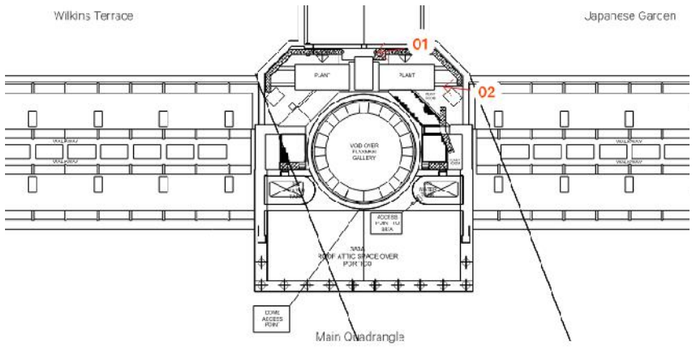
6. Structural Proposals
Wilkins Building

New Roof Plant

At roof level above the Octagon existing water tanks are to be replaced with new air source heat pumps (ASHP's) as outlined in BDP MEP's Planning Report.

The existing water tanks are housed within copper clad containers to match the theme of the original roof. The housing containers are supported by two reinforced concrete beams which bear into the masonry walls.



Roof Plan


View 01


View 02

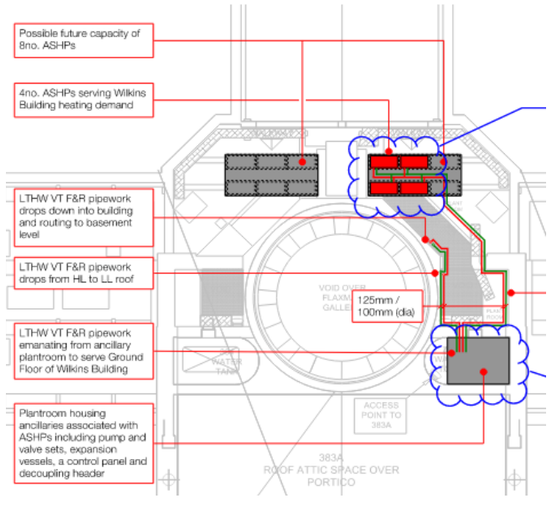
Images of existing plant on Wilkins Roof

The existing RC beams are showing signs of concrete spalling due to corrosion of the re-bar. This has in turn resulted in the reinforcement becoming exposed which is at increased risk of further corrosion. It is advised that the beams are replaced with new galvanised steel beams to support the proposed plant.

The existing water tanks at roof level vary in size. The smallest was measured as 2.5 x 1.5 x 1.2m in size. At capacity the water tank therefore weighs approximately 4000kg. The ASHPs that are replacing the water tanks each weigh approximately 1600kg. The mechanical engineering proposals are provided below. In all cases where new plant is introduced it replaces a existing heavier water tank and so the proposals are considered acceptable at this stage.

