thames Water.
6.	Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) or close to, or lower than, the mean water level in any local pond (not just the pond chains in Hampstead Heath) or spring line?	yes	See section 4.2.3 (scoping)

Table 3 – Slope Stability Screening

	Question	Answer	Evidence / Comment
1.	Does the existing site include slopes, natural or manmade, greater than 7°? (approximately 1 in 8)	No	Existing site does not have any natural slopes but the canal side retaining wall creates a slope of 45° locally maintaining access to existing ground floor level from canal frontage walk. This is considered as a part of building and not functioning as a site slope. Site is naturally sloping towards the west with a slope of 3° to 5° falling from canal side to St Pancras Way. Slope Angles calculated from Digital Terrain Model Provided by Camden Borough Council evidenced that the Site does not have natural slopes greater than 7°. See slope angle map extracted from Camden Geological, Hydrogeological and Hydrological Study in Appendix 6.
2.	Will the proposed re-profiling of landscaping at site change slopes at the property boundary to more than 7°? (approximately 1 in 8)	No	There is a 3m level difference across the site falling from canal side to St Pancras Way. This is formed in the public realm with Part M compliant steps and ramps. Different floor levels are maintained within the building to suit the perimeter external levels such that the level access is achieved through out. Refer to Architect's drawing 1603_P_100 & Fabrik's drawings D2477 L.200& 201 in Appendix 6 for levels.
3.	Does the development neighbour land, including railway cuttings and the lake, with a slope greater than 7°? (approximately 1 in 8)	No	As in 1. above, Slope Angles calculated from Digital Terrain Model Provided by Camden Borough Council evidenced that site does not have natural slopes greater than 7°. See slope angle map extracted from Camden Geological, Hydrogeological and Hydrological Study in Appendix 7.
4.	Is the site within a wider hillside setting in which the general slope is greater 7°? (approximately 1 in 8)	No	Slope Angles calculated from Digital Terrain Model Provided by Camden Borough Council evidenced that site does not have natural slopes greater than 7°. The 1:50000 scale geological map for the area indicates that the site does not lie within an 'Area of Significant Land Slide potential'. The BGS landslide potential map is extracted from Arup report attached to Appendix 7.
5.	Is the London Clay the shallowest strata at the site?	Yes	See section 4.3.1 (scoping)
6.	Will any tree/s be felled as part of the proposed development and/or are any works proposed	Yes	See section 4.3.2 (scoping)

	within any tree protection zones where trees are to be retained?		
7.	Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	No	There is no evidence of seasonal shrink-swell effects on site. Given that the underlying natural ground is high volume change potential London clay, there is potential for such effects, but it is not known whether there are any structures that have been affected in wider area.
8.	Is the site within 100m of a watercourse or a potential spring line?	Yes	See section 4.3.3 (scoping)
9.	Is the site within an area of previously worked ground?	Yes	See section 4.3.4 (scoping)
10.	Is the site within an aquifer? If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction?	No	The existing site is underlain by 2m-5m of made ground underlain by approximately 20m of London Clay formation. London Clay forms an impermeable layer classified as a non-aquifer (non-productive stratum). Phase ll SI had been done for Plots A and B, please refer to RSK- Geoenvironmental and Geotechnical Assessment SI Report 371654-01 (01) Aug 2019 in Appendix 3
11.	Is the site within 50m of the Hampstead Heath ponds?	No	The Site lies 3.0km Southeast of the nearest Hampstead Heath drainage catchment, will therefore not impact any catchments.
12.	Is the site within 5m of a highway or pedestrian right of way?	Yes	See section 4.3.5 (scoping)
13.	Will the proposed basement significantly increases the differential depth of foundations relative to neighbouring properties?	Yes	See section 4.3.6 (scoping)
14.	Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	Yes	See section 4.3.7 (scoping)

4 STAGE 2 - SCOPING

4.1 Surface Flow and Flooding Scoping

4.1.1 QUESTION:
Will the proposed basement development result in a change in the proportion of hard surfaced/paved external areas?

POTENTIAL IMPACT:
A change in the proportion of hard surface or paved areas of a property will affect the way in which rainfall and surface water are transmitted away from a property. This includes changes to the surface water received by the underlying aquifers, adjacent properties and nearby watercourses.

SCOPE: All surface water drainage from existing site, including on the canal-side, appears to flow into the public combined sewer. The site in its existing state does not provide any attenuation of surface water, and during an extreme storm event it is expected to overload the public sewer network and flow onto adjacent land/canal.

The proposed development will have a large provision of biodiverse roofs resulting in significantly reduced hard roof area. From the biodiverse roof with attenuation, surface water will be discharged to the canal under controlled rate that had been agreed by the Canal & River Trust. The areas not covered by biodiverse roofs and the remaining areas at ground level will be attenuated within ground floor/basement underground storage and will be drained to the sewer network at a permitted rate by the Thames Water. We will be liaison with Canal River Trust and Thames Water Utilities Ltd as we have done on Plot A.

Therefore, the new development will have further improved surface water management system that will help to reduce the risk of flooding in the surrounding area. There is no risk of free flow of surface water in and around the site caused by new development.

4.2 Subterranean (Ground water) Scoping

4.2.1 QUESTION:
Is the site within 100m of a watercourse, well (used/disused) or potential spring line?

POTENTIAL IMPACT:
The flows or levels of water features may be impacted if the groundwater flow regime that supports them is affected by a proposed basement.

SCOPE: The north-eastern boundary of the site is immediately adjacent to the canal bank of the Regent's Canal. The canal wall along the boundary had been a massive 0.72m wide brick wall construction. According to the IStructE report published during the construction of existing mechanised post office building, following investigations, a decision had been made to construct an impermeable sheet pile wall alongside the massive brick wall. Therefore, the boundary along the canal now consists of cantilever sheet pile wall which will not be disturbed by the new construction. Water level in the canal is 23.13m AOD and the canal is approximately 1.5m to 2.0m deep (i.e., the base of the canal is at approximately 21.15m AOD).

In addition, it is assumed that the culverted Fleet River, one of the 'Lost Rivers of London' follows a course down St Pancras Way. The section of the Fleet River between Camden and Kings Cross was culverted during the development of the Regents Canal from 1812 onwards and now exists as a large underground sewer. This feature is not indicated to impinge on the site.

Given the general impermeability of London Clay and that the Regent's canal is a man-made structure with controlled inflows, it is considered that there will be no hydraulic continuity between the site and the canal. Therefore, there should be no impact in relation to groundwater flow regime or the canal water flow or level.

4.2.2 QUESTION:
Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?

POTENTIAL IMPACT: The sealing off the ground surface by pavements and buildings to rainfall will result in decreased recharge to the underlying ground. In areas of non-aquifers (i.e. London Clay), this may mean changes in infiltration and the degree of ground saturation, which in turn may affect stability.

SCOPE: In its current configuration, the site is considered to be predominantly impermeable, consisting of concrete buildings with large flat roofs and hard paving around the buildings. A CCTV survey of the existing site drainage undertaken by Drainage Technical Services Ltd on 2dn April 2017 confirms all surface water drainage from the site, including on the canal-side, appears to flow into the public combined sewer under St Pancras Way via a connection between plot A and B. There are no existing surface water outfalls to Regent's Canal from the site.

