Appendix 5

Max Fordham - MEP & Sustainability

Cambridge Civic Quarter

MEPH Engineering Services & Sustainability Consultancy

Stage 2 Report

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ISSUE HISTORY

Issue	Date	Description
P01	14/10/2024	Stage 2 Issue
P02	31/10/2024	Stage 2 Final Issue (client comments addressed)

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Engineer (Initials)	Role
CB	Engineering Director
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1.0 EXECUTIVE SUMMARY

1.1 Executive Summary

This report sets out the mechanical, electrical and public health (MEP) engineering proposals and the sustainability strategy for the refurbishment of the Cambridge Guildhall, Corn Exchange and Market forming the Cambridge Civic Quarter.

For the Guildhall the proposals have considered options for different uses, based around the Council retaining use of the democratic rooms, halls and some office and meeting spaces. Options for letting some of the building space to either a commercial office or hotel operator have been worked through, allowing a revenue appraisal to be completed. Prior to the submission of this report the office option was confirmed as the preferred option. For completeness and for record purposes the report includes the information relating to the hotel option.

To inform the Guildhall architectural and MEPH proposals, an EnerPHit assessment has been progressed. This is appended to this report and more accurately and practically quantifies and evaluates the approach to Net Zero Carbon than would be undertaken by a typical RIBA stage 2 benchmark analysis.

The proposal for the Corn Exchange is based on feedback from a number of stakeholder meetings and seeks to modernise the building, reduce its carbon emissions and operating costs and address some of the challenges that are currently experienced. The MEP proposals and sustainability strategy explore the feasibility of what could be achieved within the constraints of the existing listed building. The level of detail provided is less than that for the Guildhall, the intention being that it provides a basis for an initial cost estimate and indicative scope to allow the Council to consider revenues and value. The outcomes can be considered in conjunction with the Council's core operational and sustainability objectives to inform a decision as to whether to proceed with a more detailed design process.

The market MEP proposals are largely responsive to supporting the design development of the architect whilst the sustainability strategy has sought to guide the development of the architectural proposals.

Though the architect has provided some high level proposals on space usage, this report does not currently consider Parsons Court.

Though they are services that Max Fordham offer the report does not include acoustic or lighting design proposals. The sustainability scope is only strategic and does not include detailed embodied carbon, circular economy or BREEAM assessments or reports or Soft Landings services. The EnerPHit assessment is only for the Guildhall and does not include moisture modelling.

Report Objectives
The objectives of this report are to:

- Record and confirm the building services engineering and sustainability brief.
- Highlight key information requirements to progress the design to a level suitable to submit a detailed planning application. This is to include decisions, surveys and existing information.
- Provide concept designs and outline proposals for the building services.
- Provide space planning information to allow the architectural and structural aspects of the design to be developed.
- For fill our responsibility as a designer under the CDM Regulations.
- Provide information to allow the Quantity Surveyor and commercial advisor to prepare a cost estimate and evaluate revenues.

Other Related Reports
This report has been written so that it can be read as a standalone report, however it is one of a number of reports provided by the design team consortium led by Cartwright Pickard Architects. In particular the following reports should be referred to;

- Architectural report, by Cartwright Pickard Architects.
- Landscape and Market Architectural report, by LDA Design.
- Structural engineering report, by Conisbee.
- Fire strategy report, by Arup Fire.

The above is not an exhaustive, it lists the reports that are most informative in relation to the design coordination of the proposals.

Presentation of Report
The report is presented with the initial report sections summarising the existing situation and the current guidance and requirements that will inform the design. The design proposals that then address these are then presented in dedicated report sections, the intention being that the reader can focus on that particular aspect of the project.

The associated drawings and schedules are attached as individual appendices, allowing them to be separately accessed so that they can be read in conjunction with the relevant report section.

After the proposals the report concludes with a combined vertical transportation section, reflecting the specialist nature of this analysis and work and then combined sections for value engineering and next steps. These concluding combined report sections aim to provide focussed summaries for commercial considerations, decisions and scopes of works to inform decisions and instructions to progress with the design.

Due to its specialism and the extent of its content, the EnerPHit analysis is included as a dedicated appendix section. Effectively this allows it to be read as a standalone report.

1.2 Appointment

Max Fordham are appointed as a member of the consortium led by Cartwright Pickard Architects (CPA). The original Civic Quarter-Architectural and Commercial Development Proposal, Cambridge' included an 'MEP and Sustainability Brief' which includes a scope of services. We have progressed our works on the basis of this scope, including the comments we provided prior to commencement

The following services were offered in our tender but not included in our appointment.

- Building Performance Modelling – Energy.
- Embodied carbon/Circular economy.
- BREEAM pre-assessments.
- Acoustics.
- Noise survey.
- Moisture modelling.
- Soft Landings & Building performance.
- Architectural lighting.

A reduced scope of Passivhaus/EnerPHit services was added part the way through the design stage. This was confirmed on 2024 and is on the basis of our offer titled 'EnerPhit Technical Support Fee V2', dated 27 June 2024.

The Project Team
The consortium team includes;

- Cartwright Pickard Architects.
- BWS group, principal designer.
- LDA-design (market and landscape architects).
- Conisbee structural and civil engineers.
- Marick Real Estate, quantity surveyors and commercial advisors.
- Arup Fire.
- Theatre plan, theatre consultants.
- KMC transport.
- Carter Jonas, planning consultants.
- Turley, heritage consultants.
- Engage Communicate Facilitate (E.C.F), community engagement consultancy.

1.3 Council Brief

The primary objectives for the Civic Quarter project are;

- Creating a more attractive central Cambridge destination for residents that would increase visitor numbers for the market, the Corn Exchange and businesses in the area.
- Making essential, long-term savings and enhancing revenue to ensure we can preserve services that our residents need and value most.
- Helping the Council to meet its net zero carbon by 2030 target.

The brief outlines the requirement for consultation to consider the use of the Guildhall for 'Hotel (with and without conferencing) and Council offices' and for 'Commercial and Council offices'. The Council offices are to meet the Council's operational requirements for office, civic and customer service use.

The halls are to be made available for Council and community use on a number of days per year.

The Corn Exchange, including Parsons Court is to seek an increase in capacity and improvement in the performance space, acoustics and F&B offering.

The market is to consider a permanent F&B structure which shall also provide storage, public toilets and space for bins. The market stall layout is to be flexible to allow the use of the civic square. A decant strategy for the market is critical to ensure continuity of trading.

There is no MEP brief from the Council. Our proposals will form the brief. Specific briefing considerations are contained in the proposal sections, with specific feedback/input summarised in section 15, 'next steps'.

There is no EIR (Employers Information Requirement).

As the use of the Revit models has been limited a BEP (Bim Execution Plan) has not been developed. It is recommended that this be agreed in advance of the following design stage commencing.

Project Sustainability Brief
The Civic Quarter brief contained these key sustainability goals that are relevant to all aspects of the project:

- To target Net Zero Carbon in operational energy.
- To target water neutrality.
- To target a Biodiversity Net Gain (BNG) of 20%.

Parsons Court
The existing Council events team premises in Parsons Court has been introduced into the project. This is referred to as part of the Corn Exchange 'brief' and is to be considered with the Corn Exchange. Though the architect has provided some high level proposals on how these spaces could support the Corn Exchange, this report does not currently consider Parsons Court.

Construction Projects
The proposals have been developed such that they can be procured and progressed as stand-alone construction projects. They could also be considered in conjunction with one another. The proposals are on the basis that the buildings will be closed and unoccupied throughout the construction periods. The works in each will therefore be completed in a single phase. For the Corn Exchange this will mean the building will be 'dark' for some time. The market proposals will be phased to ensure that the stall holders will have business continuity. This reflects our understanding of the brief.

It is understood that should the project progress into the developed design stage, three separate (unlinked) planning applications would be submitted.

1.4 Existing MEP Information

MEP Record Information
We have not been provided with record drawings, operating and maintenance manuals or commissioning test sheets. We understand that these are not available.

GPRS – Below Ground Services Survey
To reduce up front costs it is understood that the below ground services survey is to be deferred to RIBA stage 3. This does introduce a risk to the schemes, though as they are existing buildings and ground floor extensions are not proposed, the risk is felt to be manageable for both the Guildhall and Corn Exchange. The potential impact and therefore risk is greater for the market and associated landscape.

Building Condition Surveys
Survey reports, written by Potter Raper, have been provided for the Guildhall and Corn Exchange. With respect to the MEP services these highlight the following.

<u>Guildhall</u>
The report is dated 15th November 2021 (QA approved). There is a dedicated MEP sub section, however this only summarises the solar photovoltaic installation on the roof and describes the method of heating (as reported to them by FM). It recommends that a detailed survey should be undertaken and report provided by a suitably competent M&E Engineer, including a specialist lift engineer (to survey the lifts) and fire engineer (to survey the fire alarm system).

The report also has a sub section for 'Net Zero Carbon Commentary/ Recommendations'. This refers to the EPC/DEC and summarises improvements recommended in the current Building Regulations (Part L), should a development take place. It focusses on improving the performance of the insulation, which in turn would reduce the heating energy requirements. This report sections continues to provide high level strategic advice such as reviewing the potential to use air source heat pumps, using more efficient plant, installing lighting and BMS controls.

<u>Corn Exchange</u>
The report is dated 6th December 2021 (QA approved). There is a dedicated MEP sub section, however this only summarises the following points that were relayed to them by the site team;

- The gas boilers are due for replacement (from our visual site survey it appears that this has been completed).
- The building is difficult to heat. The building is overheated to ensure that there is adequate heat at ground level, which leads to an excessive build-up of heat at first floor level, which is allowed to escape the building by natural ventilation (opening the casement windows to the main roof above the hallway).
- Ongoing issues with the internal drainage and plumbing due to the age of this building.
- The electrics are tested annually with upgrades provided, particularly to the stage area every year.

The section appears to make a recommendation that 'this needs to be reviewed by a Mechanical and Electrical Engineer to ascertain if a heat recovery could be in place to ensure that the heating system operates more efficiently'. It is not clear to what this refers. It is likely that it refers to the ventilation systems that are used for background heating purposes. In relation to this, our surveys did identify dampers within the systems that appear to allow recirculation of the return air that would reduce the heating energy demand in comparison to a full fresh air system.

It concludes that a detailed survey should be undertaken and report provided by a suitably competent M&E Engineer.

The report also has a sub section for 'Net Zero Carbon Commentary/ Recommendations'. This refers to the EPC/DEC and summarises improvements recommended in the current Building Regulations (Part L), should a development take place. It focusses on improving the performance of the insulation, which in turn would reduce the heating energy requirements. This report sections continues to provide high level strategic advice such as reviewing the potential to use air source heat pumps, use of LED lighting, lighting controls and BMS controls.

Asbestos Registers
Asbestos registers have been provided for the Guildhall, the Corn Exchange and the below ground accommodation associated with the market. These record the presence of asbestos in some areas. The advice in relation to these has been not to access the basement of the Guildhall.

Revit/Cloud surveys
We understand that during this design stage these surveys have been progressed. The model for the Corn Exchange was provided towards the end of the design stage and has been used to generate the drawings. We understand that the Guildhall model was not sufficiently completed to be issued for this purpose. We are not aware of the position regarding the market.

The Corn Exchange survey model was issues with a number of 2D photographs. Our experience is that these surveys often provide the 3-D images available from their survey, with an accompanying plan to identify where the image was taken from. We find this very useful when developing proposals for existing buildings. On enquiring we understand that this level of information will not be made available.

1.5 Risks (Design and Cost)

Marick have managed a project risk register. This relates to the proposals and costs rather than health and safety. During the design period we have provided input into this.

A summary of our key MEP risks is included below. The risks associated with the sustainability strategy are detailed separately in section 5.8. In relation to EnerPHit the related risks are summarised in the dedicated appendix (Appendix II).

<u>Guildhall</u>
- Power capacity (available power).
- UKPN equipment access (existing and proposed).
- Existing mobile phone equipment on the roof.
- Existing plant and connecting installations serving 'Giggling Squid' and 'Sticks 'n' Sushi'.
- The Cambridge City Centre Heat Network (see section 7).
- Ensuring all spaces are sufficiently thermally improved to suit the low temperature ASHP heating solution.
- Understanding the existing reinforced ceilings and related structure to inform the coordinate MEP design.
- Establishing existing ceiling voids and levels.

- Establishing suitable space and routes for the proposed services (as limited existing information to define the existing ones and it appears a number are cast in and/or enclosed).
- Daylight levels reducing in spaces located directly off the current lightwells (once lightwells are enclosed).
- Plant screening on the roof to limit visual appearance and noise break out.
- Implementing the results of the acoustic survey.

Corn Exchange

- Plant space required in close proximity to the neighbouring/overlooking buildings.
- Design proposals/performance is limited by existing building constraints.
- Environment of the bleacher seating area, including the mezzanine.
- Power capacity if ASHPS are required (available power).
- The Cambridge City Centre Heat Network (could be a positive, see section 7).
- Ensuring all spaces are sufficiently thermally improved to suit the low temperature ASHP heating solution.
- Agreeing a suitable heat emitter provision to the auditorium.
- Establishing suitable space and routes for the proposed services (as limited existing information to define the existing ones). In particular routes into foyer ceiling and forming the plenum under the balcony.
- Establishing that the roof access walk way is safe and can be used to access PVs (with roof enhancements?)
- Plant screening on the roof to limit visual appearance and noise break out.
- Implementing the results of the acoustic survey.
- Implementing the fire strategy, in particular any smoke ventilation requirements.
- Fire detection within the auditorium.

Market

- Optimising roof for PVs (South pitch) and daylight (North face) without having direct solar gain radiating onto stalls below.
- Agreeing the brief/provision.

2.0 EXISTING MEP SERVICES

The below does not include the incoming utility services or lifts, these are described in sections 3 and 13 of this report respectively.

2.1 The Guildhall

It is currently assumed that all existing services will be stripped out, particularly where they would interfere with the new insulation works in the building fabric. Where cast in services may impact on the airtightness strategy, appropriate detailing for capping off and infilling is to be developed at the next stage.

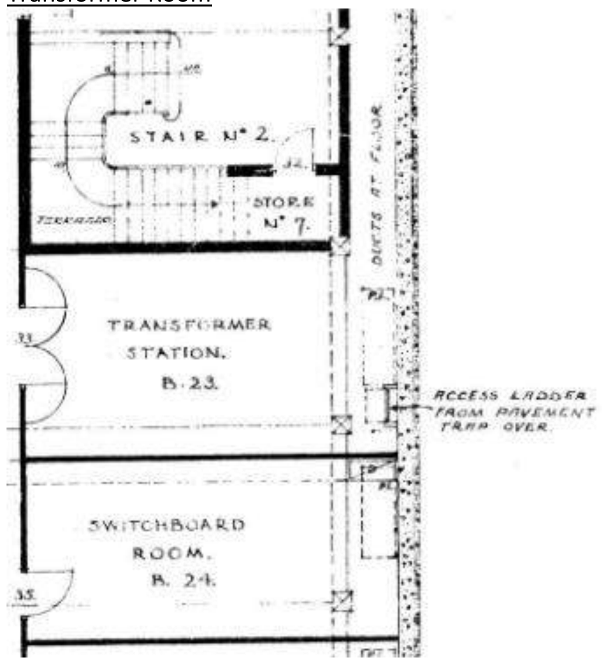
Without record MEP drawings the following has been established from visual site surveys and discussions with the Guildhall's facilities manager (FM).

In addition to the main plant and equipment rooms, this subsection summarises some of the key spaces and provisions that have influenced the proposals. Not all MEP systems are described, particularly when they are considered to be typical to a building of this nature e.g. the fire alarm system.

Basement

Due to the dangerous presence of asbestos in the basement, we have not been able to visit the basement. All the information in this section has been taken from discussions with the Guildhall's FM.

Transformer Room

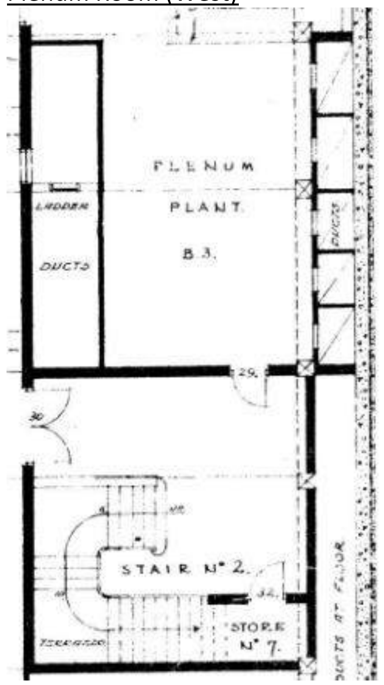


The existing substation is located next to the main west stair by the entrance from Peas Hill. It serves the Guildhall and it is believed to serve seven other meters. The FM stated the Guildhall only has a single electricity meter.

The included picture taken from layouts dated from 1935, states there is an access ladder from the pavement. This has not been observed in site visits and the FM claimed UKPN are given access to the basement, from where they have a key to access the substation.

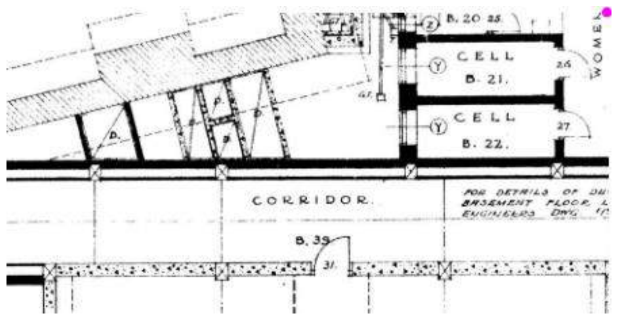
The ventilation provision to the room is unknown. Current UKPN guidance for basement substation requires installations to provide ducted passive ventilation over the transformer.

Plenum Room (West)



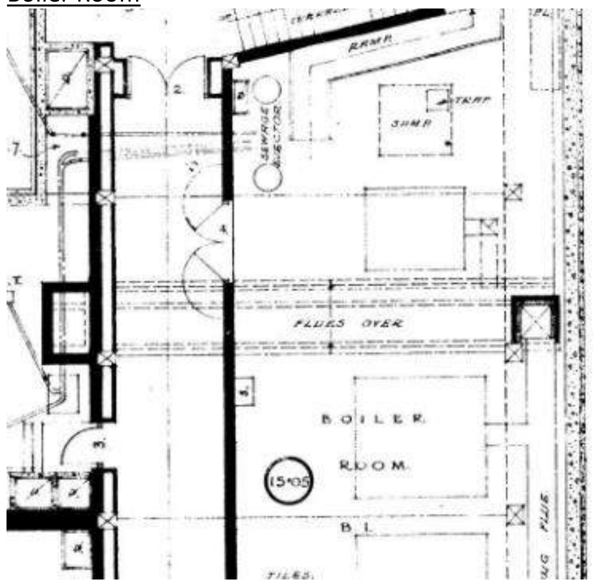
On the other side of the stair is a plenum room. From the FM, it is understood this room has five supply and five extract fans. One fan serves the basement and Gift Shop above, one the Council Chamber, one the Committee Rooms, one the Tourist Information Office, and the last the Sessions Court.

The individual supply duct routes are not known. Some run in the existing void beneath the basement floor level along the corridor, linking east and west, to vertical voids at the north-east corner of the Large Hall's footprint (below picture).



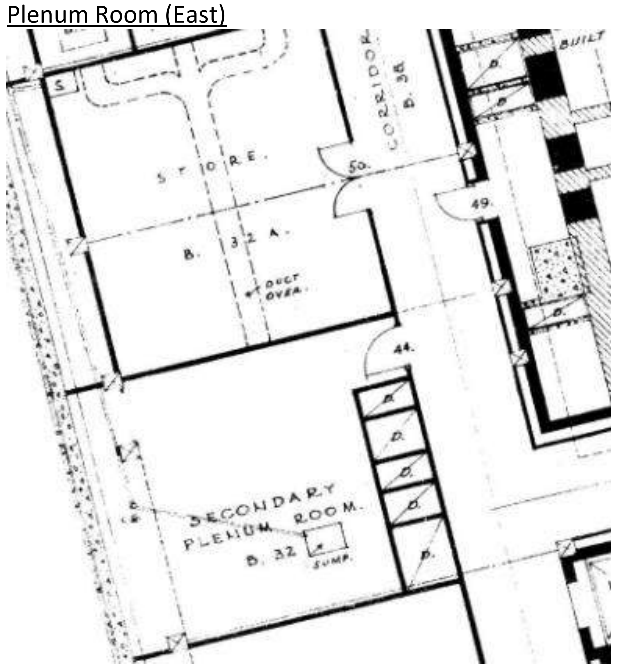
The exhaust duct routes are also not certain. It is believed they run together under the floor of the Boiler Room to the southern stack that runs up the height of the building (see first picture in following subsection).

Boiler Room



The existing boiler room is a tall room, over five metres, dropped lower into the ground than the rest of the basement. From the FM, it is understood to contain six boilers, CHP plant and two calorifiers. A flue crosses to the South-west Lightwell and also runs up the height of the building.

Plenum Room (East)



On the east side of the basement is another plenum room, thought to be providing the supply air for the Small and Large Halls. The duct routes are again unknown but thought to rise up in the wall that separates the two halls.

Ground Floor

Gift Shop

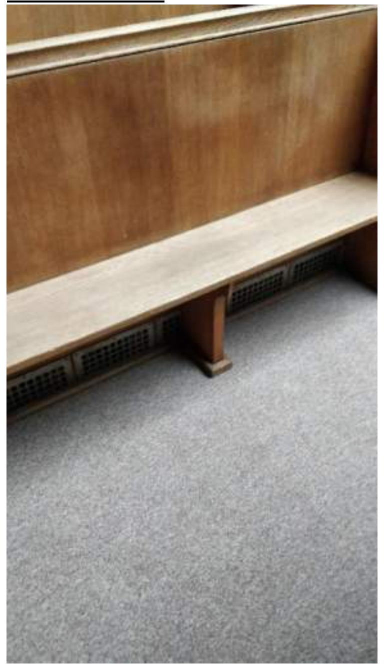
The gift shop located between the two west entrances from Peas Hill has supply at low level and extract ventilation at high level (pictured). The duct routes are behind the wall panelling and connect to the fan system that serves the wider basement according to the FM.

Tourist Information Office

Supply air to the room is through low level grilles around the room (above picture), with extract air at high level into the ceiling void via the decorative detail (below picture).

There is heating pipework above the ceiling to prevent condensation forming on the internal faces of the roof void.

Sessions Court



The Sessions Court has the same ventilation strategy as the Tourist Information Office, with low level supply (above left picture) and high level extract (above right picture). It also has the same heating arrangement above the ceiling to prevent condensation in the roof void.

South-west Lightwell

There are existing services serving the Giggling Squid restaurant adjoined to the Guildhall in the South-west Lightwell. The design proposal has attempted to avoid clashing with plant in this area, but will need to be investigated further during stage 3.

It is thought that the four ventilation routes shown running up the height of the south-west of the building in the above picture are, from left to right, Giggling Squid's kitchen exhaust, Plenum Room (West)'s exhaust air, Boiler Room's flue, and Sticks'N'Suchi's kitchen exhaust.

First Floor

Kitchen

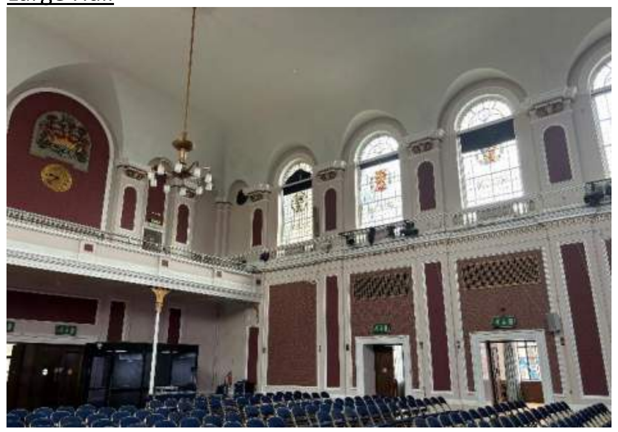
The cooking preparation area south of the Small Hall has an extract canopy ducted directly to the south façade. It also has three dumbwaiter lifts to the ground floor and basement levels, but it is understood they are no longer used.

Small Hall

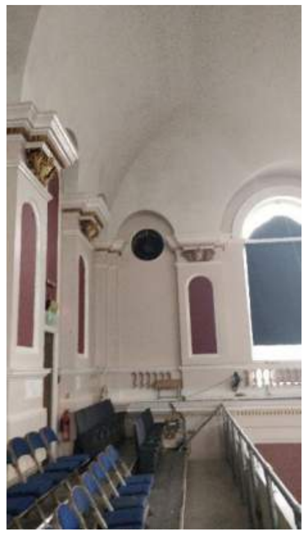
The Small Hall has louvred panels on its west and east walls. It is not known if they are both supply air, or one side is supply and the other extract air.

There are decorative, open details at high level similar to the Tourist Information Office and Sessions Court, but it is not known if that is the extract air route.

<u>Large Hall</u>



The Large Hall supply air is through the east walls halfway up the height of the room. Extract air is done by fans mounted in the wall at high level on both the east and west sides.



There are some radiators at low level on the east and west walls.

<u>Central Lightwell</u>

There are existing services serving the Sticks'N'Sushi restaurant adjoined to the Guildhall in the Central Lightwell. The design proposal has attempted to locate ventilation plant above on a new grated platform in an attempt to avoid clashing, but will need to be investigated further during stage 3.

<u>Council Chamber</u>

Similar to other rooms previously, the Council Chamber has low level supply air and high level extract air through decorative openings.

However, the ventilation strategy does vary a little from those previously, as it is understood supply air can be partially heated. There are also two radiators beneath the tall windows on the east and west walls. Below picture is from within the roof void above the Council Chamber.

<u>Committee and Members Rooms</u>

The Committee and Members Rooms in the north-west corner of the building are the exceptions, are also provided with mechanical ventilation. Again, with supply at low level (above left picture) in all three rooms and extract at high level (above right picture).

Second and Third Floors

Unique spaces on these floors are typically the gallery or roof void of other spaces already discussed.

Fourth Floor

<u>South-west Roof</u>

The South-west Roof accessed from the fourth floor contains a large cabin serving the telecommunication antennae mounted across the Guildhall roofs.

Further south on the roof are the ends of the Sticks'N'Sushi and Giggling Squid kitchen exhaust ducts, along with some heat pumps providing heating and/or cooling to the restaurants.

The current architectural plans will clash with this rooftop plant and it will have to be removed and reinstalled.

Consideration should be given as to how the restaurants can continue to remain open during the works. Also, by enacting any changes to existing installations, will there be consequential more onerous requirements to meet with any new installation, for example providing safe access to clean kitchen exhaust ducts every two metres up the building.

Roof Level
<u>Main Roof</u>

The Main Roof is largely covered with PV panels. There are two tank rooms by the two existing lightwells that are proposed to become the atriums. There are also the two lift overruns accessed via double doors from the roof.

Heating
The general approach to heating in the building is hot water pipes cast into the floors and ceilings. The heating is controlled by the existing BMS but the control is extremely limited by the vertical zonal arrangement.

As the building was constructed in sections, Zone 1 is the east side of the building, Zone 2 the north side, Zone 3 the north-west section, Zone 4 the south-west section, and Zone 5 the Large Hall footprint.

Therefore to heat one area of floor, its whole vertical zone must also be heated.

2.2 The Corn Exchange

Without record drawings the below has been established from visual site surveys and reviewing the Revit survey model.

As a significant refurbishment is proposed, dictating the venue will go dark for a period, it will be appropriate to take the opportunity to replace the existing MEP systems with new. This will allow implementation of a decarbonisation strategy. A full strip out will therefore be required.

In addition to the main plant and equipment rooms, the below summarises some of the key spaces and provisions that have influenced the proposals. Not all MEP systems are described, particularly when they are considered to be typical to a building of this nature e.g. the fire alarm system.

Auditorium

The auditorium utilises integrated high level plenums to supply air into the space. The plenums run the full length of the auditorium, along both sides. An extract from the survey model shows these, with each measuring approximately 1.9m^2 in cross sectional area. These plenum also appear to form part of the external envelope to the building, being externally clad (possibly zinc). To deliver the air into the space linear supply diffusers are installed within the plenum. Approximately a meter below each there also appear to be small circular diffusers. For acoustic reasons typical air velocities in auditorium ductwork are in the region of 2-3m/s. This indicates an estimated total air volume of 7.6-11.4m^3/s. A higher (noisier) velocity can be problematic to a spoken word or orchestral performance but less problematic to a 'rock' concert.

The supply fan serving these plenum is located in the south roof plant room. Downstream ductwork routes outside and connects into the plenum near to the south west junction of the plenum (the plenum routes behind the stage to serve that on the east side of the auditorium). A duct heating coil is included within the plant room's auditorium ventilation ductwork arrangement. The cladded plantroom ductwork measures approximately 1300x1250mm. Being relatively close to the auditorium a typical air velocity within this ductwork is likely to be 4-5m/s. This indicates an estimated total air volume of 6.2-7.7m^3/s which is similar to the lower end of the plenum estimate. The velocity would have to increase to approaching 7.5m/s to near the upper end of the plenum estimate. Though possible off the fan this would likely cause regenerative ductwork noise as it turns towards the atrium so it is unlikely to be operating at this upper end.

The return air routes through 3 'dummy' windows to the south of the level 1 side balconies. These do not contain glass and back onto a return air plenum that extends up into the south plant room. Due to the position of the plenum opening into the plant room, most of the air is passing through the first (furthest south) window. The plenum is accessed via the level 2 dimmer room.

There appear to be motorised dampers in both the supply and extract plant room ductwork. The ductwork also crosses, suggesting that recirculation (heat recovery) may be possible. This would certainly be beneficial during winter heating periods when the auditorium has a low or no occupancy.

It appears that four smoke fans are provided above the upper technical gallery. Two at each end of the auditorium, spaced apart. It appeared that these may not have been used/tested recently and there capacity is likely to be relatively limited.

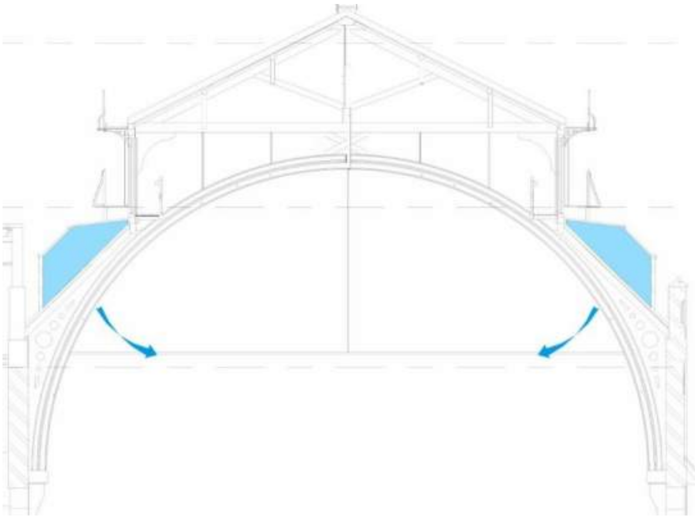
It appears that the auditorium is heated via this high level ventilation system. It is likely that there is significant inter heat loss through the roof and glazing above, including related infiltration. Coupled with the height and volume of the auditorium and acoustic restrictions on the grille air velocities space, this method of heating is unlikely to be effective or efficient. It is likely to lead to a significant temperature gradient forming, with potentially excessively high temperatures at the top required to achieve 'comfortable occupant' temperatures in the occupied zone off the auditorium floor. Discussions with representatives of the technical/FM team have relayed that audience members seated at high level on the balcony complain of overheating and that the auditorium takes a significant amount of time to warm up.

The power and lighting to the auditorium is understood to be adequate, including capacity. Lighting bridges incorporating two follow spot positions and a technical gallery are provided. Motorised lifts allow the front of the stage to be extended.


Auditorium high level supply grilles. Linear above timber slats, circular in metal panel under.

Auditorium return air path via window.

Typical smoke fan (external side).



Auditorium high level supply plenums(blue), section from Revit survey model

Supply duct from south plant room connects into auditorium supply plenum.

Clad auditorium supply plenum on west elevation forming thermal line.

The Foyer
The foyer has a dedicated ventilation system supplying and extracting air via its ceiling. The plant is located in the third floor plant room above. Air is drawn in from the louvre set into the window frame over the main entrance and exhausts through a louvre forming a similar detail over the north west escape stair.

It is anticipated that heating of the foyer is by this high level ventilation system, utilising a duct heating coil within the plant room. As the foyer space is not as high as the auditorium and is likely to perform better thermally, this should not be as problematic as that of the auditorium, though it is not an energy efficient method of providing the heat. It is likely to be utilised as it has no impact on the space below and therefore offers flexibility for using the space. As the grilles are located close to one another the distribution of the air may not be good and particularly when heating will rely on a good through from the grille to project down into the occupied space before returning up and being removed from the space by the extract air grille.

The supply duct appears to route out of the plant room, before splitting east/west and entering the auditorium. Within the auditorium the ducts are clad (circular) with carpet fitted around them. Initially appearing like a column. These ducts set down passed the balcony seating and into the ceiling of the foyer. The return air ductwork drops directly form the plant room into the level 2 staff office where it runs in a bulkhead before setting into the ceiling of the foyer.

It appears that an additional two extract ventilation systems (smaller) have been installed over the west bar and bar store behind. These connect to louvres in the façade to Parsons Court. It is anticipated that these are extract ventilation systems. They may have been introduced to improve the air circulation and distribution into these lower areas.

1F bar
The first floor bar has a local ventilation system within the bulkhead over the bar itself. Whether this is dedicated or part of a more general ventilation systems is not clear. It is likely that this is also providing some heating.

The store area behind the bar was not accessible.

Public health services to sinks etc are anticipated.

Front of House WCs
The front of house (public) WCs are typically served by mechanical ventilation systems, supplying air near to the wash had basins and extract over the WCs. Hot water is likely to be from the cylinder in the plant rooms above (basement WCs from south plant room, foyer WCs from north plant room).

Back of House WCs
Where individual WCs are provided off external walls they typically have a window providing the WC ventilation.

Individual dressing room WCs are described below. The larger level 2 dressing room WC has mechanical ventilation as described for the front of house WCs.

Domestic hot water will be from the plant room cylinder that is most local to the WC.

Dressing Rooms
Where they are on the perimeter the dressing rooms often have windows to provide daylight and ventilation. Where dedicated showers (or WCs) and wash rooms (wash hand basins) are provided within a dressing room they typically have dedicated, individual through the ceiling (roof) or wall ventilation fans within the shower changing or WC area (nothing dedicated to wash room, but generally these are in close proximity to the shower).

Domestic hot water will be from the plant room cylinder that is most local to the WC.

The electrical power and lighting provision is considered basic but adequate, some rooms appear to have been more recently refurbished and are therefore provide a higher standard of fitting and aesthetic. Some show relay was identified.

Kitchen
The first floor kitchen incorporates a gas fired cooking unit (oven/hob) and a grille. An extract canopy if positioned over these. Extract from the canopy is discharged externally via an in line fan through the west facing kitchen wall. Intake air is drawn through a fixed mesh within part of the original window unit. A local wall mounted fan speed controller is provided. A gas proving and safety control system is provided. There also appears to be a small through ceiling local extract fan over the wash up sink.

Wardrobe
The second floor wardrobe (laundry) provides a commercial washing machine and two commercial dryers. The room is mechanically ventilated but not cooled.

Managers and Technicians Office
These second floor offices have windows for the provision of natural light and ventilation. Radiators provide heating.

The managers office contains a data cabinet, show relay screen and MEP plant control panel. The plant control panel includes a touch screen, timers and switches to operate the auditorium ventilation plant, foyer ventilation plant, WC ventilation plant (both FoH and Basement) and FoH HWS. The panel also includes control for 'front block wash up ventilation plant'.

General small power is provided for each office. A distribution board is installed in the manager's office.

Cellars
There appeared to be three cellar/drink store areas. One behind each ground floor foyer bar and one to the north east corner of the building (at ground floor). These all incorporated dedicated cooling cassettes. We anticipate the condensers off Parsons court serve these cassettes. We could not access the first floor bar store (behind bar), however the bar did not appear to offer draught beers and therefore is not anticipated to have an associated cellar.

Dimmer Room
The second floor dimmer room is served by a mechanical ventilation system but does not appear to have any dedicated cooling.

The room provides access onto the lighting bridge and into the auditorium return air plenum.

Ventilation grilles and lighting in foyer ceiling.

Flues and ventilation louvres above south plant room roof.

Foyer ventilation duct routing through auditorium balcony seating.

North Plant Room
The north plant room is located at level 3 above the main entrance. It has an upper level formed with a timber floor and using the pitched roof space. The plant room contains;

- Foyer supply fan/ventilation system (with heating coil).
- Foyer extract ventilation system.
- WC ventilation extract fans.
- WC ventilation supply fan.
- Wash up supply fan.
- Wash up extract fan.
- Smoke extract fans (1 and 2).
- Cold water storage tanks (appear disconnected/made redundant).
- Hot water storage cylinder and circulating pump.

South Plant Room
The south plant room is located at level 3 above the wardrobe, WCs and dressing room 5. The plant room contains;

- The buildings heating system (boilers, pumps, pressurisation etc.).
- Hot water storage cylinders and circulating pump.
- Auditorium supply fan/ventilation system (with heating coil).
- Auditorium extract ventilation system.
- 2nd floor WC Vent Changing Area supply ventilation.
- 2nd floor WC extract fan.
- 2nd floor Changing Area toilet ventilation.
- Changing area extract fan.
- Basement WC extract
- Basement WC supply.
- 1st floor bar extract ventilation.

Parsons Court External Condensers
There are a number of condensers located by the bicycle rack on the corner of Parsons Court (see photograph). These are likely to be serving the cellars, possibly the comms room.

Central Battery Room
Off the third floor, front of house north ventilation plant room, is a dedicated room containing the central battery equipment and assocaited distribution wiring. This will be providing back up power to the emergency lighting system throughout the building. The room contains a window but no mechanical ventilation or cooling.

Electrical Switchgear & Comms/Data Cabinet
The ground floor stage store room contains the incoming power supply, meter and switchgear ad a data cabinet. An additional rack/data cabinet is located in the store room off this space, adjoining the auditorium.

External Transformer
A utility transformer is located within an open metal mesh fence compound west of the rear stage entrance, behind Parsons Court. Refer to utility section 3 of this report for further details.

Gas Meter Room
Although not accessed it is likely that the buildings gas meter is housed in the dedicated room off the rear stage entrance, behind Parsons Court. Refer to utility section 3 of this report for further details.

North plant room, supply duct leaving, splitting and setting into auditorium

Flues and ventilation louvres above south plant room roof.

Condensers in Parsons Court


Electrical switchgear and data cabinet/comms equipment in stage store

MAX FORDHAM

2.3 The Market

Without record drawings the below has been established from visual site surveys.

Some areas of the basements were not entered due to a lack of testing according to the asbestos report or were inaccessible from stored goods.

Above Ground

The existing fountain sits within the centre of the square (above picture). The only other water connection observed is an external tap (below left picture) on the west side of the square.

Next to the external tap is an electrical feeder pillar (above middle picture). It is presumed this feeder pillar is no longer in use. Neighbouring the tap and feeder pillar is a cardboard compactor (above right picture) within the refuse area of the square.

It is apparent fixed stalls are provided an individual electrical connection (following left picture) from a below ground distribution route under the cobbled surface (visible in following right picture).

The street lighting on the perimeter of the market is assumed to be retained along with telecom, CCTV (below left picture) and help point (below right picutre) connections mounted onto the columns.

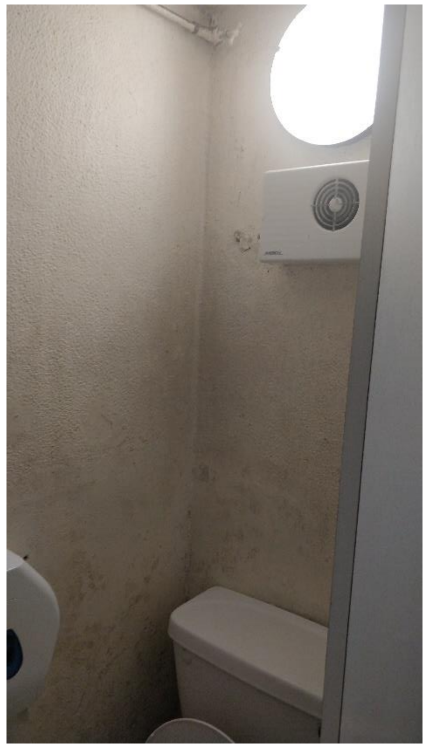
Basement

There are two existing basement entrances via locked gates, entrance to southern-side of the basement in below photo.

Within the southern-side basement are urinals, WCs and basins (below picture) all with a cold water connection. The basins have separate hot and cold water taps, we didn't establish the source of the hot water.

Foul drainage from sanitaryware routes into the northern wall and there is a floor gully.

There appears to be an extract fan serving the WC (below picture), but no above ground exhaust point was found.



Also in the southern-side basement is the incoming electrical connection and meter (below left picture). It is presumed this supplies the small power and lighting in the basements as well as supplying the stalls and other above ground electrical equipment associated with the market, such as the cardboard compactor. The distribution board (below right picture) appears to be provided with three-phase power via three 32A breakers.

The northern-side basement is used only for storage. There is general power and lighting and a uninsulated cold water pipe with an outlet (below picture).

3.0 INCOMING UTILITY SERVICES

Buried Services Survey
A below ground services survey is not available and has not been arranged/progressed during RIBA stage 2. This is as it was understood that if surveys were not considered critical to inform the stage 2 design, they were to be deferred until RIBA stage 3.

At the commencement of RIBA stage 2, minimal, if any, below ground works were envisaged and it was anticipated that the FM representatives would be familiar with the location of the existing services that enter the buildings. On this basis and considering the time required (post topographical survey) and challenging logistics for completing the survey, particularly around the market, our view was that the below ground services survey was not considered critical for informing the stage 2 design.

We recommend considering progressing this survey prior to the commencement of the RIBA stage 3 design.

Below Ground Drainage
The review of the existing and design of the proposed below ground drainage has been progressed by the project civil engineer, Conisbee. Please refer to their reports/drawings for this information.

3.1 The Guildhall – Existing Utility Services

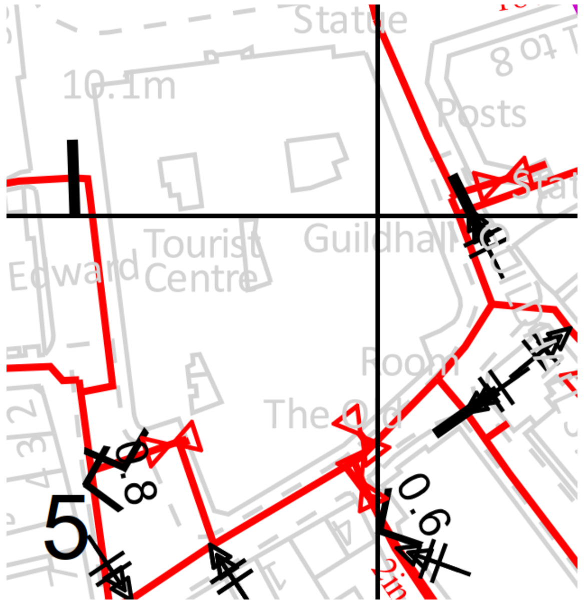
It is envisaged that the existing utility services will be disconnected, stripped out and replaced with new connections in locations that coordinate with the proposed layouts.

Unfortunately, due to the presence of asbestos preventing safe access into the basement, the locations of the existing incoming services could not be determined by on site visual inspections. Deferring the below ground services survey also meant that this was not available to inform our understanding.

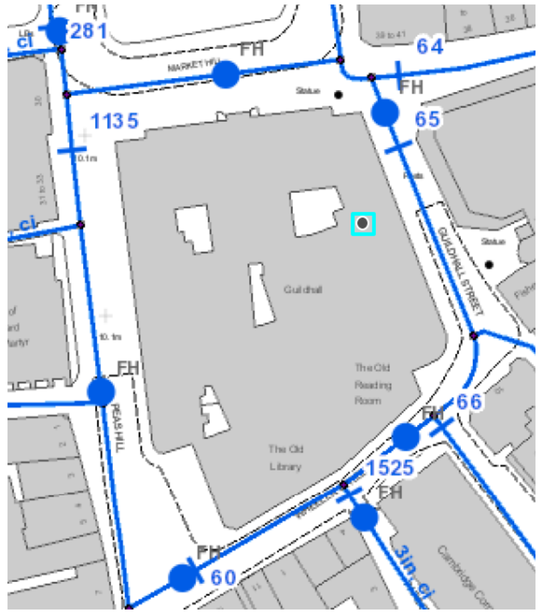
Gas
The current gas provider is Cadent Gas. There are Low Pressure (LP) mains on: the east side running down Guildhall Street, the South side along Wheeler Street and on the west side there are two smaller length runs on Peas Hill.

How the pipes enter and serve the Guildhall is to be determined. From the Cadent Gas section of the desktop survey, it appears that the connection into the building is on the south-west corner as seen in the following image. The on-site FM team understand that the gas connection enters the building at this south-west corner. It was also understood by the FM team that the incoming gas pipe and the Guildhall's meter is located in a basement corridor belonging to the Giggling Squid restaurant.

Extracts from the related desktop information are provided below.

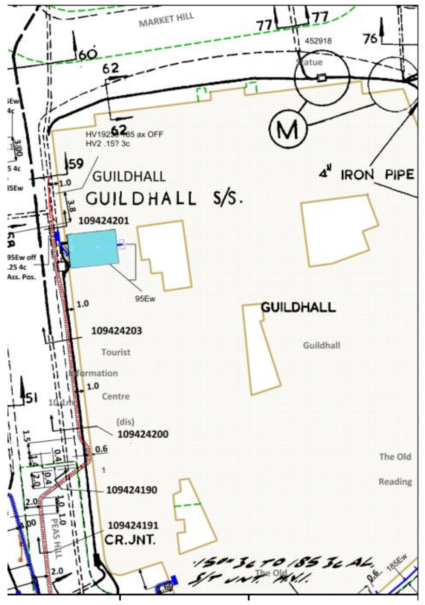


Extract from Cadent Gas Utility Plan showing mains around the Guildhall.



Extract from Thames Water Utility Plan showing mains around the Guildhall.

Extract from Cadent Gas information indicating mains entering the Guildhall.



Extract from UKPN Utility map showing mains around and substation in the Guildhall.

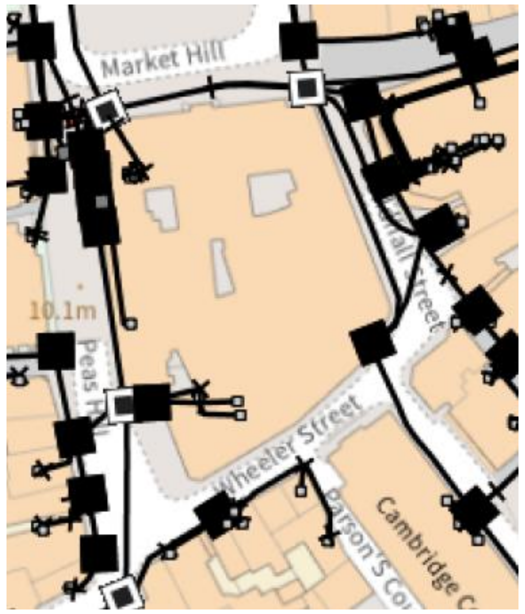
Water
The current water provider is Cambridge Water. There are mains pipes running on all sides of the Guildhall. In close proximity to the Guildhall there are six hydrants, represented by the circles in the utility map extract below. The hydrants will be used by the fire service to supply firefighting water in the necessary scenarios.

It is understood by the FM team that the water meter is housed in the basement in the north-west corner of the building, it is assumed that this is the location also of the incoming water mains supplying the building.

Electricity
The current electricity provider is UKPN. There are High Voltage (HV) cables supplying the building on the west side (red line in following image). This HV route serves a substation on the west side of the building represented by the blue rectangle. The MPAN number provided by the Council for the Guildhall meter is 1023532024731.

The existing 1MVA substation is known to have multiple metered connections. It is to be determined which and how many of these supplies serve the project areas. It is also to be determined the purpose of the metering point shown on the north side of the Guildhall, represented by the circled M.

Telecommunications
There are multiple telecommunications providers who have services in the region of the Guildhall, these are; Openreach - British Telecommunications (BT); Cityfibre; Virgin Media; and Granta Backbone Network, who are owned by the University of Cambridge. It is understood by the FM team that all the providers mentioned are serving, or have some equipment in, the Guildhall. The FM team also understand that the main incoming location for the telecommunication companies is in the north-west corner of the building, entering from Peas Hill. Extracts from the respective utility maps of each provider are below, with a short summary provided after each.



The BT drawing extract above shows one connection point in the north-west corner and two connection points in the south-west believed to be serving Giggling Squid. It is not yet understood exactly what the singular point on the west side of the building is, or whether this is potentially in the street.

The Virgin Media drawing extract above shows the location of a cabinet outside the south-west corner of the building and potentially an incoming cable from Guildhall Street on the east side.

The Cityfibre drawing extract above shows possibly four telecommunication points entering the building with two of these routing through the Sticks'n'Sushi demise.

The Granta Backbone drawing extract above shows a connection point to the Guildhall, routing through Sticks'n'Sushi, from a supply which runs through the Corn Exchange.

3.2 The Guildhall – Proposed Utility Services

This section provides a concise summary of the proposed utility services to serve the Guildhall.

All retained services penetrations to be made airtight in accordance with the detailing to be developed at the next design stage.

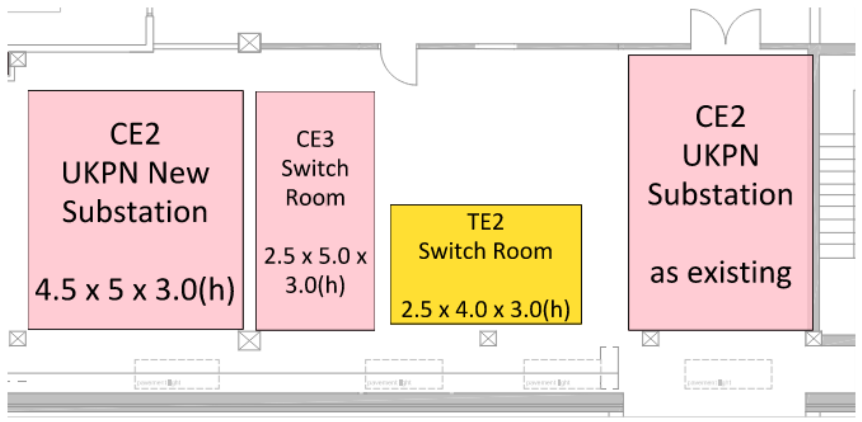
Gas
No new gas connection is proposed, with the heating and hot water provided by electric heat pumps or direct electric technologies. It is proposed to remove the existing gas supply and meter from within the Giggling Squid's basement corridor that currently serves the Guildhall, safely capping off any cut back pipework.

Water
A new connection application should be made to Cambridge Water in the next stage. No sprinkler installations are proposed, and it is assumed the firefighting water will be supplied by existing hydrants in close proximity to the building.

Separate supplies and plant rooms are currently proposed for the Council-operated areas of the Guildhall and tenant-operated areas. A new incoming main will be requested for the proposed cold water services plant rooms, refer to basement drawing J7562-MXF-GH-ZZ-DR-J-30101.

Electricity
A new connection application with UKPN is being progressed. Initial feedback is that the current 1MVA substation will not be enough due to the new electrical load of the proposed building works and appliances. Further work is to be undertaken to establish options to use the existing substation, upgrade it, or have a new substation to serve the building. A formal application has been submitted with UKPN to allow for a site visit of a UKPN project engineer.

Separate plant rooms containing the main switchgear are proposed for the Council-operated areas of the Guildhall and tenant-operated areas. A dedicated utility metered supply will be requested for each of the plant rooms but would be powered by the substation, shown in the following image in the location of the existing substation.



Conversations are currently progressing with UKPN to establish the position of requirements for substations and subsequent loads on the substation. From the initial plant sizing calculation, it was projected that the existed capacity of the substation may not be enough for the redevelopment of the building and to continue serving the supplies also fed from the existing substation. The initial response from UKPN was that a new substation will be required in the building to supply the redevelopment however further work needs to be undertaken to determine the possible options. The primary position of UKPN is that any new substations must be housed at ground level however given the heritage and listed status of the Guildhall the possibility of avoiding a new substation is being investigated or if a new one is required, then this to be located in the basement. UKPN require permanent 24-hour access to basement substations and also the installation of equipment that makes it possible to replace the transformer from the street, when required.

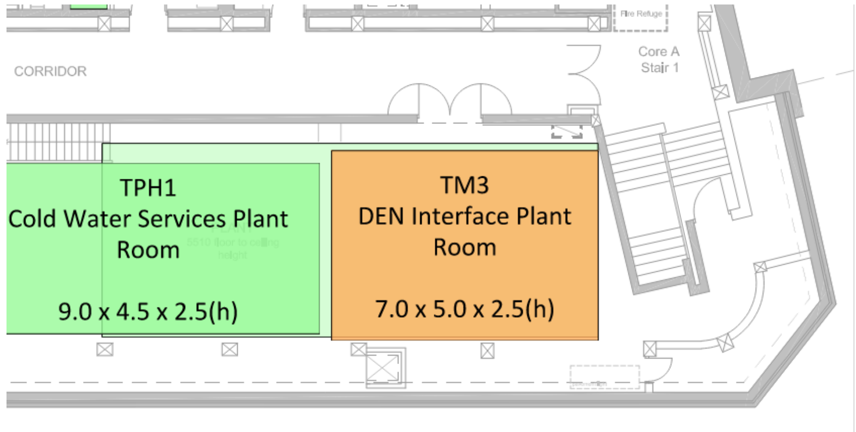
Telecommunications

There is viability for a number of telecommunication providers to supply the building from their existing infrastructure surrounding the building, see section 3.1. The Council are to confirm their required telecom connections.

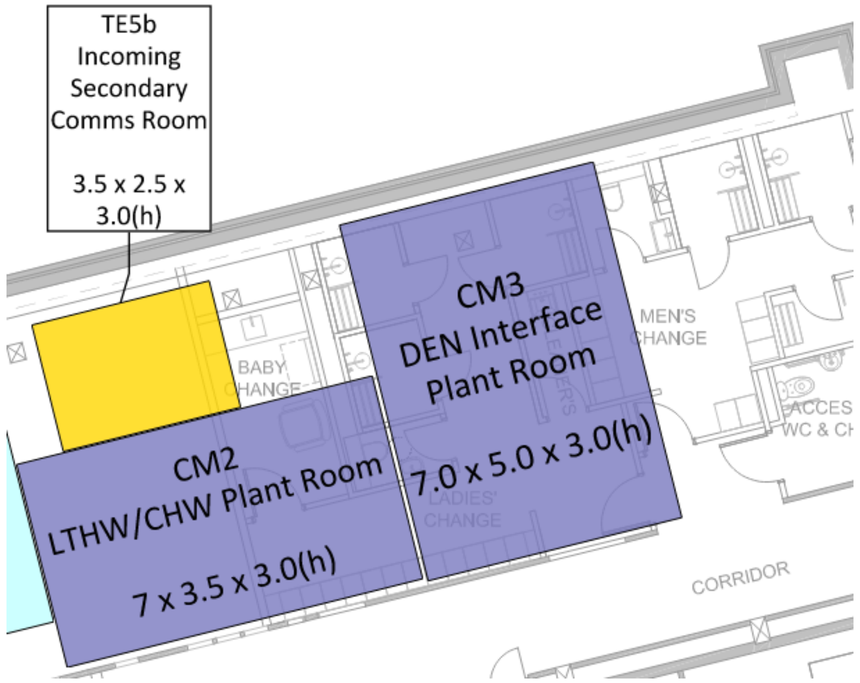
Separate incoming services and comms rooms are proposed for the Council-operated areas of the Guildhall and tenant-operated areas. The availability of more than one provider and what appear to be separate routes will support a more robust infrastructure.

District Heating Network

The Cambridge Plan states the building should future proof for connecting to a nearby community energy network that could potentially be constructed. Separate plant rooms for connecting to this network in the future are proposed for the Council-operated areas of the Guildhall and tenant-operated areas. The heating strategy and inclusion of these plant rooms should be reviewed and confirmed by the Council. Section 7.0 of the report provides further details on this.



The tenant's district heating network interface plant room has been located on the basement floor, near the west facade.



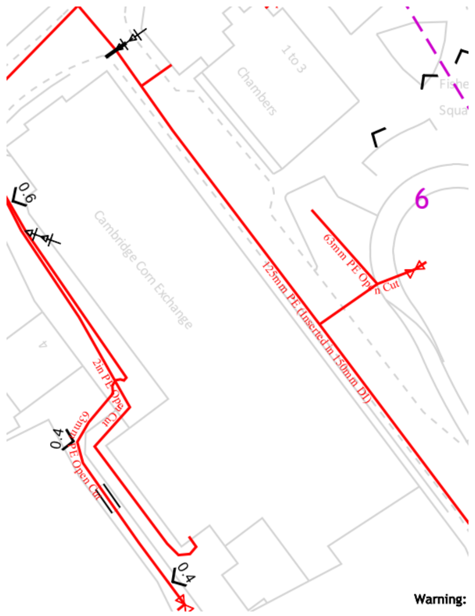
The Council's district heating network interface plant room has been located on the basement floor, near the east facade.

3.3 The Corn Exchange - Existing Utility Services

It is envisaged the majority of existing utility services will be stripped out and replaced with new connections in locations to work with the new layouts.

Gas

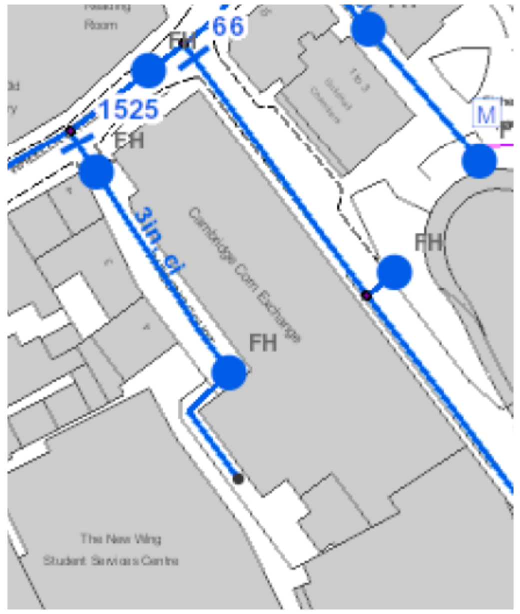
The current gas supplier is understood to be Cadent Gas. There are low pressure (LP) mains routing down the east (Corn Exchange St) and west (Parsons Court) sides of the Corn Exchange. One of the services routing down Parsons Court is shown entering in the south-west corner where we understand the gas meter is housed.



Water

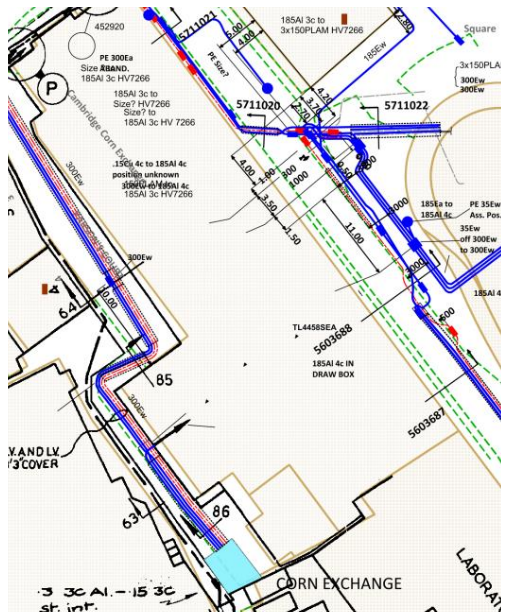
The current water supplier is Cambridge Water. From the main in Wheeler street that routes across the north of the building, there are mains pipes routing down the east (Corn Exchange St) and west (Parsons Court) sides of the Corn Exchange. It is to be determined where the water services enter the building.

Off these surrounding mains there are four hydrants, represented by the circles in the utility map extract below. The hydrants will be used by the fire service to supply firefighting water in the necessary scenarios.



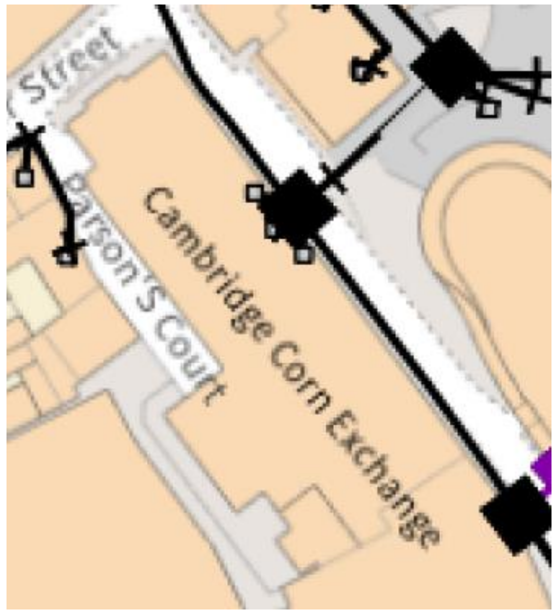
Electricity

The current electricity provider is UKPN. There are HV (red line) and Low Voltage (LV) (blue lines) cables on both the east and west side of the building. It is assumed that the Corn Exchange is served by the substation, represented by the blue quadrilateral, to the south-west of the building.

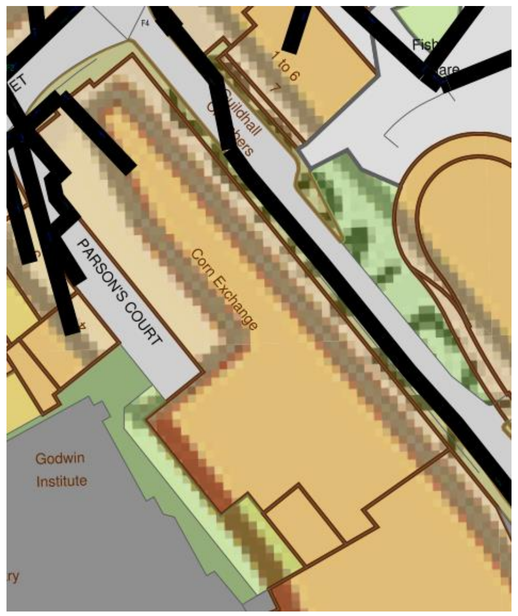


Telecommunications
There are multiple telecommunications providers who have services in close proximity to the Corn Exchange; Openreach - British Telecommunications (BT); Cityfibre; Virgin Media; and Granta Backbone Network, who are owned by the University of Cambridge. It is to be determined exactly which providers are serving the Corn Exchange. Extracts from the respective utility maps of each provider are below, with a short summary provided after each.

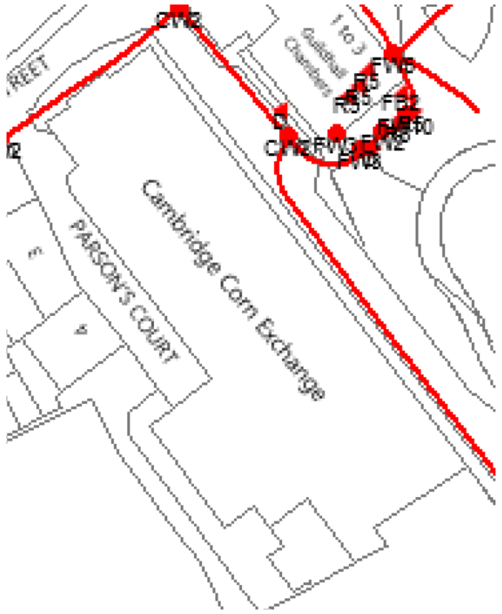
The BT drawing extract below shows services routing along the east (Corn Exchange St) side of the building. It is to be determined whether the BT infrastructure enters the building.



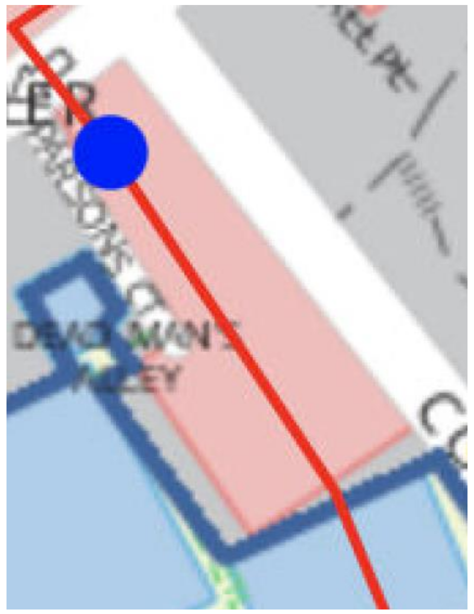
The Cityfibre drawing extract below shows services in Wheeler St (north), Corn Exchange St (east) and Parsons Court (west). A service is shown entering the Corn Exchange from the north (Wheeler Street), most likely entering the box office.



The extract from the Virgin Media desktop survey drawing below shows no existing connections into the Corn Exchange building however, there is infrastructure shown routing along Wheeler Street (north of the building) and Corn Exchange Street (east of the building).



The Granta Backbone survey information below shows services routing through the Corn Exchange that go on to supply the Guildhall as described in section 3.1. The service is shown entering the Corn Exchange after routing through the University (David Attenborough) building to the south. A connection point is shown in the Corn Exchange suggesting the service serves the Corn Exchange and runs through the Corn Exchange.



3.4 The Corn Exchange - Proposed Utility Services

This section provides a concise summary of the proposed utility services to serve the Corn Exchange.

Gas
No new gas connection is proposed, with the heating and hot water provided by electric heat pumps or direct electric technologies. The existing supply will be redundant.

Water
A new connection application will be submitted to Cambridge Water during RIBA stage 3.

Electricity
Engagement with UKPN is required to establish the properties of the existing substation and general available capacity in the area. Further work with the Theatre consultant will be progressed during RIBA stage 3 to establish the maximum demand for the Corn Exchange, as the majority will be from theatre equipment and the associated HVAC systems.

Telecommunications
There is viability for a number of telecommunication providers to supply the building from their existing infrastructure, see section 3.3. The Council shall confirm their required telecom connections. The Theatre consultant shall also be integral to these discussions and ensuring suitable performance in the public and performance spaces.

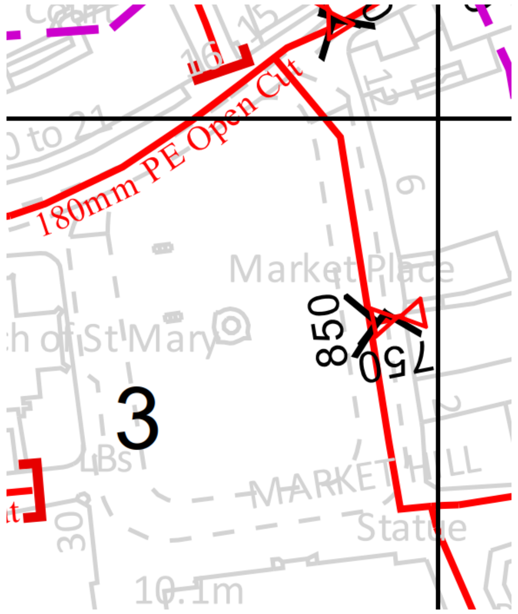
District Heating Network
The Cambridge Plan states the building should future proof for connecting to a nearby community energy network that could potentially be constructed. A new plant room for connecting to this future network would be required. The inclusion of this plant rooms and connection to the district heat network should only be considered if the refurbishment works are to be progressed at a time when the Network is available. If this is to be the case then during the following design stage a revised plant layout should be developed to ascertain if the alternative plant can be coordinated into the space available, without negatively impacting on the proposals. Report sections 7 and 11 provide further details in relation to this.

3.5 The Market - Existing Utility Services

It is envisaged the majority of existing utility services will be stripped out and replaced with new connections in locations to work with the new layout.

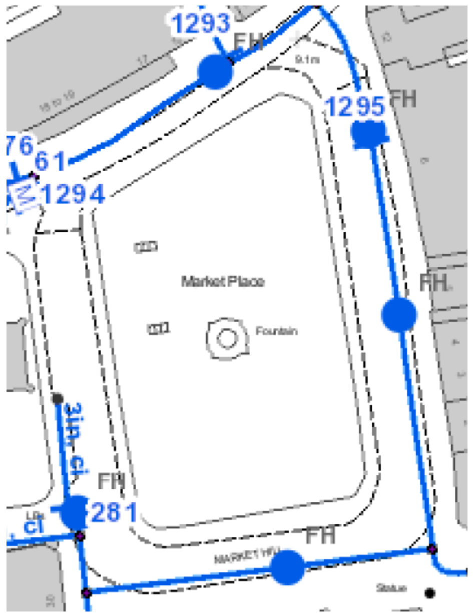
Gas

The current owner/operator of the low pressure (LP) gas mains in the area surrounding the Market Square is Cadent Gas. The utility map (extract below) does not show any connections to the Market, which is as would be expected.



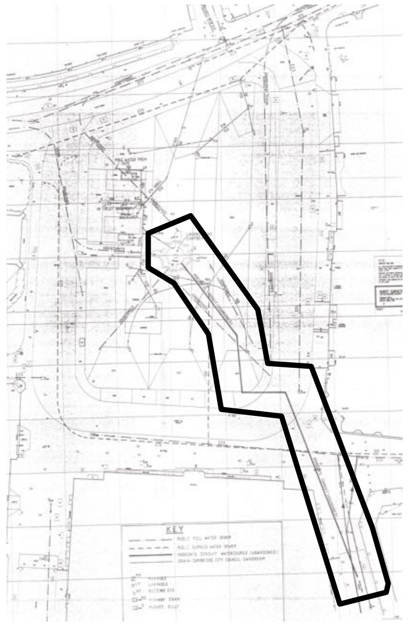
Water

The existing Cambridge Water-owned and operated infrastructure routing around the Market Square is shown in the utility map extract below. The mains route around the majority of the perimeter (Market Hill and St Mary's St). It is to be determined where any existing connections to the square are.



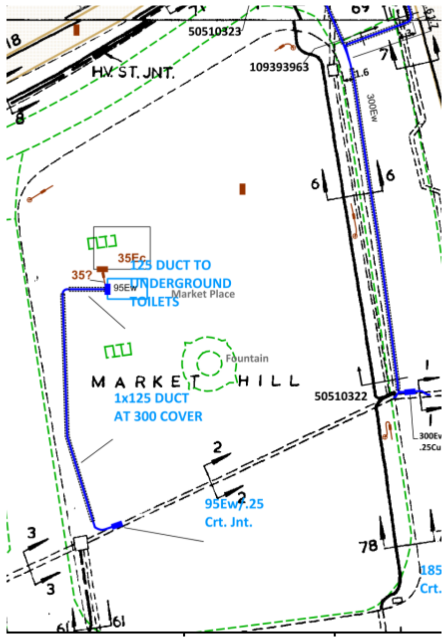
This extract shows that fire hydrants are available on all 4 sides (blue circles, referenced FH). These will offer the fire service water supplies, should they require them for fire fighting purposes.

Review of an existing drainage drawing identified that Hobsons Conduit is used to route an existing water supply under the Market Square to supply the fountain. This is shown by the thicker dark line in the drawing extract below, routing from Guildhall Street. This may be a private supply, hence not being shown on the Utility map.

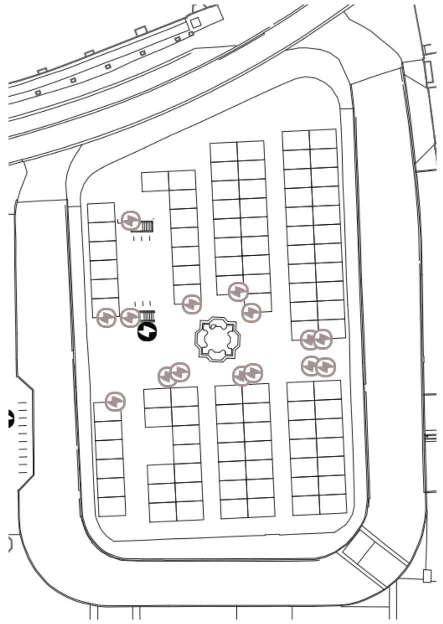


Electricity

There is an existing UKPN LV cable going directly through the Market Square as shown in the following image (represented by the dashed black line), there is also a duct (represented by the blue line) being powered by the LV cable to supply the existing underground toilets.



It is anticipated that the duct coming from this LV cable runs to the cleaner's store, located in the room next to the toilet, and distributes from here to supply some of the market stalls.



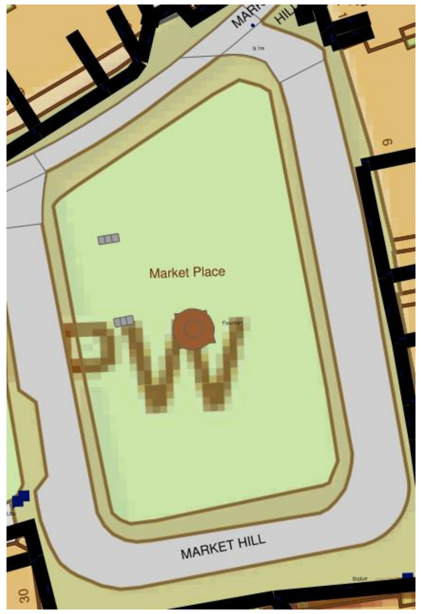
The grey lightning bolt symbols are electrical cable locations currently in the Market Square that are used to supply the stalls, these are buried currently but pop up at each specified point to serve a row of stalls. The black lightning bolt symbol is a junction box however it is currently unknown how this relates to utility supply to the square and/or basement.

Telecommunications

There are multiple telecommunications providers who have services in close proximity to the market square; Openreach - British Telecommunications (BT); Cityfibre; Virgin Media; and Granta Backbone Network, who are owned by the University of Cambridge. It is not anticipated that the stalls have hard wired telecommunication services, nor have any been identified. However, the need for good wireless communication is a necessity for the use of the general public and also to support cashless payments to the market stalls.

The above extract from the BT Openreach utility map shows the existing BT infrastructure located around the north, east and west sides of the Market Square, however, there are no direct connections to any stalls. The filled in black area represents a 'box' and the white concentric squares represent a manhole.

The above extract shows that there are no existing Virgin Media services routing into the Market Square. There is existing infrastructure on the far (north) side of St Mary's Street and east (retail/shop) side of Market Hill. A service also emanates from Peas Hill and is shown turning and terminating in the junction to St Mary's Passage.



The above extract shows that there are no existing Cityfibre services routing into the Market Square. There is existing infrastructure on the surrounding footpaths, all be it on the other side of the surrounding road.

The above extract shows that there is no existing Granta Backbone infrastructure serving or near to the Market Square.

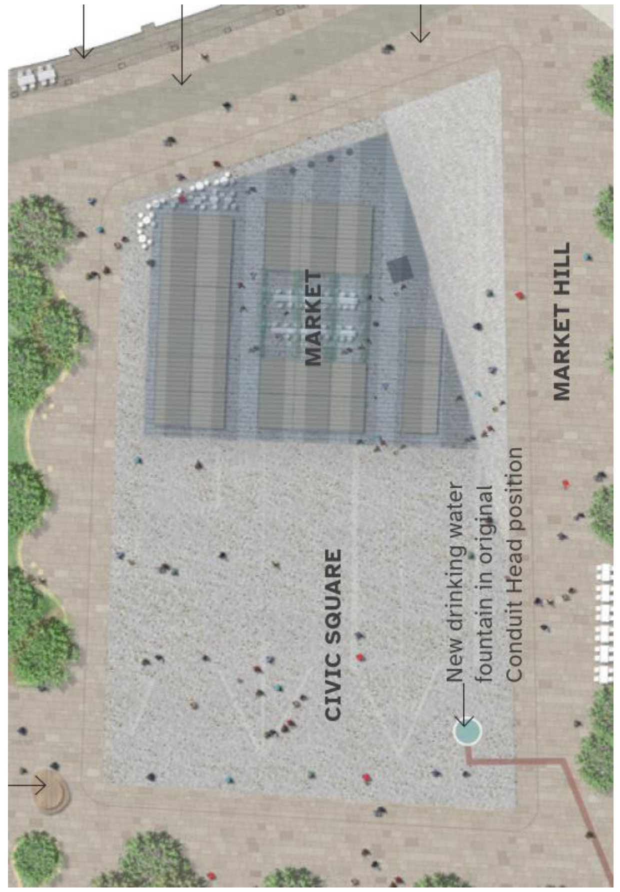
3.6 The Market - Proposed Utility Services

Gas

No new gas connection/supply is proposed to serve the Market Square. Any cooking (F&B) stalls or vans will be required to utilise bottled gas (to be provided and set to work by the trader in a safe and neat manner).

Water

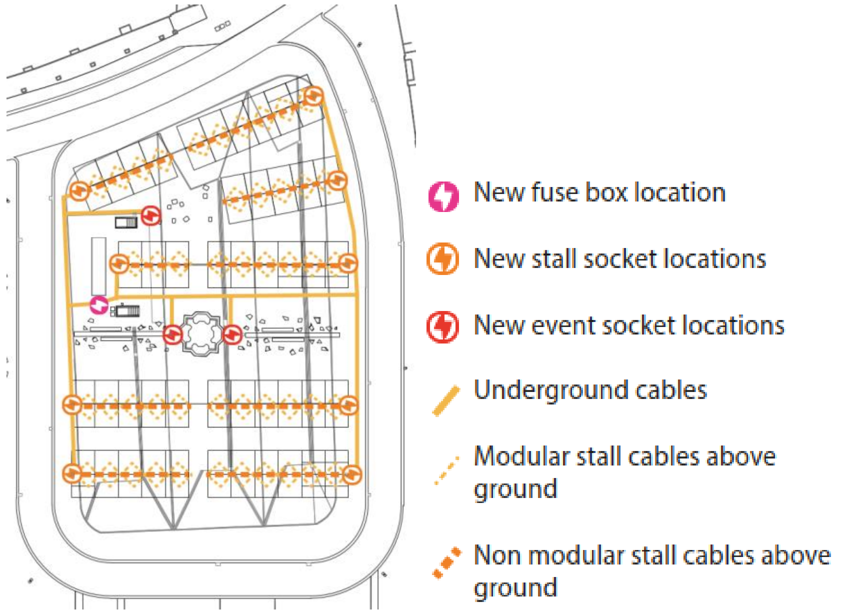
A new Cambridge Water connection application will be progressed during RIBA stage 3. The provisions are to be developed and agreed integral to the sign off of the stage 2 brief. LDA's proposed plans as of early September 2024, show the relocation of the fountain to the south-east corner of Market Square and to be served by mains water (shown by the brown line coming in at the south-east corner).



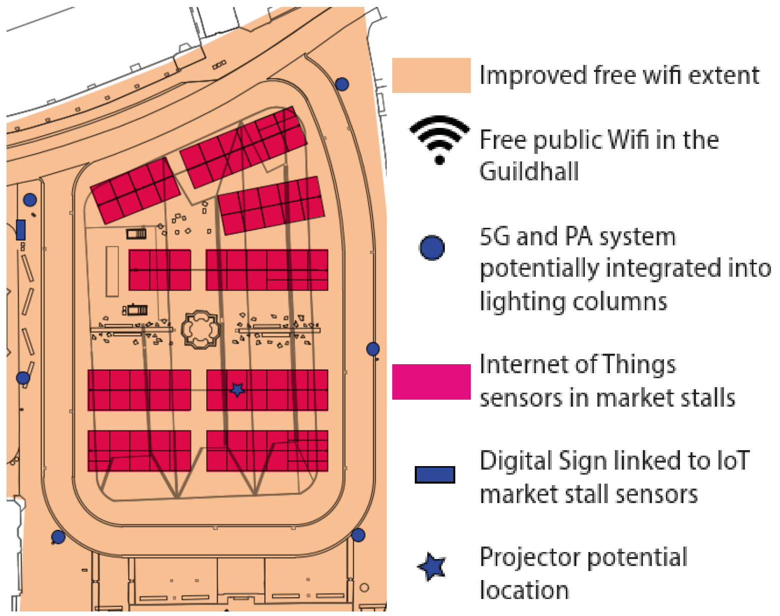
Electricity

A new UKPN supply application will be progressed during RIBA stage 3. The provisions are to be developed and agreed integral to the sign off of the stage 2 brief. The most up to date information in regards to LDA's proposed plan for electricity for the Market Square (extract below) shows an arrangement of power outlet locations, however this is dated as of 05/01/2021. As described in section 3.5 these can be private sub metered supplies, emanating from a single new Utility supply (to be agreed as brief), however the individual connections to each of the stalls is likely to be a private connection.

In addition any external 'performance/Event' provisions shall also inform this brief. The cost of 'availability' charges from UKPN should be considered in conjunction with any provision (how often will it be used/what is the standing charge cost).



Telecommunications
The telecommunications brief and how this is delivered requires Council briefing and input from their IT specialist team. Also dated as of 05/01/2021 and the most up to date information received, LDAs proposal (extract below) for telecommunications, shows a number of provisions that would require connectivity. The proposed plan is to have a better provision of free Wi-Fi and 5G systems across the Market Square to assist the stall traders.



4.0 STATUTORY AUTHORITY AND REGULATORY REQUIREMENTS

4.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF) sets out the overarching planning policies on the delivery of sustainable development through the planning system. The NPPF, revised in 2021, sets out the Government's planning policies for England and compels planning authorities to facilitate and promote good quality and sustainable development. Section 4.2 summarises how Cambridge City Council implement this.

4.2 Local Authority Requirements/Planning

There are a number of Local Authority (CCC) Planning policy documents that the development must address in its approach to energy use and sustainability. These inform the MEP, as well as the wider energy and sustainability proposals. The following report sub sections summarise these documents and the key policies and related requirements within them. To avoid duplicating information resulting in a long report section, the Policy documents shall be referred to for further details.

Local Policy: Cambridge Local Plan 2018
Key local policies in terms of sustainability and energy are;

- Policy 28: Carbon reduction, community energy networks, sustainable design and construction, and water use.
- Policy 29: Renewable and low carbon energy generation.
- Policy 31: Integrated water management and the water cycle.
- Policy 32: Flood risk.
- Policy 34: Light pollution control.
- Policy 35: Protection of human health and quality of life from noise and vibration.
- Policy 36: Air quality, odour and dust.

<u>Policy 28: Carbon reduction, community energy networks, sustainable design and construction, and water use</u>
This is an overarching policy requiring that all developments should take the available opportunities to integrate the principles of sustainable design and construction into the design of proposals.

Key requirements for non-residential developments which are therefore applicable to the Civic Quarter include:

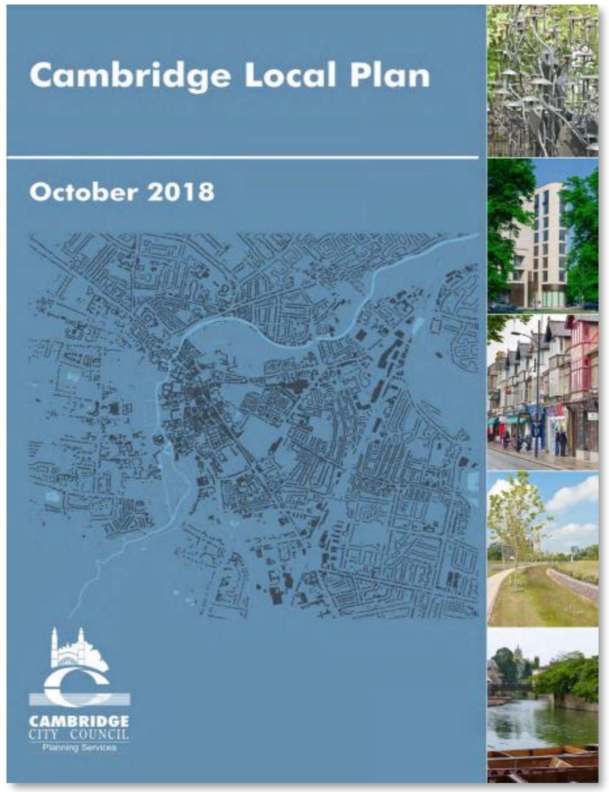
- Achieve minimum requirements for ENE 01 BREEAM Excellent
- Achieve all credits against Wat 01 from BREEAM
- Achieve BREEAM Excellent

However, the Cambridge Local Plan also states that;

"Proposals that lead to levels of environmental performance equivalent to or higher than BREEAM will be supported." Or that "The Council will be supportive of innovative approaches to meeting and exceeding the standards set out in the policy."

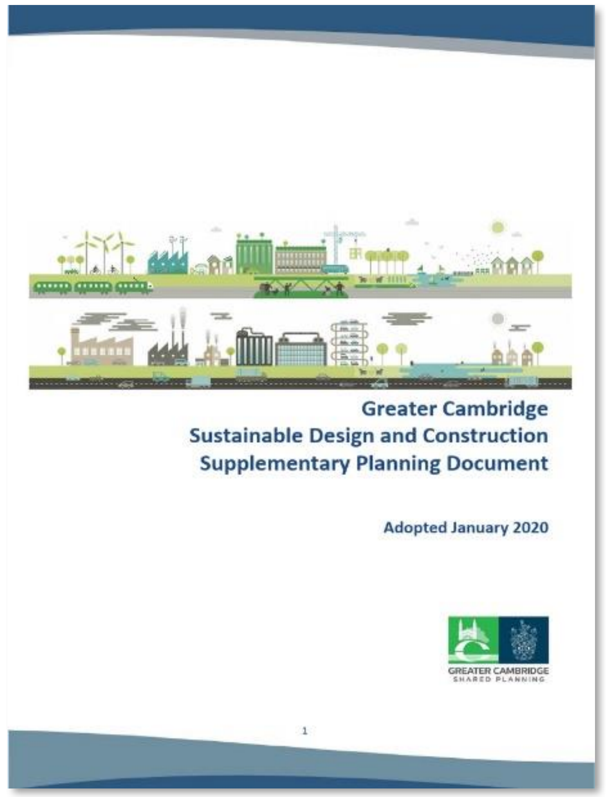
The Sustainability Statement (submitted to support the planning application) should outline the project's approach to the following issues:

- <u>Adaptation to</u> Climate Change: All developments should be designed to be adaptable to changing climate, both in terms of building design and their wider landscape setting.
- <u>Carbon Reduction</u>: A hierarchical approach should be taken to reducing carbon emissions that is set out as follows:
  1. Minimises the energy demand of new buildings from the outset through the use of passive measures;
  2. Utilises energy efficient supply through low carbon technologies; and,
  3. Supplies energy from new, renewable energy sources.
- <u>Water Management</u>: To introduce high levels of water efficiency in new developments.
- <u>Site Waste Management</u>: Developments should be designed in a way that reduces the amount of construction waste and maximises the reuse and recycling of materials at all stages of a development's lifecycle.
- <u>Use of Materials</u>:
  - Responsible sourcing.
  - Secondary materials – reuse demolition materials.
  - Embodied impact – maximise the specification of major building elements to achieve an area-weighted rating of A or B.
  - Healthy materials – low VOC finishes.