Image showing spalling of RC beam supporting existing roof plant

Image showing existing RC beam bearing into masonry wall

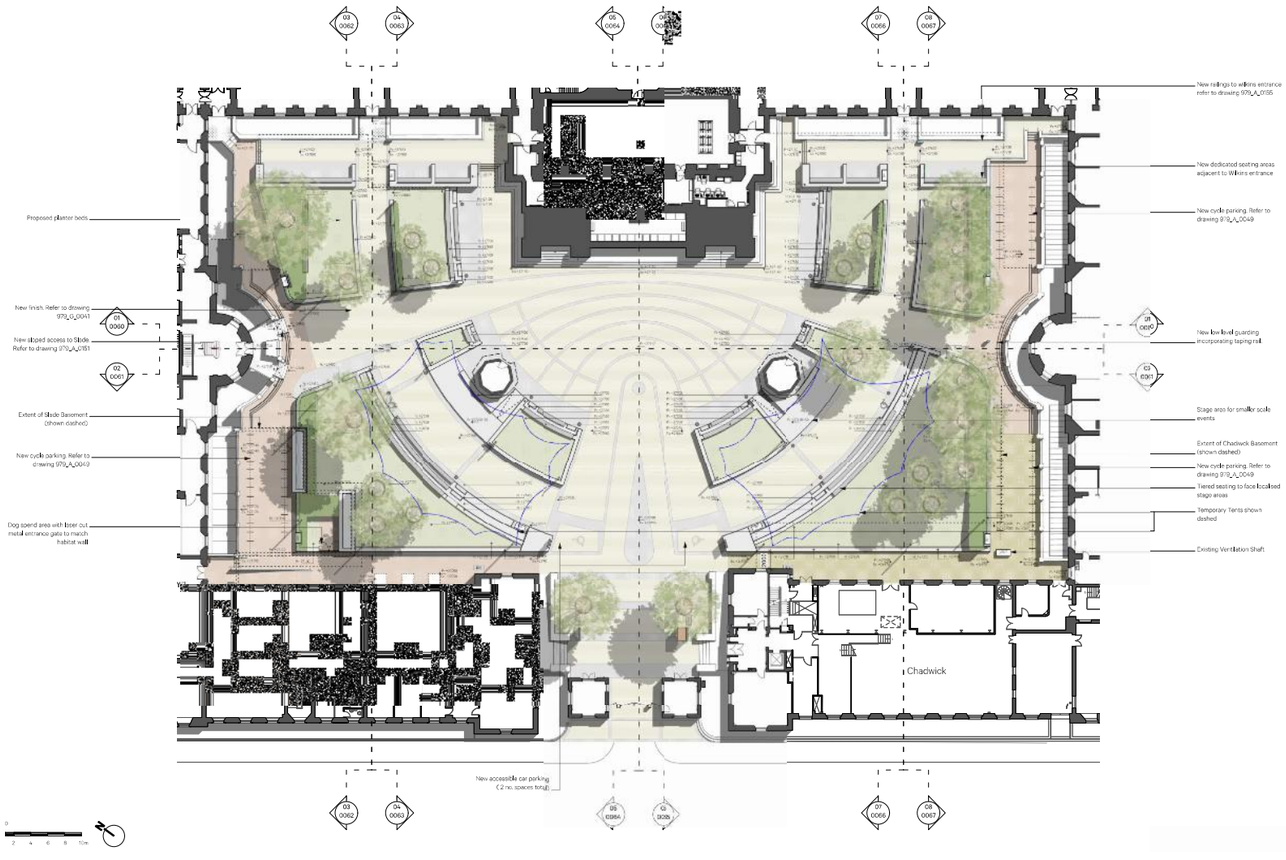


Mechanical engineering proposals at roof level.

7. Structural Proposals
Main Quad

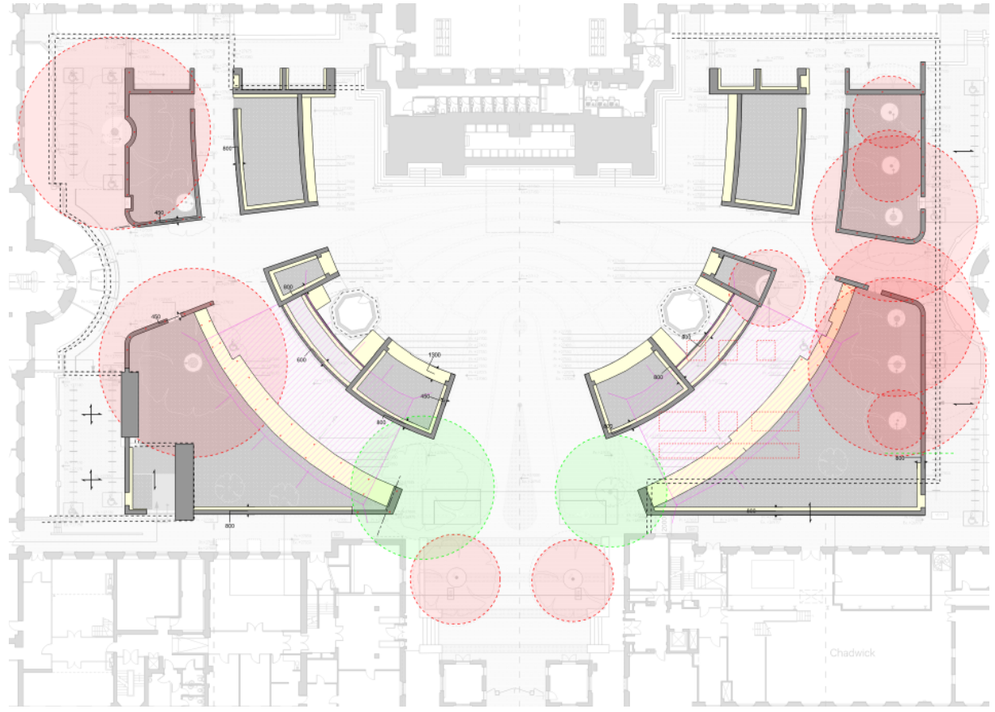
Architectural Scheme

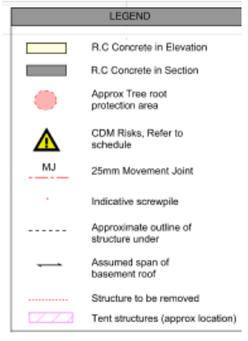
Refer to the Burwell Architect's section of the RIBA Report for a detailed description of the architectural proposals. The proposed general arrangement of the quad is shown below.



Structural Scheme

Refer to the Appendix for the structural drawings. The proposed structural general arrangement of the quad is shown below.





