Daleham Gardens
Stage 3 - Report

RP-001_Rev00

May 2023

www.simple-works.co.uk

Table of Contents

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Approved	PI

1 Introduction

Simple Works has been appointed by NW3 CLT to develop a structural scheme for the proposed development of a plot of land on Daleham Gardens. This report outlines the work completed for Stage 3 of the proposed works at 31 Daleham Gardens, London, NW3 5BU. It includes the assessment of the existing site information and constraints, preliminary structural options for the superstructure and substructure works, and outlines the key opportunities, constraints, and risks to the project.

The current proposal for the project involves the erection of a new five-storey residential dwelling. The site previously comprised a residential block of flats that was damaged by fire and has recently been demolished.

2 The Project

The new project will involve the construction of a six-storey residential building, comprising of fourteen flats and a duplex located in the upper floors. Due to the sloping nature of the topography, the project will also involve the construction of a lower level which will be partially a basement, for which an arrangement of retaining walls will be needed in conjunction with the landscape proposal required throughout the site.

Figure 1: Render of proposed building (Mole Architects)

Figure 2: Proposed development within site context (Mole Architects)

3 The Site

3.1 Site Location

The site is located in the London Borough of Camden, between Hampstead Heath and Regent's Park. It is bounded by Daleham Gardens to the east, Gloucester House School to the north and a residential building to the south. The site is located in a predominantly residential area, with schools, restaurants and hotels nearby.

3.2 Site Description

The site has been recently cleared of the original 4-storey building due to the damage sustained in a fire accident. The site slopes about 4.5m towards Daleham Gardens. Vehicular and pedestrian access is from the east via Daleham Gardens.

3.3 Surrounding Buildings

To the north of the site is Gloucester House School and Akenside Road. To the east of the site is Daleham Gardens Road and some residential housing. To the south of the site there is more residential housing and Nutley Terrace road. Finally, to the west of the site there is a tree area separating the site from more residential dwellings.

3.4 Surveys/Tests

The majority of the surveys required for the early stage design have been carried out although some allowance should be made for carrying out additional surveys. A summary is outlined in the table opposite.

Survey	Description/status
Arboriculture	An arboricultural report was carried out on September 2021 by Sharon Hosegood Associates. The report can be found in Appendix E for further information.
Asset, GPR & utilities	Desk studies indicate the presence of a Network Rail tunnel under 31a Daleham Gardens, further surveys are required to establish location and depth of the tunnel. A utility search has also been undertaken and is presented in Appendix F.
CCTV	A CCTV survey was carried out in September 2021. This was used to coordinate the foundation design/locations with the below ground drainage and inform the drainage strategy. Refer to Appendix I for the full survey
Land Contamination	A Phase 1 desk study was carried out and flagged the risk of land contamination to be moderate. A full geotechnical investigation has been carried out. No further action is required. Refer to Appendix C for further information
Flooding	A Flood Risk Assessment has been carried out and outlines the development site is located within Flood Zone 1 'Low probability'. Flood risk from other sources has also been assessed as low. Refer to Appendix C for further information
Geotechnical	A full geotechnical investigation has been carried out by Geofirma in March 2023. Due to a significant depth of made ground found on the site, a further site investigation will be required to determine the made ground distribution more accurately. These will allow the design of the raft slab foundation in the next stages as well as the assessment of the feasibility/options for ground improvement techniques. The full report can be found in Appendix C
Topography	A topographical survey has been carried out by Edward Gardner Surveys in March 2022 and can be found in Appendix D
UXO	An UXO preliminary assessment by the contractor will be recommended before the commencement of the construction stage

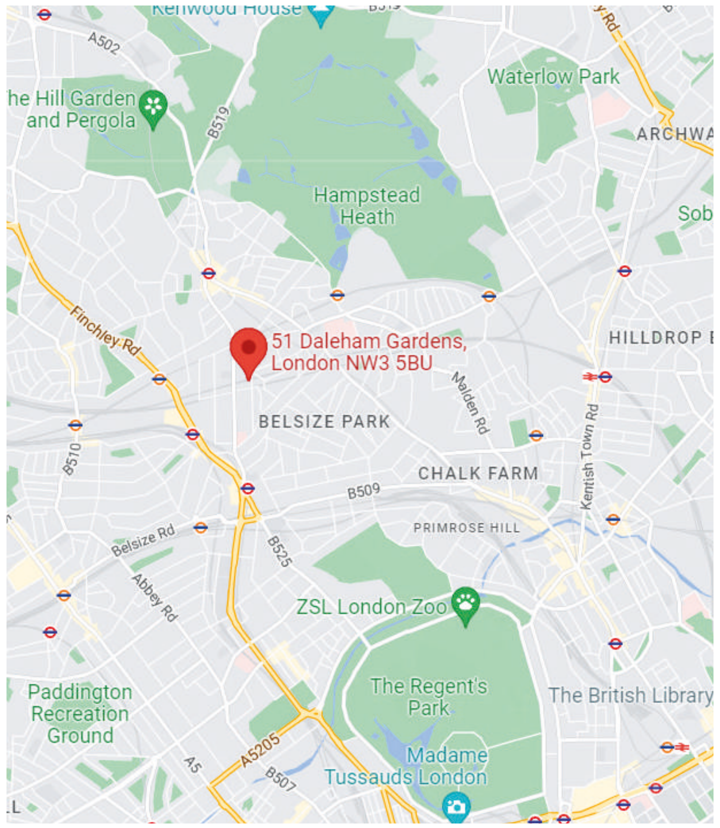


Figure 3.1: Map of site location

Figure 3.2: Annotated Site View

4 Site History

4.1 Archival searches (OS maps)

Information about the site history has been obtained from available online maps and the environmental report provided by STM Environmental in 2021.

Examination of Ordenance Survey historic maps revealed that the site and the surrounding area comprised open undeveloped land in c. 1866.

The surrounding area appears to have already been significantly developed for residential use and by c. 1894, resembled the original building.

By 1896, the site had been developed, comprising a building that resembles the last building that was recorded on site before the fire. The maps from c. 1957 show that The Belsize New Railway Tunnel had been developed.

4.2 Archaeology

The site and the study area are not located within any Archaeological Priority Areas (APAs) as per the London Borough of Camden Archaeological Priority Areas Appraisal published in October 2018. According to the British Listed Buildings database there are no listed buildings on or immediately near our site, the closest ones being St Mary's Convent School and 11/13 Wedderburn Road. It is relevant to mention that our site is located in the Fitzjohns and Netherhall conservation area.

4.3 Fire

A tragic fire took place in 2017 at the site, leaving the building unhabitable and abandoned for three years. Camden Council resolved to demolish the remains of the building onsite in 2020 for the public's safety, following ongoing fears over contamination from the structure as it stood; with the fire having exposed asbestos, as well as concerns over how stable the remnants of the building would remain if not pulled down.

As mentioned above, the site currently stands as an empty green area, and the upcoming site investigation will confirm whether the demolition did in fact remove all structural elements from site.