Local Policy: Greater Cambridge Sustainable Design and Construction Supplementary Planning Document 2020
Key sections within the SPD are listed below.

- Section 2 – The importance of urban design.
  - 2.2 Achieving more sustainable development forms.
  - 2.3 Transport, movement and accessibility.
- Section 3 – Policy implementation
  - 3.2 Energy & carbon reduction.
  - 3.3 Water efficiency
  - 3.4 Climate change adaptation
  - 3.5 Biodiversity
  - 3.6 Pollution
  - 3.7 Sustainable drainage systems (SuDS) and flood risk
  - 3.8 Construction standards (BREEAM).
  - 3.11 Construction waste & recycling and waste facilities
- Section 4 – Further approaches to sustainable design and construction.
  - 4.2 Health and wellbeing.
  - 4.3 Modern methods of construction.
  - 4.5 Smart technologies.
  - 4.6 Responsible sourcing of building materials and embodied carbon.



Greater Cambridge Local Plan (Regulation 18: Preferred Options 2021)
A new strategic plan is being prepared by Greater Cambridge Shared Planning Authority. This will set out a spatial vision and strategic policies to guide development within the area to 2041. An Initial Consultation on the Greater Cambridge Local Plan – First Proposals was undertaken in 2021.

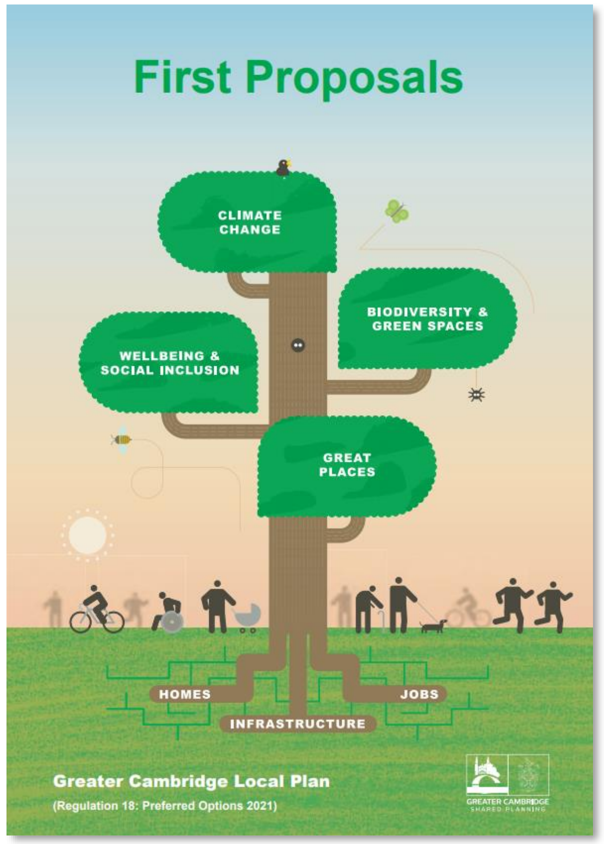
Key policies relating to energy and sustainability are:

<u>Policy CC/NZ: Net zero carbon new buildings</u>
Greater Cambridge Local Plan is expected to mandate energy use intensity targets (EUI) and a requirement for all energy to be generated onsite (or require an offset payment).

- All new offices should achieve an EUI of no more than 55 kWh per m^2 per year
- Non-residential development of 1,000 m^2 or more should calculate whole life carbon emissions

<u>Policy CC/WE: Water efficiency in new developments</u>
Non-residential development will be required to achieve full credits for category Wat 01 of BREEAM unless demonstrated impracticable.

<u>Policy CC/DC: Designing for a changing climate</u>
Design to achieve a low overheating risk – use future weather files.



4.3 Interpretation of Planning Requirements for The Civic Quarter

Consultation with the Council
During the stage 2 design process we have consulted with the Greater Cambridge Planning Authority, including their Principal Sustainability Officer. The overarching objective of the discussions was to understand the specific sustainability requirements for this project, considering it is a somewhat unusual typology, being constrained by the heritage value of the existing buildings and setting. Guidance was provided on the interpretation of 'net zero carbon' and response to certification and embodied carbon assessment. The following was established.

- Energy use intensity (EUI) targets are the preferred metric for operational energy and a Net Zero Carbon ready approach setting carbon budgets in line with best practice.
- Due to the unusual use type of the buildings, Max Fordham will propose EUI targets based on current industry thinking. These will be in line with the emerging Net Zero Carbon Standard for the Guildhall, the Corn Exchange is identified as having less scope for improvement due to the increased heritage, use and scope of refurbishment.
- Carbon offsetting is not proposed or expected. It is recommended to adhere to EUI limits and maximise energy generation.
- Passive House Planning Package (PHPP) is the recommended modelling approach by the Council but no specific requirement is given.
- EnerPHit would offer the most robust methodology to demonstrate NZC compliance. Moisture analysis may well be required for thermal upgrades even if EnerPHit is not pursued in full. This would assist the Council to provide a clear audit trail, helping to support why decisions are made and to help the consultation process.
- NABERS certification is an alternative to measuring predicted energy usage but it only relevant for the office option of the Guildhall.
- BREEAM Wat01 is recommended for water management by the Council for measuring water usage even if BREEAM is not used.
- Biodiversity Net Gain (BNG) requirement minimum target is 10% but best practice would be achieving 20%. Local policy encourages the implementation of green and bio-solar roofs around Cambridge.
- Embodied carbon modelling, reporting and comparative studies is required to demonstrate informed decision making in selection of low carbon materials.
- Extending the useful life of the building as well as salvaging and reusing materials would provide a good narrative for circular economy considerations.
- WELL standard is viewed favourably by the planning authority.
- BREEAM is not specifically required by the planning authority on either project, the Guildhall or Corn Exchange.
- Engineered timber is viewed favourably by the planning authority and would be examined as an option for extensions.

Public Consultation & Stakeholder Engagement
The consultation process was far reaching and feedback from the local community and interest groups was received. Some of this related feedback is summarised below:

Results from public consultation survey in relation to sustainability

Other related valuable feedback included;

- Wish to see a maximising of renewables included on both Guildhall and Corn Exchange roof.
- Would like to see a water feature included in the market square if this could be demonstrated as water efficient in order to provide an important element of play to the square and help to relieve future climate concerns.
- Wish to see means of improving summertime comfort in the market square.

4.4 Cambridge City Council Climate Change Strategy and Carbon Management Plan

Whilst not strictly Planning policy or Regulatory requirements the Council has set out its Climate Change strategy, an associated action plan and a carbon management plan. These are for the period 2021-2026.

Objective one of the strategy is to 'reduce carbon emissions from City Council buildings, land, vehicles and services'. This effectively forms the over-arching brief for the project to 'help the Council to meet its net zero carbon by 2030'. The strategy document specifically highlights the challenge in relation to the Guildhall and Corn Exchange buildings, primarily due to their site, structure and listed status. It notes that low-carbon heating solutions are not currently viable at these building whilst the carbon management plan notes them as the most technically challenging and expensive to retrofit and includes dedicated summaries that expand on this for both buildings. The management plan also includes the Corn Exchange's carbon emissions from gas consumption as an individual emitter, due to it being so high.

This project seeks to address these challenges and make these improvements.

4.5 Building Regulations

The Building Regulations are a legal obligation, defined to ensure that safe and healthy provisions are made for both the building and it's occupants. Our design will comply with these.

The Regulations acknowledge that historic existing buildings may have constraints that impact on the ability of their refurbishment and/or extension to meet the current Regulations. They include 'Exemptions for listed buildings, buildings in conservation areas and scheduled monuments'. Generally the exemption is where to meet the current Regulations would require the proposal to 'unacceptably alter the building's character or appearance'. Where this is the case the proposal is to look to achieve the standard as far as is 'reasonably practicable'. We have identified such constraints for the Corn Exchange and there may become some as we develop further detail for the Guildhall. The respective report sections for the related proposals describe these considerations in further detail.

Practical guidance on how to meet the requirements of the Building Regulations for common building situations are summarised in 'Approved Documents'. The most relevant to informing the MEP design and related proposals are;

- Approved Document B – Fire Safety.
- Approved Document F – Ventilation.
- Approved Document G – Sanitation, HW Safety & Water Efficiency.
- Approved Document H – Drainage and Waste Disposal.
- Approved Document L – Conservation of Fuel and Power.
- Approved Document M – Access to and Use of Buildings.
- Approved Document R – Physical Infrastructure (comms).

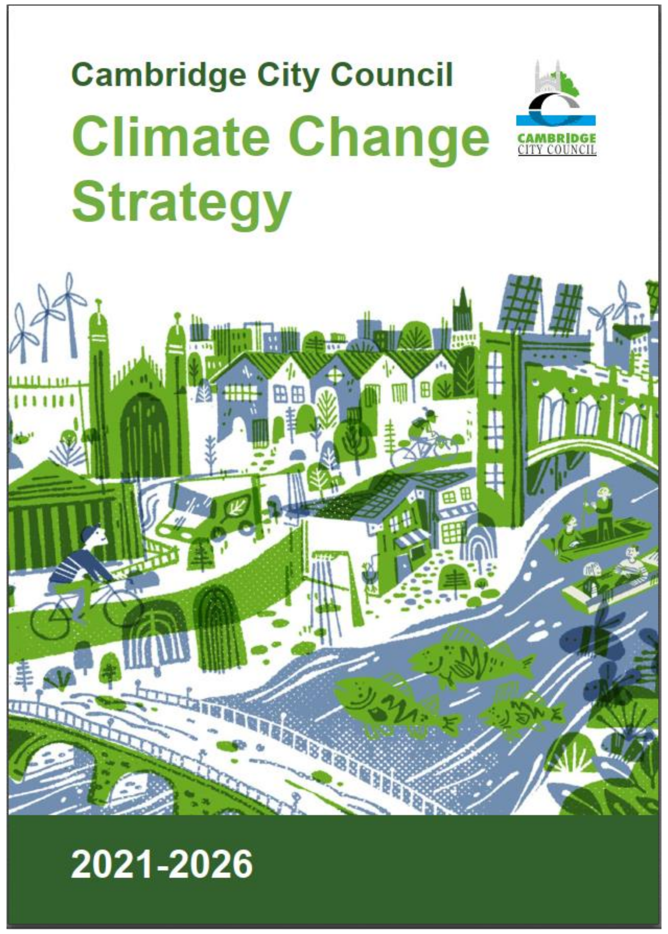
With respect to parts G and H; the related room design and sanitaryware provision, selection and specification is being undertaken by the architects, including traps and the below ground drainage is design by the civil engineer.

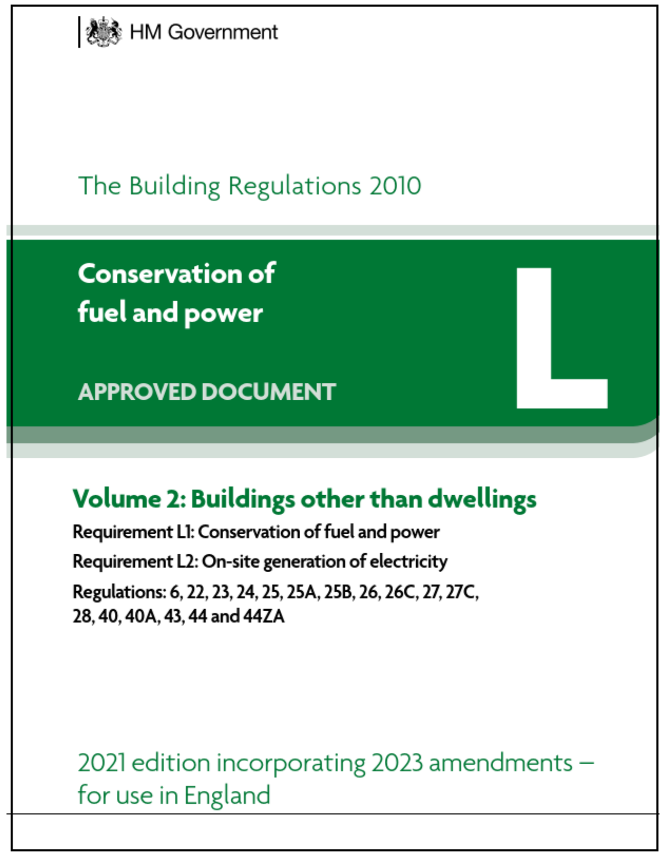
Approved Document J (Combustion Appliances & Fuel Storage) will not be relevant if the proposals are progressed to remove the gas supplies to the buildings and utilise either electrically powered heat pumps or the district heating system and electric cooking.

Approved Document S (Infrastructure for the Charging of Electric Vehicles) only relates to a major renovation of an existing building if it has at least 10 car parking spaces. The proposals do not currently include such a car parking provision.

Approved documents A; C; D; E; K and T do not provide guidance for relating to MEP design requirements. In addition, Approved Documents O; P & Q refer only to dwellings and are therefore not relevant to the proposed works;

Key briefing requirements for Cambridge City Council are to make essential, long-term savings (reduce operating and maintenance costs) and to help the Council to meet its net zero carbon by 2030. These are primarily driven by the building's energy efficiency, including its engineering services. Approved Document L is therefore very relevant to these. The approach to achieving this brief on the Guildhall is to use EnerPHit (refer to appendix II). This targets net zero carbon and is therefore expected to exceed the minimum requirements of the Regulations. Existing constraints may prevent this from being the case for all areas/details and as such the above exemption to compliance may be relevant. During RIBA stage 3 there will be a full review of the coordinated architectural and MEP proposals to meet the EnerPHit strategy. This review will include a comparative 'Part L requirement'. As at the time of tender the Corn Exchange proposal was not anticipated to be so significant, an EnerPHit review and analysis has not been progressed. Should the current proposal be developed the recommendation is that it should be. A review of the requirements of Part L will be progressed in parallel to this, or if EnerPHit is not progressed, with the evolving architectural design.





4.6 CDM Regulations

Our work, including our site visits and design development, continuously considers the Approved Code of Practice for Managing Health and Safety in Construction (the Construction (Design and Management) Regulations 2015).

Our experienced engineers who represent us at the project team meetings ensure continuity is provided and that the full extents of our work is understood and coordinated with the design team. This allows risks to be identified early, be managed and designed out. Some of these meetings include discussions with the Principal Designer.

This report section does not re-iterate risks that are not considered as being 'project specific' for existing refurbishment projects of this nature. We expect that the successful contractor will be suitably experienced in anticipating and dealing with these. For example the working at height to install MEP services.

Existing Services

As noted previously, we have not been provided with existing MEP record information (Guildhall, Corn Exchange or Market). As the proposals are for complete removal and provision of new MEP this reduces the criticality of this information, however it does increase the risk in relation to the contractor stripping out the existing services. This has also limited our understanding of the existing services strategies and the associated main distribution routes that are used. Typically we would look to maximise the reuse of existing distribution routes, in particular vertical risers. Not being able to identify these knowing these introduces risk to the design and construction of the works. To mitigate these risks we have completed more visual surveys than we would typically do so and have had meetings with and completed walk arounds with the FM representatives from the Council. To support our understanding and the design development we have identified a number of surveys that should be undertaken prior to us commencing the following design stage. Section 15 of this report includes this summary.

The presence of asbestos within the basement of the Guildhall has prevented our access to this level. The basement contains a number of plant rooms that could therefore not be visually surveyed to inform our understanding of the existing services.

The following identified risks relate to the existing services and require further works to reduce or mitigate them;

<u>General (common to Guildhall, Corn Exchange and Market)</u>

- Below ground services surveys have not yet been undertaken.
- Existing record MEP drawings are not available.
- Making safe the existing incoming (Utility) services prior to strip out of existing services.

<u>Guildhall (office option)</u>

- Asbestos in the basement has prevented access to survey the existing MEP and to familiarise ourselves with this area of the building.
- There does not appear to be suitable access or a strategy in place for UKPN to replace their equipment (transformer room in basement).
- Existing mobile equipment including equipment rooms, masts/antenna are present on the roof. Associated power supplies to them will route through the building. These will require removal and disconnection in advance of the contractor taking possession of the building.
- Plant/equipment and associated connecting MEP services that appear to serve the 'Giggling Squid' and 'Sticks and Sushi' are present on the existing roof and in the existing lightwells.
- Existing gas meter connection to the Guildhall within the Giggling Squid's basement.

<u>Corn Exchange</u>

- Access to the existing utility transformer appears constrained by the 'external store' and must be reviewed and maintained throughout.
- Existing rainwater systems and strategy will require establishing to inform design.

<u>Market</u>

- The routing of the power supplies to the stalls is anticipated to be buried and may be fairly 'shallow'. A radar survey shall be undertaken to identify routes and depths.
- Ensuring business continuity will dictate the need to;
  - retain and provide power to the stalls and support spaces,
  - retain and provide water for general use and to the sanitary accommodation.
  - provide sanitary accommodation and all associate MEP.

  whilst the construction works are progressing.
- Landscape planting is to avoid existing buried services or use above ground 'planters' (this has been discussed with LDA Design).

As noted above additional surveys are requested to inform the design development and assist with mitigating these risks.

Proposed Services

At this early stage of the design (RIBA stage 2, concept design) a number of project specific MEP hazards have been identified with respect to the proposals. As we develop the design we look to eliminate, or at least quantify and reduce, these. The below summarises these, with the exception of the MEP operating and maintenance considerations which are addressed under a dedicated sub heading below.

<u>General (common to Guildhall, Corn Exchange and Market)</u>

- Stage 2 design information provided by other team members requires further review and coordination with the proposals in this report. The late decision to prioritise the office option has affected the level of coordination that has been achieved.
- Cambridge water is considered to be 'hard'. Current experience and a suitable way of addressing this is to be agreed.

<u>Guildhall (office option)</u>

- Provision of general access to roof plant, current vertical ladders to main roof and Large Hall roof void. Short and narrow access to central roof areas.
- Existing plant serving Stick'n'Sushi and Giggling Squid restaurants within the project area that will require works affecting them to be coordinated and agreed.
- Coordination and agreement with UKPN on continuing power supply from existing substation to connected neighbours.
- Access into the basement for UKPN for personnel and replacement equipment.
- Double height Council Chamber will require careful consideration in relation to access to high level services.
- Double height Large Hall will require careful consideration in relation to access to high level services.

Our understanding is that the office option is to be progressed rather than the hotel option and therefore we have not listed out the project specific hazards that we have identified for the hotel option.

<u>Corn Exchange</u>

- The existing building constraints are limiting the performance of the proposed MEP systems. Further details are contained in section 11 of this report.
- Provision of general access to roof plant (replacement of current vertical ladders to be coordinated with removal of existing plant room and provision of new roof plant areas). Consider both north and south plant rooms and roofs off these.
- Double height foyer space will require careful consideration in relation to access to high level services. Use of theatre equipment may be possible to aid this e.g. if they use/have a tallescope.
- General access to maintain high level services in auditorium (perimeter walkway and lighting bridges are currently in place). Review existing provisions and strategies and look to develop design to utilise current access.
- Routing between the front and rear of the building, without passing through the auditorium (for acoustic reasons), requires a route around the roof. Access to install and maintain this route requires development.

<u>Market</u>

- The new MEP services routing to the stalls requires development to provide the required flexibility in a safe and neat manner.
- Any services provision to support flexible external event use requires briefing and designing in.

Operating and Maintenance Strategy

Our plant schedules identify the installation, maintenance and replacement strategies for the main plant items. A dedicated 'Access' column is used for this purpose. These schedules are contained in appendices 3, 4 and 5 of this report and are referenced 7562-MXF-GH-ZZ-SH-J-30001 & 3004 and 7562-MXF-CE-ZZ-SH-J-30001.

The constraints of the existing buildings introduce a number of challenges. These are contained in the schedules and include;

<u>Guildhall (office option)</u>

- Double doors to be provided on all routes to plant spaces in the basement.
- Plant opening into double stacked plant space in the west side of the basement. Additional lifting eye or beam to lower equipment down to lower plant level from basement corridor.
- Investigate existing trap door in south-west corner of basement to determine if the size is suitable for future plant removal.
- New substation access hatch required on Peas Hill.
- Improve ladder access to first floor central roof area, currently vertical ladder to a short hatch.
- Widen access door to roof above Small Hall for ease of standard maintenance.
- New and large plant replacement access into Large Hall roof void for ventilation equipment located within it.

- Heat pump replacement and related enclosure to be developed in detail once decision on heat network/ASHPs is made.
- PV cleaning to be reviewed for Large Hall roof and on the main roof, but outside the architectural scree. Consider provision mansafe system and of water supply.
- Stair climber trolleys will be required to transfer plant items up/down staircases (various e.g. hot water cylinders).

Our understanding is that the office option is to be progressed rather than the hotel option and therefore we have not listed out the CDM plant maintenance challenges for the hotel option.

<u>Corn Exchange</u>

- Level 2 existing doorway off north west escape stair to be extended for plant room access (initial installation and replacement, refer to cold water services plant room, PH1 and Foyer WC MVHR, M9).
- Level 2 doorway into plant room off south west BoH stairway to be maximised in width in consideration of existing structure (refer to auditorium MVHR4A&4B). Requires confirmation at commencement of following design stage.
- Level 3 new roof access hatch / method for replacing auditorium AHU in level 2 plant room below.
- Level 3 existing partition wall between plant room and central battery room to be modified to allow cooling coil and ductwork installation (refer to auditorium balcony MVHR6).
- Level 3 plant room roof to be removed to allow initial installation of new balcony AHU (in conjunction with thermal upgrades). Strategy for future plant replacement to be developed in conjunction with roof design (refer to auditorium balcony MVHR6).
- Level 1 bar MVHR (M10) plant deck and access to be developed to consider ease of maintenance access (filter change etc.).
- Basement cupboard door to be widened to facilitate hot water cylinder.
- Heat pump replacement and related enclosure to be developed in detail once decision on heat network/ASHPs is made.
- PV cleaning to be reviewed with existing walkway around outside of roof. Consider provision of water supply.
- Stair climber trolleys will be required to transfer plant items up/down staircases (various e.g. hot water cylinders).
- General roof access routes for maintenance to be developed as noted above for proposed services. Design to look to improve existing arrangements.

5.0 SUSTAINABILITY

5.1 CCQ Sustainability Vision

The sustainability strategy for the Cambridge Civic Quarter (CCQ) has considered both the buildings and the market square as individual projects, as well as the site as a whole to achieve the projects sustainability aspirations.

The key aspirations are captured graphically in the image below. This presents the 'Sustainability Vision' for the Cambridge Civic Quarter. Further considerations and details for each aspiration, for each element of the project are summarised in the following report sub sections.

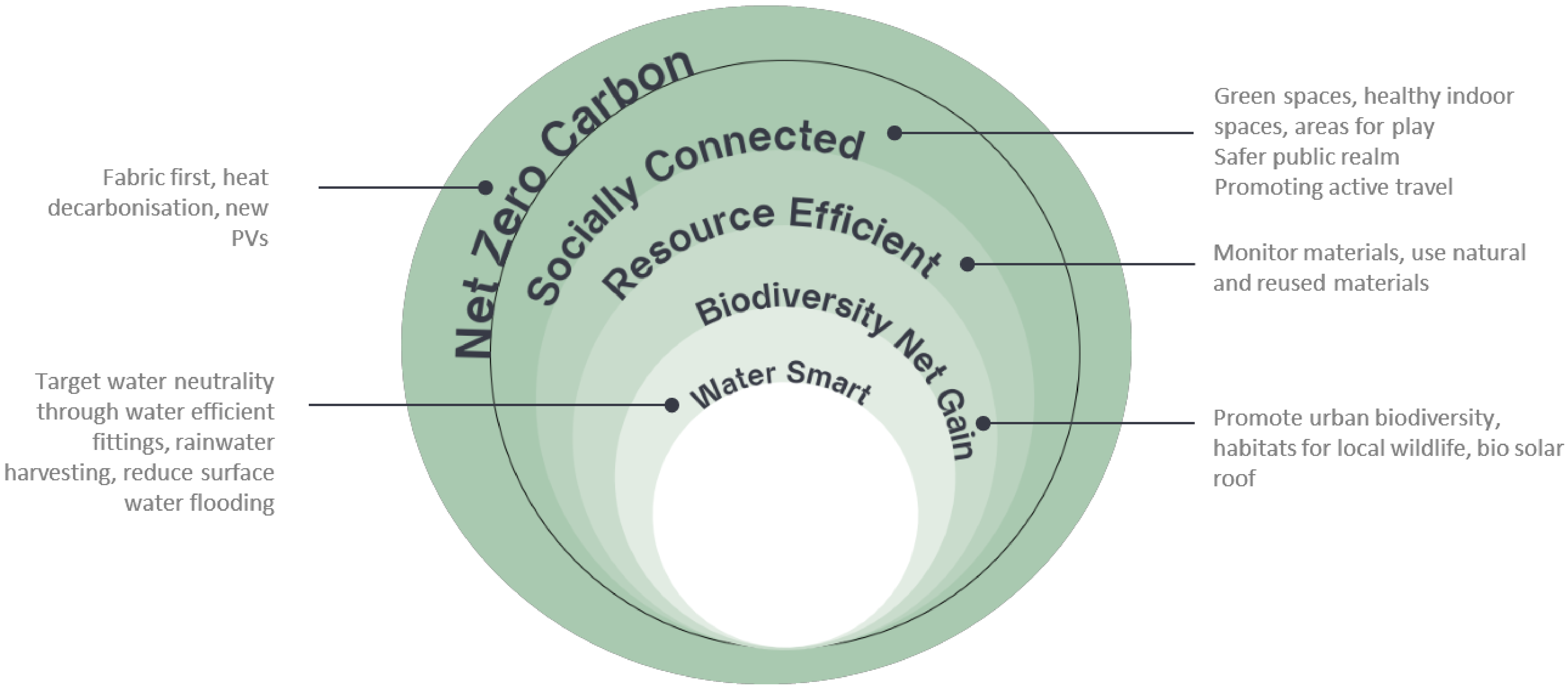


Figure.3: CCQ Sustainability Vision

5.2 Net Zero Carbon

Net zero carbon is a term interpreted by different parties in different situations and thus requires definition. At present the UKGBC is the most current definition for UK Buildings, soon to be replaced by the UK Net Zero Carbon Building Standard. This report was produced before the release of The Net Zero Carbon Building Standard Pilot version. A detailed feasibility study will therefore be conducted, and the report updated in line with the requirements of this Pilot version, at stage 3.

Net Zero Carbon (NZC) is defined by the UK Green Building Council (UKGBC) in two ways:

- Net zero carbon – construction (for new buildings and major renovations).
- Net zero carbon – operational energy (for all buildings in operation).

Based on conversations with the Councils Principal Sustainability Officer, we propose that the CCQ should follow the UK Net Zero Carbon Building Standard (UKNZCBS) in relation to **Operational Energy.**

The UK UKNZCBS is set to be released by the end of 2024 and will replace the current UKGBC Framework. It is anticipated that it will closely align with the UKGBC Framework and we anticipate that this will include the following:

- Set operational energy use (EUI) limits of buildings (retrofit energy limits to be in-line with new builds).
- Require buildings to be Fossil Fuel Free.
- Stipulate renewable electricity generation needed to support grid decarbonisation.

To achieve Net Zero carbon in operational energy, energy demand must be reduced and energy generation using renewable energy sources maximised. We suggest the following measures are implemented in order to achieve this:

- Utilise efficient building fabric and passive design principles – explore the option of EnerPHit certification for the Guildhall.
- Design efficient systems.
- Implement efficient energy management.
- Maximise the supply of renewable energy on-site by maximising the PV array across the development, particularly on the angled roof of the large hall.

Energy Use Intensity (EUI) Targets
EUI is the total amount of energy a building uses in a year, divided by the buildings floor area. This figure is expressed in kWh/m2 and is an in-use metric, meaning the building will be designed to meet the target, but compliance will be determined by meter readings and/or utility bills.

The UKNZCBS is expected to outline EUI targets for different building types. Max Fordham have estimated aspirational EUI targets for the CCQ to align with the emerging UKNZCBS. These are summarised for the two relevant building types (office for Guildhall) and Theatre (for Corn Exchange) in the table below.

Building Type	Pioneering ($kWh/m^2/yr$)	Best Practice ($kWh/m^2/yr$)	Good practice ($kWh/m^2/yr$)	Benchmark (DEC D equiv) ($kWh/m^2/yr$)
Office	**60** *(Passivhaus EnerPHit)*	**90 - 100** *(REEB 2023 - Passivhaus EnerPHit)*	**114** *(REEB 2023)*	**215** *(CIBSE TM46)*
Theatre	No data	**130 - 140** *(UK NZCBS Tech Update/DEC A esti*	**240** *(Julies Bicycle)*	***570*** *(CIBSE TM46)*

Estimated NZC Energy Use Intensity (EUI) Targets
Note: MF Estimates only. Roughly align with the New Build Operational Energy Performance Levels given in the recent UK NZCBS Technical Update and energy supplied by on-site level of PV is ***included*** *in these EUI estimates. Will be superseded by UK Net Zero Carbon Building Standard when released.*

It should be emphasised that achieving these targets is dependent on operation as well as strategy, as they are in-use rather than modelled targets. Such low EUI targets are still recognised as high-risk.

The Guildhall
If the Guildhall (Office) were to achieve the pioneering EUI target, this would indicate up to a 70% improvement compared to industry benchmarks.

Given that the building is a retrofit, we expect the EUI targets to be relaxed and therefore aim to achieve the 'Best Practice' standards.

In order to meet the EUI target it is imperative that the building fabric is considerably enhanced and that the operational energy use is reduced in practice. Appendix II includes the EnerPHit recommendations to assist with meeting these reduced energy targets. During subsequent design stages further fabric investigations and surveys will be required to inform the detailed recommendations.

Following the benchmarks provided within the Net Zero Carbon Building Standard Pilot version, we predict that if construction were to start before 2031, the refurbishment of the Guildhall following the EnerPHit requirements would be able to achieve Net Zero Carbon in operation status (for more information see the EnerPHit report in Appendix II). However, a detailed reviewed will be conducted in stage 3 to cover the following:

- Energy Use intensity limits
- Minimum On-site renewable electricity generation
- Fossil fuel free
- Annual and peak heating / cooling limits
- Refrigerant GWP limits

The Corn Exchange
The Corn Exchange currently has a baseline energy consumption of 920kWh/m2/yr (taken from 1 year's DEC data). A large amount of energy is consumed by gas heating, which inefficiently warms the auditorium via the high level ventilation system (warm air heating). Our current energy prediction is that energy consumption could theoretically be reduced by 65% to be in line with 'Good Practice'. The fabric, aesthetic and plant space constraints of the building make it unlikely that a lower energy use intensity can be achieved in practice.

This is an initial 'theoretical' estimate only and is subject to detailed investigations, analysis and energy modelling as the detail develops. Should the development be progressed the EnerPHit analysis approach used for the Guildhall should be applied to the Corn Exchange. At a minimum to near these targets our recommendations to improve the fabric performance are;

- Enhance the roof insulation (replacing it with new).
- Replace all high level (roof) glazing if required visually and highly insulate (currently all blacked out).
- Improve (replace) secondary glazing and possibly outer glazing where it is used for natural lighting.
- Address uncontrolled ventilation (improve air tightness).
- Investigate upgrade / replacement of high-level ventilation plenums and ducts that form part of the thermal line.
- Implement fabric upgrades to achieve best practice fabric standards in all back of house areas.

In addition to the fabric upgrades operational energy reduction measures will require implementing via new MEP systems and related automatic controls, as described elsewhere in this report.

A further complexity for the Corn Exchange is the nature of its use (short periods of high intensity). The number of and type of events held, along with the number of attendees will directly affect the operational energy.

Soft Landings and Building Performance
Energy consumption in use is highly dependent on achieving good handover, users understanding how to operate the building efficiently and appropriate controls.

We recommend using the soft landings process during the design and construction stages (RIBA stages 3 through to 7) in addition to including an allowance of 2 years of aftercare (attendance and fine tuning during occupation, including seasonal commissioning). Our experience is that teething problems can be resolved that may not otherwise have been identified and energy and bills are reduced.

This service should include a visual building user guide or room guidance to help operators understand the building controls as well as communicating energy savings aspirations.

EnerPHit
EnerPHit applies the Passivhaus principles to existing buildings to achieve high levels of energy efficiency, reduce moisture risk, maintain internal temperature and high indoor air quality, and provide third-party verification. This in turn provides high levels of thermal comfort and occupant wellbeing.

EnerPHit certification is the lowest risk approach to achieving Net Zero Carbon in operational energy and has been investigated at Stage 2 for the refurbishment of the Guildhall. Key findings from this investigation were:

- The design that meets minimum EnerPHit (Component) compliance is expected to achieve Net Zero operational energy limits for 2031-

2032. To target 2035 and beyond, thermally improving the high heritage value spaces will be necessary.

- Thermal improvements and low carbon energy sources, such as air-source heat pumps, are expected to reduce heating energy use by 85%.
- Electricity for lighting, building systems, IT, office/data equipment, and appliances is anticipated to be the highest energy use in the retrofitted building, with heating anticipated to be the second highest energy use. Additional investigation into reducing these energy loads further will be explored at Stage 3.

For more information, please see the full EnerPHit report in Appendix II.

5.3 Socially Connected

One of the primary objectives for the Civic Quarter project is to create a more attractive central Cambridge destination for residents that will increase visitor numbers for the market, the Corn Exchange and businesses in the area. To achieve this related project aims include:

- Revitalising the Civic Quarter to increase a sense of community and better utilise the spaces.
- Improving the market square for vendors, customers and the general public. This includes making the site more accessible, improving wayfinding through the market and grouping market vendors into goods categories.
- Minimising the number of permanent stalls on the market square to enable space for changing community events. This will also open up the view of the surrounding historical architecture.
- Enhancing the entertainment and conference offerings currently provided by the Corn Exchange and Guildhall. As well as supporting the local community the modernised facilities will enable their intensity of use to increase and attract and facilitate more visitors to Cambridge.
- Refurbishing the Guildhall to become a centre of civic functions.

The Civic Quarter aims to provide residents of and visitors to Cambridge a better-connected public environment that supports community and is informed by community wishes. We have addressed this part of the vision through the following:

Safer Public Realm
As part of the redevelopment of the Market Square, changes to the market stall structures aims to reduce crime and antisocial behaviour currently present in this area of the city centre. Lockable permanent market stalls and temporary stalls that can be fully taken down and put away have been discussed to reduce dark corners and improve the safety of the market square at night. Improved external lighting to the market square and surroundings will enhance security and nighttime activation.

Refurbishment of the granite setts will increase accessibility to the civic quarter for those with physical disabilities and walking difficulties. Whilst the introduction of temporary stalls will increase wayfinding across the market square and into the civic quarter from east, south and west.

During specified daytime hours, reduced traffic access will also enable users to walk safely and freely through the civic quarter and surrounding pedestrianised areas via Rose Crescent and Petty Curry. Cycle parking located under the market square and within the Grand Arcade will reduce the number of cycles travelling through the market square and reduce traffic further. For more details see KMC's transport strategy

Supporting Active Travel
Cycling is a popular mode of transport in Cambridge and facilitating easy and convenient access to shops and leisure facilities in the Civic Quarter by cycling is key. However, it is important to balance the location and quantum of cycle parking with also providing space for public realm including seating and parking.

The current design demonstrates how much public realm including seating and planting could be achieved if a large amount of cycle parking was relocated from the Civic Quarter. In order to maintain strong cycle access into the Civic Quarter, it is recommended that cycle parking is re-provided via the expansion and enhancement of the cycle parking hub at the Grand Arcade, which could form the first phase of a Cambridge city cycle parking strategy to intercept cycle trips at convenient key locations in the City Centre.

The report by KMC Transport Planning sets out the above in more detail.

Cycle parking facilities will also be improved as part of the Guildhall proposals for those working in the building, this includes the provision of enhanced changing facilities.

Green Spaces and Supporting Play
Landscaping, planting and seating will be increased throughout the market square and Peas Hill to activate these spaces, increase biodiversity, wildlife, thermal comfort and the overall attractiveness and appeal of the market square.

Elements of gamification and play should also be incorporated into these areas to support children and families using the space. Opportunities to develop a play strategy will be further reviewed at stage 3.

<u>External thermal comfort</u>
Across external spaces, increases in the frequency of extreme weather, particularly hotter summer temperatures, will require increasing levels of external shading to enable people to continue utilising outside spaces.

Within the market square, this will require shading provided by trees or external structures, particularly over seated areas and benches. This has begun to be addressed along Peas Hill and along the west side of the market square. As well as within the Market Square with the proposal for permanent market stall structures that provide shading and can house photo voltaic panels (PVs).

Healthy Indoor Spaces
<u>Summertime thermal comfort</u>
Overheating can not only become uncomfortable for occupants but can induce issues with concentration, productivity, and exhaustion. Key requirements to manage overheating are:

- Policy CC/DC: Designing for a changing climate.
- Design to achieve a low overheating risk – use future weather files.
- Hea 04: Adaptability - for a projected climate change scenario (If BREEAM is pursued).

The existing listed buildings will limit the possible architectural interventions to reduce overheating e.g. glazing areas, solar shading etc. Reducing solar gains by glazing specification and internal heat gains by equipment specification will reduce the heat gain within the occupied spaces. Providing openable windows in conjunction with exposed thermal mass, as well as future cooling adaptation will also be considered.

The level of futureproofing against predicted weather patterns will be considered in conjunction with detailed design. Over sizing to future proof will likely reduce initial efficiency and energy performance and will likely require larger systems (plant, pipework and emitters etc). Therefore, considerations for how the building might be retrofitted should be made. As such the decision is one that requires analysis, discussion and agreement.

<u>Indoor air quality</u>
Poor indoor air quality can have both short and long-term health implications including headaches, fatigue, respiratory irritation, heart disease and cancer. Indoor air pollution consists of smoke, vapours, mould, particulate matter and volatile organic compounds (VOCs) which are often made up of chemicals residing in the air from construction materials and processes, furniture, finishes, paints and chemicals used for cleaning.

The most effective way to reduce the level of indoor air quality pollutants is through efficient ventilation systems and reducing the source of emissions.

Mechanical ventilation with heat recovery is generally proposed to serve the occupied spaces within the Guildhall and Corn Exchange. This will improve air quality in the winter and spring months.

Internal emissions can be minimised through:

- Specifying low VOC paints and finishes.
- Specify low VOC glues and adhesives to be used during construction.
- Reducing fixed furniture options and opting for moveable furniture options instead.
- Have a significant flush out period after project completion and before occupation.

5.4 Resource Efficient

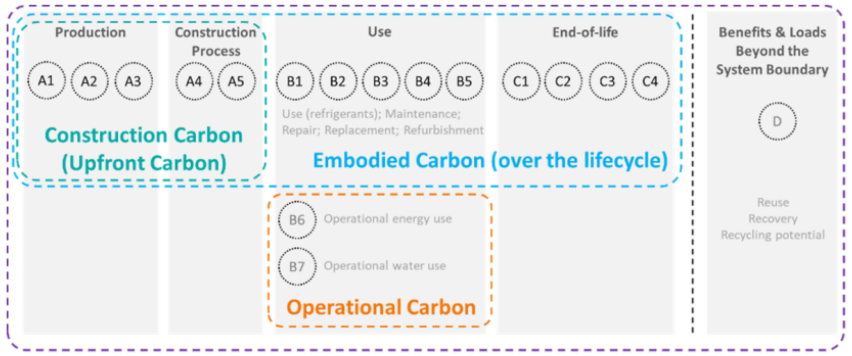
Embodied Carbon
The rapid decarbonisation of the UK's electricity grid, and the adoption of electrified and low carbon heating systems, has dramatically reduced whole life operational carbon emissions.

However, rapid decarbonisation is not yet occurring in the production of construction materials as the major materials that are used, such as concrete, steel and plastics, have significant process emissions that can't be easily solved by using low carbon electricity. This means that embodied carbon emissions are a much more significant proportion of a building's whole life carbon emissions than they have historically been and has growing importance in understanding the whole life carbon of a project.

Whole Life Carbon
Carbon emissions of a building can be assessed and measured across their whole life, as demonstrated in **Figure.5**. Upfront carbon includes the

emissions of a building project up to practical completion, and lifecycle embodied carbon includes upfront carbon plus emissions associated with the building's use and end of life scenarios. Whole Life Carbon includes both the lifecycle embodied carbon and the operational carbon of the building's use.

The best way to reduce embodied and whole life carbon is to use less materials, use reused/recycled materials, design high structural efficiencies, and to choose low carbon alternatives only when reused or recycled options are not available/suitable. Reuse opportunities should be considered as early in the design process as possible in order for materials and existing structures can be fully utilised and integrated into the design.



Whole life carbon definitions.

Embodied Carbon Targets and Reporting Requirements
LETI and RIBA have developed a set of industry metrics for embodied carbon buildings (refer to image below, right). RIBA have chosen to adopt lifecycle embodied carbon metrics which consider the construction, maintenance, refurbishment and end of life impacts of a building. This metric encourages the use of long-life and low replacement cycle materials. LETI and RIBA targets will be superseded later in 2024 by the target defined by the UKNZCBS. Although this standard is not published yet limits to upfront carbon for specific building types, with 'retrofit factors' applied to determine upfront carbon targets for retrofit buildings, have been set out as expected requirements of the Standard.

RIBA Awards
From 2026 RIBA will require any project that is put forward for a RIBA Regional Awards should provide embodied carbon reporting.

Planning
Cambridge City Council have confirmed they would expect embodied carbon reporting for the Guildhall, they would not expect the level of refurbishment undertaken on the Corn Exchange to required embodied carbon requirement.

Embodied Carbon Approach for the Civic Quarter
For the Cambridge Civic Quarter a commitment has been made to use low embodied carbon design approaches and materials to manage embodied carbon impacts. During this stage qualitative guidance has been given around material decisions to inform a low carbon approach. These include:

- Avoidance of new basement construction in the Guildhall.
- Impact of extension options considered for the Guildhall.
- Repurposing of 'site-won' materials associated with internal partition demolition in the Guildhall.
- We recommend that a strategy of embodied carbon optioneering to compare and optimise construction and materiality options is decided early in the planning stage. An embodied carbon study as per the RICS Whole life carbon guidance will also fulfil the materials requirements set out in Policy 28 and SPD Section 4.6, and Draft GCP Policy CC/NZ.

The following strategies should be implemented to reduce the projects embodied carbon.

The Guildhall
Full embodied carbon modelling should be undertaken on the Guildhall project with an aim at benchmarking the project against LETI and the UK NZCBS. No specific target has been set at this stage and will be considered further at RIBA Stage 4 based on the results of initial modelling. It is proposed that optioneering is undertaken where necessary at the planning stage with a full estimate produced for planning. Further modelling should be undertaken at RIBA Stage 4 to inform a target to be included in tender documents. The contractor should be required to monitor impacts during RIBA Stage 5 and produce an updated estimate for RIBA Stage 6.

The Corn Exchange
At the time of commencing this design stage the proposal for the Corn Exchange was not defined and therefore no commitment had been made to modelling the embodied carbon. Should the current proposal be progressed, then embodied carbon modelling should be considered as is proposed for the Guildhall. If a lesser scope is instructed then it is likely to be worthwhile undertaking modelling of specific design considerations/options e.g. materials for the extensions, roof etc.

The Market Square
The majority of the embodied carbon impact of the market square is expected to be associated with the market square canopy. Optioneering of these specific design options is therefore proposed to take place during Stage 3, with modelling undertaken at Stage 4. Within the market square structure, reclaimed steel, glass with high recycled content and the substitution of steel for biobased materials wherever possible are beginning to be explored.

Targeted whole life carbon guidance should be sought as early a stage as possible within RIBA stage 3 in order for high impact decisions to be made and targets to be met.

Upfront Embodied Carbon, A1-5 (exc. sequestration)

	Band	Office	Residential (6+ storeys)	Education	Retail
	A++	<100	<100	<100	<100
	A+	<225	<200	<200	<200
LETI 2030 Design Target	A	<350	<300	<300	<300
	B	<475	<400	<400	<425
LETI 2020 Design Target	C	<600	<500	<500	<550
	D	<775	<675	<625	<700
	E	<950	<850	<750	<850
	F	<1100	<1000	<875	<1000
	G	<1300	<1200	<1100	<1200

Life Cycle Embodied Carbon, A1-5, B1-5, C1-4

	Band	Office	Residential (6+ storeys)	Education	Retail
	A++	<150	<150	<125	<125
	A+	<345	<300	<260	<250
	A	<530	<450	<400	<380
RIBA 2030 Design Target	B	<750	<625	<540	<535
	C	<970	<800	<675	<690
	D	<1180	<1000	<835	<870
	E	<1400	<1200	<1000	<1050
	F	<1625	<1400	<1175	<1250
	G	<1900	<1600	<1350	<1450

Embodied carbon targets kgCO2e/m² – LETI 2020 and 2030, and RIBA 2030 to be superseded by the UKNZCBS requirements.

Existing Buildings & Material Reuse
A pre-demolition audit will be crucial to identify and manage the reuse of high value items for reuse within the scheme. This is particularly important for the Guildhall where significant redevelopment works are currently proposed. Increasing the level of material reuse within each project will be key to reducing its embodied carbon impact. It was also highlighted as a key desired approach in the consultation.

On a project-by-project basis, low carbon materials should be specified for all areas of the design, alongside adopting a reuse/circular economy strategy.

Low carbon materials and strategies to consider include, but are not limited to:

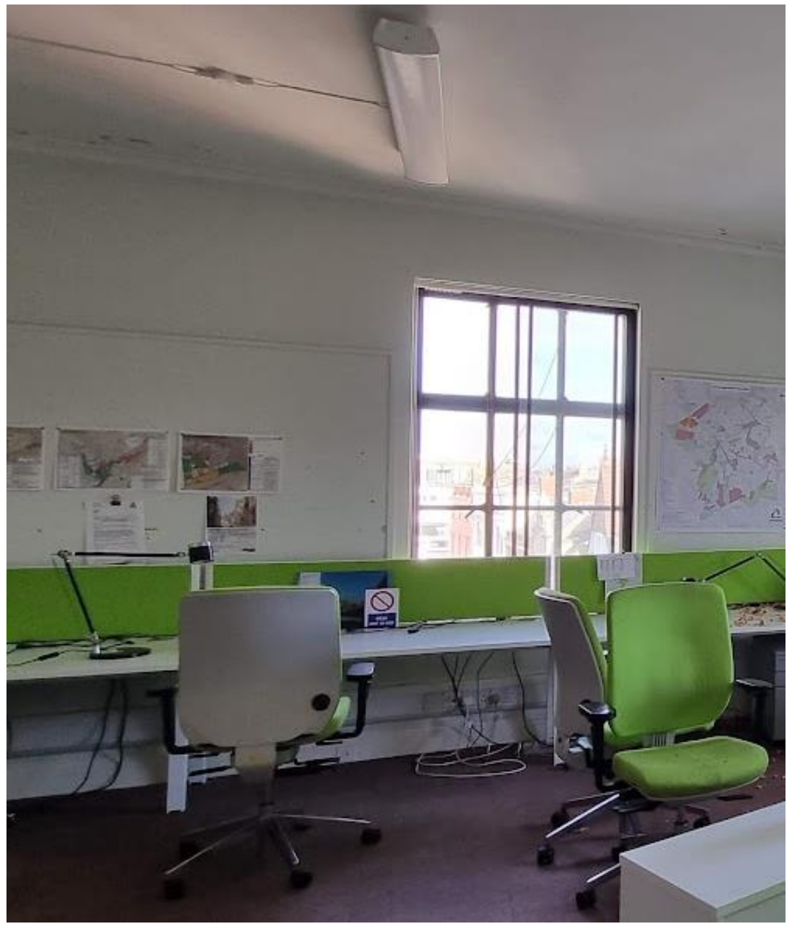
- Reclaimed and recycled bricks.
- Hempcrete.
- Timber.
- Stone.
- Natural biogenic materials.
- Lean MEP design reducing material quantities and refrigerant related carbon impact with very low Global Warming Potential (GWP) heat pump solution.
- Higher recycled content within structural elements, landscaping, and internal finishes such as carpets and plasterboard.
- Reusing existing granite setts.
- Use alternative to concrete subbase and cement mortar for granite setts in the Market Square.

Circular Economy / Material Reuse
Alongside specifying low carbon materials, we propose that a **reuse register** is created for all internal fittings currently in the Guildhall and Corn Exchange and across the market square. This will include items such as:

- Internal blockwork demolition.
- Chairs.
- Desks.
- Desk fans.
- Overhead lighting and task lighting.
- Crockery.
- Blinds.
- White goods.
- Heritage features no longer proposed for use – e.g. ventilation grilles, signage, heritage electrical fixtures, radiators.
- Market stalls.

The photos opposite show some of the features that should be considered for reuse.

It is important that these items are reused and repurposed as much as possible, with reuse reportable, to avoid going to landfill and being subject to public criticism.





Opportunities for reuse within the Guildhall

Demolition, Excavation and Construction Waste
Targets for the diversion of waste should be determined and set for each proposed development. Proposed targets of waste diversion targets are as follows:

- At least 80% by volume (or 90% by weight) of demolition material is diverted from landfill.
- >50% by volume of excavation waste (non-hazardous) is diverted from landfill 85% of construction waste by weight is diverted from landfill.

These goals may depend on the available space for storing waste, but they should be achievable with the right waste management provider.

A construction Resource Management Plan (RMP) shall be outlined and will be further developed in detail by the contractor to ensure a thorough approach to waste control is undertaken during the construction phase of the development. The RMP should include for the following:

- Quantifying raw material wastage and the generation of each waste stream.
- Methods by which the waste streams are being handled and stored and available waste disposal routes used, e.g. landfills, waste transfer stations.
- Establishment of a “Just in Time” delivery strategy, in collaboration with local suppliers to minimise oversupply and the time materials are stored on site.
- Establish material storage areas that will prevent damage to materials whilst on site, but to also mitigate the effects of land contamination and ensure protection of the environment from volatile materials.
- Introduce educational programme to inform site workers and craftsmen of the sites waste management practices and their expect code of conduct.
- Establish a strategy for the reuse of materials on site.
- Establish a comprehensive recycling strategy to ensure residual waste is minimised.

The appointed contractor will be responsible for the implementation of most of these reduction and recycling measures and they will be encouraged to follow any additional practices they see fit or have experience in operating.

Responsible Sourcing
All key materials should be responsibly sourced. All timber (100%) used on-site should be legally sourced and certified by either the Forest Stewardship Council (FSC) or PEFC, which provides a product-specific chain of custody number confirming that the timber used in the manufacture of the product originates from a sustainably managed source.

The Contractor should source construction materials responsibly from sustainably managed supply chain better than ISO 14001 (E.g. ISO 14001 including key processes, or BES 6001 certified or Cradle to Cradle).

During procurement, the architect should review the options for responsible sourcing of the following significant construction materials with recognised certification systems [e.g. FSC timber, ISO14001 certified products and/or the use of BRE’s Framework Standard BES 6001 by suppliers]:

- Timber (including timber composites, and wood panels)
- In situ concrete.
- Brick (including, clay tiles and other ceramics), pavers.
- Stone and gravel.
- Plasterboard

5.5 Biodiversity Net Gain

A legally binding requirement of Biodiversity Net Gain of 10% has been set by the Government for new developments.

The project is targeting a biodiversity net gain (BNG) of 20% for the market and public realm. The current landscape plan aims to address this through an increase in planting and landscaped area throughout Peas Hill and the west side of the market square.

This landscaping will contain biodiversity enhancing planting that is drought resistant. Trees that support native wildlife will be planted throughout the civic quarter including across the front of the guildhall, the east side of the market square, at the junction between Guildhall Street and Wheeler Street, as well as integrated into the planting on Peas Hill and the west side of the market square.

During RIBA Stage 3, an ecological survey needs to be conducted to understand the baseline biodiversity of the site and if the proposed landscape design can achieve the target of increasing BNG by 20%.

5.6 Water Smart

Water Neutrality
Cambridge is one of England’s most water-stressed areas with efforts to reduce water usage and prevent increased pressure on water resources at the forefront of local planning and local activism.

The CCQ’s current baseline water usage is as follows:

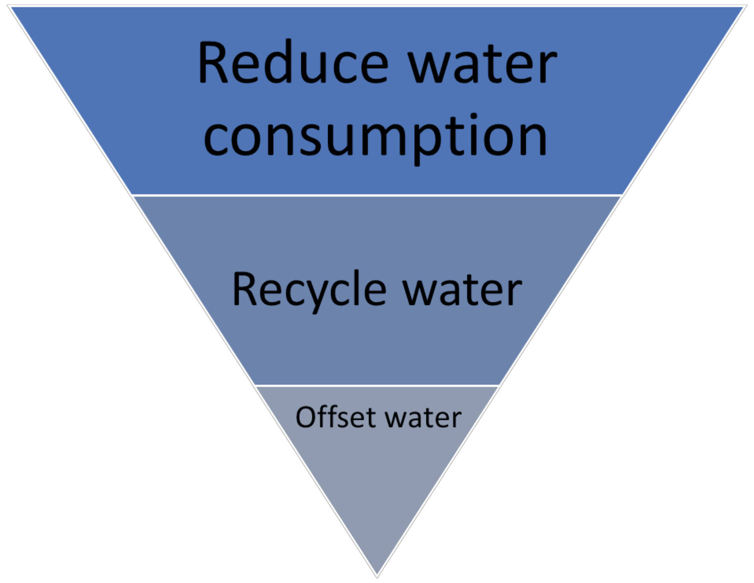
- Guildhall: 4945m3/year
- Corn Exchange: 7012m3/year
- Market Square: 1429m3/year
- Parsons Court: 433m3/year

The Environment Agency’s (EA) definition of water neutrality is: “For every new development, the predicted increase in total water demand in the region due to the development should be offset by reducing demand in the existing community” (EA, 2009)

Water neutrality can be achieved through the water hierarchy as presented in the image below. We suggest that the Cambridge Civic Quarter aims to achieve water neutrality and follows the water neutrality hierarchy via the following measures.

- Fit water efficiency fittings to reduce water consumption and aim to achieve 5 BREEAM Wat01 credits within the Guildhall and Corn Exchange
- (and if thought not technically achievable, 4 Wat 01 credits). Refer to table below for the sanitary ware specification required to achieve this.
- Rainwater harvesting and greywater reuse should be maximised across the Guildhall and Corn Exchange.
- Investigate the opportunity to retrofit water efficiency fittings in additional Cambridge Council owned buildings in order to offset the excess water usage.

Chapter 6 of this report provides further detail on Water Neutrality and the current proposals.



Water Neutrality Hierarchy

Component	Performance levels (quoted numbers are minimum performance required to achieve the targeted level)		
	4 Credits	5 Credits	Unit
WC (effective flush)	3.5	3	Litres
Wash hand basin tap	3.5	3	litres/min
Shower	4	3	litres/min
Bath	120	100	Litres
Communal kitchen sink	5	5	litres/min
Domestic washing machine	35	30	litres/use
Domestic dishwasher	11	10	litres/cycle
Rainwater Harvesting	50	75%	% of buildings flushing demand

Table summarising sanitaryware specification to achieve BREEAM Wat01 Performance Targets.

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5.7 Assessment Methodology/Certification

As described in section 4.2 Planning policy 28 refers to the use of the Building Research Establishment Environmental Assessment Methodology (BREEAM) as a means of demonstrating sustainable design. However the Cambridge Local Plan acknowledges alternative approaches will be accepted.

BREEAM certification is not considered to bring high value sustainable outcomes, particularly for current refurbishments projects/assessments and therefore is not proposed for the Guildhall or the Corn Exchange. This has been discussed with the planning officer and agreed. However, it is considered a risk that BREEAM may be considered desirable from the point of view of letting an affordable workspace, or for the Council officers, or through public consultation. Therefore, the possibility of pursuing BREEAM at the start of the planning stage has been discussed.

Early guidance has been given in relation to spatial planning constraints such as cycling amenities and waste storage. Early stage BREEAM actions are listed in the Appendix I

5.8 Risks

Current risks associated with achieving the Sustainability objectives are as follows:

- Budget limitations prevent full interventions.
- EnerPHit not being pursued fully or achieved on the Guildhall.
- EnerPHit not being pursued on the Corn Exchange and required fabric enhancements may not be delivered to achieve energy savings or to suit air source heat pumps/lower heating water temperatures.
- Limited space for plant for both the Guildhall and Corn Exchange limit efficiency of systems and opportunities to reduce water consumption.
- Achievement of net zero carbon may require relaxed comfort standards and conflict with future climate requirements. This needs further testing with the Council and against lettability standards with detailed modelling at the next stage.
- Heritage constraints prevent PV integration onto the Large Assembly Hall Roof.
- Accessibility improvements to the market square may not be achieved due to the heritage listing of the granite setts.
- External thermal comfort is not addressed within the market square (dependent on structure).
- Ecologists input and baseline survey is required to assess the achievability of 20% BNG.
- Reuse register to identify high value items to reused, integrated into the design as early as possible.
- Buildings are not run efficiently due to inefficient operation. Soft Landings appointment should be made from stage 3 onwards.

5.9 Next Steps

Next steps for the Cambridge Civic Quarter include:

- Ecologist to conduct baseline survey to indicate current biodiversity of the site and help in achieving BNG target.
- Develop play strategy for the market square and landscaping.
- Produce reuse register to identify high use items and integrate into design.
- Appoint Soft Landings consultant to comment on design and help buildings to run efficiently in use.
- Conduct invasive building fabric investigations and surveys.
- Undertake Embodied carbon optioneering.

6.0 WATER NEUTRALITY

6.1 Introduction

Water is a finite resource in growing demand. As the global population increases and economic development continues, many countries' water resources and infrastructure are failing to meet accelerating demand. Climate change is making water scarcity worse, causing water to become more unpredictable and diminishing terrestrial water storage. This results in increased water scarcity, which disrupts societal activity.

One strategy that could prove effective is the concept of water neutrality. This idea is similar to carbon neutrality, where any carbon dioxide released into the atmosphere is balanced by an equivalent amount being removed. Water neutrality aims to ensure that new developments or refurbishments do not increase the overall water demands within its catchment area. This involves reducing water consumption and offsetting any additional usage through conservation efforts, reuse, and other sustainable practices.

"For every new development, the predicted increase in total water demand in the region due to the development should be offset by reducing demand in the existing community" (Environment Agency, 2009). It involves 3 main steps:

1. **Reducing Water Use:** Implementing efficient water fixtures, encouraging behavioural changes, and optimizing processes to minimize water consumption.
2. **Reusing Water:** Utilizing greywater and rainwater harvesting systems to reduce reliance on freshwater sources.
3. **Offsetting Water Usage:** Investing in local water-saving projects to compensate for the remaining water usage.

6.2 Cambridge Requirements

Cambridge City is focused on managing its water resources efficiently. Water neutrality is a key component of the city's environmental strategy, ensuring that any development does not increase the overall demand on local water resources.

The Importance of Water Neutrality for Cambridge

Water neutrality is crucial for Cambridge due to:

1. **Water Scarcity:** Despite its green image, Cambridge faces significant water scarcity issues. The region relies heavily on groundwater sources, under pressure due to over-extraction and climate change. The East of England, including Cambridge, is classified as an area of serious water stress. Achieving water neutrality helps alleviate this stress.
2. **Population Growth:** Cambridge's population is growing rapidly, driven by its status as a leading academic and innovation hub. This growth puts additional strain on the city's water resources. Water neutrality ensures new developments do not exacerbate this pressure.
3. **Environmental Protection:** Cambridge is home to environmentally sensitive areas that rely on stable groundwater levels. Over-extraction can degrade these habitats. Water neutrality helps protect these ecosystems.
4. **Climate Resilience:** Climate change is expected to increase the frequency and severity of droughts in Cambridge. Water neutrality strengthens the city's resilience by promoting efficient water use and reducing dependence on finite resources.
5. **Regulatory Compliance and Leadership:** By committing to water neutrality, Cambridge sets a standard for other municipalities. This leadership can attract environmentally conscious businesses and residents.

Local Regulations and Policies

While specific regulations for water neutrality might not be explicitly stated, the following guidelines and policies are highly relevant as they lay the groundwork for achieving water neutrality in the city.

1. **Building Regulations Part G:** This sets standards for water efficiency in new buildings and refurbishments, including maximum water consumption of individual appliances.
2. **Local Planning Policies:** Cambridge City Council's Local Plan emphasizes sustainable water management. Key policies include:
    - **Policy 28:** Encourages the use of water-saving devices and measures.
    - **Policy 31:** Promotes integrated water management, including water conservation and sustainable drainage systems (SuDS).
    - **Greater Cambridge Sustainable Design and Construction SPD:** Provides guidance on sustainable practices, such as rainwater harvesting and greywater recycling.

6.3 Reducing Water Use

The first step to achieving water neutrality is to ensure efficient water use. This involves equipping buildings with efficient products and designing them to promote water-saving behaviours. By reducing a building's water demand through smart design and fittings, less water needs to be reused and offset.

Water Efficient Devices:

- Aerated taps and shower heads.
- Low flush or air flush toilets.
- Efficient appliances, like dishwashers and washing machines.

Technologies such as waterless toilets, recycling showers, smart taps, and non-potable water use could reduce demand.

Behavioural Changes:

- Installing water-efficient fittings.
- Not leaving taps running while washing up.
- Using eco settings on appliances.
- Using water butts in landscapes.

Metering:

- Installing meters, especially smart meters, can help identify leaks and track water usage.
- Meters support behavioural changes by showing building managers their water usage and costs, encouraging conservation.

Public Awareness:

- Acceptance of water-efficient fittings and adoption of water-saving behaviours in new buildings are crucial.

Public awareness about the importance of water conservation and the value of water resources needs to increase to ensure the effectiveness of these measures.

This first step will be incorporated into the design of the Guildhall, Corn Exchange and Market.

6.4 Reusing Water

The second step to achieving water neutrality is to reuse water, when possible, that would otherwise drain away. This can be done with rainwater harvesting and greywater recycling.

Rainwater Harvesting
Rainfall can be drained into a specific tank, going through the necessary filters and collected in a large volume. This water can then be pumped to serve non-potable uses such as flushing toilets and cisterns around the building.

Greywater Recycling
Reclaimed water from the draining of showers, baths and wash basins can be collected in tanks, going through the necessary filtering and chemical disinfection. Like the rainwater harvesting, the processed grey water can be used for non-potable appliances such as toilets and urinals.

It is possible to combine rainwater harvesting and greywater recycling, once they have been processed separately. This provides some space and plant efficiencies.

Proposal
The use of rainwater harvesting and greywater recycling is being considered for the Guildhall.

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The Corn Exchange is not changing its use and has limited plant space for the large water tanks that would be required, therefore the target to achieve water neutrality is via reducing water use.

The opportunity for rainwater harvesting in the Market square, via the market structure roof, could be explored for irrigation and cleaning purposes, to be reviewed at the next stage. Water reuse is not recommended from surface run off as it will be of very poor quality.

6.5 Offsetting Water Usage

To achieve water neutrality for developments, any remaining water demand that cannot be met with non-potable sources needs to be offset. This can be done by investing in local water-saving schemes, such as retrofitting existing buildings with water-efficient devices or water reuse systems. The water saved through these schemes should equal the residual mains water usage of the new development. These offset schemes must be within the same water resource zone as the new development.

Offsetting is typically done in partnership with organizations like water companies, councils, businesses, or charities. Options for offsetting schemes include:

- Funding water efficiency audits and retrofits for existing homes or businesses.
- Donating to housing associations for retrofits.
- Retrofitting school buildings to improve water efficiency.
- Reducing leaks in schools, public buildings, businesses, or homes (excluding planned water company works).
- Retrofitting water reuse systems in public buildings or schools.

These activities should be supported by awareness campaigns and promoting water-saving behaviours. Installing smart meters can also encourage water-saving by providing information on water usage.

This final step will be assessed following progress on the first two. Consideration should be given on whether the Guildhall, Corn Exchange and Market must reach neutrality independently, or can be considered all or partly together.

Cambridge Council manage many other buildings in the catchment area that could incorporate the reducing and reusing water steps to potentially act as an offset for the project.

6.6 Guildhall Modelled Performance

Cambridge City Council's Local Plan requires new non-residential developments to achieve full credits for BREEAM's category Wat 01. For the redevelopment of existing buildings, the Plan states that bespoke assessment methodologies will be supported if the levels of performance are equivalent or better than BREEAM. It is assumed this equates to achieving a single BREEAM credit within the Wat 01 category, representing at least a 12.5% improvement compared to the BREEAM baseline.

The Guildhall is a mixed-use building, with the proposal including offices, event spaces and a council chamber. BREEAM Wat 01 assesses by building use type and its standard calculation method is unable to process multiple uses within a building. Some initial experimentation with BREEAM's calculator of just the WCs that serve the Small and Large Halls during events, and the office space during normal business hours, found the office model was the more water demanding building type. Therefore we deemed it suitable to treat the whole building as an office to model the overall consumption.

Table 6.1 includes the water efficiencies of some sanitaryware appliances for BREEAM's baseline, their target levels of performance to achieve the number of credits stated, and our current proposed performance for the sanitaryware. The proposed values are to be reviewed at the next stage but are considered achievable flow rates without overly reducing product options.

Table 6.1

Appliance	BREEAM Performance Levels						Stage 2 Proposal
	Baseline	1	2	3	4	5	
WC (litres)	6	4.5	4	3.75	3.5	3	3.375*
Wash-hand Basin Tap (litres/min)	10	8	6	5	4	3	6
Shower (litres/min)	12	10	8	6	5	3.5	6
Tea Point Tap (litres/min)	10	8	7	6	5	5	8

*WC with large 4.5 litre and small 3 litre flush options.

Table 6.2 provides a breakdown of water consumption improvements from the BREEAM calculation including the reduced-flow components and water reuse systems. Rainwater harvesting accounted for the average rainfall in Cambridge, available roof area, and efficiency factors for yield and from filtering. Greywater recycling was assumed to capture all drainage from basins and tea point sinks at the ground floor level and above, not from appliances in the basement. The reuse systems serve all WCs in the building.

Using the proposed appliance flow rates achieves over a 40% reduction on BREEAM's baseline for the equivalent office, the awarding of 3 credits. Including rainwater harvesting, greywater recycling or both systems, is currently modelled to achieve the reductions required for 4, 5 or the maximum available 6 credits respectively.

The NIA inputted into the calculation was 5,351.2 m^2, based on Cartwright Pickard's area plan drawings, dated 18/09/2024. The area is converted into an occupancy of 594 people by the BREEAM calculation. Table 6.3 shows the previous water consumption of the Guildhall over the years compared to the estimated water usage with and without both water reuse systems. The record water consumption data for the Guildhall was provided by Cambridge City Council's Housing Development Agency.

Table 6.2

	litres/person /day	m^3/person /year	Percentage Improvement
BREEAM Baseline for Equivalent Office	39.90	10.09	0 %
Calculated Appliance Consumption	23.01	5.82	42.34 %
Demand Met by Rainwater Harvesting	4.42	1.12	+ 11.08 %
Demand Met by Greywater Recycling	6.10	1.54	+ 15.28 %
Net Modelled Water Consumption*	12.49	3.16	68.70 %

*Value excludes contributions BREEAM has determined as fixed uses, such as vessel filling, kitchen cleaning and food preparation. Using BREEAM's default values for fixed uses results in a net consumption of 14.07 litres/person/day (3.56 m^3/person/year). Value not used for comparing to baseline but has been used to compare to previous recorded building water usage in Table 6.3.

Table 6.3

	Time Period	Water Consumption (m^3/year)
Recorded	01/04/17 – 31/03/18	8,443
	01/04/18 – 31/03/19	3,857
	01/04/19 – 31/03/20	4,011
	01/04/20 – 31/03/21	3,817
	01/04/21 – 31/03/22	3,223
	01/04/22 – 31/03/23	4,033
	01/04/23 – 31/03/24	7,234
Modelled	Appliance Consumption	3,695
	Net Water Consumption	2,115

The results suggest the modelled water consumption without rainwater harvesting and greywater recycling will be less than all previous years, with the exception of the year April 2021 to March 2022. To determine if the proposed Guildhall will achieve water neutrality, consideration to the reasoning behind inconsistent water usage over the years should occur when comparing to modelled values.

Including the water reuse systems suggests the proposed Guildhall's water consumption would significantly reduce compared to what it has required historically. Possibly acting as an offset to other developments with Cambridge Council.

7.0 CAMBRIDGE CITY CENTRE HEAT NETWORK

7.1 Introduction

A heat network is currently being considered for the City Centre. The project to design, procure, install, set to work and operate the heat network is a partnership between Cambridge City Council, the University of Cambridge and Anglian Ruskin University.

The routing of the network and buildings served will be developed during future detailed design stages. The current 'area' to be served and the key buildings identified within it are shown on the summary image to the right.

On 20th June 2024 a meeting was held between the Cambridge Civic Quarter design team and the Cambridge City Centre Heat Network (CCCHN) project management team.

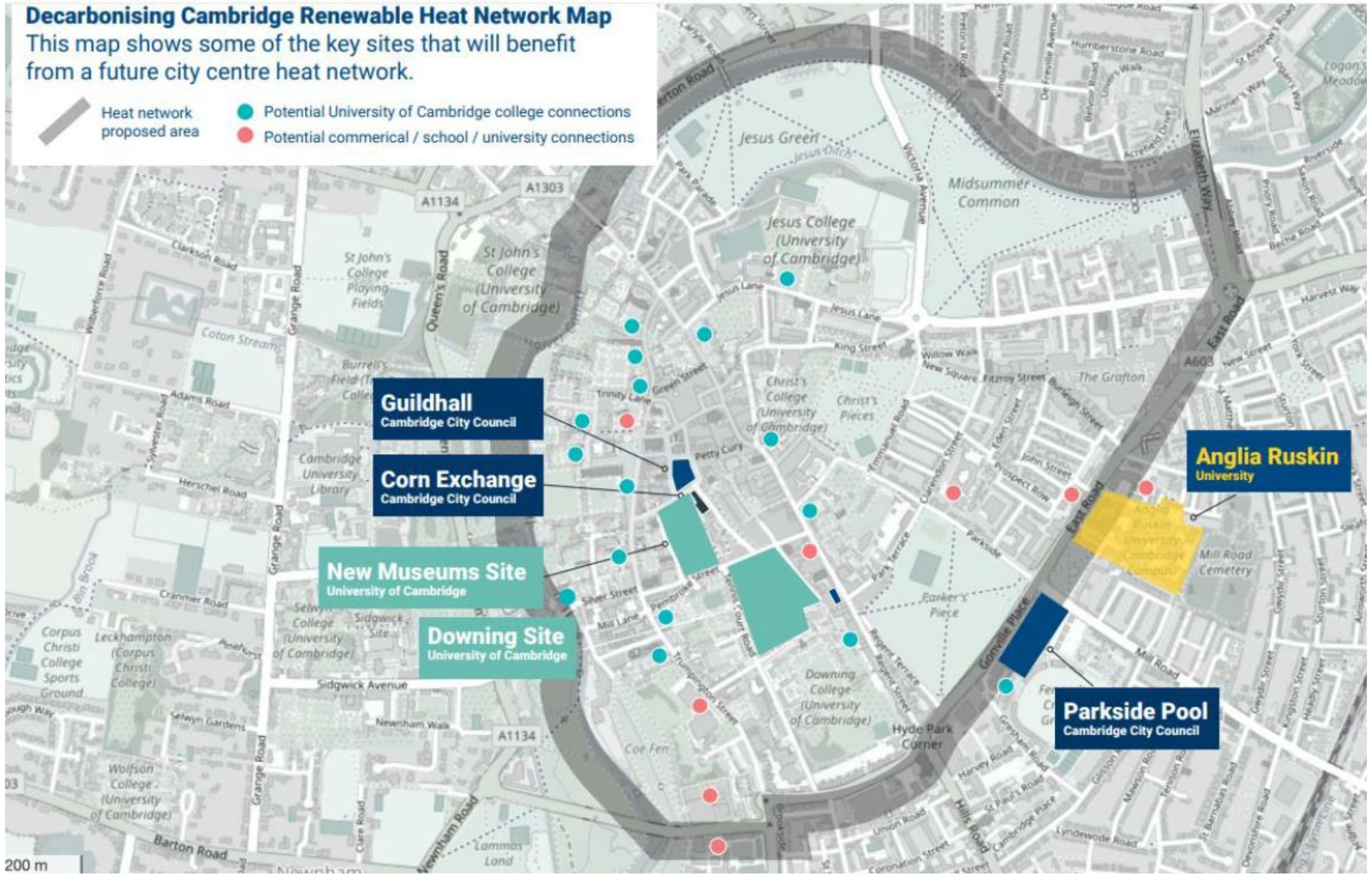
Envisaged Benefits
The principal envisaged benefit of the heat network is to address the current 'Climate Emergency'. The network will supply heating water, sourced from renewable energy sources, around the City Centre. The provision of this heating water will allow the removal of existing local (in each building) fossil fuel heating plant and should therefore reduce the assocaited carbon emissions. The Council has a target to reduce their direct carbon emissions to net zero by 2030 and see the CCCHN as supporting them to achieve this. The Universities have similar strategic carbon reduction targets and also see the CCCHN as a means to achieve these.

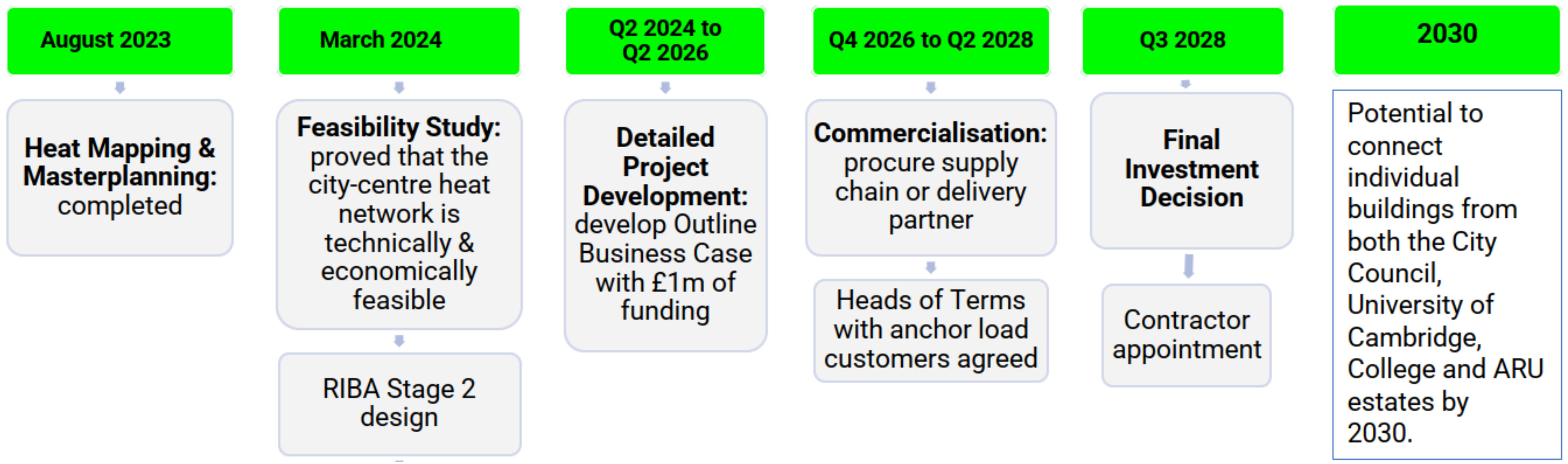
A second key benefit that supports the Council's strategic plans is the improvement in local air quality that should result from the removal of the local (in building) fossil fuel plant/systems. Their removal should reduce the nitrogen dioxide emissions into the local environment within the City Centre. The network aligns with the City's Air Quality Management Area (AQMA).

Programme
During the meeting of 24th June it was explained to us that the CCCHN project has completed its initial mapping and master planning works and a subsequent feasibility study. The feasibility study concluded that the network will be technically and economically feasible and helped to secure £1million of funding for the detailed development of the project. With this funding in place consultants were being procured to commence the detailed design of the network. It was envisaged that this detailed design would commence in the Autumn (2024). Sustainability Co. has been appointed as the 'Heat Network Programme Managers'

A key milestone for the project is to finalise a robust outline business case (May 2026) and to develop this to obtain Green Heat Network Funding by Christmas 2026. This funding is a Government backed grant managed by the Department for Energy, Security and Net Zero.

The longer term target is to have a building from each Partner connected to and served by the network by 2030. The Council currently envisage that their connected building is likely to be the Guildhall.





7.2 Heat Network Design Temperatures

The Evolution of Heat Networks
Heat Networks have been in operation throughout the 20th Century. They have evolved to reflect the processes, functions, buildings and people that they serve and critically the fuels used to generate the heat. With the original Networks typically transferring steam as a heat source, the initial evolution around the 1930's led to networks being pressurised and distributing water. These networks are referred to as second generation heat networks, often providing water temperatures above 100°C. Following the 1970s oil crisis, the third generation of networks reduced the water temperatures often using coal, biomass and waste as their energy source.

During the early 21st Century Climate Change became much better understood and revised Planning Policy reflected this. The resulting development and utilisation of renewable energy technologies supported the decarbonisation of the UKs electricity grid and the wider use of low and zero carbon technologies. These technologies operate at enhanced efficiencies when receiving and supplying lower temperature hot water. These 'fourth generation heat networks' typically provide water at 70°C, with water typically returning to the associated plant at 40°C. The system heat losses are reduced due to the lower temperatures. Current network design looks to reduce these temperatures further, though typically this is to serve new buildings with lower heat demands. Existing buildings are a greater challenge (as acknowledged in the Council's Carbon Management Plan and Climate Change Strategy). Pasteurising the domestic hot water is also a key consideration as this requires raising the temperature of the water to 60°C to kill bacteria.

Whilst some would say that the fourth generation heat networks are still in their relative infancy, particularly operable ones, fifth generation heat networks are already being established. The fifth generation networks distribute water near ambient ground temperatures (10°C), therefore minimising grid losses and insulation requirements. The local plant served is therefore very different and will return cold water to the Network. A further key benefit is that at this temperature the network water can also be used to provide cooling, though in that case the water returned to the network will be warmer than that taken from it. This introduces further considerations and complexities. These networks are sometimes referred to as 'ambient loops'.

The CCCHN
It is understood that the current (feasibility study) heat network solution will provide water to the served buildings at flow and return temperatures to and from the buildings interface heat exchanger at 85°C and 65°C respectively. This is likely to reflect that a large number of the buildings to be served are existing buildings, typically of historical interest and in some cases being listed. Therefore the expectation is that it will be extremely challenging to reduce their heating demands to levels that would suit a lower temperature, fourth generation network. This is acknowledged in The Council's Carbon Management Plan and Climate Change Strategy

During our meeting of 20th June 2024 the heat network project team highlighted that the design development includes consideration to reduce the operating temperature of the network. This was to be inconsideration of the technologies available to heat the network, including both air source and ground source heat pumps. A particular emphasis is being applied to ground source heat pumps and the land available from the project partners. It was acknowledged that this was a fundamental decision that would directly impact on the detailed design of the Cambridge Civic Quarter. They envisage that this decision would likely be made March-June 2025 and again acknowledged that this was in conflict with current intention to complete the first phase of the Civic Quarter project, envisaged to be the refurbishment of the Guildhall, in 2027.

7.3 CCCHN Connection Guidance

Early stage guidance for future connection to the CCCHN is available (AECOM Connection Note, dated November 2023). This is for initial reference and notes that it "is expected to be updated with additional details on the technical requirements for new connections". The principles within this document follow industry good practice for heat networks, whilst acknowledging the challenges faced by existing buildings and that these will result in the need for higher network operating temperatures (compared to new builds or even modern existing buildings).

Technical Suitability for Civic Quarter
The refurbishment projects provide an opportunity to address some of the technical considerations highlighted in the guidance note and therefore make them more suitable for connection to the CCCHN. The refurbishment projects will allow us to;

- Reduce the building heating demands and therefore offer the potential to lower the existing return water temperatures.
- Consider and allow for heat network plant rooms (substation) and the related pipework routes.
- Utilise variable speed heating pumps with associated differential pressure controls valves.
- Implement two port control strategies.
- Provide suitable BMS interfaces and controls.
- Include heat meters in accordance with the Heat Metering and Billing Regulations.

Further building specific considerations and proposals are summarised below.

<u>The Guildhall</u>
A wet heating system is currently utilised in the Guildhall. It consists of pipework that is embedded both in the structure and also in the ceilings. The proposal is to replace the heating system in its entirety. A new wet system is proposed so that this can be served from the CCCHN and incorporate the components and strategies summarised above.

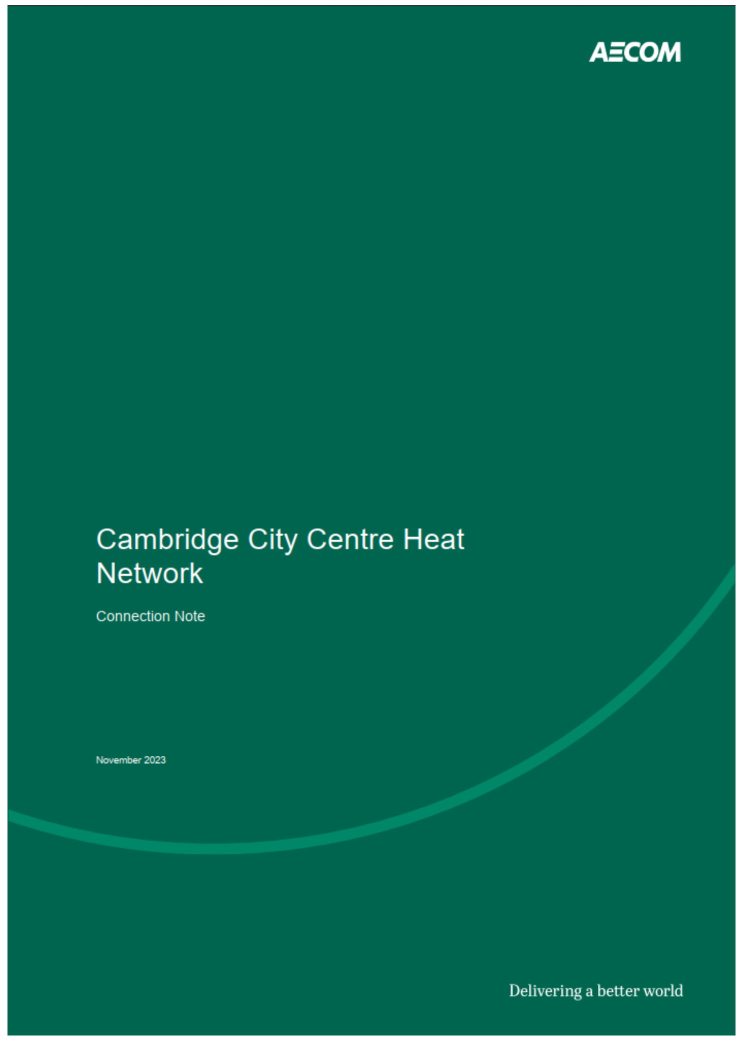
The operating temperature of the heating system will be determined by the fabric improvements that can be achieved to reduce the rate of heat loss. This relates to enhancing insulation, glazing performance and air tightness. In conjunction with this the size of the proposed heat emitters that can be coordinated into the spaces, particularly the heritage rooms, will influence the operating temperatures.

The domestic hot water will generally be provided by point of use electric water heaters which would therefore not utilise the CCCHN and therefore not influence the operating temperature of the buildings heating system. Domestic hot water storage is proposed for the Council's Guildhall Street (East) side ground floor and basement sanitary accommodation as this is anticipated to have short periods of high demand reflecting them being used by visitors to the Assembly Halls as well as the Council's staff. As such stored volumes of hot water will serve these peak periods. The tenant may have a similar requirement if they have a food and beverage facility. These storage cylinders should be located close to the served areas. Depending on the heating system operating temperatures these cylinders may be served and would likely result in higher return water temperatures from the cylinders, however in this scenario these should be a relatively small proportion of the total winter heating flow rate.

<u>The Corn Exchange</u>
A wet heating system is currently utilised in the Corn Exchange. The main auditorium and foyer appear to be heated via their ventilation system. Local radiators have been identified in back of house spaces.

The proposal is to replace the heating system in its entirety. A new wet system is proposed so that this can be served from the CCCHN and incorporate the components and strategies summarised above. The fabric improvements are more challenging than for the Guildhall, as is the nature and use of the building. Required operating temperatures are therefore anticipated to be higher.

Domestic hot water considerations are as summarised for the Guildhall. The nature of use of the Corn Exchange dictates high demand across short periods and therefore greater need for domestic hot water storage.



Plant Interface – Thermal Substation

The guidance note identifies the requirement to and benefits of providing a hydraulic break between the CCCHN and the buildings heating system. A thermal substation provides this using plate heat exchangers, typically in conjunction with valves, controls and heat meters. The guidance describes the approach of having two plate heat exchangers, each sized at 66% of the peak heat demand to offer a level of resilience. The note also highlights the requirement to allow space within the substation room to route the incoming district heating pipework. We consider this to be good practice for heat network applications.

The building side heating distribution equipment (pumps, pressurisation and expansion vessels) can be installed in the same room or a separate room to the substation. This is dependent on;

- The security considerations relating to access to the substation (by heat network operator and building owner/operator).
- If existing (in use) building heating distribution equipment is being retained and reused
- What the space identified for locating the substation is currently used for and the related spatial constraints associated with it and its repurposing.