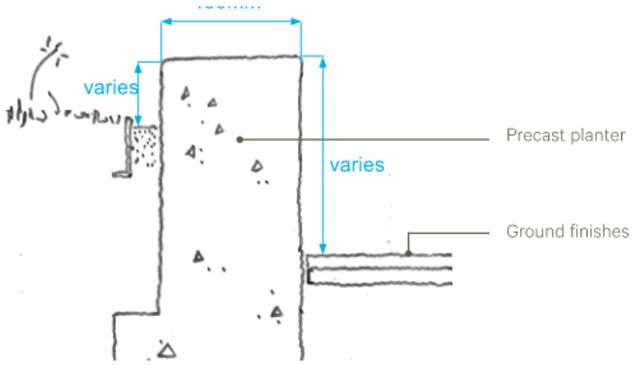
7. Structural Proposals
Main Quad

Raised Planter Beds and Walls

Retaining Walls

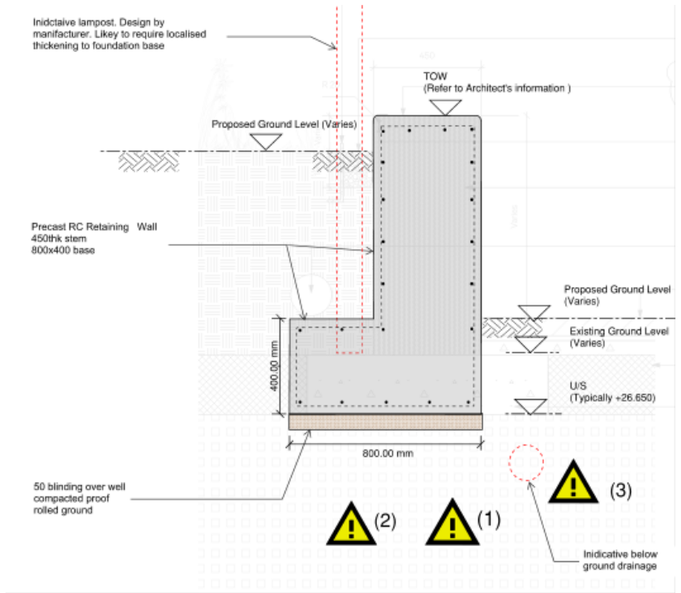
Raised planter beds with raised varying levels of up to 730mm (Max OD proposed +27.700; Min OD existing +26.970) are proposed as part of the remodelling to the soft landscaping to the quad.

Feature retaining walls (typically TOW +27.850) are proposed to frame out the raised planter beds and provide seating at varying heights relative to the hard landscaping.



The retaining walls are 450mm wide monolithic elements formed from precast reinforced concrete. This has been advised by the supplier as a more practical option than an in-situ core with precast cladding option when considering durability, aesthetics and weathering. The castings are expected to be in 3-4m lengths Two solutions haven been considered:

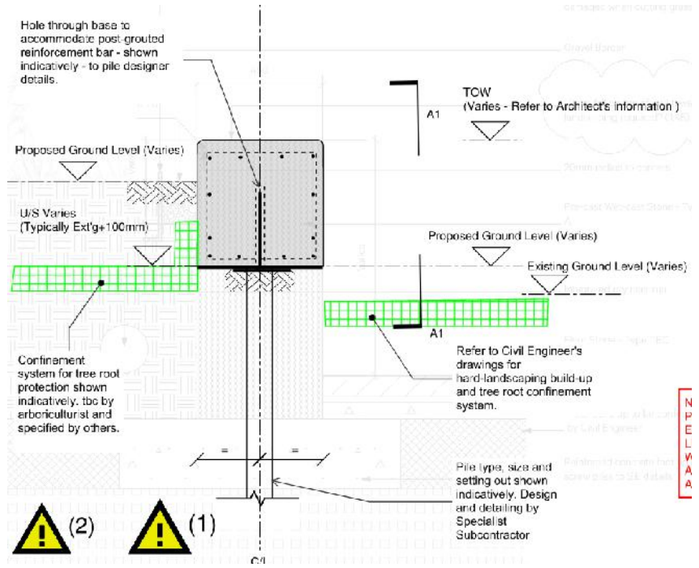
1. Outside root protection areas ('RPA') -v 'Traditional' Ground bearing L-shaped retaining wall.



7. Structural Proposals
Main Quad

These will bear into the Made Ground which is to be proof-rolled to provide a suitably compacted bearing. The underside has been kept consistent for all the planters to simplify construction and the depth taken to approximately 350mm below existing ground where there is expected to already some ground consolidation whilst also limiting the excavation to minimise potential clashes with buried services.

2. Within RPA - Straight retaining wall on screwpiles:



This type of pile is generally accepted as a suitable foundation to help minimise disturbance to tree roots and lower the risk of causing harm to trees. They can also be well suited to poor ground conditions such as the 3-4m of ground that has been encountered from previous S.I work where they can provide an economical option for 'lighter' loads.