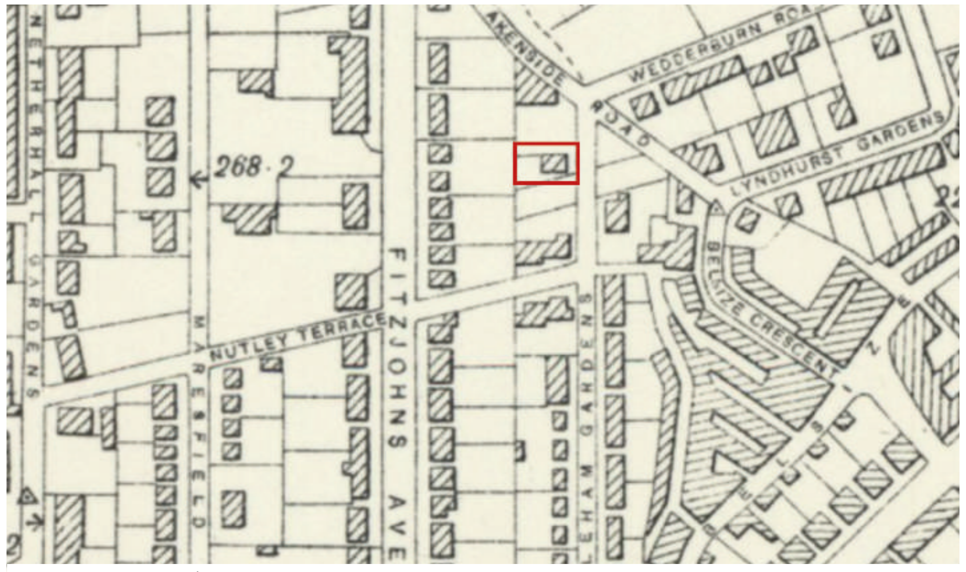


Figure 4.1: Archive map, 1894

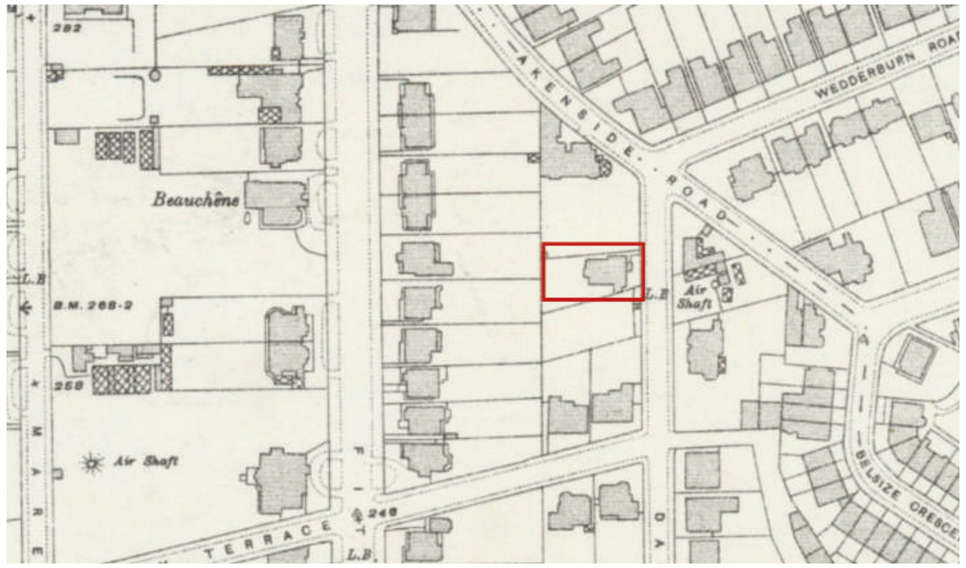


Figure 4.2: Archive map, 1915

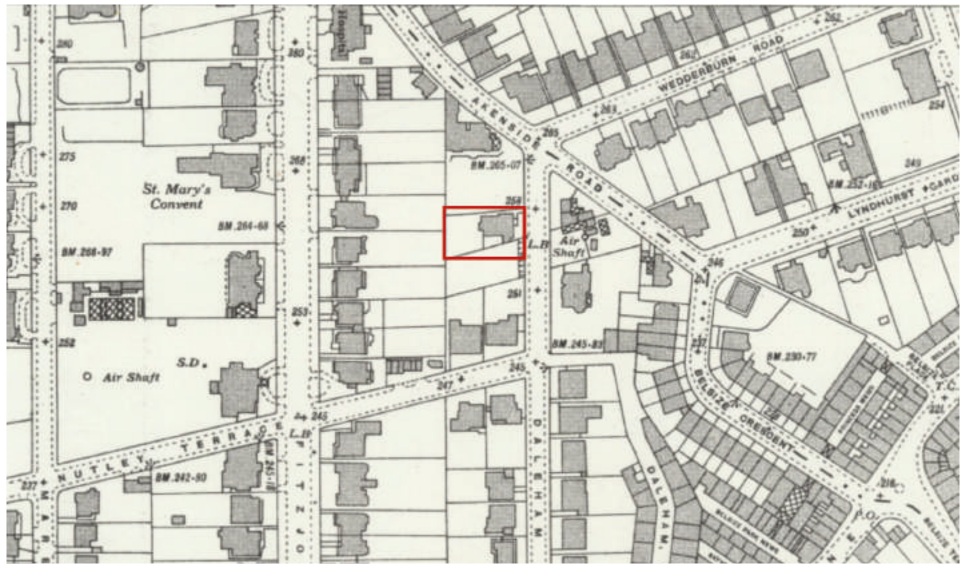


Figure 4.3: Archive map, 1935

Figure 4.4: Archive map, 1957

5 Ground Model

5.1 Historic BGS borehole records

British Geologic Survey (BGS) maps had no boreholes available in direct vicinity of the site. According to the STM Environmental Report, the bedrock geology consists of Claygate Member of the London Clay group (Sandstone), and no superficial deposits are indicated. The site is underlain by a Secondary A Bedrock Aquifer, with no surface water bodies located on or within 250m of the site. The information available on the three closest boreholes is summarised below.

1. TQ2711684876 indicates Made Ground was present to 1.5m, London Clay to 90m, various coloured clay to 105m, and running sands to the termination depth of 110m.

2. TQ28NE44 indicates topsoil was present to 5m, followed by Claygate to the termination depth of 12m.

3. TQ28SE2333 indicates Made Ground was present to 0.5m, followed by London Clay to the termination depth of 0.91m.

A significant depth of made ground is expected due to the demolition of the original building which had a partial basement.

None of the available BGS maps encountered any groundwater that could determine the ground water level.

5.2 Site Investigations

A site-specific geotechnical investigation has been undertaken by Geofirma in February 2023. The two borehole undertaken found made ground, overlying claygate beds, followed by London clays to a termination depth of 25m. The maximum depth of made ground encountered in the 2 boreholes undertaken was 3.6m.
According to the report, outside the area of the original building, the made ground was less than 1m. Based on the in-situ tests undertaken on the clay, it was found to be firm to stiff in strength and therefore, shallow foundations are proposed for light to medium loaded structures.
A shallow groundwater strike was encountered in one of the boreholes at 1.8m bgl. This is believed to be perched water according to the geotechnical report.

5.2.1 Environment Agency Classification

According to the STM Environmental Report, the risk of fluvial and tidal flooding is considered to be low. The site is located within Flood Zone 1, which is defined as land having less than 1 in 1,000 annual probability of river or sea flooding (<0.1%). The Environment Agency (EA) long term flooding maps indicate that the site is also at Low risk of surface water flooding. Low risk means that each year this area has a chance of flooding of between 0.1% and 1%.

The BGS groundwater flood maps indicate that the risk of groundwater flooding at the site is Negligible.

5.3 Ground Contamination

According to the contamination assessment carried out as part of the site investigations in March 2023,

A Tier 1 (generic) quantitative risk assessment has been undertaken by screening measured contaminant concentrations derived from the ground investigation works against reference values for chronic (long term) risk to human health known as Generic Assessment Criteria (GAC). Direct analysis of all the chemical assessment data indicates the contaminants are all below their relevant GAC for all contaminants within both the Made Ground and natural strata.

Although no elevated contaminants were encountered it was recommended that mitigation measures stated in Table 11 are adhered to. This is especially relevant due to the history of the site, even though the information in appendix J does contain information indicating the site clear up was performed to the satisfaction of Camden Council.

Based on the gas monitoring visits undertaken during the site investigations, ground gas protection measures are not considered to be required for this site.

Waste Acceptance Criteria testing was carried out on a single sample retrieved from TP3 at a depth of 0.1 m bgl within the Topsoil. A Loss on Ignition (LOI) of 10.1% and a Total Organic Carbon (TOC) of 5% were measured, which exceed the Hazardous Waste for LOI, and stable non-reactive hazard waste in a non-hazardous landfill criteria for TOC of 10% and 3% respectively.

The single sample tested is not representative of the considerable amount of material likely to be won during the excavation works required to form the basement. Therefore, further testing must be performed by the earthworks contractor during construction prior to removal of any soil off site to classify the site soils to be transported to a suitably licensed landfill facility to enable a more rigorous assessment to be undertaken.

Based on the findings of this Phase 2 report for the site the risks to human health are considered to be acceptably low, providing appropriate mitigation measures are adopted at the site. It is particularly important that the mitigation measures are employed during the earthworks because of the site history.

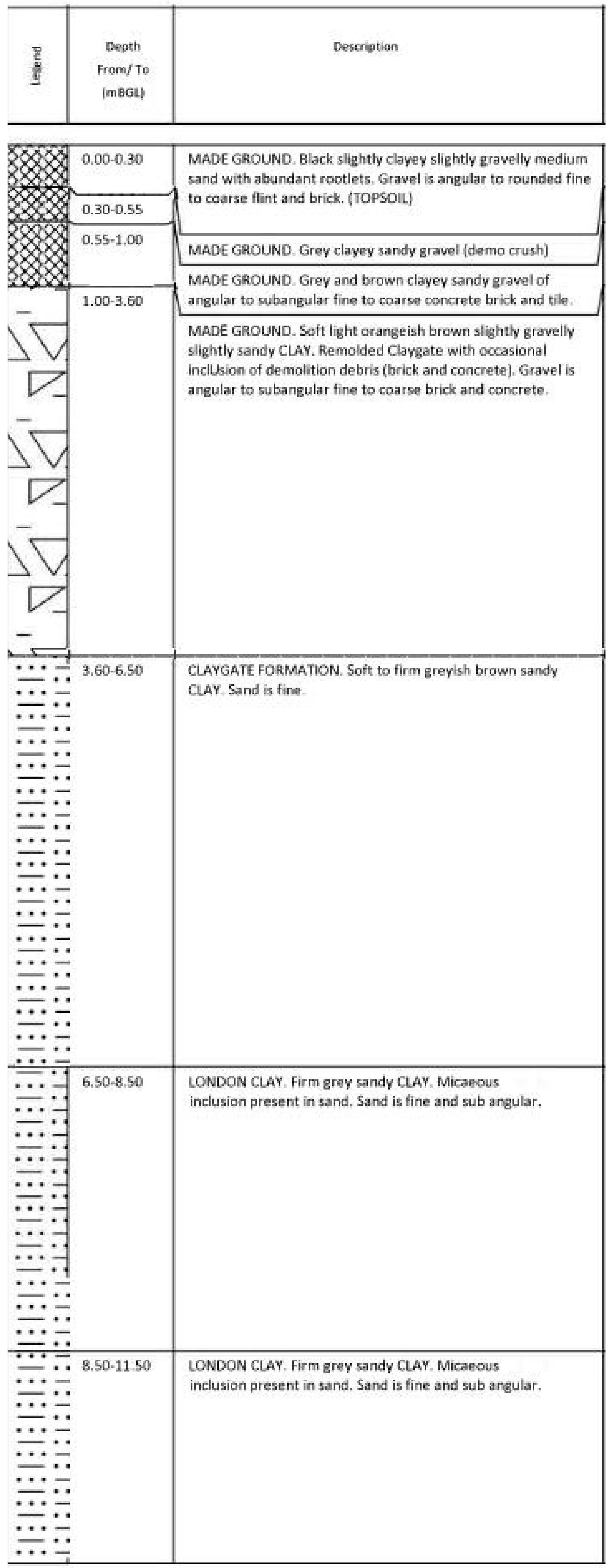


Figure 5.1: Borehole extract from Geotechnical Report

6 Site Constraints

6.1 Unexploded Ordnance (UXO)

According to online available risk map, the site and surroundings are in an area of moderate bombing density from World War II, although no specific information could be found in reference to our site. A preliminary site investigation will be recommended before the commencement of the construction phase.

6.2 Utilities

A utilities report is available and can be found in Appendix F. Several data and power cables, including BT and Virgin, pass through the adjacent road. The most relevant utility is a Vodafone data route that passes lengthwise across the site. This will need to be considered at future stages of the project.

6.3 Sewers

Using the CCTV survey, recent topographical survey and historic pre-demo surveys, the size and level of the existing drainage outfall was determined. Due to Lower Ground Floor level of the proposed development, the existing sewer is too shallow to re-use. It also has insufficient capacity to receive the increased flows of the re-development.

6.4 Levels

The site slopes throughout the terrain, particularly at the back. The western boundary level is around 53m AOD sloping down to 49.75m at the Eastern boundary limit. A topographical survey has been undertaken and can be found in Appendix D.

6.5 Trees

The arboricultural report outlines that the onsite trees do not pose a constraint. The retaining wall act as a root barrier to trees to the depth of its foundations and is highly likely a total root barrier. There is a London plane tree on the site which has a poor vitality - the overhanging dead branches should be removed and the crown pruned back so that the live branches are not newly exposed and end loaded.

6.6 Basement & foundations of existing structure

According to the foundation trial pits undertaken, the foundation remains of the original building were not found on the site. They are therefore likely to have been removed completely during the demolition of the original building.