Appendix A of the guidance note provides some indicative substation sizes. These appear to be the dimensions of the packaged 'skids' without maintenance access space or any building side plant/equipment being allowed for.

The Guidance indicates either a basement or ground floor plantroom location will be suitable. Our experience is that Network Operators will request ground floor locations with direct external access and a means of ventilation. A basement level room within an existing building is likely to require access through the building and will make the initial installation and future maintenance works more complex (plant delivery etc.). Ventilation to avoid overheating of a basement plant room will also be more complex.

Further project specific considerations and proposals are summarised below.

It should be noted that the drawings and schedules refer to the CCCHN interface room (sub station) as 'DEN Interface Plant Room' (DEN=District Energy Network).

<u>The Guildhall</u>

Areas within the Guildhall are to be used by the Council to provide their Customer Service Centre, work stations for their staff and the reprovision of the Assembly Halls and Democratic rooms. Separate areas are to be let to and operated by a tenant. Both a hotel and commercial office tenant have been considered in detail. For each we have been requested to provide completely separate plant and systems (separate to that serving the Council areas). To avoid this requiring additional hydraulic breaks and incurring the related additional system temperature drops and hydraulic resistance this dictates the requirement for separate incoming CCCHN connections and sub stations. Separate CCCHN provisions will allow direct billing by the network operator, however we anticipate that the operator is likely to prefer a single building supply/connection (less initial cost and on-going management and maintenance), particularly considering the anticipated heat demand.

Current estimates suggest the Council substation would consist of 2No. 240kW heat exchangers (HEs) and the tenant substation would consist of 2No. 150kW HEs. At this scale of heat load consideration is typically given as to whether to utilise a single heat exchanger/substation rather than providing two (for resilience) at 67% of the peak demand. This would reduce the substation provision to 1No. 350kW HE(Council) and 1No.210kW HE(Tenant). If a single combined substation were to serve the building it is currently estimated to require 2No. 375kw HEs.

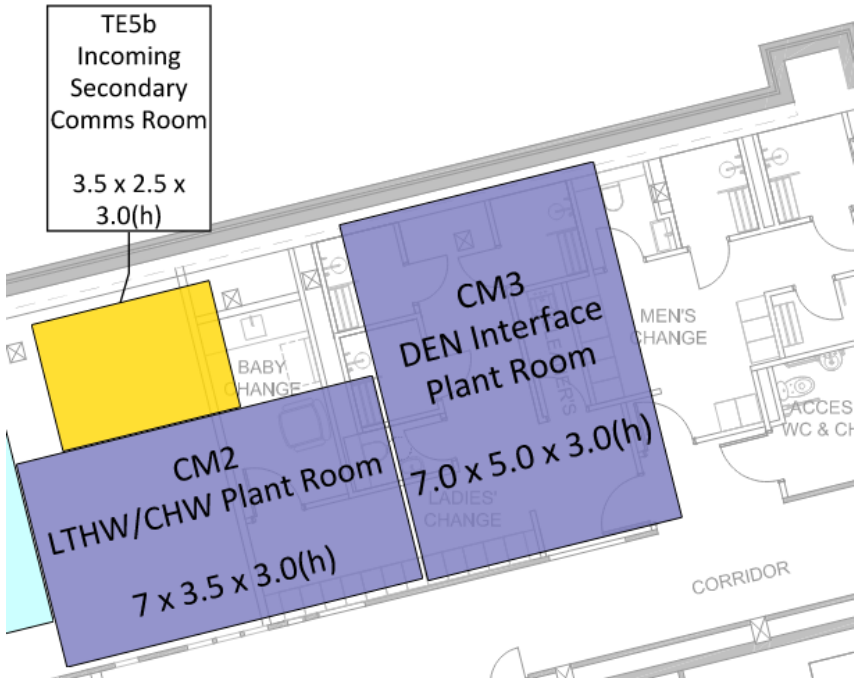
The office tenant option drawings in Appendix IV currently show the Council heat substation (ref CM3) located in the south east corner of the basement and the tenant substation (ref TM3) located in the south west corner of the basement. Extracts from this drawing are included to the right. The drawing itself is included within appendix IV. The locations are in consideration of the anticipated heat network route looking to avoid crossing the market and routing along Wheeler Street to also serve the Corn Exchange (discussed at meeting of 20th June). The rooms have also been located in close proximity to access stairways which provide direct external access at ground floor level. Direct ground floor plant locations and related access was not considered to be possible due to the listing of the building and the related sensitivity of the facades. As highlighted earlier heat dissipation will require careful consideration. Both rooms are currently shown as being 7m wide, 5m deep and 3m high and allow for inclusion of the building side distribution equipment. Plant schedule 7562-MXF-GH-ZZ-SH-J-3002 provides further detail on this. With detailed design and further analysis, particularly the EnerPHit proposals, the tenant room can probably be slightly reduced in width. Should the operator require a single substation to serve the building a room of 7x5x3m should still be suitable but would only contain heating distribution plant to circulate water to the related secondary heating plant rooms. These secondary heating plant rooms would then need to contain additional plate heat exchangers and the building/space heating distribution plant (current sizes do not allow for this). Should these two rooms be located in close proximity to the incoming CCCHN substation plant room then there is a greater chance of the 7x5m room being suitable (as pumps and expansion vessels will be smaller).

<u>The Corn Exchange</u>

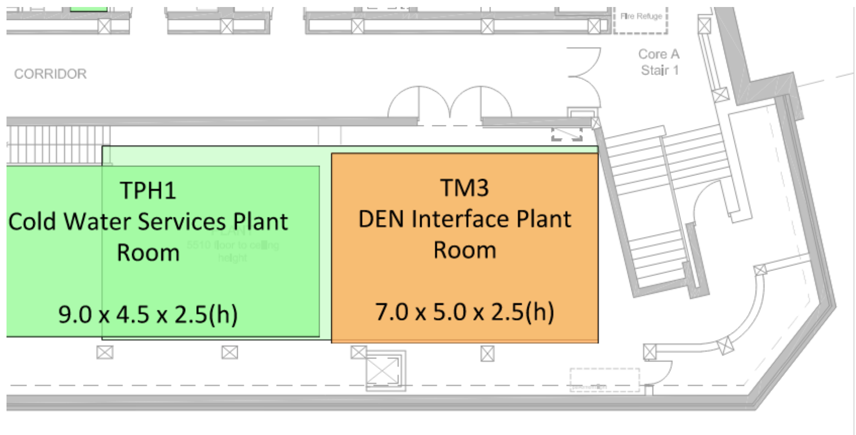
Current estimates, assuming significant fabric improvements are implemented, suggest the substation would consist of 2No. 270kW heat exchangers. Consideration can be given as to whether to utilise a single heat exchanger/substation rather than providing two (for resilience) at 67% of the peak demand. This would reduce the substation provision to 1No. 400kW HE. Due to the buildings function/use this would require careful consideration as to the risk of not having this resilience.

As there is no space available for this room in either the basement or at ground floor level, the plant room is not currently shown on the drawings and is highlighted in schedule 7562-MXF-CE-ZZ-SH-J-3001 accordingly. The room would house similar equipment to that serving the Guildhall Council areas and would therefore be a similar size (7x5x3m). If it is required it would likely be located on the second floor, within the area currently proposed for the air source heat pumps (see below).

The existing boiler plant room is located at second floor level and is proposed to be replaced by the heat pump enclosure. As cooling is proposed the heat pump enclosure would not become redundant when the network is available. Chillers or an alternative form of cooling will require locating within this space. A detailed analysis and coordination exercise will be required once the brief and proposal for the HVAC provision and fabric improvements to the Corn Exchange are agreed.



The Council's district heating network interface plant room (CM3) for the Guildhall has been located at basement level, near the east façade.



The Tenant's district heating network interface plant room (TM3) has been located at basement level in the Guildhall, near the west façade close to the south west stair (1).

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7.4 Programme / Timing & Implications

As outlined in the introduction section 7.1, the Guildhall refurbishment is targeted for completion in 2027. The CCHN is targeting the first buildings being supplied in 2030. Though not discussed with THE COUNCIL, it is anticipated that the Corn Exchange refurbishment could follow on from the Guildhall refurbishment and therefore may complete at a similar time to the CCCHN.

Due to the significant investment required to provide a heat network it is not an unusual situation that commitment from buildings, often new buildings, is required prior to the network installation progressing. The buildings therefore require an interim heating solution. The cost and embodied carbon considerations related to this are significant.

The Guildhall
The current Guildhall proposal is for The Council and their tenant to each have dedicated 4-pipe heat pumps (referenced CM1 and TM1 on the previously referred to drawings and schedule). These will provide heating and cooling to the served areas. They have associated distribution plant rooms (pumps, pressurisation etc.) referenced CM2 and TM2 respectively. These will provide the required heating prior to the network being available. To facilitate future connection these plant rooms will incorporate valved connections in their primary heating low loss headers.

Once the heat network is available the substation(s) would be installed and connected to the Network. The heating distribution plant located within the DEN Interface plant room (CCCHN substation) would be installed and connected into the valved connections in the primary heating low loss header. The heating will then be 'switched over' using the header valves to close off the primary supply from the heat pumps and open that provided from the heat network substations and associated distribution plant. In this scenario (district heating providing the buildings heating demand and heat pumps the cooling demand) discussions with manufacturers suggest that the maintenance regime for the 4-pipe heat pumps should include some regular circulation and setting to work of the heating circuit. This will require further discussion as it was not something (a scenario) they have encountered and if there are examples they may not have been used in this way for long and therefore potential detrimental effects may not have been established.

<u>Temporary Plant Alternative</u>
When the period of time in between the building being occupied/used and the network being available is considered 'short' then temporary heating plant can be considered. This is to minimise abortive capital cost and embodied carbon. This tends to be the utilisation of gas boilers, sometimes in temporary housings or sometimes being located within the DEN Interface plant room (CCCHN substation). This would require agreement as part of the planning consent and also with Building Control (Regulations).

This should be considered, particularly as the timing for changing over could be managed to occur during the summer months and therefore potentially look to avoid a temporary plant housing.

For the Guildhall the benefit of temporary plant would not be clear cut as there would still be significant abortive costs and embodied carbon (boilers, gas supply, boiler flue etc.) with some benefits (4 pipe heat pumps replaced by more efficient chillers and avoiding the future 4PASHP, heating maintenance regime). If the existing heating plant could continue to operate throughout the anticipated 'interim' period then this could be an attractive option, subject to analysing the impact on spatial coordination.

The Corn Exchange
As suitable plant space does not appear to be available and the programme for the works is even less certain, the implications are subjective.

Should it be considered appropriate for the refurbishment of the Corn Exchange to be programmed so that the heat network is operational and available prior to the refurbishment being completed then a revised plant strategy and rearrangement of the second floor can be considered to ascertain if an alternative cooling strategy could reduce the plant space currently allocated for the air source heat pumps to an extent that the district heat network plant room (substation) can be incorporated. A route for the district heating pipework would require coordinating the layouts and agreement to these locations (plant and rising pipework) would require agreeing with the heat network operator.

Programme Risks
The associated project programme risks should also be considered. Refurbishment of existing heritage buildings often take longer than anticipated (due to findings or construction restrictions) whilst the logistical and practical complexities associated with installing a heat network within a City Centre are considerable. Delay scenarios for either or both projects should be factored in to inform the decision as to whether or not to connect into the CCCHN and if so the strategy for doing so.

7.5 Impact of Reduced Network Temperatures

As the Council's Carbon Management Plan, Climate Change Strategy and AECOM's guidance note highlight, existing buildings are likely to require higher heat network operating temperatures. Whether lower temperatures are suitable is dependent on the fabric improvements that can be achieved.

Initial Heat Network Temperature Reduction
To decarbonise the buildings without the use of the CCCHN, the proposed building independent plant solutions will be required. To operate efficiently and to work towards Net Zero Carbon these solutions are reliant on significant fabric improvements being made to reduce the peak heating loads and allow heating water temperatures to be used that suit air source heat pumps e.g. no higher than 60°C flow, ideally 55°C or less. The suitability of this can only be analysed once the fabric proposals are detailed and themselves analysed and the subsequent emitter sizing and coordination progressed. This will require an advanced level of detailing to be progressed early in RIBA stage 3. Some of these works would typically be progressed in RIBA stage 4.

The stage 2 proposals assume the Council's commitment and briefing priority for these buildings to contribute to their aim to be Net Zero Carbon by 2030 will prioritise investment in these fabric improvements and decarbonisation strategies. The proposals are therefore on the basis that the heating temperatures within the buildings will suit air source heat pumps. As such they should allow a reduction in the heat network operating temperatures proposed in the feasibility study.

It should be acknowledged that the Corn Exchange is much more limited in relation to opportunities to improve the fabric and the current design team appointment does not include for the same level of detailed review and analysis into what can be improved and what improvements this could deliver (as the Guildhall). As such the suitability of the Corn Exchange ASHP proposal is considered to be higher risk than the Guildhall. Should the heat network connection be progressed as described above (delaying Corn Exchange works until the network is available) then higher temperatures can be utilised and the building would still be decarbonised (as currently envisaged and proposed by the heat network feasibility study). We recommend a similar detailed EnerPHit analysis be progressed for the Corn Exchange to allow more accurate assessment of the heat loads and energy consumption, particularly if the Corn Exchange programme does not suit the heat network connection approach described above.

Ambient Heat Network Temperatures
Further decreasing the heat network temperatures, such that the network is considered as an ambient loop, significantly changes the strategy. This is because water source heat pumps, utilising refrigerant cycles, are required within the building to transfer heat from the water into the buildings heating system. The associated plant can in theory provide both heating and cooling, though simultaneous provision of both would require complex arrangements and controls with large heating and cooling water storage vessels. Due to this complexity separate cooling systems should be allowed for and therefore the additional internal plant space associated with the water source heat pump will be a further challenge on the viability of the proposals.

7.6 Key Decisions/Strategic Direction

Due to the current status of the heat network it is introducing a risk and complexity to the Civic Quarter development. Considering the future programme and likely logistical and practical challenges for the CCCHN, the risk and impact is likely to remain but vary throughout the life of the Civic Quarter.

Agreeing the design approach to the CCCHN is a critical project decision. Direction is required to form the basis of the stage 3 design and cost plan. Section 14.1 summarises the required strategic decisions and direction. Some will require response from the CCCHN project team.

8.0 THE PROPOSED GUILDHALL – HOTEL OPTION

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Early in September 2024 the design team were instructed to hold progressing the hotel/aparthotel design option for the assigned areas of the Guildhall to be leased, separate to the council-run areas of the building. Read the below in conjunction with drawings and schedule within Appendix III.

8.1 Specific Design Brief/Criteria

The following documentation has been provided to form the 'brief':

- Civic Quarter: Approach to November 2024 Strategy and Resources Committee – briefing note sent to Max Fordham 17th May 2024.

Please refer to Section 9.1 below for an outline of Cambridge Council's ambition for the Guildhall.

Fire Fighting Services
Please refer to Section 9.1 for a detailed description of the firefighting services strategy in the Guildhall.

Low and Zero Carbon Technologies
Please refer to Section 9.1 for a detailed description of low and zero carbon technologies in the Guildhall.

Specifically for the hotel option, it is proposed air source heat pumps will provide the building with space heating and cooling, as well as hot water for the hotel areas of the building.

Mechanical Design Conditions
Please refer to Section 9.1 for a detailed description of the mechanical design conditions for the Guildhall.

Specifically for the hotel option the below rows on space/room type would apply.

Space / Room Type	Design Temperature		Ventilation Design Criteria
	Summer	Winter	
Hotel - Bedroom	21-25 °C (CIBSE GUIDE A)	19-21 °C (CIBSE GUIDE A)	12.5 l/s person (CIBSE GUIDE B2)
Hotel - Bathroom	23-23 °C (CIBSE GUIDE A)	20-22 °C (CIBSE GUIDE A)	8 l/s (Appr. Doc. F)
Restaurant / Dining Room	24-25 °C (CIBSE GUIDE A)	21-23 °C (CIBSE GUIDE A)	10 l/s person (CIBSE GUIDE A)
Corridor / Lobby	21-25 °C (CIBSE GUIDE A)	19-21 °C (CIBSE GUIDE A)	0.2 ACH (EnerPHit)

8.2 Proposed Plant / Equipment

Mechanical Services
Low Temperature Hot Water Heating
Please refer to Section 9.2 for a description of the LTHW heating strategy.

Chilled Water System
Please refer to Section 9.2 for a description of the CHW cooling strategy.

Hotel rooms are proposed to have individual fan coil units in the ceiling void above the entrance to the room, with a local wall-mounted controller.

VRF Cooling
Please refer to Section 9.2 for a description of the VRF cooling strategy.

Mechanical Ventilation
Please refer to Section 9.2 for a description of the mechanical ventilation strategy.

Hotel rooms are proposed to have a fixed continuous ventilation rate. The potential to control this based on occupancy would need to be looked at in the next design stage.

Public Health Services
Hotel bathrooms are proposed to group with their neighbour to be served by the same riser containing water supplies and drainage stacks.

Sanitaryware
Please refer to Section 9.2 for a description of the sanitaryware strategy.

Rainwater Drainage
Please refer to Section 9.2 for a description of the rainwater drainage strategy.

Foul Drainage Above Ground
Please refer to Section 9.2 for a description of the above ground drainage strategy.

Cold Water Systems
Please refer to Section 9.2 for a description of the cold water strategy.

Domestic Hot Water
Domestic hot water for the hotel-operated areas of the building to be provided by air source heat pumps on the roof.

The main plant would also be located on the roof in a new internal space. From here domestic hot water would be pumped to manifolds around the hotel. The manifolds would provide many individual microbore connections to individual sanitaryware connections.

The purpose of the manifold and microbore arrangement is to minimise the amount of hot water stored in the distribution.

Rainwater and Greywater Systems
Please refer to Section 9.2 for a description of the water reuse strategies.

Dry Risers
Please refer to Section 9.2 for a description of the dry riser strategy.

Electrical Services
Electrical Generation Plant – PV
Please refer to Section 9.2 for a description of the electrical generation plant strategy.

High Voltage Distribution
Please refer to Section 9.2 for a description of the HV distribution strategy.

Low Voltage Distribution
Please refer to Section 9.2 for a description of the LV distribution strategy.

For the hotel rooms, local consumer units serving pairs of rooms with sufficient number of individual metered circuits for small power and lighting. Proposed link to the key slot within the rooms so that power is only provided when the rooms are occupied.

General LV Power
Please refer to Section 9.2 for a description of the general LV power strategy.

Earthing and Bonding
Please refer to Section 9.2 for a description of the earthing and bonding strategy.

General Lighting
Please refer to Section 9.2 for a description of the general lighting strategy.

Lighting Controls
Please refer to Section 9.2 for a description of the lighting control strategy.

Emergency Lighting
Please refer to Section 9.2 for a description of the emergency lighting strategy.

Uninterrupted Power Supply
Please refer to Section 9.2 for a description of the UPS strategy.

Telecommunications and Data
Please refer to Section 9.2 for a description of the telecommunications and data strategy.

Accessibility Systems
Please refer to Section 9.2 for a description of the accessibility systems strategy.

Access Control
Please refer to Section 9.2 for a description of the access control strategy.

CCTV
Please refer to Section 9.2 for a description of the CCTV strategy.

Security Detection and Alarm
Please refer to Section 9.2 for a description of the security strategy.

Fire Detection and Alarm
Please refer to Section 9.2 for a description of the fire detection and alarm strategy.

Lighting Protection
Please refer to Section 9.2 for a description of the lightning protection strategy.

Leak Detection
Please refer to Section 9.2 for a description of the leak detection strategy.

Trace Heating
Please refer to Section 9.2 for a description of the trace heating strategy.

Building Management
Please refer to Section 9.2 for a description of the BMS strategy.

8.3 Distribution Strategies

Risers
The services proposal consists of mostly new risers to work with the new layouts. Located with consideration to the plant room they may originate from and areas they go on to serve.

The majority of risers are serving the hotel rooms. Work has been done to make neighbouring bathrooms share a wall so that two rooms can be served by one riser.

Please refer to Section 9.3 for further description risers serving the Council-operated areas.

Horizontal Distribution
Basement
Please refer to Section 9.3 for a description of the service distribution strategy in the basement.

Ground and First Floors
Please refer to Section 9.3 for a description of the service distribution strategy on the ground and first floors.

Second, Third and Fourth Floors
Services will be hidden in the new hotel areas, mostly at high level.

Roof
Please refer to Section 9.3 for a description of service distribution strategy on the roof.

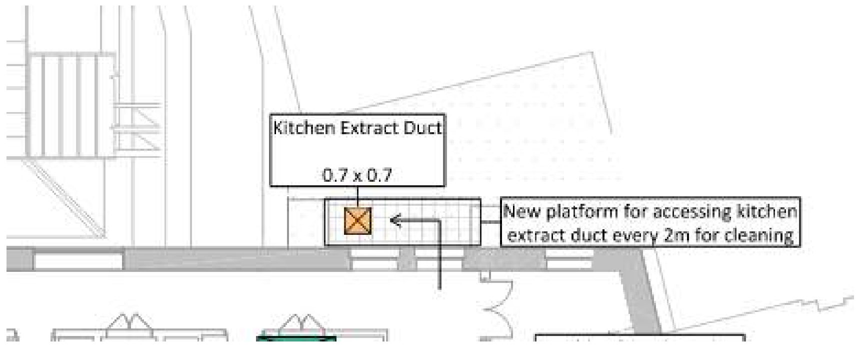
Chambers and Halls
Please refer to Section 9.3 for a description of service distribution strategy in the council chamber, old courts and both the halls.

8.4 General MEP Strategies & Provisions

Metering Strategy
Please refer to Section 9.4 for a description of the metering strategy.

Structurally Significant MEP Builderswork
Please refer to Section 9.4 for a description of most of the significant builderswork items.

In addition, to access the kitchen exhaust duct throughout its length up the building, new platforms and access openings on the first to fourth floors were proposed.



9.0 THE PROPOSED GUILDHALL – OFFICE OPTION

Early in September 2024 the design team were instructed to proceed on the basis that the assigned areas to be leased were to be used as offices, separate to the council-run areas of the Guildhall. Read the below in conjunction with drawings and schedule within Appendix IV.

9.1 Specific Design Brief/Criteria

Generally the design will be in accordance with current British Standards. These are not stated/referenced below.

The following documentation has been provided to form the 'brief':

- Civic Quarter: Approach to November 2024 Strategy and Resources Committee – briefing note sent to Max Fordham 17th May 2024.

It outlines Cambridge Council's intention to create a more attractive central Cambridge destination for residents that would increase visitor numbers to the neighbouring market and businesses in the area.

The refurbishment works will help the Council meet their net zero carbon by 2030 target, with the ambition to achieve operational net zero and water neutrality.

Specifically for the Guildhall, the Council is looking to enhance the revenue available from the building, leasing mostly the upper floors, while the remainder of the building meets the Council's operational requirements for office, civic and customer service use.

Fire Fighting Services
The fire consultant, Arup, have produced an Initial Fire Strategy note outlining their expectations for the MEP services. They also note the risks of their proposal rely on the condition of the existing building and briefing queries to Cambridge Council on the building's planned use and occupancy.

Sprinklers
Sprinklers are not required with respect to the legislation.

If sprinklers become a requirement, a $70\ m^3$ tank would be the starting size. Changes to the below smoke ventilation strategy or the allowed occupancy for evacuation could be consequential in the need for a sprinkler system.

Basement Smoke Ventilation
There are existing break out panels to the basement on Peas Hill, Market Hill and Guildhall St, though Arup report there is less area than the current guidance would require.

The new atria to the basement are being considered as possible routes to exhaust smoke and the approach needs to be investigated in detail at the next design stage. Currently the proposal requires opening dampers in the top of the atria, that could also be used for general, passive ventilation of the basements. Any requirements for secondary power are proposed to come from dedicated, local batteries.

Firefighting and Evacuation
No firefighting shaft required, which would include a firefighting lift.

An evacuation lift is proposed to serve all levels. The proposal is to provide this lift's control panel with two power supplies that have travelled diverse routes through the building but from the same switch panel in the basement.

Refuges with call points are located on every floor in each stairwell except the ground floor.

New dry risers are planned in the lift lobbies. For the east side, the external inlet connection is proposed to be by the main entrance from Guildhall St, makes its way to the ground floor lift lobby (Core D) before running vertically, with outlets on every level, up to the fourth floor. Similarly for the west side, the external inlet connection is proposed by the main entrance from Peas Hill, makes its way to the ground floor lift lobby (Core B), then runs both up and down to the fourth floor and basement, with an outlet at every level.

Fire Compartmentation
Services passing through fire compartment walls, floors and ceilings will need to maintain the compartment's performance rating.

Consideration for maintaining the performance of compartments with a insulation rating will need to occur in detail during the next design stage. To maintain the insulation rating typically requires services to be wrapped in appropriate insulation for a length either side of the compartment line. This can be impactful on the services strategy, potentially requiring deep risers and larger cable sizes throughout the building.

Within the stairwells and lobbies of the building, the intention is to avoid locating any services in these spaces that are serving other areas. This is to follow the intention of the wiring regulations and fire regulations to avoid unnecessary services in escape routes.

Low and Zero Carbon Technologies
We have investigated low and zero carbon (LZC) technologies in detail to work towards the building's ambition to be operationally net zero carbon.

Solar Photovoltaics
Solar photovoltaic panels (PV) convert solar radiation into electricity, providing a carbon free source of electricity for use in the building. They are a low impact technology which provides CO_2 savings for a relatively low capital cost. Solar PVs are also a relatively simple technology to install, with little ongoing maintenance involved.

An Electrical Based Energy Strategy
The carbon intensity of the UK electricity grid has been falling as a result of the decommissioning of coal fired power stations and a greater proportion of renewable and nuclear energy in the energy mix. With the continuing decarbonisation of the national grid, the benefit of using electricity for heating, and where necessary cooling, is constantly increasing when compared to a more traditional natural gas solution.

The high efficiency of heat pumps and the low (and decreasing) associated carbon emissions associated with electrical systems, mean that they are an appropriate choice for the building, to be reviewed with the considered heat network discussed in Section 7.0.

Air Source Heat Pumps
Heat pumps transfer thermal energy from a source to a sink, powered by an energy input such as electricity. They can move several times more heat than their energy running cost.

Air source heat pumps (ASHPs) work by using a refrigerant cycle to extract heat from the air and transferring it into a building system and can be used to provide the building with one or a combination of hot water, heating, and cooling. They require a large amount of space and need to be installed in open air but can provide significant energy and CO_2 savings.

Suitable space is available on the roof for plant equipment, and it is proposed that ASHPs will provide the building with space heating and cooling.

Mechanical Design Conditions
Refer to the Mechanical Strategy drawings (J7562-MXF-GH-ZZ-DR-M-00101) for the proposed approach to heating, cooling and ventilating the Guildhall.

The following table outlines the proposed design conditions throughout the Guildhall. Considering the brief to reduce operational carbon and running costs, where a range of temperatures is given, we will adopt the upper value in summer and lower value in winter.

Space / Room Type	Design Temperature		Ventilation Design Criteria
	Summer	Winter	
Council Office – Mechanically Ventilated	24°C ± 2°C (BCO Guide)	20°C ± 2°C (BCO Guide)	10 l/s person (CIBSE GUIDE A)
Commercial Office – Mechanically Ventilated	24°C ± 2°C (BCO Guide)	20°C ± 2°C (BCO Guide)	10 l/s person (CIBSE GUIDE A)
Council Office – Mixed Mode	≥25°C for <5% of occupied hours per year & ≥28°C for <1% of occupied hours per year (BCO Guide)	20°C ± 2°C (BCO Guide)	10 l/s person (CIBSE GUIDE A)
Commercial Office – Mixed Mode	≥25°C for <5% of occupied hours per year & ≥28°C for <1% of occupied hours per year (BCO Guide)	20°C ± 2°C (BCO Guide)	10 l/s person (CIBSE GUIDE A)
Meeting Rooms	22-25 °C (CIBSE GUIDE A)	21-23 °C (CIBSE GUIDE A)	10 l/s person (CIBSE GUIDE A)
Chambers and Halls	21-25 °C (CIBSE GUIDE A)	19-21 °C (CIBSE GUIDE A)	10 l/s person (CIBSE GUIDE A)
Tea Point	21-25 °C (CIBSE GUIDE A)	19-21 °C (CIBSE GUIDE A)	15 l/s (CIBSE GUIDE A)
WCs	21-25 °C (CIBSE GUIDE A)	19-21 °C (CIBSE GUIDE A)	6 l/s per cubicle (CIBSE GUIDE A)
Circulation Areas	21-25 °C (CIBSE GUIDE A)	19-21 °C (CIBSE GUIDE A)	0.2 ACH (EnerPHit)
Bike Stores	21-25 °C (CIBSE GUIDE A)	19-21 °C (CIBSE GUIDE A)	0.2 ACH (EnerPHit)
Plant Rooms	21-25 °C (CIBSE GUIDE A)	19-21 °C (CIBSE GUIDE A)	0.2 ACH (EnerPHit)

To achieve the above conditions in an efficient manner, improvements to the building fabric are required. This is in relation to enhancing the standard of insulation throughout and reducing the air infiltration rate.

EnerPHit
Additional criteria of the ventilation installation that must be complied with for the Guildhall to be certified:

- Mechanical ventilation with heat recovery to all spaces.
- Minimum flow rate 20 m^3/h per person.
- Heat recovery efficiency of the entire ventilation system (including intake/exhaust ducts) must be or exceed 75%. To achieve this, ventilation units with high heat recovery efficiency will be required.
- Ventilation systems must be controllable, either automatically via sensors or manually.
- Ventilation systems to achieve the following acoustic requirements by providing appropriate attenuation:
  - ≤ 25 dB(A): bedrooms and recreational rooms in non-residential buildings,
  - ≤ 30 dB(A): other rooms in non-residential buildings.
- Ventilation to be fully balanced throughout the building which must be demonstrated at commissioning.

9.2 Proposed Plant / Equipment

Refer to schedule J7562-MXF-GH-ZZ-SH-J-30001 for a summary of the proposed plant items, their capacity, specific considerations and the strategies for their initial installation, ongoing maintenance and future replacement.

Mechanical Services
Low Temperature Hot Water Heating

Separate groups of 4-pipe chillers for the lettable areas and the Council's areas are located on the west and east sides of the main roof of the Guildhall. Both are able to simultaneously generate LTHW and CHW.

As the sources of heating and cooling for the building, it is important that there be enough redundancy in the systems to account for any maintenance or critical failures of plant equipment in day-to-day operation. To provide some protection from faults, multiple smaller chillers are proposed in each group, rather than a single larger chiller.

In the absence of an acoustic consultant, we have drawn full acoustic enclosures to mitigate potential noise breakout.

The main LTHW heating plant will be located in the heating/cooling plantrooms on the roof of the building for the system serving the lettable areas, and in the basement for the system serving the Council's areas.

All space heating pipework to be insulated to a high standard, including thermally broken clips and valve jackets.

The proposed methods for heating the building are to be worked through in stage 3, following further investigative works to establish existing and possible new service routes.

Chilled Water System
Chilled water provided by same roof mounted air-source heat pumps as LTHW.

Refer to Low Temperature Hot Water Heating section above as shared system.

The proposed methods for cooling the building are to be worked through in stage 3, following further investigative works to establish existing and possible new service routes.

VRF Cooling
Rooms where the use of wet fan coil units presents a risk will be provided with an inverter controlled refrigerant cooling system.

All cooling pipework to be insulated to a high standard, including thermally broken clips and valve jackets.

Currently it is intended to use this system in the incoming and distributed comms rooms.

Mechanical Ventilation
Generally, all areas of the building will be provided with a central heat recovery mechanical ventilation system which will be sized predominantly to maintain air quality.

VAV control will be used in areas of the building where a single fan system is supplying multiple rooms that may require varied ventilation rates to maintain air quality.

Large, individual rooms have been provided with dedicated fan systems.

To aid in achieving EnerPHit's overall energy use certification criteria, all heat recovery units are to have a summer bypass controls option and airtight shut off dampers to the fans that will be used intermittently.

All intake and exhaust ducts are to be insulated, allow for at least 100mm thick closed cell insulation. Intake and exhaust ducts that are significantly longer than two metres recommended by Passivhaus will require additional insulation.

Public Health Services
Sanitaryware
Low flow fittings to target 'water neutrality' from reduced usage alone. Refer to Table 6.1 in section 6 for proposed flow rates.

Rainwater Drainage
The system will need to cover rainwater drainage from all the roofs. The proposal is to harvest all rainwater into tanks via filters to be processed for use as flushing water for WCs and urinals.

The system will be gravity drainage where possible, a combination of external downpipes and internal insulated downpipes (in HDPE). To aid in achieving EnerPHit's overall energy use certification criteria, the number of internal downpipes and roof penetrations are to be minimised.

Foul Drainage Above Ground
A complete above ground drainage installation is to be provided to convey wastewater from all sanitary and other devices within the building and connected to either the below ground drainage points (see structural engineer's information), or proposed greywater recycling system.

Waste from sinks, basins and any showers at ground level or above are proposed to drain into the greywater recycling system.

Plant areas are to be provided with floor gullies for wash-down and discharge of condensate drains, etc. The number and location of these outlets will be informed by the final plant layout.

In-slab drainage in the basement (mainly in the form of gullies), where required, will form part of the structural and architectural packages.

To aid in achieving EnerPHit's overall energy use certification criteria, the number of soil vent pipes (SVP) venting to atmosphere should be minimised, using air admittance valves (AAVs) where possible. When an SVP is unavoidable, its entire internal length is to be insulated.

Cold Water Systems
A central mains water storage tank and variable speed booster set are to be provided in both the Water Services plantrooms in the basement; and are to provide potable boosted mains water to all sanitary appliances (except toilets), taps and hot water heaters within the building. The booster sets will have a minimum of three pumps arranged as duty/assist/stand-by.

Dedicated packaged duty/standby Cat5 variable speed booster sets/break tanks will serve to provide 'protected water' to any external water taps and irrigation points.

An electromagnetic scale reducer will be provided on the incoming water mains; and salt-based water softening to the building's water supply for the protection of heating elements within the electric hot water heaters, heat exchangers, the heat pumps and chillers.

Major leak detection is proposed for the incoming supplies to the building.

Domestic Hot Water
Domestic hot water throughout the building will be generated by efficient, unventilated local electric hot water heaters.

The length of pipework is to be minimised.

Rainwater and Greywater Systems
Within both water recycling plant rooms in the basement, packaged rainwater harvesting and greywater recycling systems are to be provided. Both systems consist of tanks and filters, with a small booster set to supply a combined header tank. A third booster set then provides water for flushing all toilets and urinals.

The header tank requires a mains cold water supply to ensure there is water in the system.

All the tanks require an overflow into the foul drainage system. Below ground drainage requirements associated with potential sump pits and any builderswork to be investigated further in stage 3.

Dry Risers
Dry risers will be provided as per the fire strategy for the building (currently two dry risers, one in the west stair core and the other in the east stair core.

Electrical Services
To achieve EnerPHit criteria for overall energy use, a combination of energy efficient equipment and a lean design will be required. Energy budgets for the key pieces and equipment to be agreed early in the next stage.

Lighting, lifts, IT equipment, AV equipment and kitchen appliances can have a very high energy use and corresponding internal heat gains. This is also the case for some building systems, such as access control and CCTV and fire dampers, items that tend to be permanently powered.

Electrical Generation Plant – PV
High efficiency photo voltaic panels on the main roof and on the angled roof of the Large Hall. IP65 inverters local to panels to connect into the proposed PV battery storage plant room via a generation meter. The battery storage would form part of the Council's LV distribution network and act as a store for when PV production exceeds the building's electrical demands.

High Voltage Distribution
There is an existing HV/LV substation in the basement that serves the Guildhall and is understood to also provide LV supplies to neighbouring premises. This is to be retained.

UKPN currently believe a new HV/LV substation arrangement is required to serve just the Guildhall. Refer to Section 3.2 for further details.

Low Voltage Distribution
New, separate LV cubicle switch panels for the Council LV distribution and tenanted office LV distribution, to be located within dedicated electrical plant rooms in the basement, near to the supplying substation.

Distribution boards (DBs) on the floor plates to provide general lighting and small power, located in risers. Specialist spaces to be served from dedicated metered distribution boards (panel boards (PBs) if the expected loads are significant). All DBs and PBs to have surge protection on their incoming feeds and arc-fault detection devices (AFDDs) on outgoing circuits as recommended in 18th Edition of the Wiring Regulations.

Assume that distribution from the cubicle switch panels to the PBs and DBs will be either dedicated SWA submains run on cable ladder or a proprietary busbar system or a combination of both.

Modbus meters will be provided to new incoming ways and all outgoing ways. All meters monitored by remote metering management software.

General LV Power
Flexibility is to be considered in the small power and data distribution strategy to minimise visual clutter and provide enough outlets for the building users. The appropriate solution for each area will be dictated by the space type and then by the intended use of the space. Could include under-floor distribution, dado trunking on wall, chased wiring with flush accessories and ceiling void distribution on concealed containment systems.

Earthing and Bonding
The building's existing earth electrode installation needs to be surveyed. A low-impedance path to earth (<200 Ohms) for all systems will be required.

All DBs and PBs are to be provided with type 2 & 3 combined surge protection at their incoming devices.

A protective bonding network is to be provided for telecoms equipment, as BS 50310, connected at the main earth terminal.

Additional earthing measures may be necessary for circuits supplying equipment with high protective conductor currents (e.g. IT equipment).

General Lighting
The general lighting proposal will be designed following all CIBSE, ILP and British Standards, to provide a safe, functional, energy efficient, architectural, and high-quality installation for the Council and occupants of the building.

All areas throughout the Guildhall are to have artificial lighting installed. LED light fittings will be used throughout.

Fittings for all plantrooms and storerooms are to be IP65 and IK08.

Fittings are to be IP65 in areas with risk of water ingress, following the zones outlined in the IEE Wiring Regulations.

Switch plates, scene setting panels, fittings, all cabling and other infrastructure associated with the lighting installation and controls is to be provided.

Lighting Controls
A combination of DALI scene setting, daylight dimming, presence/absence detection and manual on/off switching will be provided throughout the building for different areas, dependent on use and occupancy type; all controlled from a central DALI lighting control system with software, web and BMS interface.

Emergency Lighting
The emergency lighting will be designed following all CIBSE, ILP, CIE and British Standards, to provide a safe, functional, energy efficient, high-quality installation for the Council and occupants of the building.

Emergency lighting to be provided via distributed, self-contained 3hr duration fittings, either maintained or non-maintained according to type and location. Fittings are to have centralised testing and monitoring. Light levels to be selected in accordance with anticipated testing regime, and in accordance with BS 5266.

If a firefighting shaft (stairs, lobbies) later becomes relevant to the project, it is to be provided with normal lighting levels from maintained luminaires in the event of a primary power failure. This is to be achieved with a localised central battery, located within the firefighting, powering the primary lighting circuits, which are to be wired in fire resisting cable in accordance with BS8519 and BS9999.

Uninterrupted Power Supply
Service critical items to have an in-built UPS, e.g. BEMS/mechanical control panels/outstations, fire alarm.

MAX FORDHAM

UPS associated with IT equipment to be specified by the Cambridge Council IT services.

Telecommunications and Data
Incoming Fibre Optic (FO) cables will be run to the Incoming Comms Rooms. Separate incoming comms rooms are provided for the Council and tenanted areas, with the tenanted office also having a secondary incoming comms room for an improved security of network continuity.

Details and requirements for diverse incoming routes are to be agreed with Cambridge Council's IT services.

Distributed comms rooms in the Guildhall are to be connected to their incoming comms room via two diverse routes using OS2 fibres. The distributed comms rooms can accommodate data racks including patch panels and ancillaries. From the distributed comms rooms data distribution will take place in Cat6A cabling generally distributed on cable basket and terminated at Cat6A data outlets; the length of each cable shall not exceed 90m.

Data outlets will allow the direct connection of computers and equipment by the users but will also allow the connection of IP based systems like the CCTV, Access Control, the integration of AV installations and Wi-Fi access points. It is proposed that all spaces shall have the facility to be provided with fixed data points.

Generally, it is anticipated that all areas the building will have access to the Wi-Fi network. Allow for every room to have one fixed wi-fi data point. Areas of high data demand are to have more than one wi-fi point (generally one per 20-30 desks). Principles and quantities to be developed at the next stage.

Active equipment like servers, PoE switches and rack mounted UPS' are not included in the MEP package. It is assumed that such items will be provided by the Council and tenant as part of their IT fit-outs.

Accessibility Systems
Disabled WC Alarm System: A disabled WC alarm system will be provided to all accessible WCs.

Disabled Refuge Alarm System: A Disabled Refuge Alarm will be provided which will provide a two-way intercom from each refuge point within the building, with a central location.

Fixed Induction Loops: The requirement for fixed induction loops is still to be determined. It is envisaged that fixed induction loops will be required at reception areas and the Council Chamber. Other areas TBC.

Access Control
An Access Control System (ACS) is proposed within the building, with access control provided on all strategic doors:

- all non-public perimeter entrances,
- internal doors that mark the perimeter of a service area,
- internal doors that mark the boundary between Council and tenanted areas,
- rooms that require restricted access to a significant number of people,
- plant and comms rooms,
- rooms with high value equipment,
- storerooms,
- bike stores,
- bin store,
- doors leading into staff/'back of house' areas from public access area,
- all bookable rooms,
- all sensitive or secure areas,
- all lifts.

In addition, the access control system could be used to monitor external doors other than entrances for security purposes.

'Offline', wireless access control systems such as Salto's door handle integrated card readers could be implemented to reduce constant energy demands. Minimising the amount of hardwired access control doors and maglocks would also be beneficial.

The system requirements will require specific briefing from Cambridge Council's security services.

CCTV
The building will be protected by a building wide CCTV System. The proposal included below are to be worked through in detail with Cambridge Council at the next stage.

It is proposed that CCTV coverage is provided to the following areas of the building:

- the external perimeter of the building,
- all entrances/exits to the building,
- at locations where cash may be handled,
- rooms with high value equipment,
- in all lift cars.

CCTV system should allow the Council to identify individuals.

The initial proposal is for the CCTV system to be based on an Internet Protocol (IP) system.

Security Detection and Alarm
An intruder detection system (IDS) is proposed as it is assumed that the building is not to be occupied 24/7. Primarily non-entrance external access control doors will be monitored for unauthorised use, see Access Control section. In addition, the IDS could monitor all external doors and ground floor spaces, as well as all spaces that have pedestrian access to their external facades and those containing high value items.

Fire Detection and Alarm
The fire detection system will be designed in accordance with the Building Regulations, the relevant British Standards, and the requirements of the overall fire strategy.

At this stage a category L1 Fire Alarm System in accordance with BS 5839-1 is proposed throughout, (fully addressable).

PAVA System: Requirements TBC subject to Fire Strategy Report.

Lighting Protection
A new lighting protection system will be required subject to a lightning protection risk assessment. Assume a LPL 1 system at this stage.

Existing installation only covers some roof areas and what is observable doesn't appear to be a complete system.

Leak Detection
Propose leak detection to all plant rooms in the basement.

Trace Heating
All external water filled pipework is to be trace heated.

Building Management
IP based BMS system to enable energy efficient control of mechanical plant, monitoring of all energy metering and sub-metering. Logging of all data.

Cambridge Council to confirm if they have system preference. Standalone system is proposed.

9.3 Distribution Strategies

Minimising the length of distribution routes should be a key aim in reducing unwanted energy losses and gains from relevant mechanical and public health services.

Risers
The services proposal consists of mostly new risers to work with the new layouts. Located with consideration to the plant room they may originate from and areas they go on to serve.

The majority of risers are located around and in the new atriums, going up the entire height of the building. This has been led by the new office tea points and WCs next to the atriums on multiple floors, areas that require multiple services.

Further work in stage 3 is required to review the riser strategy to work with the fire strategy of avoiding services in the main stairwell lobbies. This will likely increase the number of risers required.

Some of the large ducts from ventilation systems serving the basement and ground floor are proposed within the existing thick walls around the Large Hall. It is understood there are existing ventilation routes in these locations, but further investigation is required to confirm their viability as future service routes.

To aid in achieving EnerPHit's overall energy use certification criteria, the number of risers penetrating the roof should be minimised.

Horizontal Distribution
Basement
Services in the basement will be exposed at high level.

Care will be required when coordinating the distribution from the multiple plant rooms as we understand the ceiling height is 3010mm for the majority of the floor. We have not been able to enter the basement due to the risks of asbestos.

Ground and First Floors
Services will be hidden, mostly at high level within the existing, and at times, substantial ceiling voids.

The ground and first floors of the Guildhall have several heritage areas that will require bespoke solutions to fit the services in, particularly where we are expanding the provision of mechanical ventilation.

Our intention is to replicate the current service routes where possible into individual rooms, to be developed in stage 3.

Second, Third and Fourth Floors
Services will be exposed in the new office areas, mostly at high level.

Roof
Distribution on the roof will be at low level and coordinated to provide safe access to service roof plant. It is expected much of the plant will be on bigfoot systems, with stepovers required to cross service routes.

Chambers and Halls
The council chamber, old courts and both the halls will have their services hidden. The intention is to replicate the existing service strategies where possible.

It is understood the existing ventilation plant for these rooms is in the basement. Our proposal is to move the equipment to the roof levels near the spaces to benefit from the heat recovery available when served by a single piece of equipment.

9.4 General MEP Strategies & Provisions

Metering Strategy
Our proposal is to provide a meter monitoring system, either on the BMS or separately, to the Council's preference. All meters would then be monitored and logged in a central location.

Utility meters on all incoming mains water, electrical and possible heat network connections. Heat meters in plant rooms.

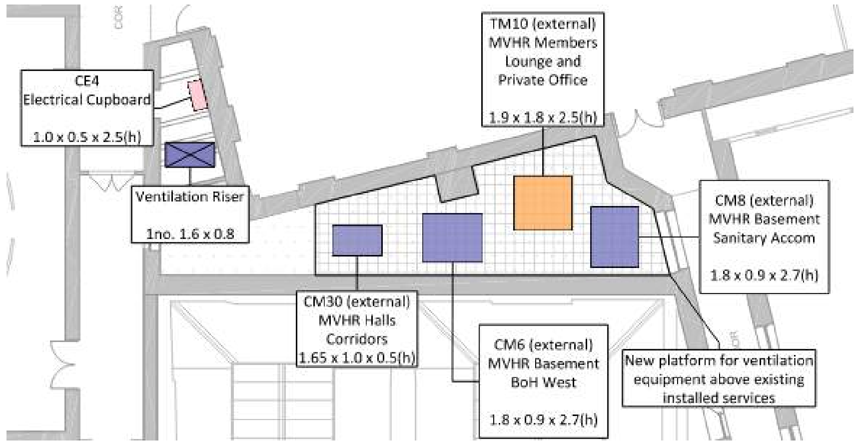
All electrical switch gear will have a meter per connection, except for certain life safety equipment. Meters will be on all panelboard connections and individual Powertag meters for each circuit on the distribution boards.

To accurately capture the usage of potentially multiple tenants in the office spaces, allow for metering of heating/cooling, electricity and water per floor. All meters to be MID approved that are to be used for billing purposes.

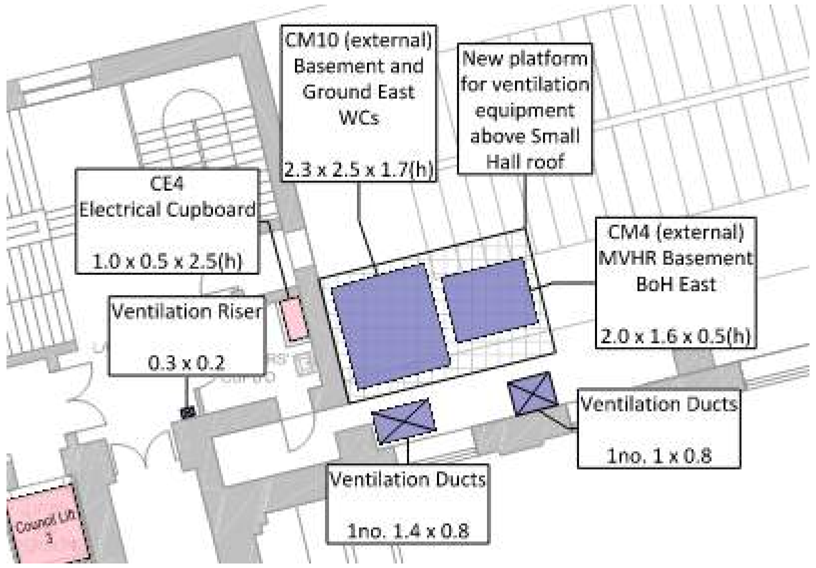
Structurally Significant MEP Builderswork
Multiple proposals for significant builderswork are proposed to provide new and improved conditioning to the Guildhall.

Within the basement, a 5510mm tall plant space is proposed to be split into two levels to accommodate separate plant spaces. This will require a substantial new structure within the existing space.

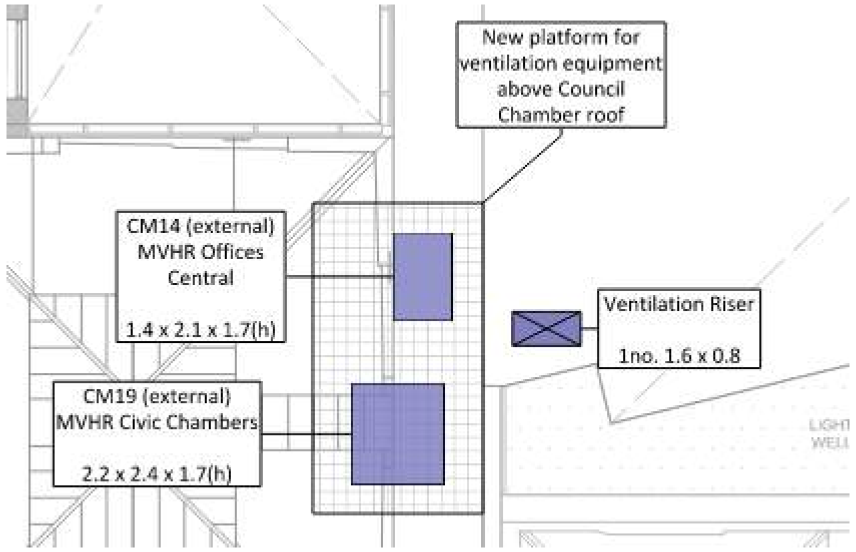
To support ventilation equipment, plus ancillary ductwork and attenuators, multiple new platforms are proposed. One is in the central lightwell, above existing services understood to belong to Sticks'n'Sushi.



Another platform is over a section of the Small Hall roof, potentially at a height to maintain the current access route beneath the platform.



Another platform is similarly over the Council Chamber roof, again potentially at a height to maintain the current roof access route.



We have proposed to locate the large ventilation equipment serving the Large Hall within the Large Hall's roof void. Existing access provisions into the space are not large enough and a new opening for plant installation and removal would be required. In addition, the existing arrangement of trusses within the roof void would need to be reworked to provide the necessary space for the equipment.

10.0 THE PROPOSED GUILDHALL – THE MUSEUM OF CAMBRIDGE

Early in September 2024 the team were instructed to consider the feasibility of integrating the Museum of Cambridge into the Guildhall. The below is a summary of the anticipated impact and initial considerations.

10.1 Specific Design Brief/Criteria

The following documentation has been provided to form the 'brief';

- The Museum of Cambridge – Cartwright Pickard presentation dated 5th September 2024.
- Feasibility Questions Reimagining The Museum of Cambridge.

A funding summary note has also been provided. This highlights a number of potential funding streams. Each is likely to require specific information to support an application. Each may have slightly different priorities in terms of the design proposals (use of museum). Should the integration of the museum be progressed a detailed review of these requirements and potential differences should be completed. The preferred funding streams can then inform the design development.

The current Museum of Cambridge has not been visited. If the integration of the Museum is to be progressed we would like to arrange a visit to the current museum, in conjunction with meeting the Museum's curator.

Area and Occupancy
It is noted that the area indicated in the Cartwright Pickard presentation and drawings is less than that indicated in the Museum brief, prior to any future expansion. The various types of use identified within the brief and their related occupancy will require aligning to the general arrangement drawings prior to progressing the design. The current weekend opening also requires consideration, particularly with respect to the operation of shared/centralised MEP systems that would otherwise not be in use.

Independent or Shared MEP Plant/Systems
The brief highlights that a partnership with the Council should be considered and questions what this would mean for building maintenance and support? The brief highlights the Museums desire to support green use and environmental sustainability and the need to agree the financial arrangement including utilities and service charge.

To minimise additional capital and maintenance costs and the assocaited plant space, it would be prudent to maximise the use of the CCC MEP Plant and systems and sub meter the services to the Museum. A shell and core type arrangement could be considered subject to agreeing responsibility for the Museum fit out. As highlighted above, weekend use requires consideration both in terms of part load system performance and operating costs.

Some of the Museum requirements are anticipated to dictate that some dedicated plant/systems are provided. Further details are described below.

Fire Fighting Services
This report section has been written in advance of receiving a fire strategy from the qualified fire engineer. The strategy should confirm the MEP fire-fighting requirements.

Mechanical Services
Environmental control, particularly the rate of change of temperature and humidity, is critical to the preservation of materials. The brief requires stable conditions of 'circa 18°C and 40-60% RH'. This is identified for the 'Collections Storage' and 'Visitor Display (exhibition) area'. As this is required by the 'collection' this environmental control would be required 24/7, year round. Dedicated plant and controls will be required to deliver this environment. It will be energy and carbon intensive, further increasing the challenge of delivering a Net Zero Carbon Guildhall.

Our experience is that a greater relaxation in these conditions can be applied, particularly to the temperature. This is acknowledged by the 'Bizot Green Protocol', published in September 2023 and supporting a 'greener practice first mindset' when defining a Museums environmental brief. It is also likely that a number of the displays would not require such conditions and a more typical 'office environment' may be suitable e.g. digital, sculpture, pottery.

We recommend an approach of limiting the extent of space provided with close environmental control, acknowledging the need for some future flexibility. In addition to the extent of area served, the energy and carbon loads can also be reduced by positioning these spaces in consideration of the building fabric (locate internally) and using surrounding spaces to act as 'environmental buffers'. In visiting the existing Museum and discussing the collection with the curator we would look to apply this approach to the developing Museum layout.

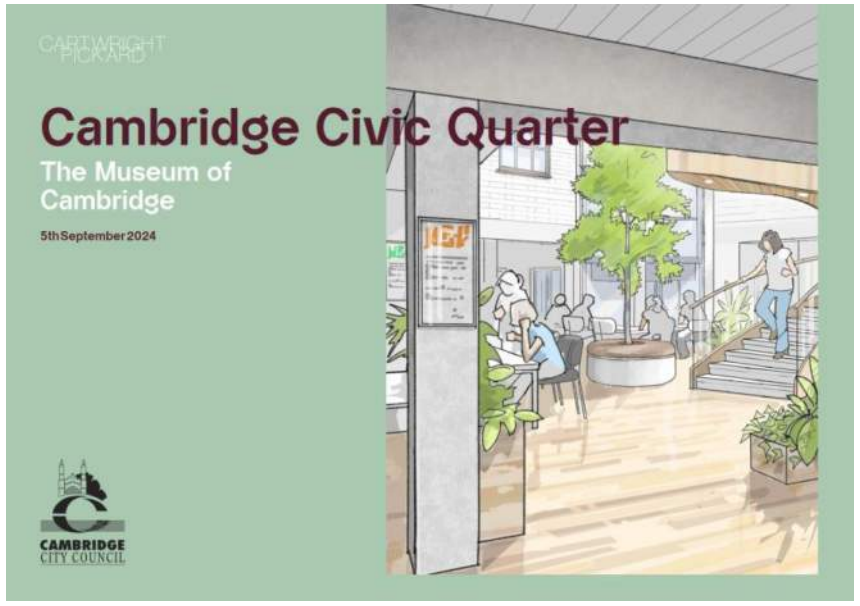
In addition to the storage and display areas the brief also refers to staff work areas, welcome desk, meeting rooms, school pupil event spaces, WCs, kitchens etc. We envisage that all of these would be served by extending the Coouncil's plant/systems and would be provided with mechanical services to deliver conditions and provisions considered 'typical' for these spaces.

Electrical Services
The brief highlights the additional security considerations assocaited with a Museum (intruder alarm, 24 hour monitoring, dedicated CCTV, probably also some access control). It references a closed loop circuit in the 'Events Space', which we anticipate being an induction loop for the hard of hearing.

Lighting is referred to as 'adjustable' and would need to offer flexibility to light the displays.

Digital displays are referred to and would require power and strong Wi-Fi. The ability to play sound/music is also noted (sound, possibly a PA, system).

In addition to the above general lighting, emergency lighting, power and data provisions will be required. Any specific display power should be identified (that greater than a socket outlet).



Public Health Services
The brief does not contain any specific Public Health service requirement. It does refer to WCs, a kitchen and to a water supply to the engagement area. We envisage that all these would be served by extending the Council's plant/systems and would be provided with public health services considered 'typical' for these spaces.

The brief highlight the risk of damage should wet services in a neighbouring space leak and enter the Museums demise. Leak detection systems may be required to some areas e.g. in ceiling voids over displays.

Vertical Transportation
The brief notes the requirement for a large accessible goods lift. The size and loading capacity would need to suit the largest collection/display items including the related protection and method of transporting/moving.

The Museum will require a lift to provide access for both staff and visitors. Who have a walking impairment and may require the use of a wheelchair.

10.2 Proposed Plant, Equipment & Strategies

The layout and brief require development before plant and primary MEP systems can be sized and the suitability of what is currently proposed to serve this basement area can be evaluated. The below is an initial indication of what we anticipate. It assumes sharing of the Council's plant and systems will be maximised to reduce capital cost, plant space and maintenance costs. As noted in section 10.1 this will require particular consideration when either space is used when the other is not (part load performance and sub metering/charging)

Fire Fighting Services
This report section has been written in advance of receiving the fire-fighting requirements from the fire engineer. It is currently assumed that the fire-fighting services required to serve this space, prior to the inclusion of the Museum, will be suitable. The Museum may be considered a different fire load which could impact on this, as could visitor numbers (occupancy).

Mechanical Services
On the assumption that the Council's plant can suitably serve the 'general' areas, including sanitary provision, additional dedicated ventilation plant, providing heating, cooling and humidity control shall be provided to serve the Collection storage/archive and also any display areas where close environmental control is required. The differing nature and occupancy of these spaces is likely to dictate separate systems for each. Duct routing for intake and exhaust air is likely to be via the surrounding lightwells with the AHUs located within the Museum space. LTHW and CHW, downstream of the Museum sub meters, will be piped to these AHUs.

In addition to the storage and display areas the brief also refers to staff work areas, welcome desk, meeting rooms, school pupil event spaces, WCs, kitchens etc. We envisage that all these would be served by extending the proposed Council's mechanical plant/systems to deliver conditions and provisions considered 'typical' for these functions. The 'kitchen' may be the exception to this, though it is assumed that this is a 'kitchenette' for staff rather than a larger kitchen to support a visitor/hire type use. The latter would require ventilation systems that would be complex to fit into the space and to route through the building.

The method of heating, ventilating and where required cooling the areas that are not considered to be 'closely controlled' will be dictated by the layouts, ceilings and wall space. Should a dedicated comms room be required, a dedicated refrigerant based cooling system may be required in a similar way to what would be provided to an office tenant for their comms room.

Enhanced controls are likely to be required to reflect the more stringent environmental control requirements.

Electrical Services
The electrical services will generally be dedicated to the Museum, being considered as 'second fix' or 'fit out'. Power would be derived from the main building switchgear, including a dedicated sub meter. A fire alarm Mimic panel and interface with the main buildings panel will allow zoning, installation and management to reflect the different occupancy and use.

As noted in section 10.1 the intruder, access and CCTV security systems will be more extensive and bespoke to reflect the Museums requirements.

Lighting, power and data will be enhanced to reflect the collections and displays. Digital (AV/projection) and sound systems also.

Induction loops will be required to support an 'access for all' strategy.

It is assumed emergency lighting can utilise self-contained (integral battery) fittings and that a central battery systems is not required.

Back up power is not envisaged. Careful arrangement of the spaces containing the sensitive display/collection items can reduce the rate of change in the environmental conditions and therefore effect on the items should the buildings power supply be lost.

Public Health Services
We envisage that the Council's plant/systems would be utilised to serve the sanitary accommodation, kitchens and requirements of the engagement area. Dedicated local electric hot water heaters will be utilised.

As noted in section 10.1 leak detection systems may be required to provide early warning of any leaks in surrounding areas (to be reviewed and developed).

Water softening will be required to serve the supply to the humidifiers in the AHUs. Condensate connections will be provided to serve drip trays under the AHU cooling coils and any space fan coil units.

Vertical Transportation
As noted in section 10.1, goods and wheelchair passenger lift provision is required. As with the Councils's plant systems, it would seem cost and space efficient to consider sharing these across the tenancies/uses.

Distribution Strategies
These will be developed in conjunction with the layouts and assessment of what additional plant and services are required. Ideally additional vertical distribution will be avoided. As noted above, additional ventilation routes will look to use the lightwells to the south west of the Museum demise. If Comms room cooling is required the heat rejection would be on the roof and a related pipework route will require coordinating into the vertical risers.

Horizontal Distribution will use the ceiling voids.

Daylighting
Opportunities to have daylight are limited by the basement location. This will be beneficial if sensitive objects are on display and will also help stabilise the environmental control. Daylight will be present at the base of the atria/circulation space. The use of this space and those joining it should be developed to benefit from it.

Metering Strategy
The sub metering strategy, including that of the 'shared systems' which will be operated at times to serve only one of the tenants requires careful consideration and development as the design evolves.

10.3 Impact on Current Proposals

The inclusion of the Museum reduces the extent of area being provided to the other building users (the Council and either office tenant or hotelier). The provisions detailed in sections 8 and 9 of the report will require modifying to suit. A high level summary of the anticipated changes is;

Basement Level
In addition to the reduction in basement area being provided to the Council and their tenant the proposed North East area of the basement is to provide dedicated Council meeting rooms only, rather than a mixture of meeting rooms and some open plan/break out work space. It appears that the total occupancy will slightly increase requiring the ventilation plant to increase. As the meeting rooms provide more self-contained spaces the MEP services provision will slightly increase (lighting, heating, cooling, access control, fire alarm etc.). The related controls provision will also increase.

Basement Floor Plan - Museum of Cambridge Potential

Ground Floor

There are no changes proposed to the ground floor. Main building access will be shared. Museum access is then via the new stair in the lightwell. As described above lift provision is also required to the Museum.

First Floor

There do not appear to be any changes to the first floor proposals, possibly a minor change (removal of a partition wall) to the South West Council office area. If this is the case the local MEP may be simplified (opposite of what is described for the additional basement meeting rooms).

Second Floor

The Council staff will now use the North East end of the second floor (was tenant space). Compared to the office option, the use is the same, just the tenancy that differs. This will therefore result in an increase in capacity for the Council plant/systems and installation (as they are still serving the Museum area) and a reduction in the tenant systems and installations. As the Council area extends beyond the centre of the building (east/west) it will require the current 'balance' between some of the plant and distribution to be revisited.

11.0 THE PROPOSED CORN EXCHANGE

Initially the MEP engineering services design for the proposed Corn Exchange was developed to provide a flexible multi-purpose auditorium space that would achieve comfortable environmental conditions for the audience via dedicated ventilation systems. With the related plant and systems sized and selected it became apparent that these could not be incorporated due to the existing spatial and heritage constraints of the building, both internally and externally. The proposal is therefore a 'reduced' provision to suit these constraints. They key differences are summarised in this report section.

11.1 Specific Design Brief/Criteria

Generally the design will be in accordance with current British Standards. These are not stated/referenced below. The below describes project specific brief and criteria.

Occupancy
A number of the below design criteria relate to the occupancy. It is therefore a key briefing figure to agree. During a meeting of 7th July, representatives from the Corn Exchange referred to the venue audience capacities being:

- Flat floor (standing): 1089 people.
- Mezzanine (standing or seating): 66 people standing or 42 sitting.
- Balcony seating: 490 people.

From a seating plan it appears that there are also 12 seats in the first floor near stage, side balconies. The total audience capacity for a standing event is therefore 1657 people.

The seating plan shows a total seating capacity of 1460 for an all seated event (688 flat floor seats and 228 tired seats replacing flat floor standing).

The total building occupancy requires the Corn Exchange staff (front and back of house), the performers and the performer's support crew to be added to the maximum audience capacity of 1657. This occupancy requires confirmation. For the purpose of this report it is estimated that this totals in the region of 60people (for a capacity event) and therefore the maximum building occupancy is approximately 1720people.

It is necessary to understand the anticipated 'interim' occupancies in the bars and foyers (staff + public). It is understood that occupants will move between the auditorium and these spaces, with some dwelling in the space for a period. An equivalent permanent occupancy and understanding of the likely duration of this will inform the ventilation design. Further details and explanations are included in sections 11.2 and 11.4 below.

Fire Fighting Services
As part of the final draft stage 2 documentation, Arup's fire strategy report for the Corn Exchange, revision P01, was issued on 27/9/24. This should be referred to with respect to the requirement for the MEP fire-fighting services. As this was received after the MEP design was developed this may not be fully reflected in the MEP proposals. Should the Council wish to progress with the development of the Corn Exchange then at commencement of the following design stage the fire strategy documentation shall be reviewed and coordinated into the MEP proposals.

Mechanical Services
Heating
CIBSE Guide A 'Environmental Design', incorporating corrections as of January 2021, table 1.1 recommends winter dry resultant temperatures for Public Assembly buildings as;

- Auditoria: 22-23°C.
- Changing/dressing rooms: 23-24°C.
- Circulation spaces: 13-20°C.
- Foyers: 13-20°C.

Separately (not for public assembly buildings it also recommends);

- Bars, lounges: 22-23°C.
- Exhibition halls: 19-21°C.
- Toilets: 19-21°C.
- Offices: 21-23°C.

The Association of British Theatre Technicians (ABTT) provides Technical Standards for Places of Entertainment (2022). Section F4 is dedicated to heating and cooling. In relation to the above spaces, table 19 recommends winter design temperatures of;

- Auditoria: 21 ± 1°C.
- Dressing rooms: 21 ± 1°C.
- Circulation spaces: 17 ± 1°C.
- Foyers: 17 ± 1°C.
- Bars: 21 ± 1°C.
- Exhibition spaces: 19 ± 1°C.
- Toilets: 21 ± 1°C.
- Offices: 21 ± 1°C.

Table 19 also recommends a temperature of 14 ± 1°C for occasionally occupied spaces such as scenery stores, workshops and stores; a night setback temperature of 12°C and a frost protection temperature of 5°C.

Considering the brief to achieve net zero carbon and reduce operational carbon and running costs where the above recommended temperatures differ we will adopt the lower of the two.

Refer to section 11.2 regarding simultaneous heating and cooling.

To achieve these temperatures in an efficient manner improvements to the building fabric are required. This is in relation to enhancing the standard of insulation and reducing the air infiltration rate.

Cooling
Currently the building does not appear to have centralised cooling. Local refrigerant based cooling systems are present, generally to serve the cellars/ bar stores. These would not form part of the MEP design or installation, they would be defined by a catering or beverage specialist such as Fosters refrigeration.

The existing ventilation systems can provide cooling when the outside air temperature is sufficiently low so that when the air is supplied into the room it is cooler than the rooms internal air temperature. With current UK climates this would occur for a large proportion of the year, particularly during evening performances. The quantity of cooling provided is dependent on the temperature difference between the air supplied into the room and the room itself. Future climate predictions suggest that the extent of these occurrences will reduce and the extremes will increase.

Table 19 of the ABTT guidance recommends the spaces summarised above (heating sub section) should have summer time temperatures of 4 ± 1°C.

Guidance acknowledges that mechanical cooling is energy and carbon intensive and recommends use of passive measures to reduce the requirement for mechanical cooling.

The current proposal is to provide comfort cooling to the main auditoria only, utilising the ventilation systems. This will be an enhancement on the existing provision. The quantity of cooling provided and what it can achieve requires design development as it is constrained by the space available to install the ventilation plant that incorporates the cooling coils and also the central cooling plant. Refer to section 11.2 regarding the cooling plant and simultaneous heating and cooling. The activity taking place within the auditorium will also affect the internal temperature that can be achieved e.g. for the same quantum of cooling, an energetic rock concert will be warmer than a performance to a fully seated sedentary audience.

As the foyer ventilation system is to be shared with that serving the auditorium balcony this will also be enhanced in comparison to the existing provision (as it will have some mechanical cooling).

Ventilation
Part F of the Building Regulations requires the following minimum ventilation rates;

- Sanitary Accommodation: Intermittent air extract rate of 6l/s per WC pan or urinal.
- Sanitary Accommodation: Intermittent air extract rate of 15l/s per shower.
- Office accommodation: 10l/s supply air per occupant.

For 'Places of Assembly' these Regulations refer to 'CIBSE Guide B2: Ventilation and Ductwork (2016)', in turn this refers to 'minimum fresh air requirements for specific building types are given in CIBSE Guide A'. Table 1.5 of CIBSE Guide A defines air supply rates of 10l/s per person for;

- Concert hall, theatre.
- Changing/dressing rooms.
- Circulation spaces.
- Foyers.

- Multi-purpose halls.

The Association of British Theatre Technicians (ABTT) provides Technical Standards for Places of Entertainment (2022). Section F3 is dedicated to ventilation. Table 17 details minimum fresh air supply rates to habitable spaces and table 18 recommended fresh air supply rates (litres per second for each occupant(person). These are;

- Seated (sedentary) accommodation: 8l/sp min and recommended.
- Offices: 10l/sp min; 12l/sp recommended.
- Light activity - staff in bars/serveries: 16l/sp recommended.
- Light activity - playing musical instruments: 16l/sp recommended.
- Dancing: 12l/sp min; 24l/sp recommended.
- Dressing rooms/Changing rooms: 10Ach (though text also states 'ventilate in accordance with Building Regulations part F').
- Lavatories: minimum to be the greater of 6l/s per WC or 6Ach; recommended to be 6l/s per WC + 6ACH.
- Kitchens: 30Ach min.
- Reheat kitchen: >20Ach recommended.

Where only a minimum or recommended rate is noted this is due to the space/use category not appearing in both tables.

The ABTT also recommends;

- Auditoria are slightly positively pressurised (extract upto 90%).
- Variable speed fans be used to provide demand control (on measured CO_2).
- Control of ventilation to the stage to be separate to the auditorium (to allow auditorium system to be 'off' when only stage is in use e.g. set up or rehearsal).
- Supply to the stage is considerably less than extract (to support smoke ventilation systems).

Considering this guidance and the Regulatory requirements the ventilation has been designed to achieve the following which will be considered to be the brief;

- Main entrance lobby: No mechanical ventilation (ventilate via door opening).
- Main foyer including bars: 10l/s person, including bar staff.
- Auditorium standing: **target 10l/s** audience member (see section 11.2&3).
- Auditorium balcony seating: **target 10l/s** seat, consider increasing to 11l/sp.
- Changing/Dressing rooms: 10l/s person or balance of WC/shower rates (if sanitary accommodation is included).
- First floor bar: 10l/s visitor (public) + 16l/s bar staff.
- Bar stores (behind staffed bars): 6ACh (consider arranging extract to use bar's ventilation system, drawing air across bar and out through store).
- WCs: Target 6ACh and ensure the minimum Part F rates are exceeded*.
- Circulation to sanitary accommodation: 10-20% of WC supply air to be provided into surrounding circulation and drawn into the WCs.
- General storage spaces and cupboards: No mechanical ventilation (assumed no COSHH requirements, Council to confirm).
- Piano store: No ventilation or climate control (as existing).
- WC stores/Cleaners cupboards: Consider as a WC.
- Staircases: No mechanical ventilation (use windows if present).

*Reduce down from 6Ach only where existing building constraints dictate this e.g. locating the ventilation plant, routing the ductwork or the size of the external louvres. This is most likely to be the case in the larger sanitary accommodation (>2WHBs) or for larger footprint AWCs.

Exceptions are specifically stated and explained within the below report sections.

The areas highlighted as 'target 10l/s' may not achieve the minimum provisions required by the Building Regulations. If this is to be the case then the limitations imposed by the historic building will need to be used to justify this to Building Control. Pre 'flushing' of these spaces can also be modelled which may demonstrate compliance (as capacity use is only for a relatively short duration).

A catering specialist shall advice on the hood requirement for the second floor kitchen. This will define the related plant and system sizes.

Electrical Services
A detailed brief is required for the electrical services. In part this will come from the theatre consultant and fire engineer and be expanded by the centre manager and technical manager.

From discussions with the technical team we understand that the current power available, particularly to the auditorium, is adequate for their events/visitors. As such the brief will be to replicate this. Whether additional capacity is required to the building will be dictated by the increase in provision relating to the ventilation and electric water heating plant and the addition of cooling plant, potentially also the heating air source heat pumps.

Council briefing is required for the following electrical systems;

- DDA strategy requirements (WC alarms, hard of hearing loops).
- AV (via theatre consultant)
- CCTV
- Access control.
- Security detection/alarm.
- Lightning protection (it appears the current building does not have this, is it required?).
- Telecomms/phone requirements.
- Data/Wi-Fi requirements.

The theatre consultant shall specify any required AV, show relay and PA systems and confirm any MPE requirements (power etc.).

Public Health Services
<u>Rainwater</u>
The existing architectural rainwater strategy is to be retained (roof pitches, falls, gutters/channels, downpipe locations etc.). Downpipe sizes will be verified against current BS EN12056-3. Future climate allowances will be considered. All external elements will be specified by the architect. Downpipe sizes and gulley outlet flow rate requirements will be advised to the architect. New roofs (extensions) will be analysed in accordance with this BS EN12056-3 and considered in conjunction with the existing strategy and system that serves the local area.

<u>Cold Water Storage</u>
Current BSRIA BG85/2024 Mechanical Criteria sites CIBSE Guide G : Public health and plumbing engineering (2014 with 2019 amendments), which requires;

- Table 2.9: Recommended cold water storage: Theatres: 3l/person.

<u>Hot Water Storage</u>
Current BSRIA BG85/2024 Mechanical Criteria sites CIPHE Plumbing Engineering Services Design Guide, which requires.

- Table 41: Recommended hot water storage: Theatres: 1l/person.

Using this guidance the hot water storage would be 1720l. To target Net Zero Carbon it is proposed to reduce this and maximise the use of local electric water heaters. Located close to the outlets served this reduces the standing and circulating heat loss and electrical pumping energy attributed with centralised, circulated domestic hot water systems. The proposal which is summarised in section 11.2 below is likely to provide less than half of the storage capacity recommended by the CIPHE guidance, however for comparison it appears similar to that of the existing. The existing provision, estimated from the external cylinder dimensions obtained during our survey, is;

- 3F north plant room estimated 170l cylinder to serve FoH WC WHBs.
- 3F south plant room estimated 2x200l cylinders to serve the BoH accommodation, first floor bar and WHBs in the basement FoH WCs.

There may also be some existing local electric water heaters.

<u>Irrigation Water/External Watering</u>
Should external watering be required, including for cleaning purposes, this is to be confirmed (location and purpose).

11.2 Proposed Plant / Equipment

Refer to schedule J7562-MXF-CE-ZZ-SH-J-30001 for a summary of the proposed plant items, their capacity, specific considerations and the strategies for their initial installation, ongoing maintenance and future replacement. The below section summarises those which have been constrained by the existing building or where the proposal differs to the brief summarised above.

Fire Fighting Services
Currently there is no MEP plant proposed for the purpose of supporting the fire fighting strategy. This relates to the plant highlighted red in the 'additional plant rooms' table at the rear of the plant schedule (appendix 5) e.g. sprinkler plant, smoke extract fans etc. The ancillary supporting electrical systems such as the fire alarm and emergency lighting systems are included under the electrical services sub section.

As noted in section 11.1 the Arup fire strategy report for the Corn Exchange should be referred to with respect to the requirement for the MEP fire-fighting services. Any defined requirements are to be coordinated with the current proposals at commencement of the following design stage.

Mechanical Services

Heating

The Council brief is to target Net Zero Carbon. For this reason it is proposed to decarbonise the Corn Exchange by removing the gas fired heating plant. The drawings and plant schedule identify air source heat pumps (ASHPs). These are to provide low temperature heating to the building. Associated distribution systems and equipment (pressurisation unit, buffer vessels, pumps etc) will be incorporated into the heating system. Fabric enhancements must be provided to reduce the heat losses to levels that the ASHPs can offset in an efficient manner.

Consideration should be given to the programming of this refurbishment project and connection to the Cambridge City Centre Heat Network. Use of the heat network may allow the plant spaces to be reconfigured to enhance the ventilation offering (see below). Refer to section 7 for further details on the heat network.

The removal of gas from the building will also dictate the level 2 kitchen requires an electric cooker (currently gas).

Cooling

Comfort cooling is proposed to the main auditoria, utilising the ventilation systems. This will be an enhancement on the existing provision. The quantity of cooling provided is constrained by the space available to incorporate the ventilation plant that will contain the cooling coils.

Due to the limited space available it is proposed that the air source heat pumps that provide the heating will also provide the cooling. To do so they must switch between heating and cooling modes. The heat pumps are not proposed to provide simultaneous heating and cooling (as is the case for the Guildhall). This is considered suitable as the ventilation systems are providing the cooling and are therefore only envisaged to require chilled water to supplement the cooling when the air temperature is at or above approximately 16°C and an event is in progress. At these external temperatures space heating should not be required within the Corn Exchange.

Dedicated chilled water distribution systems (pressurisation, buffer vessel and pumps) will be provided to circulate the water through the ventilation cooling coils.

Should the district heat network be implemented the ASHPs can be removed. The cooling could then be via refrigerant based systems as oppose to chilled water provided by chillers. For the refrigerant (DX) based systems each AHU cooling coil would have dedicated condensers and refrigerant circuits. The DX solution is likely to require less space and be a lower capital cost. It is less accurate and stable to control which may not be problematic for the high level system but could be for the displacement system.

Ventilation – Auditorium (flat floor)

The existing auditorium ventilation plant is located in the south plant room, connecting into the architectural high level plenum that routes around the perimeter of the auditorium at high level. It serves the entire auditorium including the tiered, mezzanine and balcony seating. Section 2.3 provides further details on this.

To retain the character of the exposed roof and structure and the flexible flat floor open space below, the proposal is to retain the principles of the existing high level ventilation system, modifying some of the components.

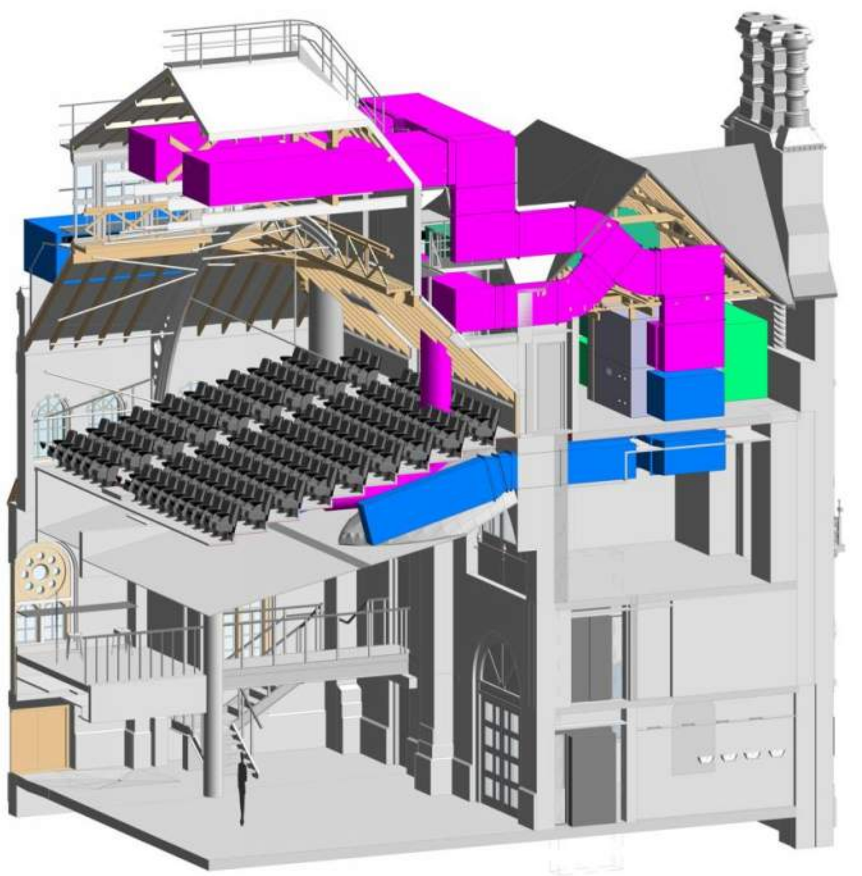
The initial proposal was based on a rate of 16l/s which reflects light activity /dancing and should therefore suit a proportion of more energetic dancing (moderate) and a proportion standing fairly sedentary which is understood to be likely during a concert. This ventilation rate, exceeding the Regulatory minimum, is also better suited to cooling the space. With an audience of 1101 (1089standing +12side balconies, excluding mezzanine) this required two ventilation AHUs, each at 8.8m^3/s.

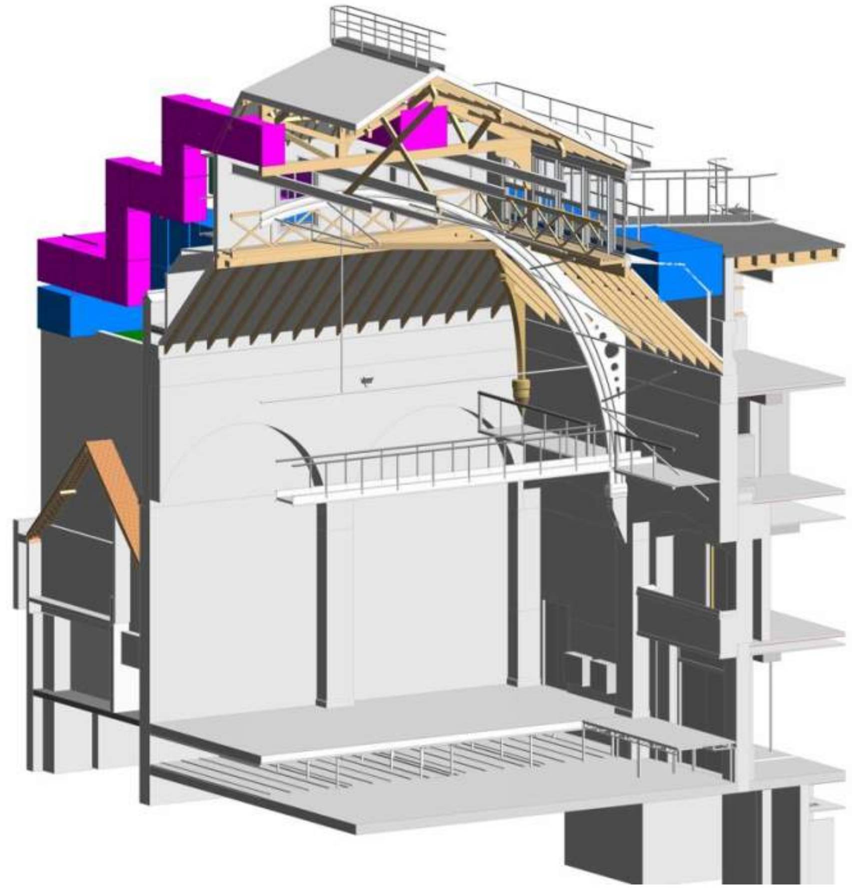
The existing building constraints and those imposed by the neighbouring properties limit the areas that could house this plant. After a number of reviews with the architect, the level 2 back of stage space and external roof area above were allocated for this use. The size and related capacity of these units is then limited by this available space, in conjunction with the associated duct routing. The 3D Revit drawing extract to the right shows this plant area and the duct routes. Subject to detailed calculations and development with manufacturers the AHUs are anticipated to deliver 4.5-5m^3/s of air each, totalling 9-10m^3/s. This will be in the region of 51-56% of the preferred solution. It is anticipated to be more than the existing (estimated to be 7-8m3/s with this also serving the balcony seating, refer to section 2.3,). The proposal may be able to deliver the 9.7m3/s total required to provide 10l/s person to each audience member for a seated event (flat floor, tiered, mezzanine and side balcony seating) and in this scenario would exceed the ABTT recommendation of 8l/s person. It is unlikely to be able to deliver 10l/sp for a capacity standing event (refer to 11.1). Advanced (prior to occupation) use of the ventilation system can 'flush through' the space which would assist the air quality.

As described below, in addition to the above this plant will also be required to serve the stage (performers) and may be required to serve the bleacher seating (though the above figures do consider the related audience members standing and sitting in this area (the standing excludes the mezzanine seating).

Ventilation – Auditorium Stage

As noted in section 11.1 the ABTT guidance recommends a separate ventilation system to serve the stage. This is to avoid operation of the larger auditorium systems during rehearsals and periods of stage set up. The initial design allowed for this, however the spatial constraints have led to its omission. Having 2 ventilation AHUs for the auditorium will allow only one to be operated in this scenario. In addition implementing speed control on the fans will allow each system to operate at low speed (demand control). Separating the balcony seating and not operating this during set ups and rehearsals will also assist with this consideration.





Images of proposed ventilation plant and main duct routes into auditorium.

Ventilation – Auditorium (bleacher seating)
The preferred strategy is to have a dedicated ventilation unit serving this 'zone' within the auditoria. The unit would provide ventilation and temperature control to this seating where the audience members would otherwise likely experience a different environment due to the overhanging balcony (see images to right). Further details are contained within section 11.4. With this seating retracted to support a standing event the ventilation strategy would ideally continue to serve the area, though audience members are more likely to stand further forwards towards the stage.