The piles are to be arranged at discrete points and centred along the retaining wall - The final size and position of the piles will be to the piling subcontractor's design and coordinated with the precast concrete wall lengths and details.

The underside of the wall is set approximately 100mm above the existing ground level to avoid disturbance to roots and allow the tree roots to breath through a tree root confinement system.

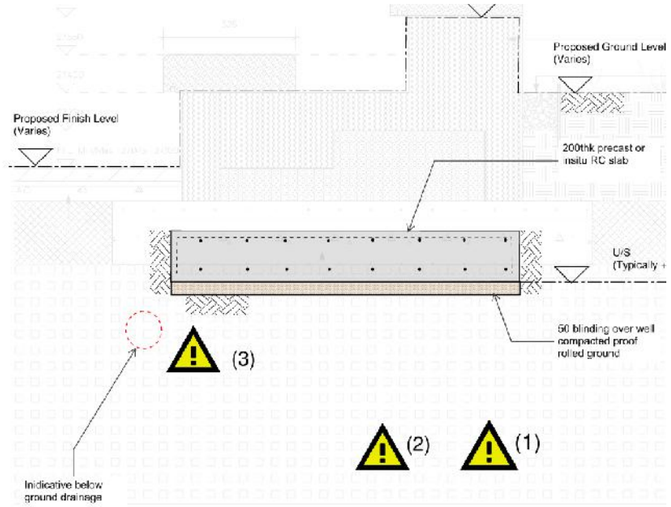
The screwpile solution has been provisionally discussed with the Arboriculturalist as a means to minimise impact on tree roots. The response has generally been favourable however the final pile layout once received from the pile designer along with the wall details ` levels will need to be sent to the arboriculturalist for review.

Seating and Planter Access

Tiered seating and stepped access to the raised planters are proposed in some locations. The steps and seating, similarly to the new walls, are understood to be precast. These will act as buttresses to retain the raised ground and will sit on 200mm thick RC foundation slabs. Two conditions have been considered:

1. Outside RPA - Ground bearing reinforced concrete insitu raft slab.
A 200mm thick RC raft slab bears into the Made Ground which is to be proof-rolled to provide a suitably compacted bearing.

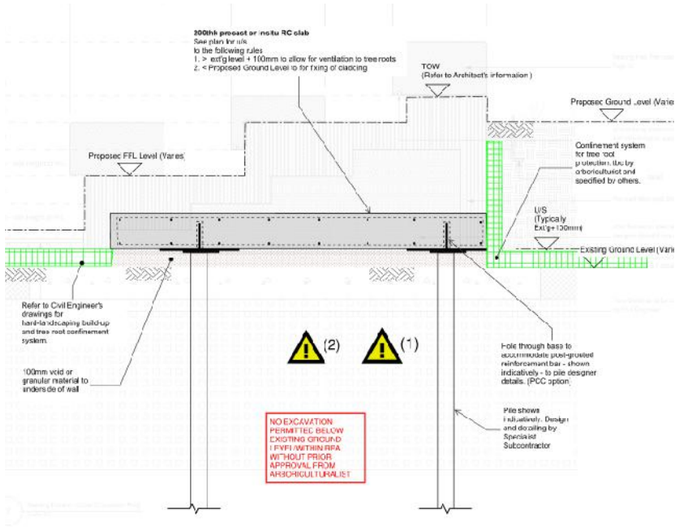
The underside has been kept consistent with the adjacent retaining walls to simplify construction and the depth taken to approximately 350mm below existing ground where there is expected to already some ground consolidation whilst also limiting the excavation to minimise potential clashes with buried services.



7. Structural Proposals
Main Quad

2. Within RPA - Reinforced concrete insitu flat slab on screwpiles.

The 200mm thick slab on 2 rows of screw piles is proposed to provide support for the tiered seating.
This type of pile is generally accepted as a suitable foundation to help minimise disturbance to tree roots and lower the risk of causing harm to trees. They can also be well suited to poor ground conditions such as the 3-4m of ground that has been encountered from previous S.I work where they can provide an economical option for ‘lighter’ loads.



The piles are to be arranged at discrete points and centred along the retaining wall - The final size and position of the piles will be to the piling subcontractor’s design and coordinated with the precast concrete wall lengths and details.

The underside of the wall is set approximately 100mm above the existing ground level to avoid disturbance to roots and allow the tree roots to breath. The screwpile solution has been provisionally discussed with the Arboriculturalist as a means to minimise impact on tree roots. The response has generally been favourable however the final pile layout once received from the pile designer along with the wall details and levels will need to be sent to the arboriculturalist for review.