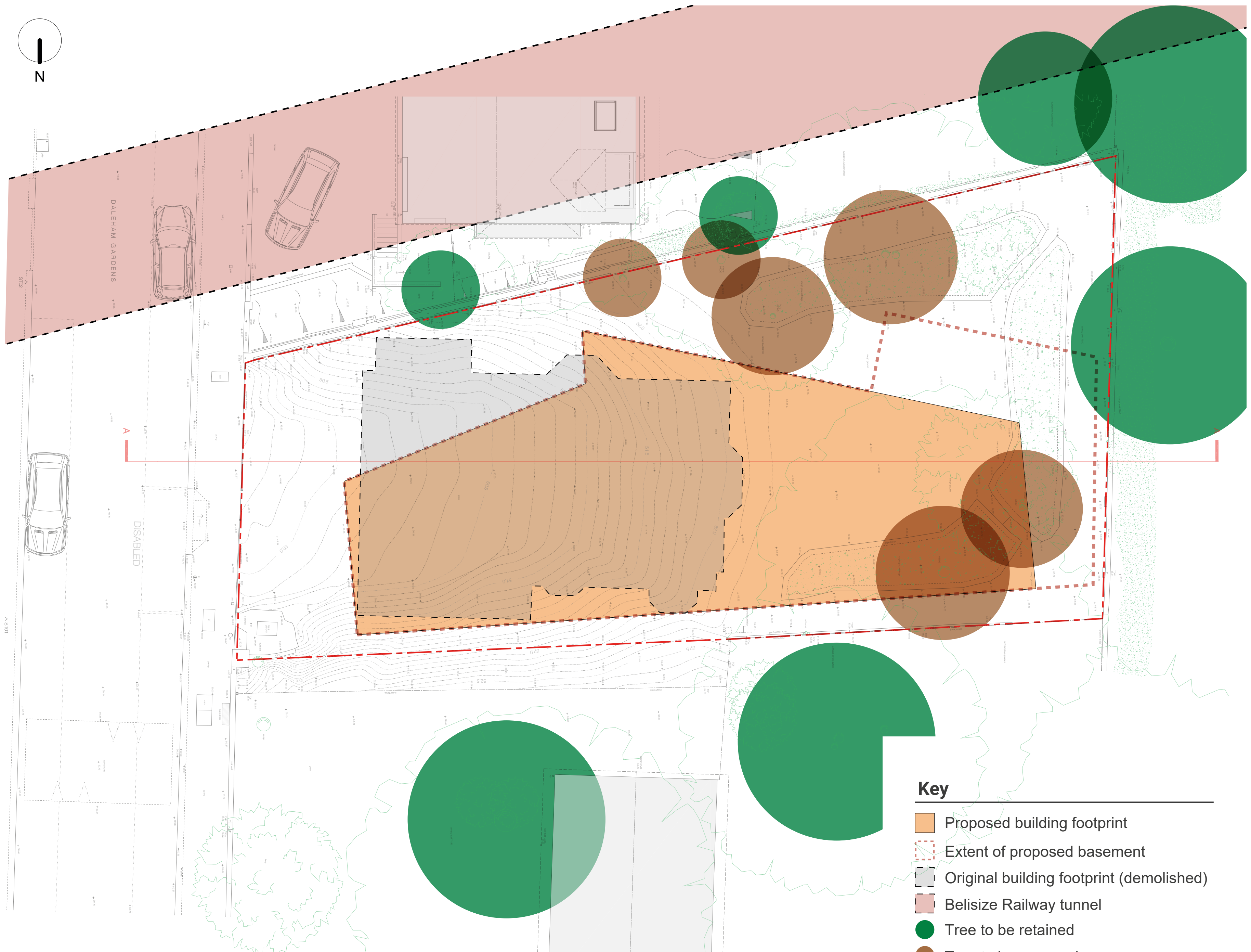


Figure 6.1: Site Constraints Sketch with topographical survey as background

6.7 Network Rail

Network Rail (NR) own the land adjacent to the site along the Southern boundary. On this land, there is a tunnel passing underneath the adjacent residential house running east-west. Works adjacent to and within the Zone of Influence of Network Rail' tunnels that may have an adverse effect on the tunnel structure include, but are not necessarily limited to:

- Demolition of any buildings or structures.
- Any ground investigation works.
- Any excavations or earthworks.
- Any ground improvement (piling, vibro-compaction, grouting, etc.).
- Any new construction.

Loads induced by temporary works and plant.

Network Rail's Engineer is to approve details of any development works within 15m, measured horizontally, from the outside face of the tunnel extradites with special reference to:

- The type and method of construction of foundations
- Any increase/decrease of loading on the tunnel both temporary and permanent. Certified proof that the proposals shall have no detrimental effect upon the tunnel will be necessary.

Any proposal must not interfere with Network Rail's operational railway nor jeopardise the structural integrity of the tunnel, and it is important that no work on site results on ground movements that could impact the rail lines.

As part of the approval process by Network Rail the design team will need to submit documentation for an Approval in principle according to National Rail guidelines. A series of requirements are also specified in the guidance, a summary is included below:

1. A correlation survey of the site locating and verifying the depth and position of the tunnel.
2. Ground movement analysis outlining any movement imposed and additional stresses on the tunnel
3. Monitoring of the train tracks might also be required following the outcome of the Approval in principle.

As at the time of the report, the location of the tunnel is being established through record drawings provided by National Records Centre of the Network Rail. This will need to confirmed by the survey as per above. The interaction between the ground layers and the foundation will determine the impact the building will have on the tunnel. Different types of foundations will also result different stresses and movement of the tunnel. Through liaison with the soil consultant (Geofirma) and with the information collected up to this point a raft slab foundation is believed to give minimal impact on the tunnel. Further soil investigations are required to confirm the current assumptions.

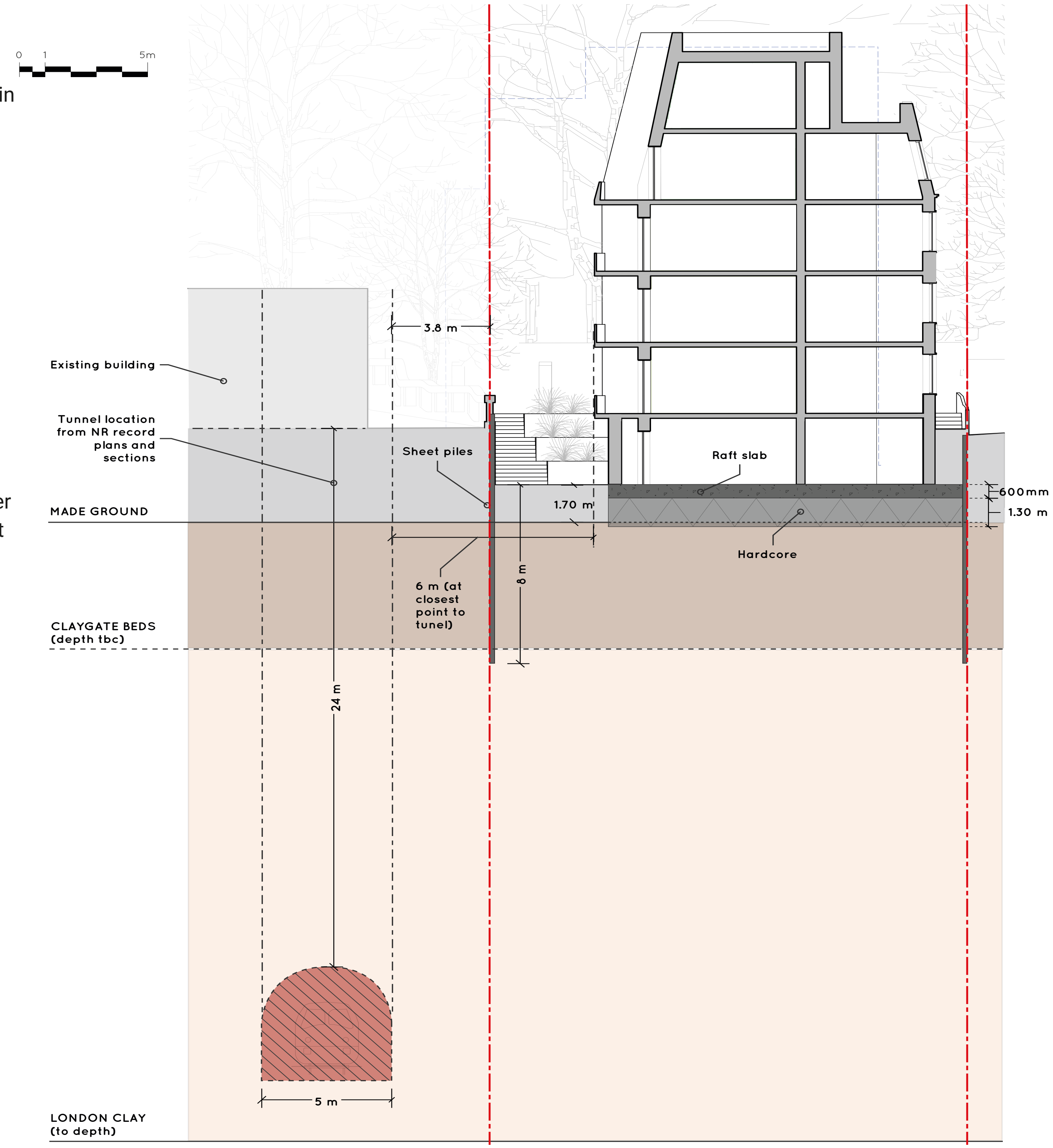


Figure 6.2: Section showing approximate assumed tunnel location relative to proposed development

7 The Climate Emergency

Our present climate emergency requires all of us to take immediate action on the release of carbon dioxide into the atmosphere. Reaching zero-carbon emissions by 2050 will give us a good chance of limiting global temperature rise to 1.5C. Buildings and construction currently account for around 40% of energy-related CO2 emissions - we require deep changes across the design, construction, use and reuse of buildings and infrastructure if we are to have a chance of achieving the required objectives.

Contributing to the built environment in 2022 is set against a back-drop of some key metrics, including:

• The UK Government is committed to net-zero emissions by 2050.

• The Royal Institute of British Architects has set targets for the built environment of reducing embodied carbon by 50–70% by 2030.