This ventilation AHU could not be located locally to this zone. The proposal to locate it on a mezzanine in Parsons Court with the ductwork penetrating the facades was felt by the design team to be too obtrusive and impactful on the Parsons Court proposal and aesthetic and heritage of the building. As such the constraints of the existing building have dictated the ventilation plant be located at either end of the building and a dedicated system to serve this seating could not be facilitated. The proposal will therefore either require air to be supplied from the high level auditorium system (possibly as existing, subject to establishing if grilles are present in the rear wall of the mezzanine) or via the balcony seating ventilation system. The latter would be dependent on the routing of ductwork in conjunction with the new balcony floor plenum and would best suit a displacement strategy (due to the supply air temperature). As both ventilation plant sizes are constrained by the space available to house them the capacity taken to serve this 'zone' will reduce the effectiveness of that provided to the 'other' served areas, however overall this reduction would be less than if a dedicated bleacher seating AHU was to be incorporated. If the high level system is to be utilised careful consideration will be required as to how to implement and control what will be a different environment experienced by the audience in these seats. Reheat coils may be a solution. A further challenge will be that the extract locations will not be local and therefore can not serve grilles in the ceiling directly over the bleacher seating.

Ventilation – Auditorium Balcony
The preferred strategy is to have a dedicated ventilation unit serving this fixed seating. A displacement system is proposed, further details are included in section 11.4.

The plant is located in the existing level 3 north plant room. The constraints of this room, particularly the length and space available to route the assocaited ducts will dictate the capacity available. Providing 10l/s seat appears possible but can not be confirmed at this stage. As noted in the schedule it is also anticipated that the inclusion of a cooling coil will dictate the requirement to rebuild/reposition the existing partition wall between the plant room and central battery room.

The final ventilation rate is subject to the required surveys, subsequent design coordination and displacement grille selection. The strategy for supplying the bleacher seating may also affect this.

As described below this unit is also proposed to serve the foyer, though when a performance is in progress it will be dedicated to this audience seating.

Ventilation – Main Foyer and Ancillary Spaces
The preferred provision and original intent was to provide a dedicated foyer ventilation system. The stage 2 proposal prioritises enhancing the current auditorium and therefore the limited plant space available houses the balcony seating ventilation plant and does not permit a dedicated foyer ventilation AHU.

As the foyer occupancy will be transient with the same people moving to and from the auditorium, the proposal is to utilise the ventilation plant serving the balcony seating. For the periods prior to the performance commencing and potentially during the intervals and after show periods, a proportion of the air will be diverted into the foyer. Prior to doors opening the ventilation system will supply the foyer, flushing it through prior to occupancy. It is anticipated the foyer will then maintain suitable air quality once the ventilation system is serving the balcony seating, immediately prior to the show commencing and during the performance. This is on the expectation that the foyer will have a relatively low 'permanent equivalent' occupancy. The control of this ventilation (switching priority between foyer and balcony seating) will require active management.

As the ducting will provide a sound path between the auditorium and foyer it requires careful acoustic consideration and detailing.

Confirmation of the foyer occupancy will allow the proportion of 'diverted' air to be confirmed. Considering the foyer area that will be occupied by the public, the balcony ventilation provision is anticipated to be greater than the likely 'permanent equivalent occupancy' in the foyer.

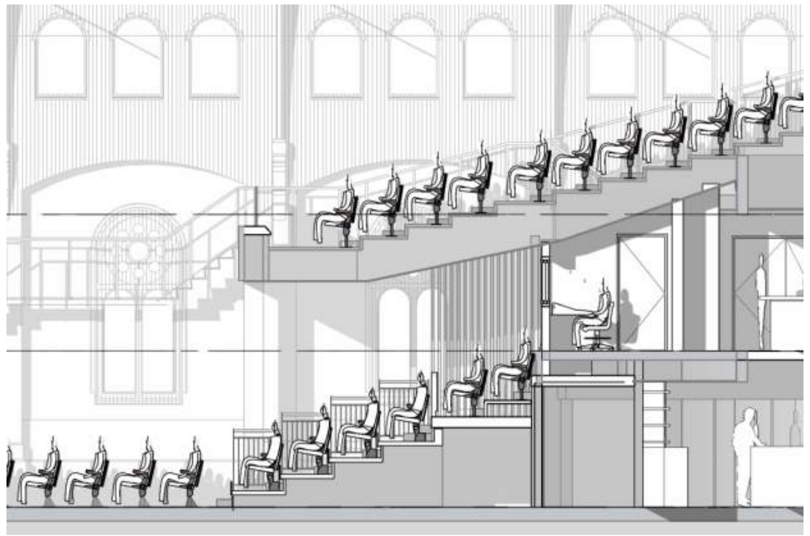
During the 'performance period', the bar MVHR (M9) will supplement this and ensure ventilation of staff. This bar store unit will also ventilate the staff and store when the building is not open for an event, allowing the main AHU to be turned off.

Mechanical Ventilation with Heat Recovery (MVHR) unit M9 serves the foyer WCs. The initially proposed ground floor male WC is identified on the latest architectural proposals as a 'Overflow Store/Bar Store'. Depending on its contents/use, particularly considering moisture and odours, this room is likely to benefit from having a dedicated MVHR system. This should be reviewed with the subsequent developing design, once the room use/content is confirmed.

Electrical Services

Photovoltaics
The schedule and drawings identify photovoltaic (PV) panels to be installed on the upper pitched roof (east and west facing pitches). The size and capacity of these, along with the related inverters and electrical equipment is to be confirmed during the following design stage.

Public Health Services
Rainwater.
There is no rainwater storage/recycling proposed. Chapter 6 of this report should be referred to regarding water neutrality and local planning policy. As the Corn Exchange is an existing listed building with limited internal space and constrained surrounding areas, locating the recycling plant would severely impact on the building and its viability. It is therefore not proposed to provide rainwater recycling.



Bleacher seating with balcony overhanging above.

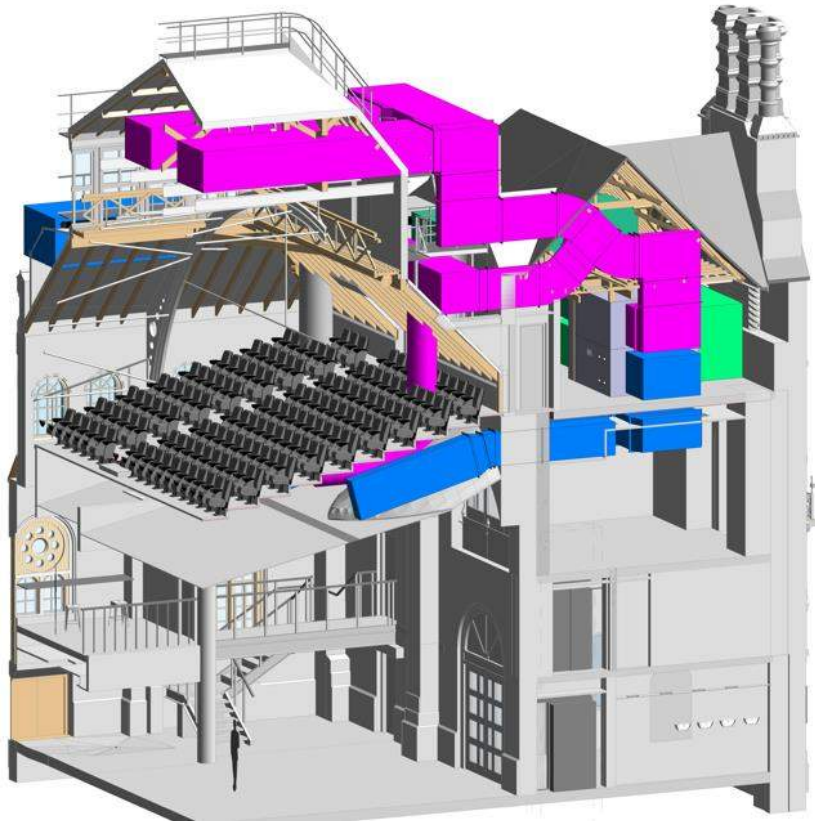


Image of proposed ventilation plant and amin duct routes into auditorium.

Irrigation Water/External Watering
As noted in section 11.1, should external watering be required, including for cleaning purposes, this is to be confirmed (location and purpose). Local cat 5 booster sets will be required to serve these outlets. Space will be required to locate these (not currently on drawings).

Domestic hot water
As described in section 11.1 to target Net Zero Carbon the proposal is to use local electric water heaters. Those serving front of house WHBs will see high demand for short periods and will therefore benefit from having some storage. The proposal is to provide;

- Dressing/changing room WHBs: Local electric water heaters: 5l/WHB.
- Dressing room shower: **To be electric shower,** specified by architect**.**
- Individual WC WHB (FOH): 7l.
- Individual WC WHB (BOH): 5l.
- Basement FoH WCs: 145l for 9No. WHBs
- GF&1F FWC + GF AWC: 170l for 12No. WHBs
- Mezzanine Bar: Layout TBC. Estimated 1x10l/sink.
- Level 1/Mezz bar Male WC: 70l total for 4No. WHBs.
- Level 1 Bar: Layout TBC. Estimated 1x7l/sink.
- Level 1 BoH Common Rm: Layout TBC. Estimated 1x7l.
- Level 2 BoH Unisex WC WHBs: Layout TBC. Estimated 2x10l.
- Level 2 BoH showers: **To be electric showers,** specified by architect**.**
- Level 2 BoH kitchen: Layout TBC. Estimated 1x30l.
- Level 2 BOH laundry: Layout TBC. Estimated 1x30l/sink. Washing machines to be cold water feed only.

The cylinder serving the FoH FWCs is currently proposed to be in the second floor plant room. It would be preferable for this to be in the first floor cupboard directly off the 1F FWC, however it is anticipated that a riser may be at the rear of this existing cupboard and therefore locating the cylinder here would prevent access to it. This will be reviewed with the stag 3 surveys.

11.3 Distribution Strategies

Risers
The existing risers are not clear from the third party survey and subsequently provided Revit model. Our own visual surveys have identified a number of potential routes and established how we anticipate the main ducts route to the auditorium and foyer. As such new risers have not been proposed and general MEP distribution will look to use the existing risers. Equipment such as the switchgear and central battery is proposed to be located in the current locations to facilitate this. Similarly for WC ventilation plant etc.

This requires surveys and development to finalise a coordinated stage 2 design.

The main ductwork routes for the auditorium, balcony seating and foyer are shown on the drawings.

Horizontal Distribution
The main horizontal ductwork routes for the auditorium, balcony seating and foyer are shown on the drawings.

To connect the front and rear of the building, without passing through the auditorium there will need to be a reprovision of the horizontal route across the west side of the auditorium roof (outside of plenum). This is currently used for heating pipework and power cabling, possibly also domestic cold water (unless there are two incoming mains). This route will become larger to incorporate the boosted cold water and chilled water.

All external water filled pipework is to be trace heated.

Structurally Significant MEP Builderswork
The buildserwork associated with the auditorium and foyer/balcony duct routes is significant in size and will require acoustically sealing.

Other significant builderswork will be developed in conjunction with the horizontal and vertical distribution strategies. Prior to progressing this, detailed surveys of the existing MEP routes are required to look to maximise reuse of existing builderswork.

11.4 General MEP Strategies & Provisions

The below provides further details and descriptions to the plant and equipment proposals detailed in section 11.2 and on the plant schedule J7562-MXF-CE-ZZ-SH-J-30001.

Rainwater.
Refer to section 11.1 (brief) for the approach and strategy. It is anticipated that a new rainwater system is to be installed. External rainwater goods are to be specified by the architect. Any internal rainwater pipes will be specified and coordinated for the MEP subcontractor to install. All internal rainwater downpipes will be insulated. Acoustic insulation shall be used when passing through a noise sensitive space.

There is no rainwater storage/recycling proposed. Chapter 6 of this report should be referred to regarding water neutrality and local planning policy. As the Corn Exchange is an existing listed building with limited internal space and constrained surrounding areas, locating the recycling plant would severely impact on the building and its viability. It is therefore not proposed to provide any rainwater recycling.

Domestic hot and cold water
New installations throughout, served from the plant/equipment referred to in section 11.2.

Heating
From the ASHPs and associated distribution equipment a new heating pipework and valving system shall be distributed around the building to feed new emitters within the spaces and the new coils in the ventilation plant.

Achieving significant thermal improvements (insulation and air tightness) is critical to ensuring the low temperature ASHPs can operate efficiently and provide the required heating.

Heating of the auditorium is challenging due to the exposed aesthetic nature of the space. The existing strategy of using the high level ventilation system is problematic and likely to be very energy intensive (operational carbon and cost). Section 2.3 provides further details on this. High level stratification fans, possibly with integral heating coils, mixing the air and discharging the warm air back down would likely improve the current situation. These would be quite 'obtrusive' within the space and take away the exposed aesthetic of the roof and high level structure. As such the proposal, as well as improving the performance of the building fabric, is to decouple the heating from the ventilation system. A method if integrating heat emitters at low level within the auditorium is to be developed with the architect. It is likely that this will need to be above head height to prevent audience standing or leaning on them during a performance (although they can be switched off when a performance is in progress). Fan convectors discharging the heat down should be considered. The fans could only be operated when a performance is not in progress and acoustics is not as critical. It is understood that the aesthetic of the exposed brick is critical and the heating strategy must be sympathetic to this, however it is also critical to address the current situation of high operating costs and either a cold auditorium or a warm one that has overheating seats at the upper level of the balcony.

Fan coil units shall provide heating to the entrance lobby (as existing), foyer (ceiling and under window integrated) and first floor bar.

Radiators are envisaged to be suitable for all back of house spaces. Fan convectors can be considered if space is limited and higher outputs are required. The FoH WCs and associated circulation space could also utilise radiators (subject to available wall space).

Air curtains shall be provided over the get in and stage delivery access doors (doorways left open for periods during deliveries/set up etc.).

Where the pipework is not providing a useful heat source to the room, high levels of pipework insulation shall be provided.

Cooling
Chilled Water
From the ASHPs and associated distribution equipment a new chilled water pipework and valving system shall be distributed to serve the cooling coils within the auditorium and balcony seating AHUs.

DX Systems
The scheduled DX (refrigerant) systems will require room fan coil units with insulated refrigerant pipework installed between them and the external condenser units. Each installation will be a dedicated packaged system with associated controls and wiring.

Trace Heating
All external water filled pipework is to be trace heated.

Ventilation
Auditorium (flat floor)
As described in 11.2 the auditorium flat floor area will be ventilated by a reprovision of the existing high level supply plenum. The reprovision will look to increase the cross sectional area of this, will integrate new diffusers or nozzles to project the air down into the occupied space and provide an enhanced insulation performance on the external side.

The extract will be at high level at the south end of the auditorium. Coordination with the stage and associated gantry's and lighting grids will be progressed during the following developed design stages.

To supply the bleacher seating, the plenum may require routing down to the underside of the balcony seating (see below)

Auditorium (bleacher seating)
To maintain the seating capacity the architectural proposal is for bleacher seating to replace that which is currently provided by the tiered and mezzanine seating. As shown by the image to the right this is located directly underneath the overhanging balcony. This arrangement restricts the existing high level supply air from reaching these audience members and creates a ceiling where the hot air from the occupants will gather. During our site survey we did identify what may be some high level grilles on the rear wall, behind the mezzanine seating. If these are active ventilation grilles they would assist with either driving (if supply) or drawing (if extract) air across this area. This is likely to reduce the 'overheating' effect that these audience members are otherwise likely to experience.

To resolve this the preferred strategy is to have a dedicated ventilation unit supplying the area. This could either be a displacement or high level system. The displacement system would supply air into the bleacher arrangement and if possible into a plenum formed under the mezzanine floor. The high level alternative would utilise ducted supply grilles located within the ceiling.. Both strategies would utilise ducted extract grilles within the ceiling and at the rear of the mezzanine. The ducting and grilles in the ceiling over are likely to introduce significant complexities into the sealed floor plenum that is serving the balcony seating above (see below). The displacement strategy would require careful selection and part sealing of the bleacher seating and also sealing of the mezzanine floor with permanent sealed duct routes coordinated into both. With the bleacher seating being retractable this would be challenging, with the duct routing likely to impact on the mezzanine layout and foyer bars/bar stores.

To develop the design it is critical to establish the existing build ups and routes available via the foyer and ceiling, whether there are grilles in the rear mezzanine wall and if there are, the related air flow rates and how the associated ducts route to these grilles.

We anticipate that the effectiveness of the ventilation and temperature control to these areas/occupants will be constrained. At this stage we can not provide assurances on the outcome.

Auditorium Balcony
The proposal is to have dedicated ventilation plant serving the balcony seating. An under seat displacement ventilation strategy coupled with high level extract is proposed. With this established strategy the air warms as it naturally rises around the seated audience member. With its increasing buoyancy, the air continues to stratify as it rises passed the lighting zone to the high level extract grilles. The images to the right show a typical temperature profile for this type of application, with the warm air at the high level outside of the occupied zone and comfortable temperatures around the seated occupant. Displacement systems operate at a higher supply temperature (typically 19°C) which, as highlighted in the ABTT guidance for ventilation, allows the ventilation system to run in the evening without mechanical cooling for a large proportion of the year. The warmer high level extract temperatures also offer improved heat recovery during winter periods.

This proposal changes the current high level supply air strategy and coupled with a change to the heating strategy (no longer using the high level ventilation system) should resolve the current 'overheating' effect that is understood to be experienced by those seated in the upper level (rear) of the balcony.

The strategy is reliant on a sealed plenum being formed under the seating, with the air distributed into it. The floor grilles should be the only air path for the air to leave the plenum. The current foyer ceiling appears to provide this, however this is subject to completing some invasive investigations to confirm the build up and detail between the balcony seating and foyer ceiling.

WCs/Sanitary Accommodation
Each system shall be provided with associated controls, ductwork, grilles and ancillaries. These are to be controlled to only operate when the spaces are in use, with an overrun period afterwards.

Kitchen Ventilation
Related ductwork and ancillaries shall be provided from the extract canopy through the roof to the extract fan. It is anticipated that fire rated ductwork is not required as it does not route into another fire compartment (straight from kitchen to roof).

The supply air ductwork system shall route from the roof AHU plant to new grilles in the kitchen ceiling.

Associated controls shall interlock the supply and extract systems. The fan shall be operated from a chef's speed control switch within the room. A CO_2 sensor/visual alarm shall highlight if it should be operated during times when cooking may not be in progress.

Mechanical Ventilation of Miscellaneous Spaces (dressing rooms, office etc.)
Each system shall be provided with associated controls, ductwork, grilles and ancillaries. These are to be controlled to only operate when the spaces are in use.

Power
Refer to section 11.1 regarding the overall capacity and incoming supply.

From the new LV switchgear sub main distribution will supply local equipment, distribution boards, MCPs and plant. Indicative local distribution board locations are shown on the drawings. Final circuits will be routed from these local boards.

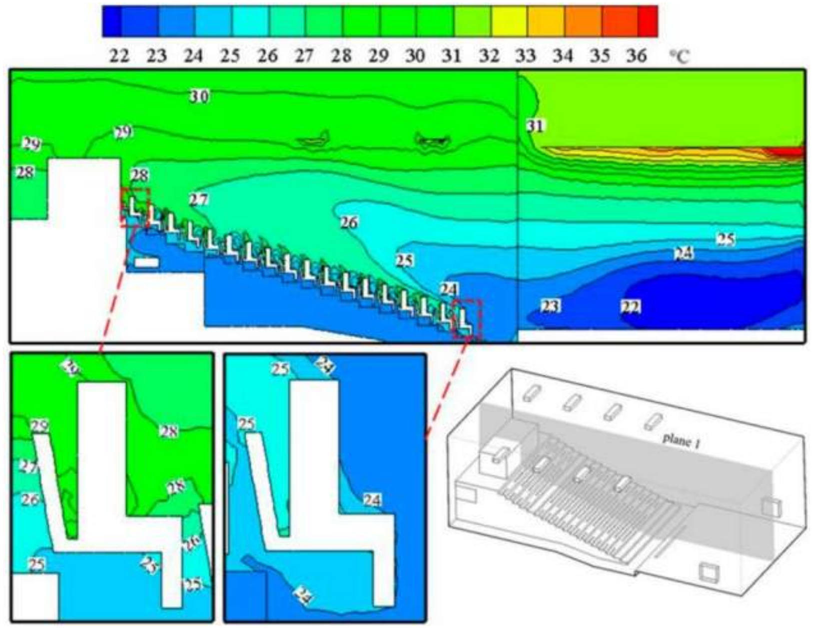
Where suitable for an MEP contractor to install e.g. cat 6 cabling and standard power provisions, power and data shall be provided to serve the systems specified by the theatre consultant. This may include AV, show relay, sound and PA systems.

Lighting
New LED lighting will be provided throughout.

Emergency lighting and emergency escape lighting will be wired in fire rated cabling from the central battery systems.

New external lighting to the front of the building and Parsons Court shall be provided. This is to be discussed at the following design stage.

An architectural lighting designer is to be appointed to advise on all front of house and external lighting.



Typical temperature distribution assocaited with a seating displacement ventilation strategy.


Typical in floor displacement ventilation terminals in auditoria

Miscellaneous Electrical Services
As noted under briefing the requirements for the following are to be confirmed.

- CCTV.
- Access control.
- Security detection/alarm.
- Telecomms.
- Data/Wi-Fi requirements.

Electrical Systems to Support Buildings DDA Strategy
The brief/requirement for these is to be confirmed. At a minimum this should include;

- WC alarms for all AWCs, cabled back to a central management position.
- Hard of hearing loops at bars and public management/information positions.

Fire Detection and Alarm
A new British Standard compliant installation will be provided, interfacing with all other systems in accordance with the requirements of the fire strategy.

Lightning Protection
As noted in section 11.1 the existing building does not appear to have a lightning protection system. Should one be required it will consist of new external tapes and earth pits. This may not be acceptable considering the historic nature and listing of the building.

Building Management and Metering System
A new centralised building management system shall be provided, integrated with new energy metering to record and allocate the energy usage of the building in accordance with Part L of the building REgualtions. The system shall be remotely accessible over the world wide web, allowing access to staff in Parsons Court and the Guildhall as well as more remotely. Local displays will be provided on the control panels within the main plant areas.

MAX FORDHAM

12.0 THE PROPOSED MARKET

Briefing for the Market to be developed as part of the next stage in design. Current proposals outlined in this section shall act as the brief in the meantime.

12.1 Specific Design Brief/Criteria

The following documentation has been provided to form the 'brief':

- CCQ-CPA-PR-B1-DR-A-2001 – Market Square Proposed Basement Level drawing by Cartwright Pickard, dated 11th October 2024.
- Cambridge Civic Quarter Stage 2 Report Draft by LDA Design, dated September 2024.

They outline the Architect's intention for the basement areas of the market and the Landscape Architect's intentions for the landscape design.

Fire Fighting Services
No strategy outlined from qualified fire engineer for the Market. Confirmation of strategy should follow in the next design stage.

It is expected that if a significantly larger basement is taken forward, smoke extract fans and commercial sprinkler tanks will be required.

Low and Zero Carbon Technologies
Solar Photovoltaics
Solar photovoltaic panels (PV) convert solar radiation into electricity, providing a carbon free source of electricity for use in the building. They are a low impact technology which provides CO_2 savings for a relatively low capital cost. Solar PVs are also a relatively simple technology to install, with little ongoing maintenance involved.

Mechanical Design Conditions
The proposed ventilation design criteria for the Market basement WCs is 6 l/s per cubicle. It is understood the basement and stalls above ground will be unheated, so no temperature conditions provided.

12.2 Proposed Plant / Equipment

Mechanical Services
Mechanical Ventilation
Local extract fan serving the WCs, ducted to sufficiently high point above ground.

Public Health Services
Sanitaryware
Low flow fittings to target 'water neutrality' from reduced usage alone. Refer to Table 6.1 in section 6 for proposed flow rates.

Rainwater Drainage
Expected no internal rainwater pipes required, with all drainage to be surface run off.

Foul Drainage Above Ground
A complete above ground drainage installation is to be provided to convey wastewater from all sanitary and other devices within the basement and connected to the below ground drainage points (see structural engineer's information).

Store and WC areas are to be provided with floor gullies for wash-down.

In-slab drainage in the basement (mainly in the form of gullies), where required, will form part of the structural and architectural packages.

Cold Water Systems
Incoming, metered mains supply to branch out to dedicated packaged duty/standby Cat5 variable speed booster sets/break tanks that will serve to provide 'protected water' to WC basins and any external water taps and irrigation points around the Market.

Domestic Hot Water
Domestic hot water for the WC basins will be generated by efficient, unventilated local electric hot water heaters. The length of pipework is to be minimised.

Rainwater and Greywater Systems
Potential to store rainwater for irrigation.

Electrical Services
Electrical Generation Plant – PV
Optimising the roof that covers the stalls for PVs (south pitch) and daylight (north facing) without having direct solar gain radiating onto stalls below, is to be worked through at the next design stage of the project.

High Voltage Distribution
No known existing or proposed requirements for the Market.

Low Voltage Distribution
New, metered three-phase incoming supply to serve new electrical panel board. Panel board to be sufficiently IP rated and proposed location is in the basement.

Below ground distribution via steel-wire-armoured cables to provide individual power connections for the fixed stalls to replicate current arrangement, plus power to general power and lighting in the basement, and ancillary equipment serving the Market, such as the proposed underground bins on a hydraulic lift.

Earthing and Bonding
The existing earth electrode installation needs to be surveyed. A low-impedance path to earth for all systems will be required.

All DBs and PBs are to be provided with type 2 & 3 combined surge protection at their incoming devices.

General Lighting
The basement shall have LED artificial lighting installed throughout. Fittings to be IP65 and IK08.

Switch plates, scene setting panels, fittings, all cabling and other infrastructure associated with the lighting installation and controls is to be provided.

Lighting Controls
A combination of presence detection and manual on/off switching will be provided in the basement.

Emergency Lighting
The emergency lighting will be designed following all CIBSE, ILP, CIE and British Standards, to provide a safe, functional, energy efficient, high-quality installation.

Emergency lighting to be provided via distributed, self-contained 3hr duration fittings, either maintained or non-maintained according to type and location. Fittings are to have centralised testing. Light levels to be selected in accordance with anticipated testing regime, and in accordance with BS 5266.

Telecommunications and Data
No known existing or proposed requirements for the Market.

Accessibility Systems
No known existing or proposed requirements for the Market.

Access Control
No known existing or proposed requirements for the Market.

CCTV
No known existing or proposed requirements for the Market. Assumed existing cameras in area are not within scope of project.

Security Detection and Alarm
No known existing or proposed requirements for the Market.

Fire Detection and Alarm
The fire detection system will be designed in accordance with the Building Regulations, the relevant British Standards, and the requirements of the overall fire strategy.

Lighting Protection
No known existing or proposed requirements for the Market.

Leak Detection
Propose leak detection for the basement. A packaged system linked to close a solenoid isolation valve on the incoming water supply.

Trace Heating
All above ground water filled pipework is to be trace heated, as no internal heated spaces proposed.

Building Management
No known existing or proposed requirements for the Market.

12.3 Distribution Strategies

Minimising the length of water distribution routes and dead legs should be a key aim in preventing water stagnation.

New below ground duct routes from incoming utility connections and distributing to stalls, hydraulic bin lift and possible water outlet locations.

12.4 General MEP Strategies & Provisions

Metering Strategy
Utility meters on all incoming mains water and electrical supplies.

Supplies to all stalls, the basement and significant pieces of equipment, such as the hydraulic bin lift, are to be metered. All meters to be MID approved that are to be used for billing purposes.

Potential to provide a meter monitoring system so all meters could then be monitored and logged in a central location. This shall be discussed and agreed during the following design stage (RIBA stage 3).

13.0 VERTICAL TRANSPORTATION

The below summarises our advice for the projects vertical transportation. The final proposals may be constrained by the existing building. The detailed design and coordination will be developed by the design team during RIBA stage 3.

Brief
There is no brief or guidance for the vertical transportation (VT). The stage 2 analysis and recommendations are based on the related occupancy (population) and achieving a suitable VT performance in accordance with industry guidance. Any Council requirements with reference to car size, stair use, DDA provisions/ strategy, movement of goods (goods lift) and their fire risk assessment should be confirmed to ensure the proposed lift provision meets these requirements.

For all analysis and recommendations it should be noted that in the event of a lift being out of operation, the service provided by the reduced provision will not meet the target performance criteria and will likely result in a 'poor' or 'unsatisfactory' lift service.

It is understood that the building is not currently seeking BREEAM accreditation so the lift provision has not been assessed to consider the BREEAM analysis for the energy performance of alternative lift systems.

DDA Guidance
All passenger lifts are to be DDA compliant, meet the requirements of the Equality Act 2010 and BS EN 81-70:2018. To accommodate a manual wheelchair with an accompanying person the smallest suitable car size is provided by a 630 kg lift (Type 2 car) with internal clear dimensions of 1100 mm wide and 1400 mm deep. It should be noted that with this minimum car size, passengers with wheelchairs or walking aids are unlikely to be able to turn around and would have to leave the car backwards. A 1000kg, 13 person lift with internal width of 1600mm and depth of 1400mm should allow these users to turn and leave the lift car moving forwards.

Evacuation Lifts
BS 9999 defines an evacuation lift as a lift used as part of the evacuation sequence for persons with disability and persons requiring assistance, which has appropriate structural, electrical and fire protection and is capable of being taken under control by trained authorized person.

An evacuation lift, where provided, should always be available for evacuation purposes. Wherever practicable it should be a lift used routinely as a passenger lift and not one used solely for evacuation or occasionally as a lift for transporting goods.

Commercial and Public buildings with high occupancy, complex layouts, or where occupants may have limited mobility benefit hugely from evacuation lifts so their provision should be considered by the Council in conjunction with their fire risk assessment.

Standard Lift and Lift Shaft Sizes
For planning purposes the below table summarises lift shaft sizes that can accommodate the stated lift car size using a number of manufacturers. All widths and depths are clear internal dimensions in mm and shall be provided 'as built', therefore the design shall allow for suitable tolerances etc.

Lift Car Size			Lift Shaft Size	
Person/load	**Width**	**Depth**	**Width**	**Depth**
8p/630kg	1100	1400	1650	1860
10p/800kg	1350	1400	2025	1850
13p/1000kg	1100	2100	1750	2500
13p/1000kg	1600	1400	2175	1760
15p*/1150kg	1200	2100	1950	2385
15p*/1150kg	1600	1550	2145	1835
17p/1275kg	1200	2300	2065	2700
17p/1275kg	2000	1400	2700	2025
21p/1600kg	1400	2400	2450	2800
21p/1600kg	2100	1600	2780	2175

*Fewer manufacturers offer a 'standard' 15person lift solution.

Lift Overrun and Lift Pit depth
To ensure that the lifts can operate and be maintained safely, the shafts lift pit and 'over run' (headroom) shall meet the requirements of BS EN81-20 and BS EN81-50. These requirements are dependent on shaft and lift sizes, shaft access, balustrade heights, lift speed and car (ceiling) height.

The lift overrun is measured from the finished floor level of the highest served floor, to the underside of the lifting eye fixed into the underside of the shaft's soffit. A distance of **3800-4650mm** should be allowed for. This will be refined as the design progresses into the detailed design stage.

The lift pit depth is measured from the finished floor level of the lowest served floor, to the inside base of the lift shaft. A distance of **1350mm-2000mm** should be allowed for. This requirement will be refined as the design progresses into the detailed design stage.

13.1 The Guildhall – Hotel Option

Existing Provision
The existing Guildhall has the following lifts;

- East side 10-person, 800 kg passenger lift. Located in the east lightwell in close proximity to the Guildhall Street entrance. The lift opens onto the east circulation corridor, serving from basement level up to the fourth floor. The shaft appears to be 1200(w) x 1300(d). The shaft dimensions will be confirmed upon receipt of the measured survey (Revit survey).
- West side 10-person, 800 kg passenger lift. Located in the west lightwell in close proximity to the Peas Hill entrance. The lift opens onto the west circulation corridor, serving from basement level up to the fourth floor. The shaft appears to be 1100(w) x 1500(d). The shaft dimensions will be confirmed upon receipt of the measured survey (Revit survey).

Representatives of the Facilities Management team confirmed that the lifts were regularly serviced and provided a good service (no regular or frequent breakdowns/problems).

The 'Large Hall' has a platform/scissor lift to transfer 'items' from ground floor up to the hall (floor level at first floor). This appears to provide a platform in the region of 3.5x1.8m. This allows hall furniture or equipment to be stored at ground level and for items to be delivered via the south east entrance (corner of Guildhall and Wheeler Street). It is anticipated that this is a hydraulic lift with the hydraulic motor room at ground floor level.

Though not lifts, there are 3No. dumb waiters that were reported as not being operational. These would have served the first floor 'Small Hall kitchen', providing a route to transfer goods from the ground floor where they are in close proximity to the south east entrance (corner of Guildhall and Wheeler Street).

Fire Strategy
The fire strategy, proposed by the qualified fire engineer confirmed that an evacuation lift is required for both the Council's use and for the hotel use. A single lift is proposed by the west entrance, serving all floors. A strategy for management and control during an evacuation would have to be developed between the Council and hotel operator. It confirms that a firefighting lift is not required.

Basis of Design
Dynamic simulations of the lift design in different configurations and under different traffic conditions were undertaken using Elevate 8, industry standard lift simulation software.

The initial lift analysis was based on Cartwright Phillips Architects drawings 'CCQ Hotel and CCC Option REV 2 25.06.24.'

Whilst there have been updates to these drawings the principles have remained the same and 'served areas' similar enough for the strategic Vertical Transportation advice to remain relevant. Following approval of the stage 2 concept design, upon commencement of the stage 3 detailed design the analysis will be re-tested to ensure the performance requirements are achieved.

The served floor levels were taken from the original record drawings resulting in the following travel distances;

From Floor	To Floor	Distance
Basement	Ground	3200mm.
Ground	First	3962mm.
First	Second	4750mm.
Second	Third	3835mm.
Third	Fourth	3695mm.

Hotel use

Lift performance is to achieve the standard performance requirements as recommended by the Chartered Institute of Building Services Engineers (CIBSE) in their guidance for transportation systems in buildings (Guide D). In terms of the waiting times this requires;

- Average Up Peak Wating Time ≤60seconds at 12% population/5minutes.
- Average Up Peak Total Time to Destination ≤90 seconds at 12% population/5minutes.

This is to be achieved at the most demanding times which are at check-out and check-in. At these times heavy two-way traffic occurs with guests going to and from rooms, restaurants and in and out of the hotel. The model was tested for morning peak traffic using CIBSE profile for a hotel building with an assumed arrival rate of 12% for a hotel and an interval of less than 60 seconds.

The CIBSE guidance states that the average room occupancy is dependent on the type of hotel and provides the following occupancies to determine the likely demand for lift use.

- Business (professional) – 1 guest per room.
- Transit (short term) – 1.5 guests per room.
- Holiday (many days stay) – 2 guests per room.

For this initial modelling we have used 'Holiday use' which felt appropriate for central Cambridge and also provided the most stringent density to analyse. A utilisation factor of 80% was applied to the 2 guests per room occupancy.

Floor	Number of Rooms	Occupancy
Basement	0 rooms.	0 people.
Ground	0 rooms.	0 people.
First	4 rooms.	8 people.
Second	21 rooms.	42 people.
Third	22 rooms.	44 people.
Fourth	14 rooms.	28 people.

Occupancy is prior to utilisation factor being applied (so 100% occupied)

CIBSE recommend that hotel lifts are evaluated with the lift cars loaded to 0.3m² per person (to accommodate luggage) rather than 0.21m² per person when only passengers are considered e.g. for office use.

Recommendations from CIBSE Guide D were used to define constants in the simulation of lift configurations. Observed typical traffic patterns were applied (dispersed arrival rate, reflecting the nature of use of this building).

The current drawings show a cycle changing area and bike store at basement level. This will require the staff or visitors to enter via Peas Hill and use the hotel lifts to access the basement level. The lift car size may be dictated by the size of the bicycle that it is required to be able to transfer.

Office use

Lift performance is to achieve all standard performance requirements as recommended by the British Council of Offices (BCO) guidance 2023 and shall provide a 'good' quality of service as defined by the Chartered Institute of Building Services Engineers (CIBSE), in terms of interval times and waiting times. This requires;

- Average Up Peak Wating Time ≤25 seconds at 12%population/5minutes.
- Average Up Peak Total Time to Destination ≤90 seconds total time period at 12%population/5minutes.
- Average Lunch Time Two-way Waiting Time ≤40 second two-way waiting period at 13%population/5minutes.

The British Council of Offices (BCO) guidance 2019 and Chartered Institute of Building Services Engineers (CIBSE) Guide D, were used to define constants in the simulation of lift configurations. The BCO observed typical traffic patterns were applied (more dispersed arrival rate, reflecting the nature of use of this building). Throughout the analysis, the variables evaluated were a number of lifts, lift capacities, speed of lifts and workplace densities.

It is assumed that the stairs are well-signed and easily accessible. This enables a high allowance for stair usage in the analysis. This should be confirmed by specialist design advice to ensure that a suitable stair factor is applied to the analysis. No stair factor allowance should be included if these criteria are not met.

Stair factors of 50% and 80% have been analysed. A 80% stair factor assumes 80% of the population will use the stairs when travelling one floor; 64% when travelling two floors (80%x80%); 51% when travelling between three floors (80%x80%x805) etc.

For the Council's staff work spaces, including the customer services the identified work stations were used to define the population. Additional seating within meeting rooms and break out spaces was not included (if used, not anticipated to arrive in the peak time).

With no data on usage and arrival patterns for the Democratic Rooms, Meeting Rooms and Assembly Halls it is assumed that when being occupied for large events the majority of attendees will use the stairs to reach the 1st and 2nd floors, with the lift being predominantly available for use by people with mobility impairments.

The Council Lift analysis were therefore run assuming either no use from attendees of the Democratic Rooms, Meeting Room and Assembly Halls and assuming full occupancy of the Large Hall and Large Hall Gallery only. This provides the following populations, on which an 80% utilisation factor was applied.

Floor	CCC Population incl Democratic Rooms etc.	
	Staff Work Spaces only	Work Spaces + Large Hall
Basement	108 people.	108 people.
Ground	49 people.	49 people.
First	32 people.	392 people.
Second	0 people.	45 people.
Third	0 people.	0 people.
Fourth	0 people.	0 people.

The current drawings show a Council cycle store adjacent to the changing facilities at basement level. This will require the staff to enter via the south east entrance off Guildhall St (Wheeler St junction) and use a dedicated cycle lift to access the basement level. For the commercial tenant (office) option the cycle store and changing facilities are provided in a similar location as described for the hotel tenant and will therefore require lift movement from ground floor to basement level.

Proposed Provision – Hotel Use

The performance of the drawn 2No. 8 person, 630kg lifts, travelling at 1m/s is as follows.

Analysis (drawn)	SF	UPWT	UPTTD
100% enter at GF.	0%	11.0	35.7

SF – Stair Factor.
UPWT - Average Up Peak Wating Time (≤60 seconds).
UPTTD - Average Up Peak Total Time to Destination (≤90 seconds).

A stair factor of 0 is applied, reflecting that people will be unfamiliar with the building and considering the use and nature of the user, unlikely to use the stairs.

As summarised earlier in this report section, an 8 person lift is the smallest DDA compliant lift (internal car at 1100x1400mm).

The VT analysis demonstrates that 2No. 8 person lifts will provide a suitable passenger performance. CIBSE recommends that hotel lifts should be at least 1275 kg (17person). This is advised in order to accommodate luggage and provide guests with uncrowded and comfortable travel conditions. This size of lift also caters for large mobility scooters. The requirement to transfer bicycles to and from basement level shall also be considered.

Goods Lift

The benefit of a dedicated Goods lift should also be considered both independently and in conjunction with the size of the passenger lifts and transfer of bicycles. CIBSE recommends that the shape and size of housekeeping trolleys be considered to inform this (to maximise handling capacity).

Refuse (bin) Platform Lift

This is understood to be a shared provision with the Council, refer to the associated details below.

Proposed Provision – Council Staff Workspace, Customer Services, Democratic Rooms, Meeting Rooms and Assembly Halls
The performance of 1No. 13 person lift, travelling at 1m/s is as follows.

Analysis	SF	UPWT	UPTTD	LT2WWT
Staff Work Spaces only	80%	10.2	25.4	9.6
	50%	10.8	27.3	12.6
Staff Work Spaces + Large Hall & Gallery	80%	20.1	39.6	21.9
	50%	33.2	58.5	46.6

SF – Stair Factor.
UPWT - Average Up Peak Wating Time (≤25 seconds).
UPTTD - Average Up Peak Total Time to Destination (≤90 seconds).
LT2WWT - Average Lunch Time Two-way Waiting Time (≤40 seconds).

When considering only the staff work spaces all performance criteria are achieved by some margin. A smaller lift is likely to suitable.

When also considering the large hall and its gallery the performance of the 13person lift is still suitable when applying an 80% stair factor (as people enter at ground floor a significant proportion of the hall users will use the stairs). When applying a 50% stair factor the performance reduces and does not meet the average up peak waiting time or average lunch time two way waiting time performance criteria.

The Council are to consider whether the analysis including occupation of the large hall and this coinciding with the morning arrival and lunchtime use of the Council staff is appropriate and if it is what they feel a suitable stair factor allowance is (to consider type of hall use/user).

The provision of 1No. 13 person, 1150kg lift appears to provide a 'balance' between the use scenarios and stair factor considerations.

Entrance Platform Lifts
New platform lifts are proposed for the main north entrance from Market Square, and the main east entrance from Guildhall Street. They will provide step free access from the street to the ground floor level with through access.

It is understood they are not to be used as part of any evacuation strategies for disabled building occupants. This is to be confirmed by the fire engineer.

Large Hall Platform/Scissor Lift
The existing lift is to be refurbished and retained or replaced with new. During RIBA stage 3 the existing maintenance company shall be requested to provide a condition survey of the lift and all associated mechanisms and components and provide a recommendation report for refurbishment or replacement. Due to it being similar to a stage lift, the theatre consultant shall also be requested to review and comment on this.

Bicycle Lift
A new platform lift is shown on the architectural drawings in close proximity to the south east entrance (corner of Guildhall and Wheeler Street). The new lift is to allow the building users to transfer their bicycles between ground floor and basement level to utilise the basement bicycle store.

The lift shall be of suitable size, strength and robustness to be fit for purpose. To avoid impacting on the first floor layout the lift structure will have to be contained under the existing first floor structure. Similarly to avoid works to the existing basement slab the lift should look to avoid the requirement for a pit/recess. This will be analysed during stage 3, following receipt of the Revit survey models that will contain and provide these structural survey details. The requirements of the fire strategy must also be integrated, ensuring suitable compartmentation is provided between the two served levels and surrounding spaces.

For planning purposes, some provisional cycle lift information is provided below:
- Capacity: 1000 kg
- Platform Size: 2300 x 1200 mm
- External Size: 2610 x 1720 mm
- Pit Depth: 350 mm
- Headroom: 2700 mm
- Door Width: 1000 mm

Dumb Waiters
It is understood that the existing dumb waiters are not operational and that the first floor kitchen has functioned for some time since they were last in use. A catering consultant, or suitable Council catering representative, should advise on whether there is any vertical transportation requirement to support the catering operation. Currently the architectural drawings show the existing dumb waiters. The dumb waiters would not be considered as 'vertical transportation'. Should the catering strategy require them to be reinstated it should also outline the works required to achieve this.

Goods Lift
BCO guidance suggests that a goods lift be provided for buildings with a net internal area (NIA) greater than 10,000m^2 and considered for buildings with an NIA greater than 5,000m^2 NIA.

CIBSE recommend that goods lift has minimum capacity of 1600kg (21 person), but preferably a capacity of 2500Kg.

The Council is to consider the suitability of the passenger lift to move their furniture and associated business equipment. As the design progresses, plant maintenance and replacement strategies will also be considered.

Refuse (bin) Platform Lift
Due to the change in level between the ground floor refuse/bin store and the associated back of house corridor from the hotel and Council spaces a platform lift is required to lower 'bins' down into the storage area. The drawings show 1100litre refuse bins which will dictate the size of the platform (to support the bin + a staff member). The required 'travel' is to be confirmed during stage 3, following receipt of the Revit survey model that will contain and provide these finished floor levels. A recess may be required to house the mechanisms.

13.2 The Guildhall – Office Option

Existing Provision
Refer to 'Hotel Option'.

Basis of Design
Refer to 'Hotel Option'.

The initial lift analysis was based on Cartwright Phillips Architects drawings 'CCQ Commercial and CCC Option REV 2 25.06.24'.

For the commercial tenant (lettable) office space the layout drawings show a desk and seating arrangement that is more dense than that which would be typically analysed (British Council of Offices guidance is for a workplace density of 1 person/10m^2 which at 80% utilisation is an effective density of 1 person/12.5m^2). The analysed drawn population, excluding meeting room and breakout seats, along with a comparison to the BCO guidance is summarised in the table below.

To consider the cycle store and changing area in the basement the VT analysis was completed assuming 10% of the occupants start their passenger lift journey from this accommodation at basement level. For comparison analysis is also provided for 100% of the population entering and starting their journey at ground floor level.

Floor	Drawn Population	BCO Population
Basement	0 people.	0 people.
Ground	54 people.	34 people.
First	0 people.	8 people.
Second	101 people.	71 people.
Third	117 people.	73 people.
Fourth	65 people.	40 people.

Fire Strategy
The fire strategy, proposed by the qualified fire engineer confirms that an evacuation lift is required for both the use of the Council and the commercial tenant. A single lift is proposed by the west entrance, serving all floors. A strategy for management and control during an evacuation would have to be developed between the Council and tenant or tenants. It confirms that a firefighting lift is not required.

Proposed Provision – Commercial Office Tenant
The performance of the drawn 1No. 15 person lift, travelling at 1m/s for the drawn occupancy (seating) is as follows.

Analysis (drawn)	SF	UPWT	UPTTD	LT2WWT
100% Population enter at Ground.	80%	26.6	60.6	34.0
	50%	36.7	71.9	46.7
90% Pop enter at GF/10% Basement.	80%	41.4	83.8	46.1
	50%	61.2	105.5	65.9

Using the BCO guidance for occupancy the performance improves to the following;

Analysis (BCO)	SF	UPWT	UPTTD	LT2WWT
100% Population enter at Ground.	80%	23.1	51.1	24.3
	50%	28.3	58.6	31.5
90% Pop enter at GF/10% Basement.	80%	31.6	67.3	37.0
	50%	40.7	75.8	49.2

Considering this performance to be unsuitable we modelled 2No. 8 person, 630kg lifts, travelling at 1m/s for the drawn occupancy (seating). The performance is as follows.

Analysis (drawn)	SF	UPWT	UPTTD	LT2WWT
100% Population enter at Ground.	80%	11.6	39.2	11.7
	50%	14.0	43.6	13.2
90% Pop enter at GF/10% Basement.	80%	12.1	42.9	16.0
	50%	16.2	50.4	19.6

From a purely lift traffic analysis/performance perspective the recommendation is to provide 2No. 8 person, 630kg lifts. However, our experience is that a number of developers consider a 13 person, 1000kg lifts to be the minimum lift car size that they consider as being suitable for a commercial tenant. We understand that this is a view based on the 'journey experience' that the provision of a car size more suitable for the occasional movement of light goods that may be used within a commercial space. We recommend that this be considered and confirmed as a briefing requirement. The requirement to transfer bicycles to and from basement level shall also be considered.

Goods Lift

BCO guidance suggests that a goods lift be provided for buildings with a net internal area (NIA) greater than 10,000m^2 and considered for buildings with an NIA greater than 5,000m^2 NIA.

CIBSE recommend that goods lift has minimum capacity of 1600kg (21 person), but preferably a capacity of 2500Kg.

The current architectural drawings do not show a goods lift in the building. The Council is to consider the suitability of the passenger lifts for their tenants to move their furniture, associated business equipment and bicycles. As the design progresses plant maintenance and replacement strategies will also be considered.

Refuse (bin) Platform Lift

This is understood to be a shared provision with the Council, refer to the associated details within the Council's demise (hotel option) above.

Proposed Provision – Council Staff Workspace, Customer Services, Democratic Rooms, Meeting Rooms and Assembly Halls

Refer to 'Hotel Option', including passenger, entrance platform, large hall, goods, refuse and bicycle lifts and the dumb waiters.

13.3 The Corn Exchange

Existing Provision

The Corn Exchange currently has two platform lifts, both serving only the ground and first floors. One which would provide passenger access between the two levels is located just inside the 'Stage Get In' and is accessible from the west (stage left) side of the main auditorium, providing movement up to the first floor bar and balconies. The second lift is a back of house lift to transfer deliveries up to the first floor bar and is externally accessible, being located behind the back of house/stage stair. It has been relayed that both are problematic and that the bar lift has not been operable for some time.

Basis of Design

The proposals seek to improve;

- The experience for visitors who experience movement impairments and may require the use of a wheelchair.
- The operational functionality of the venue.

As such there are no specific 'performance parameters' or analysis that inform the proposals. The size, strength and robustness of the lifts are dictated by the functions they are required to provide.

Proposed Provision – Public Front of House

Main Entrance/Foyer

A new platform lift is proposed on the east side of the main entrance lobby. This will provide wheelchair access to the first floor foyer. A through lift is required to allow movement from/to the ground floor lobby via the west side of the lift to/from the first floor via the east side of the lift.

To avoid impacting on second floor layout (staff office/meeting room) the lift structure must be contained under the existing second floor structure. Similarly to avoid works to the existing ground floor slab the lift should look to avoid the requirement for a pit/recess. This will be analysed during stage 3, following receipt of the Revit survey models that will contain and provide these structural survey details.

Any compartmentation requirements of the fire strategy must also be integrated. The proposal will connect the ground floor entrance lobby into the foyer and may therefore compromise any existing compartmentation that exists between these spaces.

New South Entrance

A new platform lift is proposed to replace the existing one. This will allow wheelchair movement between the ground floor new south entrance area and the first floor bar and balconies. on the east side of the main entrance lobby.

To avoid impacting on the second floor WCs, the lift structure must be contained under the existing second floor structure. Similarly to avoid works to the existing ground floor slab the lift should look to avoid the requirement for a pit/recess. This will be analysed during stage 3, following receipt of the Revit survey models that will contain and provide these structural survey details.

The existing stair and existing lift arrangement suggests that at these two levels, these areas are not separate fire compartments. As such the lift structure will not be required to provide compartmentation. This is to be confirmed by the fire engineer.

Proposed Provision – New Crew Lift / Back of House

A new external platform lift is proposed on the west side of the back stage entrance. A through lift is required to allow goods and movement from the accessible ground floor external area to the west of the lift to/from the internal (east) side of the lift to serve the first and second floor levels.

This proposal will compromise the thermal performance and integrity of the building envelope. The architect should detail this to minimise cold bridges and air infiltration. From a thermal consideration it would be preferable for the thermal line to include a new external door to form a boundary between the buildings thermal line and the 'cold' external lift structure. It is acknowledged that this may be detrimental to movement to and from the lift. The architect and Council are to consider this and the surrounding environmental conditions.

Depending on the lift requirement, particularly strength (weight it can lift) the structure may require a pit/recess to the existing external ground floor slab. Any 'pit' drainage requirements or surrounding landscape drainage requirements shall be confirmed by the civil engineer and landscape architect respectively.

Any fire rating/compartmentation requirements of the fire strategy must also be integrated. If required, the suggested external door/thermal line arrangement may assist with providing this, without the requirement for fire rating the lift structure and doors.

Proposed Provision – Theatre Lifting/Driving Equipment

Any proposed stage lifts, orchestra pit lifts, hoists, motorised flying bars or bleacher seating will be specified by the theatre consultant and do not form part of the Vertical Transportation package.

13.4 The Market

Existing Provision

We are not aware of any existing lifting provisions associated with the market.

Basis of Design

Any lifting requirements associated with movement of refuse or market goods would be proposed by the related specialist consultant. This would not form part of the Vertical Transportation package.

Should the 'building' proposals require personal or wheelchair movement between two levels, the basis of design is likely to be as noted in the introduction with respect to DDA guidance (subject to receipt and review of proposals).

Proposed Provision

No vertical transportation for passengers, cyclists or goods is proposed at this stage of the Market's development.

14.0 VALUE ENGINEERING

The below outlines some opportunities to reduce the cost of the proposed scheme. These have not been developed with the design team.

14.1 Guildhall – Hotel Option

Shared Plant
Consider centralising/sharing MEP plant and systems throughout building and sub metering the hotel's MEP services. This could be considered for;

- Cold water storage tank and associated distribution (booster set and some common pipework).
- 4-Pipe Air Source Heat Pumps (4P-ASHPs) and associated storage, pressurisation and distribution.*
- Electrical Utility metering/supply arrangement (hotel to be considered as sub metered supply from the Council).
- Electrical switchgear (main switchgear, including sub metering).

*also see below regarding the District Heating Interface Plant (substation).

To support the energy and Net Zero Carbon strategy the hotel would still utilise dedicated centralised domestic hot water plant/systems.

The detriment of this is that the hotel operator will be reliant on the Council for the operation and maintenance of the centralised plant/systems. Marick Real Estate, as the project cost consultant and business advisor, has highlighted that the preference of the hoteliers is to have their own plant and systems so that they can be responsible for their operation and maintenance. Their view is that not having so will make the offer less attractive as it induces a risk to their business continuity that they are not in direct control of.

Should the intention be that the hotel designs, selects and installs its own plant/systems then adopting a 'shared plant strategy' would increase the project's construction cost. This may though be seen as an attraction to a prospective hotel operator as it would mean a reduced upfront programme and cost for them.

<u>DEN Interface Plant Room</u>
As described in section 7 of the report, the CCCHN operator may insist on a single, shared interface plant room (substation) for the Guildhall. If so then in isolation this should be cheaper, however as noted earlier in the report, <u>**IF**</u> the hotel and Council's heating systems are to be separate then this will require additional down-stream heating plant and distribution equipment that is likely to offset the initial saving. If the heating systems within the building are to be common/shared then the additional down-stream installation would not be required and it would be logical to also have a shared DEN interface plant room, achieving the space and cost saving.

Shared Back of House Facilities
Consider centralising and sharing the following back of house facilities, including the related MEP plant and systems;

- Bike storage, changing rooms and associated bike lifts.

This would require careful consideration in relation to security and access control (to and from the shared spaces). It is anticipated that the MEP services would be from the Council's systems and would not be sub metered/charged to the hotel tenant. The offering would form part of the overall lease agreement, including operating costs for energy and maintenance.

Water Reuse Plant
As described in section 6 of the report, Cambridge Council's ambition is to minimise water usage. Both rainwater harvesting and greywater recycling have been proposed, with two plant rooms containing both systems in the basement.

Given the size of the Guildhall and its existing restrictions for routing services, it will likely be difficult to drain all roof areas and basins into one plant location.

Consideration could be given to consolidating plant area and equipment, at the cost of reduced capture to be reused. Consideration can also be given to only pursuing either of rainwater harvesting or greywater recycling. The removal of both systems may be possible with the building still achieving 'water neutrality' from reduced usage measures alone.

PV Battery Storage
Consider removing the dedicated plant room for batteries storing excess electrical energy produced by the PVs. The detriment of this is it removes the ability to store energy when the grid pricing is low to be used instead in peak times. Also a loss in potential letting space for a commercial battery storage company. In times of excess PV electricity production, the surplus energy could be returned to the grid with or without the battery storage.

Passenger Lift
Consider removal of one lift from the proposed two serving the main west entrance from Peas Hill and all floors. It would be to the detriment of traffic performance.

Consultation with the fire consultant would be required to determine viability when considering fire and evacuation strategies.

14.2 The Guildhall – Office Option

Shared Plant
The potential Value Engineering options are as described above for the hotel option.

In addition there should also be an opportunity to rationalise and share some of the associated mechanical ventilation systems. This will be dictated by 'zoning' internal spaces in relation to vertical risers and positioning related roof AHUs accordingly. To achieve a saving the number of AHUs would require reducing. As well as the saving in plant this also reduces the related attenuators, pipework connections, valves, power supplies and automatic controls. This becomes less beneficial if areas served have different occupancy times.

The office tenant would utilise distributed/local domestic electric hot water heating and therefore though different to the hotel arrangement, would still not offer the opportunity to centralise and share the domestic hot water systems.

Shared Back of House Facilities
As described above for the hotel option.

Water Reuse Plant
As described above for the hotel option.

PV Battery Storage
As described above for the hotel option.

Passenger Lift
As described above for the hotel option.

14.3 The Corn Exchange

Due to the constraints of the building, to an extent a Value Engineering exercise has already been implemented into the proposals for the Corn Exchange.

Section 7 of this report describes the potential benefit of delaying the project until the district heating network is available and utilising this and DX cooling systems as opposed to heat pumps. Though this requires working through, this should provide a cost saving. DX cooling is 'less stable' to control, typically resulting in a greater variance in supply air temperatures. For the Auditorium this should not be detrimental to the extent that it causes complaints from the audience.

14.4 The Market

The MEP provisions to the market area are relatively minimal, to support the operation of the market traders. As such there is unlikely to be an opportunity to Value Engineer the proposals. The provisions to the external performance space can be considered but would reduce the flexibility of the space/its use and therefore maybe its commercial value.

During the next design stage, the development of the roof canopy over the stalls will impact the extent and ability to install PVs. The quantity and method of installation of PVs, in addition to the energy storage infrastructure could be potential areas of saving. This would be to the detriment of the Council's Net Zero ambitions.

The extent of basement and the functions that it offers was evolving during the latter stage 2 design period. As we highlighted during these discussions, our interpretation of Part B of the Building Regulations is that to avoid the requirement for smoke ventilation the basement size should not exceed either 200m^2 or 3m deep. Once the basement exceeds either of these a natural ventilation strategy would be most economical but would require an equally distributed ventilator clear area equivalent to at least 2.5% of the floor area. This would impact on the external paving area of the market. The alternative of ducted mechanical smoke ventilation combined with a sprinkler system and secondary power would incur a significant space and cost.

15.0 NEXT STEPS

15.1 Council Briefing and Direction

Prior to commencing stage 3 it is important that the Council understand the concept design proposals and are happy that they meet their requirements and budget. As such any questions or clarifications required relating to the content of this report and the associated drawings and schedules should be raised as part of the review and sign off process.

The sections below summarise some of the key specific briefing questions/considerations that are highlighted within this report. We request that as a minimum these be responded to as part of the stage 2 sign off process. This will enable the efficient commencement of RIBA design stage 3. In addition the recommended surveys and specialist input/appointments are also summarised.

Heat Network (CCCHN)
Section 7 outlines the considerations, risks and complexities in relation to the CCCHN and its current status. In summary the key strategic decisions and input are;

General
Should the design of the Civic Quarter be developed for future connection to the CCCHN (as Local Planning Policy)?

Guildhall
Should a temporary/interim gas fired heating plant arrangement be provided rather than the roof mounted air source heat pumps?

If temporary gas fired heating plant is to be utilised is the current plant considered suitable for retention and reuse for the interim period and therefore should the stage 3 design be coordinated around it? Suitability to be informed by current maintenance team works/views.

Corn Exchange
Should the design assume that the CCCHN will be available in advance of it being required to serve the refurbished Corn Exchange? This may provide additional space that can enhance the ventilation to the auditorium.

In addition, items that are likely to require input and response from the CCCHN project team are;

General
What heating water temperatures should the design be based on.

Guildhall
Are separate incoming substation rooms (DEN Interface plant rooms) acceptable or is only one per building permitted?

Corn Exchange
Is a second floor location suitable for the DEN interface plant room (CCCHN substation)?

Corn Exchange
Occupancy
Design occupancy numbers should be confirmed for each space, including the foyers/bars (refer to section 11.1).

Heating, Ventilation and Cooling
Agreement to proposed brief in section 11.1. In particular acknowledging the constraints imposed by the existing building and that this is limiting what can be achieved by the ventilation and cooling and that cooling will only be provided to the auditorium.

If the design is not to be based on heating from the district heat network (refer to earlier sub section) then acceptance to their not being heating available to the building when the ASHPs are providing cooling to the auditorium (refer to section 11, this is not anticipated to be problematic).

Hot Water Storage
Agreement to use local hot water cylinders with reduced storage capacity to guidance (but anticipated to be similar to existing).

Irrigation Water/External Watering
Confirmation of external watering requirements (if any).

Electrical Services
Council briefing is required for the following electrical systems;

- DDA strategy requirements (WC alarms, hard of hearing loops).
- AV (via theatre consultant)
- CCTV
- Access control.
- Security detection/alarm.
- Lightning protection (it appears the current building does not have this, is it required?).
- Telecomms/phone requirements.
- Data/Wi-Fi requirements.

The details for the above can be developed in conjunction with the stage 3 design. For sign off of this proposal strategic briefing will be adequate (for spatial coordination and cost consideration)

Room Use/Requirements
Use, occupancy and content of the following rooms should be confirmed;

- Ground floor 'Overflow Store/Bar Store' and space accessed from it (under stair/off Corn Exchange St). Currently appears to be used for lockers, crates of drink and a cellar respectively).

Vertical Transportation
Guildhall Hotel Use
Is there a preference for larger lift cars? In particular with consideration of passengers carrying luggage, the cycle store being at ground floor level, housekeeping trolleys and the movement of goods?

Council Workspace, Halls and Democratic Rooms
What stair factor is suitable?

How should the halls and democratic rooms be considered/analysed (what is the current experience and feedback)?

Is a 13person lift considered to be the minimum suitable size?

How are goods to be transferred? Is use of the passenger lift suitable for all envisaged goods movements?

Is it agreed the dumb waiters are not required?

Any views/challenges on the existing large hall lift performance and details of the current maintenance company?

Any views on size of bicycle lift/platform?

Office Tenant Use
What stair factor is suitable?

Is there a minimum lift car size e.g. 13person.

How are goods to be transferred? Is use of the passenger lift suitable for all envisaged goods movements or should a dedicated goods lift be considered? Also consider access to the cycle store and changing facilities at basement level.

Corn Exchange
Requirements for back of house/Crew lift (size, load capacity)

15.2 Surveys Required

For informing stage 3 design the following surveys should be undertaken. The stage 3 design programme shall consider the timing of when the surveys can be completed and information provided.

Below Ground Services Survey
A below ground services survey (GPRS survey) shall be completed to inform the works required of the utility services (refer to section 3). The survey will also inform the landscaping proposals, particularly the planting which is to avoid requiring any diversions to existing buried services. The survey will therefore 'de-risk' the landscape proposals (also the proposed market basement).

Ecology
An ecologist is required to complete a baseline survey to indicate the current biodiversity of the site and help in achieving the biodiversity net gain.

Though a RIBA stage 1 activity, the appointment of the ecologist should consider expanding the survey and including the associated reporting to address BREEAM credit 'LE04 Land Use and Ecology' to advise on minimising ecological impact and maximising ecological enhancement. Refer to appendix I for further details.

Noise Survey
An acoustician shall be appointed to complete noise surveys/measurements to inform the design proposals and planning applications that are to be progressed. Refer to section 15.3 below.

Light Level Survey
An architectural lighting designer shall be appointed to complete surveys of the existing external lighting (night time lighting) to inform the planning application. Refer to section 15.3 below.

Invasive Building Fabric Surveys
To inform the design details and to reduce future risk invasive surveys of the building fabric will establish current provisions (in detail) to inform the proposed enhanced details. The extent and type shall consider current use/disruption and associated project risk (impact and cost).

Existing Building Survey
The following surveys are required to inform the following design stage.

Guildhall
Invasive surveys are required to establish;

- Height of ceiling and floor voids throughout the building.
- Structural design of concrete floors and ceilings to determine continuity of voids potentially used for services. Awareness of structural pinch points.
- Structural strength of ceilings throughout building to suspend mechanical ventilation plant and ancillary ductwork.
- Structural strength of Large Hall ceiling to support large air handling equipment in roof void.
- Structural strength of angled roofs above the Council Chamber and Small Hall where new platforms are proposed to support plant.
- Structural ability to install new platform in central lightwell above existing plant serving Sticks'N'Sushi restaurant.
- Existing ventilation duct routes in basement and continuing to serve numerous spaces in the Guildhall. Refer to Section 2.1 of this report to follow currently understood duct routes.
- Airflow testing to establish existing ventilation rates provided to currently mechanically ventilated areas.
- Electrical riser routes and sizes.
- Low temperature hot water distribution riser routes and sizes.
- Potential routes to provide mechanical ventilation to office space on the ground and first floors.
- Establishing locations of all connected utility providers (gas, water, electricity, all telecoms).
- The ownership and necessity of all existing plant serving the Sticks'N'Sushi and Giggling Squid restaurants that are within the project areas.

Corn Exchange
Invasive surveys are required to establish;

- The section detail through the foyer ceiling and balcony seating (to establish space and build up). A number of locations will be required to understand if this is consistent or if it varies. Some may be obtainable via the existing ceiling access panels.
- The route of the foyer extract ductwork from the level 2 office/meeting room into the foyer ceiling (builderswork detail and location). Also establishing the high level structure along this wall (office to foyer).
- Type and size of ducts routing through balcony seating into foyer ceiling.
- Riser routes and sizes from the level 3 north plant room down to the ground floor WCs and store room. Including the first floor Female WC cupboard (assumed riser at rear?).
- That the auditorium plenums are clear and operating as anticipated (removal of some blocked off grilles in the balcony may facilitate this).
- Basement WC ceiling void depth and slab level from ffl.
- Riser routes and sizes to the basement WCs.
- Riser routes and sizes in the west extension (possibly continues up from basement WCs?).
- Electrical distribution routes, including vertical risers and horizontal mains throughout building.
- Routes to mezzanine grilles (if present, visually survey first).
- As no EnerPHit analysis has been progressed is likely that this process will require some invasive surveys to establish existing build ups/construction details.

Visual surveys are required to establish;

- If there is any ventilation to the control room.
- If there are ventilation grilles in the rear of the mezzanine (if so are these operable and if so supply or extract?).
- Type and size of duct routes through balcony seating into foyer ceiling.
- As no EnerPHit analysis has been progressed is likely that this process will require some visual surveys to inform initial understandings of the existing build ups/construction details.

Testing and Commissioning works shall be completed to confirm;

- Ventilation supply air rate into auditorium (from plant room into high level plenum or if that is challenging to measure the intake air volume coming into the system).
- Ventilation extract air rate from the auditorium (into plant room ductwork or from extract fan to discharge louvre).
- Foyer ventilation supply and extract rates from and to fans or their related louvres in level 3 north plant room.
- Performance of mezzanine grilles (if present, visually survey/establish first).

In addition the latest electrical test sheets (NICEIC) shall be provided (retesting only required if these pre date any subsequent changes to the electrical installation).

If a maintenance company has knowledge of the existing control system it may be useful to understand how the main auditorium and foyer ventilation systems are operated/controlled and if there are any sensor readings that can be logged and relayed (temperatures, CO_2). If not it may be useful to install temperature and CO_2 loggers within the space.

15.3 Specialist Appointments/Input Required

For informing stage 3 design, in addition to the survey works, the following additional specialist input is required (Additional to that provided by the stage 2 design team). These appointments should be made in conjunction (parallel) with the instruction for the design team to commence the stage 3 design.

Acoustician
An acoustician shall be appointed to provide stage 2 and stage 3 acoustic consultancy. They will input into the design and also provide information to support the planning application. The Cartwright Pickard tender includes this as an optional service that will be provided by Max Fordham LLP.

Moisture Modelling
Moisture modelling shall be completed to support the fabric upgrade proposals that will support the planning application (Energy assessment/EnerPHit works). The Cartwright Pickard tender includes this as an optional service that will be provided by Max Fordham's Passivhaus team.

Embodied Carbon
As described earlier in this report, embodied carbon analysis shall be completed to inform the stage 3 detailed design and to support the sustainability proposals submitted to support the planning application. The Cartwright Pickard tender includes this as an optional service that will be provided by the sustainability consultant.

Architectural Lighting
A specialist lighting design shall be appointed to complete surveys of the existing external lighting (night time) and the existing internal heritage fittings for reuse/conversion. The lighting designer will progress the external lighting design to support the planning application and will also provide stage 3 design for the front of house 'architecturally sensitive areas'.

Soft Landings
The Cartwright Pickard tender includes this as an optional service that will be provided by Max Fordham LLP.

Early Stage BREEAM Credits
As highlighted in design team meetings and noted in section 5.7 of this report, BREEAM accreditation may be beneficial should the office option be the preferred option.

Appendix I includes the summary note circulated during this design period. This includes a number of credits that if targeted would require additional appointments/works (noted in appendix I). Depending on the status of the related design elements and the instruction from the Council to further develop the design, It may still be possible to obtain those that are indicated as being RIBA stage 2 works. This will require review on a credit by credit basis.

APPENDIX I – GUILDHALL EARLY STAGE BREEAM CREDITS

Purpose of this Document

‘Excellent’ is a very challenging rating requiring a score of 70%. There are a number of early stage credits that need to be completed by RIBA stages 1 and 2.

While there is a choice over which credits the project pursues, it is likely that many early stage credits must be achieved in order to secure an ‘Outstanding’ rating.

This document lists a number of actions that need to be undertaken in RIBA Stage 1 to achieve various BREEAM credits. For full details of the credit requirements, see the BREEAM RFO 2014 Manual:

https://www.breeam.com/ndrefurb2014manual/Default.htm

CREDITS THAT REQUIRE EARLY DOCUMENTATION – STRICT RIBA DEADLINES

Credit	Deadline	Requirement	Additional Appointment?	Action	Owner
Man 01: Project Brief and Design (credit 3)	RIBA Stage 1	Credits are available for appointing a Sustainability Champion (BREEAM Accredited Professional) from Stage 1* to attend key DTMs, and provide guidance and progress updates. Target rating should be contractually set by RIBA Stage 2 and be achieved to gain these credits. *The BRE has since approved making this appointment in Stage 2 if it can be proven that the ability to provide advice has not been hindered.	✓	Max Fordham can act as Sustainability Champion (BREEAM AP). AP to attend key DTMs to monitor progress. AP to issue regular score updates to team	Man 01: Project Brief and Design (credit 3)
Mat 06: Material Efficiency *(New credit to BREEAM 2014)*	RIBA Stage 1	Produce a material efficiency brief Opportunities and measures to optimise the use of materials in building design, procurement, construction, maintenance and end of life have been identified, investigated and implemented by the design/construction team as appropriate in consultation with the relevant parties at **every RIBA** stage from Preparation and Brief to Construction.	✓	A material efficiency brief should be produced A Statement detailing decisions on optimising the use of materials at Stage 1 should be produced (Standalone or in a Stage report)	Brief: TBD Architect (support from structural engineer) *Note: MF can facilitate a workshop to complete this credit*
LE 04 Land Use and ecology	RIBA Stage 1	An ecologist should be appointed to conduct the following: a Phase I habitat survey and advise on minimising ecological impact and maximising ecological enhancement and providing input into a habitat management plan. It is important the ecologists’ scope covers all requirements to gain full credits. They should include the requirements of ‘BREEAM Appendix F’ in their report, and this should be updated as necessary in later stages.	✓	Appoint an ecologist	
Man 01: Project Brief and Design	RIBA Stage 2	Prior to completion of the Concept Design (RIBA Stage 2), the client, occupier, design team, and contractor have met to identify and define their roles, responsibilities, and contributions for each of the key phases of project delivery. Responsibilities must be defined for: a. End user requirements b. Aims of the design and design strategy c. Particular installation and construction requirements/limitations d. Occupiers' budget and technical expertise in maintaining any proposed systems e. Maintainability and adaptability of the proposals f. Requirements for the production of project and end user documentation Requirements for commissioning, training and aftercare support		Roles and responsibilities up to post-completion to be defined and details of appointment confirmed in a project meeting(s). Responsibilities schedule should be issued Provide meeting minutes, or statement demonstrating how early involvement has influenced the design. This credit could be coordinated by a Soft Landings Champion	? (Often Soft Landings Champion)

CREDITS THAT REQUIRE EARLY DOCUMENTATION – STRICT RIBA DEADLINES

Credit	Deadline	Requirement	Additional Appointment?	Action	Owner
Man 01: Stakeholder Consultation (credit 3)	RIBA Stage 2	Prior to completion of the Concept Design stage (RIBA Stage 2), a consultation plan has been produced and all relevant third party stakeholders have been consulted by the design team. This must cover the minimum consultation content		Produce a consultation plan mapping out - who will be consulted - roughly when - the format of consultation how they will be kept informed of changes	Consultation lead
Man 02: Life Cycle Cost & Service Life Planning	RIBA Stage 2	Two credits – Elemental life cycle cost at Concept Design stage (RIBA Stage 2) The LCC analysis should include: a. An outline LCC plan for the project based on the buildings basic structure and envelope, appraising a range of options and based on multiple cash flow scenarios e.g. 20, 30, 50+ years; b. The fabric and servicing strategy for the project outlining services component and fit-out options (if applicable) over a 15 year period, in the form of an 'elemental LCC Plan'.	✓	Appoint QS to conduct LCC. All to agree design option(s) to be analysed	QS (Client input)
Hea 06 Safety and Security (credit 2)	RIBA Stage 2	Suitably Qualified Security Specialist (SQSS) conducts a Security Needs Assessment during or prior to Concept Design (RIBA Stage 2). They develop a set of recommendations and solutions. These must be incorporated into the final design. Deviation from their recommendations must be agreed by the SQSS. SQSS can be the local Architectural Liaison Officer from the local police department.		Architect to contact local Architectural Liaison Officer and schedule a meeting.	Architect
Ene 04: Low Carbon Design – Passive Design Analysis	RIBA Stage 2	Passive design analysis during Concept Design (RIBA Stage 2) – Carry out an analysis of the proposed building design to identify opportunities for the implementation of passive design solutions that reduce demands for energy consuming building services.	✓	Carry out passive design analysis	MEP
Ene 04: Low Carbon Design – Free Cooling Analysis	RIBA Stage 2	The passive design analysis (above) must be completed. It must include an analysis of free cooling and identify opportunities for the implementation of free cooling opportunities.	✓	Carry out free cooling analysis	MEP
Ene 04: Low Carbon Design – LZC Feasibility Study	RIBA Stage 2	A feasibility study is carried out by the completion of the Concept Design stage (RIBA Stage 2) by an energy specialist to establish the most appropriate local low or zero carbon (LZC) energy source for the project. The recommendations of the study must be incorporated into the building.	✓	Carry out LZC feasibility study	MEP
Wst 05: Adaptation to Climate Change	RIBA Stage 2	Conduct a systematic risk assessment by the end of Concept Design (RIBA Stage 2) (specific to structural and fabric resilience) to identify and evaluate the impact of the expected increase in extreme weather conditions arising from climate change on the building over the projected life-cycle of the building. The assessment should cover the following stages: a. Hazard Identification b. Hazard assessment c. Risk estimation d. Risk Evaluation e. Risk Management		Carry out a climate change adaptation strategy (specific to structural and fabric resilience)	Structural Engineer/ Architect *Note: MF can facilitate a workshop to complete this credit*
Wst 06: Functional Adaptability	RIBA Stage 2	Client and design team must conduct a functional adaptation strategy study by Concept Design (RIBA stage 2), which includes recommendations for measures to be incorporated to facilitate future adaptation. These measures must be adopted in the design, where practical. Omissions must be justified.		Carry out a functional adaptation strategy study	ALL *Note: MF can facilitate a workshop to complete this credit*

CREDITS THAT REQUIRE EARLY DESIGN CONSIDERATION – NO STRICT RIBA DEADLINES, BUT SHOULD BE INCORPORATED EARLY TO ACHIEVE CREDIT

Credit	Stage guidance	Requirement	Additional Appointment?	Action	Owner
Hea 01: Visual Comfort (Daylight 1 credit)	RIBA Stage 1/2	80% of occupied spaces to achieve good practice daylight standards. Average daylight factors: • 2% for occupied spaces, 40%/60% of spaces to comply for 1/2 credit(s) • 2% of 35% of retail space At least 3000 lux for at least 2000 hours per yr See manual for full details. In addition a uniformity ratio of 0.4 Auditoria and rooms for media use are exempt.		Calculate likelihood of achieving in 80% spaces Maximise daylight potential through building arrangement and window design.	Architect/ MEP
Hea 05: Acoustic Performance	RIBA 2	Meet the acoustic performance standards and testing required for that building type (for this building this will require guidance from an Acoustician)	✓	Appoint Acoustician to set performance targets and provide design guidance	Architect
Tra 03 Cyclist Facilities	RIBA Stage 2	Provision of lockable cycle storage externally and lockers and showers internally. Where the new buildings form part of a larger existing site, the required number of facilities can be determined on a development wide basis. The number of compliant facilities should cater for the assessed buildings and other buildings that will share the facilities. Number compliant spaces: The site has a high PTAL index and would achieve 50% of available public transport accessibility credits. It would therefore reduce the storage requirements. Exact numbers tbc. Roughly 1 per 20 occupants up to 500 and sliding scale beyond. Occupant numbers are required to calculate the cyclist requirements.		Dependent on occupant numbers. Agree cycle facilities provision and strategy with client and incorporate areas into design as appropriate.	Transport Architect
		Internal space for cycling facilities is also required: • Either 1 shower per 10 cycle spaces and changing facilities or, • 1 shower per 10 cycle spaces and lockers drying space or, • 1 shower per 10 cycle spaces and drying space			
Wst 03: Operational Waste	RIBA Stage 2	There must be dedicated spaces to cater for the segregation and storage of operational waste, and recyclable waste volumes generated by the building, its occupants, and activities. Internally and externally. It must be accessible and within 20m of building entrance. Organic waste collection required and tap nearby Documentation must include meeting minutes from the design stage.		Consider appointing specialist waste consultant	Architect
Wst 01: Construction Waste Management	RIBA Stage 2	Where pre-construction demolition must be performed, the team should perform a demolition audit and include this audit in the credit documentation.	✓	Appoint an auditor	To be appointed
Hea 01: Visual Comfort (Glare Control 1 credit)	RIBA Stage 2/3	Disabling glare has been designed out via building form and layout and/or design features such as low eaves, occupant controlled devices, external shading, brise soleil, etc.		Regular checks will need to be undertaken	Architect
Hea 01: Visual Comfort (View Out 1 credit)	RIBA Stage 2/3	95% of desks/work benches are within 7m of a window providing a view out. Livings spaces / lounges / bedrooms: positions to be within 5m of wall providing view out. The window/opening must be ≥ 20% of the surrounding wall area.		Regular checks will need to be undertaken	Architect
Hea 02: Indoor Air Quality	RIBA Stage 2/3	For air-conditioned and mixed-mode buildings: air intakes and exhausts > 10m apart to minimise recirculation, intakes > 20m from sources of external pollution. For naturally-ventilated buildings: openable windows/ventilators > 10m from external pollution sources.		Ensure layout compliant. Prepare draft IAQ to include in stage C / D reports.	Services

APPENDIX II – GUILDHALL ENERPHIT REPORT

MAX FORDHAM

Cambridge Civic Quarter

Guildhall

EnerPHit Stage 2 Report

31.10.2024

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ISSUE HISTORY

Issue	Date	Description
P01	27/09/2024	DRAFT Stage 2 Issue
P02	14/10/2024	Final Stage 2 Issue
P03	31/10/2024	Final Stage Issue (typo amended on p21)

MAX FORDHAM LLP TEAM CONTRIBUTORS

Engineer (Initials)	Role
GS	Passivhaus Director
NL	Senior Passivhaus Consultant
IN	Passivhaus Designer
TM	Passivhaus Graduate

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EXECUTIVE SUMMARY

Introduction - Why EnerPHit?

The retrofit of the Guildhall is part of the broader redevelopment of the Civic Quarter, led by Cambridge City Council. The primary goal for the Guildhall is to achieve net zero operational energy, in accordance with the UK Net Zero Carbon Building Standard (UKNZCBS), while preserving the building's CPural and historical value. This retrofit aims to reduce operational energy consumption by up to 70% compared to the existing building.

If embodied carbon targets are also met, the building could be classified as “net zero- aligned”. While energy offsets are not considered in this phase, they can be evaluated later if the Client decides to pursue full Net Zero certification.

The Passivhaus methodology provides a proven approach to designing and delivering buildings that achieve low operational energy consumption while ensuring high levels of comfort. The UKNZCBS targets are broadly aligned with Passivhaus performance levels, which in turn have been validated over three decades of practical application.

In addition to its rigorous energy modelling methodologies, Passivhaus requires stringent quality control during design and construction phases. This process is verified by an independent third-party certifier, ensuring that Passivhaus-certified buildings perform as intended. This is particularly important, as performance gaps—the discrepancies between predicted energy use at the design stage and actual energy consumption—can reach as high as 53% * in conventional office and multipurpose buildings.

Passivhaus methodology provides a well-established and low-risk pathway to achieving net zero operational energy use. This approach not only aligns with UKNZCBS requirements but also guarantees significant reductions in operational costs for the Council.

EnerPHit is the Passivhaus Institute version of the standard adopted for existing buildings. EnerPHit follows the same principles as Passivhaus for new build but relaxes some of the criteria to acknowledge constraints of existing buildings, whilst achieving the same aims of comfortable indoor environment and low energy use.

There are two routes to achieve EnerPHit compliance: Energy Demand and Component Methods. Given the constraints of this heritage building, the latter method is recommended, as it allows for reasonable exemptions, particularly concerning the preservation of valuable heritage building fabric.

*A Review of the energy Performance Gap and its Underlying Causes in Non-Domestic Buildings
Chris van Dronkelaar , Mark Dowson , E. Burman , Catalina Spataru and Dejan Mumovic

Activities in Stage 2 and further steps.

Max Fordham LLP (MFLLP) has been appointed to act as the Passivhaus consultant and support the design team in developing a design to achieve EnerPHit certification.

Max Fordham have collaborated with the design team to define certification criteria that take into account the constraints of the existing building. The building fabric analysis and the certification criteria can be found in this report.

We have discussed strategies for achieving each of the criteria with the team, identified key risks, and developed mitigation strategies (see Appendix). The highest risk items—airtightness, internal wall insulation, and ETFE roofs—have been analysed in detail within this report.

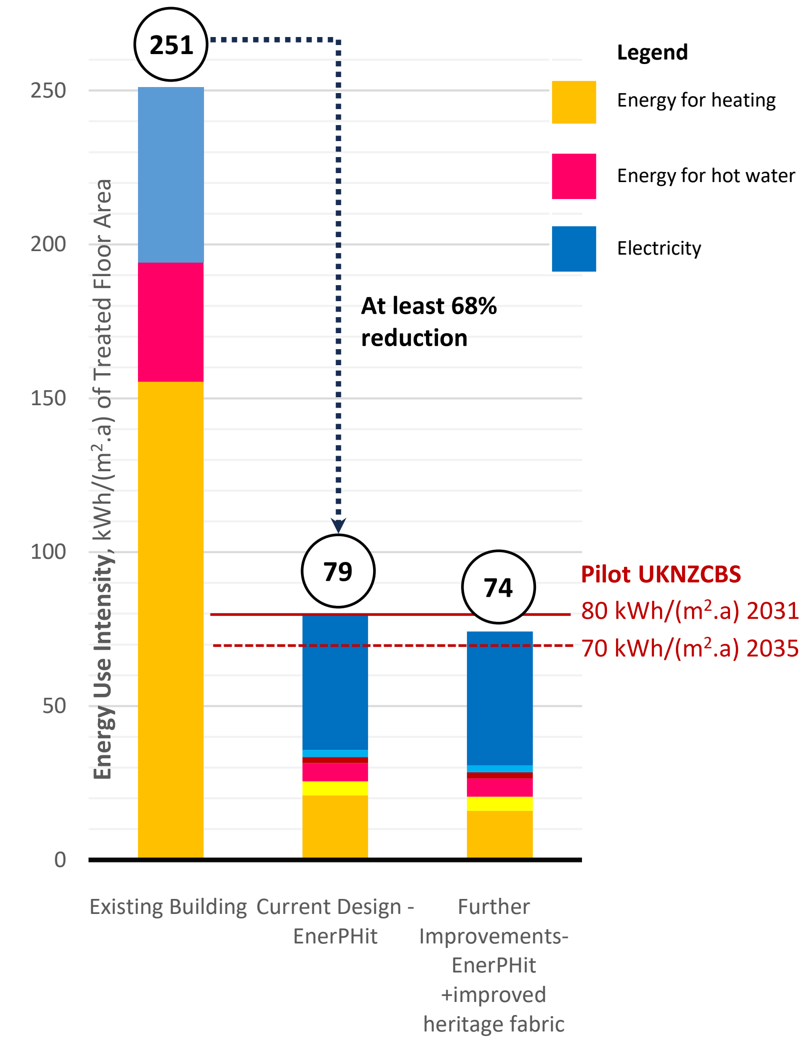
Max Fordham have conducted a series of workshops with the CPs, M&E team, and cost consultant to explain the overarching principles and communicate detailed requirements. Our qualitative analysis has been supported by the initial energy modelling of two options in PHPP, the Passivhaus Planning Package. We have benchmarked the preliminary results against the recently launched Pilot UKNZCBS, as demonstrated in the graph on the right.

The design that meets minimum EnerPHit (Component) compliance is expected to achieve Net Zero operational energy limits for 2031-2032. To target 2035 and beyond, thermally improving the high heritage value spaces will be necessary.

Thermal improvements and low carbon energy sources, such as air-source heat pumps, are expected to reduce heating energy use by 85%. Nevertheless, heating will still represent the second-largest energy use in the retrofitted building, and further potential for its reduction should be investigated in Stage 3.

Electricity for lighting, building systems, IT, office/data equipment, and appliances is anticipated to be the highest energy use in the retrofitted building. These will need to be designed and specified strictly within the allocated energy budgets, which will be defined in Stage 3.

It is important to remember that Passivhaus/EnerPHit are also comfort standards, meaning they include requirements for occupant comfort and building fabric protection. This is fully aligned with the principles of a “good retrofit” and ensures that unintended consequences of the retrofit are avoided.



Please note that these are early-stage modelling results which assume that all requirements and recommendations set out in this report have been fully incorporated into the CPural/mechanical and structural design.

To sum up, the EnerPHit Certification provides both the rigour and flexibility to the retrofit design. We believe it is the most appropriate route to achieving Net Zero aspirations, ensuring operational energy savings and providing a healthy environment for people to work and visit.