UXO Considerations

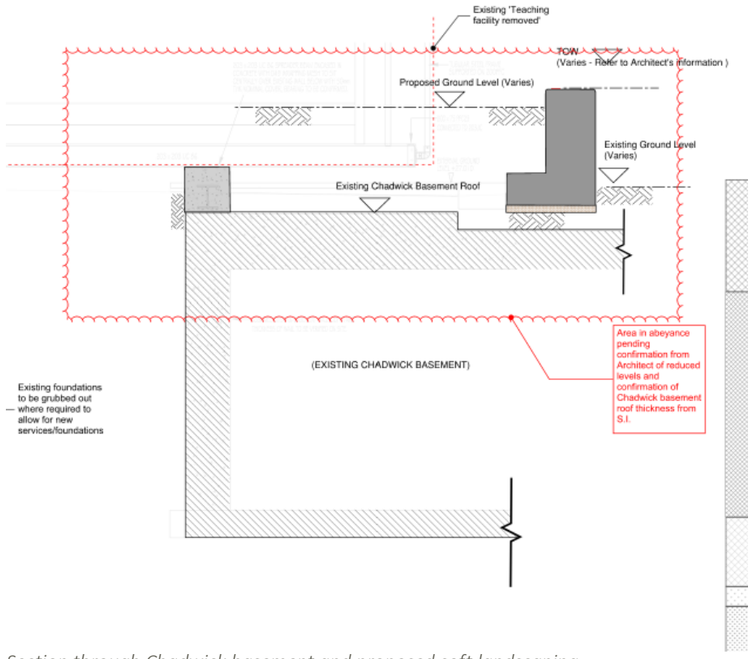
The excavations for the ground bearing foundations solutions (‘1’) are classed as ‘open’ intrusive works, therefore UXO mitigation measures may involve a ‘watching brief’ where ground has been ‘undisturbed’ since WWII.
The piled solution is classed as ‘blind’ intrusive works, therefore UXO mitigation measures may involve a magnetometer survey where the ground has been ‘undisturbed’ since WWII.

The design will be sent to a UXO specialist for review; these potential mitigation methods may have project cost and programme implications.

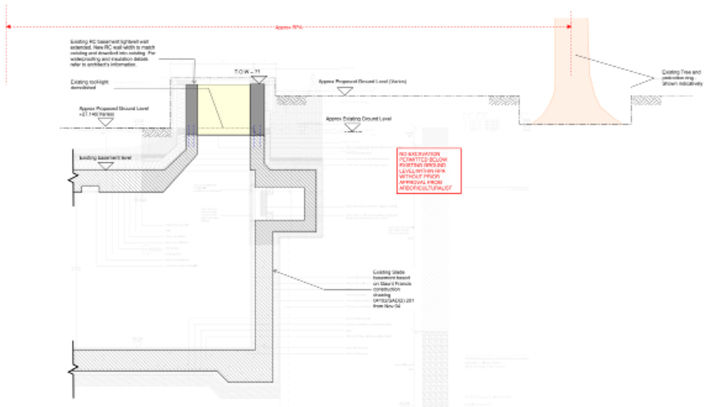
Existing Basements

The increased ground levels will apply a surcharge to the existing basement walls or additional dead weight where directly over the basement roofs.

For the Slade basement preliminary calculations have been a carried out to assess the capacity of the new loads against the existing structure. The results of the site investigation trial pits will be required to verify assumptions about the existing wall thicknesses and ground levels.