For the proposed development, the underlying London Clay geology is unlikely to be appropriate for direct infiltration of surface water. Surface water therefore will only leave the site via Regent's Canal or the Thames Water combined sewer network and will be actively managed on site through the provision of Sustainable Drainage Systems (SUDS) where possible.

The proposed development will have a large provision of biodiverse roofs, resulting in significantly reduced hard roof area, and providing a multitude of other benefits. Biodiverse roofs provide a certain amount of attenuation, but they will be enhanced to provide an additional volume of 'blue' roof attenuation.

These will be drained to the canal by gravity at a controlled discharge rates per plot as agreed with the Canal & River Trust as the approved FRA report dated the August 2017. The areas not covered by biodiverse roofs and the remaining areas at ground level will be attenuated within ground floor/basement underground storage and will be drained to the sewer network at a permitted rate by the Thames Water.

The system will be designed such that runoff from the 1% annual probability rainfall event and +40% for climate change is fully retained on the site within biodiverse roofs attenuation tanks and discharged at a controlled rate. Please refer to the approved FRA report rev. C which was issued Mar 2018 as in Appendix 10.

We can confirm that the core principles of the FRA and SuDS report for Plot A as submitted for planning in August 2017 remain unchanged for Plot B. Details of the Sustainable Drainage Strategy are still to be resolved as the building and roof layout is still under review, however the design intent is to discharge as much as possible of the clean surface-water drainage to the adjacent canal, in accordance with the principles previously agreed with CRT. Key components of the drainage strategy include Green Roofs, Blue Roofs and a shallow drainage system which will discharge to via a demarcation chamber to the Canal. For areas of the site which are below the canal level, site runoff will discharge to the public sewer via a gravity drainage system, attenuated to a restricted rate to be agreed with Thames Water.

Therefore, there will be no risk of infiltration or ground saturation and any associated risks like ground stabilisation. Site will also be watertight with cavity drained system mitigating any risk from perched ground water while the perimeter contiguous pile wall will form the structural stability.

The phase II site investigation has now been commissioned and any mitigation measures will be clarified /included in detail design as necessary.

4.2.3 QUESTION:
Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond (not just the pond chains on Hampstead Heath) or spring line?

POTENTIAL IMPACT:
Groundwater may drain from the water feature and flow into the basement excavation space.

SCOPE: The site is adjacent to the Regent's canal. Water level in the canal is at 23.13m AOD and the canal is approximately 2m deep which means the base of the canal is at approximately 21.15m AOD.

The proposed basement level at the site varies from 13.4 to 18.00m AOD, some 7.75m below the base of the canal at its deepest area.

However, as noted 4.2.1 above, given the construction of the canal wall and the general impermeability of the London Clay, it is considered that there should be no hydraulic continuity between the site and this feature and that the proposed basement development should have no impact in relation to groundwater, and vice versa. Please refer to the Phase ll SI report in appendix 3

4.3 Slope Stability Scoping

4.3.1 QUESTION:
Is the London Clay the shallowest strata at the site?

POTENTIAL IMPACT:
The London Clay is prone to shrink-swell (subsidence and heave)

SCOPE: As previously noted, the existing site is underlain by a layer of Made ground underlain by London Clay formation which have been confirmed by Phase II site investigations. There will be both vertical and horizontal soil movements as a result of deep excavations.

Contiguous piled retaining wall structure will be installed around the perimeter of the site which will be designed to resist both horizontal and vertical movement by heave and subsidence. A numerical assessment of heave potential will be followed by monitoring of ground movement before, during and after excavation at predetermined time intervals.

An Impact Assessment based on site investigation and study have been carried out as the detail design stage and reported in section 6

4.3.2 QUESTION:
Will any tree/s be felled as part of the proposed development and/or are any works proposed within any tree protection zones where trees are to be retained?

POTENTIAL IMPACT:
The soil moisture deficit associated with felled trees will gradually recover. In high plasticity clay soils (such as the London Clay) this will lead to gradual swelling of the ground until it reaches a new value. This may reduce the soil strength which could affect ground stability.

SCOPE: There are 30 no. individual trees within influence of the application area according to the Arboricultural Impact assessment issued by Aspect in April 2017. The proposed development will require all the existing trees to be removed. 21 out of 30 trees are completely within the proposed basement footprint and will be removed entirely by the new excavations. Remaining trees along the canal edge will also be removed in order to accommodate the new landscape.

As noted in section 4.3.1, any impact from heave or subsidence will be taken into account during detail design.

4.3.3 QUESTION:
Is the site within 100m of a watercourse or a potential spring line?

POTENTIAL IMPACT:
Seasonal spring lines and changes to groundwater regimes within slopes can affect slope stability.

SCOPE: As previously noted, northeast boundary of the site is immediately adjacent to the Regent's Canal. The ground and groundwater conditions identified through the Phase 2 Site Investigations reveals there is no mobile or significant groundwater regime beneath the site and no significant slopes in the site area.

Given the general impermeability of London Clay and that the canal is a man-made structure with controlled inflows, it is considered that there will be no hydraulic continuity between the site and the canal. Therefore, there will be no impact in relation to ground water flow, slopes or stability to the proposed basement.

4.3.4 QUESTION:
Is the site within an area of previously worked ground?

POTENTIAL IMPACT:
Previously Worked ground may be less homogeneous than natural strata and may include relatively uncontrolled backfill zones.

SCOPE: The IStructE paper included a summary of an intrusive site investigation that was undertaken prior to construction of the sorting office.

It was indicated that the former granary building had been founded upon a concrete raft foundation that had been placed by excavating down approximately 6m below the water level of the adjacent canal, above which 225mm thick sandstone blocks had been placed on a 4.2m grid to form bases to cast iron columns. According to the paper the concrete raft had been placed directly upon London Clay and infilling above the concrete raft and around the sandstone blocks had been carried out with approximately 1.2m of reworked clay upon which the floor had been constructed.

This has been confirmed within nine borehole records which indicated that the hardstanding of the former granary building was underlain by approximately 20m of London Clay that was in turn underlain by clay of the 'Woolwich and Reading Beds'.

Phase II site investigations confirmed these ground conditions and most of the made ground material will be removed as part of the new development and the new structure will be supported on piled foundation secured with contiguous perimeter walls. Basement slabs will be suspended on ground beams supported by pile caps with collapsible compressible material as a heave protection layer underside. Therefore, there will be no impact or risk of land stability.

As described in item 4.3.1, contiguous piled retaining wall structure will be installed around the perimeter of the site which will be designed to resist both horizontal and vertical movement by heave and subsidence.

An Impact Assessment based on site investigation and study will be carried out at the design stage and reported in section 6.

4.3.5 QUESTION:
Is the site within 5m of a highway or pedestrian right of way?

POTENTIAL IMPACT:
Excavation for a basement may result in damage to the road, pavement or any underground services buried in trenches beneath the road or pavement.

SCOPE: Granary Street and St Pancras way are located to the immediate south and southwest of the site, respectively. There is the potential for ground movements associated with basement excavation to impact the adjacent highways.