Actions in Stage 3:

- Instruct the team to continue developing design at RIBA 3 to be capable of EnerPHit certification
- Carry out opening up works and surveys - to be scoped by CP with MF’s input.
- Address actions through this report and Risk Register

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INTRODUCTION TO PASSIVHAUS & ENERPHIT

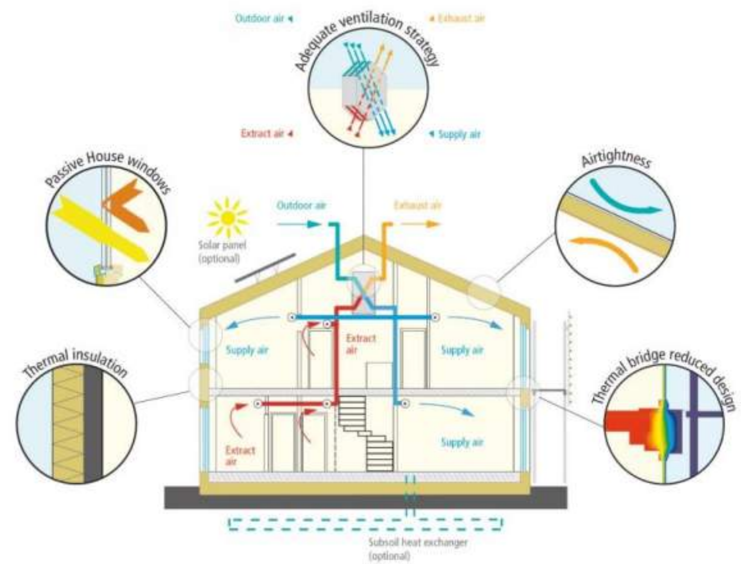
Passivhaus is a thermal comfort and energy standard for buildings. It provides a set of tools and processes to design, build, commission, and hand over a low energy building with high thermal comfort.

Passivhaus follows several key principles:

- Use **building physics principles** to design an energy efficient building (this includes the thermal envelope, glazing, and ventilation systems)
- **Reduce the heating demand** of the building
- **Consider all energy uses**, both regulated an unregulated, in the building design
- Use **tried and tested energy modelling** tools, which allow the design to be monitored throughout the project
- Employ **stringent quality control** during design and construction.

The common building physics principles of a Passivhaus building are shown below. Clockwise from the top:

- **Low-energy reliable ventilation**: mechanical ventilation with heat recovery delivers good indoor air quality with minimal energy use, and avoids cold draughts.
- **Excellent airtightness** also avoids cold draughts, protects the building fabric, and limits energy use.
- **High quality building fabric** (thermal bridging and thermal insulation) help control heat loss, and protect the building fabric against mould growth.
- **High performance glazing**: triple glazing limits unwanted heat transfer, and helps keep people comfortable by avoiding cold surfaces.
- EnerPHit is the Passivhaus institute (PHI) standard for existing buildings which follows the same principles as Passivhaus Classic but relaxes some of the criteria to acknowledge constraints of existing buildings, whilst achieving the same aims of comfortable indoor environment and low energy use.



There are two approaches to achieving EnerPHit criteria:

- **Component Method.** Compliance is demonstrated by showing that the fabric meets limiting values for conductivity ("U-values") & that an efficient MVHR system has been installed. A PHPP of the building including its total heating demand is produced as to demonstrate compliance with the overall energy performance criteria (PER).
- **Energy Demand Method.** This method is similar to the Passivhaus Classic criteria; however the Heating Demand limit is relaxed from 15 kWh/m2.a to 25 kWh/m2.a.

Irrespective of the route for certification the building must still meet:

- a **demanding airtightness target** of 1.0 air changes per hour at 50 Pa
- a **project specific Primary Energy Renewable (PER) limit**,). It is a measure of the building's total energy demand, including consumer electronics and small appliance usage. It is based on a theoretical energy grid supplied entirely by renewable energy and includes factors for energy storage and transmission. For EnerPHit this will typically fall within the range of 75 – 130 kWh of total energy use per m^2 of internal floor area per year (kWh/m2/a), depending on the type of heating system used and presence of on-site renewables.

Table below provides a summary of key similarities and differences between the two Certification routes for Enerphit.

The Component method is generally more suitable for building where opportunities for the fabric upgrade are constrained by the conservation and heritage considerations. Therefore, this method appears to be more appropriate for the Guildhall.

Passivhaus Enerphit Component	Passivhaus EnerPHit Energy Demand
• Upgrade opaque envelope to meet or exceed standards (U-values etc)	• Meet maximum heating demand limit
• Upgrade windows	• Upgrade windows
• Provide mechanical ventilation with heat recovery throughout	• Provide mechanical ventilation with heat recovery throughout
• Make airtight	• Make airtight
• Meet total energy demand limit	• Meet total energy demand limit
• Some exemptions e.g. for historic fabric	• n/a

ENERPHIT CRITERIA – PAGE 1 OF 2

Tables on the next two pages provide a detailed breakdown of all certification criteria, their comparison with the current building regulations, and design impact. All High and Medium risk items have been analysed and appropriate mitigation strategy developed. Please refer to the Risk Register in the Appendix and relevant sections within the report.

Parameters	Part L Existing elements in existing buildings (given for reference)	Passivhaus Enerphit Component Certification Criteria (Cold Temperate Climate)	Design Impact and Comments.	Certification Risk
Criteria applicable to all EnerPHit Component				
Existing Exterior Wall (internal insulation) U-value	0.30-0.70 W/m².K	<0.35W/m².K	• The criteria must be complied with for the entire building at least as an average area-weighted value. • All proposed solutions must effectively mitigate the moisture risk. And be compliant with Part C (responsibility of the CP).	Medium
Existing roof U-value	0.16-0.35 W/m².K	<0.15 W/m².K	• The solutions proposed in Feasibility studies is likely to meet the criteria.	Low
Basement Floor U-value	0.25-0.70 W/m².K	U-value <= limit calculated in PHPP to achieve optimal balance. *Sample value 0.26 W/m².K*	• Basement floor insulation to be insulated. This might have significant impacts on: stairs, door heights.	Medium
Basement Wall U-value	TBC	U-value <= limit calculated in PHPP to achieve optimal balance. *Sample value 0.32 W/m².K*	• Basement wall in contact with the ground to be internally insulated. This is not expected to be very disruptive.	Low
Vertical Windows U-value	1.4 W/m².K (1.7 W/m².K in Passivhaus definitions)	<0.85 W/m².K (installed)	• Triple glazed units will need to be used as secondary glazing to achieve this criterion. • Very efficient installation detail to be developed. • Insulation- to the window reveals can potentially be omitted.	Medium
Inclined Windows/ Glazing U-value		<1.0 W/m².K (installed)	n/a	n/a
Horizontal Windows/ Glazing U-value		<1.1 W/m².K (installed)	• ETFE units itself will need to achieve a component U value of 0.8-0.9 W/m².K as a minimum • Very efficient installation detail to be developed.	High
Solar Heat Gain Coefficient (g-value)	Not regulated	Project specific	• Not expected to be an issue.	Low
Max Specific Solar load during cooling period	Not regulated	Project specific	• Not expected to be an issue.	Low
Ventilation Heat Recovery	Not regulated	Total system efficiency >= 75%	• Long intake and exhaust ducts will have a detrimental effect on the overall efficiency of the system. This will need to be compensated with efficient ventilation units and/ or additional insulation to the ducts.	High

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ENERPHIT CRITERIA AND DESIGN IMPACT

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Parameters	Statutory Compliance	Passivhaus Enerphit Component Certification Criteria (Cold Temperate Climate)		Certification Risk
Criteria applicable to all EnerPHit Projects				
Air leakage/ air permeability @50Pa	Not regulated	1.0 ACH @ 50 Pa	• Treatment will be required to all elements of the external envelope, including those in the “High Heritage Value” category. • Where airtightness is provided by existing elements (e.g.concrete beams/slab), the condition of the concrete to be investigated. • Robust strategy for the main elements and all connections.	High
Primary Energy Renewable	Not regulated	Project specific, *124kWh/m².a*	• Efficient domestic hot water and heating system: distribution losses to be minimised. • “Energy budgets” for key energy uses are to be established. • Efficient systems and appliances including but not limited to: access control, appliances, office equipment.	High
Criteria applicable to all Passivhaus projects				
Overheating	Not regulated	• <10% of all hours above 25 deg. For building without active cooling • with active cooling: cooling system must be adequately dimensioned.	Not expected to be an issue.	Low
Ventilation	Part F compliance	• Ventilate all rooms • Min at least 20 m³/h per person • Controllable ventilation • Quiet • Draughts free	• Not expected to be an issue. • Review of the airflow rates and ventilation controls to be carried out.	Low
Noise protection	TBC	≤ 25 dB(A): supply air rooms in residential buildings, as well as bedrooms and recreational rooms in non-residential buildings ≤ 30 dB(A): rooms in non-residential buildings (except for bedrooms and recreational rooms) and extract air rooms in residential buildings	• Acoustic assessment will be required to determine requirements for attenuation.	Medium
Thermal Comfort	n/a	The interior surface temperatures of standard cross-sections of walls and ceilings may not be more than 4.2 K below the operative indoor temperature.	• ETFE might not be feasible on this basis. • Might be an issue for some details where fabric upgrades to the external walls are not possible.	Medium
Moisture protection	Part C compliance	*minimum temperature factor fRsi=0.25 m²K/W*	• Might be an issue for some details where fabric upgrades to the external walls are not possible. • Please note that statutory requirement in Part C might be more onerous. To be checked by the CP.	Medium

ENVELOPE PRINCIPLES

The build-up on the top right is an idealised application of the key principles of the thermal envelope:

Thermal performance

- Continuous thermal envelope external to the building's main structure.
- Thermal bridges to be designed out or minimised.

Airtightness

- Continuous airtightness layer to warm side of insulation.
- Continuous windtightness layer external to insulation.

However, in retrofit scenarios, the application of these principles need to be modified to account for the existing building constraints. This is an example of applying these principles to the internal wall insulation:

Thermal performance

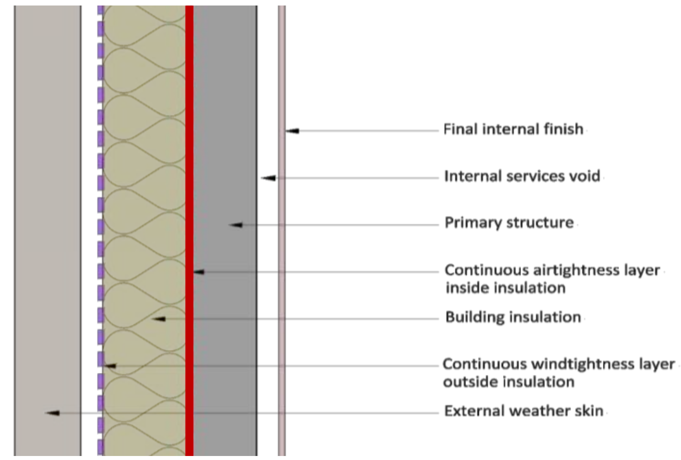
- Internal wall insulation to be continuous (where possible).
- Where it is interrupted by the structure, resulting thermal bridges to be mitigated by returning insulation (where possible).
- Some spaces might qualify for an exemption from thermal improvement criteria.

Airtightness

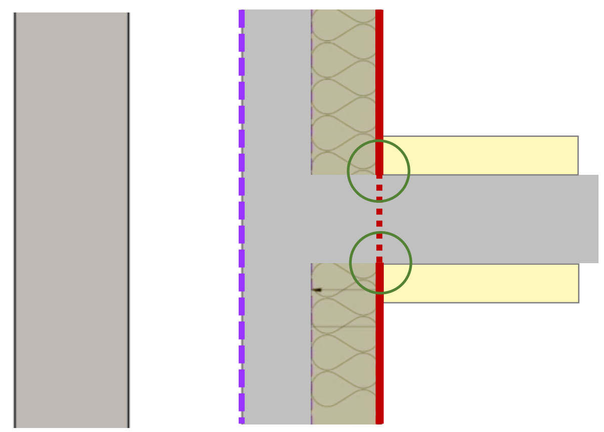
- Continuous airtightness layer to warm side of insulation.
- Where airtightness is provided by an existing element, e.g.. concrete slab, consider how it is connected to the main airtightness layer.
- While some spaces might be exempt from meeting the thermal improvement criteria, the building overall must meet the limiting airtightness of 1ach@50Pa. Therefore it is critical to follow the steps to achieving airtightness outlined in the diagram on the far right.
- Windtightness in this case will be provided by the external brickwork.

Moisture

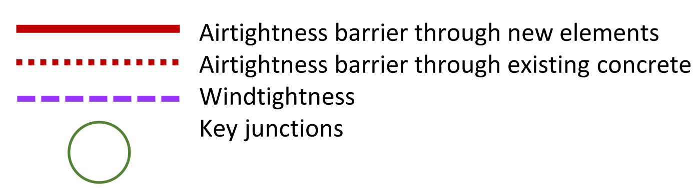
Internal wall insulation has got an inherent risk of moisture related issues. Hence, the design must adequately address this risk.



Thermal Envelope Principles



Constrained Retrofit Thermal Envelope Principles



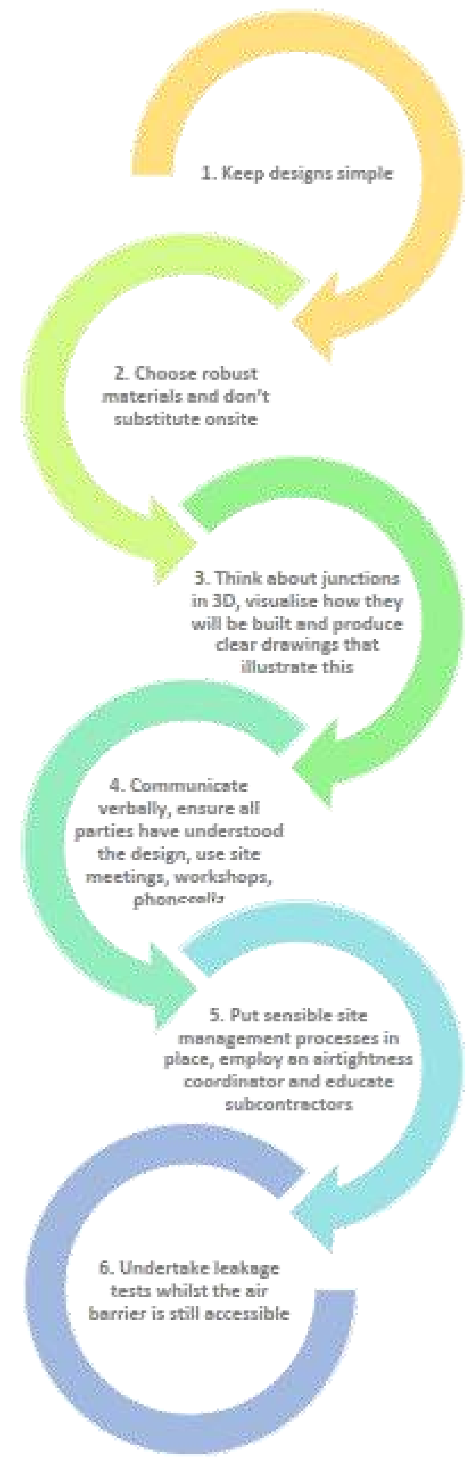


Figure from Passivhaus Trust's 'Good Practice Guide to Airtightness'

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THERMAL ENVELOPE – HERITAGE CONSTRAINTS

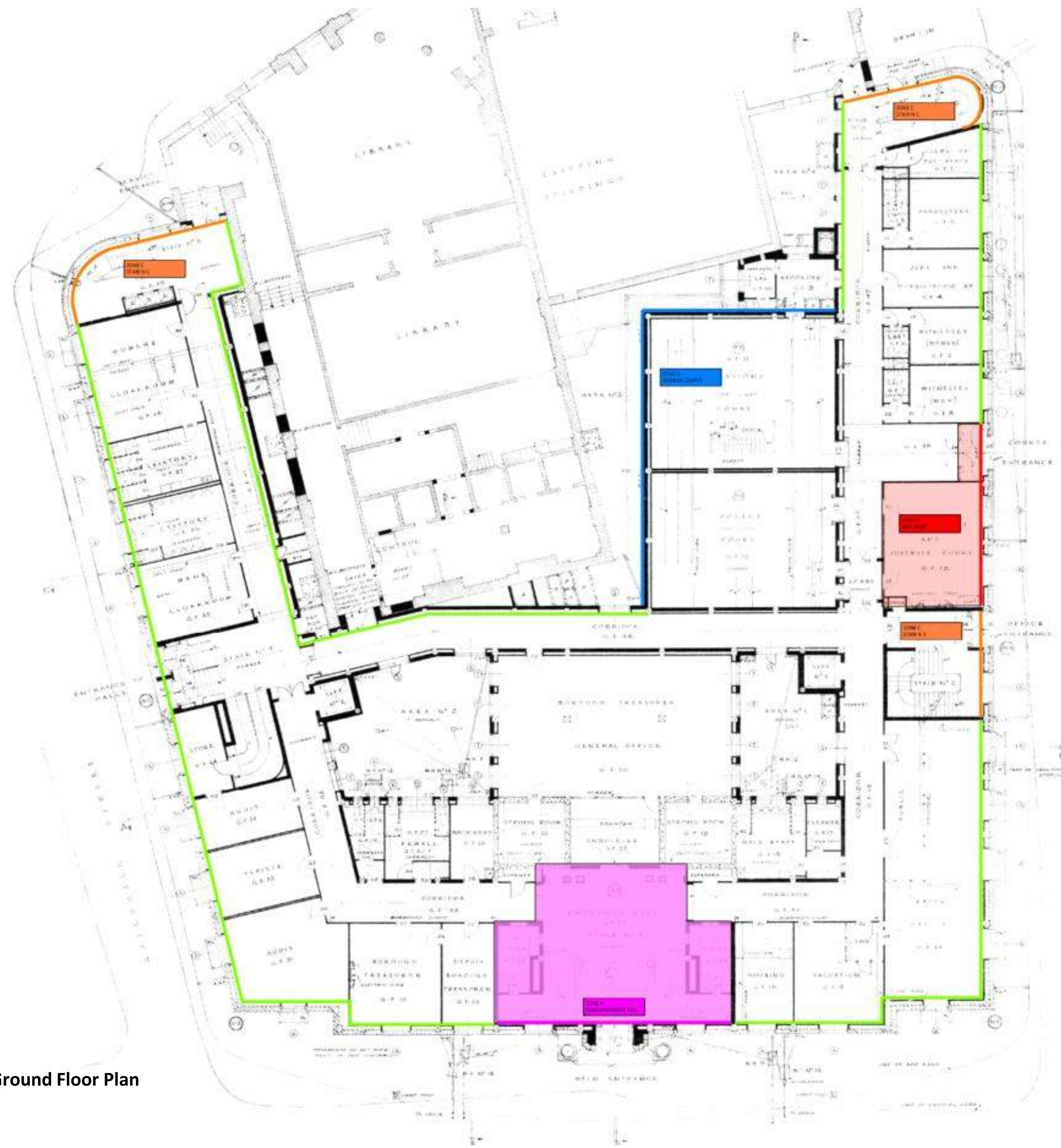
EnerPHit Component method allows for certain exemptions from thermal upgrades for elements that have got justifiable heritage and conservation constraints.

We have carried out a site visit with CP CPs and developed a strategy for upgrading the building fabric in accordance with its heritage value:

ZONE A	No thermal upgrades. Stonework and decorative elements
ZONE B	Timber panelling- Potential thermal upgrades as Wall Options Matrix (p.15)
ZONE C	Stairwells- necessary upgrades as Wall Options Matrix (p.15)
ZONE D	External Wall insulation
AMBIENT WALLS- Internal wall lining	No constraint- Internal wall lining

Actions in Stage 3:

- Opening up works and surveys - to be scoped by CP with MF's input.
- MF to agree exemptions with the Certifier
- CP to Agree approach with the Heritage officer
- Carry out Thermal and hygrothermal modelling of options.



Ground Floor Plan

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THERMAL ENVELOPE - HERITAGE CONSTRAINTS

Options	Wall Options	Windows
Zone A	Op.0 - No thermal or AT upgrades.	No upgrades apart from essential repairs?
	Op.0 - No thermal or AT upgrades.	No upgrades apart from essential repairs?
Zone B	• Op.1 -Liquid applied AT membrane. • Op.2- Sheet membrane (behind panelling?) • Op.3-Insulating plaster • Op.4 - Sheet membrane + thin layer of insulation behind panelling. • Op.5-cavity filled with insulation+Brick cream +AT membrane internally	Airtight replacement secondary glazing
Zone C	• Op.1 -Liquid applied AT membrane. • Op.3-Insulating plaster • Op.5-cavity filled with insulation+Brick cream +AT membrane internally	Windows upgraded to achieve Uw inst=0.85W/m2.K (triple glazing)
Zone D	TBC	No windows
Zone E	• **Op 1. Protecting masonry.** Masonry to be treated with a pore lining brick cream. • **Op 2. Moisture buffering.** Use of hygroscopic materials which can temporarily absorb a small amount of liquid water. • **Op 3. Decoupling. Separate** an external wall from the IWI with a ventilated void.	Windows upgraded to achieve Uw inst=0.85W/m2.K (triple glazing)

First Floor Plan

INTERNAL WALL LINING

It is important to bear in mind that internal wall insulation to solid masonry wall has an inherent moisture risk. Therefore, the purpose of the design is to reduce this risk to acceptable levels and to develop a strategy for managing any residual risks.

Max Fordham have proposed three conceptual approaches to managing moisture in the walls with internal wall lining-summarized in the Table below.

A detailed overview is provided on the following three pages.

Legend

- Definite disadvantage
- Definite advantage
- Both advantage and disadvantage
- Insulation layer
- Airtightness layer
- Brick Cream

Important notes :

This advice is given in relation to the thermal, airtightness and moisture performance ONLY.

The requirements in relation to fire, structural, acoustic performance etc are not within Max Fordham remit.

Actions in Stage 3:

- All advice is qualitative and must be verified by the hygrothermal modelling.
- Opening up works and surveys - to be scoped by CP with MF's input.

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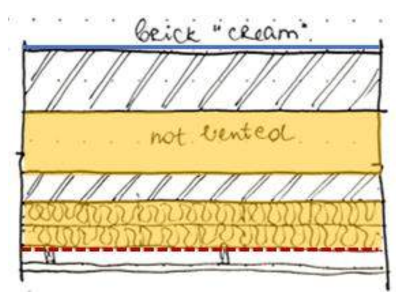
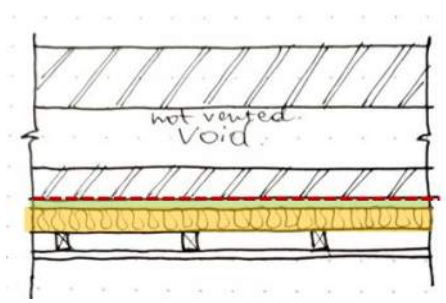
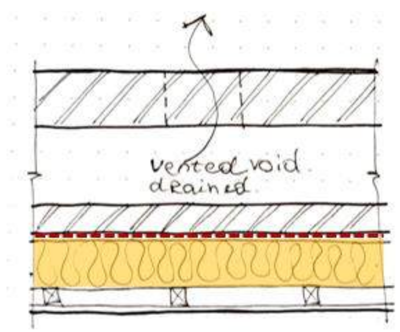
Approach	**Approach 1. Protecting masonry.** Masonry to be treated with a pore lining brick cream.	**Approach 2. Moisture buffering.** Use of hygroscopic materials which can temporarily absorb a small amount of liquid water.	**Approach 3. Decoupling.** Separate an external wall from the IWI with a ventilated void.
Sketch			
Cost	• Simplifies the internal build, BUT potentially different products required for masonry and stone details. • Also, cost will depend on whether voids are infilled or not.	Typically, expensive materials. A few sub-contractors are trained to carry out installation	Cost of inserting airbricks.
Construction	External scaffolding	Wet trades are likely to be involved. Programme impact from curing times,.	Providing adequate ventilation in the cavity External scaffolding is likely to be required.
Maintenance	Regular maintenance every 7-10 years*. Not clearly visible when it needs to be reapplied	No maintenance required.	No maintenance required.
Planning	Generally, the measure will help protecting brickwork, but will probably need to be agreed with the planning officer as well	No heritage impact	Heritage impact on the façade by inserting airbricks.
Monitoring required	Yes	Yes	Yes

INTERNAL WALL LINING – OPTION 1

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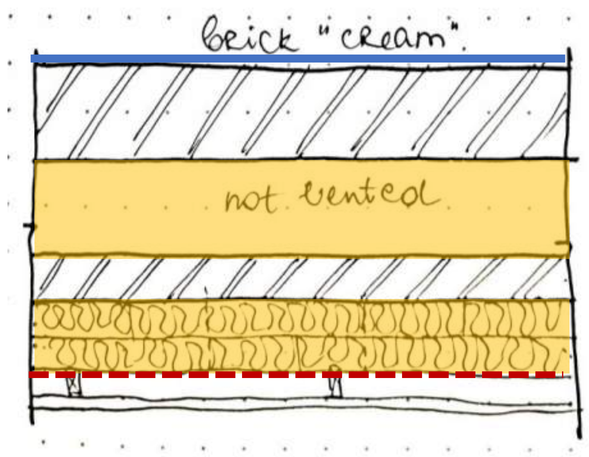


Moisture management	**Approach 1a.** Pore-lining Brick cream
Void	Can potentially be safely insulated. (EPS beads or Vermiculite). To be verified by the thermal modelling. Airbricks might still be required.
Applicable to all scenarios?	Should be safe to apply to section of the wall without the cavity. Hygrothermal modelling recommended.
Insulation	Vapour open. Potentially vapour closed too.
Airtightness	Vapour open. Potentially vapour closed too. *Example here: membrane*
Fixings	Can be a framed system however thermal bridges will need to be considered.
Service cavity	Avoid fixings into the AT layer. *Independent wall lining.* *Thermal bridging at the base and head might need to be resolved*
U-value	Less limited by the moisture risk. Walls can be upgraded significantly. *Approx. 110mm of insulation to achieve 0.35W/m^2.K* *Approx. 150mm of insulation to achieve 0.27W/m^2.K* *Or higher if the void is insulated.*

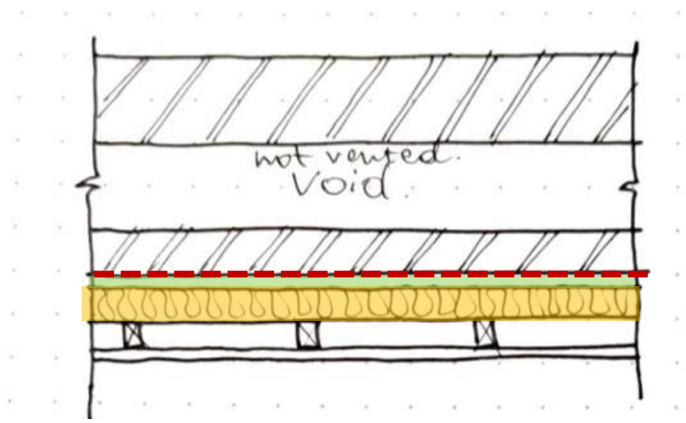
Use of Brick Cream

Water repellent creams can be applied to masonry to reduce the absorption of rain water. They are generally colourless and there is evidence that they work in practice, though not without risks. The cream must be applied completely across the whole façade without gaps leaving a weak point.

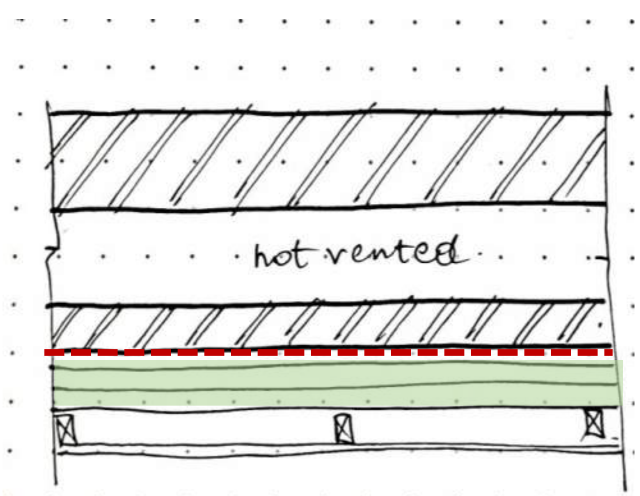
Different products have got different life spans after which they need to be reapplied. Stormdry by Safeguard has a BBA certificate which states it is effective for 25 years.

When making a decision about application of the brick cream, the Client should consider maintenance burden which comes with this approach.

INTERNAL WALL LINING – OPTION 2

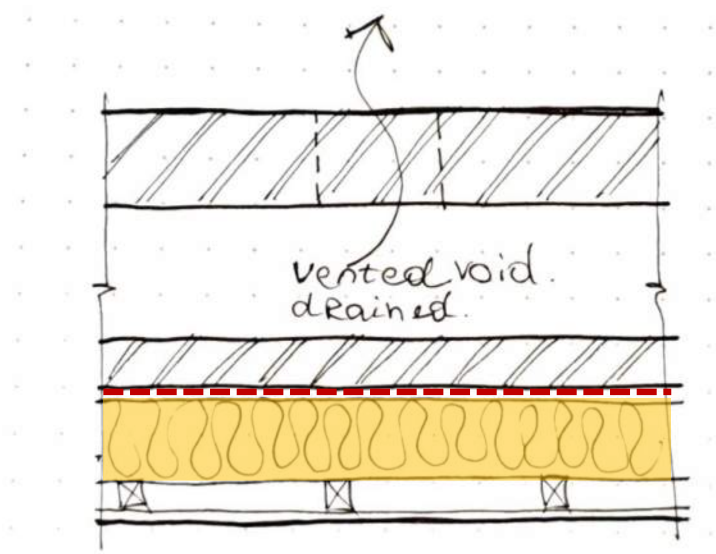


Moisture management	**Approach 2a.** Through a moisture buffering layer (Diathonite)
Void	Unlikely to be able to insulate it safely
Applicable to all scenarios?	Should be safe to apply to section of the wall without the cavity. Hygrothermal modelling recommended.
Insulation	Vapour open *Example: Diathonite & Woodfibre (75mm)*
Airtightness	Vapour open – *Example: One layer of Diathonite (25mm)*
Fixings	Avoid fixings into the AT layer. *Example: Insulation to be bonded to the wall.*
Service cavity	Avoid fixings into the AT layer. *Independent wall lining.* *Thermal bridging at the base and head might need to be resolved*
U-value	Restricted by the moisture risk. Approx. 25+75mm of insulation to achieve 0.35W/m^2.K

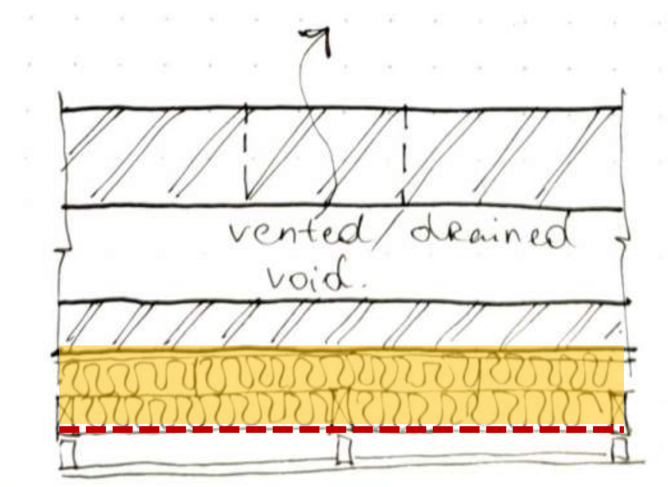


Moisture management	**Approach 2b.** Through moisture buffering layer (Calcitherm)
Void	Unlikely to be able to insulate it safely
Applicable to all scenarios?	Should be safe to apply to section of the wall without the cavity. Hygrothermal modelling recommended.
Insulation	Vapour open *Example: Calthitherm (2x50mm)*
Airtightness	Vapour open – *Example: Lime parge applied to the solid wall.*
Fixings	Avoid fixings into the AT layer. *Example: Insulation to be bonded to the wall. If two layers are required- to be bonded to each other.*
Service cavity	Avoid fixings into the AT layer. *Independent wall lining.* *Thermal bridging at the base and head might need to be resolved*
U-value	Restricted by the moisture risk. Approx. 2*50mm of insulation to achieve 0.50W/m^2.K

INTERNAL WALL LINING – OPTION 3



Moisture management approach	**Approach 3a.** Through the vented and drained cavity. Installation of airbricks will be required. 3a. Vapour open approach.
Void	Can't be insulated as it must remain vented/drained.
Applicable to all scenarios?	Could be safe to apply to section of the wall without the cavity. Hygrothermal modelling recommended.
Insulation	Vapour open *Example: Woodfibre*
Airtightness barrier	Vapour open *Example: Lime parge applied to the solid wall.*
Fixings	Avoid fixings into the AT layer. *Example: Insulation to be bonded to the wall/ adhesively fixed to the wall. If two layers are required- to be bonded to each other.*
Service cavity	Avoid fixings into the AT layer. *Independent wall lining.* *Thermal bridging at the base and head might need to be resolved*
U-value	Less limited by the moisture risk. Walls can be upgraded significantly. *Approx. 110mm of insulation to achieve 0.35W/m^2.K* *Approx. 150mm of insulation to achieve 0.27W/m^2.K*



Moisture management Approach	**Approach 3b.** Through the vented and drained cavity. Installation of airbricks will be required. 3b. Vapour closed approach.
Void	Can't be insulated as it must remain vented/drained.
Applicable to all scenarios?	Could be safe to apply to section of the wall without the cavity but is likely to be less safe than 3a. Hygrothermal modelling recommended.
Insulation	Vapour closed *Example: Mineral wool*
Airtightness	Vapour closed *Example: Membrane to the warm side of the insulation.*
Fixings	*Insulation can be mechanically fixed or fitted b/w studs.*
Service cavity	Avoid fixings into the AT layer. *Membrane protected by the service void* *Thermal bridging at the base and head might need to be resolved*
U-value	Approx. 100mm of insulation to achieve 0.35W/m^2.K Approx. 150mm of insulation to achieve 0.23W/m^2.K (subject to the thermal conductivity, timber fractions etc)

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AIRTIGHTNESS

Introduction.

A key principle of Passivhaus is to achieve excellent airtightness standards. Three key reasons are:

- to help with thermal comfort by avoiding cold drafts.
- to protect the building fabric by reducing the risk of interstitial condensation.
- to reduce the volume of warm air leaking out of the building and hence the energy needed to heat up the cold air it's replaced by.

The minimum requirement for EnerPHit is an air change rate of 1.0 (during a test at 50 pascals). For larger buildings the Passivhaus Institute recommend also achieving a *permeability* rate of 0.6 m^3/m^2hour. Permeability is a measure of the leakiness of the building in relation to its external heat loss area (HL).

Airtightness barrier must be continuous and typically should be located on the warm side of insulation.

Design Review.

We have worked with CP CPs to develop a strategic approach to achieving airtightness.

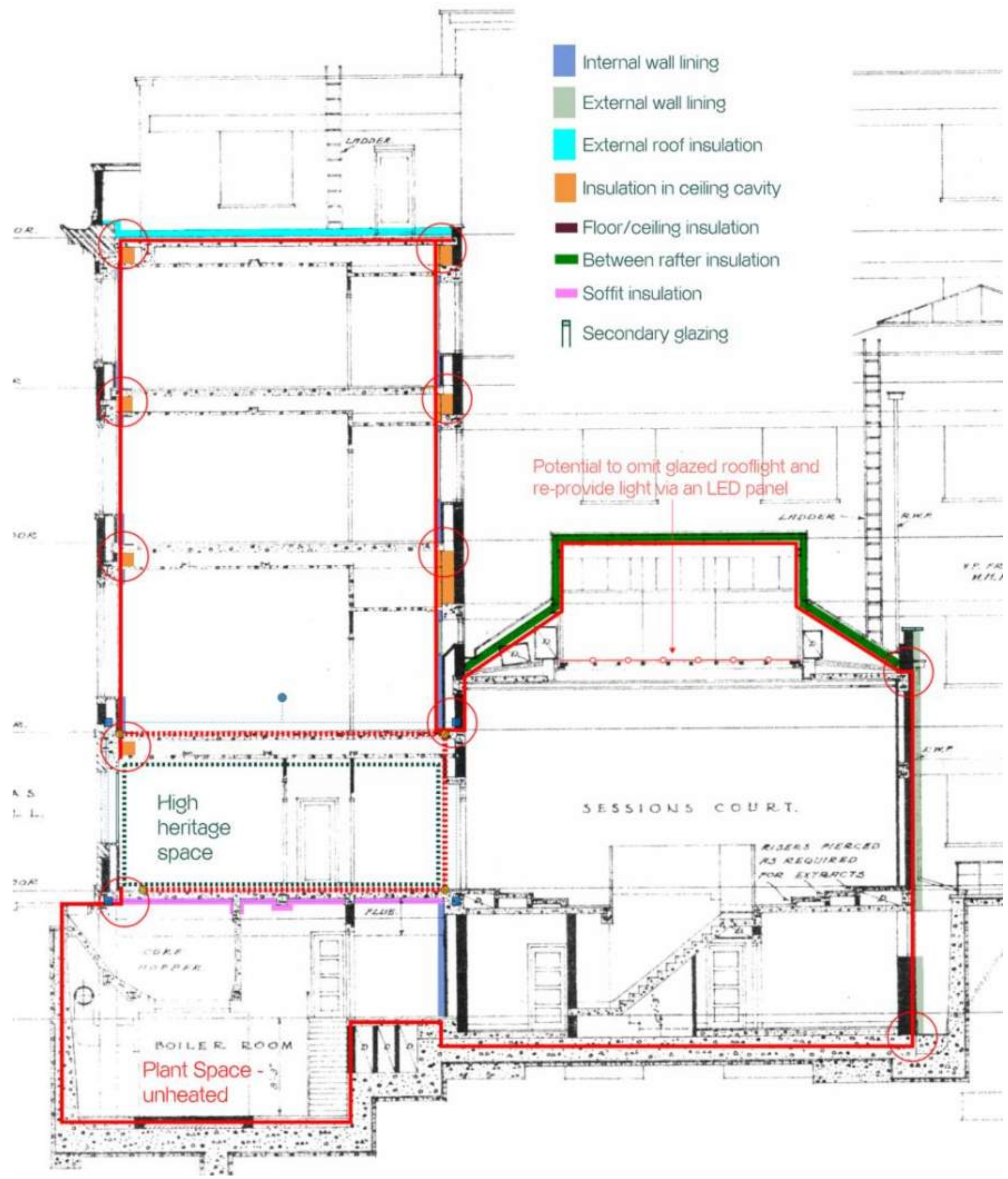
The key challenges for this project are:

- Making external walls in high heritage spaces airtight. The approaches outlined in the Wall *Options Matrix* on next page.
- Junctions with the slabs where the existing concrete might not be airtight. The mitigation strategy is to allow for remedial works in the cost plan . These might include but not limited to: removing a strip of existing flooring and ceiling along the external perimeter, providing localised infills and applying liquid airtightness membrane.

Refer to the section on the Main wall build up for airtightness barrier solutions.

Actions in Stage 3:

- Opening up works and surveys - to be scoped by CP with MF's input.
- Testing concrete for airtightness
- CP to develop a set of drawings, showing AT barrier, materials and junction details.



Conceptual AT strategy section

Airtightness barrier through external elements.

Airtightness barrier taken through internal elements to separate a high heritage space.

Key junctions to be resolved

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WALL OPTIONS MATRIX

Options	Sample products	Sketch	Application	Pros	Cons
Op.0 – No thermal or AT upgrades.	OSB for airtight plywood for temporary works		Zone B	• Will not require removing any panelling.	• Approach A: Temporary airtightness construction for 3 air tests- fiddly, expensive and doesn't benefit to the quality of the building. This approach poses higher risk to certification. • Or AT line is somewhere else in the building? • Will contribute to overheating
Op.1 -Liquid applied AT membrane.	Blowerproof, Aerosana, Passivpurple		Zone B	• Will not add to the thickness of the walls.	• Will require removing panelling • Higher risk of surface condensation in comparison to the insulated option 3. • Battens will need to be removed or taped with AT tapes.
			Zone C	• Will not add to the thickness of the walls.	• Will require removing panelling • Higher risk of surface condensation in comparison to the insulated option 3.
Op. 2- Sheet membrane (behind panelling?)	Intello, Wraptite or similar		Zone B	• Battens can remain in place.	• Will require removing panelling • Higher risk of moisture related issues • Should be vapour open
Op.3-Insulating plaster	Diathonite Or alternatives (Bauwer, Hempcrete)		Zone B	• Safest option for moisture/condensation	• Will require removing panelling • Fiddly to apply between battens • Battens will need to be taped. • Wet trade- impact on the programme
			Zone C	• Safest option for moisture/condensation	• Will add to the thickness of the wall. Detailing around skirtings, handrails, coving etc to be resolved. • Wet trade- impact on the programme
Op.4 - Sheet membrane + thin layer of insulation behind panelling	Intello/Wraptite+Aerogel/Woodfibre or a hybrid product such as Wraptherm		Zone B	• Reduced risk of surface condensation	• Will require removing panelling • Fiddly to apply • Aerogel is costly • Should be vapour open
Op.5-cavity filled with insulation+Brick cream + AT membrane internally	TBC- subject to hygrothermal modelling at Stage 3		Zone B	• Will not affect the thickness of the wall internally • Improved surface temperature	• Not compatible with Op.2 and 3 for internal lining, unless insulation cavity insulation is only installed within the limited areas. • Still require an AT layer internally and hence removal of panelling
			Zone C	• Will not affect the thickness of the wall internally • Improved surface temperature	• Not compatible with Op.2 and 3 for internal lining, unless insulation cavity insulation is only installed within the limited areas. • Still require an AT layer internally

KEY DETAILS – SLAB JUNCTION

Design review

The junction between the external wall and concrete slab present several challenges to EnerPHit certification:

- Continuity of airtightness barrier (discussed in the Airtightness Section)
- Thermal bridge due to the interrupted insulation will result in additional heat loss.
- Low surface temperature might increase the risk of condensation and mould growth and fail the thermal comfort criteria.

Thermal bridges

A thermal bridge occurs in any area where the effectiveness of the insulation layer is decreased. A conductive material penetrating the insulation or a gap in the insulation can form a 'bridge' between the inside of a building and the outside world increasing heat transfer.

Thermal bridging can account for up to 30% of a dwelling's total heat loss in highly insulated buildings.

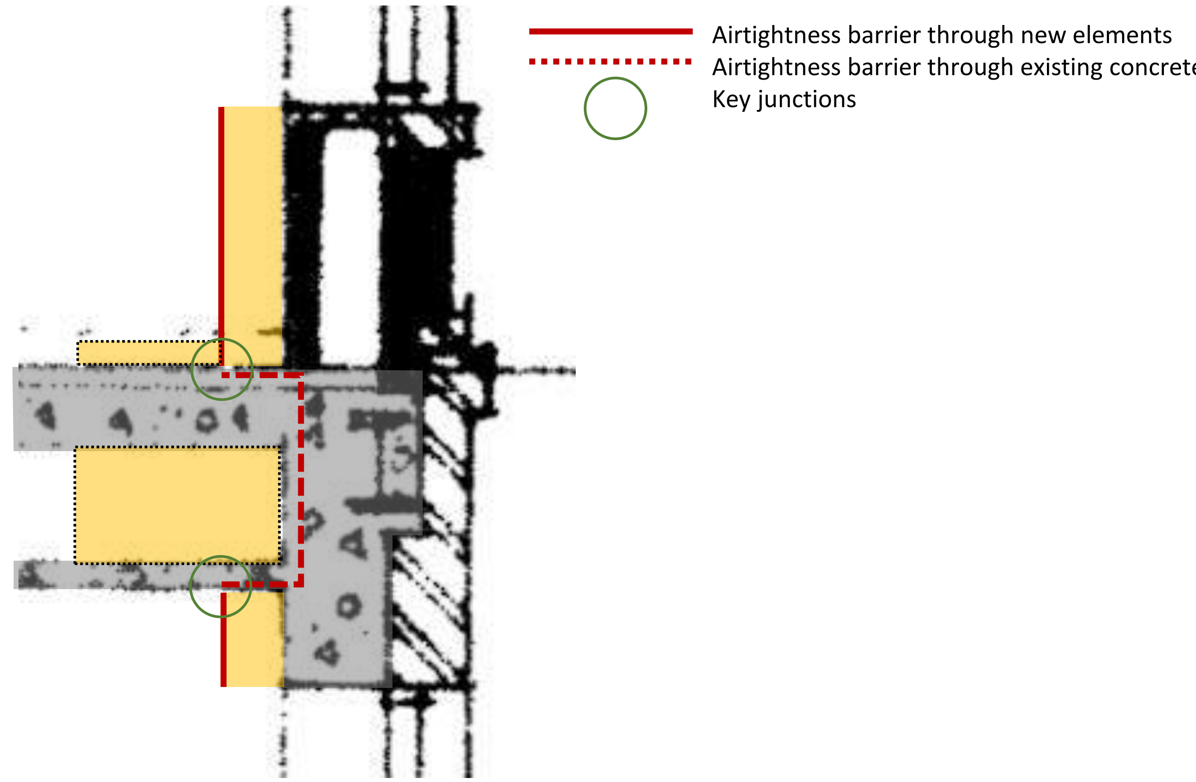
As well as increasing heat loss, poor thermal bridge design can lead to mould growth, draughts, cold spots, overheating and increased energy use.

EnerPHit Component method doesn't set a specific limit on the Heating Demand and therefore the approach to thermal bridges in this method is slightly more relaxed than in the EnerPHit Heating demand method. However, we would expect the approach to at least address the surface moisture and health risk issues, and then consider heat loss further.

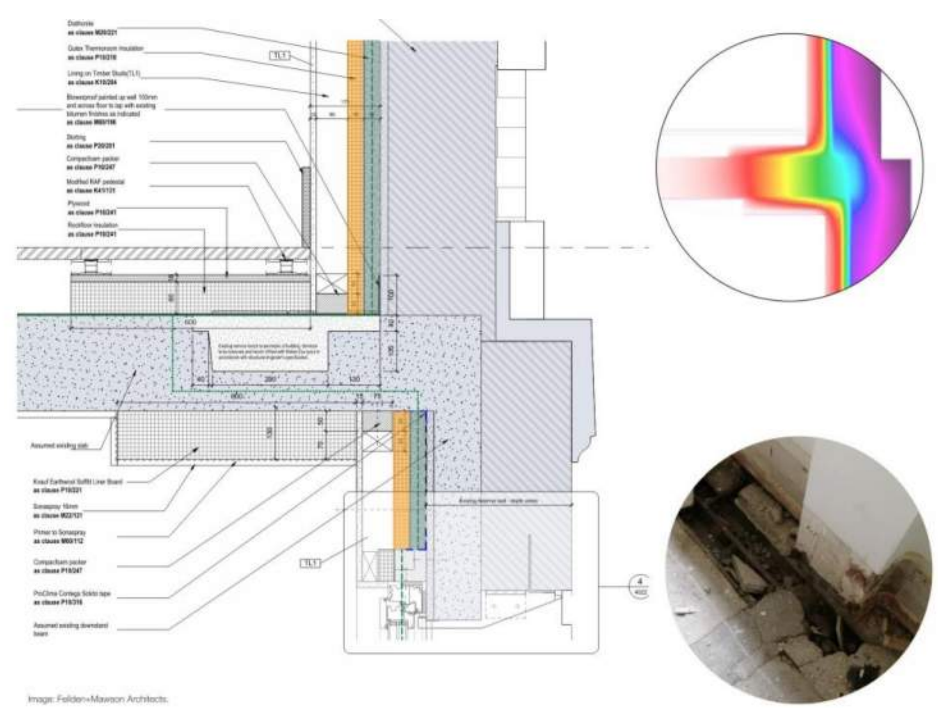
To increase the surface temperature, insulation can be installed into ceiling void and potentially to the floor, as shown in the sketch in the top right. In the bottom right there is a similar detail from Entopia Building.

Actions in Stage 3:

- Opening up works and surveys - to be scoped by CP with MF's input.
- Testing concrete for airtightness
- CP to develop a set of drawings, showing AT barrier, materials and junction details.
- Thermal bridge modelling



Guildhall Slab Junction Detail



Entopia Slab Junction Detail (Feilden & Mawson Architects)

TRANSPARENT ROOFS OVER LIGHTWELLS

Criteria
ETFE roofs will need to meet the criteria for horizontal glazing U installed 1.1 W/m².K.
Passivhaus takes into account the installation thermal bridge. Therefore, to achieve this U-value the system itself should provide a better performance. Typically to achieve Uw installed of 1.1, the U-value of the system should be 0.9 or better.

The product also should not lead to overheating while providing adequate daylight. This is achieved by balancing a g-value again VLT.

Current design
The ETFE products currently on the market are roughly equivalent to double glazing.
To provide a performance equivalent of triple glazing expected in Passivhaus, and innovative product would be required.

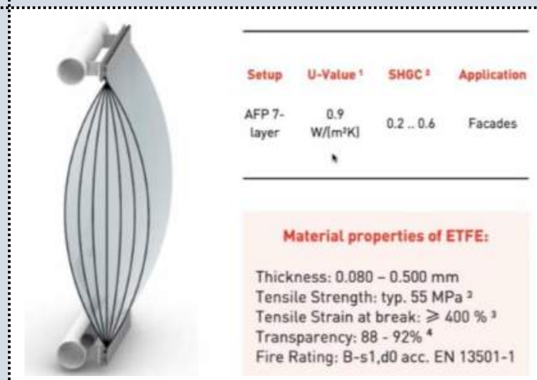
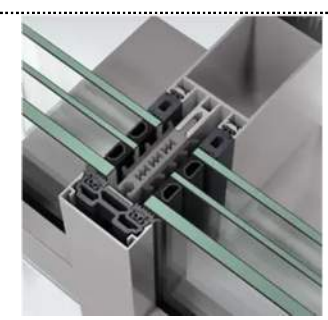
Alongside CP we have engaged with the leading manufacturer of ETFE systems Novum who would be interested in developing a solution for this project and provided a rough cost estimate. While this can become an industry innovation, this approach carries certain technological, financial and programme risks.

Below is the summary of all performance requirements for an ETFE roofs.

Actions in Stage 3:

- Obtain a more accurate cost estimate for higher-performing ETFE from Novum
- Seek comparable data and input from another ETFE supplier
- As a backup, consider triple glazing

U installed	**1.1 W/m².K**
U value of the system	*<0.9 W/m2.K*
Airtightness	*Class 4*
G-value	*Equivalent to g=0.4*
Installation detail	*Psi value 0.04 W/m.K or better*
Energy consumption	*To be minimised*
VLT	*Approx. 70%*
Longevity/warranty	*Compatible with other elements of external envelope*
Hygiene criteria	*fRsi=0.25 m²K/W*

Options	Sketch	Pros	Cons
Op.1 ETFE – innovative solution		• Lightweight • Can be an innovative product	• Technological risk (that the solution that meets the parameters can be developed) • Programme risk • Cost uncertainty
Op.2 Triple glazing		• Established solutions that work • Cost certainty • Can achieve a good quality daylight in the atriums	• Heavier system- structural impact

WINDOWS

Criteria

In EnerPHit Component method windows must achieve an average installed U-value **Uw installed** =0.85W/m².K. This Uw installed takes into account installation thermal bridges and will be higher than Uw of the window itself (the value provided by manufacturers).

Design review

To achieve this criteria well-performing triple glazed unit with max U= 0.85W/m².K of better will need to be installed as secondary glazing. Examples of such windows are given in the table below. The windows have been graded by how likely they are to meet the EnerPHit Component Criteria **Uw installed.**

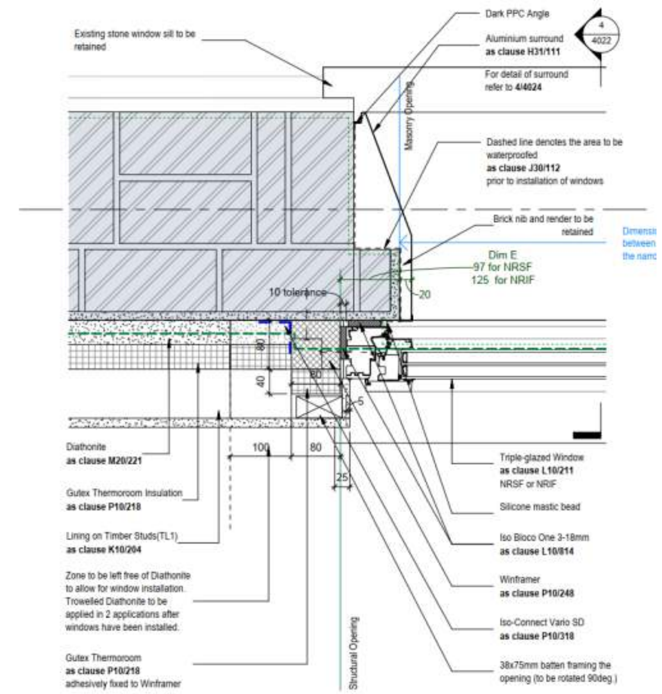
- Unlikely to meet
- May meet
- Data not available

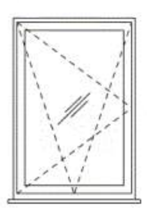
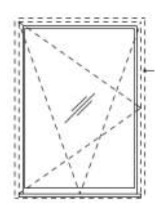
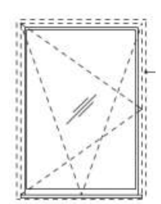
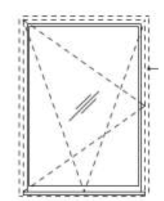
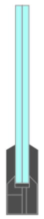
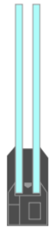
U-values given in the table are approximate values from the manufacturers marketing information. All values will need to be verified for actual window sizes when detailed information on frame and glazing is available.

Special attention will need to be given to an installation detail. Aligning windows with internal insulation and carefully detailing fixings can minimise the thermal bridge. The detail on the right is an example of thermally efficient detail.

Vacuum double glazing can be an alternative to triple glazed secondary glazing. It has a relatively high cost and therefore not currently expected to be used throughout the project, but might be a useful solution in high value heritage spaces.

Where secondary glazing is installed, it is not required to upgrade or draught-proof existing windows for EnerPHit compliance.



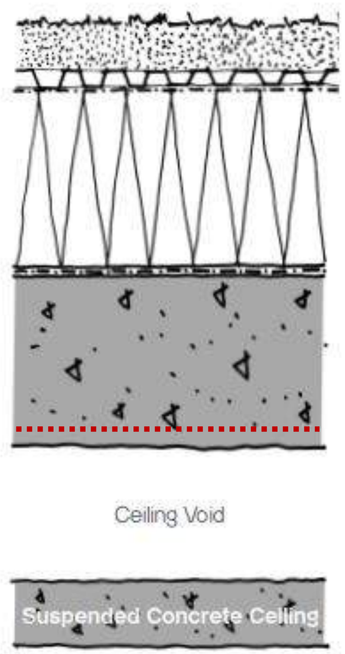
Type of Window	Triple glazed Tilt & Turn	Triple glazed Inward recessed frame	Triple glazed Inward recessed frame	Triple glazed Inward recessed frame	Ecospheric (with Transoms)	Vacuum double-glazing	Secondary double-glazing
Image							
Example product	**Green Building Store Ultra**	**Slavona Progression**	**Internorm HF 410**	**Batimet TA35 SE IN**	**SW14**	**Fineo vacuum glazing retrofitted into existing or new timber sashes.**	**Histoglass D10 – putty fronted insulating glass units**
Website	Tilt & turn window triple glazed timber Green Building Store	Passivhaus certified windows Green Building Store	Timber/aluminium windows HF 410 | Internorm GB	batimet - Wood-Aluminium | Window | TA35 SE FVNG	SW14 Passive House Window (triple glazed) | ecospheric	CPs | Fineo by AGC (fineoglass.eu)	d10-thin-double-glazing - Histoglass
Typical Uw-value	Uw = 0.76 W/m²K	Uw = 0.69 W/m²K	Uw = 0.76 W/m²K	Uw = 0.71 W/m²K	Uw=0.63 W/m²K (1.23 x 1.48 m opening standard window)	Ug=0.7 W/m2.K Fineo Hybrid Ug=0.4-0.5W/m2.K	Ug=1.9 W/m²K
Reference project and notes	Considered for CISL	Originally specified for CISL	Installed at CISL	Considered for CISL	Zetland Passivhaus	Specified on MF decarbonisation projects	Trinity College New Court

BASEMENT AND ROOF BUILT-UPS

Roofs
The requirement for the roof U-value of 0.15 W/m².K can be met by the buildups proposed by the CPA at the feasibility stage (shown on the right).
The airtightness barrier should be located on the warm side of insulation. In case of the flat roof existing concrete can perform this function (subject to its condition).

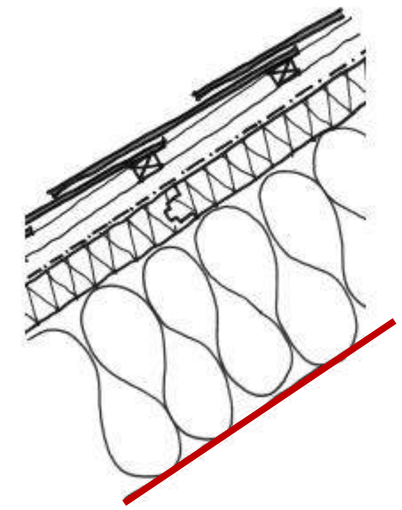
If there is no access to the rafters from inside, an airtight membrane might need to be wrapped around the rafters prior to the installation of insulation.

Basement
The EnerPHit Component limits the overall heat loss through the elements in contact with the ground.
This limit can be met with the following U-values
- Basement floor- 0.26W/m².K (which can be achieved with 80mm of PIR with thermal conductivity 0.021 W/m.K)
- Basement walls - 0.32 W/m².K (which can be achieved with 100mm of Mineral wool with thermal conductivity 0.035 W/m.K



Proposed
Our advise would be to remove the existing roof system and install a hot applied polymer modified bitumen waterproofing system, such as Alumasc Hydrotech. 200mm of high performance insulation would then be installed, thinner areas may be required adjacent to parapets. To improve biodiversity on site we are proposing installing a Biosolar green roof in combination with the photovoltaic panels.

U-value: 0.13 W/m2K



Proposed
To improve the air tightness and thermal efficiency of the roofs all tiles, membrane and sarking boards would be removed.

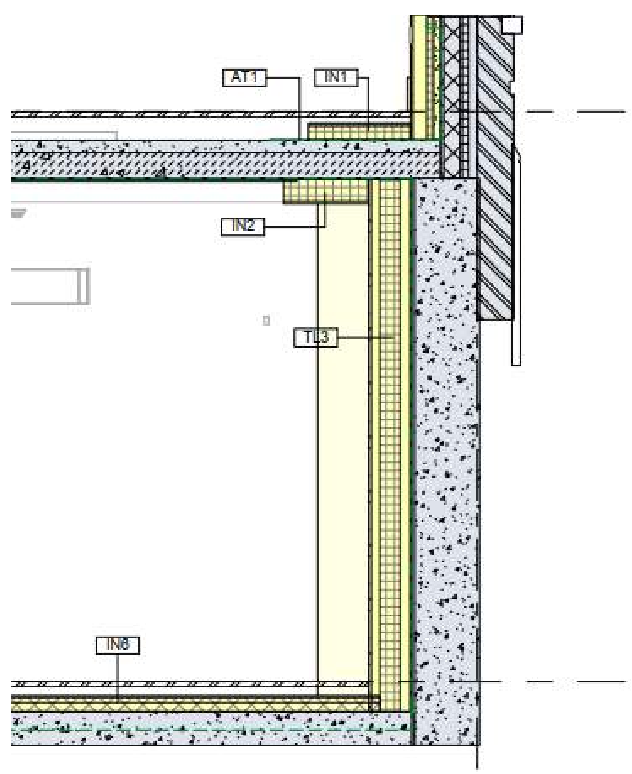
The sarking board would be replaced with an insulated sarking panel, above this an airtight vapour permeable membrane would be installed. Insulation would be installed between rafters, 240mm currently proposed.

New battens and counter battens would carry photovoltaic slates where possible. The existing slates, those in good condition, would then be re-installed.

U-value: 0.13 W/m2K

Cartwright Pickard's Feasibility Study Details

Airtightness barrier through new elements
Airtightness barrier through existing concrete
Key junctions



Example of Basement Upgrade from Entopia (Feilden & Mawson Architects)

Actions in Stage 3:
- Opening up works and surveys of the basement and roofs - to be scoped by CP with MF's input.
- Develop details to include interfaces and make sure thermal performance and airtightness can be achieved

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VENTILATION

Ventilation- Key Principles

Offices typically have high peak occupancy, and can also have a high typical (diversified) occupancy. Providing good air quality is a key part of creating an enjoyable and healthy building, and is also necessary for achieving Passivhaus certification.

On Passivhaus projects mechanical ventilation with heat recovery (MVHR) is used to provide reliable low-energy ventilation. Fans drive the air past a heat exchanger, which uses the heat from the outgoing stale air to pre-warm the fresh air being brought in to the building.

Ventilation units should be certified by the Passivhaus Institute – there are online catalogues at https://database.passivehouse.com/en/Component/. These units should be used to inform plant space allowances. It's clear this has been considered in the perimeter office ventilation design, including a decentralised ventilation option using Passivhaus certified units.

To limit both the air flow rate and the cost of equipment, a common approach for Passivhaus buildings, including offices, is to use a cascade ventilation system:

- Fresh air is supplied in to offices and some other spaces
- Passive transfer paths allow the air to move into corridors, circulation spaces etc.
- From there the air moves, again by passive transfer paths, into spaces that require extract ventilation, such as toilets, cleaners cupboards, and store rooms.
- The air is then extracted back through the ventilation unit

This avoids the doubling up on equipment and energy use that would happen if each space was ventilated independently.

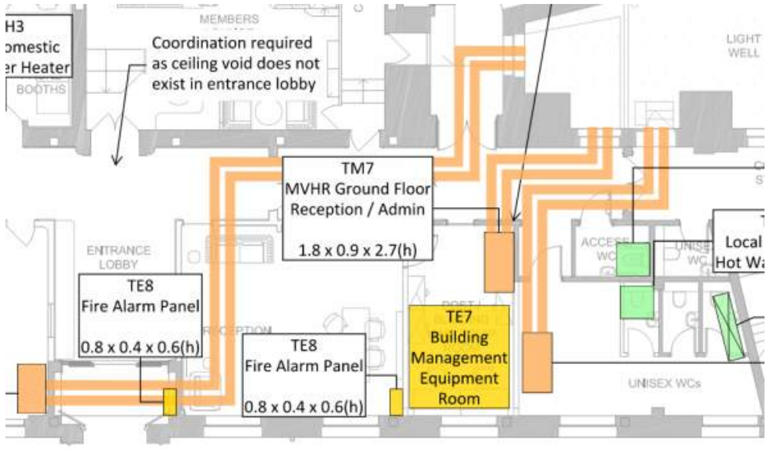
There are some key considerations with this sort of system, including:

- The most efficient ventilation units can reduce the ventilation heat loss by 70% compared to a standard unit, but there needs to be enough space for them.
- Ventilation ductwork needs to be fairly large to limit the power needed to move the air around.
- The ventilation unit should be near the thermal line of the building, to minimise heat loss from the ductwork.

Ventilation- Design Review

The systems serving spaces in the building need to respond to both the peak expected occupancy, and to typical occupancies. From our initial modelling the ventilation heat loss is the second largest heat loss for the building, and so worthy of detailed consideration. Alongside the system design, we want to ensure we understand the building occupancy patterns that the systems will be responding to. We expect this to be a key early RIBA 3 activity, including client workshop(s).

Due to the historical fabric constraints, there are a number of units with very long intake and exhaust ducts. From a thermal perspective this presents a challenge, as the air in these ducts is cold, and draws heat from the building en route to the ventilation unit, reducing the overall heat recovery efficiency. In stage 3 we will be working with the team to rationalise the design as much as reasonably possible.



Snapshot showing long duct runs.

Actions in Stage 3:

- CP and PH team to work with the Client to establish occupancy/ expected usage profiles
- MF M&E & CP to rationalise lengths of ducts as much as possible.
- MF PH Identify minimum heat recovery efficiencies of the MVHR units and requirements for the duct insulation.
- MF M&E, Cost consultant to specify PH certified units only

SUMMER COMFORT

Summer Comfort - Key Principles

Passivhaus certification requires excellent thermal performance both in winter and summer. There is a Passivhaus metric for summer comfort which will need to be met for the naturally ventilated offices. Where mechanical cooling is provided in the design, the annual cooling demand metric (the amount of active cooling required to keep the building comfortable) becomes the key driver.

It is still important to consider passive measures in the design, for both naturally ventilated spaces, ones with a hybrid approach, and those which are purely mechanically cooled.

The Diagram below explains the Cooling Balance of the building and the most effective strategies are those that reduce Solar and unwanted internal heat gains.

Design Review

While some of the most effective measures such as optimised orientation and glazing ratio are not possible due to the existing building fabric, the focus of the Stage 3 design should be on the following passive measures:

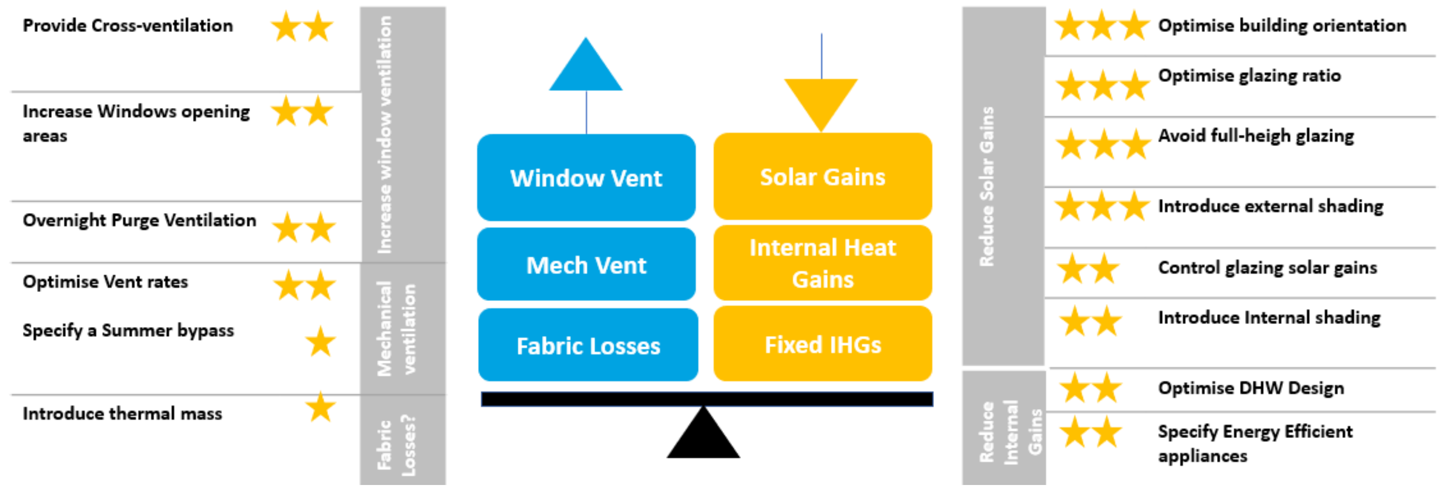
- Introducing Internal shading where possible
- Controlling glazing solar gains
- Designing efficient Hot Water systems
- Specifying energy efficient appliances
- Designing effective natural ventilation
- Retaining access to thermal mass where possible.

Dynamic Thermal modelling

PHI recommends that a dynamic thermal modelling is carried out on complex projects. Most of the certifiers who we work with request it as well.

There are 9 climate files- please see the Table on the right.

- For PH compliance -To be clarified with the certifier. Typically, we have seen certifiers to request modelling to Near Future (DSY1, DSY2, DSY3)
- Some clients would like to futureproof their buildings and request testing to medium future.



Cooling Balance Diagram.

Options	Current weather 2020s:2011-2040			Near Future 2050s: 2041-2070			Medium future 2080s:2071-2100		
	DSY 1	DSY 2	DSY 3	DSY 1	DSY 2	DSY 3	DSY 1	DSY 2	DSY 3
1) Minimum compliance Compliance with Approved Document O to the Building Regulations dynamic method (minimum legal requirement), using all the assumptions mandatory within that assessment	●								
2) Robust for current weather Compliance with ADO dynamic method for 2020s DSY 1, 2, & 3	●	●	●						
3) Near-term future proofing Compliance with ADO dynamic method for 2050s DSY 1, 2, & 3, with amended assumptions	●	●	●	●	●	●			
4) Future-proofed Compliance with ADO for 2080s DSY 1, 2, & 3, (with amended assumptions as above) or have an identified route to achieving compliance	●	●	●	●	●	●	●	●	●

Weather Files Matrix.

Actions in Stage 3:

- CP and PH team to work with client to establish occupancy/ expected usage profiles and provide a brief for cooling
- Cooling strategies to be developed by the design team.
- Dynamic thermal modelling to TM52 to be commissioned and carried out to climate files agreed with the Client.
- PH team to carry out cooling model within PHPP.

TOTAL ENERGY USE – 'PER'

The Passivhaus total energy metric (PER) includes all energy uses within the building, both regulated and unregulated. This is often challenging for office and higher education buildings, and requires support from both the design team and client.

The images to the right show some appliances which can have significant energy use – clockwise from top left:

- Lighting
- IT equipment, particularly servers
- Pumps, fans etc

Some of these items are within the control of the design team, some are decided or provided by the client.

Some of the ancillary MEP systems on previous Passivhaus projects have had surprisingly large energy uses, and these become proportionately more significant as the overall energy use drops.

Often at an early stage in the project, it's not possible to know exactly what equipment will be used. To help the design progress, we advocate agreeing some high-level energy budgets for the different energy-consuming systems and equipment within the building. For example, the client might commit to providing all of the IT equipment, interactive whiteboards etc, and to them consuming less than an agreed number of kWh/a, based on an agreed realistic pattern of operation.

ICT Equipment

- If in-building servers etc are required, we suggest making use of free cooling when it's available. One approach to this is by positioning the server rooms at a façade, and using a local ventilation unit (without heat recovery) which runs controlled by the room temperature.
- We suggest agreeing sensible permissible room temperatures to avoid excessive energy use.
- We'd recommend minimising energy demand from the ICT equipment. Some studies show following a thin client approach reduces energy use at a client building but also, overall, both the building and the data centre combined.

We will work with the design team to help achieve Passivhaus Certification:

- Liaise with the MEP team to understand the energy use from the equipment proposed as well as guiding the design to optimise energy use.
- Engage with the CP to ensure sanitary items are proposed which consider the hot water use.
- Agree an energy 'budget' with the client to encourage the use of energy-efficient items.

Next steps required

- Early in RIBA 3, agree energy budgets for the key pieces of equipment and systems within the building, and who's going to take responsibility for delivering to them.
- ICT equipment can be energy intensive. Choose efficient technology, agree on sensible permissible room temperatures and make use of free cooling when available.

ENERGY MODELLING RESULTS & NET ZERO

The graph on the right compares the operational energy of the proposed design – Current Design and Further Improvements – against the existing building, the Pilot version of the Net Zero Building Carbon Standard, published at the end of September 2024 and The Entopia Building.

We have modelled two scenarios:

- "Current Design- EnerPHit": A more conservative scenario in which high heritage fabric (Zones A, B, & C) is assumed to remain uninsulated.
- "Further Improvements- EnerPHit + upgraded heritage fabric": A scenario in which some insulation is allowed for high heritage walls, in accordance with the options outlined in this report.

The Pilot NZCB Standard sets operational energy limits that will gradually decrease over time. Targets are differentiated based on new builds, retrofits conducted "in one go," step-by-step retrofits, as well as by various building typologies. The Guildhall has been benchmarked against the targets for retrofit "in one go" for general office buildings.

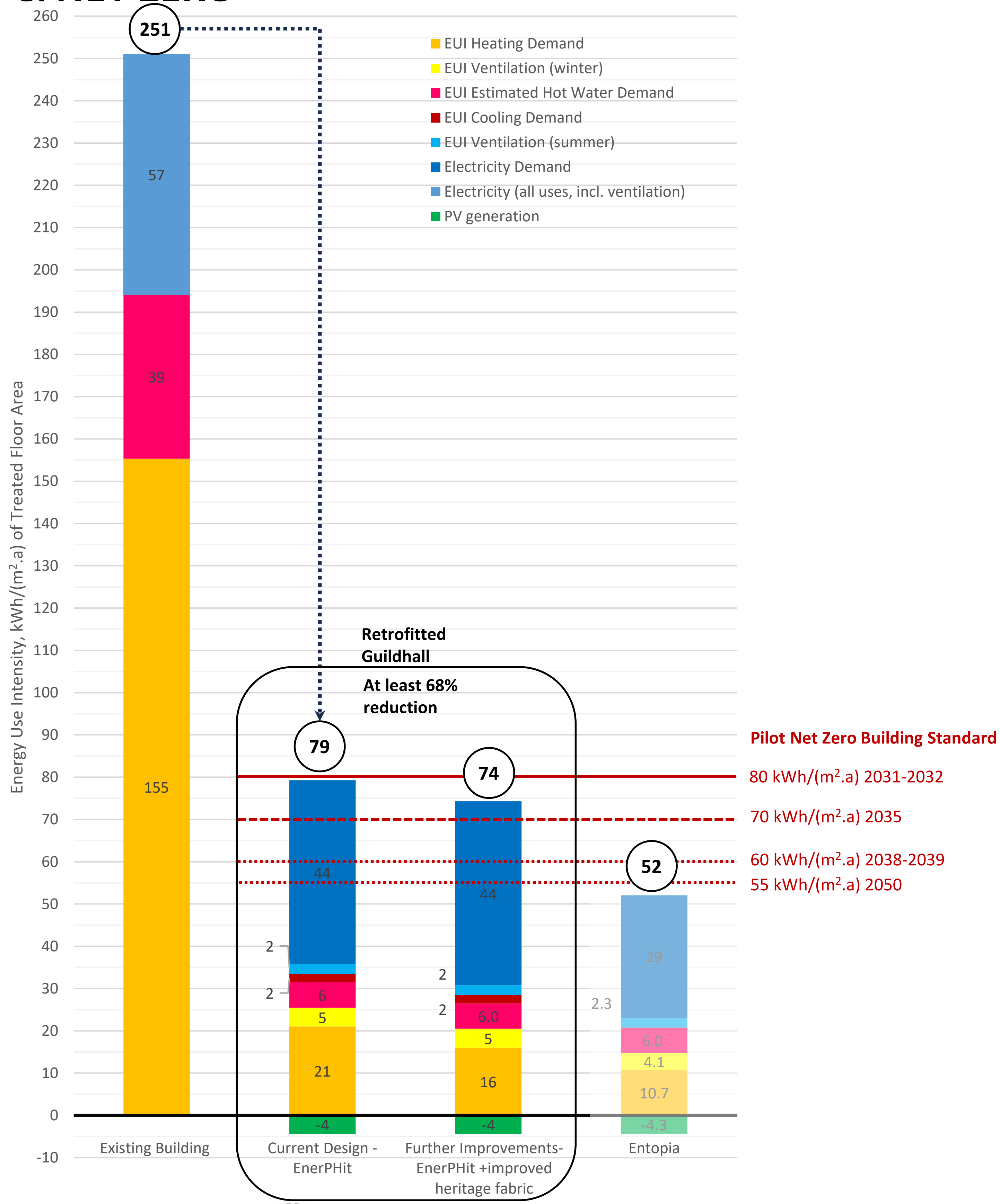
As the saying goes, "All models are wrong, but some are useful." There is an inherent degree of uncertainty in any modelling involving multiple variables. Therefore, at this early stage of the design process, these modelling results should be viewed as a tool for comparing options and guiding the design rather than as an accurate prediction of the final performance.

The current Base Case meets the operational energy limit for 2031-2032 (80 kWh/m^2.a), while the Improved Case may aim for the 2035 target (70 kWh/m2.a). The office building targets have been slightly relaxed in the Pilot NZC Standard compared to previous industry benchmarks. Therefore, we propose to set 2035 as an aspirational target while designating 2031-2032 target as a backstop.

In the retrofitted building, operational energy demand is expected to be primarily driven by general electricity use associated with lighting, ICT and office equipment, appliances, and building systems (e.g., access control, servers, and data storage). At this stage, it is not possible to model this electricity use accurately, as building occupancy and utilization have not yet been defined. However, benchmarks from Entopia and other retrofitted office buildings provide a useful starting point for establishing a preliminary energy budget, expected to be (29-44 kWh/m^2.a).

Energy demand for space heating will be significantly reduced by improving the building fabric and installing low-carbon heating through air source heat pumps. Nonetheless, it is anticipated that space heating will still be the second largest contributor to energy consumption.

Other energy uses, such as hot water, ventilation, and cooling, are based on benchmarks from the Entopia building. **Continues on next page->**



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ENERGY MODELLING RESULTS & NET ZERO

Continues from previous page.

The additional graphs on the right clearly demonstrate that this measure would be highly effective in reducing space heating demand and the corresponding Energy Use Intensity (EUI). Therefore, it should be given proper consideration in Stage 3.

The existing building has been modelled using pre-pandemic energy bills and the Display Energy Certificate (DEC). Space heating demand accounts for 80% of the overall gas demand, while hot water accounts for the remaining 20%.

It is predicted that overall energy use in the building post-retrofit will improve by at least 68% and energy for heating –by 86%, which would be a commendable achievement. Please note that the retrofitted building is expected to have a significantly higher occupancy than the existing one, meaning that if energy use is calculated per occupant, the reduction is likely to be even greater.

Specific Heating Demand (SHD)

As explained in the Introduction, Specific Heating Demand is not a certification criterion in itself under the EnerPHit Component Method. However, since it is the second largest energy use in the building, it should be reduced as much as possible. It is also useful to compare the estimated SHD with industry benchmarks, such as the LETI Retrofit targets.

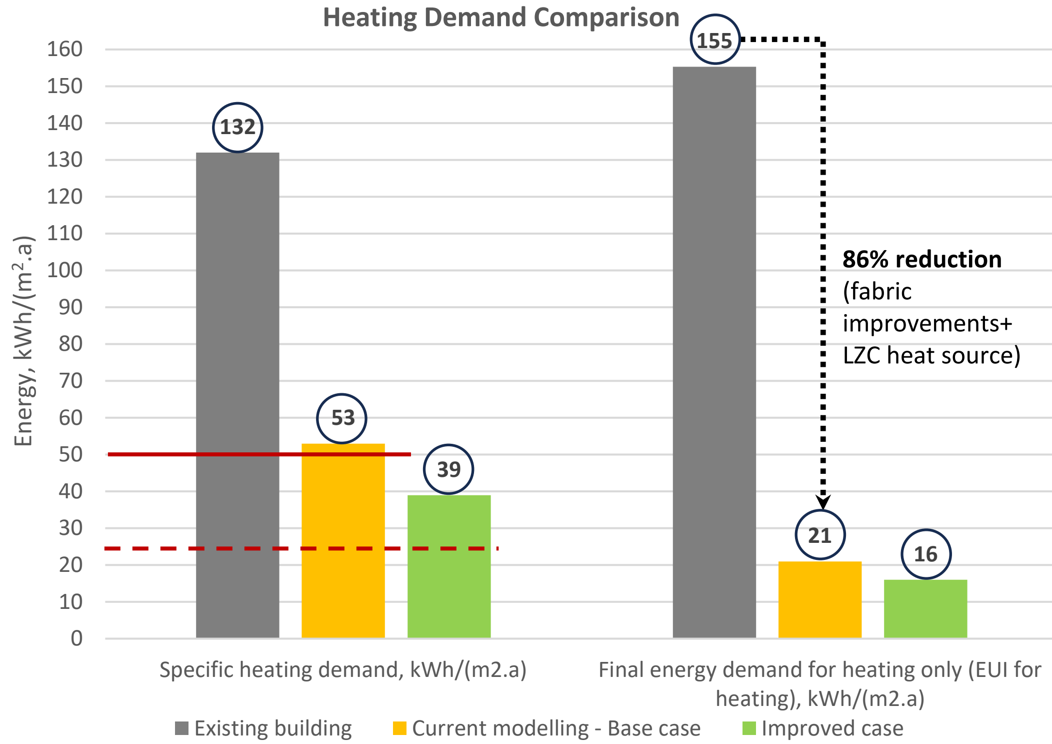
The SHD of the Base Case (53kWh/m^2.a) is just slightly above the Best Practice target and is consistent with the constrained retrofit target.

In Passivhaus methodology, SHD is calculated as the sum of all losses minus the sum of all gains, which can be visualized in a “Heating Energy Balance Graphs” on the right.

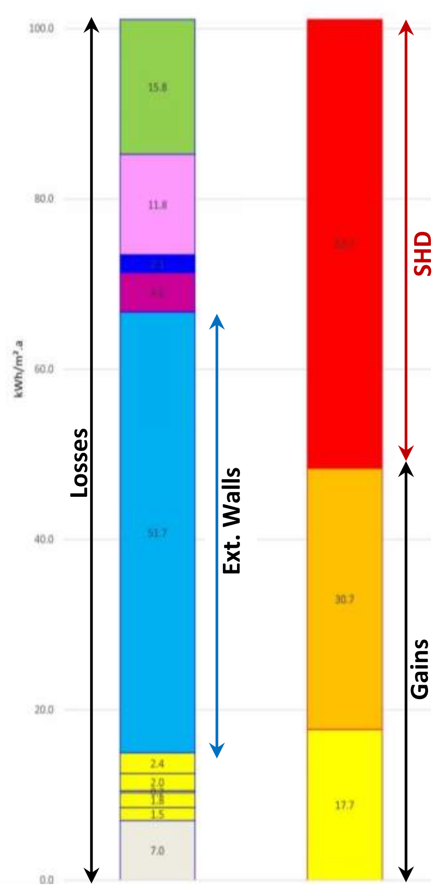
Losses include all heat losses through opaque elements, windows, thermal bridges, ventilation, and air infiltration, while gains include solar gains through windows and internal heat contributions from people and equipment.

The key design principle is to minimize losses while optimizing “useful” gains. As long as gains (solar and internal) do not lead to overheating, they can be beneficial in reducing overall energy demand.

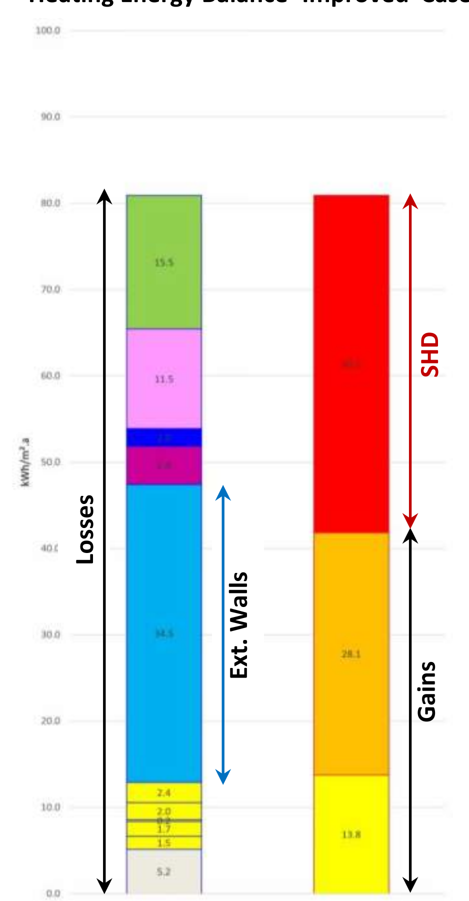
The Heating Balance for the Guildhall’s Base Case reveals that ambient solid walls are the largest contributors to the building's heat loss, even with internal wall linings applied to all low-heritage-value spaces. Therefore, insulating high-heritage spaces would be the most effective way to reduce heating demand, as demonstrated in the Improved Case. Additionally, optimizing ventilation and addressing thermal bridges could yield further savings on heating demand that can be explored in Stage 3.

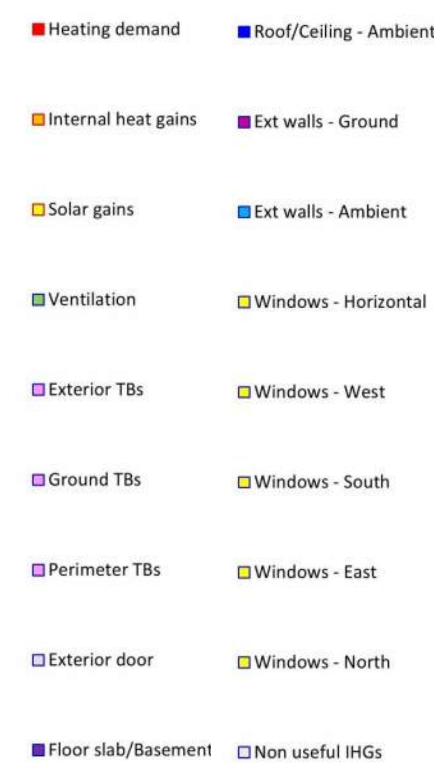


Heating Energy Balance- Base Case.



Heating Energy Balance- Improved Case.