Section through Chadwick basement and proposed soft landscaping



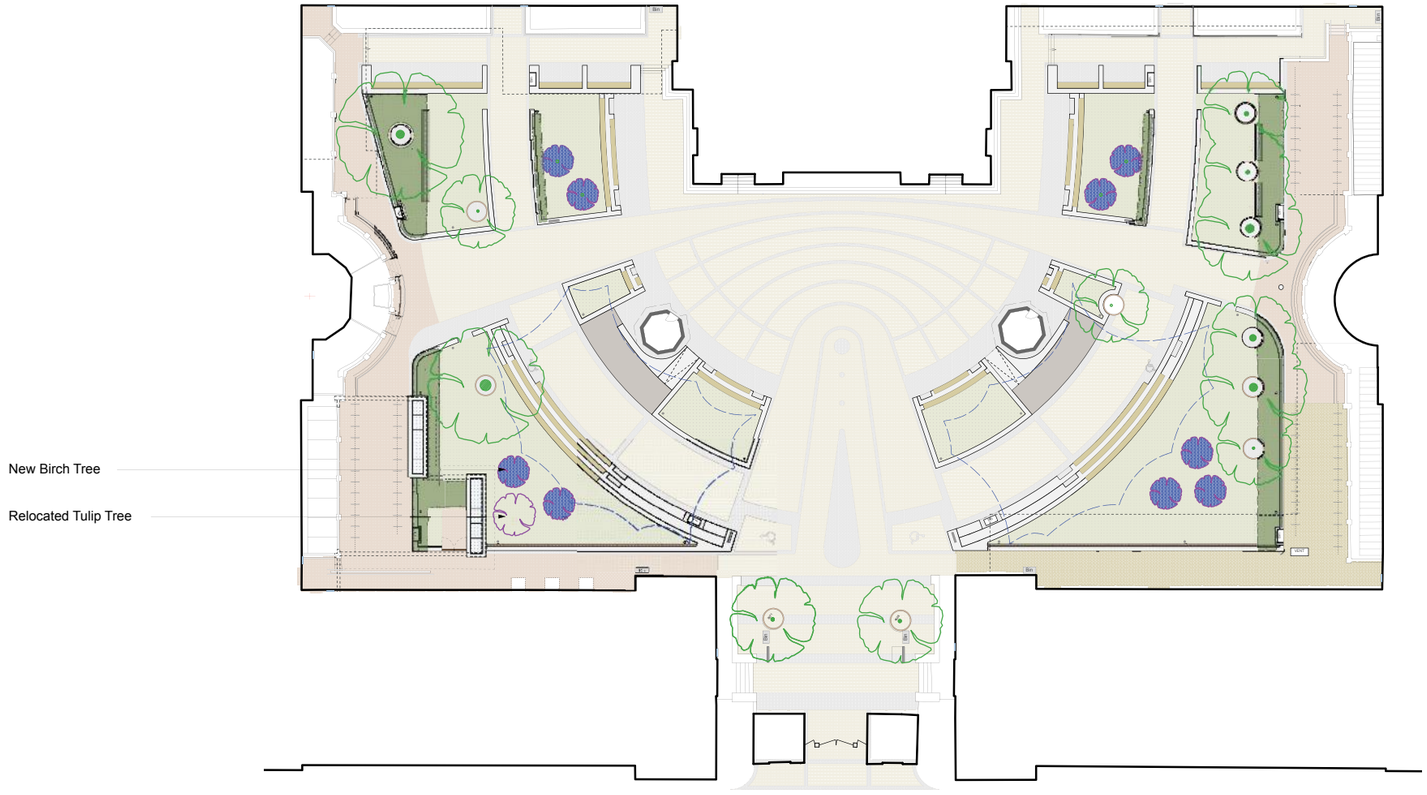
Section through Slade basement and proposed soft landscaping

7. Structural Proposals
Main Quad

Biodiversity Net Gain Proposals

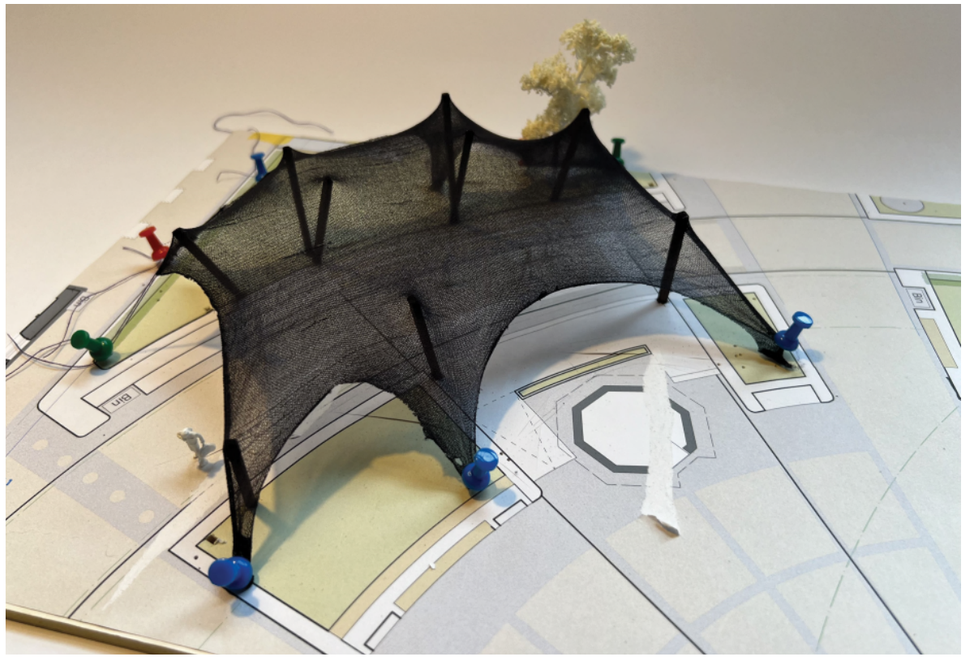
The Tyler Grange report on Biodiversity proposed the inclusion of 9 new Birch trees. These will be planted after the completion of the main hard landscaping works.

There is a risk that the new tree roots could damage the hard landscaping (pavements, retaining walls, below ground infrastructure etc.) To prevent damage, root barriers could be installed which would guide roots deeper and away from any structures.