Contiguous piled retaining wall structure will be installed around the perimeter of the site which will be designed to resist both horizontal and vertical movement by heave and subsidence. A numerical assessment of heave potential will be followed by monitoring of ground movement before, during and after excavation at predetermined time intervals.

An Impact Assessment based on site investigation and study will be carried out at the design stage and reported in section 6.

4.3.6 QUESTION:
Will the proposed basement significantly increases the differential depth of foundations relative to neighbouring properties?

POTENTIAL IMPACT:
Excavation for a basement may result in structural damage to neighbouring properties/ structures if there is a significant differential depth between adjacent foundations.

SCOPE: The following nearby structures were identified as being potentially at risk from damaging ground movements and differential depths in foundations:

- The northern site boundary retaining wall adjacent to Canal Side Studios, this has no existing basement.
- The Regent Canal Structure / Sheet Piles
- The Thames Water Sewer line beneath the site across plot A
- Culverted Thames sewer running underneath the St Pancras Way
- St Pancras Hospital building
- Travis Perkins at 11-13 St Pancras Way opposite Southwest boundary of the proposed. This building has no existing basement.
- Beaumont Court at 1-45 College Grove, with a part basement.

Contiguous piled retaining wall structure will be installed around the perimeter of the site which will be designed to resist both horizontal and vertical movement by heave and subsidence. A numerical assessment of heave potential will be followed by monitoring of ground movement before, during and after excavation at predetermined time intervals.

An Impact Assessment based on site investigation and study will be carried out at the design stage and reported in section 6.

4.3.7 QUESTION:
Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?

POTENTIAL IMPACT:
Excavation for a basement may result in damage to the underground structure.

SCOPE: There are no tunnels, tunnel exclusion zones, but there is a Thames Water Sewer line across the site. The middle level sewer no. 2, a part of London's historic sewer system, now part of the Thames Water Authority's system, has been constructed by tunnelling under the northern part of the site. The sewer is approximately 2m in diameter and is brick lined throughout, with its crown about 4.5m below the canal bed level. The existing building has been built bridging over the sewer with contiguous piles outside the easement area.

New contiguous piled wall will be installed outside the easement zone to resist both lateral and vertical movement by heave and subsidence. A numerical assessment of heave potential will be followed by monitoring of ground movement before, during and after excavation at predetermined time intervals.

Detail design will be informed by the proposed intrusive site investigations and testing. An Impact Assessment will be reported in section 6

5 SITE INVESTIGATION AND STUDY

The following studies have already been undertaken as preliminary stage and submitted with this report.

1. Phase II Site Investigations for Plots A and B.
2. Thames Water sewers beneath Plot A and along the St. Pancras Way had been investigated, surveyed, and located.
3. Existing canal steel sheet piled wall including the brick retaining wall had been investigated and surveyed.
4. The approved Flood Risk Assessment (FRA) by Water Environment Limited.
5. Ordinary Meeting paper on The Granary Site – Design and construction of a mechanised letter sorting office including the discussion paper.
6. Predicted heave movement during construction for the existing UBB building.
7. The original section and plan of the existing building (Appendix 6)
8. Topographical survey by Clugston Survey Services.
9. Arboricultural Impact Assessment by Aspect.

The following investigations are to be carried out prior to detail design:

10. Further Intrusive investigations to determine the lower existing RC retaining wall that provide the footpath along the canal and the existing piles diameter, reinforcement, depth, durability and capacity for possible re-use within the plot B where required.
11. RSK – Ground Movement and Building Damage Assessment Report ref. 371654-02 (01) dated Aug. 2020 will need to be revised to take into account of the double basement that is now proposed within plot B.
12. Additional Phase II site investigations will be required for Plot C development.

The report will be extended to include geotechnical assessments/calculations, predicted movements, Burland scale and proposed foundation designs etc. when completed before commencement of construction.

6 IMPACT ASSESSMENT

This stage is concerned with evaluating the direct and indirect implications of the proposed basement development. It involves describing, quantifying and aggregating the effects of the development on those attributes or features which have been identified in the scoping stage as being potentially affected.

Surface flow and flooding: No potential impacts identified beyond the scoping stage.

Subterranean (ground water) flow: No potential impacts identified beyond the scoping stage.

Land stability: Potential impacts identified relate to ground movements associated with:

- Retaining walls installation and ground excavation adjacent to Plot B.
- Existing Thames Water Sewer beneath the Plot A.
- Elastic heave of the London Clay in the basement excavation due to relief of overburden.

GDP will complete the detailed design on receipt of additional Ground Movement Assessment set out in paragraph 5.0.

As part of the assessment the following nearby structures have been identified as being potentially at risk from damaging ground movements:

- The Regent Canal structures.
- The Thames Water Sewer line beneath the site across Plot A
- Thames Water culverted Fleet River sewer running underneath the St Pancras Way.
- Phased Construction of the new buildings Plot A, Plot B and Plot C.
- Surrounding buildings like St Pancras hospital, Travis Perkins, Beaumont Court and Canal Side Studios.

Likely ground movements and building strains associated with basement construction can be estimated in two ways: by an empirical approach adopted by reference to previous case studies of similar developments, and computer analysis employed to model the basement excavation and its construction.

For this project both approaches will have been adopted in an attempt to give a balanced estimate of the ground movements that may occur.

The assessment of vertical ground movements (heave and settlement due to unloading and loading of basement) will have been carried out by numerical modelling, while ground movements resulting from installation of the contiguous piled wall and basement excavation have been determined by reference to empirical results.

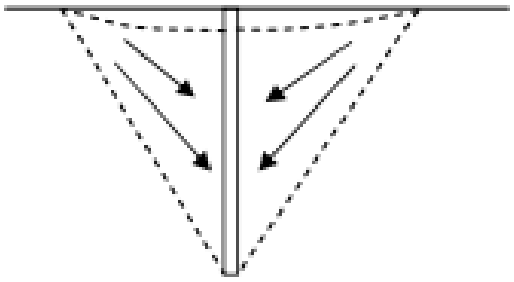
Contiguous piled retaining wall structure will be installed around the perimeter of the site which will be designed to resist both horizontal and vertical movement by heave, settlement and subsidence. A numerical assessment of movement potential will be followed by monitoring of ground movement before, during and after excavation at predetermined time intervals.

6.1 Structural stability of adjacent structures from Retaining wall and basement excavation.

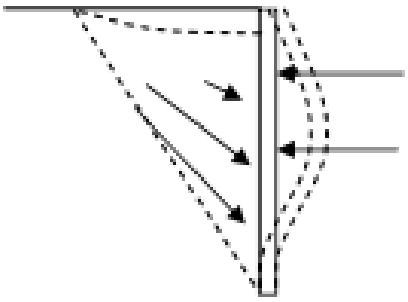
Below ground construction, involving the installation of basement retaining walls and excavation of the ground to form the basement accommodation space, has the potential to cause movements in the surrounding ground

We will have undertaken ground movement analyses based on the empirical approach described in CIRIA C580 “Embedded Retaining Walls – Guidance for Economic Design”. This document provides charts of vertical and horizontal ground movements resulting from installation of embedded retaining walls and excavation in front of the walls, as shown schematically in Illustration 1 below. The C580 charts have been normalised with wall length and excavation depth to facilitate their use for new developments.

