10 Construction Methodology / Engineering Statements

10.1 Outline Geotechnical Design Parameters

The conservative geotechnical parameters have been determined based on the site investigation data presented in the appendices of this report and standard technical guidance. A summary of the ground model and design parameters is presented below.

Soil type	Elevation of top of stratum (m OD)	Bulk unit weight, gγb(kN/m³)	Drainage Type	Angle of internal friction, φf' (°)	Effective cohesion, c' (kPa)	Eu/cu	Undrained shear strength, Cu_o (kPa)	Delta Cu (kPa)	Undrained Youngs Modulus Eu_o (kPa)	Delta Eu(kPa)	Drained Young's Modulus, E'_o (kPa)*	Delta E'(kPa)*
Made Ground	17.50	18	Drained	28 (**)	0	-	-	-	-	-	5000	-
London Clay (for Raft design)	12.00	20	Undrained A	23(**)	0	425	50	8	21250	3400	17000	2720
London Clay (for Retaining Wall design)	12.00	20	Undrained A	23(**)	0	600	50	8	30000	4800	24000	3840
Lambeth Group (Top)	-4.00	20	Undrained A	24(**)	0	600	100	11	60000	6600	48000	5280
Thanet Sands(**)	-21.00	20	Drained	28(**)	0	-	-	-	-	-	300000	-

10.2 Outline Temporary and Permanent Works Proposals

10.2.1 Foundations

The proposed foundation solution is a ground bearing raft, 1.70m thick, throughout the entire development. Local thickening may be required to facilitate lift pits and manholes, but this is subject to detailed design at the following stages.

10.2.2 Retaining Walls

The proposed retaining wall solution is a secant piled wall utilising 750mm diameter piles. 900mm piles are allowed for at all areas over the exclusion zone of Piccadilly line due to the limited available depth. Secant piles have been adopted to provide a temporary watertight solution to prevent perched water entering the excavation during the excavation stage of construction. In the permanent case, an RC liner wall will be constructed in front of the piled wall to ensure a watertight solution.

10.2.3 Temporary Works

The most common method of basement construction, bottom up sequence, is being proposed. This method generally offers a simpler methodology and involves constructing the substructure followed by the superstructure. The proposed bottom up sequence is illustrated below.

The project requires the demolition of the existing structure before the start of the temporary works. Firstly, the existing structure will be demolished up to ground floor, followed by installation of the perimeter retaining secant pile wall and capping beam at ground floor level.

Before the demolition continues from ground floor slab down, the retaining wall will be propped horizontally, this allows further demolition and excavation of the site. The final design of the temporary propping will be the responsibility of the main contractor however assumptions have been made to develop the basic design.

That allows as last step to construct the raft, followed up by a typical bottom up construction.

10.2.4 Permanent Structure

The permanent structure i as described in Sections 4 & 5.

10.2.5 Drainage Strategy/ SUDS Proposals (including assessment calculations)

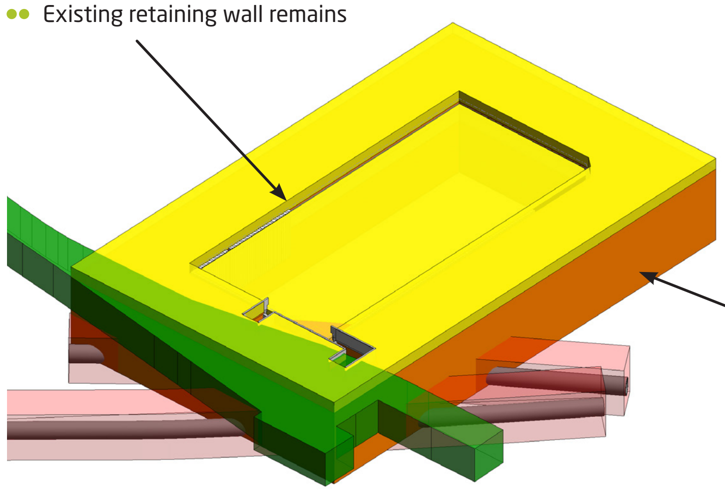
Drainage strategy / SUDS proposals (including assessment calculations) as described in the Flood Risk Assessment report included within Appendix 03.