• 39% of global energy related CO2 emissions is accounted for by the built environment whilst construction generates 13% of global GDP

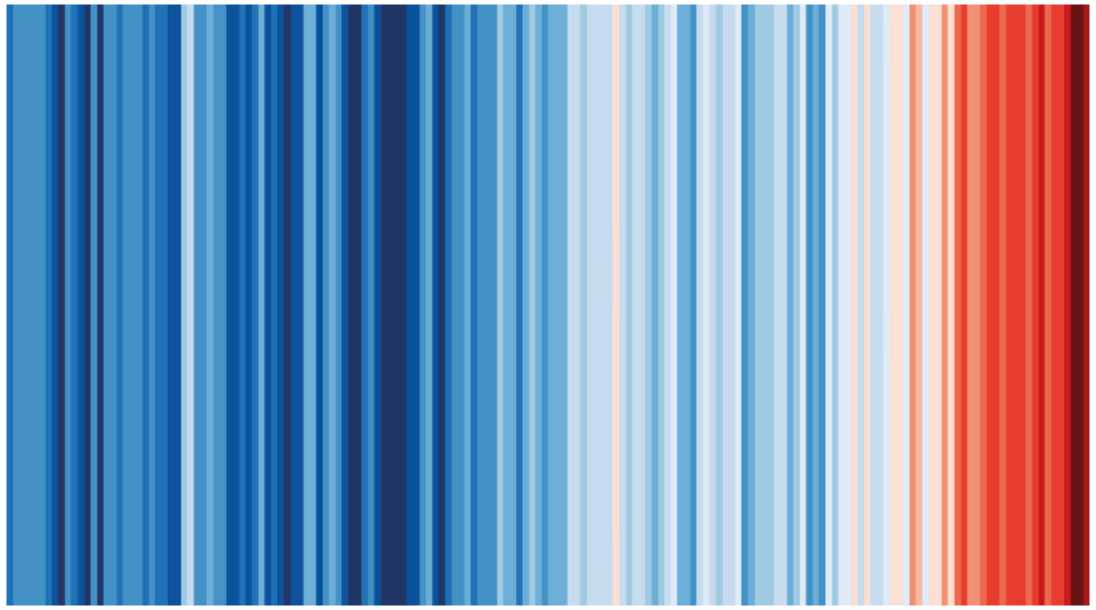


Figure 7.1: Average annual temperature since 1850 (each line represents one year)

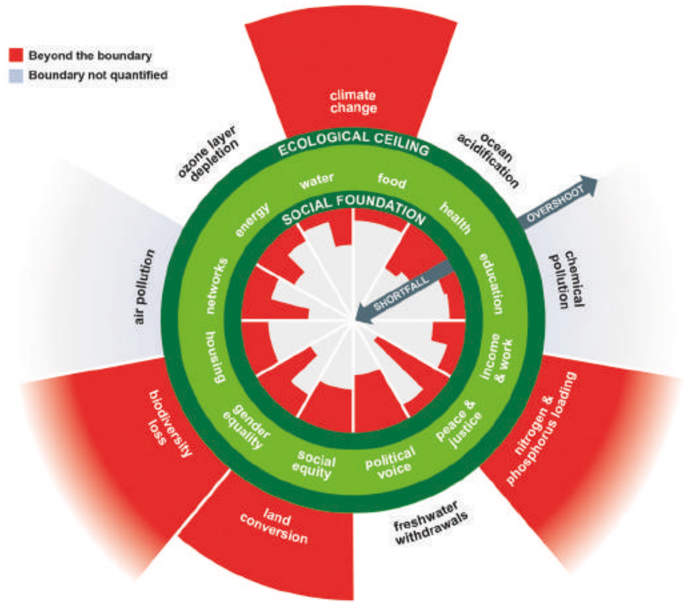


Figure 7.2: Planetary Boundaries (Kate Raworth - Doughnut Economics)

7.1 The Planetary Boundaries

To contextualise the damage we're doing to the planet, it helps to have a framework in which to measure it and understand it. Planetary boundaries are a powerful tool to do this, as they offer us the thresholds within which humanity can survive, develop and thrive for generations to come.

These boundaries have been used to build the Doughnut of social and planetary boundaries (Kate Raworth – Doughnut Economics), a brilliant concept that outlines 9 ecological boundaries which define a ceiling that the planet can ecologically sustain and 12 social foundations which define a minimum threshold of basic needs all citizens of planet earth should be entitled to.

The idea is that we should all be living within the doughnut - everyone's basic needs should be met without exceeding the ecological capacity of the planet. However, the reality is that we are currently exceeding our planet's ecological ceiling in four different areas and falling short of the social foundations in nearly all areas when measured globally.

Figure 7.2 shows one version of the doughnut, where the four different ecological boundaries we are currently exceeding (climate change, nitrogen and phosphorus loading, land conversion and biodiversity loss) have been outlined, and Table 7.1 shows how the built environment is contributing to the degradation of these boundaries. The aim of a regenerative design strategy would therefore be to reverse the damage caused in each of these areas.

Table 7.1: How is the built environment contributing to exceeding the different ecological boundaries?

Biodiversity loss	Urban areas and infrastructure cross through continuous habitats and fragment them, isolating entire ecosystems. Urban areas are also favourable for invasive species, as they are more adaptable to high levels of disturbance than native ones. Humans importing non-native plans and animals for ornamental values drastically alters biological communities. Furthermore, impermeable urban surfaces, such as concrete and asphalt, cannot absorb rainwater and contribute to stormwater flooding that eventually carries pollutants to the seas.
Climate change	Cities account for more than 70% of C02 emissions and consume two thirds of the world's energy. Transportation, energy production and buildings are the primary sources of these emissions Manmade materials such as asphalt, cement or glass create an "urban heat island" by absorbing more solar radiation than vegetated land. This causes cities to experience annual mean air temperature as much as 1-3°C warmer than the surrounding land. Higher temperatures increase summertime peak energy demand due to air conditioning, increasing cities' contribution to climate change.
Land conversion	Rising populations expanding urban land area is responsible for 10% of the global deforestation. Unsustainable logging for timber building products also contributes to global deforestation, and in a more indirect way – but still direct - steel for structures, metals and minerals for electronic products and energy resources can drive deforestation through mining.
Nitrogen and phosphorus loading	Sewage is laden with N and P, yet over 80% of global wastewater is discharged without treatment. Parks, gardens and other landscaped elements in urban areas are heavily fertilised, and nutrients enter the sewage system leading to eutrophication. Cities area also sinks for agricultural products; driving demand for food, biofuels, cotton and other agricultural products and propelling the industrial application of nutrients in large-scale agricultural practices.

7.2 Regenerative Design

Regenerative design is a process-oriented whole systems approach to design. It describes processes that restore, renew or revitalize their own sources of energy and materials. Regenerative design creates resilient and equitable systems that integrate the needs of society with the integrity of nature. Regenerative design is about ensuring the built environment is not only sustainable, but has a net positive impact on natural systems.

Figure 7.3 shows the environmentally conscious project design sphere. The design sphere is imagined here as a continual to reflect the fact that we are dealing with an interconnected system and that decisions which fall into one category will impact another (for instance, more reuse means less new materials).

We believe that all new projects should start at the 'reuse/refurb/retrofit' question and decision making follows on from that. The most important point is that thinking regeneratively means we think about every component of the circle: it's not individual parts that matter but the whole cycle.

So, what might a regenerative design approach in the context of construction look like? At a high level, it's surprisingly simple. We would take the planetary boundaries, set ourselves the goal of reversing the ones we have exceeded, and put in place safeguards to ensure we don't exceed the ones we yet haven't.

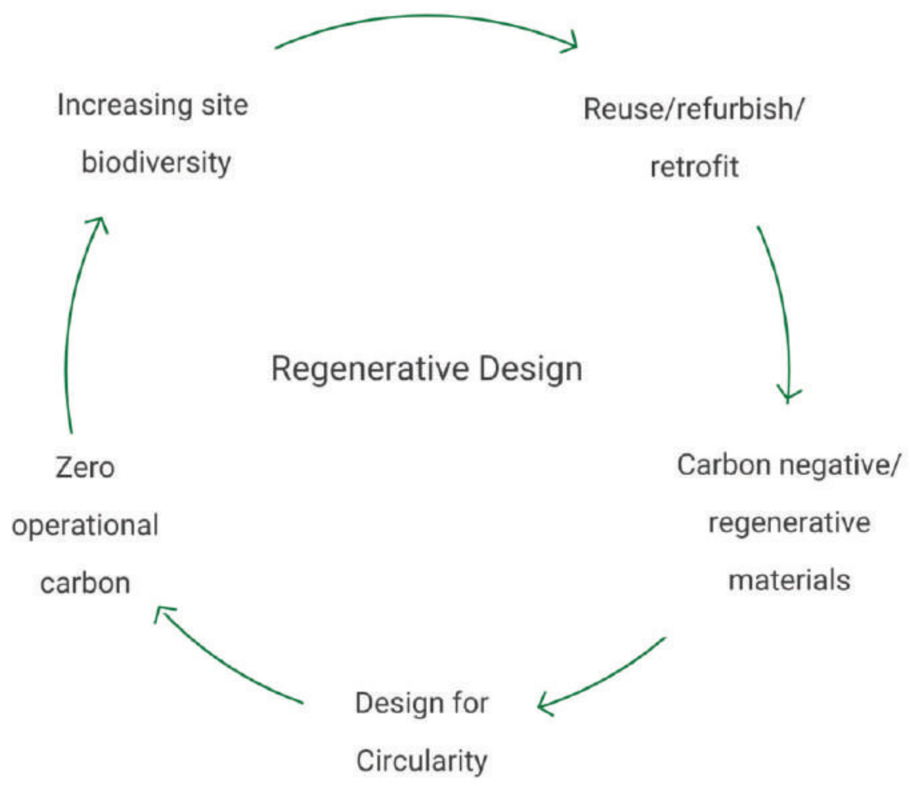


Figure 7.3: Environmentally conscious project design sphere

7.3 The Living Building Challenge

Being able to measure and evaluate projects is imperative to understanding their impact and understanding how we can improve our designs to make them regenerative.

The Living Building Challenge (LBC) is an appraisal scheme aimed specifically at assessing a project's regenerative attribute and provides a comprehensive set of criteria which could be used for carrying out appraisals. The challenge is a philosophy, certification, and advocacy tool for projects to move beyond merely being less bad and to become truly regenerative.