Illustration 1: Schematic illustration of potential ground movements associated with contiguous bored pile wall installation and excavation in front of the retaining wall



Ground Movement Due to Pile Installation



Ground and Wall Movement Due to Excavation

In the temporary condition, the proposed basement excavation will be retained by a contiguous bored pile wall supported by rigid propping. In the permanent condition, the retaining wall will be rigidly propped by the basement floor and lower ground floor reinforced concrete slabs.

The proposed basement level across the site varies from 13.4m to 18.00m AOD while the canal water level is at 23.13m AOD, canal Bed is at 21.15m AOD, Canal bank is at 23.6 AOD, and St Pancras Road level varies from 21.690m to 20.275 AOD adjacent site boundary. This indicates that excavations beneath the site are likely to extend up to approximately 3.69m on the North-western boundary to approximately 10.20m on the South-eastern boundary where the double basement proposed. In summary, Plot A excavation depth varies from 4.15m to 5.6m, Plots B and C excavation depth varies from approximately 6.9m to 10.2m. Appendix 1 gives General Arrangement of site plans and sections illustrating the proposed development.

For this analysis, we have assumed a minimum embedment depth of 1.5 times the retained height for the contiguous bored pile wall, wholly embedded in stiff clay under conditions of a high standard of workmanship during construction. We have considered the retaining wall to be of high stiffness on the basis that temporary props of high stiffness will be installed before permanent props at high level (in accordance with C580). Final design and checking of the Contiguous piled walls will be carried out by piling specialists.

A summary of adjacent structures with specific dimensions and construction details to be used for this analysis is presented in table 4 and 4a below based on Ground Movement and Building Damage Assessment Report Tables 6 and 7 as in Appendix 3.

The adjacent structures are located in figure 5.

Adjacent Property	Adopted Piled Wall Depth (m)	Adopted Excavation Depth (m.bbl)	Approximate Distance to Face of Property (m)	Approximate Length of Property Perpendicular to Basement (m)
Canal Side Studios_1 (Southern Elevation)	18.00 m – Basement Retaining wall for Plot-A	5.0 m – Western part basement 4.2 m –eastern part basement	1.50 – north-eastern corner of basement 2.00 – north-western corner of basement	30.00
Canal Side Studios_2 (Eastern Elevation)	18.00 m – Basement Retaining wall for Plot-A	5.0 m – Western part basement 4.2 m –eastern part basement	1.50 – north-eastern corner of basement 2.00 – north-western corner of basement	20.00
Canal Side Studios_3 (Northern Elevation)	18.00 m – Basement Retaining wall for Plot-A	5.0 m – Western part basement	1.50 – north-eastern corner of basement	30.00
		4.2 m –eastern part basement	2.00 – north-western corner of basement	
Canal Side Studios_4 (Western Elevation)	18.00 m – Basement Retaining wall for Plot-A	5.0 m – Western part basement 4.2 m –eastern part basement	1.50 – north-eastern corner of basement 2.00 – north-western corner of basement	20.00
Beaumont Court (Eastern Elevation)	18.00 m – Basement Retaining wall for Plot-A	5.0 m – Western part basement 4.2 m –eastern part basement	15.00	18.00m – Eastern elevation
Beaumont Court (Northern Elevation) NB: Northern elevation comprises two north facing walls)	18.00 m – Basement Retaining wall for Plot-A	5.0 m – Western part basement 4.2 m –eastern part basement	15.00	11.00 – Northern elevation (shortwall) 63.00 – Northern elevation (longwall)
Beaumont Court (Southern Elevation)	18.00 m – Basement Retaining wall for Plot-A	5.0 m – Western part basement 4.2 m –eastern part basement	15.00	74.00 – Southern elevation
Travis Perkins (Building 1) – (Eastern Elevation)	20.00 m – Basement Retaining wall for Plot-B	2.5 m – Eastern and northern part basement 5.3 m – Western and southern part basement	15.00	11.00
Travis Perkins (Building 1) – (Northern Elevation)	20.00 m – Basement Retaining wall for Plot-B	2.5 m – Eastern and northern part basement 5.3 m – Western and southern part basement	15.00	11.00 – Northern & elevation (wall nearest excavation) 12.5 m - Northern elevation (walls furthest from excavation)
Travis Perkins (Building 1) – (Southern Elevation)	20.00 m – Basement Retaining wall for Plot- B	2.5 m – Eastern and northern part basement 5.3 m – Western and southern part basement	15.00	11.00 –Southern elevation (wall nearest excavation) 12.5 m - Southern elevation (wall furthest from excavation)
Travis Perkins (Building 2) – (Northern Elevation)	25.00 m – Basement Retaining wall for Plot- C	8.6 m – Plot C Basement excavation	15.00	10.00 – Northern & Southern elevations

Table 4: A summary of adjacent structures with specific dimensions details

Adjacent Property	Building Material	Assumed Foundation Type	Assumed Foundation Depth (m.bgl)
Canal Side Studios	Concrete / Steel Framed	Strip Foundations	1.00
Beaumont Court	Concrete / Steel Framed	Piled Foundations	2.00 level – Pile cut-off
Travis Perkins Building Nos. 1 - 3	Concrete / Steel Framed	Piled Foundations	2.00 level – Pile cut-off
St Pancras Hospital Building Nos. 1-3	Masonry	Strip / Pad	1.00