10.2.6 Flood Risk Mitigation Measures

Flood mitigation measures are also discussed within the Flood Risk Assessment report included within Appendix 03.

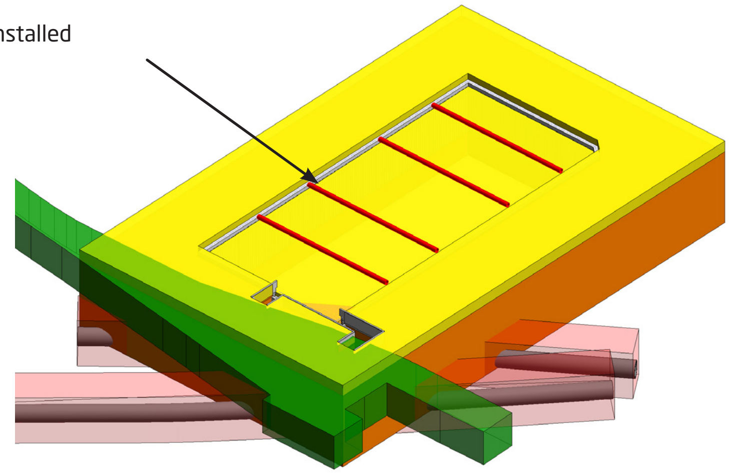
1.

- Site post demolition, clearance and enabling works
- Existing retaining wall remains



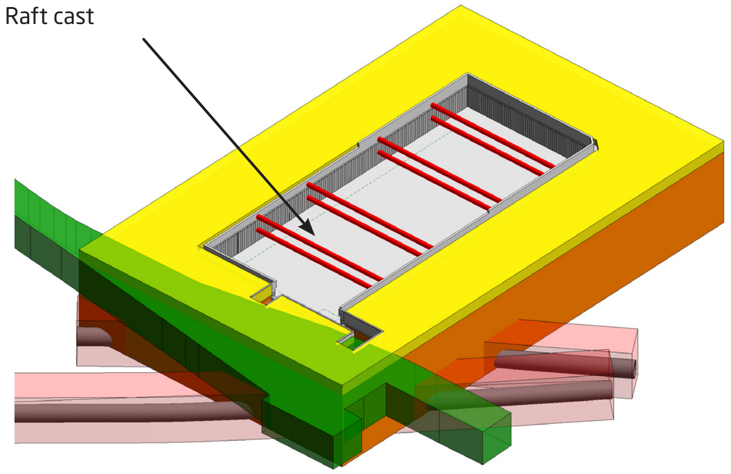
2.

- Perimeter retaining secant pile wall and capping beam installed
- Temporary props installed



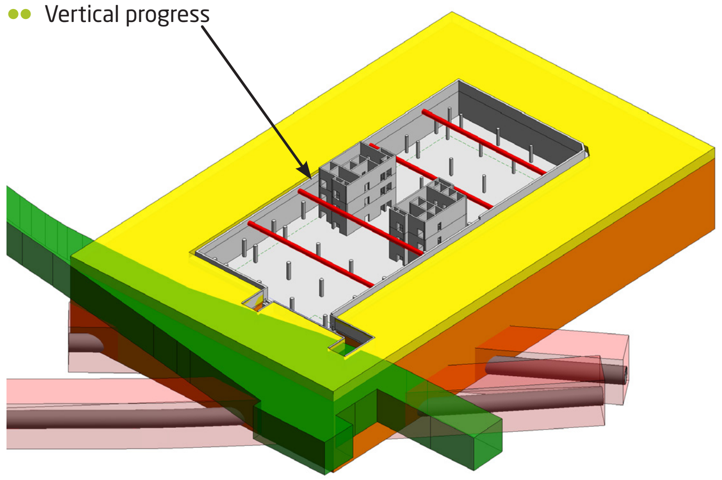
3.