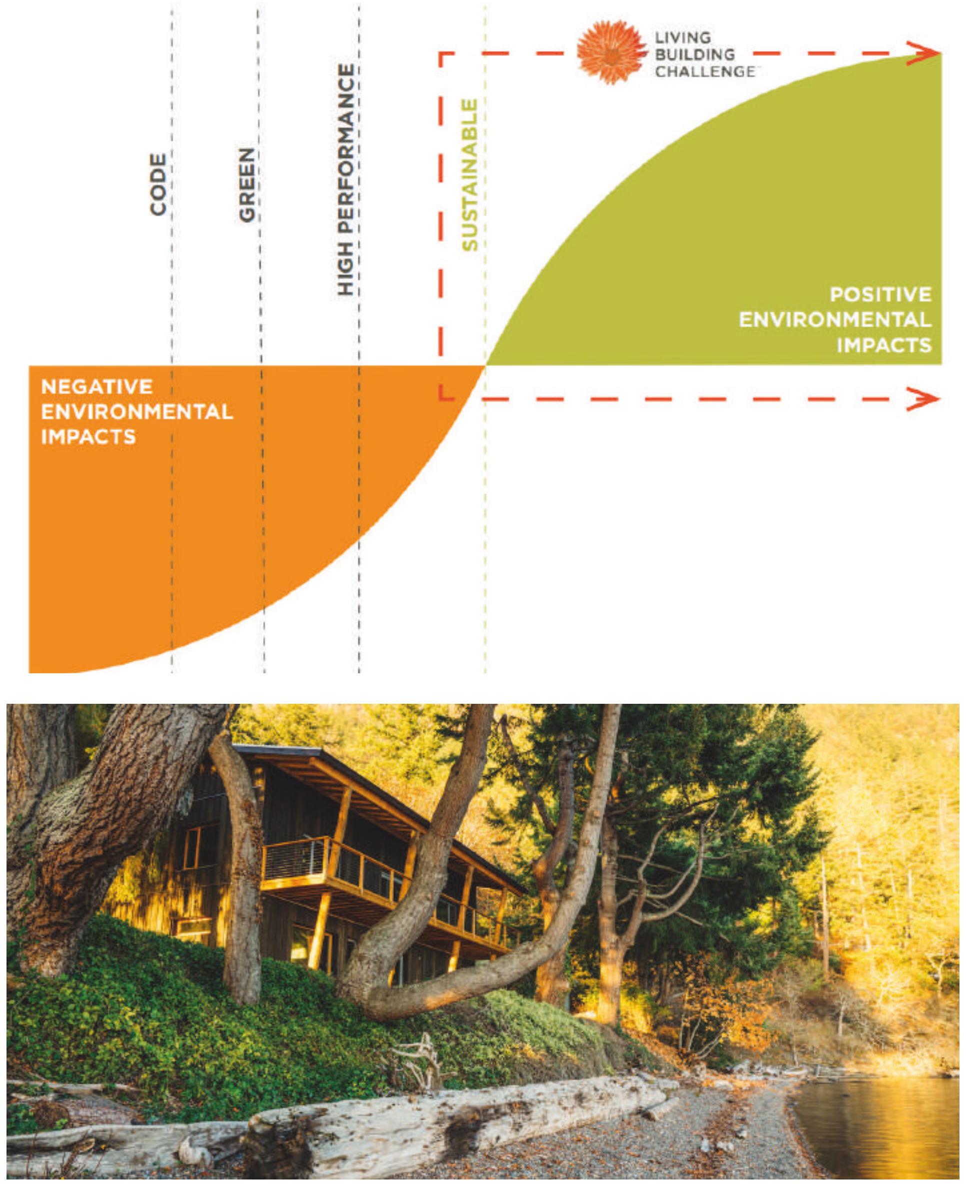


Figure 7.4: The Green Point Project in Canada (bottom) and LBC framework diagram. (top)

The LBC metrics have been developed over several years with the latest version arranging 20 "imperatives" under seven "Petals" (as shown in Table 7.2 below).

Table 7.2: LBC metrics (right).

"Petal"	"Imperative"
Place	1. Ecology of Place 2. Urban Agriculture 3. Habitat Exchange 4. Human Scaled Living
Water	5. Responsible Water Use 6. Net Positive Water
Energy	7. Energy + Carbon Reduction 8. Net Positive Energy
Health and Happiness	9. Healthy Interior Environment 10. Healthy Interior Performance 11. Access to Nature
Materials	12. Responsible Materials 13. Red List 14. Responsible Sourcing 15. Living Economy Sourcing 16. Net Positive Waste
Equity	17. Universal Access 18. Inclusion
Beauty	19. Beauty + Biophilia 20. Education + Inspiration

8 Regenerative Opportunities in Daleham Gardens

8.1 Increase site biodiversity

One way of increasing a site's biodiversity is by restoring degraded ecosystems. Due to our site having been through a fire, replanting areas or considering how to solve contamination problems due to the fire would be a great way to regenerate the space. A specialist ecological consultant should be consulted to determine the most appropriate species for the site but given the proximity of the canal there may be good possibilities. Other measures such as introducing a green roof, promoting native landscaping, using permeable pavements or protecting the trees adjacent to our site are measures which would boost the site's biodiversity.

8.2 Reuse/refurbish/retrofit

Circular materials flows can be categorised hierarchically in order of environmental damage mitigation:

1. Life extension – use materials longer to reduce total throughput.
2. Direct reuse – give materials new life in their current state.
3. Re-manufacturing – upgrading obsolete elements while directly reusing still-current elements.
4. Recycling – reducing a product to its basic materials for reuse, as a last resort.

In our project's case, there is no existing building that we can possibly reuse or retrofit, but we can look for these opportunities elsewhere. Examples of this could be using recycled materials or even re using building elements from demolished structures that were going to be disposed of.

Many schemes have been built in recent years using reclaimed steel and this should be investigated for this project.

8.3 Carbon negative/ regenerative materials

The previous section links directly to the use of carbon negative or regenerative materials. Where new materials were to be employed, we should always try to ensure they are carbon neutral or there is a possible source of regeneration, such as carbon sequestration in timber or other natural materials. Other alternatives that could also comply this are low-carbon concrete mixes.

8.4 Design for Circularity

As we know in our case that new materials will be required, our next aim should be ensuring that future generations can extract every piece of the building in a usable way. Embedding circular principles now may also not on first sight appear regenerative today, but only by thinking ahead can we prevent future generations having to make the same mistakes we have.

Whilst options are still be developed and the final structural material has yet to be decided some of the specific ways in which circularity could be designed into this project include:

- Keeping a record of the materials used in the building which can be accessed to allow future developments to reuse elements of the structure. This would allow the building to become a material bank for use by future developers.
- Making the structure easier to deconstruct for example by reducing wet trades on site. This philosophy was followed for different reasons by Walter Segal in his self-build method by the result of customisable and upgradable structures is universally applicable.
- Designing all connections to be screwed or bolted to enable the structure to be deconstructed and elements to be removed in whole pieces to be reused directly elsewhere.
- Regularising grids so that elements are more consistent sizes increasing the ease with which they can be reused on other buildings.

8.5 Zero Operational Carbon

In a truly regenerative world, our buildings would produce enough energy to support themselves, essentially existing off grid. This is currently unrealistic for most buildings; therefore a large reliance will remain on the grid making de-carbonisation and the adoption of regenerative design principles in power generation even more essential.

The other side of the coin is improving the energy efficiency of our buildings. Enormous strides have been made in recent years in this regard through the tightening of Part L and with many new projects looking to achieve the Passivhaus standard. Measures such as designing an optimal thermal envelope, choosing passive and clean heating and cooling systems or working with natural ventilation and lighting are also great measures that are in our hands to work towards a zero operational carbon building. A detailed MEP and sustainability strategy should be prepared to cover these areas.

Figure 8.1: Desert Rain House (LBC certified)

Figure 8.2: A Walter Segal House

Figure 8.3: Bolted steel connection

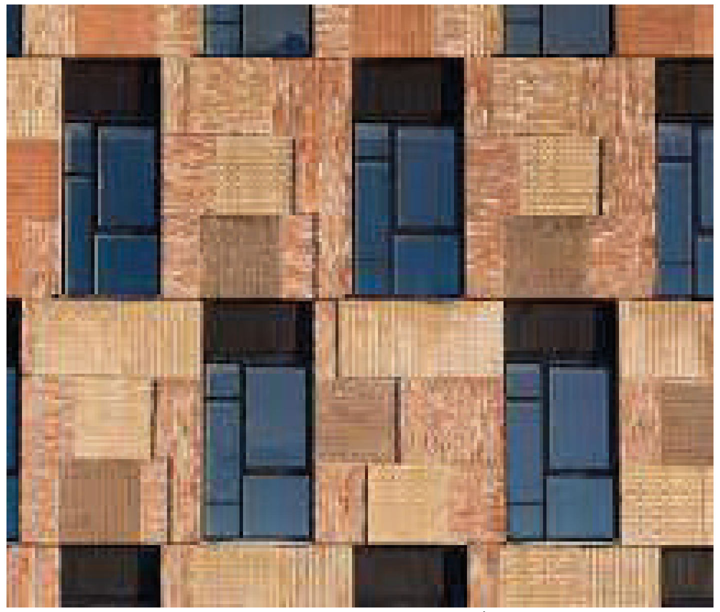


Figure 8.4: Resources Rows, Copenhagen

9 Preliminary Framing

9.1 Superstructure

9.1.1 Overview

During the previous stage, a number of structural options and different grid arrangements were considered. This included a panellised CLT structure, a framed concrete structure, and a hybrid CLT and glulam columns framed structure.

The main challenge of the panellised CLT structure were the cost implications involved with GLA funding the development.

The hybrid CLT and glulam columns framed option was discarded because the vertical structure would need to be internal which would reduce the usable internal floor area. However, the structural viability of this option was assessed through stage 3 to demonstrate it's technical feasibility

The framed concrete structure was discarded because the tapered top floor complicates formwork and concrete construction more than other options.

In response to the building tapering at the top two floors, the option being taken forward at this stage involves a **hybrid concrete and steel** scheme. This option has several benefits such as an increased flexibility for the top two floors which vary from the ones below; therefore making it the preferred and recommended option by the team.

Utilising timber joist floors would need further consideration from an acoustic and fire perspective but standard details for ensuring robustness are common.

There will be PV panels and Blue roofs in the structure. Typical details between a warm timber roof and the PV panels and Blue Roof structures are covered by contractors that will install them

Stability strategy

Stability would be provided through 200mm thick concrete shear walls. These will be placed internally and around the lift and stairs, to avoid problems with tapering floors at the top of the building.