Table 4a: A summary of adjacent structures with specific construction details

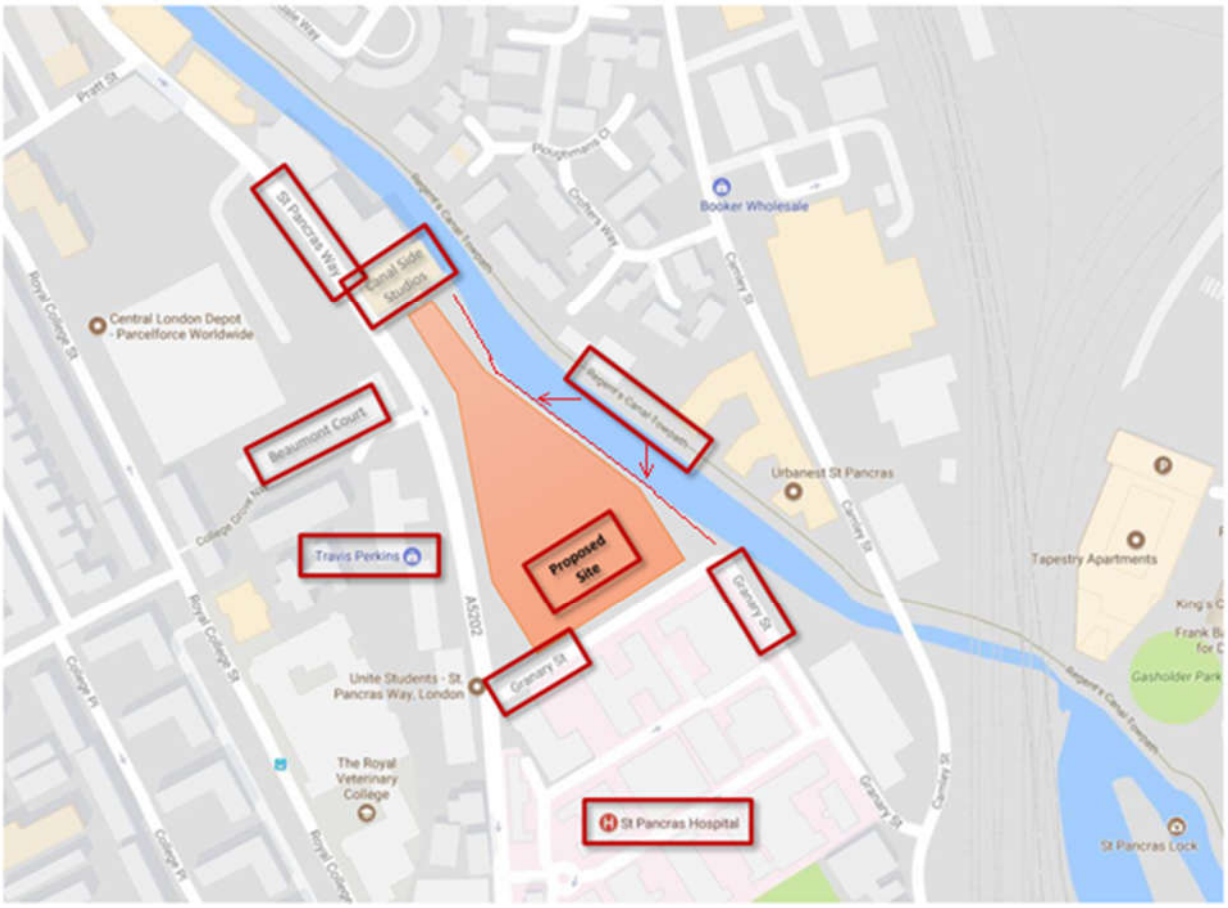


Figure 5: Location of neighbouring structures

The IStructE paper discussion on design and construction of mechanised letter sorting office attached to this document describes the actual monitoring results of the movement of the contiguous wall along the northern boundary party wall and the canal wall. In page 20 & 21, it describes the actual movement of the piles away from Atlantic Metals Building (Canal Side Studios) is only 3mm against more than 20mm of predicted movements by calculations. Similarly, the actual movement of the canal side piled wall was only 7mm.

It has also monitored the vertical movement of the Atlantic Metals building and the heads of the piles, which has been recorded as maximum 10mm and 5mm respectively. It has been confirmed that the vertical rise of the Atlantic Metals Building was less than the calculated amount the building can tolerate before it is distressed.

Following the phase ll site investigations carried out for Plots A and B and the GMA report done by RSK, we therefore use these results for the time being for the ground movement from the proposed construction of retaining walls adjacent to the canal wall and surrounding structures and are summarised below. Further GMA analysis will be carried out further in due course following detail design and submit the revised results accordingly.

The complete set of estimated ground movements at the front and rear of the adjacent structures resulting from both wall installation and basement excavation, based on the empirical assessment in CIRIA 580 will be presented in Table 5 and Table 6 below.

The calculated horizontal strains and deflection ratios are presented in Table 6, along with the Building Damage Category. These results have been extracted from RSK Ground Movement and Building Damage Assessment Report Table 10 on page 18 as in Appendix 3.

Adjacent Property (Critical Elevations only)	Development Plot (Stage)	DEMOLITION				CONTIGUOUS WALL INSTALLATION				BASEMENT EXCAVATION				NEW LOADING – SHORT TERM				FULL DEVELOPMENT – LONG TERM			
		Ground Movement at Front of Adjacent Property		Ground Movement at Rear of Adjacent Property		Ground Movement at Front of Adjacent Property		Ground Movement at Rear of Adjacent Property		Ground Movement at Front of Adjacent Property		Ground Movement at Rear of Adjacent Property		Ground Movement at Front of Adjacent Property		Ground Movement at Rear of Adjacent Property		Ground Movement at Front of Adjacent Property		Ground Movement at Rear of Adjacent Property	
		Lateral (mm)	Vertical (mm)	Lateral (mm)	Vertical (mm)	Lateral (mm)	Vertical (mm)	Lateral (mm)	Vertical (mm)	Lateral (mm)	Vertical (mm)	Lateral (mm)	Vertical (mm)	Lateral (mm)	Vertical (mm)	Lateral (mm)	Vertical (mm)	Lateral (mm)	Vertical (mm)	Lateral (mm)	Vertical (mm)
Canal Side Studios_1 (Southern Elevation)	PLOT A	0.00	0.20	0.00	0.10	1.86	2.68	1.77	2.49	6.53	5.80	2.20	5.76	6.53	14.65	2.20	14.07	--	--	--	--
	PLOTS B & C	6.53	15.01	2.20	14.43	6.53	15.01	2.20	14.43	6.53	15.01	2.20	14.43	6.53	14.16	2.20	13.58	--	--	--	--
	FULL DEVELOPMENT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6.83	17.46	2.20	17.42
Canal Side Studios_4 (Northern Elevation)	PLOT A	0.00	0.04	0.00	-0.01	1.86	2.68	0.00	0.04	6.53	5.80	0.00	0.04	6.53	14.65	0.00	-1.00	--	--	--	--
	PLOTS B & C	6.53	15.01	0.00	-0.76	6.53	15.01	0.00	-0.76	6.53	15.01	0.00	-0.76	6.53	14.16	0.00	-1.22	--	--	--	--
	FULL DEVELOPMENT	--		--		--	--	--	--	--	--	--	--	--	--	--	--	6.53	17.46	0.00	-1.42
Travis Perkins (Building 3_Elevation 2) – (Northern Elevation)	PLOT A	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.09	0.00	0.09	--	--	--	--
	PLOTS B & C	0.00	0.50	0.00	0.51	0.41	2.58	0.00	0.51	3.30	7.33	1.00	0.91	3.30	5.75	1.00	-0.69	--	--	--	--
	FULL DEVELOPMENT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3.30	0.90	0.99	-3.52
St Pancras Hospital (Building 1_Elevation 6) (Eastern Elevation)	PLOT A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.05	0.00	-0.03	--	--	--	--
	PLOTS B & C	0.00	0.45	0.00	0.40	1.01	2.82	0.00	0.39	8.34	7.04	0.00	0.40	8.34	5.40	0.00	-0.68	--	--	--	--
	FULL DEVELOPMENT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	8.34	1.48	0.00	-2.36
St Pancras Hospital (Building 2_Elevation 2) (Western Elevation)	PLOT A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.06	0.00	-0.03	--	--	--	--
	PLOTS B & C	0.00	0.25	0.00	0.38	1.05	2.64	0.00	0.38	8.60	6.89	0.00	0.38	8.60	4.93	0.00	-0.55	--	--	--	--
	FULL DEVELOPMENT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	8.60	-0.97	0.00	-2.00
St Pancras Hospital (Building 2_Elevation 4) (Eastern Elevation)	PLOT A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.06	0.00	-0.03	--	--	--	--
	PLOTS B & C	0.00	0.40	0.00	0.30	1.07	2.70	0.00	0.41	6.85	6.99	0.00	0.41	8.65	4.44	0.00	-0.58	--	--	--	--
	FULL DEVELOPMENT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	8.65	-2.80	0.00	-2.14
St Pancras Hospital (Building 3_Elevation 2) (Southern Elevation)	PLOT A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.06	0.00	-0.05	--	--	--	--
	PLOTS B & C	0.00	0.54	0.00	0.29	1.07	2.70	0.00	1.15	8.66	6.99	4.89	3.07	8.66	4.36	4.21	0.10	--	--	--	--
	FULL DEVELOPMENT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-8.66	-2.47	-4.21	-4.19

Table 5: Ground Movements resulting from Wall installations extracted from Ground Movement and Building Damage Assessment Report Table 9 on page 19 as in Appendix 3.