- Excavation to formation level
- RC Raft cast



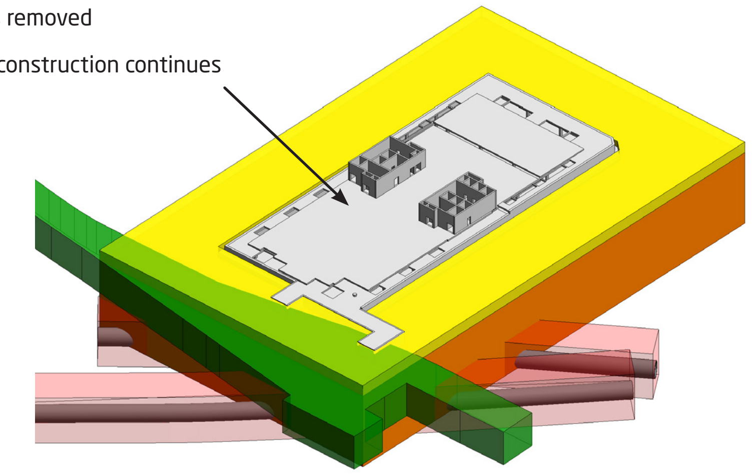
4.

- Core Construction begins from raft level
- Vertical progress



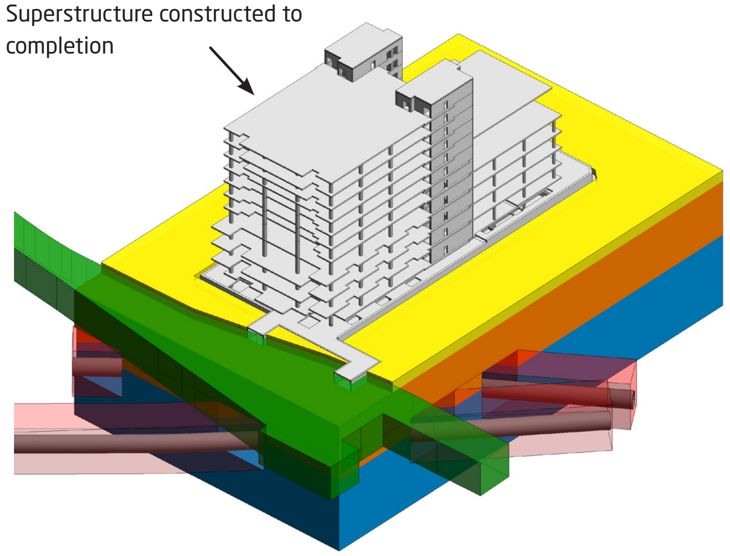
5.

- Lower ground slab cast
- Ground floor slab cast, all temporary props removed
- Core construction continues



6.

- Superstructure constructed to completion



10.3 Ground Movement and Damage Impact Assessment

A Ground Movement Assessment (GMA) has been carried out in accordance with CIRIA C760 and considers the construction methodology and site-specific ground and groundwater conditions.

A selection of the worst case scenarios for the properties within the zone of influence have been assessed. Foundation depths have not been confirmed for all neighbouring buildings due to their distance from the proposed basement. The maximum proposed basement excavation is approximately 17.25m. All neighbouring properties are well outside the zone of influence for undermining (45 degrees from lowest depth of excavation) and explicit foundation depths are therefore not required.

Also assessed are the 3rd party assets deemed to be at risk within the zone of influence. Similar to the Building Damage Assessment (BDA) described above, the worst-case sections within the zone of influence have been assessed.