Hybrid steel and concrete frame embodied CO2 for typical grid (A1-A3):

70 kgCO2e/m2

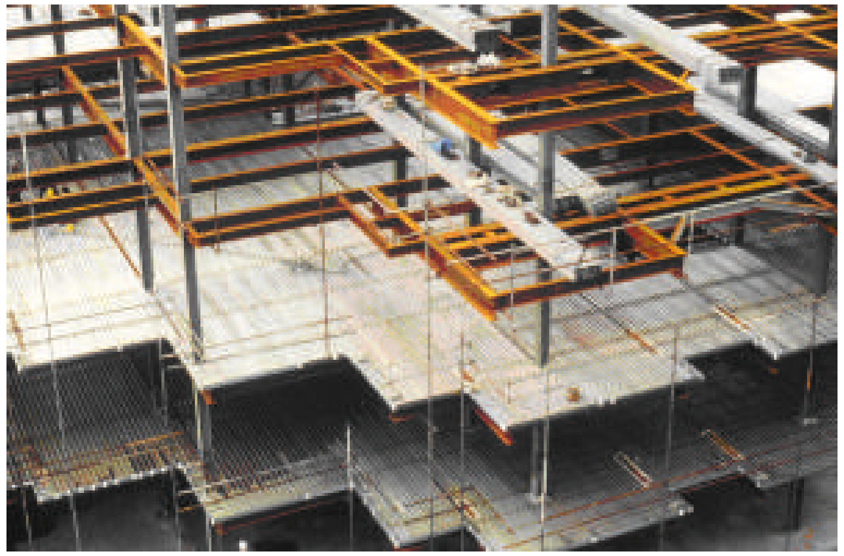


Figure 9.1: Plan of proposed structural solution (top right), section indicating where RC frame would change to a steel frame (bottom right) and example of hybrid steel and concrete frame structure.

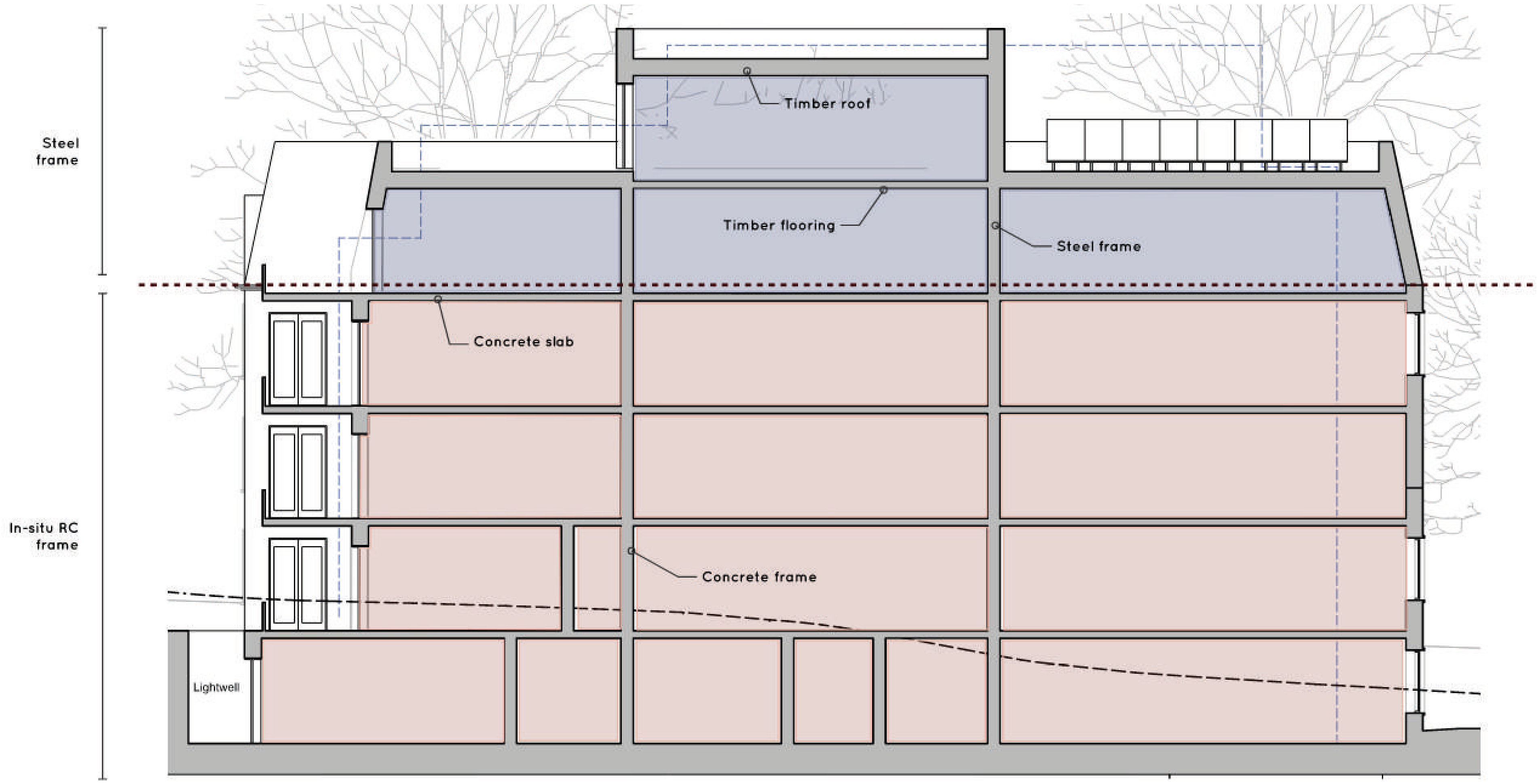


Figure 9.2: Hybrid concrete and steel scheme .

9.2 Substructure

At this stage, and based on the geotechnical report, Made Ground overlaying Clay is assumed on site as discussed previously. Clay has a tendency to shrink and swell under the influence of trees as they absorb and release water from their roots, causing volume change within the soil.

A raft slab is currently assumed to support the main structure. The raft slab was chosen over a pile foundation solution because at this time, it's considered the solution that will impose less stress and movement on the National Railway tunnel and therefore more likely to have a positive outcome on the Approval in principle. The SI report indicates shallow foundations as adequate, so raft is a viable option. This slab has been calculated to be 600mm thick as a preliminary design.

However, ground conditions are difficult and more investigation are required to determine depth of the made ground accurately and also establish feasibility of ground improvement.

At earlier stages, a comparison was carried out between a steel sheet pile solution and concrete pile solution for the proposed development. The steel sheet pile solution was selected because the piles could go as close to boundary structures and therefore were chosen due to the tight space constraints of the site for the proposed development.

The steel sheet piles will support some landscaping and soil that would be needed throughout the site. The figure below shows sketches of the sheet piles that will retain the existing boundary walls. The final sheet pile design will be by the specialist contractor.