J7562 - GUILDHALL - ENERPHIT RISK TRACKER

MAX FORDHAM

Ref	Aspect	Description	Impact	Mitigation Measures	Primary Owner	Status
001	**Airtightness**	Existing concrete might not be suitable to act as an airtightness barrier.	The continuity of the airtight barrier at the slab junction would be jeopardised. Risk to achieving certification limit for air leakage at 1ach@50Pa	At Stage 2: allow for remedial works in the cost plan . These might include but not limited to: • removing a strip of existing flooring and ceiling along the external perimeter. • Providing localised infills • Applying liquid airtightness membrane At Stage 3: • Opening up works to establish condition of concrete. • Airtightness concrete testing.	CPA MF:PH	Open
002	**Airtightness**	It might not be feasible to make the heritage walls airtight.	Risk to achieving certification limit for air leakage at 1ach@50Pa	At Stage 2 - two options explored: A. Providing temporary airtight barriers (e.g. OSB or Smartply) for airtightness testing purposes. B. Providing a continuous airtightness barrier through internal elements to exclude high heritage spaces from testing. At stage 3: • Opening up works • Agreeing the strategy with the certifier (to be appointed) • Developing testing methodology	CPA MF:PH	Open
003	**Internal wall insulation**	The design of Internal wall insulation build up must address moisture risk and consider other constraints.	Moisture risk is inherent to all internal insulation solutions. If not addressed, it can lead to damp, mould and poor internal air quality. Currently preferred Option 3 (drained and vented cavity) might not be acceptable due to the heritage risk of installing air bricks into the existing façade) Option 2 (application of insulating plaster) has got highest cost and programme implications. Option 1 (application of brick cream) will require a future maintenance regime.	At Stage 2 three conceptual options were explored and qualitatively assessed. Stage 3 • Hygrothermal modelling to be carried out to quantify the risk of the preferred options. • CP to engage with the planning officers regarding the heritage impact of Option 3. • Pros and cons of each option to be communicated to the Client. • Strategy for managing residual moisture risk (e.g. moisture monitoring) to be developed.	CPA MF:PH	Open
004	**ETFE**	Conventional ETFE products available on the market are equivalent to double glazing. EnerPHit requires levels of performance of triple glazing. The manufacturer Novum might be able to develop an innovative product which meets the performance criteria. This option will have some technological, programme and cost risks.	Stage 3 Design might be developed around a product that: • Does not yet exist on the market and might not be delivered technically • Relies on a single manufacturer (Novum) • Might take longer to develop and test than originally planned. • Might contribute to overheating in the summer or reduce the quality of daylight to office spaces.	At Stage 2 allow for the risks of ETFE in the cost plan. At Stage 3: • Consider triple glazing option as an alternative. It can provide design and cost certainty. • Seek an opinion from another ETFE manufacturer regarding the feasibility of an innovative product.	CPA	Open
005	**Basement floor insulation**	Basement floor will need to be insulated to comply with EnerPHit criteria.	Condition of the basement and design impact are currently not properly understood. Modifications to the stairs/ doors might be required to account for the raised floor level.	At Stage 2- allow for the cost of approx. 80mm of PIR and raised access/ screeded floor. • At Stage 3: basement condition survey and scoping. • Detailing	CPA	Open

J7562 - GUILDHALL - ENERPHIT RISK TRACKER

MAX FORDHAM

Ref	Aspect	Description	Impact	Mitigation Measures	Primary Owner	Status
006	**PER - overall energy use**	Client items such as office equipment, appliances, AV, ICT, servers and data cabinets etc. can have a very high energy use.	Unless carefully managed, energy consumption can exceed the EnerPHit overall Energy use (PER) and EUI Net Zero targets.	Stage 3 • MP PH to establish "energy budgets" for specific energy uses. • The Client to procure equipment within the specified budgets. • The targets for the contractor supplied and installed items to be incorporated into the Tender documents.	Client MF M&E MF PH CPA	Open
007	**Summer comfort and overheating**	Overheating risk to be quantified and summer comfort strategy yet to be developed	Active cooling can contribute significantly to the overall energy use- risk to achieving PER criteria.	Stage 3 • The Client to provide information about the occupancy/ expected usage profiles and provide a brief for cooling. • Cooling strategies to be developed by the design team. • Dynamic thermal modelling to TM52 to be commissioned and carried out • PH team to carry out cooling model within PHPP.	Client MF M&E MF PH CPA	Open
008	**Ventilation heat recovery rate**	Long intake and exhaust ducts are necessitated by the heritage constraints but have a detrimental effect on the heat recovery rates.	Vent systems might not achieve the min certification limit of 75%.	Stage 2 Review of the systems being carried out. Stage 3: • Rationalise lengths of ducts as much as possible. • Identify minimum heat recovery efficiencies of the MVHR units and requirements for the duct insulation • Only PH certified units to be specified.	MF M&E MF PH CPA	Open
009	**Thermal bridging**	Thermal bridging at floor slabs is likely to be significant	Risk to the Thermal comfort and Moisture criteria (low temperature and condensation/mould risk).	Stage 3 • Opening up works to establish condition of the ceiling void • Identify and test improvement options • Separate assessment for Part C might be required (not within MF's standard scope).	CPA MF PH	Open
010	**Thermal Comfort Moisture Risk**	Walls that have been made airtight but not thermally improved	Low surface temperature and risk of condensation/mould growth	Stage 3 • Thermal and hygrothermal modelling at stage 3 • Potential exemption from the criteria due to heritage constraints or mitigation measures – to be agreed with the certifier once appointed.	MF PH CPA	Open
011	**Passivhaus Certifier**	Not yet appointed	Heritage exemptions strategy to be approved by the certifier. If appointed too late, the design could progress so far that rectification would prove difficult, or impossible and at worst risk Passivhaus certification	Stage 3 • Appoint Passivhaus Certifier	Client	Open

SCHEDULE OF PARAMETERS - PAGE 1 OF 3

Parameters	Passivhaus Enerphit Component Certification Criteria (Cold Temperate Climate)	Design Impact and Comments. All products are given for illustration purposes only, not as a final specification
Existing Exterior Wall with internal wall lining (ambient walls)	U-value <0.35 W/m².K	• U value = 0.343 W/m².K (80mm of insulation with thermal conductivity of 0.040 W/m.K) - 09ud in PHPP. • The criteria must be complied with for the entire building at least as an average area-weighted value. • All proposed solutions must effectively mitigate the moisture risk.
Existing Exterior Wall Zone A	Exemption	• Assumed existing U-value= 1.48 W/m².K – 10ud in PHPP. • High heritage value – stone cladding/ornate features, no internal upgrades expected.
Existing Exterior Wall Zone B	Exemption	• Assumed existing U-value= 1.48 W/m².K – 10ud in PHPP. • High heritage value – timber panelling, possible improvements for airtightness/thermal performance.
Existing Exterior Wall Zone C	Exemption	• Assumed existing U-value= 1.48 W/m².K – 10ud in PHPP. • Medium heritage value – limited features however has restrictions on width, again possible improvements for airtightness and thermal performance.
Existing Exterior Wall Zone D	U-value <0.15 W/m².K	• U-value = 0.148 W/m².K (220mm of insulation with thermal conductivity of 0.035 W/m.K) – 11ud in PHPP. • High heritage value – no internal upgrades but potential for external insulation.
Existing flat roof U-value	U-value <0.15 W/m².K	• Rigid insulation in minimum of two layers, joints staggered. • U-value = 0.152 W/m².K (220mm of insulation with thermal conductivity of 0.035 W/m.K).
Existing pitched roof U-value	U-value <0.15 W/m².K	• U-value = 0.14 W/m².K (240mm of insulation with thermal conductivity of 0.034 W/m.K). • Assumed timber fraction 25%
Basement Floor U-value	U-value <= limit calculated in PHPP to achieve optimal balance.	• U-value = 0.26 W/m².K (80mm insulation with thermal conductivity of 0.021 W/m.K)
Basement Wall U-value	U-value <= limit calculated in PHPP to achieve optimal balance.	U-value = 0.324 W/m².K (100mm insulation with thermal conductivity of 0.035 W/m.K).

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SCHEDULE OF PARAMETERS - PAGE 2 OF 3

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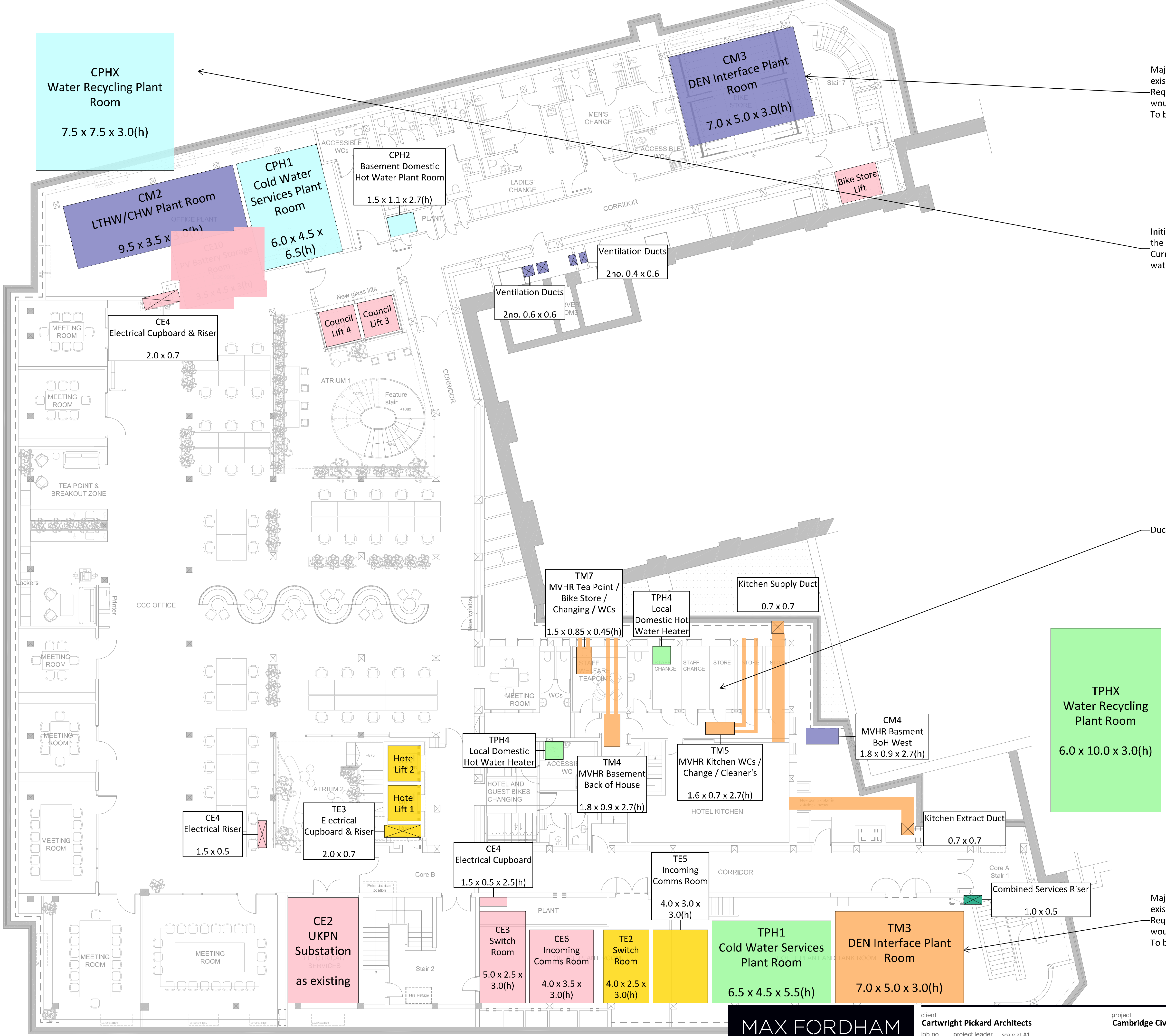
Parameters	Passivhaus Enerphit Component Certification Criteria (Cold Temperate Climate)	Design Impact and Comments. All products are given for illustration purposes only, not as a final specification
Vertical Windows U-value **Triple Glazing**	U-value <0.85 W/m².K (installed)	• Uw installed= 0.85 W/m².K • G-value =0.5 • Airtightness Class 4
Secondary Glazing (Zone B)	U-value <0.85 W/m².K (installed)	• U-value = 1.80 W/m².K • g-value = 0.60 • Airtightness Class 4
Single Glazing (Zone A)	U-value <0.85 W/m².K (installed)	• Existing - U-value = 5.80 W/m².K • g-value = 0.87
Doors		• Airtightness Class 4
Horizontal Windows/ Glazing U-value - ETFE	U-value <1.1 W/m².K (installed)	• ETFE units itself will need to achieve a component U value of 0.8-0.9 W/m².K as a minimum. • Installation psi-value – 0.04W/m.K • G-value= 0.4 • *minimum temperature factor fRsi=0.25 m²K/W*
Ventilation Heat Recovery		Total system efficiency >= 75% Long intake and exhaust ducts will have a detrimental effect on the overall efficiency of the system. This will need to be compensated with efficient ventilation units and/ or additional insulation to the ducts. • Ventilate all rooms • Min at least 20 m³/h per adult • Controllable ventilation ≤ 25 dB(A): supply air rooms in residential buildings, as well as bedrooms and recreational rooms in non-residential buildings ≤ 30 dB(A): rooms in non-residential buildings (except for bedrooms and recreational rooms) and extract air rooms in residential buildings

SCHEDULE OF PARAMETERS - PAGE 3 OF 3

Parameters	Design Impact and Comments. All products are given for illustration purposes only, not as a final specification
Air leakage/ air permeability @50Pa	• Treatment will be required to all elements of the external envelope, including those in the "High Heritage Value" category. • Where airtightness is provided by existing elements (e.g. concrete beams/slab), the condition of the concrete to be investigated. • Robust strategy for the main elements and all connections. Airtightness products at all interfaces e.g. between windows and wall, general wall condition, around incoming services penetrations etc. Main elements are expected to include products that would already be specified, or variants of them: EPDM around windows. In some cases there would be proprietary products e.g. grommets for incoming services, ducts etc. Expect three airtightness tests, with associated hold points: 1. After initial completion of airtight envelope 2. After first fix services installation and associated sealing of penetrations 3. Final airtightness test for certification. Contractor pricing for the risk of not achieving the target.
Sanitaryware	• Low flow appliances, including 6 l/min showers.
Rainwater Drainage	• All external to the building
Domestic hot water production and distribution	Refer to M&E information.
Space heating	Space heating circulation pipes insulated with 25mm insulation, thermal conductivity 0.025W/m.K.
PV system	Roof mounted PV system.
White goods (ratings generally using new A-G system, with the exception of the dryers)	Dishwashers: A rated, able to take hot feed Washing machine in the laundry: A rated, able to take hot feed Dryer: A+++ rated, heat pump tumble dryer. Allow for clothes drying on the racks in student rooms. Fridge/freezer: A rated.
Thermal bridging	Expected to be required at key locations: Farrat, Compacfoam, Spacetherm.
Lifts	Energy Efficient (A)

APPENDIX III – GUILDHALL HOTEL OPTION MEP DRAWINGS & SCHEDULE

Drawings included in this appendix have been printed at A3 paper size for the convenience of the report. Original A1 paper size drawings issued alongside this report as separate documents.



Major developments should where possible connect to existing heat networks or networks under construction.
Requirement relaxed if evidence is provided that doing so would affect the scheme's viability.
To be reviewed with council.

Initial plant room size for water recycling serving the Council-operated areas of the building.
Current intention is to locate near office cold water services plant room.

Ducts and MVHR units in area are at high level supported by ceiling.

Initial plant room size for water recycling serving the Council-operated areas of the building.
Current intention is to locate the plant room in a new double-height plant space underneath TPH1 and TM3 plant rooms
Structural works for new load-bearing floor.

Major developments should where possible connect to existing heat networks or networks under construction.
Requirement relaxed if evidence is provided that doing so would affect the scheme's viability.
To be reviewed with council.

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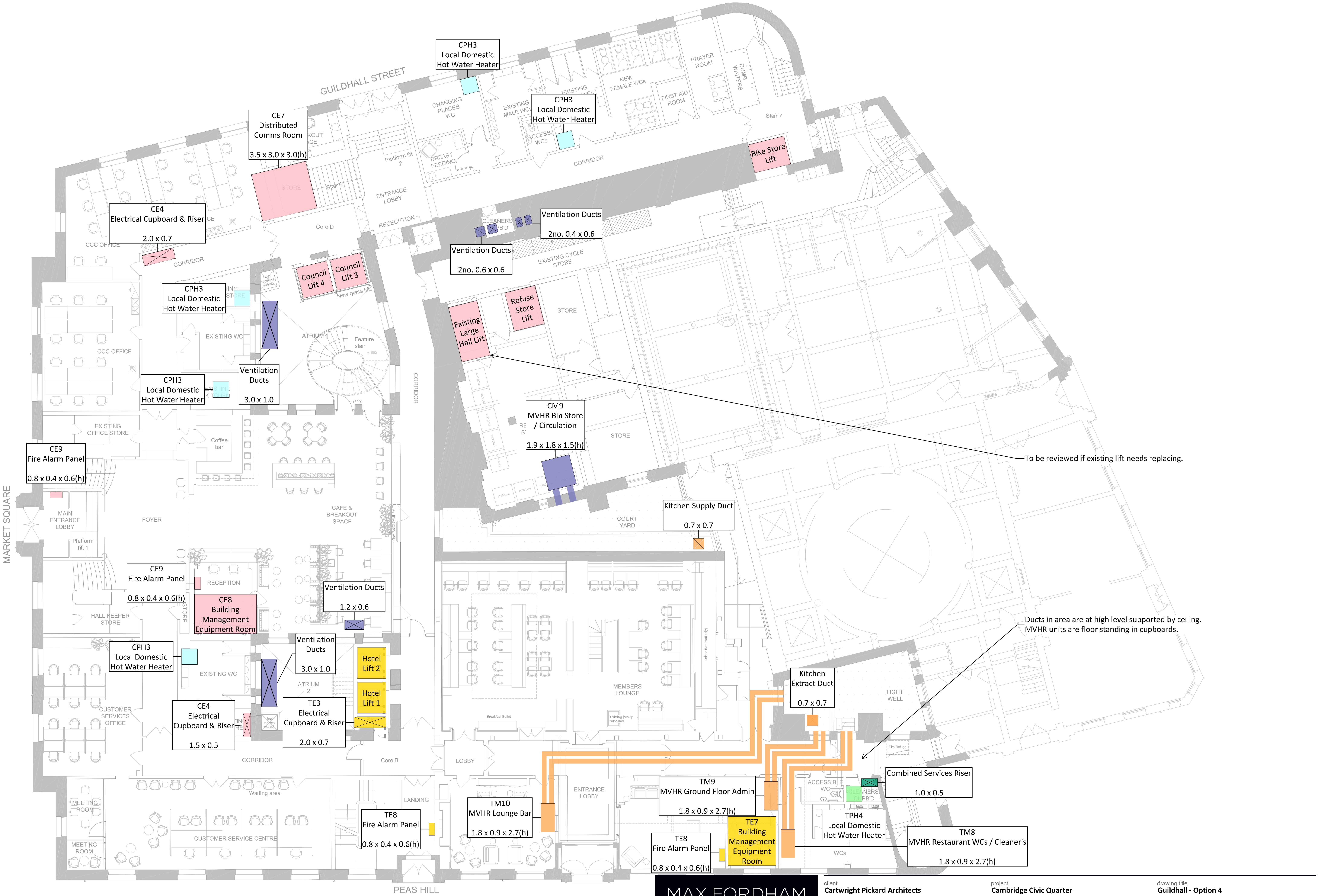
client: Cartwright Pickard Architects	project: Cambridge Civic Quarter	drawing title: Guildhall - Option 4 Combined Services Layout Basement Level	
job no. 7562	project leader CB	scale at A1 1:100	
status code and description: S1 - Suitable for Coordination	issue date 30/08/24	revision WIP	classification PM_40_40_15
project code J7562 - orig. MXF - volume GH - level B1 - type DR - role J - number 30104			



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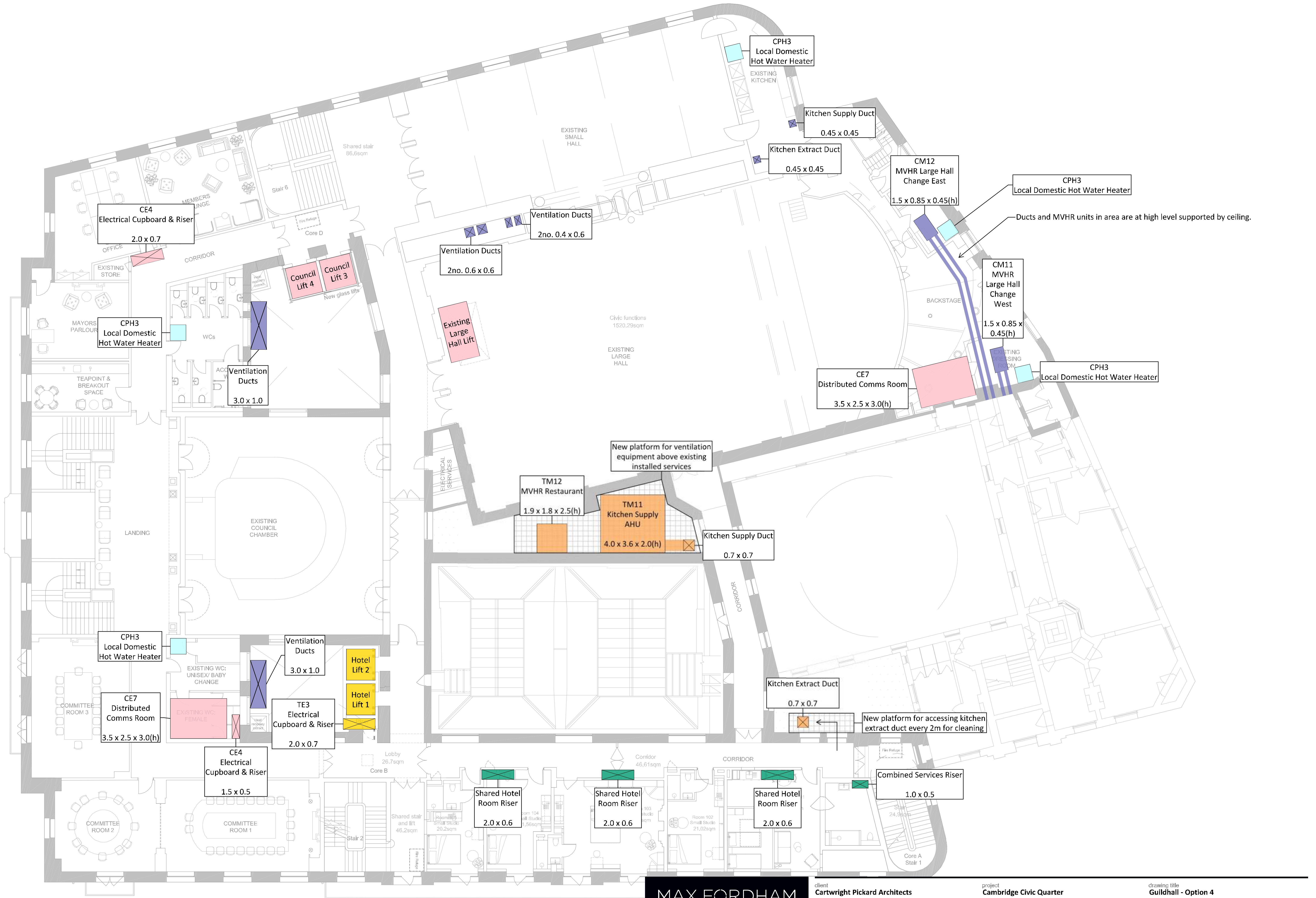
client: Cartwright Pickard Architects	project: Cambridge Civic Quarter	drawing title: Guildhall - Option 4 Combined Services Layout Ground Floor
job no.: 7562 · project leader: CB · scale at A1: 1:100	issue date: 30/08/24 · revision: WIP · classification: PM_40_40_15	project code - orig. - volume - level - type - role - number: J7562 - MXF - GH - 00 - DR - J - 30104
status code and description: S1 - Suitable for Coordination		



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client: Cartwright Pickard Architects

job no. 7562 | project leader CB | scale at A1 1:100

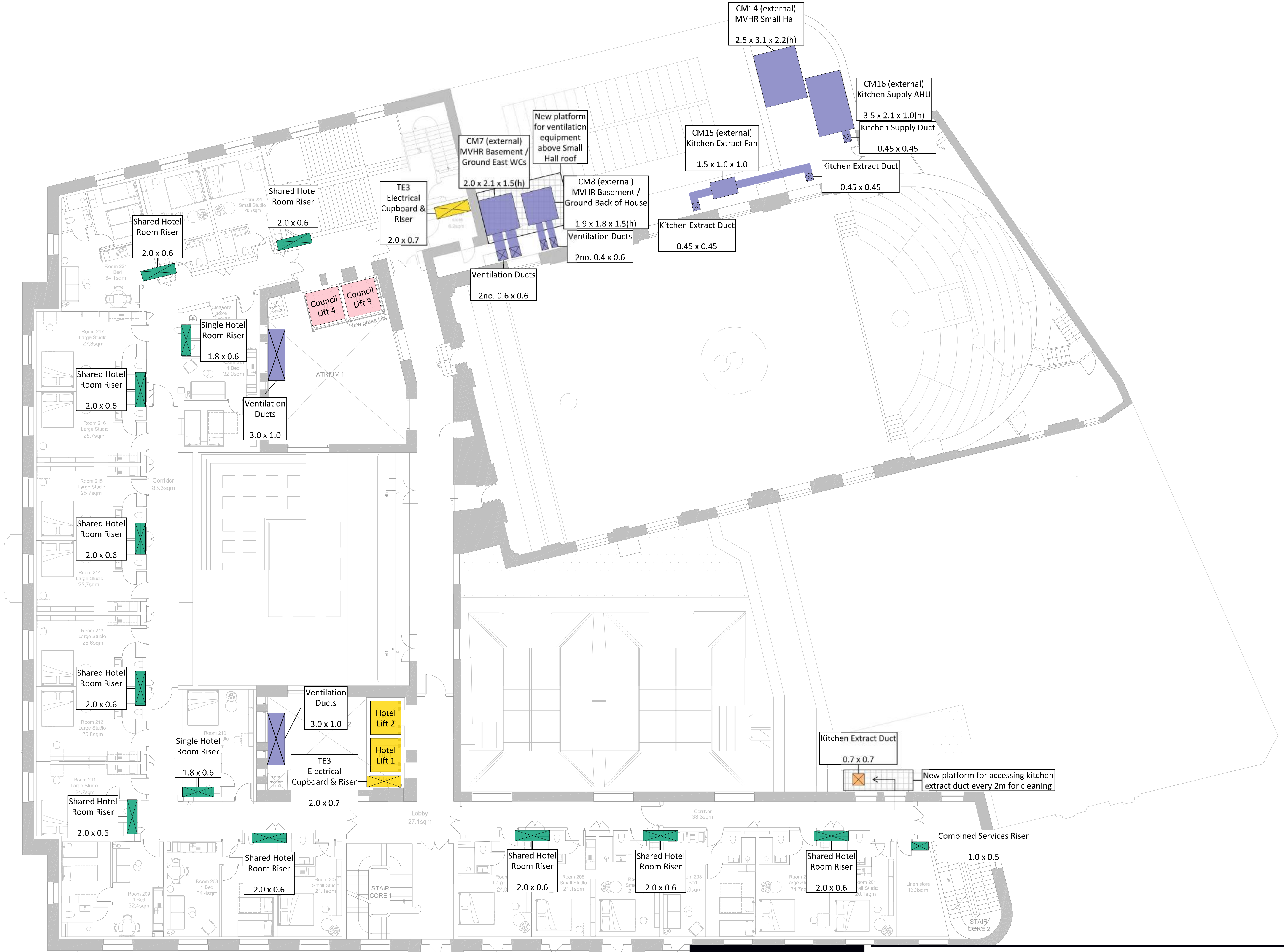
status code and description: S1 - Suitable for Coordination

project: Cambridge Civic Quarter

issue date 30/08/24 | revision WIP | classification PM_40_40_15

drawing title: Guildhall - Option 4
Combined Services Layout
First Floor

project code J7562 - orig. MXF - volume GH - level 01 - type DR - role J - number 30104



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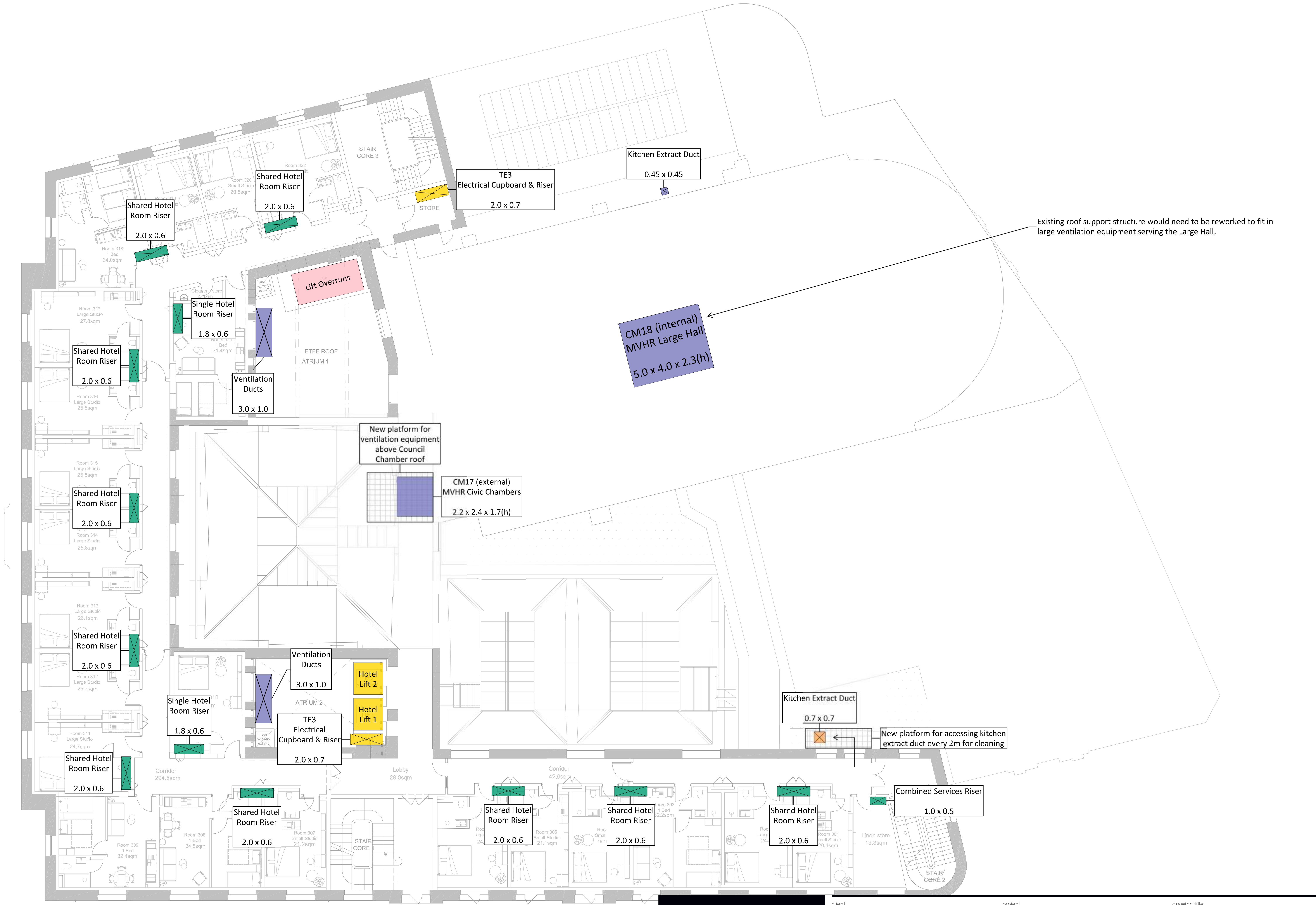
client: Cartwright Pickard Architects	project: Cambridge Civic Quarter		drawing title: Guildhall - Option 4 Combined Services Layout Second Floor
job no. 7562 / project leader CB / scale at A1 1:100			
status code and description: S1 - Suitable for Coordination	issue date 30/08/24	revision WIP / classification PM_40_40_15	project code J7562 - orig. MXF - volume GH - level 02 - type DR - role J - number 30104



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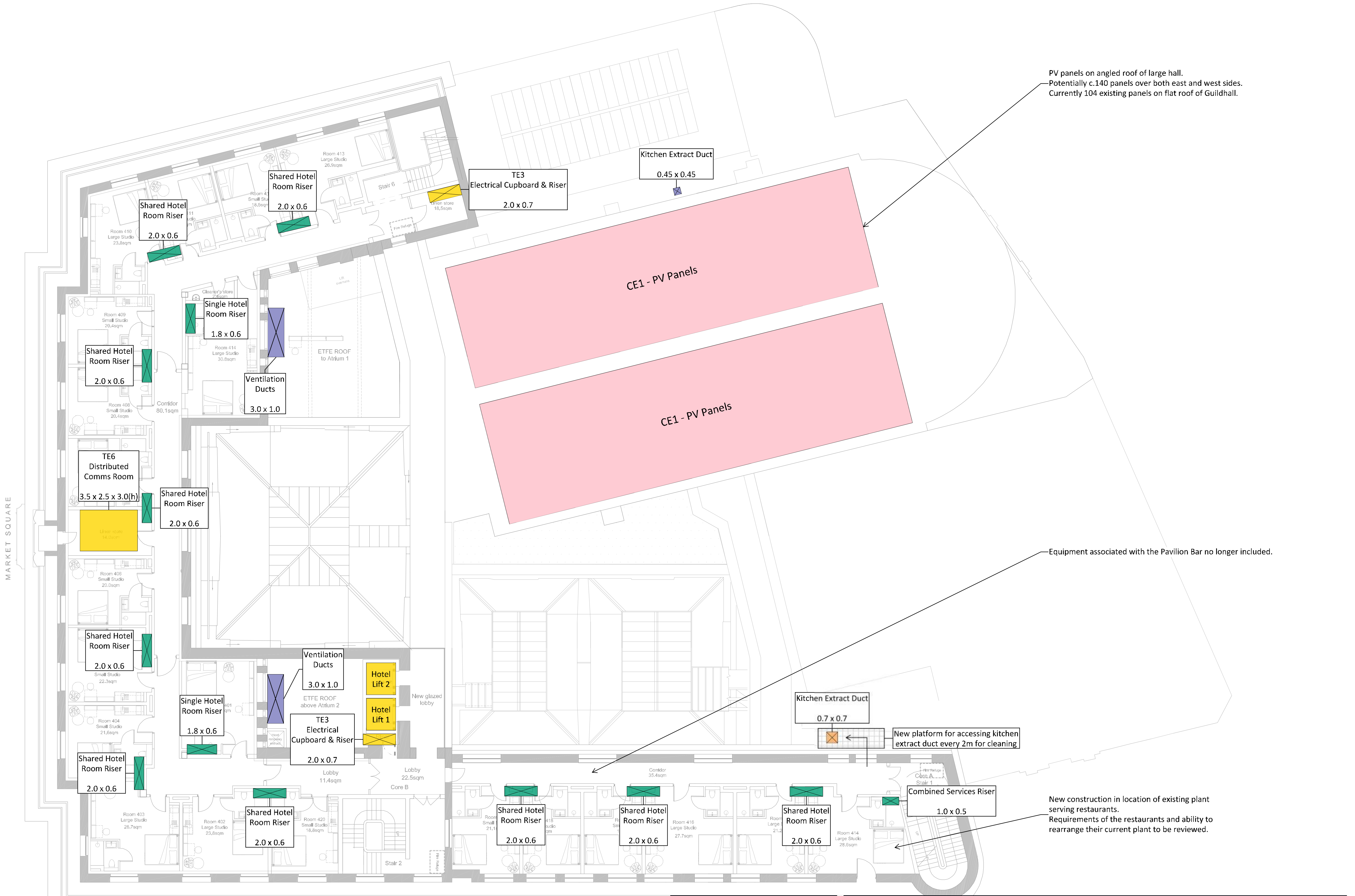
client **Cartwright Pickard Architects**	project **Cambridge Civic Quarter**	drawing title **Guildhall - Option 4** **Combined Services Layout** **Third Floor**
job no. **7562** project leader **CB** scale at A1 **1:100**		
status code and description **S1 - Suitable for Coordination**	issue date **30/08/24** revision **WIP** classification **PM_40_40_15**	project code J7562 - orig. MXF - volume GH - level 03 - type DR - role J - number 30104



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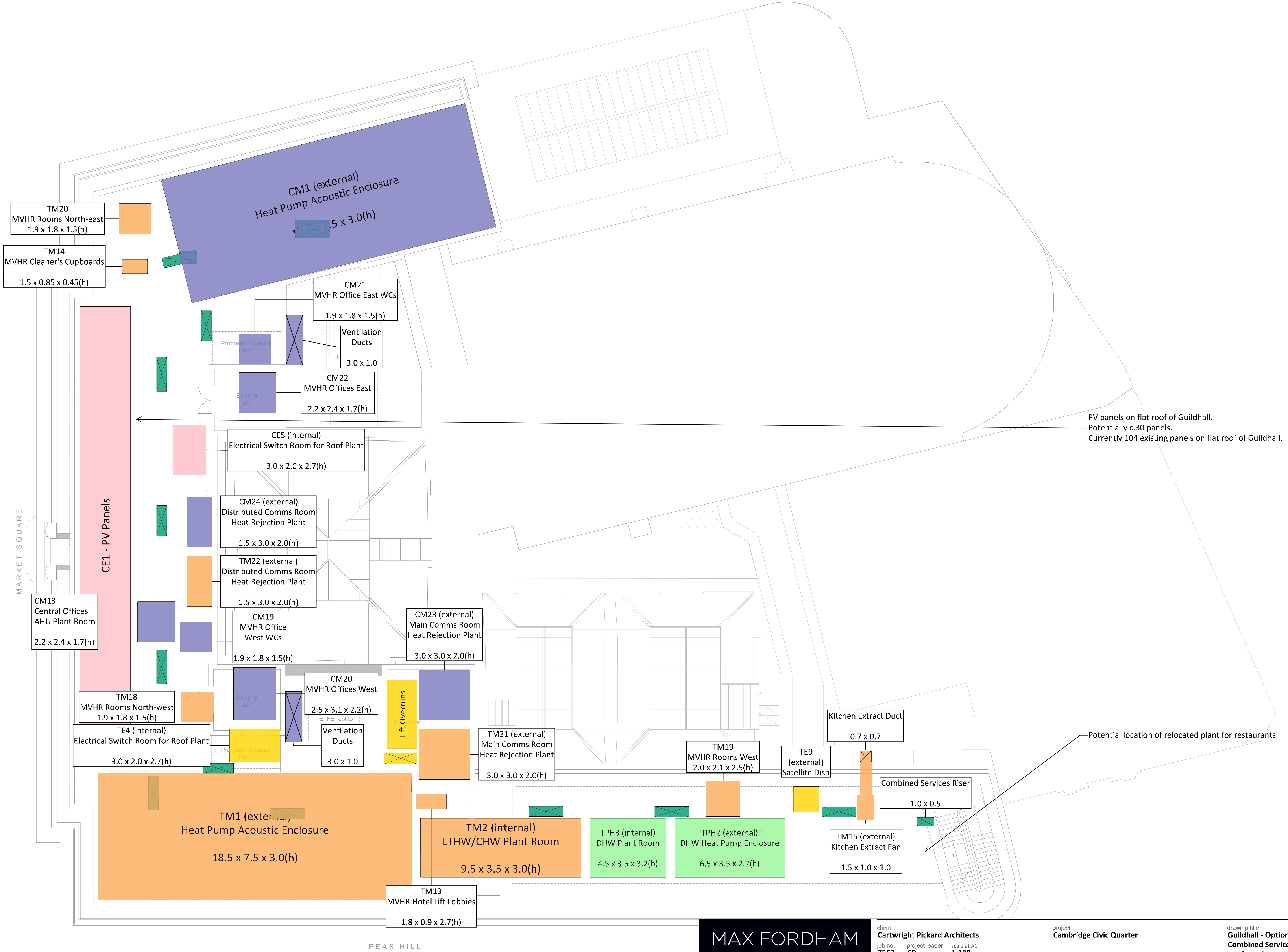
client	project	drawing title
Cartwright Pickard Architects	Cambridge Civic Quarter	Guildhall - Option 4 Combined Services Layout Fourth Floor

job no.	project leader	scale at A1
7562	CB	1:100

status code and description	issue date	revision	classification
S1 - Suitable for Coordination	30/08/24	WIP	PM_40_40_15

project code	orig.	volume	level	type	role	number
J7562	MXF	GH	04	DR	J	30104



MAX FORDHAM
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client: **Cartwright Pickard Architects**
job no. **7562** | project leader **CB** | scale at A1 **1:100**
status code and description: **S1 - Suitable for Coordination**

project: **Cambridge Civic Quarter**
issue date **30/08/24** | revision **WIP** | classification **PM_40_40_15**

drawing title: **Guildhall - Option 4**
Combined Services Layout
Roof Level
project code **J7562** - orig. **MXF** - volume **GH** - level **RF** - type **DR** - role **J** - number **30104**

Cambridge Civic Quarter - Guildhall

Architect: **Cartwright Pickard Architects**
Issue Status: S1

SCHEDULE OF GUILDHALL PLANT SPACE REQUIREMENTS – HOTEL

REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
TPH1	Cold Water Services Plant Room	Ideal : Ground floor (internal). Anticipated : Basement (internal).	Incoming cold-water supply (utility metering in public footpath). Potable cold water storage tank (15m^3 storage capacity TEF sectional tank) Booster set (duty/assist/ standby). CAT V Booster set. Water leak detection system.	6.5 x 4.5 x 5.5(h) See note re existing plant room height and columns.	Leaf and one-half doors (for plant delivery and replacement). If ground floor location access from both inside and outside preferred to aid maintenance (inspections) and delivery of plant respectively. If basement location ensure lift and route to/from are suitable for plant transfer	Ventilated tank room to ensure suitable room temperature to avoid stored water warming.	Minimum clearance of 750mm clear required above the tank. Tank based on 600mm pier walls. Consider drainage of lowered slab acting as bund. Floor gulley required (for overflow). The existing boiler plant area is understood to have a clear head height of approx 5.7m. Depth of existing room approx. 6.7m to suit 6.5m deep requirement (rear columns can be incorporated).
TPH2	Domestic hot Water Heat Pump Enclosure	Roof. (External). Fully open to above	2No. 30kW Q-TON CO2 air source heat pumps. Assumed acoustic louvred enclosure required around (TBC by acoustician).	6.5 x3.5*x 2.7(h) For suitable air movement the enclosure area must be clear above and around. *initial estimate TBC with manufacturer	Leaf and one-half doors (for plant delivery and replacement) into acoustic enclosure. Access to front and rear of heat pumps provided within enclosure (walking on paving slabs laid on finished roof). Related power and pipework to route on inside face of acoustic enclosure, setting across at ground level to heat pump (can step over). Plant installation and removal strategy requires crane lift onto/off of roof. If not possible to crane directly in/out of enclosure ensure route to enclosure from crane drop off is suitable to 'transfer' heat pumps. May require temporary screen removal. Safe personal access required onto roof and from here to heat pump enclosure.	External for heat rejection. Consider acoustics (see note under plant).	Must be completely clear above to allow heat rejection/discharge from top. Acoustic criteria and assessment may influence selection, size and requirement for acoustic screening or louvres.
TPH3	Domestic Hot Water Services Plant Room	Ideal : Internal close to heat pump (TPH2) and centralised in relation to risers serving hotel rooms (minimise pipe lengths for NZC).	Highly insulated hot water storage cylinders (2No. 2000l storage), expansion vessels, circulation pump and associated controls.	4.5 x 3.5 x 3.2(h) Room can be shared with TM2.	Leaf and one-half doors (for plant delivery and replacement). If ground floor location access from both inside and outside preferred to aid maintenance (inspections) and delivery of plant respectively. If basement location ensure lift and route to/from room are suitable for plant transfer	To consider heat dissipation but avoid 'cold room'.	Locate cylinders on plinths. Floor gulley required for expansion relief. Assumes indirect HWS (via district heating) is not appropriate due to system design temperatures.

Guildhall Plant Schedule – Option 4
J7562-MXF-GH-ZZ-SH-J-30004 Rev WIP

Cambridge Civic Quarter - Guildhall

Architect: **Cartwright Pickard Architects**
Issue Status: S1

REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
TPH4 Various Was missing so copied across from office version	Local domestic hot water heater cupboards (distributed)	Local to served outlets; Basement Changing/WCs. GF WCs. 1F WCs if provided. 2F-4F WCs and tea points (East and West). 2F&3F tea point south west 4F bar WCs	Local electric hot water heater and associated expansion relief. Size to suit outlets served.	TBC, dependent on number of outlets served.	Lockable cupboard to be fully accessible for maintenance and inspection.	To consider heat dissipation.	Layouts/requirements TBC before details can be provided. Heaters to be local, in close proximity to outlets served.
TPHX	Rain Water Recycling Plant Room. **See note re provision.**	Ideal : Internal above served WCs so as to supply by gravity.. Anticipated : Basement (internal). Rainwater downpipes to be routed to inlet of tank. Centralising tank to downpipe locations maximises roof catchment and minimises potential height impact of pipework setting under gravity. Could locate with TPH1.	25m^3 Rainwater recycling storage tank and filtration system. If pumped : Booster set (duty/standby).	6.0 x 10.0 x 3.0(h) Or 7.5 x 9.0 x 3.0(h)	Double doors (for plant delivery and replacement). If ground floor location access from both inside and outside preferred to aid maintenance (inspections) and delivery of plant respectively. If basement location ensure lift and route to/from room are suitable for plant transfer.	Background Infiltration	Anticipated to be required to satisfy planning requirement. Tank to be based on 600mm pier walls. Consider bunding room. Floor gulley required. **Does tenant require dedicated system for responsibility/maintenance or can this be shared with CCC. Likely to be dictated/heavily influenced by related downpipe locations. Will tenant be happy with recycled rainwater for WC flushing?**
TM1	Heat Pump Acoustic Enclosure	Roof. (External). Fully open to above	2 no. 265kW Cooling & 145kW Heating 4pipe Air Source Heat Pumps (4PASHP). Size does not allow for RH control. Assumed acoustic louvred enclosure required around (TBC by acoustician).	End to end; 18.5 x 7.5 x 3.0h. Or side by side; 13.0 x 10.5x3.0h Above allows tube with drawl at rear of units (3m clearance).	Regular maintenance access via doorway within acoustic enclosure. Major replacement works will require demounting of screen. ASHP access provided within enclosure (walking on paving slabs laid on finished roof). Related power and pipework to be routed on inside face of acoustic enclosure only setting across ground level to route to related condenser (step overs required). Plant removal strategy requires crane lift onto/off of roof.	External for heat rejection. Consider acoustics (see note under plant).	Must be completely clear above to allow heat rejection/discharge from top. Enclosure dimensions includes clearance to sides of units to allow air flow. Acoustic criteria and assessment may influence selection, size and requirement for acoustic screening or louvres.

Guildhall Plant Schedule – Option 4
J7562-MXF-GH-ZZ-SH-J-30004 Rev WIP

Cambridge Civic Quarter - Guildhall

Architect: **Cartwright Pickard Architects**
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REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
							If HT or MT DEN is provided this space can be allocated for chiller plant.
TM2	LTHW/CHW Plant room. See note re separation is preferable.	Ideal : Internal close to ASHPs (TM1) and risers to rooms.	For LTHW Plant; Run/standby primary pumps. Buffer vessel (highly insulated). Run/standby distribution pumps. Pressurisation unit Expansion vessel Dosing pot For CHW Plant; As listed for LTHW plant. Control panel & Energy metering for LTHW&CHW plant.	9.5 x 3.5 x 3.0h. Room can be shared with TPH3. If doing so further benefit in separating out CHW from the DHW and LTHW (see note).	Leaf and one-half doors (for plant delivery and replacement). If ground floor location access from both inside and outside preferred to aid maintenance (inspections) and delivery of plant respectively. If basement location ensure lift and route to/from room are suitable for plant transfer.	To consider heat dissipation but avoid 'cold room'.	Locate plant on plinths. Floor gulleys required for expansion relief and general water treatment processes. Ideally have LTHW and CHW plant in separate rooms to prevent heat transfer (energy loss) but will increase overall space requirement.
TM3	DEN Interface Plant Room.	Ideal : Internal on Perimeter of building onto Wheeler Street (proposed DEN route)	District Heating incoming pit. District Heating PHX substation (skid mounted duty/standby). Duty/standby Hotel Primary Heating pumps, Pressurisation set and Expansion vessels (replacing those in TM2). Dosing Pot Mechanical Control panel District Heating Control Panel? Central Energy Logger **Note :** TBC by DEN designer	7.0 x 5.0 x 3.0h. **Note :** TBC by DEN designer	DEN will want direct access from public footpath with double doors (for plant delivery and replacement). Due to listing will need to agree basement location with access via staircase. Will need to review how plant installation and maintenance can be achieved (likely to require breaking down of skid equipment into components and use of lifts). **Note :** TBC by DEN designer	To consider heat dissipation but avoid 'cold room'. **Note :** TBC by DEN designer	**Note :** We anticipate that the DEN operator will want to serve the building via one set of shared mains. This will require additional shared plant, potentially reducing operating efficiency and introducing complications in adapting the 4PASHP distribution system to suit the future DEN (when available). These future adaption complications increase if TM2 is located near to the ASHPs(far from this room).
TM4	Mechanical Ventilation with Heat Recovery – Basement Back of House	Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes.	1 No. cupboard MVHR vertical unit with top duct connections. 120l/s.	1.8 x 0.9 x 2.7h. + access to front by opening cupboard (in front of 0.9m). See notes	Access for regular maintenance and inspection from room. Unit width can just fit through doorway.	None required to plant cupboard	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Height allows for connecting ducts/attenuators routing into ceiling void.

Guildhall Plant Schedule – Option 4
J7562-MXF-GH-ZZ-SH-J-30004 Rev WIP

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Cambridge Civic Quarter - Guildhall

Architect: **Cartwright Pickard Architects**
Issue Status: S1

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REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
							1.8m length includes access. Can be 1.2m with 0.6 access into cupboard end from within room. Voids to be reviewed for suitability for intake/exhaust in conjunction with other local systems. Assume exhaust will be taken to roof level.
TM5	Mechanical Ventilation with Heat Recovery – Basement Kitchen WCs/ Change & Cleaners.	Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes.	1 No. cupboard MVHR vertical unit with top duct connections. 55l/s.	1.6 x 0.7 x 2.7h. + access to front by opening cupboard (in front of 0.7m). See notes	Access for regular maintenance and inspection from room. Unit width can just fit through doorway.	None required to plant cupboard	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Height allows for connecting ducts/attenuators routing into ceiling void. 1.6m length includes access. Can be 0.85m with 0.75 access into cupboard end from within room. Voids to be reviewed for suitability for intake/exhaust in conjunction with other local systems. Assume exhaust will be taken to roof level.
TM7	Mechanical Ventilation with Heat Recovery – Bike Store & Changing/WCs	Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes. Likely in room location will require lengths of intake and exhaust ducts within thermal envelope, reducing NZC performance.	1 No. MVHR in ceiling void unit with end connections. 120l/s.	1.5x 0.85x 0.45h + access from below (hinged door on underside).	Access for regular maintenance and inspection from room.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Voids to be reviewed for suitability for intake/exhaust in conjunction with other local systems. Assume exhaust will be taken to roof level.
TM8	Mechanical Ventilation with Heat Recovery – Restaurant WCs & Cleaners rm.	Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes.	1 No. cupboard MVHR vertical unit with top duct connections. 150l/s.	1.8 x 0.9 x 2.7h. + access to front by opening cupboard (in front of 0.9m). See notes.	Access for regular maintenance and inspection from room. Unit width can just fit through doorway.	None required to plant cupboard	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Height allows for connecting ducts/attenuators routing into ceiling void. 1.8m length includes access. Can be 1.2m with 0.6 access into cupboard end from within room.

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Issue Status: S1

REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
							Voids to be reviewed for suitability for intake/exhaust in conjunction with other local systems. Assume exhaust will be taken to roof level.
TM9	Mechanical Ventilation with Heat Recovery – Ground Floor Admin	Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes.	1 No. cupboard MVHR vertical unit with top duct connections. 150l/s.	1.8 x 0.9 x 2.7h. + access to front by opening cupboard (in front of 0.9m). See notes.	Access for regular maintenance and inspection from served room. Unit width can just fit through doorway.	None required to plant cupboard	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Cupboard to ensure suitable acoustic separation from working space. Height allows for connecting ducts/attenuators routing into ceiling void. 1.8m length includes access. Can be 1.2m with 0.6 access into cupboard end from within room.
TM10	Mechanical Ventilation with Heat Recovery – Lounge Bar	Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes. Practical restrictions on location – see notes.	1 No. cupboard MVHR vertical unit with top duct connections. 150l/s.	1.8 x 0.9 x 2.7h. + access to front by opening cupboard (in front of 0.9m). See notes.	Access for regular maintenance and inspection. Unit width can just fit through doorway.	None required to plant cupboard	As note for Ground Floor Admin MVHR (TMx). Existing building constraints on duct routes and MVHR location appear challenging. Use of windows can be considered though less energy efficient. Room use likely to be infrequent and for short periods. To be reviewed.
TM11	Mechanical Ventilation - Kitchen Supply AHU.	Ideal : Internal with close proximity to served kitchen and also external wall for intake duct route. Potentially : Look to use void at first floor behind restaurant and duct down.	Kitchen Supply AHU. 2.40M^3/s. Estimate only. Requires catering consultant to specify hoods and confirm required ventilation rates.	4.0 x 3.6 x 2.0(h) See notes.	Access for regular maintenance and inspection. Review if can crane in /out. To assist this look to deliver in sections and build in-situ (also for future maintenance and replacement strategy) .	None required for AHU itself.	Supply intake louvre location to minimise risk of entraining any pollutants, including discharge from any local exhaust ducts. Attenuator and ductwork connections will add to the 4m length. 3.6m room depth is only required opposite AHU components approx. 3.8m length. 2m height does not allow for ducts passing over top of AHU. Coordination to be worked through. Consider acoustics/noise from AHU into constrained 'well' with hall and restaurant on either side.
TM12	Mechanical Ventilation with Heat Recovery – Restaurant	Ideal : Internal with close proximity to served bar and also external wall for intake and exhaust duct routes.	1 No. horizontal floor mounted MVHR unit. 450 l/s.	1.9 x 1.8 x 2.5(h) See notes.	Access for regular maintenance and inspection. Likely to require crane lift onto/off roof for initial installation and replacement.	None required to plant room.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct.

Guildhall Plant Schedule – Option 4
J7562-MXF-GH-ZZ-SH-J-30004 Rev WIP

Cambridge Civic Quarter - Guildhall

Architect: **Cartwright Pickard Architects**
Issue Status: S1

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REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
							Attenuator and ductwork connections will add to the 1.9m length. If using suggested first floor plant deck this should suit. 1.8m room depth is only required opposite AHU components approx. 1.5m length. 2.5m height allows for services to cross. Unit approx. 1.2m high plus base.
TM13	Mechanical Ventilation with Heat Recovery – Hotel lift lobbies	Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes. Potential area : Third floor walkway beside lifts. Will require riser for supply and exhaust ducts to below.	1 No. cupboard MVHR vertical unit with top duct connections. 100l/s.	1.8 x 0.9 x 2.7h. + access to front by opening cupboard (in front of 0.9m). See notes	Access for regular maintenance and inspection. Unit width can just fit through doorway.	None required to plant cupboard	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Height allows for connecting ducts/attenuators routing into ceiling void. 1.8m length includes access. Can be 1.2m with 0.6 access into cupboard end from within room. Requires supply and extract duct riser between Basement and fourth floor (will impact on BoH corridor).
TM14	Mechanical Ventilation with Heat Recovery – Cleaners Cupboards	Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes.	1 No. MVHR in ceiling void unit with end connections. 70l/s.	1.5x 0.85x 0.45h + access from below (hinged door on underside). MF to review controls / electrics access.	Access for regular maintenance and inspection from room.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Small room will dictate connections and attenuators routing into adjacent corridor and to outside. Will impact on general ceiling coordination and RCP. Allow deep ceiling void to assist. Requires supply and extract duct riser within third and fourth floor cleaners cupboards.
TM15	Mechanical Ventilation - Kitchen Extract fan.	Ideal : External near to point of discharge. See notes re discharge/ exhaust.	Kitchen Extract fan. 2.40M^3/s. Estimate only. Requires catering consultant to specify hoods and confirm required ventilation rates.	1.5 x 0.7Ø. See notes.	Access for regular maintenance and inspection. Kitchen extract ductwork to be accessible throughout its length. Cleaning access panels required every 3m. If rising in void or lightwell the vertical/rising ductwork will require surrounding access platforms to facilitate this maintenance.	None required for.	Discharge (exhaust) to be above highest point of roof and any neighbouring buildings that are higher and within 20m. Attenuator and ductwork connections will add to the 1.5m length (but can go in vertical ductwork).

Guildhall Plant Schedule – Option 4
J7562-MXF-GH-ZZ-SH-J-30004 Rev WIP

Cambridge Civic Quarter - Guildhall

Architect: **Cartwright Pickard Architects**
Issue Status: S1

REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
					Crane on/off roof.		Consider acoustics/noise from fan (kitchen extract by nature are noisy)
TM18	Mechanical Ventilation with Heat Recovery – Rooms North West	Ideal : Internal with close proximity to served spaces and also external wall for intake and exhaust duct routes. Assumed roof location over is only practical option and can align with the duct riser. Will require modifications to PVs but roof insulation will require upgrade for NZC so likely replacement of build up/ waterproofing etc.	1 No. horizontal floor mounted MVHR unit. 540 l/s.	1.9 x 1.8 x 1.5(h) See notes.	Access for regular maintenance and inspection. Likely to require crane lift onto/off roof for initial installation and replacement.	None required to plant room.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 1.9m length. 1.8m room depth is only required opposite AHU components approx. 1.5m length.
TM19	Mechanical Ventilation with Heat Recovery – Rooms West	Ideal : Internal with close proximity to served spaces and also external wall for intake and exhaust duct routes. Assumed roof location over is only practical option and can align with the duct riser.	1 No. horizontal floor mounted MVHR unit. 600 l/s.	2.0 x 2.1 x 2.5(h) See notes.	Access for regular maintenance and inspection. Likely to require crane lift onto/off roof for initial installation and replacement.	None required to plant room.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 2.0m length. 2.1m room depth is only required opposite AHU components approx. 1.7m length. 2.5m height allows for services to cross. Unit approx. 1.3m high plus base.
TM20	Mechanical Ventilation with Heat Recovery – Rooms North East	As North West AHU (ref TM18)	1 No. horizontal floor mounted MVHR unit. 540 l/s.	1.9 x 1.8 x 1.5(h) See notes.	Access for regular maintenance and inspection. Likely to require crane lift onto/off roof for initial installation and replacement.	None required to plant room.	As North West AHU (ref TM18)
TM21	Main Comms Room Heat Rejection Plant	Ideal : Roof location in close proximity to served room. Potentially use light well to reduce pipe length/	Allow for 2No. outdoor condensers (run and standby). 5kW UK sensible cooling each.	3 x 3 x 2.0(h) Heat rejected horizontally so equivalent area	Access for maintenance single door to external.	Must be completely clear above to allow heat rejection to dissipate (not recirculate).	Acoustic criteria and assessment may dictate requirement to enclose/screen area.

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		refrigerant and also slab bwic.		won't be suitable.			
TM22	Distributed (local) Comms Room Heat Rejection Plant	Ideal : Roof location in close proximity to served room (appears possible). Roof behind (over small hall) may be possible but flat roof area appears to narrow.	Allow for single condenser. 5kW UK sensible cooling.	1.5 x 3 x 2.0(h) Heat rejected horizontally so equivalent area won't be suitable.	Access for maintenance single door to external.	Must be completely clear above to allow heat rejection to dissipate (not recirculate).	Acoustic criteria and assessment may dictate requirement to enclose/screen area. Particularly when investigating area over small hall/ next to large hall.
TE2	Hotel Switch Room	Basement (Internal) immediately beside the substation (CE2).	Incoming UKPN supply head and utility metering. Main Switchgear Distribution board for basement incl kitchen. Energy metering equipment.	4 x 2.5 x 3(h)	One and a half leaf door access. Ideally from outside and inside of the building. Basement location likely to dictate the need for the panel to be delivered in sections and formed on site/in situ.	Background Infiltration	Depending on UKPN head/metering arrangement. Assumes incoming power (substation) is in CCC demise with utility supply provided to this switch room.
TE3 (a-h) 8No.	Electrical Cupboards (dispersed)	Ideal : Internal cupboard/room local to area served and riser containing sub main power distribution. Vertically stacked (between floors) and central to served areas (to reduce cable lengths).	Distribution Boards (power and lighting) Electrical Sub Meters & logging devices. Lighting Controls	1.0 x 0.5 x 2.5(h) Dims are for DB only (not rising sub mains.	Must be fully accessible but secured (locked). Can be a locked board in a secure staff room/area or riser.	Background infiltration	Locations to be developed with risers. Suggestions shown. 2 per upper floor (east and west).
TE4	Electrical Switch Room – Roof plant	On new roof (to West).	Panel board. Control panel (MCP). Local small power/lighting board. Electrical Meters & logging devices PV inverters.	3 x 2 x 2.7 (h) Subject to confirmation with developing roof plant layout	Single door.	High and low level louvres for summer heat dissipation.	Location to relate to served plant and sub main riser routing up from below. Dispersed plant power cabling strategy to be developed with routing through existing building.
TE5	Incoming (main) Comms Room	Ideal : Secure ground floor room located off public footpath.	Incoming utility service and associated boards/distribution.	3.5 x 2.5 x 3.0(h)	Direct external access for utility provider is preferred. Constraints of existing building unlikely to allow.	Will need cooling (TM21). Ideally some background ventilation if in basement.	Basement room would ideally be avoided as IT managers are concerned about floor risk.

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		Likely : Basement room (see note)	Hotel comms rack (though could be located in dedicated rack room within reception or admin office? See TE7 & TE9.		If in basement lift and corridor to be suitable to house a data cabinet/free standing rack (width and height).		
TE6	Distributed (local) Comms Room Fibre linked to TE5 to ensure suitable cable lengths to local outlets	Internal : Upper floor (third or fourth) to serve west side rooms. Location to reduce cable lengths and quantum of cable routing from main comms room (TE5)	Rack Cabinet and racks, patches etc.	2.7 x 2.0 x 2.7(h) See access	Leaf and a half door to allow installation and removal of comms rack. Store width at level 3 will only allow access to sides and front of an 800deep, 900 wide rack and would share room with distribution board (access/security). Will be a 'pinch' between distribution board and rack.	Background infiltration ventilation only. Will need cooling (TM22).	Power and data cable routing to and within room (rising third to fourth floor) to be on same wall as distribution board at opposite end of room (by door in).
TE7	Building Management Equipment room	Assumed that all related building management staff interface equipment will be located within the ground floor admin office. UPS systems to be in comms rack (TE5).	AWC alarm system equipment Refuge alarm system equipment Access control system equipment Security system equipment	Subject to briefing. Consider forming a room within the admin office or allocating wall and worktop space within the office.	Access to all equipment for maintenance.	If in office utilise office ventilation and cooling and ensure equipment is open to the office for heat dissipation.	Management systems requiring regular staff monitoring/use will often have related accessories at the staff desk positions. Some may be accessible via the web (subject to agreed briefing). Assumes a number of rack mounted systems (contained within TE5).
TE8	Fire Alarm Panel (s)	Visible from main entrance (as defined for fire access) (Internal) May require repeater panels in reception or admin office.	Fire alarm panel. Potentially repeater panel.	0.8 x 0.4 x 0.6(h) estimated.	Fully accessible to front of panel/s	Have some ventilation openings into surrounding space.	Fire strategy TBC by fire engineer Main fire access may still be the main entrance in which case a repeater panel in reception/office may suffice. Required to be visible so if enclosed should have a glazed front.
TE9	Sound/TV/AV equipment. Satellite Dish.	Equipment to be rack mounted with local panels and equipment in main electrical riser (with data).	Digital and Satellite TV cable (data) signals coders and splitters.	Wall mounted In electrical riser and use of rack.	Access via electrical riser. Space in front to work on.	Electrical riser to allow heat dissipation.	Assumes sound (PA?) is limited to bars only.

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Additional Plant rooms that may be required in response to further assessments and/or fire strategy and/or detailed briefing

REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
TPHX	Sprinkler Tank Room. **See note re provision.**	Ideal : Ground floor (internal). Anticipated : Basement (internal)	Sprinkler system water storage tank. Sprinkler Pumps. Power and controls.	?.? x ?.? x ?.?(h)	Double doors accessible from inside or outside (preferred) of the building. **Fireman to have direct access from outside of the building**	Background Infiltration	Requirement TBC by fire engineer. Estimated size based on OH?? category and minimum flow duration of mins. Consider bunding room. Floor gulleys required. **Does tenant require dedicated system for responsibility/maintenance or can this be shared with CCC, if CCC spaces require sprinkler protection.**
TMx	Smoke Extract Fans - Basement	In separate fire compartment to that served	Mechanical smoke extract fans (run/standby). ??M3/s each.	?.? x ?.? x ?.?(h)	Regular inspection and testing. Crane lift in/out ~(heavy)	Open to surroundings for motor heat release.	Requirement to be confirmed by fire engineer/ strategy including compartmentation. Discharge to be away from all exits. Ideally at roof level to allow dispersal of smoke. Consider; - make up air (how/from where) - Attenuation? - Interfaces with fire alarm, sprinklers etc. - Secondary power.
TMx	Smoke Extract Fans -	Roof connected into ventilation shaft (external).	Mechanical smoke extract fans (run/standby).	3 x 3 x 1.5(h) including maintenance space to front	Regular inspection and testing.	Open to surroundings for motor heat release.	Initial allowance to be developed with fire engineer. Considerations as basement smoke extract fans.
TMx	Dry risers	Incoming valve on external façade. Dry riser cabinets off firefighting stairs.	Valve boxes/cabinets.	See note	Access from firefighting lobby.	None required.	Requirement to be confirmed by fire strategy
TMx	Kitchen Cold room Heat Rejection Plant	Ideal : Roof location in close proximity to fridges/cold stores served.	TBC by catering specialist.	TBC by catering specialist.	Access for maintenance single door to external.	Must be completely clear above to allow heat rejection to dissipate (not recirculate).	Acoustic criteria and assessment may dictate requirement to enclose/screen area. Fridges and cold stores could use internal heat rejection (to room).
TMx	Mechanical ventilation -	Ideal : Roof location in close proximity to wash up.	TBC by catering specialist.	TBC by catering specialist.	Access for maintenance single door to external.	Must be clear around discharge to avoid moisture	Space/facility not yet identified on drawings. Allowance made for kitchen ventilation of complete

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	Kitchen wash up extract ventilation					effecting surrounding area or installation.	kitchen area. If wash up facility is in this area use of kitchen extract system (TM15) can be considered.
TMx	Gas/Foam fire suppression for critical electrical rooms	Local to served critical electrical room, typically a data/comms room (internal).	Specialist suppression cylinders and related control, monitoring and (if required) ventilation systems.	TBC, if required size dependent on served room.	Internal door (single anticipated)	Dependent on suppression system/gasses used.	May require pressurisation/ventilation system. Consider subsequent removal of gasses/foam after use. Operator may deem comms room as a critical service?
TEx	PV Battery Storage Room.	Local to PV inverters.	Batteries.	TBC, if required.	Double doors. Access for regular testing and inspection and battery replacement.	Vents at high and low level.	To be developed with PV design and energy strategy.
TEx	Photovoltaic Panels for hotel	PVs mounted externally.	PV Panels mounted on ?? kWe total consisting of XNo. of 2XXW panels.	Total PV array area is XXm^2.	All PVs to be accessible for regular inspection and cleaning.	External.	To be developed with energy strategy. Inverters and related electrical equipment to be located internally in roof electrical switch rooms (TE5).
TEx	UPS Plant Room.	Near incoming (main) comms room or could be in rack (Internal).	Uninterruptable power supply.	TBC, if required.	Double doors.	Vents at high and low level.	If required, to be provided as part of ICT fit out. Can be installed in comms/server rooms Likely to require additional DX cooling (roof plant).
TEx	Generator Enclosure	Assumed to be on roof due to limited internal space available. Also internal generator would require room to be acoustically treated and generator to be ventilated (with attenuation) which will be complex in listed building.	Generator in acoustic enclosure. (if required size TBC once fire strategy is agreed)	?.? x?.? x ?.?(h) TBC see notes	Access for regular inspection and testing. Acoustic enclosure to allow suitable access. Diesel fill from location where barrels can be trolleyed to. Typically use lift to transfer to highest floor and provide diesel pump and pipework from that location.	Generator exhaust flue out of enclosure. Louvres in acoustic enclosure.	Generator requirement/size subject to receipt and implementation of fire strategy. In particularly the any requirement for sprinkler pumps, smoke extract fans and firefighting or evacuation lifts. Consider noise breakout. Generator exhaust flue to discharges at highest point aware from all ventilation air intakes.
TEx	Essential power switch room	Ideal : Close to (next to but separate from) the generator room/enclosure and close to served equipment (Internal room).	Essential power switchgear and automatic changeover devices.	?.? x?.? x ?.?(h) TBC see notes	One and a half leaf door accessible from the inside or outside of the building	Louvres to external space (louvred doors).	Dependent on fire strategy.
TEx	Central Emergency Lighting Battery Room.	Ground Floor. (Internal).	Inverter, batteries.	TBC, if required.	Double doors. Access for regular testing and inspection and battery replacement.	Vents at high and low level.	Fire strategy to confirm. Current assumption is self-contained emergency light fittings with integral batteries will be sufficient for the offices. Likely to require additional DX cooling (roof plant).

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TEx	Centralised Emergency Lighting Monitoring.	Close to/in areas served (Internal).	Central monitoring panel	TBC, if required.	Single door access for regular testing and inspection.	Vents at high and low level.	Alternative to using local test key switches. Can also consider web based intelligent systems.
TEx	PA System / sound equipment incl racks	Internal.	PA Racks and equipment	TBC, if required.	Access for maintenance single door to external.	May need cooling.	Requirement dependent on extent of sound system provided in hotel area and if this is also to be used for PA announcements. May require cooling, heat rejection plant replicating TM 22.

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SCHEDULE OF GUILDHALL PLANT SPACE REQUIREMENTS – CCC OFFICES AND DEMOCRATIC ROOMS

REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
CPH1	Cold Water Services Plant Room	Ideal : Ground floor (internal). Anticipated : Basement (internal).	Incoming cold-water supply (utility metering in public footpath). Potable cold water storage tank (7.5m^3 storage capacity TEF sectional tank) Booster set (duty/assist/ standby). CAT V Booster set. Water leak detection system.	6.0 x 4.5 x 6.5(h) See note re existing plant room height and columns.	Leaf and one-half doors (for plant delivery and replacement). If ground floor location access from both inside and outside preferred to aid maintenance (inspections) and delivery of plant respectively. If basement location ensure lift and route to/from room are suitable for plant transfer	Ventilated tank room to ensure suitable room temperature to avoid stored water warming.	Minimum clearance of 750mm clear required above the tank. Tank based on 600mm pier walls. Consider bunding room. Floor gulley required (for overflow). Understood the existing boiler plant area has a clear head height of approx 5.7m. Depth of existing room approx. 6.7m to suit 6m deep requirement (rear columns and steps can be incorporated).
CPH2	Basement domestic hot water plant room	Ideal : Basement within served sanitary accommodation (internal).	Highly insulated 500l direct electric hot water storage cylinder, expansion vessel, circulation pump and associated controls.	1.5 x 1.1 x 2.7(h) Depth requires access from corridor in front.	Leaf and one-half door to allow access from corridor in front of room.	Background Infiltration	Locate cylinders on plinth. Floor gulley required for expansion relief. Assumes indirect HWS (via district heating) is not appropriate due to system design temperatures.
CPH3 vario us	Local domestic hot water heater cupboards (distributed)	Local to served outlets; Basement kitchenette/WCs. GF café, WCs (East and West), tea point & first aid. 1F WCs (East and West) and reheat kitchen.	Local electric hot water heater and associated expansion relief. Size to suit outlets served.	TBC, dependent on number of outlets served.	Lockable cupboard to be fully accessible for maintenance and inspection.	To consider heat dissipation.	Layouts/requirements TBC before details can be provided. Heaters to be local, in close proximity to outlets served.
CPHX	Rain Water Recycling Plant Room. **See note re provision.**	Ideal : Internal above served WCs so as to supply by gravity.. Anticipated : Basement (internal). See notes Could locate with OPH1.	20m^3 Rainwater recycling storage tank and filtration system. If pumped : Booster set (duty/standby).	7.5 x 7.5 x 3(h)	Double doors (for plant delivery and replacement). If ground floor location access from both inside and outside preferred to aid maintenance (inspections) and delivery of plant respectively. If basement location ensure lift and route to/from room are suitable for plant transfer.	Background Infiltration	Anticipated to be required to satisfy planning requirement. Rainwater downpipes to be routed to inlet of tank. Centralising tank to downpipe locations maximises roof catchment and minimises potential height impact of pipework setting under gravity. Tank to be based on 600mm pier walls. Consider bunding room. Floor gulley required.

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REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
CM1	Heat Pump Acoustic Enclosure	Roof (over level 4, will require reduction of existing PV provision). (External). Fully open to above.	2 no. 315kW Cooling & 218kW Heating 4pipe Air Source Heat Pumps (4PASHP). Size does not allow for RH control. Assumed acoustic louvred enclosure required around (TBC by acoustician).	End to end; 18.5 x 7.5 x 3.0h. Or side by side; 13.0 x 10.5x3.0h Above allow tube with drawl at rear of units (3m clearance).	Regular maintenance access via doorway within acoustic enclosure. Major replacement works may require demounting of screen. ASHP access provided within enclosure (walking on paving slabs laid on finished roof). Related power and pipework to be routed on inside face of acoustic enclosure only setting across ground level to route to related condenser (step overs required). Plant removal strategy requires crane lift onto/off of roof.	External for heat rejection. Consider acoustics (see note under plant).	Must be completely clear above to allow heat rejection/discharge from top. Enclosure dimensions includes clearance to sides of units to allow air flow. Acoustic criteria and assessment may influence selection, size and requirement for acoustic screening or louvres. If HT or MT DEN is provided this space can be allocated for chiller plant.
CM2	LTHW/CHW Plant room. See note re separation is preferable.	Ideal : Internal close to ASHPs (CM1) and risers. Can utilise basement space allocated for plant to east side. 3.5m depth to be from inside face of columns.	For LTHW Plant; Run/standby primary pumps. Buffer vessel (highly insulated). Run/standby distribution pumps. Pressurisation unit Expansion vessel Dosing pot For CHW Plant; As listed for LTHW plant. Control panel & Energy metering for LTHW&CHW plant.	9.5 x 3.5 x 3.0h.	Leaf and one-half doors (for plant delivery and replacement). If ground floor location access from both inside and outside preferred to aid maintenance (inspections) and delivery of plant respectively. If basement location ensure lift and route to/from room are suitable for plant transfer.	To consider heat dissipation but avoid 'cold room'.	Locate plant on plinths. Floor gulleys required for expansion relief and general water treatment processes. Ideally have LTHW and CHW plant in separate rooms to prevent heat transfer (energy loss) but will increase overall space requirement.
CM3	DEN Interface Plant Room.	Ideal : Internal on Ground floor perimeter of building onto Wheeler Street (proposed DEN route). Proposed use of ground floor cloak room area.	District Heating incoming pit. District Heating PHX substation (skid mounted duty/standby). Duty/standby Office Primary Heating pumps, Pressurisation set and Expansion vessels (replacing those in CM2) & Dosing Pot Mechanical Control panel, District Heating Control Panel? & Central Energy Logger **Note :** TBC by DEN designer	7.0 x 5.0 x 3.0h. **Note :** TBC by DEN designer	DEN will want direct access from public footpath with double doors (for plant delivery and replacement). Listing will prevent this. Will need to review how plant installation and maintenance can be achieved (likely to require breaking down of skid equipment into components and use of rear escape door). **Note :** TBC by DEN designer	To consider heat dissipation but avoid 'cold room'. **Note :** TBC by DEN designer	**Note :** We anticipate that the DEN operator will want to serve the building via one set of shared mains. This will require additional shared plant, potentially reducing operating efficiency and introducing complications in adapting the 4PASHP distribution system to suit the future DEN (when available).

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CM4	Mechanical Ventilation with Heat Recovery – Basement BoH West	Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes.	1 No. cupboard MVHR vertical unit with top duct connections. 110l/s.	1.8 x 0.9 x 2.7h. + access to front (in front of 0.9m). See notes.	Access for regular maintenance and inspection from plant room/area. Unit width can just fit through doorway.	None required to plant cupboard.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Height allows for connecting ducts/attenuators routing into corridor ceiling void (behind). 1.8m length includes 600mm access which can be from surrounding plant area (unit width is 1.2m). Voids to be reviewed for suitability for intake/exhaust in conjunction with other local systems. Assume exhaust will be taken to roof level.
CM7	Mechanical Ventilation with Heat Recovery – Basement and Ground East WCs	Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes. Assumed ground floor void can be used with ducts routing up and down to roof over small hall.	1 No. horizontal floor mounted MVHR unit. 950 l/s.	2.0 x 2.1 x 1.5(h) See notes.	Access for regular maintenance and inspection. Access doors in wall forming void? Ground floor location suggested due to easier access for installation and replacement (via east entrance)	None required to plant room.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 2m length. 2.1m room depth is only required opposite AHU components approx. 1.7m length. Acoustics to be reviewed (noise breakout to Hall via void?). Rising ducts in void to hall roof. Compromises NZC.
CM8	Mechanical Ventilation with Heat Recovery – Basement and Ground BoH East	Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes. Assumed ground floor void can be used with ducts routing up and down to roof over small hall.	1 No. horizontal floor mounted MVHR unit. 435 l/s.	1.9 x 1.8 x 1.5(h) See notes.	Access for regular maintenance and inspection. Access doors in wall forming void? Ground floor location suggested due to easier access for installation and replacement (via east entrance)	None required to plant room.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 1.9m length. 1.8m room depth is only required opposite AHU components approx. 1.5m length. Review acoustics (noise breakout to Hall via void?). Rising ducts in void to hall roof. Compromises NZC.
CM9	Mechanical Ventilation with Heat	Ideal : Internal with close proximity to served areas and also external wall for	1 No. horizontal floor mounted MVHR unit.	1.9 x 1.8 x 1.5(h) See notes.	Access for regular maintenance and inspection. Access via assocaited bin (in/out) route.	None required to plant room.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct.

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	Recovery – Bin Store & Bin Circulation	intake and exhaust duct routes.	360 l/s.				Attenuator and ductwork connections will add to the 1.9m length. 1.8m room depth is only required opposite AHU components approx. 1.5m length.
CM 11	Mechanical Ventilation with Heat Recovery – Large Hall Change West	Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes. See notes re intake and exhaust ducts..	1 No. MVHR in ceiling void unit with end connections. 95l/s (subject to occupancy briefing).	1.5x 0.85x 0.45h + access from below (hinged door on underside). MF to review controls / electrics access.	Access for regular maintenance and inspection from room.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Will impact on general ceiling coordination and RCP. Allow deep ceiling void to assist. Proposed ceiling void unit but duct routes to intake and exhaust must be minimised to achieve NZC.
CM 12	Mechanical Ventilation with Heat Recovery – Large Hall Change East.	Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes. Proposed ceiling void unit but duct routes to intake and exhaust must be short for NZC.	1 No. MVHR in ceiling void unit with end connections. 70l/s (subject to occupancy briefing).	1.5x 0.85x 0.45h + access from below (hinged door on underside). MF to review controls / electrics access.	Access for regular maintenance and inspection from room.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Will impact on general ceiling coordination and RCP. Allow deep ceiling void to assist.
CM 13	Mechanical Ventilation with Heat Recovery – Offices Central	Ideal : Internal with close proximity to served spaces also external wall for intake and exhaust duct routes. Assumed first floor deck location.	1 No. horizontal floor mounted MVHR unit. 1205 l/s.	2.2 x 2.4 x 1.7(h) See notes.	Access for regular maintenance and inspection. Likely to require crane lift onto/off roof for initial installation and replacement. To be reviewed with design development.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 2.2m length. 2.4m room depth is only required opposite AHU components approx. 2m length. Acoustics to be reviewed (proximity to restaurant and large hall).
CM 14	Mechanical Ventilation with Heat	Ideal : Internal with close proximity to served spaces also external wall for intake and exhaust duct routes.	1 No. horizontal floor mounted MVHR unit. 1800l/s.	2.5 x 3.1 x 2.2(h) See notes.	Access for regular maintenance and inspection. Crane lift onto/off roof for initial installation and replacement.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct.

REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
	Recovery – Small Hall	Assumed roof over reheat kitchen. Ductwork will be very tight as is coordination with reheat AHU and related ductwork.					Attenuator and ductwork connections will add to the 2.5m length. 3.1m room depth is only required opposite AHU components approx. 2.3m length.
CM 15	Mechanical Ventilation – Hall Reheat Kitchen Extract fan.	Ideal : External near to point of discharge. Potentially : 2F (walkway over small hall, kitchen end). See notes re discharge/ exhaust.	Kitchen Extract fan. 0.75M^3/s. Estimate only requires catering consultant to specify hoods and confirm required ventilation rates.	1.5 x 0.45Ø. See notes.	Access for regular maintenance and inspection. Kitchen extract ductwork to be accessible throughout its length. Cleaning access panels required every 3m. Vertical ductwork will require provision of access platforms. Crane on/off roof.	None required for.	Discharge (exhaust) to be above highest point of roof and any neighbouring buildings that are higher and within 20m. **Will need to rise above Large Hall roof.** Attenuator and ductwork connections will add to the 1.5m length (but can go in vertical ductwork). Consider acoustics/noise from fan (kitchen extract by nature are noisy)
CM 16	Mechanical Ventilation – Reheat Kitchen Supply AHU.	Ideal : Internal with close proximity to served kitchen and also external wall for intake duct route. Potentially : 2F (roof over).	Kitchen Supply AHU. 0.75M^3/s. Estimate only requires catering consultant to specify hoods and confirm required ventilation rates.	3.5 x 2.1 x 1.0(h) See notes.	Access for regular maintenance and inspection. Crane on/off roof.	None required for AHU itself.	Supply intake louvre location to minimise risk of entraining any pollutants, including discharge from any local exhaust ducts. Attenuator and ductwork connections will add to the 3.5m length. 2.1m room depth is only required opposite AHU. To be coordinated with CM14 (refer to CM14 notes).
CM 17	Mechanical Ventilation with Heat Recovery – Civic Chambers	Ideal : Internal with close proximity to Chambers also external wall for intake and exhaust duct routes. Assumed third floor walkway location (see access).	1 No. horizontal floor mounted MVHR unit. 1450 l/s.	2.2 x 2.4 x 1.7(h) See notes.	Access for regular maintenance and inspection. Likely to require crane lift onto/off roof for initial installation and replacement. To be reviewed with design development. Assumed third floor walkway location to be reviewed with large hall roof and route past MVHR (using 1.1m access clearance within the 2.4 depth). Requires unit and ducts to be tight to Chamber wall,	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 2.2m length. 2.4m depth is only required opposite AHU components approx. 2m length. Consider acoustics, noise break out to Chambers.
CM 18	Mechanical Ventilation with Heat	Ideal : Internal with close proximity to Hall also external wall for intake and exhaust duct routes.	1 No. horizontal floor mounted MVHR unit.	5.0 x 4.0 x 2.3(h) See notes.	Access for regular maintenance and inspection.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct.

Cambridge Civic Quarter - Guildhall

Architect: **Cartwright Pickard Architects**
Issue Status: S1

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REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
	Recovery – Large Hall	Currently shown on third floor off walkway/roof over public access balcony. Need to establish existing provision/arrangement.	4M3/s (subject to confirmation of occupancy, particularly balcony).		Likely to require crane lift onto/off roof for initial installation and replacement. To be reviewed with design development. Assumed third floor walkway location to be reviewed with large hall roof/walkway depth and survey of existing ventilation strategy. Look to use walkway as part of AHU access space.		Attenuator and ductwork connections will add to the 5m length. 4m depth is only required opposite AHU to provide maintenance access that can also provide walkway past (is >1.5m).
CM 19	Mechanical Ventilation with Heat Recovery – Office West WCs (GF&1F)	Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes. Proposed : Roof over using riser to be coordinated with office lifts. Requires modification to PVs.	1 No. horizontal floor mounted MVHR unit. 295 l/s.	1.9 x 1.8 x 1.5(h) See notes.	Access for regular maintenance and inspection. Will require crane lift on/off.	None required to plant room.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 1.9m length. 1.8m room depth is only required opposite AHU components approx. 1.5m length.
CM 20	Mechanical Ventilation with Heat Recovery – Offices West	Ideal : Internal with close proximity to served spaces also external wall for intake and exhaust duct routes. Assumed roof location near west atrium with riser coordinated with circulation space around atrium to route ducts to served area. Will require modification to existing PVs.	1 No. horizontal floor mounted MVHR unit. 1800l/s (subject to decision on first floor west office or hotel, this allows for office).	2.5 x 3.1 x 2.2(h) See notes.	Access for regular maintenance and inspection. Likely to require crane lift onto/off roof for initial installation and replacement. Riser coordination with atria to ensure suitable access to install and clean related ductwork from floor plate.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 2.5m length. 3.1m room depth is only required opposite AHU components approx. 2.3m length.
CM 21	Mechanical Ventilation with Heat Recovery – Office East WCs (GF&1F)	Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes. Proposed : Roof over using riser to be coordinated with office lifts. Requires modification to PVs.	1 No. horizontal floor mounted MVHR unit. 360 l/s.	1.9 x 1.8 x 1.5(h) See notes.	Access for regular maintenance and inspection. Will require crane lift on/off.	None required to plant room.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 1.9m length. 1.8m room depth is only required opposite AHU components approx. 1.5m length.

Guildhall Plant Schedule – Option 4
J7562-MXF-GH-ZZ-SH-J-30004 Rev WIP

Cambridge Civic Quarter - Guildhall

Architect: **Cartwright Pickard Architects**
Issue Status: S1

REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
CM 22	Mechanical Ventilation with Heat Recovery – Offices East	Ideal : Internal with close proximity to served spaces also external wall for intake and exhaust duct routes. Assumed roof location near office lifts with riser coordinated with lifts to route ducts to served area. Will require modification to existing PVs.	1 No. horizontal floor mounted MVHR unit. 1130 l/s.	2.2 x 2.4 x 1.7(h) See notes.	Access for regular maintenance and inspection. Likely to require crane lift onto/off roof for initial installation and replacement. Riser coordination with lifts to ensure suitable access to install and clean related ductwork from floor plate.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 2.2m length. 2.4m room depth is only required opposite AHU components approx. 2m length.
CM 23	Main Comms Room Heat Rejection Plant	Ideal : Roof location in close proximity to served room. Not ideal pipe route as no local external space for heat rejection.	Allow for 2No. outdoor condensers (run and standby). 5kW UK sensible cooling each.	3 x 3 x 2.0(h) Heat rejected horizontally so equivalent area won't be suitable.	Access for maintenance single door to external.	Must be completely clear above to allow heat rejection to dissipate (not recirculate).	Acoustic criteria and assessment may dictate requirement to enclose/screen area.
CM 24	Distributed (local) Comms Room Heat Rejection Plant	Ideal : Roof location in close proximity to served room (appears possible). Not ideal pipe route as need to pass through hotel demise.	Allow for single condenser. 5kW UK sensible cooling.	1.5 x 3 x 2.0(h) Heat rejected horizontally so equivalent area won't be suitable.	Access for maintenance single door to external.	Must be completely clear above to allow heat rejection to dissipate (not recirculate).	Acoustic criteria and assessment may dictate requirement to enclose/screen area. Potentially investigate roof space over small hall (off East stair).
CE1	Photovoltaic Panels for office	PVs mounted externally.	PV Panels mounted on flat roof and roof of large hall kWe total consisting of XNo. of 2XXW panels (	Total PV array area is 486m^2.	All PVs to be accessible for regular inspection and cleaning.	External.	To be developed with energy strategy. Inverters and related electrical equipment to be located internally in roof electrical switch rooms (CE5)
CE2	UKPN Substation	Ideal : Ground floor with direct access and louvres from public footpath. Look to negotiate : Reuse of basement transformer room	UKPN owned transformer / CT chamber 1No. 1MVA transformer	As existing.	To be agreed with UKPN. Will require method of accessing and replacing transformer 24/7.	TBC by UKPN. Need to establish current provision. Allow for mechanical ventilation.	Requirement to be confirmed by UKPN, including position, access and construction details. Substation will serve building (office and hotel). May also serve local buildings or external provisions e.g. street lighting.