The following reasonably conservative assumptions have been made within the GMA:

- reasonably conservative soil properties adopted
- asset & property structural stiffness ignored (greenfeld movements)
- minor unloading from single storey buildings ignored for permanent loading condition (i.e. maximum settlement)

The ground movements resulting from the works are:

- movements due to installation of the retaining wall
- movements due to excavation,
- movements due to unloading,
- movements due to reloading (proposed development)

The structures highlighted on the site constraints drawings, refer to Appendix 01, have been identified as potentially within that zone of influence, summarised as follows:

- Highways: The proposed basement construction is adjacent to public roadways on all four sides. An Approval In Principle (AIP) document will be required in accordance with the provisions of the Highways Agency and the London Borough of Camden.

With the proposed building having a two-storey basement and surrounded by roads (with Euston road at the North) on all sides, the risk of damage to any surrounding property is extremely low. For this reason, a worst-case assessment has been made using the following assumptions:

- Maximum proposed basement depth (maximum ground movements)
- Minimum distance to any surrounding property (maximum ground movements)
- Masonry building construction (most suspectable to damage in the Burland assessment of damage)

In accordance with the Burland Scale, the damage impacts are assessed as Category 1 (very slight). Refer to appendix for full calculations and assessment.

The damage assessment undertaken on the surrounding Thames Water infrastructure are all within acceptable limits. Refer to appendix for full calculations and assessment.

10.3.1 Assessment of LUL Assets

For the Piccadilly tunnel below the site a stress assessment with Pdisp will been carried out to understand the change in deflection and curvature during construction (short term) as well as the long term (permanent structure) in the next stage.

Any potential heave due to demolition and excavation will be accounted for in the construction sequence by potentially using the demolition waste to fill the existing basement in order to avoid excessive unloading.

The impact on the metropolitan line has been assessed and is within the anticipated limits. At the next stage, a more detailed analysis will be undertaken in line with TfL requirements. This BIA will additionally be used as the basis for the Approval in Principle document and issued to TfL separately. As already communicated with TfL, further and more detailed analysis and approval process will be carried out during the following stages.

10.3.2 Further GMA Analysis

The GMA assessments undertaken to determine the acceptability of the proposed basement scheme with respect to asset and neighbouring property damage is being submitted to the relevant parties as part of the consultation processes. If additional analysis is considered necessary, the initial calculations will be expanded upon through more rigorous analytical processes to meet any specific requirements of the third parties.

As dialogue continues with third parties, assumptions relating to location, fabric and condition of adjacent / underground structures may change. For example, the Line, Level and Conditions surveys of the Thames Water sewers are not yet complete and may require an update to the damage assessment when confirmed.

Progress with the 3rd parties is included within Appendix 04.

10.4 Control of Construction Works

A regime of surveys and monitoring of the surrounding building, third party assets, proposed/existing retaining walls and adjacent pavements will be implemented to ensure the construction works is in compliance with the movement analysis and damage assessments.

Appropriate green, amber and red trigger levels shall be set with reference to relevant CIRIA guidance documents on the observational methodology. The scope of monitoring may include the following:

- Movement monitoring of structures in the immediate vicinity via targets surveyed using electronic levels.
- Vibration monitoring using transducers placed on the foundations of the adjacent buildings.
- Crack monitoring via the use of graduated tell-tales.
- Movement monitoring of retaining wall/capping beams via targets surveyed using electronic levels.
- Monitoring of adjacent pavement levels via studs surveyed using electronic levels.
- Monitoring of retaining wall movements via use of Inclinometers cast in secant piles.
- Potential use of extensometer bored in place to monitor heave movements in clay.

Reference is also drawn to the Draft Construction Management Plan (CPM) included with the planning submission and the notes related to phasing contained within this report. This will be further developed during subsequent stages of design and planning of the works following discussions with and the appointment of a main contractor.