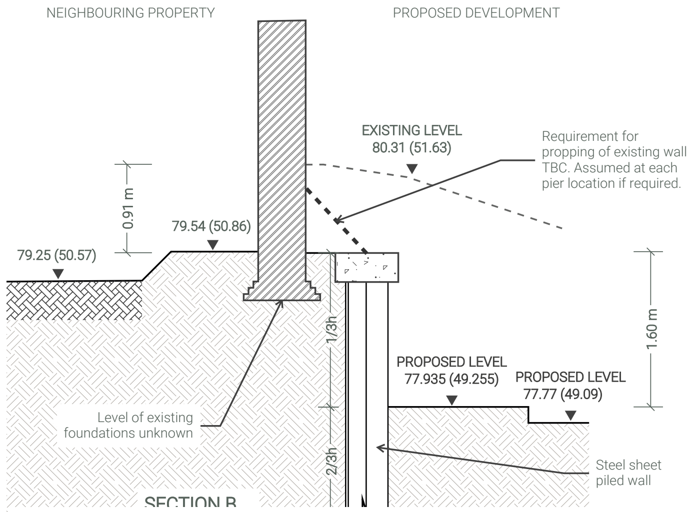


Figure 9.4 Section B

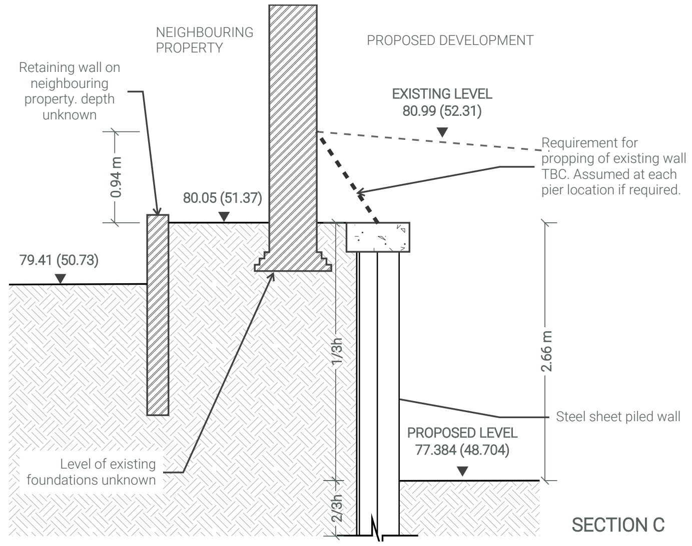


Figure 9.5 Section C

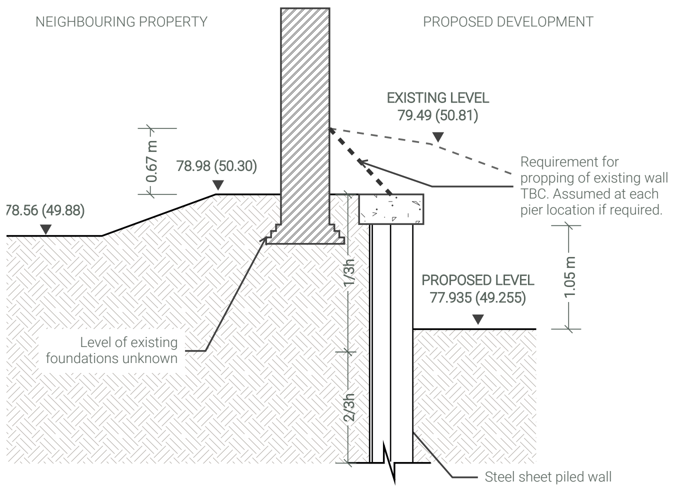


Figure 9.3 Section A

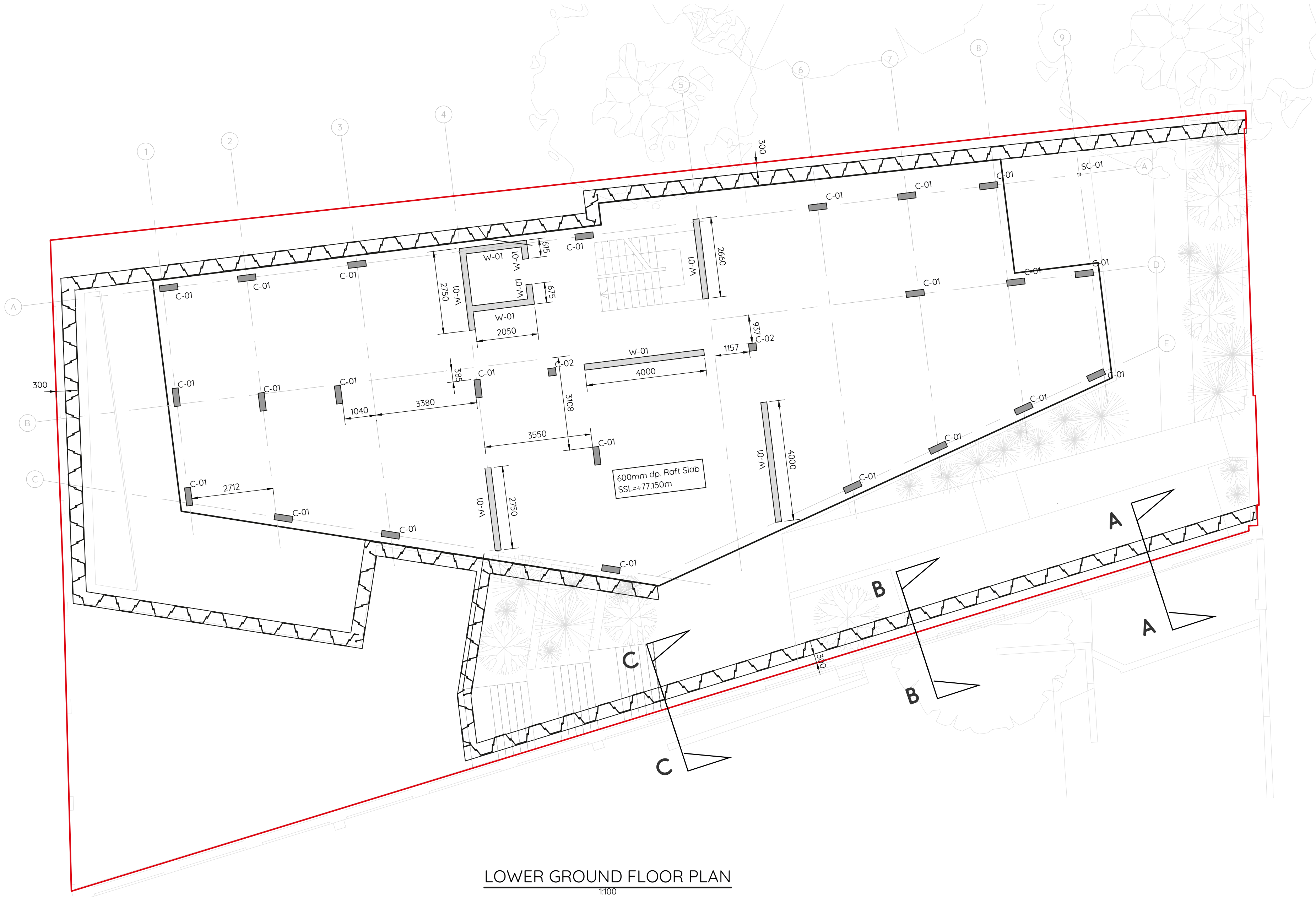


Figure 9.6 Lower Ground Floor Plan showing section locations

9.3 Key Design Items

9.3.1 Grid Interpretation

Further to the structural options, the layout of the building was analysed to study different grid interpretations that were compatible with our structural proposals.

The hybrid option was proposed. This option provides a regular and efficient grid whilst using very few internal columns to allow for flexibility in both steel and concrete frame options. The grids are similar across all floors so transfer structures are kept to a minimum.

A concrete slab floor will be incorporated up to third floor level, where the structure changes from concrete to steel frame. The concrete slab has been modelled and designed to be 225mm thick, and covers all the floor plan excluding the balconies.

9.3.2 Transfer structures

The top level comprises of a lightweight structure that has one column which is off grid. On Fourth floor, there will be a transfer beam that picks up the column which supports the proposed blue roof at the top level.

The transfer beam is at the boundary where the internal space moves to an external space. So the beam will need to be stepped to accommodate for the level drop.

9.3.3 Stability

Stability spine walls go up to the top of the structure from lower ground floor, shifting throughout the levels to accommodate for openings. Walls used for stability are exclusively internal, due to the large openings that appear around the core, stair and external walls. There are two main lines of stability in the y-direction (north to south) and one central line in the x-direction (east to west), to ensure stability in both axes.

9.3.3.1 Stability walls

The stability wall is a spine wall that goes up to the top of the structure. To accommodate for openings the spine shifts throughout the levels. The core and stair walls are ignored due to the large openings around it.

9.3.3.2 Stability frames

To provide stability to the fifth level, two portal frames have been designed to take the lateral wind loads acting on it.

One stability frame is supported on the transfer beam, and therefore the transfer beam has been designed to have a limiting deflection of 5mm.

The other stability frame is on the mansard facade, so it will be inclined.

9.3.4 Inclined steel columns

Due to the mansard-type shape of the structure, the two top floors will be steel frame and the columns on the external façades will be inclined. The worst case inclined columns have been designed as double height and restrained at the middle.

Due to the inclined frame, thrust forces will be generated in the steel beams at fifth floor and the concrete slab on the fourth floor. The concrete slab has been designed to resist the tension forces acting in it.

9.3.5 Columns

Concrete columns support the slab throughout the plan of the building. They have been designed as blade columns (200x600mm) to fit in to the wall structural zones. Along the edges, the column spacings are closer to support the cladding weight.

The columns have been designed to have limiting deflections due to the brittle cladding.

9.3.6 Balconies and Terrace

Allowance has been made for terrace and balconies in accordance with Eurocode loadings.

The balcony comprises of steel joists which will be supported on steel beams which are supported between the internal slab edge and steel columns.

The steel beams are connected to the slab edge through a thermal break.

9.3.7 Roofs

Allowance has been made for blue roofs and photovoltaic panels for the fourth floor and roof level

9.3.8 Cladding

Masonry and a lightweight internal leaf have been allowed for the concrete frame.

A lightweight steel infill and ceramic finishes have been allowed for the upper floors.

9.3.9 Internal to external spaces

When moving from the internal to the external spaces at the upper floors, there will be a 235mm step. This is achieved by dropping the steel beams and joist to the required level.

The transfer beam previously discussed will need to be stepped to accommodate for the level drop.

10 Basement Wall- Drained Cavity Waterproofing System

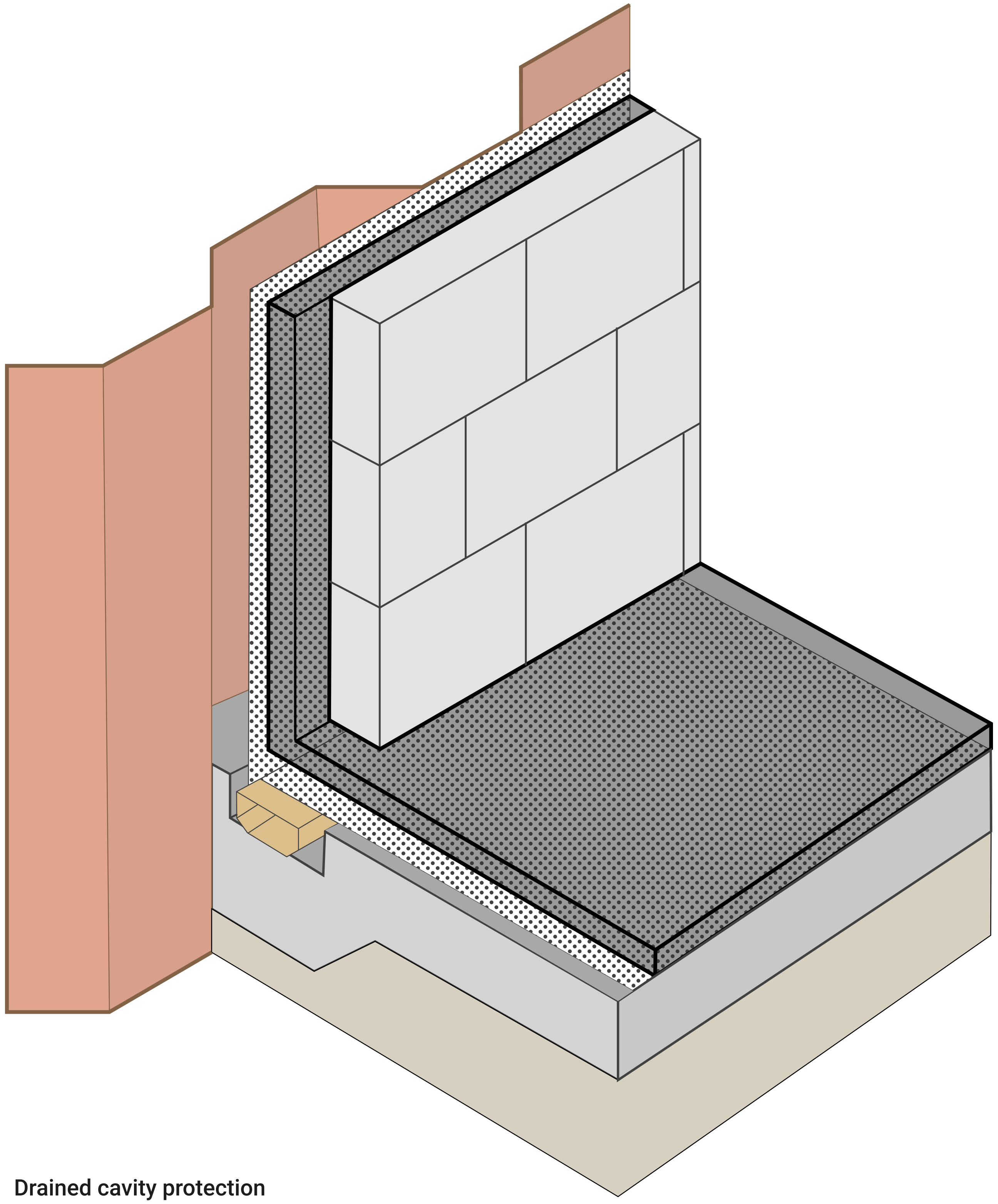
In some locations the retaining wall will also form the external wall of the proposed building meaning that below ground waterproofing will need to be considered.

BS 8102 (1990): *Protection of structures against water from the ground* states that 'a clear understanding of the degree of water tightness is required by the Client before detailed design commences'. The water tightness strategy will need to be addressed within the design team during the next stage of design. Once a decision on the appropriate system has been made, Simple Works will design and take responsibility for that part of the system which is an integral part of the new structural elements if said system looks to utilise the structure for waterproofing. The design of any waterproofing system that is not an integral part of the main structure will be to the design and under the responsibility of others.