Table 6 Resulting horizontal strains and deflection ratios

Adjacent Property	Development Plot (Stage)	DEMOLITION				CONTIGUOUS WALL INSTALLATION				BASEMENT EXCAVATION				NEW LOADING – SHORT TERM				FULL DEVELOPMENT – LONG TERM			
		Horizontal Strain (%)	Deflection Ratio (%)	Maximum tensile strain ε_{tens} (%)	Damage Category	Horizontal Strain (%)	Deflection Ratio (%)	Maximum tensile strain ε_{tens} (%)	Damage Category	Horizontal Strain (%)	Deflection Ratio (%)	Maximum tensile strain ε_{tens} (%)	Damage Category	Horizontal Strain (%)	Deflection Ratio (%)	Maximum tensile strain ε_{tens} (%)	Damage Category	Horizontal Strain (%)	Deflection Ratio (%)	Maximum tensile strain ε_{tens} (%)	Damage Category
Canal Side Studios_1 (Southern Elevation)	Plot A	--	--	--	--	--	--	--	--	--	--	--	--	0.098	0.076	0.054	1	--	--	--	--
	Plot B & C	0.098	0.076	0.054	1	0.098	0.076	0.054	1*	0.098	0.076	0.054	1*	0.098	0.076	0.054	1*	--	--	--	--
	FINAL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.098	0.100	0.073	1
Canal Side Studios_4 (Northern Elevation)	Plot A	--	--	--	--	--	--	--	--	--	--	--	--	0.033	0.030	0.066	1	--	--	--	--
	Plot B & C	0.033	0.030	0.066	1	0.033	0.030	0.066	1*	0.033	0.030	0.066	1*	0.033	0.030	0.066	1*	--	--	--	--
	FINAL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.033	0.038	0.075	1
Travis Perkins (Building 3_Elevation 2) – (Northern Elevation)	Plot A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Plot B & C	--	--	--	--	--	--	--	--	0.057	0.005	0.057	1	0.046	0.006	0.021	1*	--	--	--	--
	FINAL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.046	0.005	0.050	0
St Pancras Hospital (Building 1_Elevation 6)[1] (Eastern Elevation)	Plot A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Plot B & C	--	--	--	--	--	--	--	--	0.036	0.011	0.053	1	0.036	0.011	0.053	1*	--	--	--	--
	FINAL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.054	0.010	0.054	1
St Pancras Hospital (Building 2_Elevation 2)[1] (Western Elevation)	Plot A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Plot B & C	--	--	--	--	--	--	--	--	0.057	0.011	0.057	1	0.035	0.011	0.054	1	--	--	--	--
	FINAL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.057	0.008	0.057	1
St Pancras Hospital (Building 2_Elevation 4)[1] (Eastern Elevation)	Plot A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Plot B & C	--	--	--	--	--	--	--	--	0.057	0.011	0.057	1	0.036	0.011	0.054	1	--	--	--	--
	FINAL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.056	0.007	0.057	1
St Pancras Hospital (Building 3_Elevation 2)[1] (Southern Elevation)	Plot A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Plot B & C	--	--	--	--	--	--	--	--	0.057	0.02	0.057	1	0.057	0.020	0.057	1	--	--	--	--
	FINAL	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.056	0.001	0.057	1

Notes:

-- = Damage Category 0 (Zero) not exceeded

* Result carried forward from an earlier construction stage. Where no change in values from previous stage, the current stage has no impact on the damage category

CIRIA 580 also provides a methodology for assessing the potential damage to structures within the zone of influence of the basement excavation. This methodology uses the relationship between Damage Category, lateral strain and deflection ratio developed by Boscardin and Cording (1989) and Burland (2001). These damage categories assume affected structures to be of brick masonry with cement mortar. This methodology of damage classification has also been adopted by Camden and is presented in Camden's CPGB guidance document. The above results have been plotted on the Damage Category chart presented in CIRIA 580 as shown in illustration 2.

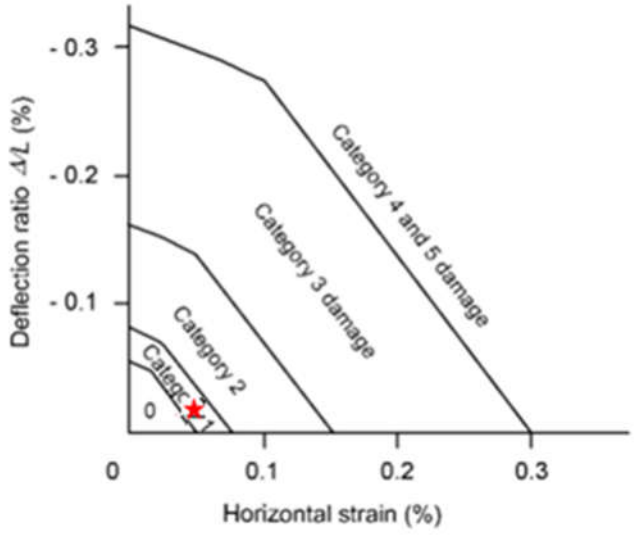


Illustration2: Relationship between damage category, deflection ratio and horizontal tensile strain (after Burland, 2001)

In accordance with C580, the adjacent building Canal Side Studios, fall into 'Category 1'. The definitions of these categories are presented in Appendix 8 showing that Category 1 is defined as 'Very Slight Damage'.

The results fulfil the requirements of CPGB in that they do not exceed the damage category of 'very slight' (Category 1) and reflect categories of cosmetic which can be repaired by decoration rather than structural damage.

These damage categories do not strictly apply to either the canal wall or the roads/pavements along St Pancras Way and Granary Street. Predicted movements associated with these structures are of the order of approximately 15mm both vertically and horizontally, which are very small. It is considered that there are unlikely to be any damaging movements, however these will be confirmed by careful analytical and empirical calculation methods, ground monitoring during and after construction /excavation. Notwithstanding the above, it is recommended that extreme care be taken during construction, as the magnitude of ground movements depends to a great extent upon the quality of workmanship. As such large local ground movements may occur where construction problems are encountered. Such movements have not been predicted by this work.

6.2 Structural stability of adjacent structures from heave of the basement excavation

The removal of overburden due to excavation and subsequent reloading from the building may potentially cause some vertical ground movement in the underlying soils, the final magnitude depending on the net loading applied at the formation level.

Therefore, an analysis will have been undertaken to elucidate any potential risk from the excavation of the new basement to the identified nearby structures. Numerical modelling will have been undertaken to determine the conditions at key stages in the construction process, namely:

- Unloading due to demolition of the existing building and excavation for the new basement; and
- Full loading following construction of the new basement and building.