7. Structural Proposals
Main Quad

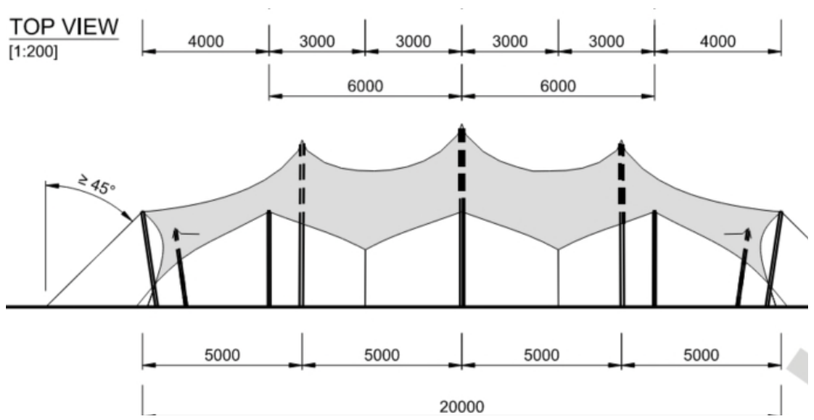
Tensile Structures

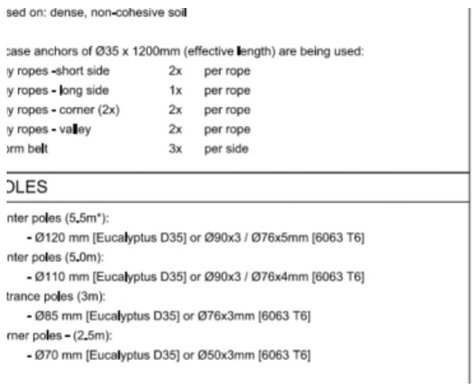


‘Temporary’ lightweight bespoke tensile structures are proposed in the south and north quads. These over sail the planter seating and stages close to the observatories and are formed from a series of poles in compression and guy ropes and a fabric cover in tension.

Some initial subcontractor information has been received from ‘Stretch and Tents’ indicating some possible General Arrangements and anchors for the guy ropes but this is very limited and coordination with the below ground obstructions, services and tree roots will be crucial in the next stages. A sensible approach could be to position the tent poles over the retaining walls.

RPA’s and the dense arrangement of buried services are likely to preclude the use of concrete anchorage blocks acting as ballast to resist tensile forces. The arboriculturalist may be more amenable to the screwpile option. The design should be sent to them for review.




sed on: dense, non-cohesive soil

case anchors of Ø35 x 1200mm (effective length) are being used:

y ropes -short side	2x	per rope
y ropes - long side	1x	per rope
y ropes - corner (2x)	2x	per rope
y ropes - valley	2x	per rope
rm belt	3x	per side

OLES

nter poles (5.5m*):
- Ø120 mm [Eucalyptus D35] or Ø90x3 / Ø76x5mm [6063 T6]

nter poles (5.0m):
- Ø110 mm [Eucalyptus D35] or Ø90x3 / Ø76x4mm [6063 T6]

trance poles (3m):
- Ø85 mm [Eucalyptus D35] or Ø76x3mm [6063 T6]

rner poles - (2.5m):
- Ø70 mm [Eucalyptus D35] or Ø50x3mm [6063 T6]

8. Civil Engineering Proposals
Main Quad

Existing Site Description and Drainage

The topography of the site is relatively flat. There are stairs or ramps provided up to the building entrances at the perimeter of the Main Quad. There are a number of basements underneath the Main Quad. Surface water drainage is collected in a series of gullies and drainage channels. The majority of the surface water is then conveyed by the below ground drainage system to a manhole located by the main gate which discharges unrestricted via a 150mm diameter outfall to the existing Thames Water combined water sewer in Gower Street. According to the Plowman Craven utility survey information the Thames Water combined water sewer in Gower Street is 1397mm x 787mm.

The latest and most comprehensive survey was carried out by EDI Surveys for the wider UCL campus. This displays much of the drainage within the Main Quad as foul water drainage. However, from a review of the arrangement of internal drainage outlets it is possible that the drainage is actually a combined water network, collecting surface water from within the Main Quad hard standing areas and building roofs as well as foul water from the buildings.

Some initial subcontractor information has been received from 'Stretch and Tents' indicating some possible General Arrangements and anchors for the guy ropes but this is very limited and coordination with the below ground obstructions, services and tree roots will be crucial in the next stages. A sensible approach could be to position the tent poles over the retaining walls.

The total existing site area is approximately 5,475m2 with an existing soft landscaping area of 1,435m2. Applying the Modified Rational Method, the existing peak run-off from the site can be calculated from the formula:

Q = 3.61 x Cv x A x i (litres/sec)

Where:

Cv is the volumetric runoff coefficient, (assumed to be 1 based on 100% run-off)

A is the catchment area in hectares (0.404ha, assuming hard landscaping only)

i is the peak rainfall intensity in mm/hr (Based on the Wallingford procedure) For the peak 1 in 1 year return period, 15 minute storm event, this gives an existing discharge rate from the site of:

Q1 = 3.61 x 1.00 x 0.404 x 32.9 = 48 l/s.