Guildhall Plant Schedule – Option 4
J7562-MXF-GH-ZZ-SH-J-30004 Rev WIP

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Cambridge Civic Quarter - Guildhall

Architect: **Cartwright Pickard Architects**
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REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
CE3	Office Switch Room	Basement (Internal) immediately beside the substation (CE2).	Incoming UKPN supply head and utility metering. Main Switchgear Distribution board for basement West. Energy metering equipment External lighting board/control.	5 x 2.5 x 3(h)	One and a half leaf door access. Ideally from outside and inside of the building. Basement location likely to dictate the need for the panel to be delivered in sections and formed on site/in situ.	Background Infiltration	Depending on UKPN head/metering arrangement. Assumes UKPN happy to route cabling into switch room via basement (should be).
CE4 (ah) Var.	Electrical Cupboards (dispersed)	Ideal : Internal cupboard/room local to area served and riser containing sub main power distribution. Vertically stacked (between floors) and central to served areas (to reduce cable lengths)	Distribution Boards (power and lighting) Electrical Sub Meters & logging devices. Lighting Controls	1.0 x 0.5 x 2.5(h) Dims are for DB only (not rising sub mains.	Must be fully accessible but secured (locked). Can be a locked board in a secure staff room/area or riser.	Background infiltration	Locations to be developed with risers and layouts. Hall requirements to be confirmed by theatre consultant. May require larger boards and more of them to suit stage equipment, performance systems and lighting.
CE5	Electrical Switch Room – Roof plant	On new roof (to West).	Panel board. Control panel (MCP). Local small power/lighting board. Electrical Meters & logging devices PV inverters.	3 x 2 x 2.7 (h) Subject to confirmation with developing roof plant layout	Single door.	High and low level louvres for summer heat dissipation.	Location to relate to served plant and sub main riser routing up from below. Dispersed plant power cabling strategy to be developed with routing through existing building.
CE6	Incoming Comms Room	Ideal : Secure ground floor room located off public footpath. Likely : Basement room (IT managers often concerned about flood risk). Locate in CCC office area to aid cable distribution (large number of cables to serve east side BF-1F).	Incoming utility service and associated boards/distribution. Office comms racks. See CE8 & CE9.	4 x 2.5 x 3.0(h)	Direct external access for utility provider is preferred. Constraints of existing building unlikely to allow. If in basement lift and corridor to be suitable to house a data cabinet/free standing rack (width and height).	Will need cooling. Ideally some background ventilation if in basement.	This assumes dual incoming comms rooms are not required. Basement room would ideally be avoided as IT managers are concerned about floor risk.

Guildhall Plant Schedule – Option 4
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Cambridge Civic Quarter - Guildhall

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REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
CE7	Distributed (local) Comms Rooms. Fibre linked to CE6 to ensure suitable cable lengths to local outlets	Internal : Ground floor west side to serve west side of G-1F. Location to reduce cable lengths and quantum of cable routing from main comms room (CE6)	Cabinet and racks, patches etc.	3.0 x 2.2 x 2.7(h) See access	Leaf and a half door to allow installation and removal of comms rack. Store width at ground floor will only allow access to sides and front of an cabinet and would share room with distribution board (access/security).	Background infiltration ventilation only- (will be cooled).	Cable routing requires local riser down to basement and upto first floor. Theatre consultant to confirm requirement for Halls (if dedicated systems are required).
CE8	Building Management Equipment room	Assumed that all related building management staff interface equipment will be located within the reception hub. UPS systems to be in comms rack (E6).	AWC alarm system equipment Refuge alarm system equipment Access control system equipment Security system equipment	Subject to briefing. Consider behind front desk work top/cupboards (appears quite open)	Access to all equipment for maintenance.	If in office utilise office ventilation and cooling and ensure equipment is open to the office for heat dissipation.	Management systems requiring regular staff monitoring/use will often have related accessories at the staff desk positions. Some may be accessible via the web (subject to agreed briefing). Assumes a number of rack mounted systems (contained within CE6).
CE9	Fire Alarm Panel (s)	Visible from main entrance (as defined for fire access) (Internal) May require repeater panels in Customer Services Reception.	Fire alarm panel. Potentially repeater panel.	0.8 x 0.4 x 0.6(h) estimated.	Fully accessible to front of panel/s	Have some ventilation openings into surrounding space.	Fire strategy TBC by fire engineer Required to be visible so if enclosed should have a glazed front.
CE10	PV Battery Storage Room.	Local to PV inverters.	Batteries.	3.5 x 4.5 x 3(h), if required.	Double doors. Access for regular testing and inspection and battery replacement.	Vents at high and low level.	To be developed with PV design and energy strategy.

Additional Plant rooms that may be required in response to further assessments and/or fire strategy and/or detailed briefing

REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
CPHX	Sprinkler Tank Room.	Ideal : Ground floor (internal).	Sprinkler system water storage tank. Sprinkler Pumps.	?.? x ?.? x ?.?(h)	Double doors accessible from inside or outside (preferred) of the building.	Background Infiltration	Requirement TBC by fire engineer. Estimated size based on OH?? category and minimum flow duration of mins.

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REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
	See note re provision.	Anticipated : Basement (internal)	Power and controls.		**Fireman to have direct access from outside of the building**		Consider bunding room. Floor gulleys required. **Would/could this also serve the hotel?**
CMx	Smoke Extract Fans - Basement	In separate fire compartment to that served	Mechanical smoke extract fans (run/standby). ??M3/s each.	?.? x ?.? x ?.?(h)	Regular inspection and testing. Crane lift in/out ~(heavy)	Open to surroundings for motor heat release.	Requirement to be confirmed by fire engineer/ strategy including compartmentation. Discharge to be away from all exits. Ideally at roof level to allow dispersal of smoke. Consider make up air (how/from where) Attenuation? Interfaces with fire alarm, sprinklers etc. Secondary power.
CMx	Smoke Extract Fans -	Roof connected into ventilation shaft (external).	Mechanical smoke extract fans (run/standby).	3 x 3 x 1.5(h) including maintenance space to front	Regular inspection and testing.	Open to surroundings for motor heat release.	Initial allowance to be developed with fire engineer.
CMx	Dry risers	Incoming valve on external façade. Dry riser cabinets off firefighting stairs.	Valve boxes/cabinets.	See note	Access from firefighting lobby.	None required.	Requirement to be confirmed by fire strategy
CMx	Sound/AV/ Dimmer room- Heat Rejection Plant (per room)	Roof over	Allow for single condenser. 5kW UK sensible cooling TBC by Theatre consultant.	1.5 x 3 x 2.0(h) per room served Heat rejected horizontally so equivalent area won't be suitable.	Access for maintenance single door to external.	Must be completely clear above to allow heat rejection to dissipate (not recirculate).	Acoustic criteria and assessment may dictate requirement to enclose/screen area. Room, equipment and assocaited cooling requirements TBC by Theatre Consultant.
CMx	Gas/Foam fire suppression for critical electrical rooms.	Local to served critical electrical room, typically a data/comms room (internal).	Specialist suppression cylinders and related control, monitoring and (if required) ventilation systems.	TBC, if required size dependent on served room.	Internal door (single anticipated)	Dependent on suppression system/gasses used.	May require pressurisation/ventilation system. Consider subsequent removal of sasses/foam after use.

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REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
CEx	Generator Enclosure	Assumed to be on roof due to limited internal space available. Also internal generator would require room to be acoustically treated and generator to be ventilated (with attenuation) which will be complex in listed building.	Generator in acoustic enclosure. (if required size TBC once fire strategy is agreed)	?.? x?.? x ?.?(h) TBC see notes	Access for regular inspection and testing. Acoustic enclosure to allow suitable access. Diesel fill from location where barrels can be trolleyed to. Typically use lift to transfer to highest floor and provide diesel pump and pipework from that location.	Generator exhaust flue out of enclosure. Louvres in acoustic enclosure.	Generator requirement/size subject to receipt and implementation of fire strategy. In particularly the any requirement for sprinkler pumps, smoke extract fans and firefighting or evacuation lifts. Consider noise breakout. Generator exhaust flue to discharges at highest point aware from all ventilation air intakes.
CEx	Essential power switch room	Ideal : Close to, ideally next to but separate from the generator room/enclosure and close to served equipment. Internal room	Essential power switchgear and automatic changeover devices.	?.? x?.? x ?.?(h) TBC see notes	One and a half leaf door accessible from the inside or outside of the building	Louvres to external space (louvred doors to service road)	Dependent on fire strategy.
CEx	UPS Plant Room.	Near Server Room. (Internal).	Uninterruptable power supply.	TBC, if required.	Double doors.	Vents at high and low level.	If required, to be provided as part of ICT fit out. Can be installed in comms/server rooms Likely to require additional DX cooling (roof plant).
CEx	Central Battery Room.	Ground Floor. (Internal).	Inverter, batteries.	TBC, if required.	Double doors. Access for regular testing and inspection and battery replacement.	Vents at high and low level.	Fire strategy to confirm. Current assumption is self-contained emergency light fittings with integral batteries will be sufficient for the offices. May require additional DX cooling (roof plant).
CEx	Central Emergency Lighting Monitoring Panel	Close to/in areas served (Internal).	Central monitoring panel	TBC, if required.	Single door access for regular testing and inspection.	Vents at high and low level.	Alternative to using local test key switches. Can also consider web based intelligent systems.
CEx	External Lighting pillars	External to suit lighting installations	Feeder pillar and electrical distribution equipment/protective devices	TBC with lighting design.	Direct access from surrounding external space	None as external installation	To be developed with external lighting design.
CEx	Performance Space (Hall) Dimmer Room	Locate room close to performance space lighting bars	Dimmer racks detailed by Theatre Consultant	3 x 3 x 2.7(h) TBC by Theatre Consultant	Leaf and a half door to allow installation and removal of comms rack.	Background infiltration ventilation only (will be cooled).	TBC by Theatre Consultant. Will require room cooling (dedicated split system located on nearby roof).
CEx	Performance Space (Hall) AV rack room	Locate room close to performance space	Equipment detailed by Theatre Consultant.	3 x 3 x 2.7(h) TBC by Theatre Consultant	Leaf and a half door to allow installation and removal of comms rack.	Background infiltration ventilation only (will be cooled).	TBC by Theatre Consultant. Will require room cooling (dedicated split system located on nearby roof).

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J7562-MXF-GH-ZZ-SH-J-30004 Rev WIP

Cambridge Civic Quarter - Guildhall

Architect: **Cartwright Pickard Architects**
Issue Status: S1

REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
CEx	Sound/AV equipment.	TBC by Theatre Consultant (for Halls and possibly Chambers). Ideally in secure room.	Racks/equipment.	TBC by Theatre Consultant	Full access required	TBC by Theatre Consultant Often require cooling.	Requirements TBC by theatre consultant.

Notes

1. Based on CPA design drawings dated 05/06/2024.
2. All dimensions are clear internal dimensions. There should not be any structural columns or down stand beams within the clear dimensions/areas defined. If this can not be the case the areas will require review, development and likely increase to coordinate accordingly.
3. Vertical transportation is not included in this schedule, refer to separate advice for this.
4. For storage(attenuation), pumping or any other plant that may be required by the below ground drainage design refer to information provided by civil engineer.
5. For plant/equipment that is associated with any irrigation systems or water features refer to information provided by landscape architect.
6. For plant/equipment that is associated with the waste or recycling refer to information provided by transport consultant e.g. compactor.

Rev	Date	Status	Description	Engineer	Project Leader
WIP	30/08/2024	Status S1	Suitable for Coordination	RF	CB
P01	05/07/2024	Status S0	For coordination/information	RF	CB

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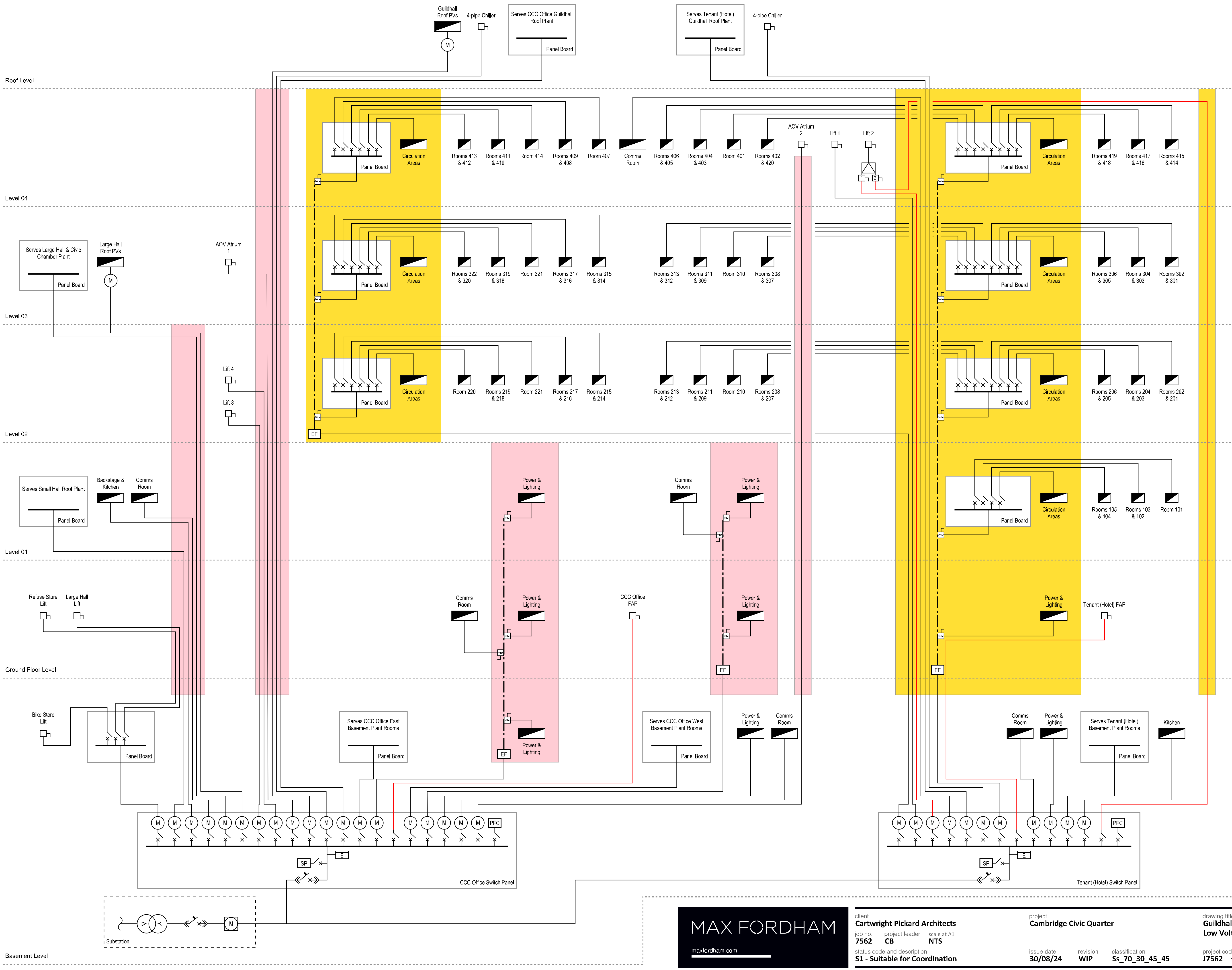
Guildhall Plant Schedule – Option 4
J7562-MXF-GH-ZZ-SH-J-30004 Rev WIP



NOTES

1. This drawing is to be read in conjunction with all other MXF drawings, schedules and specifications.
2. Do not scale from this drawing.
3. Print in colour.
4. All electrical works are to be designed, installed and tested to BS 7671 : 2018 (18th Edition of the Wiring Regulations).
5. All cabling is to be run within containment and run in safe zones regardless of mechanical protection. Direct clipping will not be permitted.
6. Separate containment is to be provided for submain, general LV, fire alarm, control and data cables.

KEY

- Fire Resistant Submain Cable
- Submain Cable
- Vertical Busbar
- Auto Transfer Switch
- Busbar Tap Off
- Consumer Unit
- Disconnector
- Distribution Board
- EF — End Feed Unit
- FAP — Fire Alarm Panel
- MCCB Circuit Breaker
- Withdrawable Air Circuit Breaker
- E — Main Power Meter (Type M1)
- M — Meter
- PFC — Power Factor Correction
- SP — Surge Protection
- Transformer
- M — Utility Power Meter
- Riser for CCC Office Areas
- Riser for Tenant (Hotel) Areas

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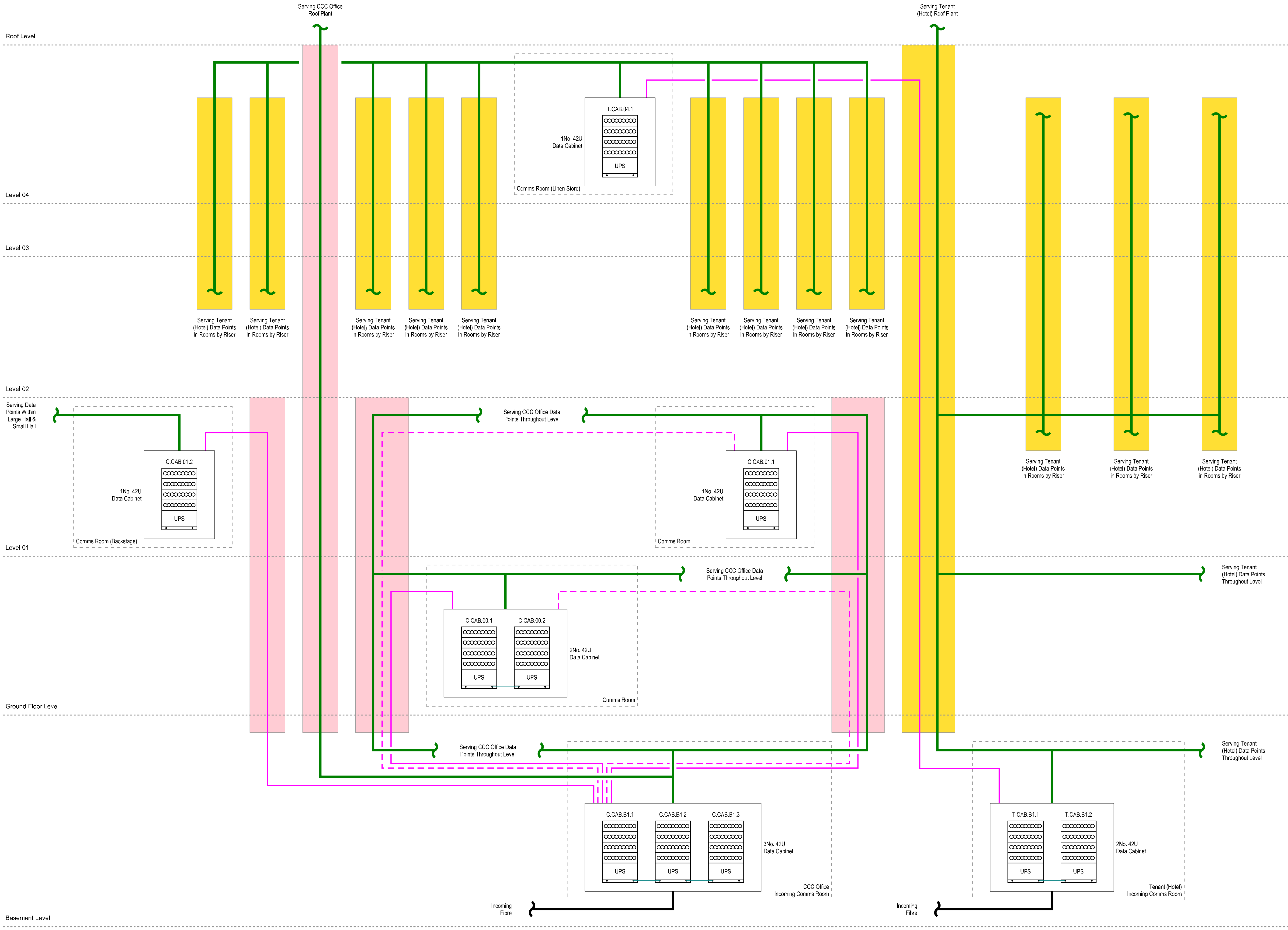
client: **Cartwright Pickard Architects**		project: **Cambridge Civic Quarter**	drawing title: **Guildhall - Option 4 Low Voltage Distribution Schematic**
job no.: **7562**	project leader: **CB**	scale at A1: **NTS**	
status code and description: **S1 - Suitable for Coordination**	issue date: **30/08/24**	revision: **WIP**	classification: **Ss_70_30_45_45**
project code: **J7562**	orig.: **MXF**	volume: **GH**	level: **ZZ** - type: **DR** - role: **E** - number: **22204**



NOTES

1. This drawing is to be read in conjunction with all other MXF drawings, schedules and specifications.
2. Do not scale from this drawing.
3. Print in colour.

KEY

- Cabling Between Data Cabinets
- Data Basket - Cat 6A Cables
- Primary Fibre Backbone Cabling
- Secondary Fibre Backbone Cabling
- UPS — Uninterruptible Power Supply
- Data Cabinet (with mounted UPS)
- Riser for CCC Office Areas
- Riser for Tenant (Hotel) Areas

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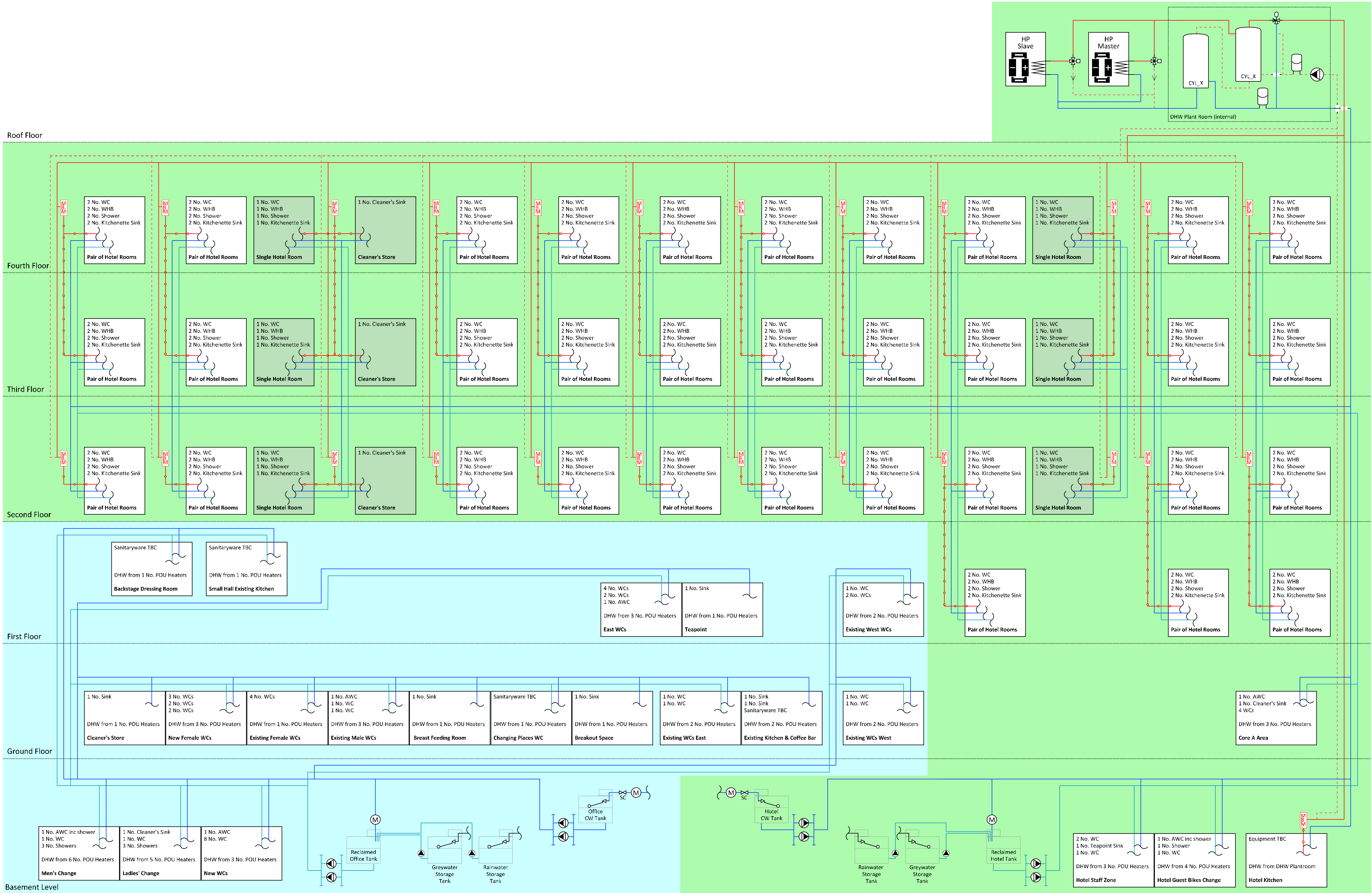
client: **Cartwright Pickard Architects**	project: **Cambridge Civic Quarter**	drawing title: **Guildhall - Option 4 Data Distribution Schematic**
job no. **7562** / project leader **CB** / scale at A1 **NTS**		
status code and description: **S1 - Suitable for Coordination**	issue date **30/08/24** / revision **WIP** / classification **Ss_75_10_21_00**	project code **J7562** - orig. **MXF** - volume **GH** - level **ZZ** - type **DR** - role **E** - number **51204**



KEY

—	Boosted Cold Water		Expansion Vessel (Potable Water)	M	Meter
—	Domestic Hot Water Flow		DHW Cylinder	SC	Stopcock
- - -	Domestic Hot Water Return		DHW Heat Pump		3 Port Valve - Diverting
—	Boosted Reclaimed Rainwater		Pump - Variable Speed		3 Port Valve - Thermostatic
—o—o—	Multiple DHW Microbore Pipes		CCC Office Areas	MBM	Microbore Pipework Manifold
			Tenant (Hotel) Areas		

NOTES

1. This drawing is to be read in conjunction with all other MXF drawings, schedules and specifications.
2. Do not scale from this drawing. Print in colour.
3. This schematic shows key components to illustrate the design intent. Not all components (valves, ancillaries etc.) are shown. This document presents the design intent developed to RIBA Stage 2 Concept Design level of information, and is subject to further design development during RIBA Stage 3.

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client
Cartwright Pickard Architects

job no. **7562** project leader **CB** scale at A1 **NTS**

status code and description
S1 - Suitable for Coordination

project
Cambridge Civic Quarter

issue date **30/08/24** revision **WIP** classification **Ss_55_70_00_00**

drawing title
Guildhall - Option 4
Water Distribution and Supply Schematic

project code **J7562** - orig. **MXF** - volume **GH** - level **ZZ** - type **DR** - role **P** - number **50204**

APPENDIX IV – GUILDHALL OFFICE OPTION MEP DRAWINGS & SCHEDULE

Drawings included in this appendix have been printed at A3 paper size for the convenience of the report. Original A1 paper size drawings issued alongside this report as separate documents.

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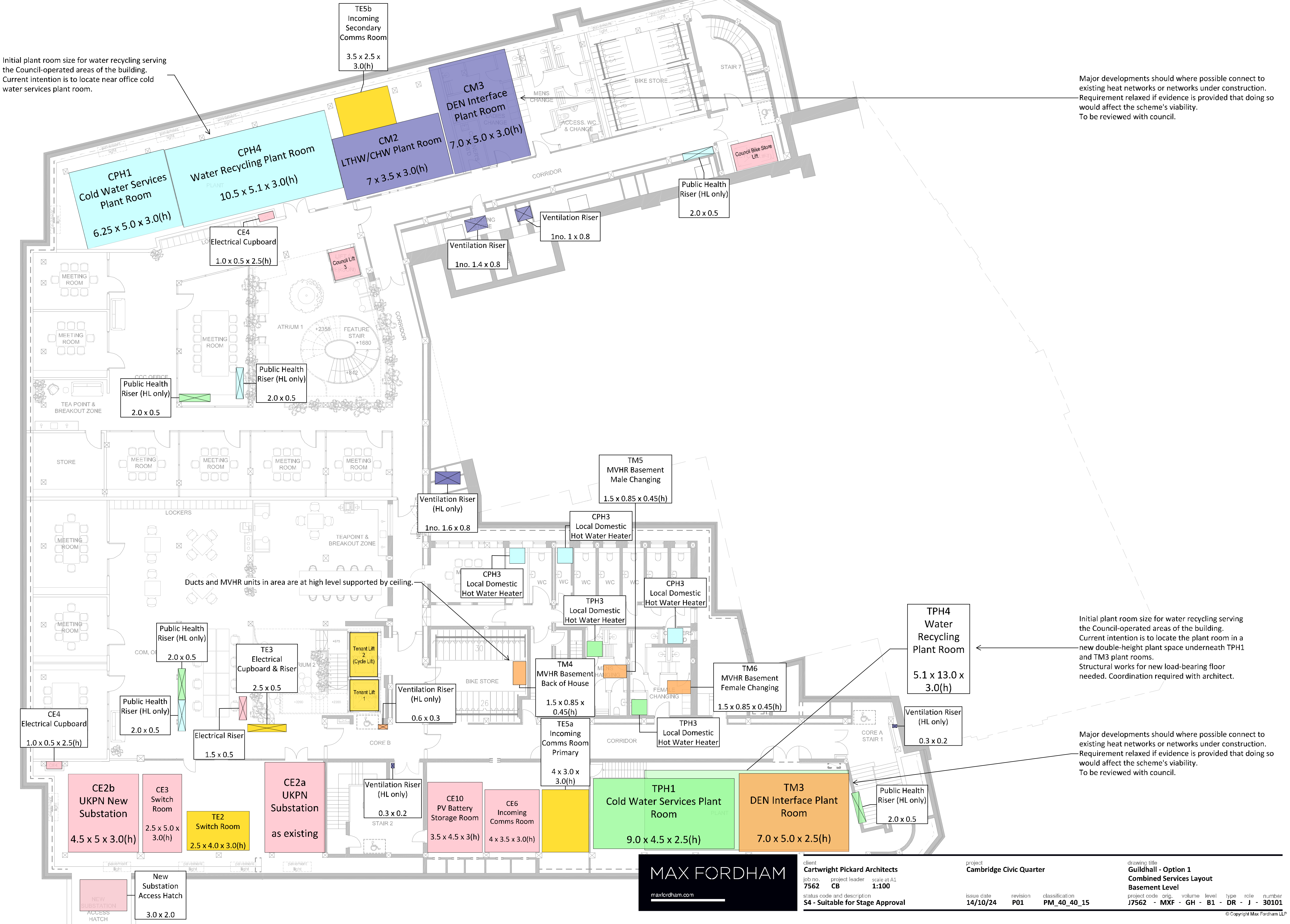

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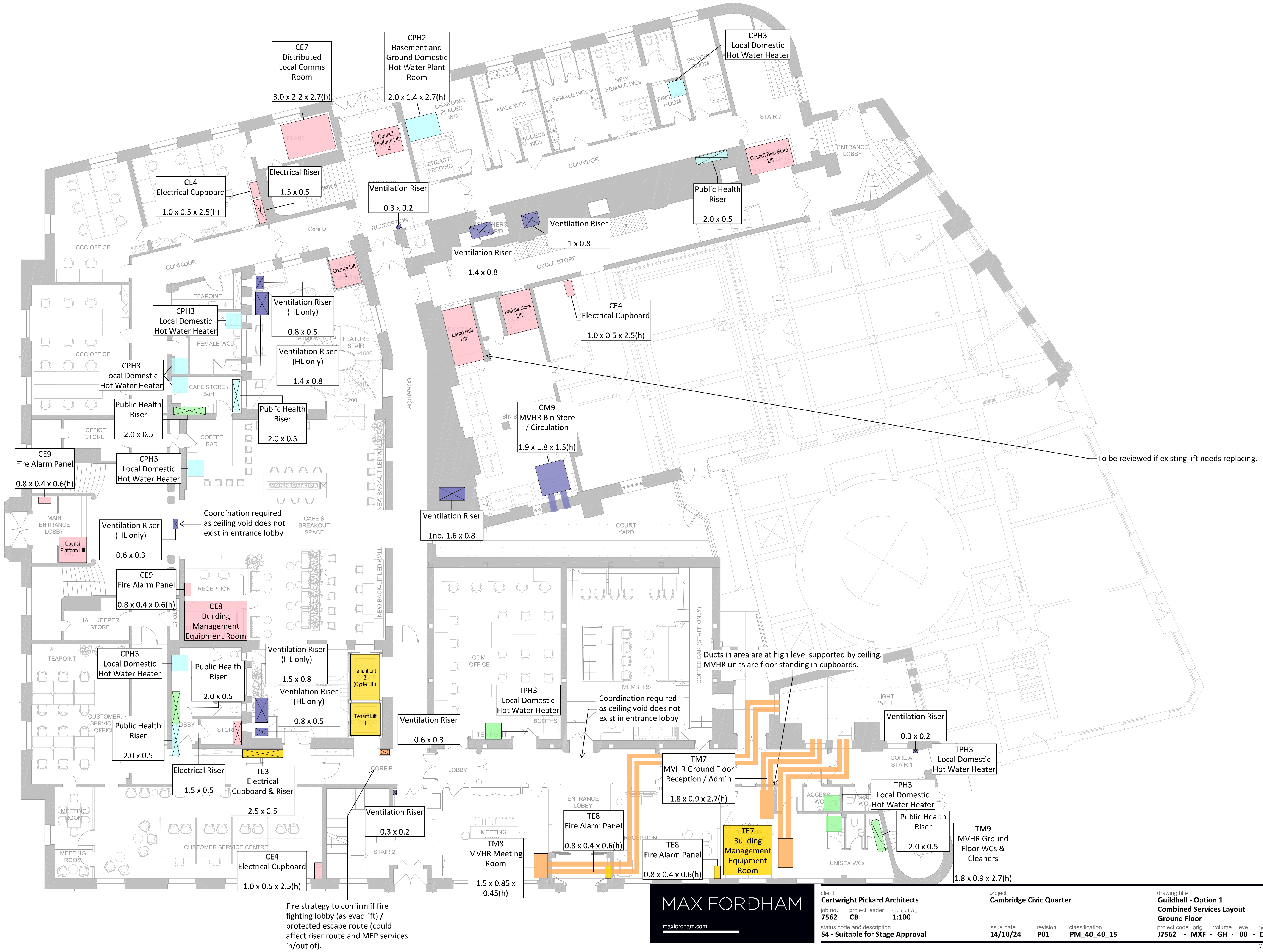
client: Cartwright Pickard Architects
job no.: 7562 | project leader: CB | scale at A1: 1:100
status code and description: S4 - Suitable for Stage Approval

project: Cambridge Civic Quarter
issue date: 14/10/24 | revision: P01 | classification: PM_40_40_15

drawing title: Guildhall - Option 1
Combined Services Layout
Basement Level

project code: J7562 - orig.: MXF - volume: GH - level: B1 - type: DR - role: J - number: 30101



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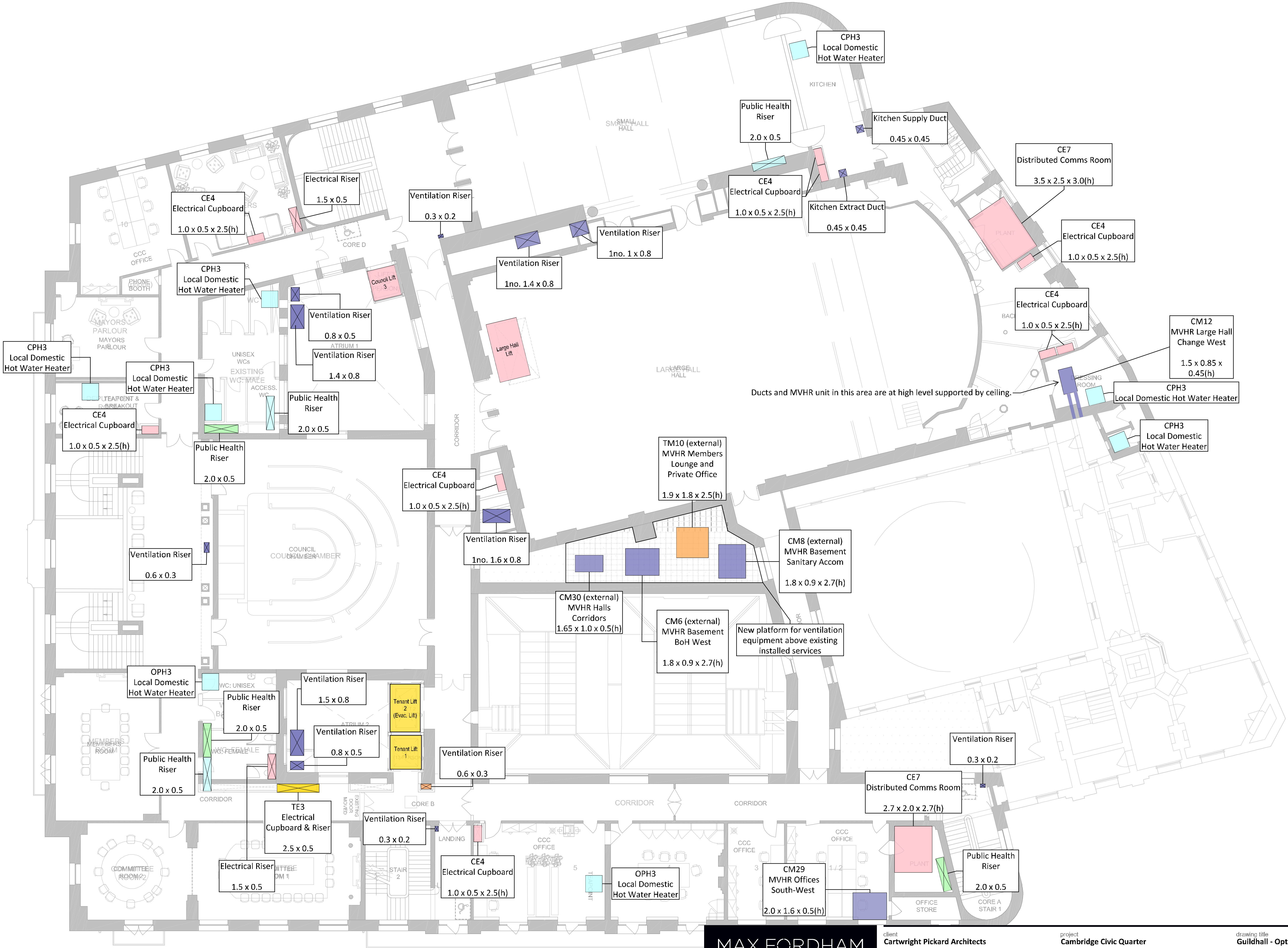
client	project	drawing title
Cartwright Pickard Architects	Cambridge Civic Quarter	Guildhall - Option 1 Combined Services Layout Ground Floor
job no. 7562 / project leader CB / scale at A1 1:100	issue date 14/10/24 / revision P01 / classification PM_40_40_15	project code J7562 - orig. MXF - volume GH - level 00 - type DR - role J - number 30101
status code and description S4 - Suitable for Stage Approval		



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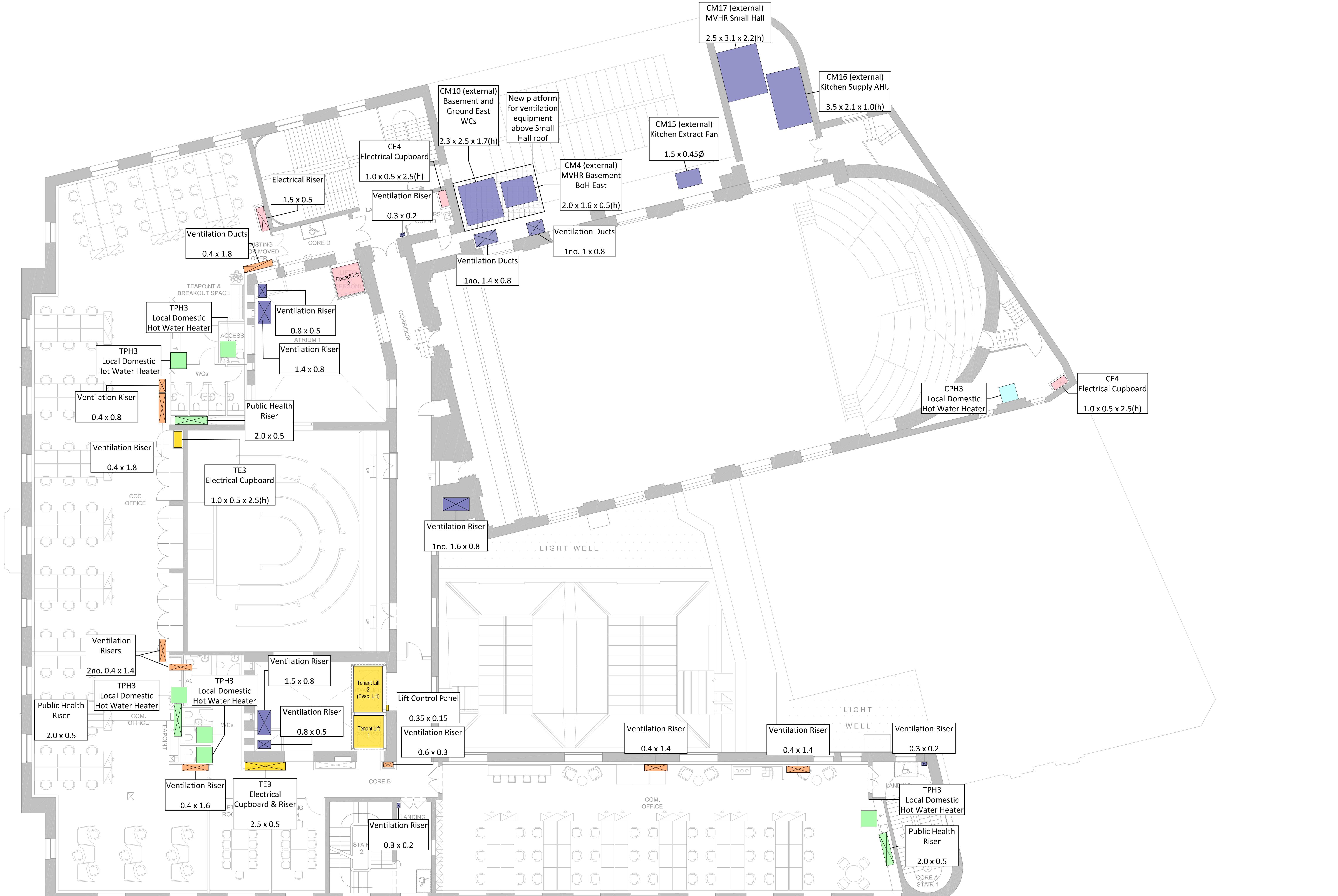
client: Cartwright Pickard Architects	project: Cambridge Civic Quarter		drawing title: Guildhall - Option 1 Combined Services Layout First Floor
job no.: 7562	project leader: CB	scale at A1: 1:100	
status code and description: S4 - Suitable for Stage Approval	issue date: 14/10/24	revision: P01	classification: PM_40_40_15
project code - orig. - volume - level - type - role - number: J7562 - MXF - GH - 01 - DR - J - 30101			



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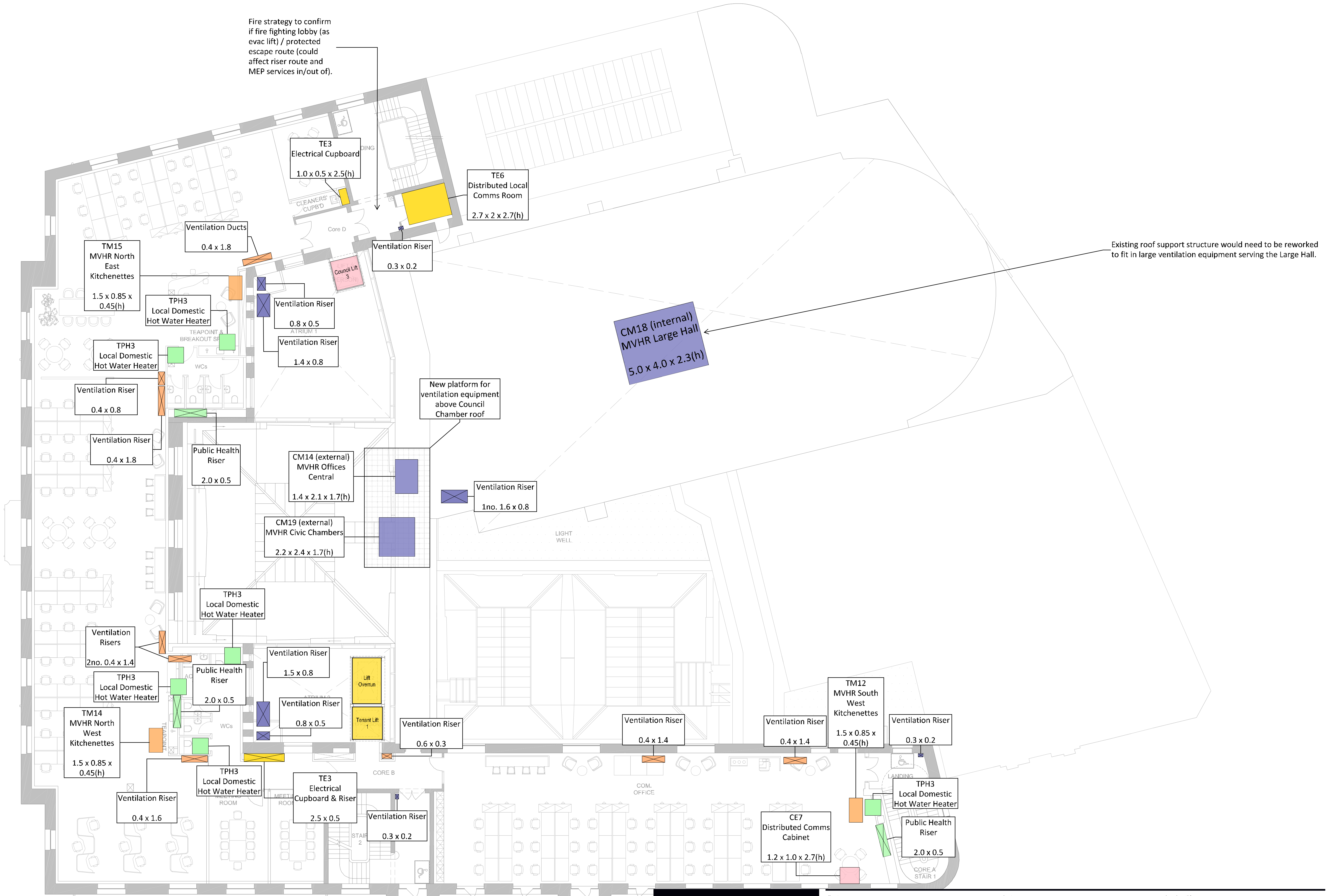
client: Cartwright Pickard Architects
job no.: 7562 | project leader: CB | scale at A1: 1:100
status code and description: S4 - Suitable for Stage Approval

project: Cambridge Civic Quarter
issue date: 14/10/24 | revision: P01 | classification: PM_40_40_15

drawing title: Guildhall - Option 1
Combined Services Layout
Second Floor

project code - orig. - volume - level - type - role - number
J7562 - MXF - GH - 02 - DR - J - 30101



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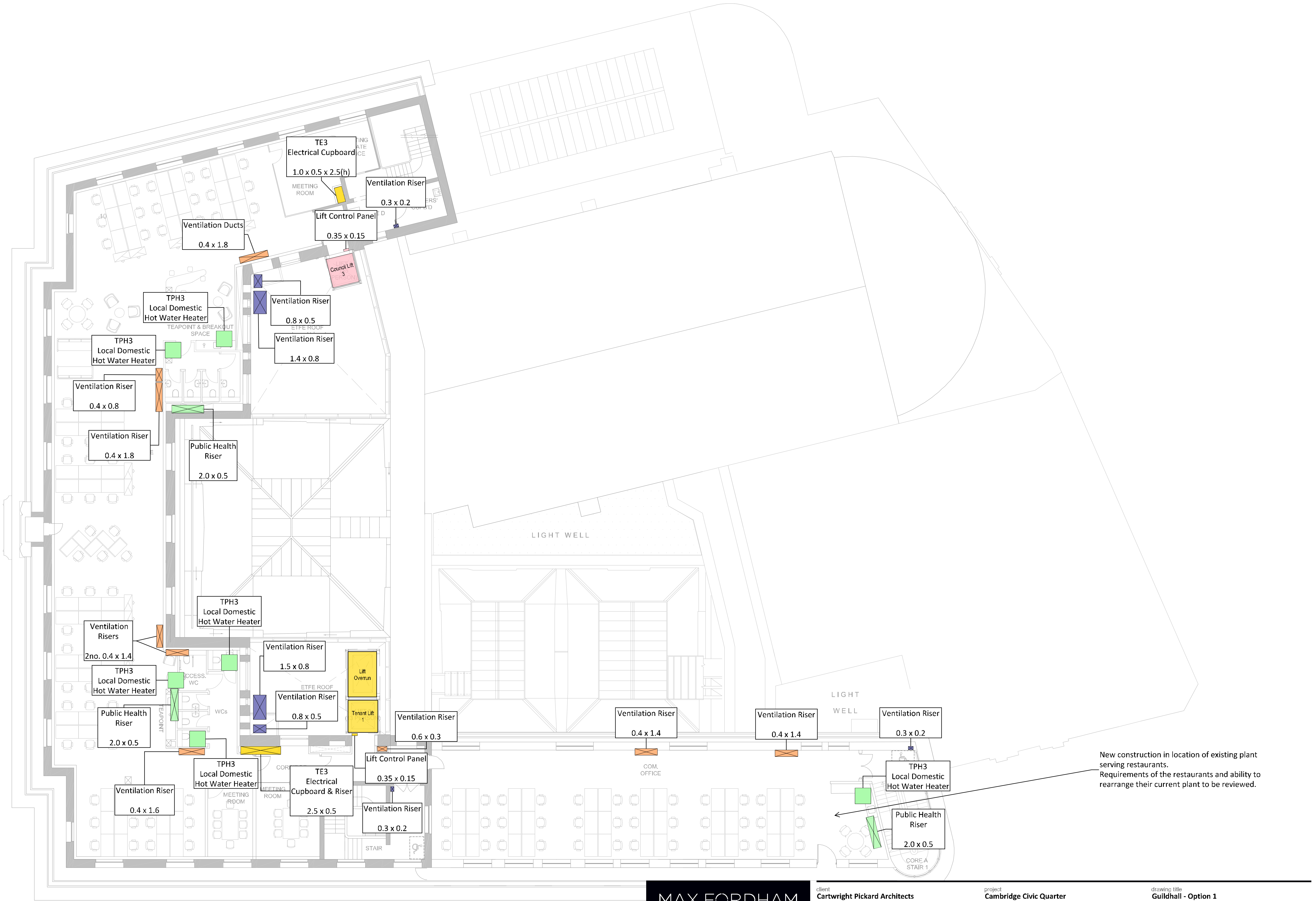
client: Cartwright Pickard Architects	project: Cambridge Civic Quarter		drawing title: Guildhall - Option 1 Combined Services Layout Third Floor
job no.: 7562	project leader: CB	scale at A1: 1:100	
status code and description: S4 - Suitable for Stage Approval	issue date: 14/10/24	revision: P01	classification: PM_40_40_15
project code - orig. - volume - level - type - role - number: J7562 - MXF - GH - 03 - DR - J - 30101			



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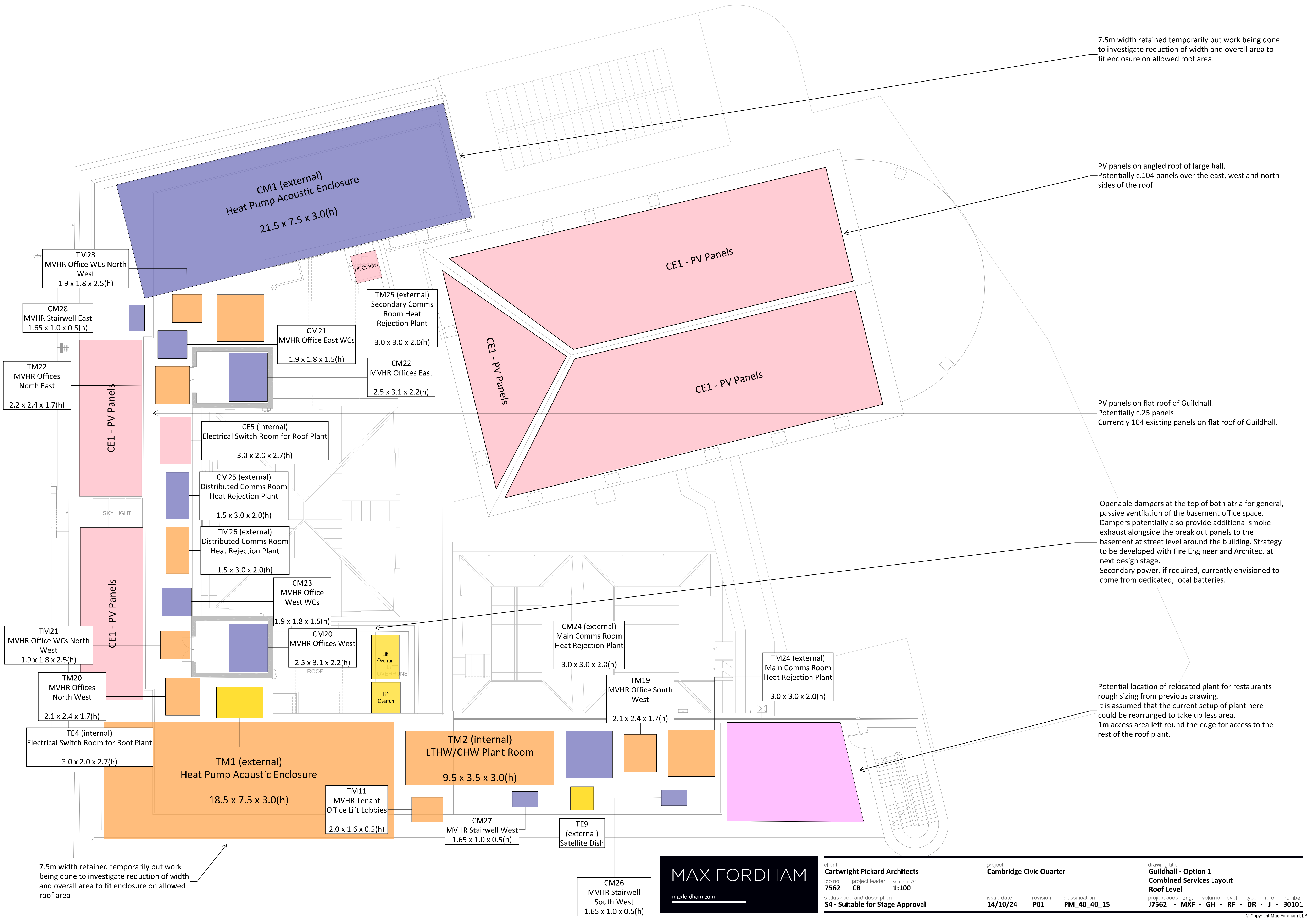
client
Cartwright Pickard Architects
job no. **7562** project leader **CB** scale at A1 **1:100**
status code and description
S4 - Suitable for Stage Approval

project
Cambridge Civic Quarter
issue date **14/10/24** revision **P01** classification **PM_40_40_15**

drawing title
Guildhall - Option 1
Combined Services Layout
Fourth Floor
project code **J7562** - orig. **MXF** - volume **GH** - level **04** - type **DR** - role **J** - number **30101**



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client: Cartwright Pickard Architects
job no.: 7562 | project leader: CB | scale at A1: 1:100
status code and description: S4 - Suitable for Stage Approval

project: Cambridge Civic Quarter
issue date: 14/10/24 | revision: P01 | classification: PM_40_40_15

drawing title: Guildhall - Option 1
Combined Services Layout
Roof Level

project code: J7562 - orig.: MXF - volume: GH - level: RF - type: DR - role: J - number: 30101

Cambridge Civic Quarter - Guildhall

Architect: **Cartwright Pickard Architects**
Issue Status: S4 – Suitable for Stage Approval

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SCHEDULE OF GUILDHALL PLANT SPACE REQUIREMENTS – COMMERCIAL OFFICE TENANCY

REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
TPH1	Cold Water Services Plant Room	Proposed : Basement (internal). Ideal : Ground floor (internal).	Incoming cold-water supply (utility metering in public footpath). Potable cold water storage tank ($8.2m^3$ storage capacity TEF sectional tank) Booster set (duty/assist/ standby). CAT V Booster set. Water leak detection system.	9.0 x 4.5 x 2.5(h) See note re existing plant room height and columns.	Leaf and one-half doors (for plant delivery and replacement). If ground floor location access from both inside and outside preferred to aid maintenance (inspections) and delivery of plant respectively. If basement location ensure lift and route to/from are suitable for plant transfer	Mechanically ventilated tank room to ensure suitable room temperature to avoid stored water warming. Ventilated at 0.2 air changes an hour (ACH) for EnerPHit.	Minimum clearance of 750mm clear required above the tank. Tank based on 600mm pier walls. Consider drainage of lowered slab acting as bund. Floor gulley required (for overflow). The existing boiler plant area is understood to have a clear head height of approx. 5.7m. Depth of existing room approx. 6.7m to suit 6.5m deep requirement (rear columns can be incorporated).
TPH2	Café/Bar hot water plant room	Proposed and Ideal : Within BoH prep area	Highly insulated 250l direct electric hot water storage cylinder, expansion vessel, circulation pump and associated controls.	1.2 x 0.9 x 2.5(h) Depth requires access from space in front.	Door centralised to allow access from space in front of room.	Mechanically ventilated at 0.2 air changes an hour (ACH) for EnerPHit.	Locate cylinder on plinth. Floor gulley required for expansion relief. Assumes indirect HWS (via district heating) is not appropriate due to system design temperatures.
TPH3 various	Local domestic hot water heater cupboards (distributed)	Local to served outlets; Basement Changing/WCs. GF WCs. 1F WCs if provided. 2F-4F WCs and tea points (East and West). 2F&3F tea point south west 4F bar WCs	Local electric hot water heater and associated expansion relief. Size to suit outlets served.	TBC, dependent on number of outlets served.	Lockable cupboard to be fully accessible for maintenance and inspection.	To consider heat dissipation.	Layouts/requirements TBC before details can be provided. Heaters to be local, in close proximity to outlets served.
TPH4	Rain Water Recycling Plant Room. **See note re provision.**	Proposed : Basement (internal). Rainwater downpipes to be routed to inlet of tank. Centralising tank to downpipe locations maximises roof catchment and minimises potential height impact of pipework setting under gravity.	$25m^3$ Rainwater recycling storage tank and filtration system. If pumped : Booster set (duty/standby).	5.1 x 13.0 x 3.0(h)	Double doors (for plant delivery and replacement). If ground floor location access from both inside and outside preferred to aid maintenance (inspections) and delivery of plant respectively. If basement location ensure lift and route to/from room are suitable for plant transfer.	Mechanically ventilated at 0.2 air changes an hour (ACH) for EnerPHit.	Anticipated to be required to satisfy planning requirement. Tank to be based on 600mm pier walls. Consider bunding room. Floor gulley required. **Does tenant require dedicated system for responsibility/maintenance or can this be shared with CCC. Likely to be dictated/heavily influenced**

Guildhall Plant Schedule – Option 1
J7562-MXF-GH-ZZ-SH-J-30001 Rev P01

Cambridge Civic Quarter - Guildhall

Architect: **Cartwright Pickard Architects**
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		Could locate with TPH1. Ideal : Internal above served WCs so as to supply by gravity.					**by related downpipe locations. Will tenant be happy with recycled rainwater for WC flushing?**
TM1	Heat Pump Acoustic Enclosure	Roof. (External). Fully open to above	2 no. 215kW Cooling & 125kW Heating (at -3C) 4pipe Air Source Heat Pumps (4PASHP). Size does not allow for RH control. Assumed acoustic louvred enclosure required around (TBC by acoustician).	End to end; 18.5 x 7.5 x 3.0(h). Or side by side; 13.0 x 10.5x3.0(h) Above allows tube with drawl at rear of units (3m clearance).	Regular maintenance access via doorway within acoustic enclosure. Major replacement works will require demounting of screen. ASHP access provided within enclosure (walking on paving slabs laid on finished roof). Related power and pipework to be routed on inside face of acoustic enclosure only setting across ground level to route to related condenser (step overs required). Plant removal strategy requires crane lift onto/off of roof.	External for heat rejection. Consider acoustics (see note under plant).	Must be completely clear above to allow heat rejection/discharge from top. Enclosure dimensions includes clearance to sides of units to allow air flow. Acoustic criteria and assessment may influence selection, size and requirement for acoustic screening or louvres. If HT or MT DEN is provided this space can be allocated for chiller plant.
TM2	LTHW/CHW Plant room. See note re separation is preferable.	Proposed : On roof close to ASHPs (TM1) and risers to rooms. Ideal : Internal close to ASHPs (TM1) and risers to rooms.	For LTHW Plant; Run/standby primary pumps. Buffer vessel (highly insulated). Run/standby distribution pumps. Pressurisation unit Expansion vessel Dosing pot For CHW Plant; As listed for LTHW plant. Control panel & Energy metering for LTHW&CHW plant.	9.5 x 3.5 x 3.0(h).	Leaf and one-half doors (for plant delivery and replacement). If ground floor location access from both inside and outside preferred to aid maintenance (inspections) and delivery of plant respectively. If basement location ensure lift and route to/from room are suitable for plant transfer.	To consider heat dissipation but avoid 'cold room'. Ventilated at 0.2 air changes an hour (ACH).	Locate plant on plinths. Floor gulleys required for expansion relief and general water treatment processes. Ideally have LTHW and CHW plant in separate rooms to prevent heat transfer (energy loss) but will increase overall space requirement.
TM3	DEN Interface Plant Room.	Proposed : Basement and internal on perimeter of building onto Guildhall Street. Ideal : Internal on Perimeter of building onto Wheeler Street (proposed DEN route)	District Heating incoming pit. District Heating PHX substation (skid mounted duty/standby). Duty/standby Office tenant Primary Heating pumps, Pressurisation set and Expansion vessels (replacing those in TM2).	7.0 x 5.0 x 2.5(h). **Note :** TBC by DEN designer	DEN will want direct access from public footpath with double doors (for plant delivery and replacement). Listing likely to prevent this. Basement location with access via staircase will need agreement. Will also need to review how plant installation and maintenance can be achieved (likely to require breaking down of skid equipment into components and use of lifts).	To consider heat dissipation but avoid 'cold room'. **Note :** TBC by DEN designer Mechanically ventilated at 0.2 air changes an hour (ACH) for EnerPHit.	**Note :** We anticipate that the DEN operator will want to serve the building via one set of shared mains. This will require additional shared plant, potentially reducing operating efficiency and introducing complications in adapting the 4PASHP distribution system to suit the future DEN (when available). These future adaption complications increase if TM2 is located near to the ASHPs (far from this room).

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J7562-MXF-GH-ZZ-SH-J-30001 Rev P01

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REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
			Dosing Pot Mechanical Control panel District Heating Control Panel Central Energy Logger **Note :** TBC by DEN designer		**Note :** TBC by DEN designer		
TM4	Mechanical Ventilation with Heat Recovery – Basement Back of House	Proposed and Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes. Likely in bike store location will require lengths of intake and exhaust ducts within thermal envelope, reducing NZC performance.	1 No. MVHR in ceiling void unit with end connections. 105l/s.	1.5x 0.85x 0.45(h) + access from below (hinged door on underside).	Access for regular maintenance and inspection from room.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Voids to be reviewed for suitability for intake/exhaust duct routes in conjunction with other local systems. Assume exhaust will be taken up out of light well area (possibly to roof level).
TM5	Mechanical Ventilation with Heat Recovery – Basement Male Changing	Proposed and Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes. Assume in void of changing room	1 No. MVHR in ceiling void unit with end connections. 90l/s.	1.5x 0.85x 0.45(h) + access from below (hinged door on underside).	Access for regular maintenance and inspection from room.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Voids to be reviewed for suitability for intake/exhaust duct routes in conjunction with other local systems. Assume exhaust will be taken up out of light well area (possibly to roof level).
TM6	Mechanical Ventilation with Heat Recovery – Basement Female Changing	Proposed and Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes. Assume in void of changing room	1 No. MVHR in ceiling void unit with end connections. 90l/s.	1.5x 0.85x 0.45(h) + access from below (hinged door on underside).	Access for regular maintenance and inspection from room.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Voids to be reviewed for suitability for intake/exhaust duct routes in conjunction with other local systems. Assume exhaust will be taken up out of light well area (possibly to roof level).

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REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
TM7	Mechanical Ventilation with Heat Recovery – Ground Floor Reception/Admin	Proposed and Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes.	1 No. cupboard MVHR vertical unit with top duct connections. 120l/s.	1.8 x 0.9 x 2.7(h). + access to front by opening cupboard (in front of 0.9m). See notes.	Access for regular maintenance and inspection from served room. Unit width can just fit through doorway.	None required to plant cupboard	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Cupboard to ensure suitable acoustic separation from working space. Height allows for connecting ducts/attenuators routing into ceiling void. 1.8m length includes access. Can be 1.2m with 0.6 access into cupboard end from within room. Assume exhaust will be taken up out of light well area (possibly to roof level).
TM8	Mechanical Ventilation with Heat Recovery – Ground floor Meeting Room	Proposed and Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes. If possible outside of meeting room to avoid acoustic challenges.	1 No. MVHR in ceiling void unit with end connections. 100l/s.	1.5x 0.85x 0.45(h) + access from below (hinged door on underside).	Access for regular maintenance and inspection from room.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Voids to be reviewed for suitability for intake/exhaust duct routes in conjunction with other local systems. Assume exhaust will be taken up out of light well area (possibly to roof level). Sensitive room from heritage perspective, further consideration required to ventilation strategy.
TM9	Mechanical Ventilation with Heat Recovery – Ground floor WCs & Cleaners rm.	Proposed and Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes.	1 No. cupboard MVHR vertical unit with top duct connections. 150l/s.	1.8 x 0.9 x 2.7(h). + access to front by opening cupboard (in front of 0.9m). See notes.	Access for regular maintenance and inspection from room. Unit width can just fit through doorway.	None required to plant cupboard	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Height allows for connecting ducts/attenuators routing into ceiling void. 1.8m length includes access. Can be 1.2m with 0.6 access into cupboard end from within room. Voids to be reviewed for suitability for intake/exhaust in conjunction with other local systems.

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REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
							Assume exhaust will be taken up out of light well area (possibly to roof level).
TM10	Mechanical Ventilation with Heat Recovery – Members Lounge & Private Office	Proposed : External with close proximity to served spaces and also external wall for intake and exhaust duct routes. Located on new ventilation platform in light well on 1st floor. Ideal : Internal with close proximity to served spaces and also external wall for intake and exhaust duct routes.	1 No. horizontal floor mounted MVHR unit. 400 l/s.	1.9 x 1.8 x 2.5(h) See notes.	Access for regular maintenance and inspection. Likely to require crane lift into/out of light well location both for initial installation and replacement.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 1.9m length. If using suggested first floor plant deck this should suit. 1.8m room depth is only required opposite AHU components approx. 1.5m length. 2.5m height allows for services to cross. Unit approx. 1.2m high plus base. Strength assessment on light well ventilation platform to be completed by Structural Engineer.
TM11	Mechanical Ventilation with Heat Recovery – Tenant office lift lobbies	Proposed : External on roof with close proximity to served areas and external for intake and exhaust. Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes.	1 No. Horizontal floor mounted MVHR unit. 100l/s.	2.0 x 1.6 x 0.5(h). See notes.	Access for regular maintenance and inspection.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Requires supply and extract duct riser between Basement and fourth floor.
TM12	Mechanical Ventilation with Heat Recovery – South-West Kitchenettes	Proposed and Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes. Assume in ceiling void on third floor.	1 No. MVHR in ceiling void unit with end connections. 80l/s.	1.5x 0.85x 0.45(h) + access from below (hinged door on underside).	Access for regular maintenance and inspection from room.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Voids to be reviewed for suitability for intake/exhaust duct routes in conjunction with other local systems. Assume exhaust will be taken up out of light well area (possibly to roof level). Kitchenette is open to office area, consider acoustics/noise from MVHR.

Cambridge Civic Quarter - Guildhall

Architect: **Cartwright Pickard Architects**
Issue Status: S4 – Suitable for Stage Approval

REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
TM14	Mechanical Ventilation with Heat Recovery – North-West Kitchenettes	Proposed and Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes. Assume in ceiling void at third floor.	1 No. MVHR in ceiling void unit with end connections. 105l/s.	1.5x 0.85x 0.45(h) + access from below (hinged door on underside).	Access for regular maintenance and inspection from room.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Voids to be reviewed for suitability for intake/exhaust duct routes in conjunction with other local systems. Assume exhaust will be taken to roof level. Kitchenette is open to office area, consider acoustics/noise from MVHR.
TM15	Mechanical Ventilation with Heat Recovery – North-East Kitchenettes	Proposed and Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes. Assume in ceiling void at third floor.	1 No. MVHR in ceiling void unit with end connections. 120l/s.	1.5x 0.85x 0.45(h) + access from below (hinged door on underside).	Access for regular maintenance and inspection from room.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Voids to be reviewed for suitability for intake/exhaust duct routes in conjunction with other local systems. Assume exhaust will be taken to roof level. Kitchenette is open to office area, consider acoustics/noise from MVHR.
TM19	Mechanical Ventilation with Heat Recovery – Office South West	Proposed : External with close proximity to served spaces. Roof location is only practical option and can align with the duct riser. Will require modifications to PVs but roof insulation will require upgrade for NZC so likely replacement of build up/ waterproofing etc. Ideal : Internal with close proximity to served spaces and also external wall or roof for intake and exhaust duct routes.	1 No. horizontal floor mounted MVHR unit. 1150 l/s.	2.1 x 2.4 x 1.7(h) See notes.	Access for regular maintenance and inspection. Likely to require crane lift onto/off roof for initial installation and replacement.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 2.1m length. 2.4m room depth is only required opposite AHU components approx. 1.8m length.

Cambridge Civic Quarter - Guildhall

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REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
TM20	Mechanical Ventilation with Heat Recovery – Office North-West	Proposed : External with close proximity to served spaces. Roof location is only practical option and can align with the duct riser. Will require modifications to PVs but roof insulation will require upgrade for NZC so likely replacement of build up/ waterproofing etc. Ideal : Internal with close proximity to served spaces and also external wall or roof for intake and exhaust duct routes.	1 No. horizontal floor mounted MVHR unit. 1600 l/s.	2.1 x 2.4 x 1.7(h) See notes.	Access for regular maintenance and inspection. Likely to require crane lift onto/off roof for initial installation and replacement.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 2.1m length. 2.4m room depth is only required opposite AHU components approx. 1.8m length.
TM21	Mechanical Ventilation with Heat Recovery – Office WCs North-West	Proposed : External with close proximity to served spaces. Roof location is only practical option and can align with the duct riser. Will require modifications to PVs but roof insulation will require upgrade for NZC so likely replacement of build up/ waterproofing etc. Ideal : Internal with close proximity to served spaces and also external wall or roof for intake and exhaust duct routes.	1 No. horizontal floor mounted MVHR unit. 490 l/s.	1.9 x 1.8 x 2.5(h) See notes.	Access for regular maintenance and inspection. Likely to require crane lift onto/off roof for initial installation and replacement.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 1.9m length. If this is constraining use of space an alternative could be a vertical MVHR with ducts rising off top (estimated 2.2x1.8x3) 1.8m room depth is only required opposite AHU components approx. 1.5m length. 2.5m height allows for services to cross. Unit approx. 1.2m high plus base.
TM22	Mechanical Ventilation with Heat Recovery – Office North-East	Proposed : External with close proximity to served spaces. Roof location is only practical option and can	1 No. horizontal floor mounted MVHR unit. 1250 l/s.	2.1 x 2.4 x 1.7(h) See notes.	Access for regular maintenance and inspection. Likely to require crane lift onto/off roof for initial installation and replacement.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 2.1m length.

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REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
		align with the duct riser. Will require modifications to PVs but roof insulation will require upgrade for NZC so likely replacement of build up/ waterproofing etc. Ideal : Internal with close proximity to served spaces and also external wall or roof for intake and exhaust duct routes.					2.4m room depth is only required opposite AHU components approx. 1.8m length.
TM23	Mechanical Ventilation with Heat Recovery – Office WCs North-West	Proposed : External with close proximity to served spaces. Roof location is only practical option and can align with the duct riser. Will require modifications to PVs but roof insulation will require upgrade for NZC so likely replacement of build up/ waterproofing etc. Ideal : Internal with close proximity to served spaces and also external wall or roof for intake and exhaust duct routes.	1 No. horizontal floor mounted MVHR unit. 330 l/s.	1.9 x 1.8 x 2.5(h) See notes.	Access for regular maintenance and inspection. Likely to require crane lift onto/off roof for initial installation and replacement.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 1.9m length. If this is constraining use of space an alternative could be a vertical MVHR with ducts rising off top (estimated 2.2x1.8x3) 1.8m room depth is only required opposite AHU components approx. 1.5m length. 2.5m height allows for services to cross. Unit approx. 1.2m high plus base.
TM24	Main Comms Room Heat Rejection Plant (TE5a).	Proposed and Ideal : Roof location in close proximity to served room. Potentially use light well to reduce pipe length/ refrigerant and also slab bwic.	Allow for 2No. outdoor condensers (run and standby). 5kW UK sensible cooling each.	3 x 3 x 2.0(h) Heat rejected horizontally so equivalent area won't be suitable.	Access for maintenance single door to external.	Must be completely clear above to allow heat rejection to dissipate (not recirculate).	Acoustic criteria and assessment may dictate requirement to enclose/screen area.
TM25	Secondary Incoming Comms Room	Proposed and Ideal : Roof location in close proximity to served room.	Allow for 2No. outdoor condensers (run and standby).	3 x 3 x 2.0(h)	Access for maintenance single door to external.	Must be completely clear above to allow heat	Acoustic criteria and assessment may dictate requirement to enclose/screen area.

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	Heat Rejection Plant (TE5b).	Potentially use light well to reduce pipe length/ refrigerant and also slab bwic.	5kW UK sensible cooling each.	Heat rejected horizontally so equivalent area won't be suitable.		rejection to dissipate (not recirculate).	
TM26	Distributed (local) Comms Room Heat Rejection Plant (TE6).	Proposed and Ideal : Roof location in close proximity to served room (appears possible). Roof behind (over small hall) may be possible but flat roof area appears too narrow.	Allow for single condenser. 5kW UK sensible cooling.	1.5 x 3 x 2.0(h) Heat rejected horizontally so equivalent area won't be suitable.	Access for maintenance single door to external.	Must be completely clear above to allow heat rejection to dissipate (not recirculate).	Acoustic criteria and assessment may dictate requirement to enclose/screen area. Particularly when investigating area over small hall/ next to large hall.
TE2	Office Tenant Switch Room	Basement (Internal) immediately beside the substation (CE2).	Incoming UKPN supply head and utility metering. Main Switchgear Distribution board for basement incl kitchen. Energy metering equipment.	4 x 2.5 x 3.0(h)	One and a half leaf door access. Ideally from outside and inside of the building. Basement location likely to dictate the need for the panel to be delivered in sections and formed on site/in situ.	Mechanically ventilated at 0.2 air changes an hour (ACH) for EnerPHit.	Depending on UKPN head/metering arrangement. Assumes incoming power (substation) is in CCC demise with utility supply provided to this switch room.
TE3 (a-h) 9No.	Electrical Cupboards (dispersed)	Proposed : Internal cupboard/room local to area served and riser containing sub main power distribution. Vertically stacked (between floors) and central to served areas (to reduce cable lengths).	Distribution Boards (power and lighting) Electrical Sub Meters & logging devices. Lighting Controls	1.0 x 0.5 x 2.5(h) Dims are for DB only (not rising sub mains, if riser version then becomes, 2.0 x 0.7 x 2.5(h)	Must be fully accessible but secured (locked). Can be a locked board in a secure staff room/area or riser.	Background infiltration	Locations to be developed with risers. Suggestions shown. 2 per upper floor (east and west).
TE4	Electrical Switch Room – Roof plant	On new roof (to West).	Panel board. Control panel (MCP). Local small power/lighting board.	3 x 2 x 2.7 (h) Subject to confirmation with developing roof plant layout	Single door.	High- and low-level louvres for summer heat dissipation. Ventilated at 0.2 air changes an hour (ACH).	Location to relate to served plant and sub main riser routing up from below. Dispersed plant power cabling strategy to be developed with routing through existing building.

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			Electrical Meters & logging devices PV inverters.				
TE5a & b	Incoming Comms Rooms (primary and secondary)	Proposed : Secure basement floor room located off public footpath. See notes. Ideal : Secure ground floor room located off public footpath.	Incoming utility service and associated boards/distribution. Tenant comms rack See TE6, TE7 & TE9.	3.5 x 2.5 x 3.0(h) Or 4.0 x 3.0 x 3.0(h)	Direct external access for utility provider is preferred. Constraints of existing building unlikely to allow. If in basement lift and corridor to be suitable to house a data cabinet/free standing rack (width and height).	Will need cooling (TM24&25). Mechanically ventilated at 0.2 air changes an hour (ACH) for EnerPHit.	Basement room would ideally be avoided as IT managers are concerned about flood risk. Provide two incoming locations to allow diverse routes for enhanced WiredScore rating.
TE6	Distributed (local) Comms Rooms / Cupboard Fibre linked to TE5a and TE5b to ensure suitable cable lengths to local outlets	Location to reduce cable lengths and quantum of cable routing from main comms room (TE5a and TE5b)	Rack Cabinet and racks, patches etc.	See drawings Guildhall – Option 1 - Combined Services Layout See access.	Leaf and a half door to allow installation and removal of comms rack.	Mechanically ventilated at 0.2 air changes an hour (ACH) for EnerPHit. Will need cooling (TM26).	Power and data cable routing to and within room (rising third to fourth floor) to be on same wall as distribution board at opposite end of room (by door in).
TE7	Building Management Equipment room	Assumed that all related building management staff interface equipment will be located within the ground floor admin office. UPS systems to be in comms rack (TE5).	AWC alarm system equipment Refuge alarm system equipment Access control system equipment Security system equipment	Subject to briefing. Consider forming a room within the admin office or allocating wall and worktop space within the office.	Access to all equipment for maintenance.	If in office utilise office ventilation and cooling and ensure equipment is open to the office for heat dissipation. Mechanically ventilated at 0.2 air changes an hour (ACH) for EnerPHit.	Management systems requiring regular staff monitoring/use will often have related accessories at the staff desk positions. Some may be accessible via the web (subject to agreed briefing). Assumes a number of rack mounted systems (contained within TE5a and TE5b).
TE8	Fire Alarm Panel (s)	Visible from main entrance (as defined for fire access) (Internal)	Fire alarm panel. Potentially repeater panel.	0.8 x 0.4 x 0.6(h) estimated.	Fully accessible to front of panel/s	Have some ventilation openings into surrounding space.	Fire strategy TBC by fire engineer

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		May require repeater panels in reception or admin office.					Main fire access may still be the main entrance in which case a repeater panel in reception/office may suffice. Required to be visible so if enclosed should have a glazed front.
TE9	Satellite/ Comms dish roof location	External roof with clear route from surrounding buildings to satellites.	Roof space for incoming tenant to locate satellite dish/comms.	TBC, if required.	Access for maintenance single door to external.	None, external	For tenant fit out. Provide cable routes to/from comms room TE5

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Additional Plant rooms that may be required in response to further assessments and/or fire strategy and/or detailed briefing

REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
TPHX	Sprinkler Tank Room. **See note re provision.**	Ideal : Ground floor (internal). Anticipated : Basement (internal)	Sprinkler system water storage tank. Sprinkler Pumps. Power and controls.	?.? x ?.? x ?.?(h)	Double doors accessible from inside or outside (preferred) of the building. **Fireman to have direct access from outside of the building**	Background Infiltration	Requirement TBC by fire engineer. Estimated size based on OH?? category and minimum flow duration of mins. Consider bunding room. Floor gulleys required. **Does tenant require dedicated system for responsibility/maintenance or can this be shared with CCC, if CCC spaces require sprinkler protection.**
TMx	Smoke Extract Fans - Basement	In separate fire compartment to that served	Mechanical smoke extract fans (run/standby). ??M3/s each.	?.? x ?.? x ?.?(h)	Regular inspection and testing. Crane lift in/out ~(heavy)	Open to surroundings for motor heat release.	Requirement to be confirmed by fire engineer/ strategy including compartmentation. Discharge to be away from all exits. Ideally at roof level to allow dispersal of smoke. Consider; - make up air (how/from where) - Attenuation? - Interfaces with fire alarm, sprinklers etc. - Secondary power.
TMx	Smoke Extract Fans -	Roof connected into ventilation shaft (external).	Mechanical smoke extract fans (run/standby).	3 x 3 x 1.5(h) including maintenance space to front	Regular inspection and testing.	Open to surroundings for motor heat release.	Initial allowance to be developed with fire engineer. Considerations as basement smoke extract fans.
TMx	Dry risers	Incoming valve on external façade. Dry riser cabinets off firefighting stairs.	Valve boxes/cabinets.	See note	Access from firefighting lobby.	None required.	Requirement to be confirmed by fire strategy
TMx	Pavilion Kitchen Cold room Heat Rejection Plant	Ideal : Roof location in close proximity to fridges/cold stores served.	TBC by catering specialist.	TBC by catering specialist.	Access for maintenance single door to external.	Must be completely clear above to allow heat rejection to dissipate (not recirculate).	Acoustic criteria and assessment may dictate requirement to enclose/screen area. Fridges and cold stores could use internal heat rejection (to room).

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TMx	Mechanical ventilation – Pavilion kitchen wash up extract ventilation	Ideal : Roof location in close proximity to wash up.	TBC by catering specialist.	TBC by catering specialist.	Access for maintenance single door to external.	Must be clear around discharge to avoid moisture effecting surrounding area or installation.	Space/facility not yet identified on drawings. Allowance made for kitchen ventilation of complete kitchen area. If wash up facility is in this area use of kitchen extract system (TM15) can be considered.
TMx	Gas/Foam fire suppression for critical electrical rooms	Local to served critical electrical room, typically a data/comms room (internal).	Specialist suppression cylinders and related control, monitoring and (if required) ventilation systems.	TBC, if required size dependent on served room.	Internal door (single anticipated)	Dependent on suppression system/gasses used.	May require pressurisation/ventilation system. Consider subsequent removal of gasses/foam after use. Tenant may deem comms room as a critical service?
TMx	Mechanical Ventilation with Heat Recovery – Pavilion Bar WCs	Proposed : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes. Assume in ceiling void on fourth floor.	1 No. MVHR in ceiling void unit with end connections. 70l/s.	1.5 x 0.8 x 0.4(h) + access from below (hinged door on underside).	Access for regular maintenance and inspection from room.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Extend ducts up through roof over, turn in opposite directions and use suitable lengths of duct to separate.
TMx	Mechanical Ventilation – Pavilion Reheat Kitchen Extract fan.	Proposed: External on roof near to point of discharge. See notes re discharge/ exhaust.	Kitchen Extract fan. 750l/s. Estimate only. Requires catering consultant to specify hoods and confirm required ventilation rates.	0.6 x 0.4Ø. See notes.	Access for regular maintenance and inspection. Kitchen extract ductwork to be accessible throughout its length. Cleaning access panels required every 3m. If rising in void or lightwell the vertical/rising ductwork will require surrounding access platforms to facilitate this maintenance. Crane on/off roof.	None required for.	Discharge (exhaust) to be above highest point of roof and any neighbouring buildings that are higher and within 20m. Attenuator and ductwork connections will add to the length (but can go in vertical ductwork). Consider acoustics/noise from fan (kitchen extract by nature are noisy)
TMx	Mechanical Ventilation – Pavilion Reheat Kitchen Supply AHU.	Proposed : External on roof with close proximity to served kitchen.	Kitchen Supply AHU. 750l/s. Estimate only. Requires catering consultant to specify hoods and confirm required ventilation rates.	2.5 x 2.8 x 1.4(h) See notes.	Access for regular maintenance and inspection. Crane onto/off of roof or to fourth floor (if located on floor).	None required for AHU itself.	Supply intake louvre location to minimise risk of entraining any pollutants, including discharge from any local exhaust ducts. Attenuator and ductwork connections will add to the 2.5m length. 2.8m room depth is only required opposite AHU components approx. 2m length. Height does not allow for ducts passing over top of AHU. Coordination to be worked through.