Drained cavity protection

A drained cavity system effectively accepts that moisture will penetrate through the retaining wall. Any moisture which does find its way through the structure is channelled, collected and discharged within a cavity created through the addition of an inner skin to both walls and floors. A drained cavity generally:

- It is most reliable method of waterproofing
- It provides liquid and vapour proof enclosure
- It increases building footprint/decreases internal area. The sheet piles are offset from the building so there for the development there should be no loss of internal area
- Additional drainage is required with associated maintenance



Drained cavity protection

11 Drainage

A drainage strategy for the site has been developed during this stage of work in accordance with

(i) National Planning Policy Framework (NPPF), (Department for Communities and Local Government, July 2021) and the accompanying

(ii) Planning Practice Guidance (Ministry of Housing, Communities and Local Government, May 2022); and

(iii) Other statutory laws and local by-laws and rules.

The full report can be found in Appendix B.

With reference to the flood map for planning published by the Environment Agency, the development site is located within Flood Zone 1 'Low probability'. Flood risk from other sources has been assessed as low. Therefore, the Sequential Test is deemed passed and the Exception Test not required.

The site is classified as 'More Vulnerable' (Flood Risk Vulnerability Classification), the development is classified as 'appropriate'.

Due to unsuitable ground conditions and a constrained development footprint, the use of infiltration as a method of surface water disposable is not considered feasible. It is proposed to discharge to the existing Thames Water combined sewer within Daleham Gardens, at a maximum discharge rate of 1.0l/s for all storm events up to and include the 1-100 year return period event with an allowance for climate change.

SuDS are to be incorporated onto the site with a green roof and functioning rain gardens, as well as below-ground attenuation and a flow control device to restrict surface water flows to 1l/s. The surface water drainage design ensures of no flooding up to and including the 1-100 year return period event with an allowance for climate change.

The current drainage proposals are subject to confirmation of any Network Rail asset protection requirements for the adjacent Belsize Tunnel under the neighbouring property.

Additional water quality measures will be provided by the inclusion of appropriate deep silt trapped gullies and silt boxes to all channel drains.

Foul water will discharge by gravity into the existing Thames Water combined sewer within Daleham Gardens.

Finished levels will ensure that any flood exceedance pathways are directed away from people and property.

The on-site foul and surface water drainage systems are to remain in private ownership, maintained by the developer in accordance with the maintenance schedule.

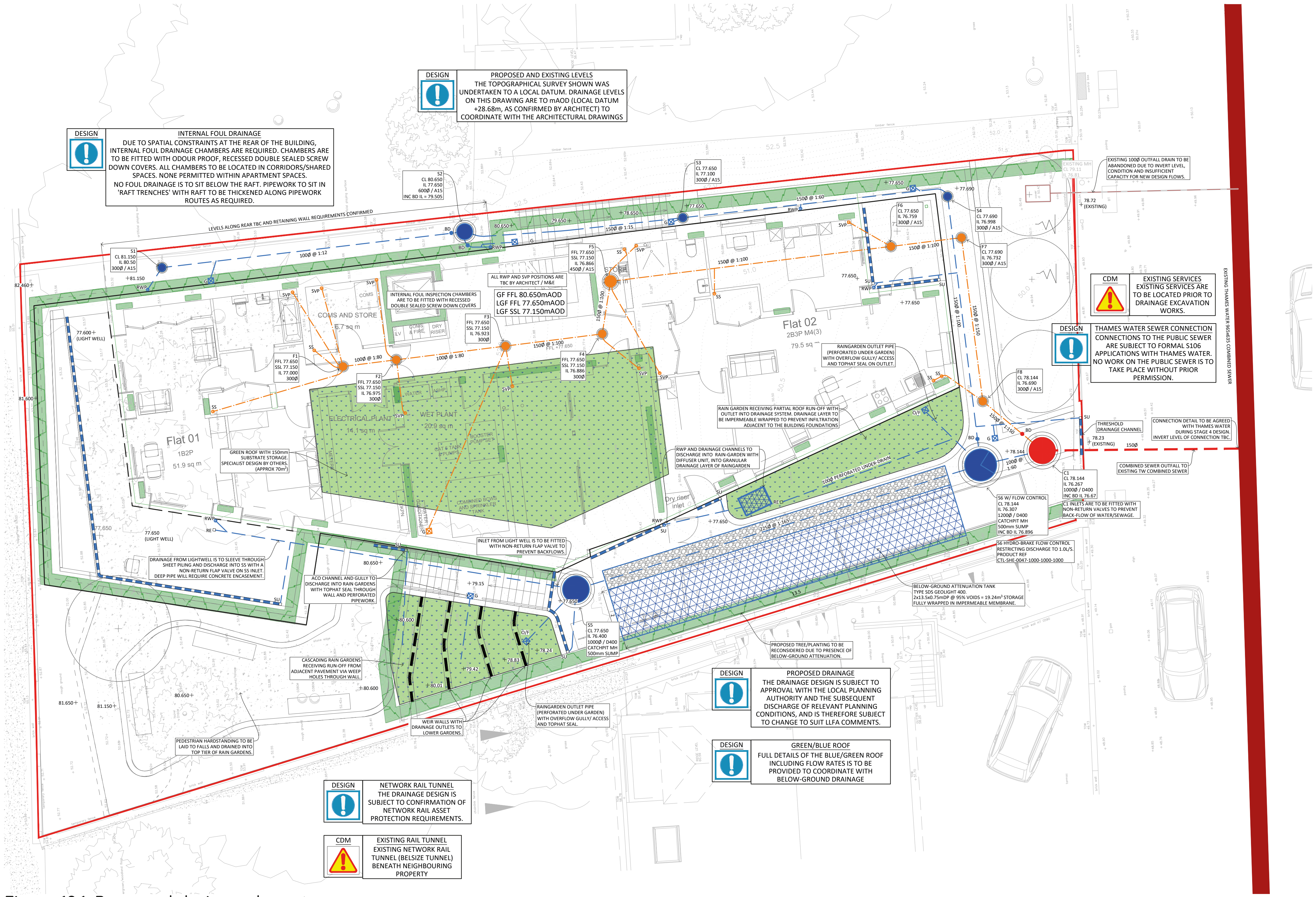


Figure 12.1: Proposed drainage layout

12 Design Criteria

This section describes the design criteria adopted.

Design Standards

The following design standards will be referenced in the design of the sub-structure and super-structure works.

BS EN 1990 (Eurocode 0) – Basis of structural design

BS EN 1991 (Eurocode 1) – Actions on structures

BS EN 1992 (Eurocode 2) – Design of concrete

Structures

BS EN 1993 (Eurocode 3) – Design of steel structures

BS EN 1995 (Eurocode 5) – Design of timber

Structures

BS EN 1997 (Eurocode 7) – Geotechnical design

12.1 Design Loads

The Stage 3 design has been based on the vertical loads described in the loading diagrams included in Appendix 3.

Wind loads are calculated in accordance with BS EN 1991 1-4:2005 loading for building: code of practice for wind loads.

Vehicle impact loads have not been considered on the assumption impact protection will be provided to any vulnerable structural elements

12.2 Vertical deflections

The deflection of the structure with spans up to 10m will be designed to meet the following criteria.

Internal beams

For beams/slabs subject to imposed loading max deflection = span/360

For beams/slabs subject to imposed and dead loading max deflection = span/250

Edge beams supporting cladding

For edge beams supporting cladding max deflection after the structure is built = span/500 or 10mm under live load only, whichever is lesser

Cantilevers

For beams/slabs subject to imposed loading max deflection = span/180

For beams subject to imposed and dead loading max deflection = span/125

12.3 Horizontal Deflections

Horizontal deflections of the structure occurring under wind loads will be limited to H/500 where H is the height of the structure above ground level.

Inter-story drifts occurring under wind loads will be limited to h/500, where h is the storey height.

All finishes, services, internal partitions are required to be detailed to accommodate the worst combination of these deflections.

12.4 Settlement

The superstructure is designed to a differential settlement allowance of distance between column position / 500.

All cladding, finishes and services must be designed and detailed to accommodate the above settlements.

A detailed settlement analysis will be carried out for the raft slab in the next stages

12.5 Material Grades

Material grades for the structural elements are as follows:

Reinforced concrete

Reinforced concrete (28-day strength) to EN 206-1:

- Foundations C30/37
- Walls C30/37
- Slabs C30/37

Steel reinforcement

Steel reinforcement to EN 10080

- Grade 500B 500 N/mm2

Steelwork

Structural steelwork to EN 10025-2

- Internal Steelwork S355

Steel bolts to EN 1993 1-8

- Bolts grade 8.8

Timber

Structural timber to BS EN 338

- Solid members C24
- Glulam members GL24h

12.6 Reinforcement rates

The following typical rates for reinforcing steel should be considered. These are liable to change as the design develops and a suitable contingency for this should be made.

Raft slab: 115 kg/m³

Suspended slab 135 kg/m³

Walls: 70 kg/m³

Columns: 175 kg/m³

Capping Beams: 230 kg/m³

13 Next Steps

This report is intended to summarise the design and assessments carried out to date and inform the next stages of the project with respect to a number of key areas as outlined below. The areas highlighted will need consideration within the wider project context through engagement of the whole design team.

Network Rail

Approvals with Network Rail will be one of the key project risks moving forward. Engagement with Network Rail has already been carried out and further engagement will be carried out during the next stage.

Site Investigation

A full geotechnical site investigation has undertaken. Further site investigations will be required to explore ground improvements as well as to check the distribution/extent of the made ground to develop the raft slab design in the next stages.

Basement Impact Assessment

At the time of writing the report, the basement impact assessment report has been submitted. Allowance should be made for further coordination on it once it has been reviewed by Camden Council.

Drainage/SUDs strategy

A drainage strategy has already been developed, further coordination of this with the design team, Thames Water and Network Rail will be required to confirm suitability of the proposals.

Team co-ordination

Coordination with the design team will be required to ensure the scheme does not contain any clashes with architectural/structural/mechanical details.

Architectural details

Floor build ups and cladding details will be required for structural design.

Structural strategy

A number of options for the structural strategy have been considered which have looked to factor in the various design drivers in terms of embodied carbon, space provision and ease of construction. It is currently considered that the hybrid concrete and steel frame offer the most benefits however, input from the wider project team will be needed to confirm this.

Fire engineer

A fire engineer will likely be required given the size of the building.

14 Project risk register

A project risk register is included in Appendix D.