Calculations will be carried out adopting the Boussinesq method of elastic analysis which calculates the stresses and strains within the ground due to applied loads and then determines the displacements by integrating the vertical and horizontal strains. It should be noted, however, that this method will not take into consideration the influence of the contiguous bored pile basement perimeter wall, as the increased stiffness at this boundary cannot be incorporated into the model. As such, the analyses can be considered conservative.

The drawing attached to Appendix 8 shows predicted heave values calculated by Arup during construction of UBB which is about 19mm of heave over Northern area, which has been excavated 6m below canal water level during 1985 construction.

6.2.1 Movements arising from demolition and basement excavation

For the initial unloading stage (demolition and excavation), the underlying clay soils will be in fully undrained conditions, therefore the analysis will have been undertaken using short-term parameters.

Long-term (drained) conditions have not been described at this stage as it is considered extremely unlikely that this condition will arise during a standard construction programme. However, we will have ground movement monitoring procedure in place after construction for a reasonable period of time following pre/ during construction monitoring.

6.2.2 Movements arising following re-loading from the construction

For the final loading stage, a drained analysis will be undertaken as fully drained conditions are expected to occur in the long-term.

Piled foundations are the preferred option for the proposed development. However, at the time of writing, no detailed piling scheme has been developed for the site. Predicted UDL loadings along the piles retaining wall and approx. column loadings have been included in 16017-GDP-ZA1-B1-DR-S-1600 P7, SK(B)250A & SK(C)-250A attached to Appendix 3. In reality, for an analysis for a piled foundation solution, the load carried by each pile would be applied at a depth equal to 2/3 of the pile length over an area determined assuming a 1 in 4 spreads of load from the top of the pile in accordance with Tomlinson's "Pile Design in Construction Practice". This would result in higher stiffness and smaller movements than those predicted.

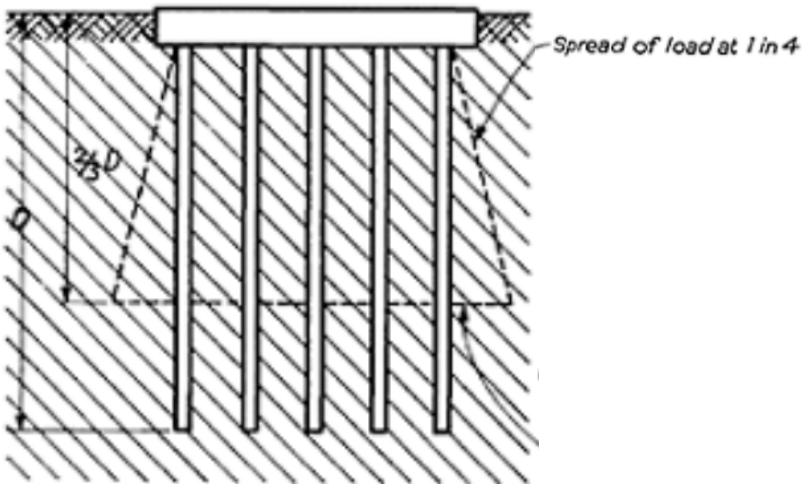


Illustration 3: Load Transfer to Soil from Pile Group (Source: Tomlinson)

An extract from predicted heave/settlement figures from RSK GMA report for adjoining property with very light foundation loadings than our proposed building illustrates that the full loading stage settlements of maximum 15mm are likely under the most heavily loaded parts of the structure .

Long-term (drained) conditions have been included for discussion for this stage as shown in RSK GMA report Table 10 on page 18.

7 CONCLUSION OF IMPACT ASSESSMENT FOR LAND STABILITY

In the short-term during construction, vertical heave movements of approximately 5mm may be anticipated in the vicinity of the features identified as potentially at risk. Table 7 shows the extracted movements from RSK Ground Movement and Building Damage Assessment Report for Plot A scheme as in Appendix 3 for the contiguous piled wall installation and excavation in front of the wall with the calculated vertical movements from elastic heave. The table will be revised once the additional Ground Movement Analysis for Plot B is completed.

Adjacent Structure	Lateral movements (mm)	Vertical movements (mm)
Retaining wall adjacent to canal towpath	-5.48	2.84
Canal Side Studios	6.53	5.80
St Pancras Way / Travis Perkins	3.30	7.33
Granary Street / Hospital	8.66	7.04
Plot A	6.53	5.80
Plot C	6.53	15.01

Table 7: Cumulative ground movements

It is considered that movements of the order of 20mm, with small tensile horizontal stresses and deflection ratios, are unlikely to be damaging to the identified features. It should be noted that the calculations undertaken as part of this assessment for Plot A and these calculations will be re-checked at the detailed design stage to ensure that more detailed predicted movements are within tolerable limits.

7.1 Control of ground movements

In order to reduce the potential for any movement over and above that expected, the following methods of safe practice should be considered prior to and during construction:

- Good workmanship will be required to ensure that pile installation induced settlements are kept to a minimum. It will be essential to ensure that the made ground is not allowed to collapse prior to casting of the contiguous piled wall;
- The contiguous piled wall should be installed to a suitable depth and have adequate embedment in stiff strata for satisfactory vertical and lateral stability;
- It should be ensured that basement slab is cast as early as possible and tight to the piled retaining wall. Sufficient time should be given for the slab to cure and gain strength prior to continuation of excavation below;
- Where temporary props are required they should be designed to provide adequate restraint to limit lateral ground movements. Walings should be tied in so they do not rely on friction or adhesion between the prop end and waling to be held in place;
- The first stage of excavation should be minimised and the first (stiff) support should be installed as early as possible in the construction sequence;
- The construction of the wall and its support systems should not be delayed;
- Over-excavation should be avoided;
- Monitoring both above and below ground should be carried out to ensure that the expected displacements are not exceeded. Limits of lateral and vertical displacement should be set beyond which the method of construction should be re assessed.

7.2 Monitoring ground movements and adjoining buildings.

Conditions surveys will be carried out to all buildings affected by the development including Thames Water sewer where required as post construction condition survey would be done when Plot A had been constructed and the reports are to be agreed by all parties prior to commencement of works on site.

Monitoring system will be installed prior to demolition works, during construction and post construction. The length of time of post construction monitoring is to be agreed with all parties following the final GMA analysis. The type of monitoring system to be installed such as live monitoring or/and fix stations is to be discussed and agreed with the Principal Contractor (PC), Monitoring Specialist/Surveyor (MC) and third parties. The positions of the monitoring system are to be placed strategically on the following buildings:

- Canal Side Studios
- Beaumont Court
- Travis Perkins buildings
- St Pancras Hospital buildings
- Thames Water sewer underneath the block A
- Thames Water culvert Fleet River that runs below the St. Pancras Way
- Canal Tow Paths

Fix monitoring stations are also to be placed on the top or sides of the newly cast RC capping beams to monitor any deflections of the piles. Inclinometer may also be installed in the piles where required, but this will depend on the final design of the piles which will be discussed and agreed with the PC, piling specialist and MC.