For the peak 1 in 100 year return period, 15 minute storm event, this gives an existing discharge rate from the site of:

Q100 = 3.61 X 1.00 X 0.404 X 104.8 = 153 l/s.

Proposed Drainage Strategy

As part of the development, the overall impermeable area is proposed to increase to allow for the additional event space. The proposed impermeable area is 4,475m2, which would lead to the runoff increasing to 53 l/s for the 1 year return period event and 169 l/s for the 100 year return period event should no mitigation measures be implemented. The proposed drainage strategy aims to mitigate the effects of the proposed scheme by ensuring surface water runoff from the site is not increased. Furthermore, the development will be used as an opportunity to reduce the rate of surface water runoff and reducing the discharge into the Thames Water combined sewer. The development will also be used as an opportunity to separate the foul and surface water drainage networks as per the current standards.

It is proposed to install a number of gullys and linear drainage channels around the quad, located at appropriate points with respect to the levels, to collect surface water and convey it to the private below ground surface water drainage network.

A flow control device (hydrobrake or similar) will be introduced at the downstream chamber prior to the connection to the Thames Water sewer, to restrict the discharge rate to 33.6 l/s (providing a 30% betterment to the existing 1 year return period event discharge rate, and an 80% betterment to the existing 100 year return period event discharge rate.). In order to achieve this, some form of attenuation will be required. Due to the nature of the development, there is little scope to provide open/surface level SuDS features such as swales/basins to provide attenuation. Therefore it is proposed to provide the required attenuation in the form of below ground geocellular crates. The below ground constraints restrict the available space to provide a greater volume of attenuation which would enable the discharge rate to be restricted further. The attenuation volume required will be confirmed during the detailed design phase and will be subject to hydraulic modelling of the proposed scheme, but based on initial calculations, an attenuation volume of 125m3 would be required in order to achieve a discharge rate of 33.6l/s. The current proposal splits this volume into two tanks due to the various aforementioned spatial constraints. Please refer to P30037860BDP-XX-XX-DR-C-0500 for proposed drainage strategy drawing.

Due to the root protection areas, it is proposed to incorporate shallow dished channels in lieu of typical linear drainage channels due to the reduced depth associated with them, to minimize the impact on the existing roots. Additionally, there are a significant number of trees to be retained along with their associated root protection areas along the southern edge of the quad which restricts what can be installed in this area. Therefore it is proposed to utilize the existing linear drainage channels and their associated connections to the below ground drainage network to minimize impact/disturbance to the existing trees and roots.

A pre development application will be submitted to Thames Water to confirm capacity within the public sewer in Gower Street. As the connection location is being maintained, and the flows are being restricted there is unlikely to be any issue related to capacity within the public sewer. A Section 106 application will be required for the proposed indirect connection to the Thames Water sewer.

Proposed Pavement Construction Details

The proposed scheme requires two categories of pavement construction. One category of pavement construction has to be suitable for occasional heavy vehicular loading in case of emergency access required by fire tenders to access the dry risers in the quad. The extent of this has been informed by the swept path analysis exercise undertaken to show the fire tender manoeuvres required. The other category of pavement construction is for the remainder of the hard standing areas of the site, which only have to be designed to accommodate pedestrian loading. In the absence of CBR testing being undertaken, the pavement design has been based on a CBR value of 5%. If the CBR value on site is less than 2.5%, ground improvement work will be required. Please refer to P3003786-BDP-XX-XX-DR-1201 for proposed pavement construction details drawing.

The arboriculturist study has indicated there are a number of trees to be retained on the site which have root protection areas, which means no excavations can take place in these areas. In these areas, a no dig solution is proposed which involves installing a sub-base confinement system above the existing sub base, so as not to disturb the roots. The proposed construction has to be permeable to allow the roots to breathe, therefore the jointing material between the york stones, and the laying course and sub base all have to be freely draining.

Proposed Swept Path Analysis

Swept path analysis was undertaken to demonstrate that a fire tender would be able to enter the quad and access the dry risers as per the fire strategy by Bureau Veritas. The analysis shows the vehicle being able to access the dry risers either side of the cloister and in the northern and southern part of the quad. Please refer to P3003786-BDP-XX-XX-DR-0150 & 0151 for fire tender swept path analysis drawings.

Swept path analysis was also undertaken to demonstrate that a mobile crane would be able to enter the quad to aid construction and to lift equipment on and off the roofs for strip out and installation of mechanical kit and the lifts, as per the access and maintenance strategy. Please refer to P3003786-BDP-XX-XX-DR-0152 for mobile crane swept path analysis drawings.