11 Basement Impact Assessment

11.1 Conceptual Site Model (CSM)

The Conceptual Site Model (CSM) as described throughout this report is summarised below:

- The ground conditions are described in Section 10 and Appendix 2.
- Perched water may be present in the Made Ground. According to the SI, this is only local and in negligible quantities.
- The existing structure on site is an industrial building and is founded on London Clay with an existing basement. The condition of the basement of the neighbouring properties is unknown at this stage, however, due to the distance of these from the basement, the depth of foundations is not critical to the damage assessments and a conservative approach assuming all foundations at ground level has been adopted. Undermining of these structures is not a risk.
- The proposed development will be founded in the London Clay formation at +17.25m AOD adopting a raft solution.
- There are no adjacent structures/basements to the proposed development as its surrounded on all side by public highways.
- The distance to the highway/footpath is approximately 1m from central line of proposed secant retaining wall.
- Adjacent utilities are located on all sides beneath the pavement and highway. These are indicated on the site constraints with levels and materiality based on initial stat information provided by the asset owners. Consultation is underway with all 3rd parties.
- There are no significant impacts expected to the surrounding infrastructure as concluded through this BIA process due to ground movements. There is also no significant impact expected to the surface water flooding or ground water plan.
- Although there are no specific proposed mitigation strategies, betterment to the existing public drainage system and risk of surface flooding is presented by the proposed SUDS design.
- Residual impacts are negligible however, as discussed in Section 10.4, construction works will be monitored throughout to ensure compliance with the movement limits and associated damage defined by this GMA process.

General arrangement drawings and sections, included within Appendix 01, 05 & 10 of this report, reflect the CSM info presented above. This information is the basis of all GMA and DIA assessments undertaken, the result of which are included within this section of the report.

11.2 Land Stability/ Slope Stability

- The London Clay is expected to provide a suitable founding stratum at approximately +17.00m AOD following the results of the Site Investigation.
- The risk of movement and damage to this development due to shrinkage and swelling of the London Clay is not deemed to be a risk considering the depth of the foundation within the London Clay and the ground bearing raft foundation.
- A Ground Movement Assessment has concluded that ground movements caused by the excavation and construction of the proposed development will not present a significant risk to the stability of the proposed or any adjacent structure. The Damage Impact to surrounding structures within the zone of influence has been assessed as Category 1 (very slight) in accordance with the Burland Scale.
- The BIA has concluded that there will not be risk(s) or stability impact(s) to the development and/or adjacent sites due to slopes.

11.3 Hydrogeology and Groundwater Flooding

- The BIA has concluded there is a very low risk of groundwater flooding. Mitigation measures are not deemed necessary to the proposed development or surrounding infrastructure.
- The BIA has concluded there are is no impact to the wider hydrogeological environment and no mitigation measures are therefore proposed.

11.4 Hydrology, Surface Water Flooding and Sewer Flooding

- The BIA has concluded there is very low risk of surface water/ sewer flooding however a SUDS design working to greenfield runoff rates is being proposed as a betterment to the current situation. This will reduce the risk of surface and sewer flooding in the vicinity if the site.
- The BIA has concluded there are no impacts to the wider hydrological environment and therefore no mitigation measures are proposed.
- Refer to the FRA and SUDS report included within the appendices of this report for full details of the assessment.

12 Design Standards

12.1 Design Standards and Guides

The building will be designed in accordance with the following standards. For the sake of brevity. National annexes are not listed.

- BS EN 1990 - Basis of structural design
- BS EN 1991 - Action on structures
- BS EN 1992 - Design of concrete structure
- BS EN 1993 - Design of steel structures
- BS EN 1994 - Design of composite steel and concrete structure
- BS EN 1997 - Geotechnical design

Additional guidance on geotechnical aspects and issues relating to the basement impact has been taken from the following:

- CIRIA C760 - Guidance on embedded retaining wall design, Gaba et al, CIRIA
- Concrete Basements - Guidance on the design and construction of in-situ concrete basement structures, Narayan & Goodchild, Concrete Centre.