7.2.1 Scope of Works

The works comprise:

1. Visual Monitoring of the party walls
2. Attachment of Tell tales or Demec Studs to accurately record movement of significant cracks that have been identified during the condition surveys.
3. Attachment of levelling targets to monitor settlement of existing buildings and horizontal movements of existing retaining walls.
4. Attachment of levelling targets to monitor horizontal movements of new contiguous piled walls after installation.
5. The monitoring of the above instrumentation is in accordance with monitoring frequency strategy (7.2.2). The number and precise locations of instrumentation may change during the works; this shall be subject to agreement with the Principal Contractor (PC)/third parties involved.
6. All instruments are to be adequately protected against any damage from construction plant or private vehicles using clearly visible markings and suitable head protection e.g. manhole rings or similar. Any damaged instruments are to be immediately replaced or repaired.
7. Reporting of all data in a manner easily understood by all interested parties.
8. Co-ordination of these monitoring works with other site operations to ensure that all instruments can be read and can be reviewed against specified trigger values both during and post construction.

9. Regular site meetings by PC and MS to review the data and their implications.
10. Review of data by GD Partnership (GDP), the Consulting Engineers.

In addition, the PC will have responsibility for the following:

- Review of methods of working/operations to limit movements, and
- Implementation of any emergency remedial measures if deemed necessary by the results of the monitoring.

The MC shall allow for settlement and crack monitoring measures to be installed and monitored on various parts of the structure described as directed by the PC and Party Wall Surveyor (PWS) for the Client.

7.2.2 Monitoring Frequency

Instrument	Monitoring stage	Frequency of recording & details
Monitoring existing cracks if available Monitoring of Horizontal movement Monitoring vertical movement	Pre-construction	Record of existing cracks, crack widths, distance between multiple cracks and photographic evidence
	Demolition of the structure up to ground floor level	Record any movements in cracks or horizontal and vertical levelling gauge readings.
	During contiguous piled wall installation	Record any movements in cracks or horizontal and vertical levelling gauge readings.
	Installation of new RC pile caps and temporary propping before excavation	Record any movements in cracks or horizontal and vertical levelling gauge readings.
	During basement excavation	staged monitoring at an agreed time interval to gauge the effect of excavation benchmarks reading
	Construction of basement slab, ground floor slab and removal of temporary propping.	carry on staged monitoring at an agreed time interval to gauge the effect of new loadings
	Construction of super structure	carry on staged monitoring at an agreed time interval to gauge the effect of new loadings
	Post construction	Long term monitoring strategy to be agreed with all parties.

Table 8: Monitoring frequency

The following accuracies/ tolerances shall be achieved:

Party Wall settlement +1.5mm
Crack monitoring +0.75mm

7.2.3 Report of results and trigger levels

- Within 24 hours of taking the readings, the MS will submit a single page summary of the recorded movements.
- All readings shall be immediately reviewed by GDP prior to reporting to the PWS and other third parties.
- Within one working day of taking the readings the MS shall produce a full report.
- The following system of control shall be employed by the PC and appropriate contractors for each section of the works.
- The Trigger value, at which the appropriate action shall be taken, for each section, is given in Table 9, below.
- During works measurements are taken, these are compared with the limits set out below table.

Movement	CATEGORY	ACTION
0mm- 5mm	Green	- No action required
5mm-12mm	AMBER	- Crack Monitoring. - Carry out a local structural review. - Frequency of the surveying shall increase - Preparation for the implementation of remedial measures should be required. - implement any additional propping or change in methodology as required
>12mm	RED	- All works are to stop immediately - Crack Monitoring. - Implement structural support as required. - Cease works with the exception of necessary works for the safety and stability of the structure and personnel. - Review monitoring data and implement revised method of works

Table 9: Preliminary Movement limits between adjacent sets of Tell-tales or stud sets or datum points.

Any movements which exceed the individual amber trigger levels for a monitoring measure given in Table 6 shall be immediately reported to GDP and PWS, and a review of all the current monitoring data for all monitoring measures must be implemented to determine the probable causes of the trigger level being exceeded. Monitoring of the affected location must be increased and the actions described above implemented. Assessment of exceeded trigger levels must not be carried out in isolation from an assessment of the entire monitoring regime as the monitoring measures are inter-related. Where required, measures may be implemented or prepared as determined by the specific situation and combination of observed monitoring measurement data.

8 STATUTORY AUTHORITY CORRESPONDANCE

The proposed development will have a large provision of biodiverse roofs resulting in significantly reduced hard roof area. From the biodiverse roof with attenuation, surface water will be discharged to the canal under controlled rate agreed by the Canal & Rivers Trust. The areas not covered by biodiverse roofs and the remaining areas at ground level will be attenuated within ground floor/basement underground storage and will be drained to the sewer network at a permitted rate by the Thames Water. We will be liaising with Canal & Rivers Trust and Thames Water Utilities Ltd during the detail design in order to get their approvals.

Party wall surveyors are being appointed currently, the correspondence will be added to the BIA while the pre-commencement works progresses.

9 GROUND MOVEMENT ASSESEMENT (GMA) BY RSK

RSK Environmental Ltd have been appointed to carry out the Ground Movement Assessment (GMA) and their findings and conclusions are shown on Appendix 3.

The Ground Model design parameters presented in Table 10 are based on the Phase ll site investigation data mentioned above.

Table 1: Ground Model Parameters

Material	Young's Modulus (kN/m^2)	Young's Modulus – Increase with Depth ($kN/m^2/m$)	Poisson's Ratio
Made Ground - Undrained	15,000	-	0.5
Made Ground - Drained	12,000	-	0.2
London Clay Formation - Undrained	32,000	1,756	0.5
London Clay Formation - Drained	25,600	1,405	0.2
Lambeth Group (Cohesive) - Undrained	72,000	5,200	0.5
Lambeth Group (Cohesive) - Drained	57,600	4,160	0.2
Notes: Uncharacteristically low SPT N Values from dynamic sampling locations have been ignored due to the known overly efficient nature of testing when undertaken in lower strength sensitive soils.			

Table 10: Ground Model Parameters

10 AUTHOR'S QUALIFICATIONS

GD Partnership Ltd.

The author Rudy Djajasaputra is a director of GD Partnership Ltd. He is a Chartered Engineer and has been a member of the Institution of Structural Engineer since 1993. He has been involved in many basements design and construction in London including recent major projects on excavation adjacent to one of the busiest Network Rail at Selly Oak and Redhill Warwick Quadrant Re-development.

Rudy Djajasaputra BSc(Hons), CEng, MIStructE

The report has been reviewed by:

1. Peter Gower is also a director of GD Partnership Ltd. He is a Chartered Engineer and has been a member of the Institution of Structural Engineer since 1987.
   Peter Gower B.Tech (Hons), C.Eng, MIStructE

RSK Environment Ltd

Dr. Shon Williams is a Director of Geotechnics of RSK who has been appointed to provide preliminary Ground Movement Assessment (GMA).
Shon Williams BSc PhD CEng MICE

Water Environment Ltd

Dr. Tony Clothier is a director of Water Environment Ltd. has been appointed to provide Flood Risk Assessment (FRA) report for the project including the hydrology of the site.
Tony Clothier PhD, BSc Eng, (Civil) CEng, CEnv, MCIWEM