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TMx	Mechanical Ventilation with Heat Recovery – Pavilion Bar	Proposed : External on roof with close proximity to served bar.	1 No. horizontal floor mounted MVHR unit. 500 l/s is an initial estimate subject to brief/ occupancy etc	1.9 x 1.8 x 2.5(h) See notes.	Access for regular maintenance and inspection. Likely to require crane lift onto/off roof for initial installation and replacement.	None required to plant room.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 1.9m length. If this is constraining use of space an alternative could be a vertical MVHR with ducts rising off top (estimated 2.2x1.8x3) 1.8m room depth is only required opposite AHU components approx. 1.5m length. 2.5m height allows for services to cross. Unit approx. 1.2m high plus base.
TEx	PV Battery Storage Room.	Local to PV inverters.	Batteries.	TBC, if required.	Double doors. Access for regular testing and inspection and battery replacement.	Vents at high and low level.	To be developed with PV design and energy strategy.
TEx	Photovoltaic Panels for office tenant	PVs mounted externally.	PV Panels mounted on ?? kWe total consisting of XNo. of 2XXW panels.	Total PV array area is XXm^2.	All PVs to be accessible for regular inspection and cleaning.	External.	To be developed with energy strategy. Inverters and related electrical equipment to be located internally in roof electrical switch rooms (TE5).
TEx	UPS Plant Room.	Near incoming (main) comms room or could be in rack (Internal).	Uninterruptable power supply.	TBC, if required.	Double doors.	Vents at high and low level.	If required, to be provided as part of ICT fit out. Can be installed in comms/server rooms Likely to require additional DX cooling (roof plant).
TEx	Generator Enclosure	Assumed to be on roof due to limited internal space available. Also internal generator would require room to be acoustically treated and generator to be ventilated (with attenuation) which will be complex in listed building.	Generator in acoustic enclosure. (if required size TBC once fire strategy is agreed)	?.? x?.? x ?.?(h) TBC see notes	Access for regular inspection and testing. Acoustic enclosure to allow suitable access. Diesel fill from location where barrels can be trolleyed to. Typically use lift to transfer to highest floor and provide diesel pump and pipework from that location.	Generator exhaust flue out of enclosure. Louvres in acoustic enclosure.	Generator requirement/size subject to receipt and implementation of fire strategy. In particularly the any requirement for sprinkler pumps, smoke extract fans and firefighting or evacuation lifts. Consider noise breakout. Generator exhaust flue to discharges at highest point aware from all ventilation air intakes.
TEx	Essential power switch room	Ideal : Close to (next to but separate from) the generator room/enclosure and close to served equipment (Internal room).	Essential power switchgear and automatic changeover devices.	?.? x?.? x ?.?(h) TBC see notes	One and a half leaf door accessible from the inside or outside of the building	Louvres to external space (louvred doors).	Dependent on fire strategy.
TEx	Central Emergency	Ground Floor. (Internal).	Inverter, batteries.	TBC, if required.	Double doors. Access for regular testing and inspection and battery replacement.	Vents at high and low level.	Fire strategy to confirm. Current assumption is self-contained emergency light fittings with integral batteries will be sufficient for the offices.

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	Lighting Battery Room.						Likely to require additional DX cooling (roof plant).
TEx	Centralised Emergency Lighting Monitoring.	Close to/in areas served (Internal).	Central monitoring panel	TBC, if required.	Single door access for regular testing and inspection.	Vents at high and low level.	Alternative to using local test key switches. Can also consider web based intelligent systems.

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SCHEDULE OF GUILDHALL PLANT SPACE REQUIREMENTS – CCC OFFICES AND DEMOCRATIC ROOMS

REF	DESCRIPTIO N	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
CPH1	Cold Water Services Plant Room	Proposed : Basement (internal). Ideal : Ground floor (internal).	Incoming cold-water supply (utility metering in public footpath). Potable cold water storage tank (7.5m^3 storage capacity TEF sectional tank) Booster set (duty/assist/ standby). CAT V Booster set. Water leak detection system.	6.25 x 5.0 x3.0(h) See note re existing plant room height and columns.	Leaf and one-half doors (for plant delivery and replacement). If ground floor location access from both inside and outside preferred to aid maintenance (inspections) and delivery of plant respectively. If basement location ensure lift and route to/from room are suitable for plant transfer	Mechanically ventilated at 0.2 air changes an hour (ACH) for EnerPHit. Ensure suitable room temperature to avoid stored water warming.	Minimum clearance of 750mm clear required above the tank. Tank based on 600mm pier walls. Consider bunding room. Floor gulley required (for overflow). Understood the existing boiler plant area has a clear head height of approx 5.7m. Depth of existing room approx. 6.7m to suit 6m deep requirement (rear columns and steps can be incorporated).
CPH2	Basement and Ground floor domestic hot water plant room	Proposed and Ideal : Ground floor within served sanitary accommodation (internal).	Highly insulated 750l direct electric hot water storage cylinder, expansion vessel, circulation pump and associated controls.	2.0 x 1.4 x 2.7(h) Depth requires access from corridor in front.	Double door to allow access from corridor in front of room.	Mechanically ventilated at 0.2 air changes an hour (ACH) for EnerPHit.	Locate cylinder on plinth. Floor gulley required for expansion relief. Assumes indirect HWS (via district heating) is not appropriate due to system design temperatures.
CPH3 variou s	Local domestic hot water heater cupboards (distributed)	Local to served outlets; Basement Tea point & WCs. GF café, WCs (East and West), tea point & first aid. 1F WCs (East and West). 1F Large hall changing incl WCs and showers. 1F reheat kitchen.	Local electric hot water heater and associated expansion relief. Size to suit outlets served.	TBC, dependent on number of outlets served.	Lockable cupboard to be fully accessible for maintenance and inspection.	To consider heat dissipation.	Layouts/requirements TBC before details can be provided. Heaters to be local, in close proximity to outlets served.
CPH4	Rain Water Recycling Plant Room. **See note re provision.**	Proposed : Basement (internal). See notes. Locate with CPH1. Ideal : Internal above served WCs so as to supply by gravity.	20m^3 Rainwater recycling storage tank and filtration system. If pumped : Booster set (duty/standby).	10.5 x 5.1 x 3(h)	Double doors (for plant delivery and replacement). If ground floor location access from both inside and outside preferred to aid maintenance (inspections) and delivery of plant respectively. If basement location ensure lift and route to/from room are suitable for plant transfer.	Mechanically ventilated at 0.2 air changes an hour (ACH) for EnerPHit.	Anticipated to be required to satisfy planning requirement. Rainwater downpipes to be routed to inlet of tank. Centralising tank to downpipe locations maximises roof catchment and minimises potential height impact of pipework setting under gravity. Tank to be based on 600mm pier walls. Consider bunding room. Floor gulley required.

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REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
CM1	Heat Pump Acoustic Enclosure	Roof (over level 4, will require reduction of existing PV provision). (External). Fully open to above.	2 no. 315kW Cooling & 218kW Heating (at -3C) 4pipe Air Source Heat Pumps (4PASHP). Size does not allow for RH control. Assumed acoustic louvred enclosure required around (TBC by acoustician).	End to end; 21.5 x 7.5 x 3.0(h). Or side by side; 13.0 x 12.0 x 3.0(h) Above allow tube with drawl at rear of units (3m clearance).	Regular maintenance access via doorway within acoustic enclosure. Major replacement works may require demounting of screen. ASHP access provided within enclosure (walking on paving slabs laid on finished roof). Related power and pipework to be routed on inside face of acoustic enclosure only setting across ground level to route to related condenser (step overs required). Plant removal strategy requires crane lift onto/off of roof.	External for heat rejection. Consider acoustics (see note under plant).	Must be completely clear above to allow heat rejection/discharge from top. Enclosure dimensions includes clearance to sides of units to allow air flow. Acoustic criteria and assessment may influence selection, size and requirement for acoustic screening or louvres. If HT or MT DEN is provided this space can be allocated for chiller plant.
CM2	LTHW/CHW Plant room. See note re separation is preferable.	Proposed and Ideal : Internal close to ASHPs (CM1) risers. Can utilise basement space allocated for plant to east side. 3.5m depth to be from inside face of columns.	For LTHW Plant; Run/standby primary pumps. Buffer vessel (highly insulated). Run/standby distribution pumps. Pressurisation unit Expansion vessel Dosing pot For CHW Plant; As listed for LTHW plant. Control panel & Energy metering for LTHW&CHW plant.	7.0 x 3.5 x 3.0(h).	Leaf and one-half doors (for plant delivery and replacement). If ground floor location access from both inside and outside preferred to aid maintenance (inspections) and delivery of plant respectively. If basement location ensure lift and route to/from room are suitable for plant transfer.	To consider heat dissipation but avoid 'cold room'. Mechanically ventilated at 0.2 air changes an hour (ACH) for EnerPHit.	Locate plant on plinths. Floor gulleys required for expansion relief and general water treatment processes. Ideally have LTHW and CHW plant in separate rooms to prevent heat transfer (energy loss) but will increase overall space requirement.
CM3	DEN Interface Plant Room.	Proposed : Internal on Basement floor near to perimeter of building onto Peas Hill. Ideal : Internal on Ground floor perimeter of building onto Wheeler Street (proposed DEN route).	District Heating incoming pit. District Heating PHX substation (skid mounted duty/standby). Duty/standby Office Primary Heating pumps, Pressurisation set and Expansion vessels (replacing those in CM2) & Dosing Pot Mechanical Control panel, District Heating Control Panel? & Central Energy Logger	7.0 x 5.0 x 3.0(h). **Note :** TBC by DEN designer	DEN will want direct access from public footpath with double doors (for plant delivery and replacement). Listing likely to prevent this. Will need to review how plant installation and maintenance can be achieved (likely to require breaking down of skid equipment into components and use of rear escape door). **Note :** TBC by DEN designer	To consider heat dissipation but avoid 'cold room'. **Note :** TBC by DEN designer Mechanically ventilated at 0.2 air changes an hour (ACH) for EnerPHit.	**Note :** We anticipate that the DEN operator will want to serve the building via one set of shared mains. This will require additional shared plant, potentially reducing operating efficiency and introducing complications in adapting the 4PASHP distribution system to suit the future DEN (when available).

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			Note : TBC by DEN designer.				
CM4	Mechanical Ventilation with Heat Recovery – Basement BoH East	Proposed : External with proximity above served areas. Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes.	1 No. horizontal floor mounted MVHR unit. 120l/s.	2.0 x 1.6 x 0.5(h). See notes.	Access for regular maintenance and inspection from plant room/area. Likely to require crane lift onto roof location both for initial installation and replacement.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Risers/hall void to be reviewed for suitability for intake/exhaust in conjunction with other local systems. Strength assessment on roof ventilation platform to be completed by Structural Engineer.
CM6	Mechanical Ventilation with Heat Recovery – Basement BoH West	Proposed : External with close proximity to served areas. Located on new ventilation platform in light well on 1st floor. Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes.	1 No. Horizontal floor mounted MVHR unit. 120l/s.	2.0 x 1.6 x 0.5(h). See notes.	Access for regular maintenance and inspection from plant room/area. Likely to require crane lift into/out of light well location both for initial installation and replacement.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Voids to be reviewed for suitability for intake/exhaust in conjunction with other local systems. Strength assessment on light well ventilation platform to be completed by Structural Engineer.
CM8	Mechanical Ventilation with Heat Recovery – Basement Sanitary Accom incl Cleaners	Proposed : External with close proximity to served areas. Located on new ventilation platform in light well on 1st floor. Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes.	1 No. horizontal floor mounted MVHR unit. 120l/s.	2.0 x 1.6 x 0.5(h). See notes.	Access for regular maintenance and inspection from plant room/area. Likely to require crane lift into/out of light well location both for initial installation and replacement.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Voids to be reviewed for suitability for intake/exhaust in conjunction with other local systems. Strength assessment on light well ventilation platform to be completed by Structural Engineer.

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CM9	Mechanical Ventilation with Heat Recovery – Bin Store & Bin Circulation	Proposed and Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes.	1 No. horizontal floor mounted MVHR unit. 360 l/s.	1.9 x 1.8 x 1.5(h) See notes.	Access for regular maintenance and inspection. Access via associated bin (in/out) route.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 1.9m length. 1.8m room depth is only required opposite AHU components approx. 1.5m length. Assume exhaust will be taken up out of light well area.
CM10	Mechanical Ventilation with Heat Recovery – Basement and Ground East WCs	Proposed : External with close proximity to served areas. Assumed ground floor void can be used for ducts routing up and down to roof over small hall. Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes.	1 No. horizontal floor mounted MVHR unit. 1250 l/s.	2.3 x 2.5 x 1.7(h) See notes.	Access for regular maintenance and inspection. Access doors in wall forming void? Ground floor location suggested due to easier access for installation and replacement (via east entrance) Likely to require crane lift onto roof location both for initial installation and replacement.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 2m length. 2.5m room depth is only required opposite AHU components approx. 2m length. Acoustics to be reviewed (noise breakout to Hall via void?). Rising ducts in void to hall roof. Compromises NZC. Strength assessment on roof ventilation platform to be completed by Structural Engineer.
CM12	Mechanical Ventilation with Heat Recovery – Large Hall Change West	Proposed and Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes. See notes re intake and exhaust ducts.	1 No. MVHR in ceiling void unit with end connections. 95l/s (subject to occupancy briefing).	1.5x 0.85x 0.45(h) + access from below (hinged door on underside). MF to review controls / electrics access.	Access for regular maintenance and inspection from room.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Will impact on general ceiling coordination and RCP. Allow deep ceiling void to assist. Proposed ceiling void unit but duct routes to intake and exhaust must be minimised to achieve NZC. Assume exhaust will be taken up out of area above Sticks'n'Sushi.

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CM14	Mechanical Ventilation with Heat Recovery – Offices Central	Proposed : External with close proximity to served spaces. Located on new platform for ventilation equipment above Council Chamber roof. Ideal : Internal with close proximity to served spaces also external wall for intake and exhaust duct routes.	1 No. horizontal floor mounted MVHR unit. 1205 l/s.	2.2 x 2.4 x 1.7(h) See notes.	Access for regular maintenance and inspection. Likely to require crane lift onto/off roof for initial installation and replacement. To be reviewed with design development.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 2.2m length. 2.4m room depth is only required opposite AHU components approx. 2m length. Acoustics to be reviewed (proximity to restaurant and large hall). Strength assessment on roof ventilation platform to be completed by Structural Engineer.
CM15	Mechanical Ventilation – Hall Reheat Kitchen Extract fan.	Proposed and Ideal : External near to point of discharge. See notes re discharge/ exhaust.	Kitchen Extract fan. 0.75M³/s. Estimate only requires catering consultant to specify hoods and confirm required ventilation rates.	1.5 x 0.45Ø. See notes.	Access for regular maintenance and inspection. Kitchen extract ductwork to be accessible throughout its length. Cleaning access panels required every 3m. Vertical ductwork will require provision of access platforms. Crane on/off roof.	None required for.	Discharge (exhaust) to be above highest point of roof and any neighbouring buildings that are higher and within 20m. **Will need to rise above Large Hall roof.** Attenuator and ductwork connections will add to the 1.5m length (but can go in vertical ductwork). Consider acoustics/noise from fan (kitchen extract by nature are noisy)
CM16	Mechanical Ventilation – Reheat Kitchen Supply AHU.	Proposed : External with close proximity to served kitchen. Located on small area next to Small Hall roof. Ideal : Internal with close proximity to served kitchen and also external wall for intake duct route.	Kitchen Supply AHU. 0.75M³/s. Estimate only requires catering consultant to specify hoods and confirm required ventilation rates.	3.5 x 2.1 x 1.0(h) See notes.	Access for regular maintenance and inspection. Crane on/off roof.	None required for AHU itself.	Supply intake louvre location to minimise risk of entraining any pollutants, including discharge from any local exhaust ducts. Attenuator and ductwork connections will add to the 3.5m length. 2.1m room depth is only required opposite AHU. To be coordinated with CM15 (refer to CM15 notes).
CM17	Mechanical Ventilation with Heat Recovery – Small Hall	Proposed : External with close proximity to served spaces. Assumed roof over reheat kitchen. Ductwork will be	1 No. horizontal floor mounted MVHR unit. 1800l/s.	2.5 x 3.1 x 2.2(h) See notes.	Access for regular maintenance and inspection. Crane lift onto/off roof for initial installation and replacement.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 2.5m length.

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		very tight as is coordination with reheat AHU and related ductwork. Ideal : Internal with close proximity to served spaces also external wall for intake and exhaust duct routes.					3.1m room depth is only required opposite AHU components approx. 2.3m length.
CM18	Mechanical Ventilation with Heat Recovery – Large Hall	Proposed and Ideal : Internal with close proximity to Hall also external wall for intake and exhaust duct routes. Need to establish existing provision/arrangement. Located in Large Hall roof void.	1 No. horizontal floor mounted MVHR unit. 4M3/s (subject to confirmation of occupancy, particularly balcony).	5.0 x 4.0 x 2.3(h) See notes.	Access for regular maintenance and inspection. Likely to require crane lift onto/off roof for initial installation and replacement. To be reviewed with design development.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 5m length. 4m depth is only required opposite AHU to provide maintenance access that can also provide walkway past (is >1.5m).
CM19	Mechanical Ventilation with Heat Recovery – Civic Chambers	Proposed : External with close proximity to Chambers also external wall for intake and exhaust duct routes. Located on third floor walkway location new ventilation platform (see access). Ideal : Internal with close proximity to Chambers also external wall for intake and exhaust duct routes.	1 No. horizontal floor mounted MVHR unit. 1450 l/s.	2.2 x 2.4 x 1.7(h) See notes.	Access for regular maintenance and inspection. Likely to require crane lift onto/off roof for initial installation and replacement. To be reviewed with design development. Assumed third floor walkway location to be reviewed with large hall roof and route past MVHR (using 1.1m access clearance within the 2.4 depth). Requires unit and ducts to be tight to Chamber wall.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 2.2m length. 2.4m depth is only required opposite AHU components approx. 2m length. Consider acoustics, noise break out to Chambers. Strength assessment on roof ventilation platform to be completed by Structural Engineer.
CM20	Mechanical Ventilation with Heat Recovery – Offices West	Proposed : External with close proximity to served spaces. Assumed roof location near west atrium with riser coordinated with circulation space around atrium to route ducts to served area.	1 No. horizontal floor mounted MVHR unit. 1830l/s (subject to decision on first floor west CCC or tenant office).	2.5 x 3.1 x 2.2(h) See notes.	Access for regular maintenance and inspection. Likely to require crane lift onto/off roof for initial installation and replacement. Riser coordination with atria to ensure suitable access to install and clean related ductwork from floor plate.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 2.5m length. 3.1m room depth is only required opposite AHU components approx. 2.3m length.

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		Will require modification to existing PVs. Ideal : Internal with close proximity to served spaces also external wall for intake and exhaust duct routes.					
CM21	Mechanical Ventilation with Heat Recovery – Office East WCs (GF&1F)	Proposed and Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes. Roof over using riser to be coordinated with office lifts. Requires modification to PVs.	1 No. horizontal floor mounted MVHR unit. 360 l/s.	1.9 x 1.8 x 1.5(h) See notes.	Access for regular maintenance and inspection. Will require crane lift on/off.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 1.9m length. 1.8m room depth is only required opposite AHU components approx. 1.5m length.
CM22	Mechanical Ventilation with Heat Recovery – Offices East	Proposed : External with close proximity to served spaces. Assumed roof location near office lifts with riser coordinated with lifts to route ducts to served area. will require modification to existing PVs. Ideal : Internal with close proximity to served spaces also external wall for intake and exhaust duct routes.	1 No. horizontal floor mounted MVHR unit. 1600 l/s.	2.5 x 3.1 x 2.2(h) See notes.	Access for regular maintenance and inspection. Likely to require crane lift onto/off roof for initial installation and replacement. Riser coordination with atria to ensure suitable access to install and clean related ductwork from floor plate.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 2.5m length. 3.1m room depth is only required opposite AHU components approx. 2.3m length.
CM23	Mechanical Ventilation with Heat Recovery – Office West WCs (GF&1F)	Proposed : External with close proximity to served areas and also external wall for intake and exhaust duct routes. Roof over using riser to be coordinated with office lifts.	1 No. horizontal floor mounted MVHR unit. 295 l/s.	1.9 x 1.8 x 1.5(h) See notes.	Access for regular maintenance and inspection. Will require crane lift on/off.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 1.9m length. 1.8m room depth is only required opposite AHU components approx. 1.5m length.

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		Requires modification to PVs. Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes.					
CM24	Main Comms Room Heat Rejection Plant	Proposed and Ideal : Roof location in close proximity to served room. Not ideal pipe route as no local external space for heat rejection.	Allow for 2No. outdoor condensers (run and standby). 5kW UK sensible cooling each.	3 x 3 x 2.0(h) Heat rejected horizontally so equivalent area won't be suitable.	Access for maintenance single door to external.	Must be completely clear above to allow heat rejection to dissipate (not recirculate).	Acoustic criteria and assessment may dictate requirement to enclose/screen area.
CM25	Distributed (local) Comms Room Heat Rejection Plant	Proposed and Ideal : Roof location in close proximity to served room (appears possible). Not ideal pipe route as need to pass through tenant office demise.	Allow for single condenser. 5kW UK sensible cooling.	1.5 x 3 x 2.0(h) Heat rejected horizontally so equivalent area won't be suitable.	Access for maintenance single door to external.	Must be completely clear above to allow heat rejection to dissipate (not recirculate).	Acoustic criteria and assessment may dictate requirement to enclose/screen area. Potentially investigate roof space over small hall (off East stair).
CM26	Mechanical Ventilation with Heat Recovery – Stairwell South-West (Stair 1)	Proposed : On roof area and directly above served area where possible. Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes.	1 No. horizontal floor mounted MVHR unit. 60l/s.	1.65x 1.0 x 0.5(h) See notes.	Access for regular maintenance and inspection. Likely to require crane lift onto roof location both for initial installation and replacement.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Located on roof for now but investigate larger dropped ceiling void as this could be relocated into 4th floor stairwell ceiling void. Requires supply and extract duct riser between Basement and fourth floor.
CM27	Mechanical Ventilation with Heat Recovery – Stairwell West (Stair 2)	Proposed : On roof area and directly above served area where possible. Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes.	1 No. horizontal floor mounted MVHR unit. 60l/s.	1.65x 1.0 x 0.5(h) See notes.	Access for regular maintenance and inspection. Likely to require crane lift onto roof location both for initial installation and replacement.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Located on roof for now but investigate larger dropped ceiling void as this could be relocated into 4th floor stairwell ceiling void.

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							Requires supply and extract duct riser between Basement and fourth floor.
CM28	Mechanical Ventilation with Heat Recovery – Stairwell East (Stair 6)	Proposed : On roof area and directly above served area where possible. Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes.	1 No. horizontal floor mounted MVHR unit. 60l/s.	1.65x 1.0 x 0.5(h) See notes.	Access for regular maintenance and inspection. Likely to require crane lift onto roof location both for initial installation and replacement.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Located on roof for now but investigate larger dropped ceiling void as this could be relocated into 4th floor stairwell ceiling void. Requires supply and extract duct riser between Basement and fourth floor.
CM29	Mechanical Ventilation with Heat Recovery – Offices South-West	Proposed and Ideal : Internal in 1st floor South-West plant room and therefore directly next to served area and also external wall for intake and exhaust duct routes.	1 No. MVHR in ceiling void unit with end connections. 300l/s.	2.0 x 1.6 x 0.5(h) See notes.	Access for regular maintenance and inspection.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Voids to be reviewed for suitability for intake/exhaust duct routes in conjunction with other local systems. Assume exhaust will be taken up out of light well area.
CM30	Mechanical Ventilation with Heat Recovery – Halls Corridors	Proposed : External 1st floor light well area and directly next to served area. Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes.	1 No. horizontal floor mounted MVHR unit. 40l/s.	1.65x 1.0 x 0.5(h) See notes.	Access for regular maintenance and inspection. Likely to require crane lift into/out of light well location both for initial installation and replacement.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Strength assessment on light well ventilation platform to be completed by Structural Engineer.
CE1	Photovoltaic Panels for council	PVs mounted externally.	PV Panels mounted on flat roof and roof of large hall. kWe total consisting of XNo. of 2XXW panels (	Total PV array area is 455m^2.	All PVs to be accessible for regular inspection and cleaning.	External.	To be developed with energy strategy. Inverters and related electrical equipment to be located internally in roof electrical switch rooms (CE5)
CE2a	UKPN Existing Substation	Existing : Basement floor with access from public footpath.	UKPN owned transformer / CT chamber 1No. 1.0MVA transformer	As existing.	Agreed with UKPN. Will require method of accessing and replacing transformer 24/7.	TBD by UKPN. Need to establish current provision.	Requirement to be confirmed by UKPN, including position, access and construction details. Substation will serve building (CCC and tenant offices). May also serve local buildings or external provisions e.g. street lighting.

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		Look to negotiate : Reuse of basement transformer room if possible.				Allow for mechanical ventilation.	
CE2b	UKPN New Substation	Proposed : Basement floor with direct access from public footpath. Look to negotiate : If not possible to reuse basement transformer room then locate new substation room in North-West corner of Basement floor. Ideal : Ground floor with direct access and louvres from public footpath.	UKPN owned transformer / CT chamber 1No. 1.5MVA transformer	4.5 x 5.0 x 3.0(h)	To be agreed with UKPN. Will require method of accessing and replacing transformer 24/7.	TBC by UKPN. Need to establish current provision. Allow for mechanical ventilation.	Requirement to be confirmed by UKPN, including position, access and construction details. Substation will serve building (CCC and tenant offices). May also serve local buildings or external provisions e.g. street lighting.
CE3	CCC Office Switch Room	Basement (Internal) immediately beside the substation (CE2).	Incoming UKPN supply head and utility metering. Main Switchgear Distribution board for basement West. Energy metering equipment External lighting board/control.	5 x 2.5 x 3(h)	One and a half leaf door access. Ideally from outside and inside of the building. Basement location likely to dictate the need for the panel to be delivered in sections and formed on site/in situ.	Mechanically ventilated at 0.2 air changes an hour (ACH) for EnerPHit.	Depending on UKPN head/metering arrangement. Assumes UKPN happy to route cabling into switch room via basement (should be).
CE4 (a-n) Var.	Electrical Cupboards (dispersed)	Proposed and Ideal : Internal cupboard/room local to area served and riser containing sub main power distribution. Vertically stacked (between floors) and central to served areas (to reduce cable lengths)	Distribution Boards (power and lighting) Electrical Sub Meters & logging devices. Lighting Controls	1.0 x 0.5 x 2.5(h) Dims are for DB only (not rising sub mains.	Must be fully accessible but secured (locked). Can be a locked board in a secure staff room/area or riser.	Mechanically ventilated at 0.2 air changes an hour (ACH) for EnerPHit.	Locations to be developed with risers and layouts. Likely to require some panel boards for dispersed plant e.g. small hall roof. Hall requirements to be confirmed by theatre consultant. May require larger boards and more of them to suit stage equipment, performance systems and lighting.
CE5	Electrical Switch Room –Roof plant	On new roof (to West).	Panel board. Control panel (MCP).	3 x 2 x 2.7 (h) Subject to confirmation	Single door.	High and low level louvres for summer heat dissipation.	Location to relate to served plant and sub main riser routing up from below.

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			Local small power/lighting board. Electrical Meters & logging devices PV inverters.	with developing roof plant layout		Ventilated at 0.2 air changes an hour (ACH).	Dispersed plant power cabling strategy to be developed with routing through existing building.
CE6	Incoming Comms Room	Proposed : Secure basement floor room located off public footpath. For Basement room (IT managers often concerned about flood risk). Locate in CCC office area to aid cable distribution (large number of cables to serve east side BF-1F). Ideal : Secure ground floor room located off public footpath.	Incoming utility service and associated boards/distribution. Office comms racks. See CE7 & CE8.	4 x 3.5 x 3.0(h)	Direct external access for utility provider is preferred. Constraints of existing building unlikely to allow. If in basement lift and corridor to be suitable to house a data cabinet/free standing rack (width and height).	Will need cooling. Mechanically ventilated at 0.2 air changes an hour (ACH) for EnerPHit.	This assumes dual incoming comms rooms are not required. Basement room would ideally be avoided as IT managers are concerned about floor risk.
CE7.	Distributed (local) Comms Rooms or Cupboards. Fibre linked to CE6 to ensure suitable cable lengths to local outlets	Proposed and Ideal : Ground floor east side to serve west side of G-1F. First floor south side to serve Halls areas. Location to reduce cable lengths and quantum of cable routing from main comms room (CE6)	Cabinet and racks, patches etc.	See drawing. See access	Leaf and a half door to allow installation and removal of comms rack. Store width at ground floor will only allow access to sides and front of a cabinet and would share room with distribution board (access/security).	Mechanically ventilated at 0.2 air changes an hour (ACH) for EnerPHit.	Cable routing requires local riser down to basement and upto first floor. Theatre consultant to confirm requirement for Halls (if dedicated systems are required).
CE8	Building Management Equipment room	Assumed that all related building management staff interface equipment will be located within the reception hub. UPS systems to be in comms rack (E6).	AWC alarm system equipment Refuge alarm system equipment Access control system equipment Security system equipment	Subject to briefing. Consider behind front desk work top/cupboards (appears quite open)	Access to all equipment for maintenance.	If in office utilise office ventilation and cooling and ensure equipment is open to the office for heat dissipation. Mechanically ventilated at 0.2 air changes an hour (ACH) for EnerPHit.	Management systems requiring regular staff monitoring/use will often have related accessories at the staff desk positions. Some may be accessible via the web (subject to agreed briefing). Assumes a number of rack mounted systems (contained within CE6).

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CE9	Fire Alarm Panel (s)	Visible from main entrance (as defined for fire access) (Internal) May require repeater panels in Customer Services Reception.	Fire alarm panel. Potentially repeater panel.	0.8 x 0.4 x 0.6(h) estimated.	Fully accessible to front of panel/s	Have some ventilation openings into surrounding space.	Fire strategy TBC by fire engineer Required to be visible so if enclosed should have a glazed front.
CE10	PV Battery Storage Room.	Local to PV inverters.	Batteries.	3.5 x 4.5 x 3(h), if required.	Double doors. Access for regular testing and inspection and battery replacement.	Mechanically ventilated at 0.2 air changes an hour (ACH) for EnerPHit.	To be developed with PV design and energy strategy.

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Additional Plant rooms that may be required in response to further assessments and/or fire strategy and/or detailed briefing

REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
CPHX	Sprinkler Tank Room. **See note re provision.**	Ideal : Ground floor (internal). Anticipated : Basement (internal)	Sprinkler system water storage tank. Sprinkler Pumps. Power and controls.	?.? x ?.? x ?.?(h)	Double doors accessible from inside or outside (preferred) of the building. **Fireman to have direct access from outside of the building**	Background Infiltration	Requirement TBC by fire engineer. Estimated size based on OH?? category and minimum flow duration of mins. Consider bunding room. Floor gulleys required. **Would/could this also serve the office tenant?**
CMx	Smoke Extract Fans - Basement	In separate fire compartment to that served	Mechanical smoke extract fans (run/standby). ??M3/s each.	?.? x ?.? x ?.?(h)	Regular inspection and testing. Crane lift in/out ~(heavy)	Open to surroundings for motor heat release.	Requirement to be confirmed by fire engineer/ strategy including compartmentation. Discharge to be away from all exits. Ideally at roof level to allow dispersal of smoke. Consider make up air (how/from where) Attenuation? Interfaces with fire alarm, sprinklers etc. Secondary power.
CMx	Smoke Extract Fans -	Roof connected into ventilation shaft (external).	Mechanical smoke extract fans (run/standby).	3 x 3 x 1.5(h) including maintenance space to front.	Regular inspection and testing.	Open to surroundings for motor heat release.	Initial allowance to be developed with fire engineer.
CMx	Dry risers	Incoming valve on external façade. Dry riser cabinets off firefighting stairs.	Valve boxes/cabinets.	See note	Access from firefighting lobby.	None required.	Requirement to be confirmed by fire strategy
CMx	Sound/AV/ Dimmer room-Heat Rejection Plant (per room)	Roof over	Allow for single condenser. 5kW UK sensible cooling TBC by Theatre consultant.	1.5 x 3 x 2.0(h) per room served Heat rejected horizontally so equivalent area won't be suitable.	Access for maintenance single door to external.	Must be completely clear above to allow heat rejection to dissipate (not recirculate).	Acoustic criteria and assessment may dictate requirement to enclose/screen area. Room, equipment and assocaited cooling requirements TBC by Theatre Consultant.

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CMx	Gas/Foam fire suppression for critical electrical rooms.	Local to served critical electrical room, typically a data/comms room (internal).	Specialist suppression cylinders and related control, monitoring and (if required) ventilation systems.	TBC, if required size dependent on served room.	Internal door (single anticipated)	Dependent on suppression system/gasses used.	May require pressurisation/ventilation system. Consider subsequent removal of sasses/foam after use.
CMx	Mechanical Ventilation with Heat Recovery – Basement Zoom Booths	Proposed : External with close proximity to served areas. Located on new ventilation platform in lightwell on 1st floor.	1 No. cupboard MVHR vertical unit with top duct connections. 85l/s.	1.8 x 0.9 x 2.7h. + access to front (in front of 0.9m). See notes.	Access for regular maintenance and inspection from plant room/area. Unit width can just fit through doorway.	None required to plant cupboard.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct – MOVE TO GREY DON'T DELETE BUT NO LONGER NEEDED. Height allows for connecting ducts/attenuators routing into corridor ceiling void (behind). 1.8m length includes 600mm access which can be from surrounding plant area (unit width is 1.2m). Voids to be reviewed for suitability for intake/exhaust in conjunction with other local systems. Assume exhaust will be taken to roof level.
CEx	Generator Enclosure	Assumed to be on roof due to limited internal space available. Also internal generator would require room to be acoustically treated and generator to be ventilated (with attenuation) which will be complex in listed building.	Generator in acoustic enclosure. (if required size TBC once fire strategy is agreed)	?.? x?.? x ?.?(h) TBC see notes	Access for regular inspection and testing. Acoustic enclosure to allow suitable access. Diesel fill from location where barrels can be trolleyed to. Typically use lift to transfer to highest floor and provide diesel pump and pipework from that location.	Generator exhaust flue out of enclosure. Louvres in acoustic enclosure.	Generator requirement/size subject to receipt and implementation of fire strategy. In particularly the any requirement for sprinkler pumps, smoke extract fans and firefighting or evacuation lifts. Consider noise breakout. Generator exhaust flue to discharges at highest point aware from all ventilation air intakes.
CEx	Essential power switch room	Ideal : Close to, ideally next to but separate from the generator room/enclosure and close to served equipment. Internal room	Essential power switchgear and automatic changeover devices.	?.? x?.? x ?.?(h) TBC see notes	One and a half leaf door accessible from the inside or outside of the building	Louvres to external space (louvred doors to service road)	Dependent on fire strategy.
CEx	UPS Plant Room.	Near Server Room. (Internal).	Uninterruptable power supply.	TBC, if required.	Double doors.	Vents at high and low level.	If required, to be provided as part of ICT fit out. Can be installed in comms/server rooms Likely to require additional DX cooling (roof plant).

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CEx	Central Battery Room.	Ground Floor. (Internal).	Inverter, batteries.	TBC, if required.	Double doors. Access for regular testing and inspection and battery replacement.	Vents at high and low level.	Fire strategy to confirm. Current assumption is self-contained emergency light fittings with integral batteries will be sufficient for the offices. May require additional DX cooling (roof plant).
CEx	Central Emergency Lighting Monitoring Panel	Close to/in areas served (Internal).	Central monitoring panel	TBC, if required.	Single door access for regular testing and inspection.	Vents at high and low level.	Alternative to using local test key switches. Can also consider web based intelligent systems.
CEx	External Lighting pillars	External to suit lighting installations	Feeder pillar and electrical distribution equipment/protective devices	TBC with lighting design.	Direct access from surrounding external space	None as external installation	To be developed with external lighting design.
CEx	Performance Space (Hall) Dimmer Room	Locate room close to performance space lighting bars	Dimmer racks detailed by Theatre Consultant	3 x 3 x 2.7(h) TBC by Theatre Consultant	Leaf and a half door to allow installation and removal of comms rack.	Background infiltration ventilation only (will be cooled).	TBC by Theatre Consultant. Will require room cooling (dedicated split system located on nearby roof).
CEx	Performance Space (Hall) AV rack room	Locate room close to performance space	Equipment detailed by Theatre Consultant.	3 x 3 x 2.7(h) TBC by Theatre Consultant	Leaf and a half door to allow installation and removal of comms rack.	Background infiltration ventilation only (will be cooled).	TBC by Theatre Consultant. Will require room cooling (dedicated split system located on nearby roof).
CEx	Sound/AV equipment.	TBC by Theatre Consultant (for Halls and possibly Chambers). Ideally in secure room.	Racks/equipment.	TBC by Theatre Consultant	Full access required	TBC by Theatre Consultant Often require cooling.	Requirements TBC by theatre consultant.

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Notes

1. Based on CPA design drawings received 10/10/2024.
2. All dimensions are clear internal dimensions. There should not be any structural columns or down stand beams within the clear dimensions/areas defined. If this can not be the case the areas will require review, development and likely increase to coordinate accordingly.
3. Vertical transportation is not included in this schedule, refer to separate advice for this.
4. For storage (attenuation), pumping or any other plant that may be required by the below ground drainage design refer to information provided by civil engineer.
5. For plant/equipment that is associated with any irrigation systems or water features refer to information provided by landscape architect.
6. For plant/equipment that is associated with the waste or recycling refer to information provided by transport consultant e.g. compactor.

Rev	Date	Status	Description	Engineer	Project Leader
P01	14/10/2024	Status S4	Suitable for Stage Approval	RF	CB
WIP	27/09/2024	Status S1	Suitable for Coordination	RF	CB
WIP	13/09/2024	Status S1	Suitable for Coordination	RF	CB
WIP	30/08/2024	Status S1	Suitable for Coordination	RF	CB

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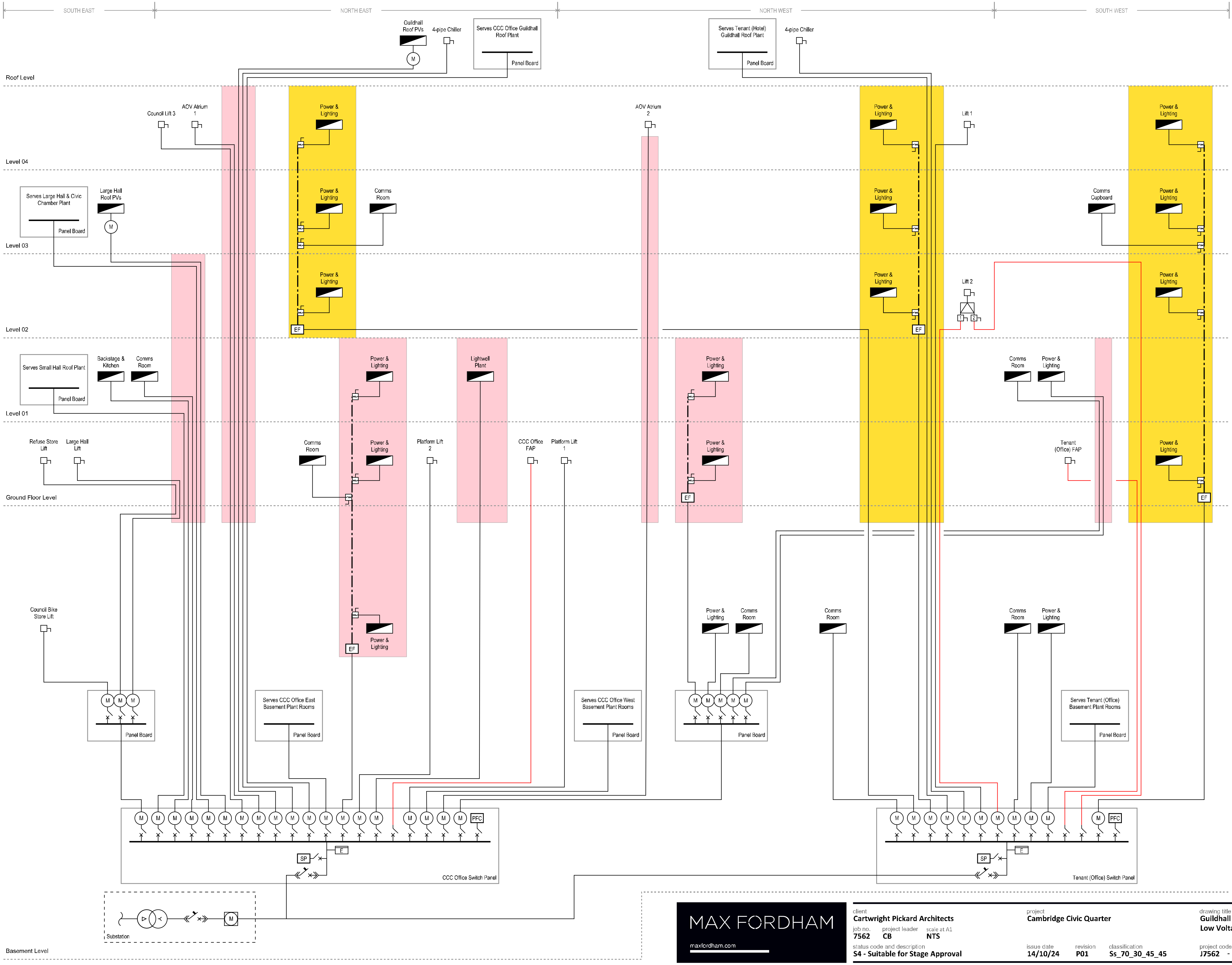
Guildhall Plant Schedule – Option 1
J7562-MXF-GH-ZZ-SH-J-30001 Rev P01



NOTES

1. This drawing is to be read in conjunction with all other MXF drawings, schedules and specifications.
2. Do not scale from this drawing.
3. Print in colour.
4. All electrical works are to be designed, installed and tested to BS 7671 : 2018 (18th Edition of the Wiring Regulations).
5. All cabling is to be run within containment and run in safe zones regardless of mechanical protection. Direct clipping will not be permitted.
6. Separate containment is to be provided for submain, general LV, fire alarm, control and data cables.

KEY

- Fire Resistant Submain Cable
- Submain Cable
- Vertical Busbar
- Auto Transfer Switch
- Busbar Tap Off
- Consumer Unit
- Disconnector
- Distribution Board
- End Feed Unit
- FAP — Fire Alarm Panel
- MCCB Circuit Breaker
- Withdrawable Air Circuit Breaker
- Main Power Meter (Type M1)
- Meter
- Power Factor Correction
- Surge Protection
- Transformer
- Utility Power Meter
- Riser for CCC Office Areas
- Riser for Tenant (Hotel) Areas

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client: Cartwright Pickard Architects

job no.: 7562 | project leader: CB | scale at A1: NTS

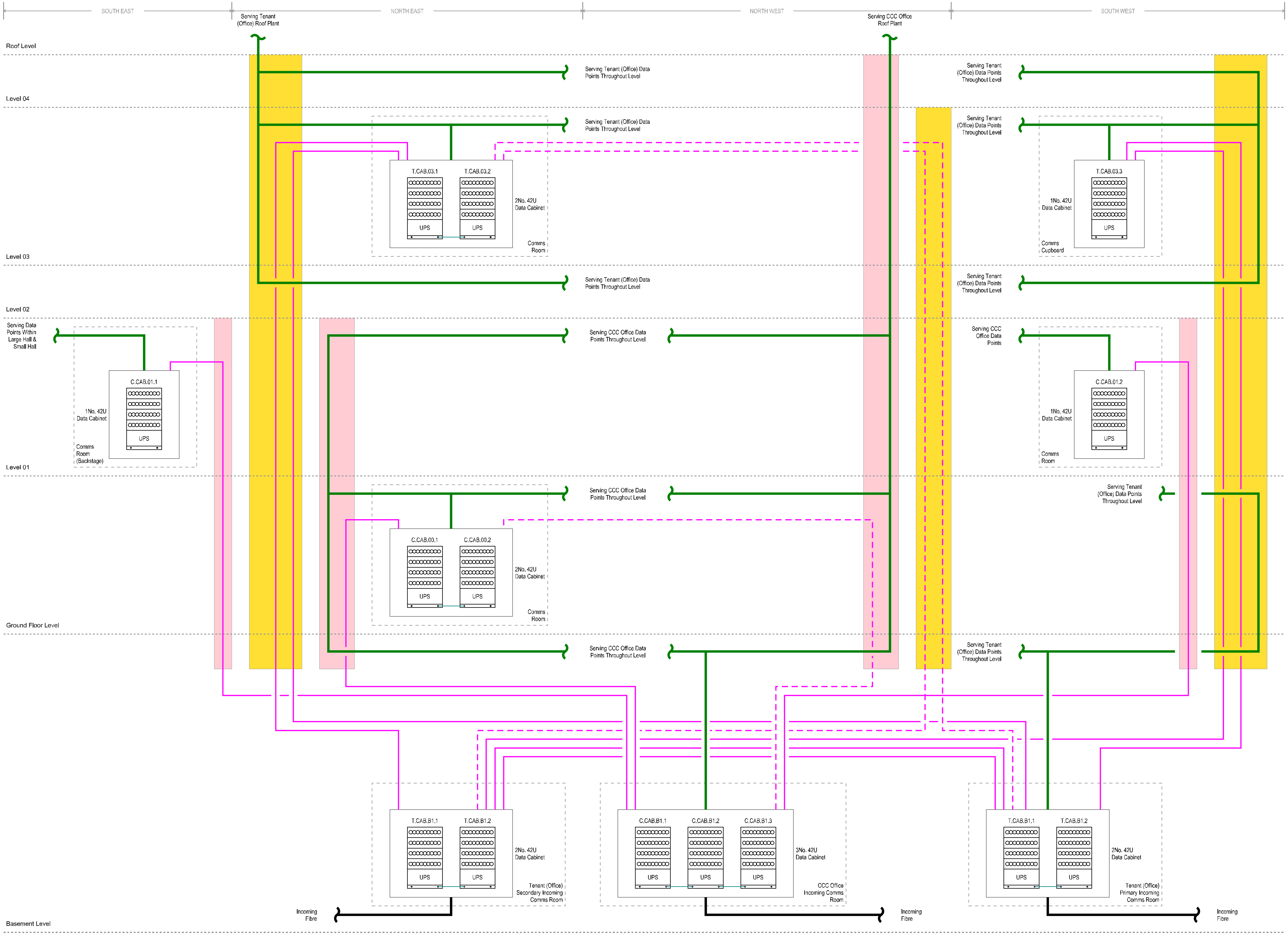
status code and description: S4 - Suitable for Stage Approval

project: Cambridge Civic Quarter

issue date: 14/10/24 | revision: P01 | classification: Ss_70_30_45_45

drawing title: Guildhall - Option 1 Low Voltage Distribution Schematic

project code - orig. - volume - level - type - role - number: J7562 - MXF - GH - ZZ - DR - E - 22201



NOTES

1. This drawing is to be read in conjunction with all other MXF drawings, schedules and specifications.
2. Do not scale from this drawing.
3. Print in colour.

KEY

- Cabling Between Data Cabinets
- Data Basket - Cat 6A Cables
- Primary Fibre Backbone Cabling
- Secondary Fibre Backbone Cabling
- UPS — Uninterruptible Power Supply
- Data Cabinet (with mounted UPS)
- Riser for CCC Office Areas
- Riser for Tenant (Office) Areas

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client: Cartwright Pickard Architects	project: Cambridge Civic Quarter	drawing title: Guildhall - Option 1 Data Distribution Schematic
job no. 7562 · project leader CB · scale at A1 NTS		
status code and description: S4 - Suitable for Stage Approval	issue date 14/10/24 · revision P01 · classification Ss_75_10_21_00	project code J7562 - orig. MXF - volume GH - level ZZ - type DR - role E - number 51201

KEY

- Extract ventilation
- Supply ventilation
- Both supply and extract ventilation
- Naturally vented / not in thermal envelope
- Mixed mode - natural and mechanical ventilation
- Heated area
- Heated and cooled area

NOTES

1. This drawing is to be read in conjunction with all other MXF drawings, schedules and specifications.
2. Do not scale from this drawing. Print in colour.
3. All areas have heat recovery on the ventilation units.

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client: Cartwright Pickard Architects	project: Cambridge Civic Quarter		drawing title: Guildhall - Option 1 Mechanical Strategy Basement Level
job no.: 7562; project leader: CB; scale at A1: 1:100			
status code and description: S4 - Suitable for Stage Approval	issue date: 14/10/24	revision: P01; classification: Ss_60_00_00_00	project code: J7562 - orig.: MXF - volume: GH - level: B1 - type: DR - role: M - number: 00101

KEY

- Extract ventilation
- Supply ventilation
- Both supply and extract ventilation
- Naturally vented / not in thermal envelope
- Mixed mode - natural and mechanical ventilation
- Heated area
- Heated and cooled area

NOTES

1. This drawing is to be read in conjunction with all other MXF drawings, schedules and specifications.
2. Do not scale from this drawing. Print in colour.
3. All areas have heat recovery on the ventilation units.

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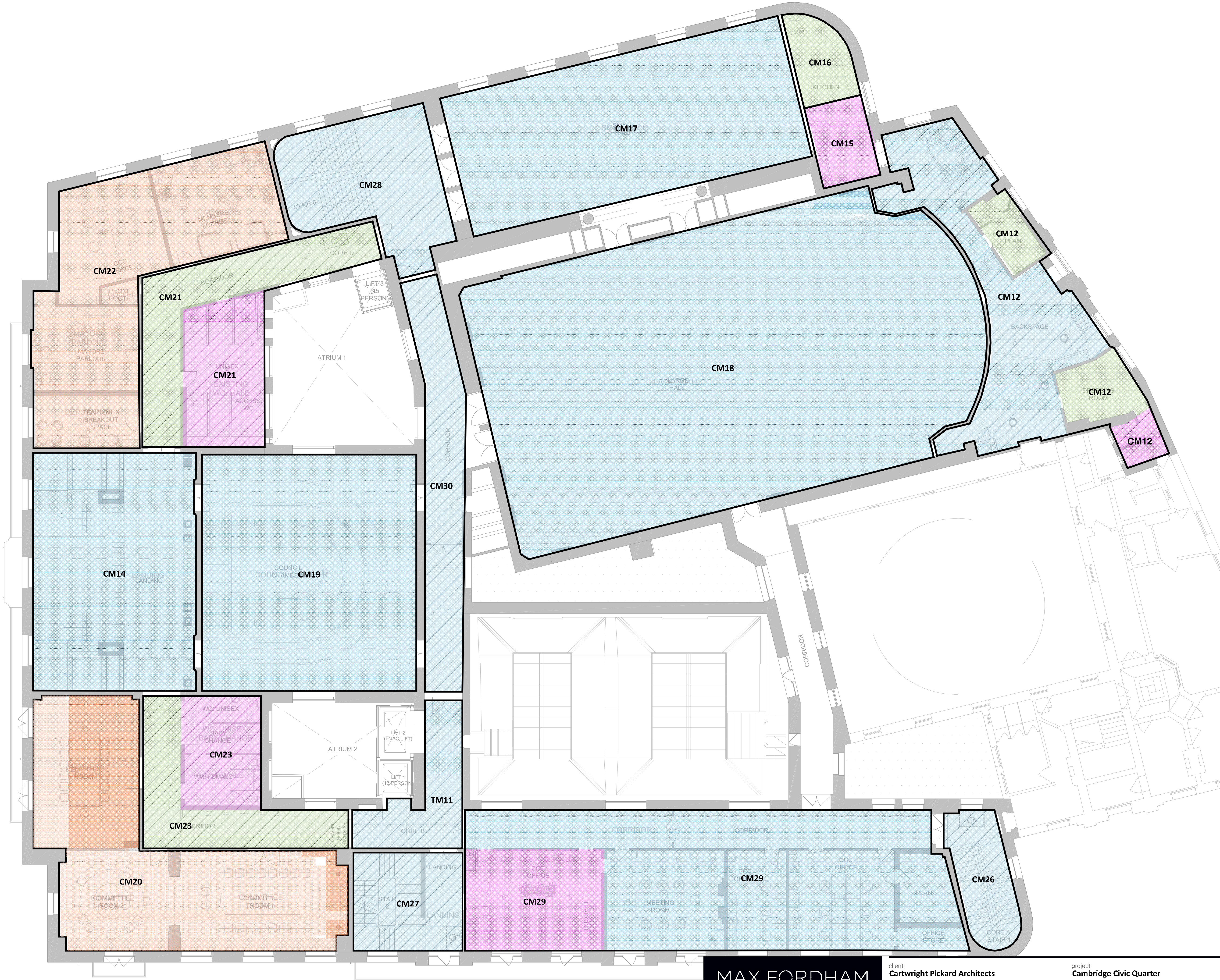
client: Cartwright Pickard Architects	project: Cambridge Civic Quarter		drawing title: Guildhall - Option 1 Mechanical Strategy Ground Floor
job no.: 7562 · project leader: CB · scale at A1: 1:100			
status code and description: S4 - Suitable for Stage Approval	issue date: 14/10/24 · revision: P01	classification: Ss_60_00_00_00	project code - orig. - volume - level - type - role - number: J7562 - MXF - GH - 00 - DR - M - 00101



KEY

- Extract ventilation
- Supply ventilation
- Both supply and extract ventilation
- Naturally vented / not in thermal envelope
- Mixed mode - natural and mechanical ventilation
- Heated area
- Heated and cooled area

NOTES

1. This drawing is to be read in conjunction with all other MXF drawings, schedules and specifications.
2. Do not scale from this drawing. Print in colour.
3. All areas have heat recovery on the ventilation units.

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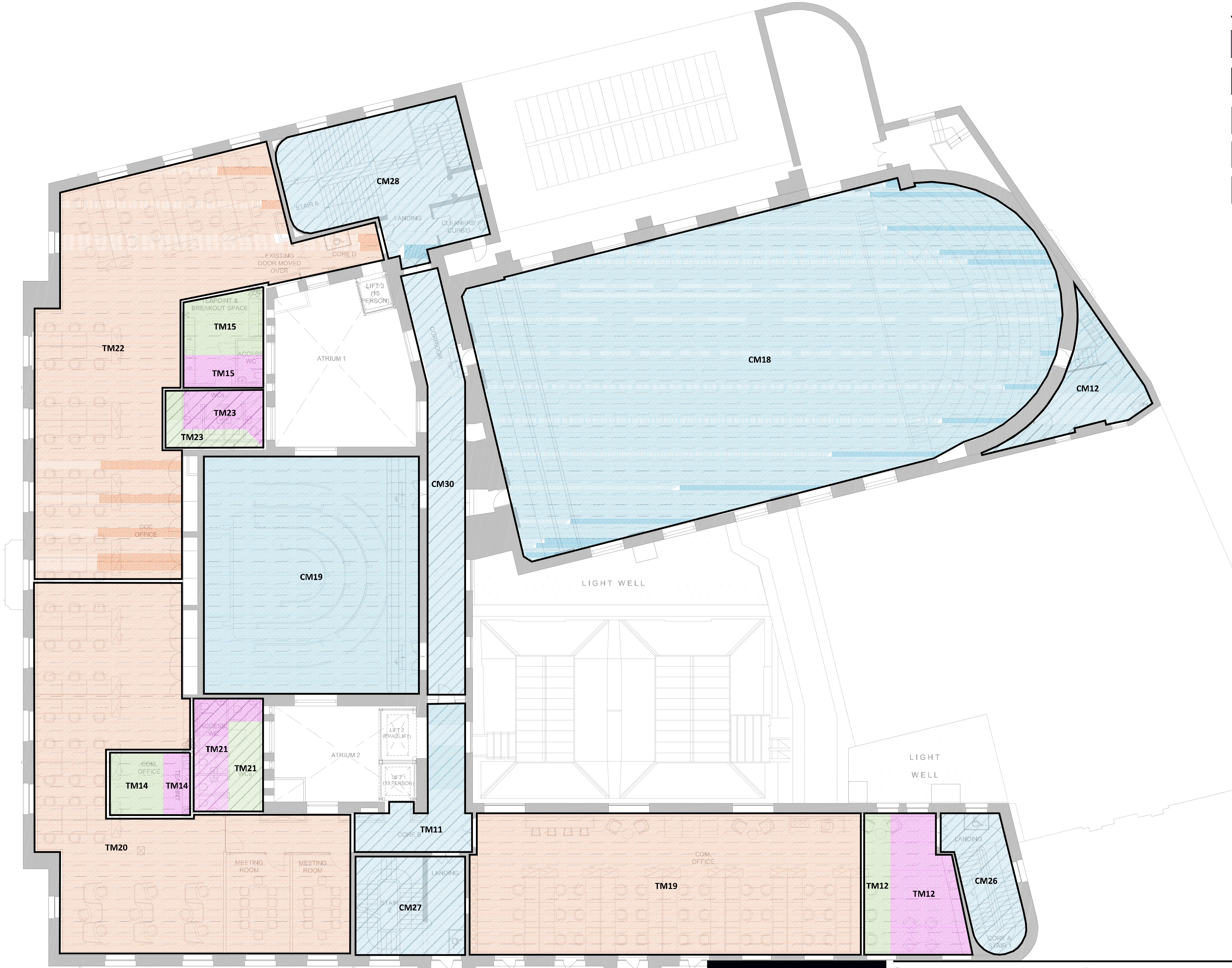
client: Cartwright Pickard Architects	project: Cambridge Civic Quarter		drawing title: Guildhall - Option 1 Mechanical Strategy First Floor
job no.: 7562 · project leader: CB · scale at A1: 1:100			
status code and description: S4 - Suitable for Stage Approval	issue date: 14/10/24 · revision: P01	classification: Ss_60_00_00_00	project code - orig. - volume - level - type - role - number: J7562 - MXF - GH - 01 - DR - M - 00101



KEY

- Extract ventilation
- Supply ventilation
- Both supply and extract ventilation
- Naturally vented / not in thermal envelope
- Mixed mode - natural and mechanical ventilation
- Heated area
- Heated and cooled area

NOTES

1. This drawing is to be read in conjunction with all other MXF drawings, schedules and specifications.
2. Do not scale from this drawing. Print in colour.
3. All areas have heat recovery on the ventilation units.

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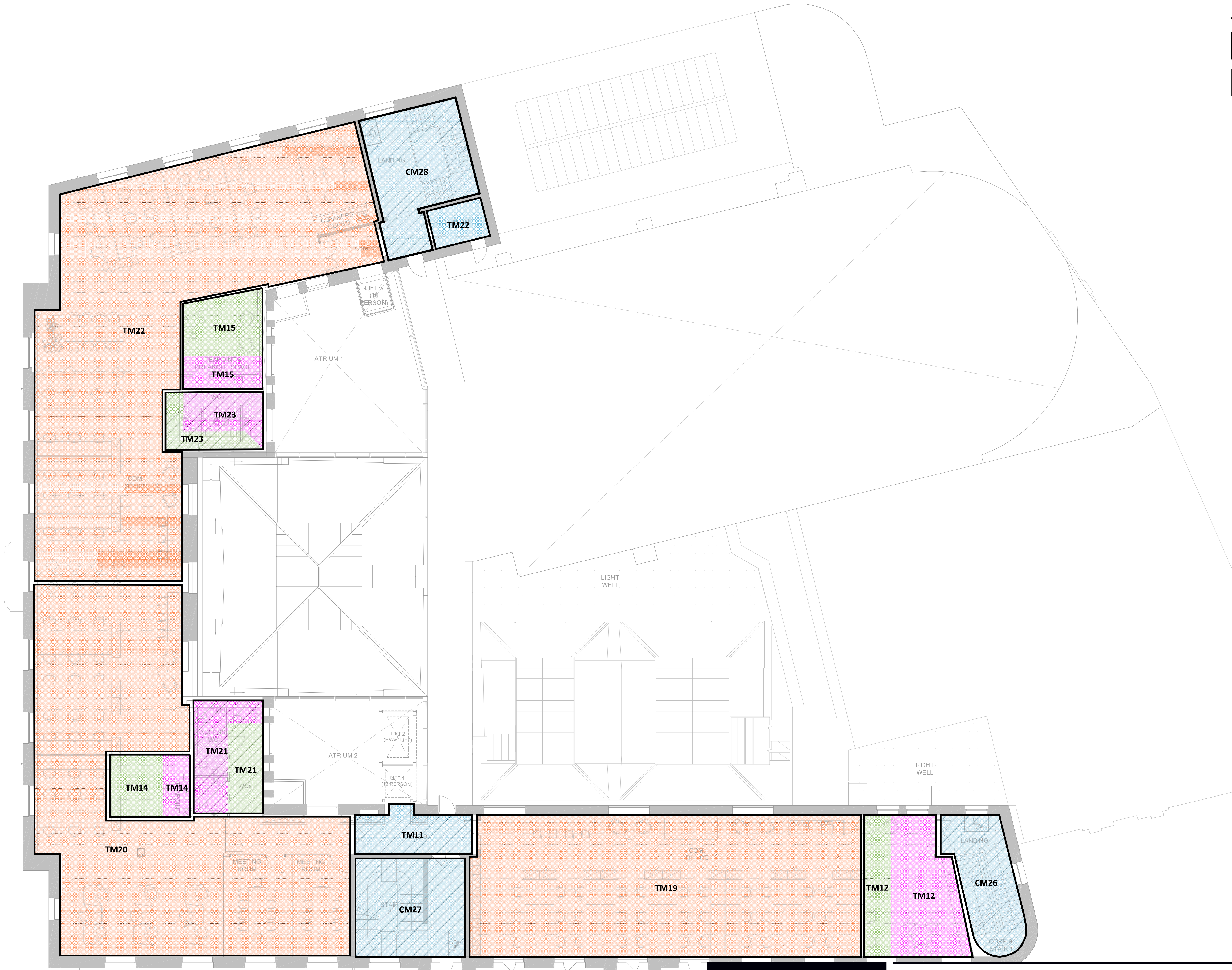
client: **Cartwright Pickard Architects**	project: **Cambridge Civic Quarter**			drawing title: **Guildhall - Option 1 Mechanical Strategy Second Floor**
job no.: **7562**	project leader: **CB**	scale at A1: **1:100**		
status code and description: **S4 - Suitable for Stage Approval**	issue date: **14/10/24**	revision: **P01**	classification: **Ss_60_00_00_00**	project code - orig. - volume - level - type - role - number: **J7562 - MXF - GH - 02 - DR - M - 00101**



KEY

- Extract ventilation
- Supply ventilation
- Both supply and extract ventilation
- Naturally vented / not in thermal envelope
- Mixed mode - natural and mechanical ventilation
- Heated area
- Heated and cooled area

NOTES

1. This drawing is to be read in conjunction with all other MXF drawings, schedules and specifications.
2. Do not scale from this drawing. Print in colour.
3. All areas have heat recovery on the ventilation units.

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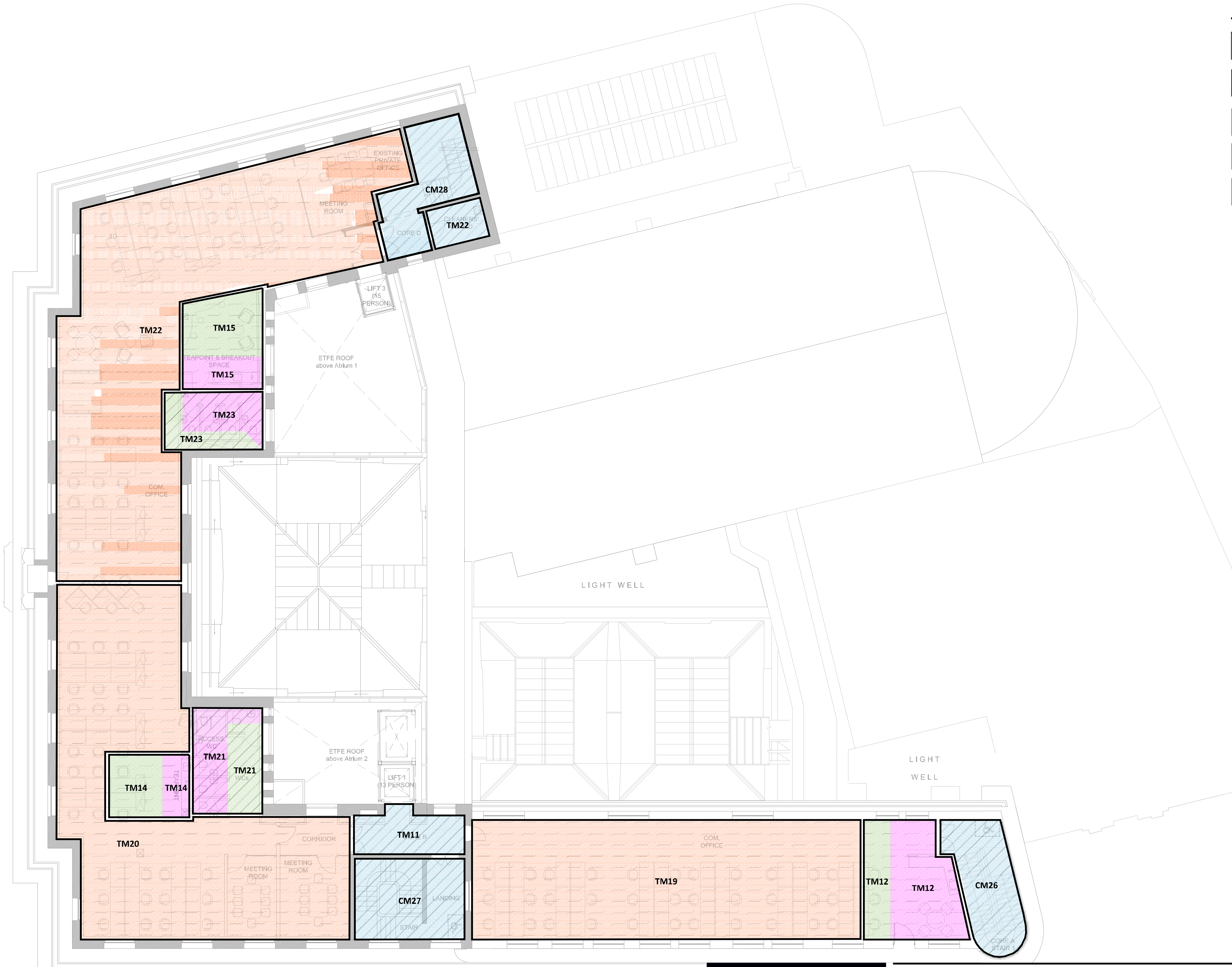
client: Cartwright Pickard Architects	project: Cambridge Civic Quarter		drawing title: Guildhall - Option 1 Mechanical Strategy Third Floor
job no.: 7562 / project leader: CB / scale at A1: 1:100			
status code and description: S4 - Suitable for Stage Approval	issue date: 14/10/24	revision: P01 / classification: Ss_60_00_00_00	project code - orig. - volume - level - type - role - number: J7562 - MXF - GH - 03 - DR - M - 00101



KEY

- Extract ventilation
- Supply ventilation
- Both supply and extract ventilation
- Naturally vented / not in thermal envelope
- Mixed mode - natural and mechanical ventilation
- Heated area
- Heated and cooled area

NOTES

1. This drawing is to be read in conjunction with all other MXF drawings, schedules and specifications.
2. Do not scale from this drawing. Print in colour.
3. All areas have heat recovery on the ventilation units.

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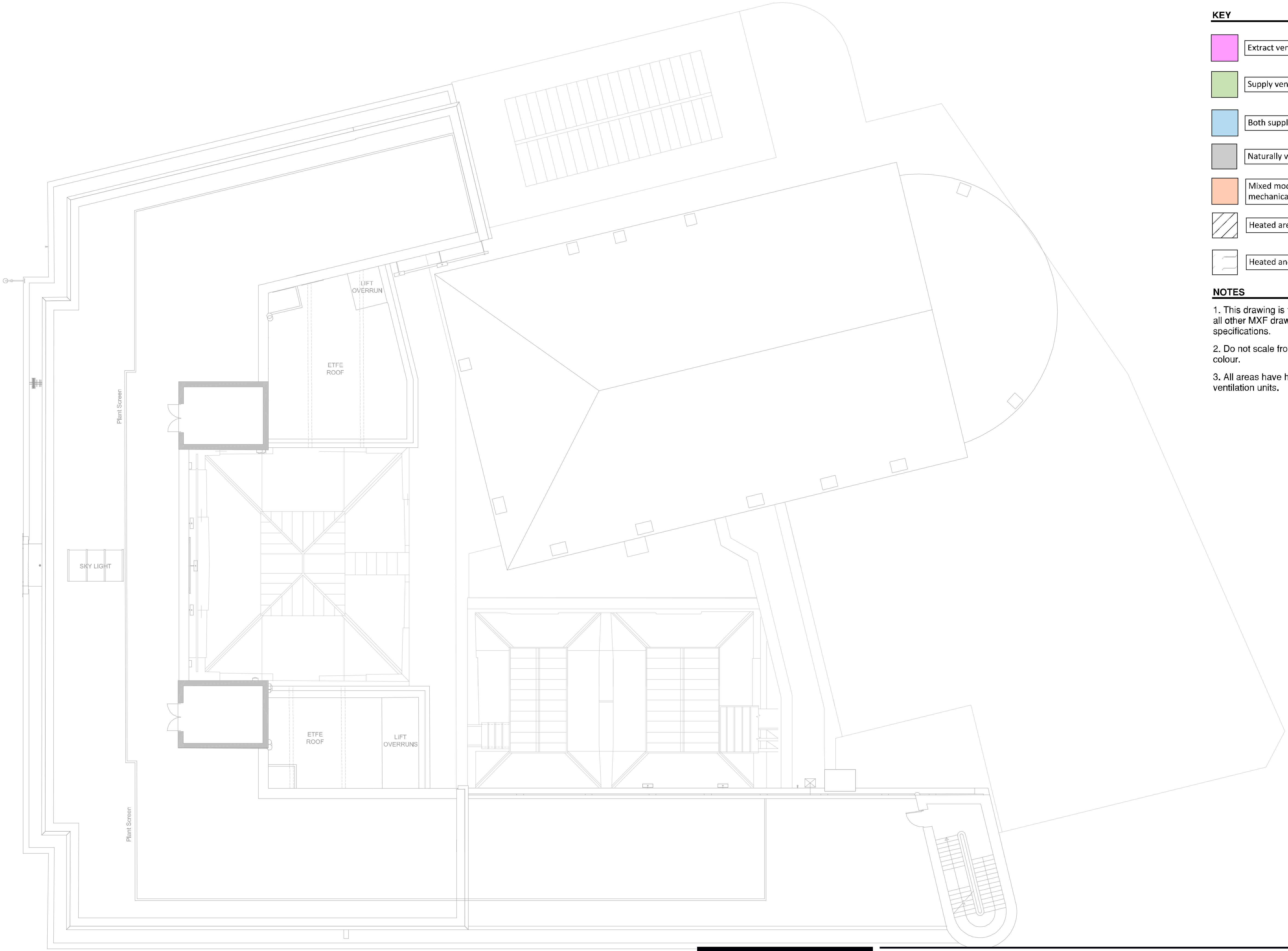
client: Cartwright Pickard Architects	project: Cambridge Civic Quarter		drawing title: Guildhall - Option 1 Mechanical Strategy Fourth Floor
job no.: 7562	project leader: CB	scale at A1: 1:100	
status code and description: S4 - Suitable for Stage Approval	issue date: 14/10/24	revision: P01	classification: Ss_60_00_00_00

project code: J7562 - orig.: MXF - volume: GH - level: 04 - type: DR - role: M - number: 00101



KEY

- Extract ventilation
- Supply ventilation
- Both supply and extract ventilation
- Naturally vented / not in thermal envelope
- Mixed mode - natural and mechanical ventilation
- Heated area
- Heated and cooled area

NOTES

1. This drawing is to be read in conjunction with all other MXF drawings, schedules and specifications.
2. Do not scale from this drawing. Print in colour.
3. All areas have heat recovery on the ventilation units.

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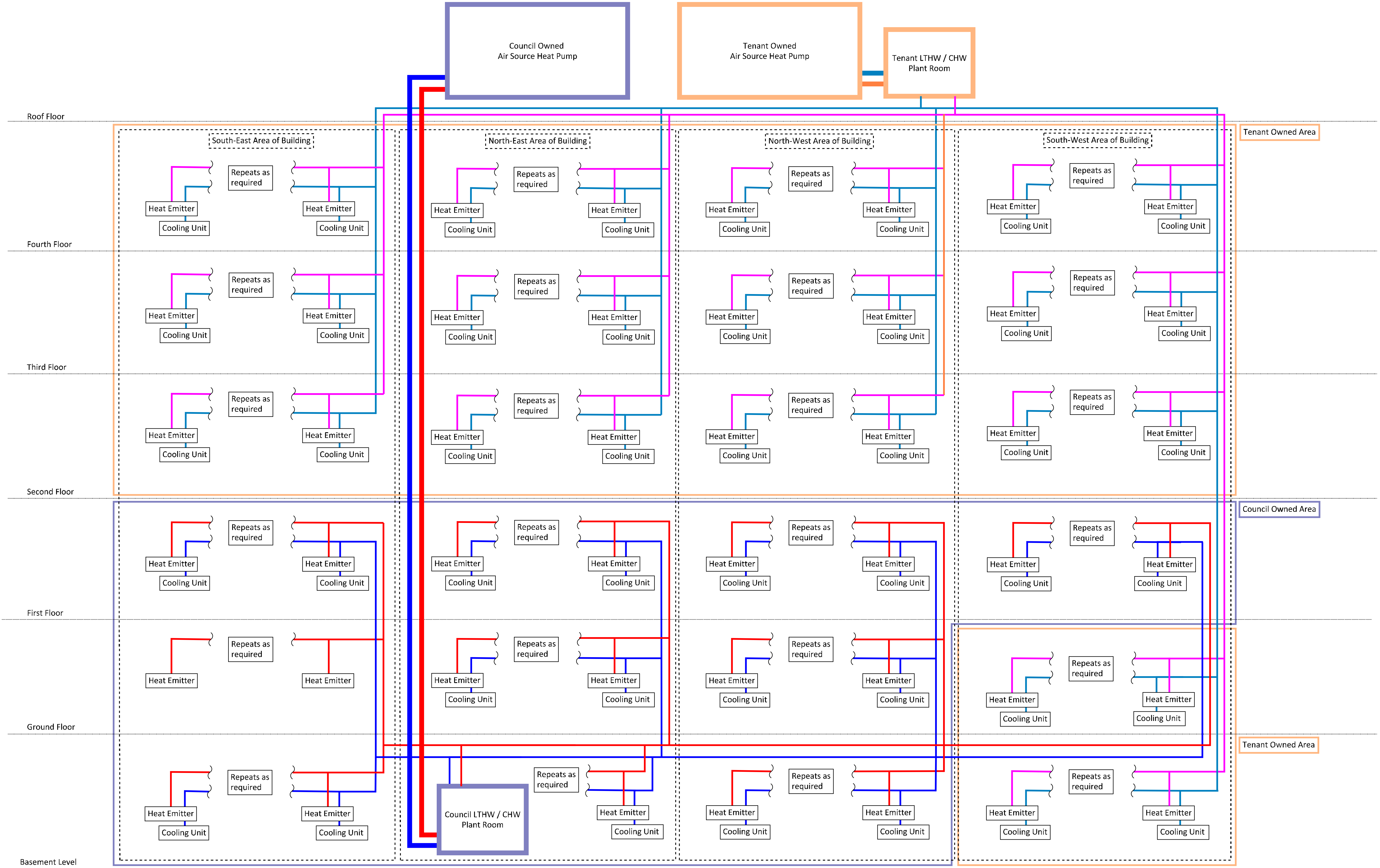
client: **Cartwright Pickard Architects**	project: **Cambridge Civic Quarter**		drawing title: **Guildhall - Option 1 Mechanical Strategy Roof Level**
job no. **7562** project leader **CB** scale at A1 **1:100**			
status code and description: **S4 - Suitable for Stage Approval**	issue date **14/10/24**	revision **P01** classification **Ss_60_00_00_00**	project code **J7562** - orig. **MXF** - volume **GH** - level **RF** - type **DR** - role **M** - number **00101**



KEY

- Flow and Return Chilled Water (Council)
- Flow and Return LTHW Water (Council)
- Flow and Return Chilled Water (Tenant)
- Flow and Return LTHW Water (Tenant)
- CCC Office Areas
- Tenant (Office) Areas

NOTES

1. This drawing is to be read in conjunction with all other MXF drawings, schedules and specifications.
2. Do not scale from this drawing. Print in colour.
3. This schematic shows key components to illustrate the design intent. Not all components (valves, ancillaries etc.) are shown. This document presents the design intent developed to RIBA Stage 2 Concept Design level of information, and is subject to further design development during RIBA Stage 3.
4. See Sheet 2 for details regarding to the LTHW/CHW Plant Rooms.

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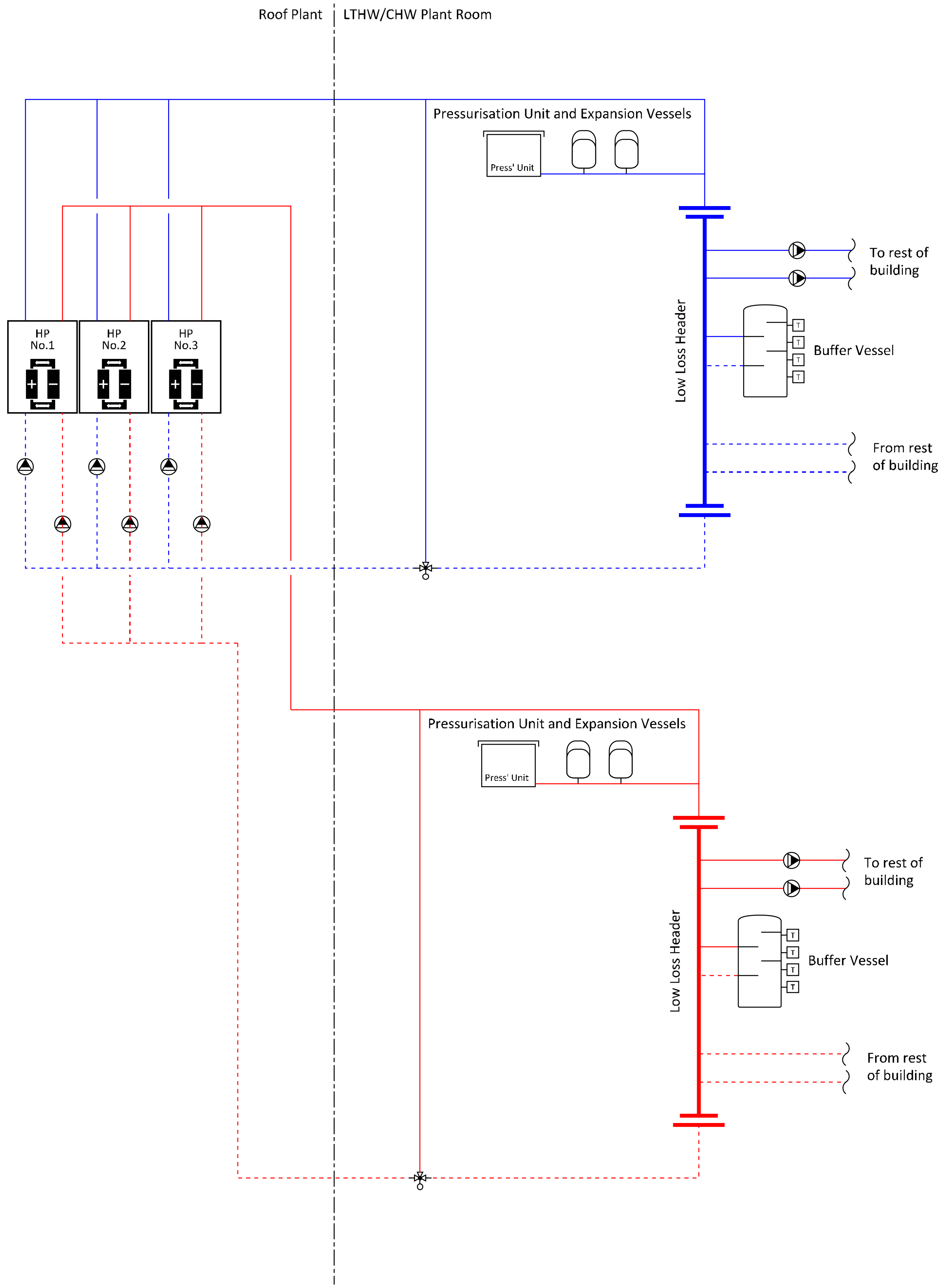
client: Cartwright Pickard Architects
job no.: 7562 | project leader: CB | scale at A1: NTS
status code and description: S4 - Suitable for Stage Approval
project: Cambridge Civic Quarter
issue date: 14/10/24 | revision: P01 | classification: Ss_60_40_00_00
drawing title: Guildhall - Option 1
Space Heating and Cooling Schematic
Sheet 1 of 2
project code: J7562 - orig.: MXF - volume: GH - level: ZZ - type: DR - role: M - number: 10201



NOTES

1. This drawing is to be read in conjunction with all other MXF drawings, schedules and specifications.

2. Do not scale from this drawing. Print in colour.

KEY

- Flow Chilled Water
- Return Chilled Water
- Flow LTHW Water
- Return LTHW Water
- Pump
- 3-port Valve

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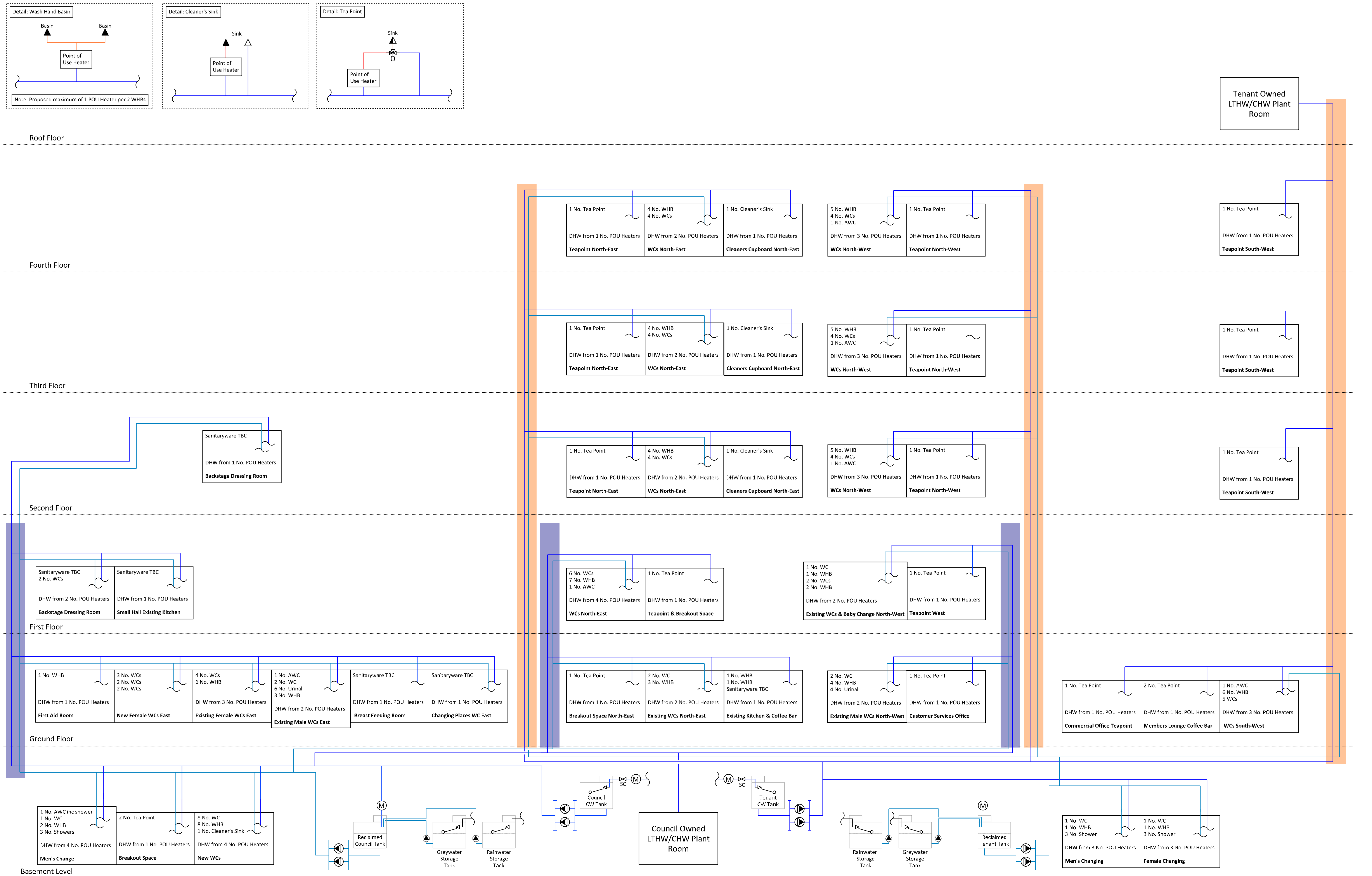
client **Cartwright Pickard Architects**			project **Cambridge Civic Quarter**		drawing title **Guildhall - Option 1** **Space Heating and Cooling Schematic** **Sheet 2 of 2**
job no. **7562**	project leader **CB**	scale at A1 **NTS**			
status code and description **S4 - Suitable for Stage Approval**			issue date **14/10/24**	revision **P01**	classification **Ss_60_40_00_00**

project code **J7562** - orig. **MXF** - volume **GH** - level **ZZ** - type **DR** - role **M** - number **10202**



KEY

Boosted Cold Water	Meter (M)
Boosted Recycled Water	Stopcock (SC)
Riser for CCC Office Areas	Thermostatic Mixing Valve
Riser for Tenant (Office) Areas	Pump - Variable Speed

NOTES

1. This drawing is to be read in conjunction with all other MXF drawings, schedules and specifications.
2. Do not scale from this drawing. Print in colour.
3. This schematic shows key components to illustrate the design intent. Not all components (valves, ancillaries etc.) are shown. This document presents the design intent developed to RIBA Stage 2 Concept Design level of information, and is subject to further design development during RIBA Stage 3.
4. Where wash hand basins, cleaner's sinks and tea points are mentioned, see details for how these are supplied.

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client: Cartwright Pickard Architects	project: Cambridge Civic Quarter	drawing title: Guildhall - Option 1 Water Distribution and Supply Schematic
job no.: 7562; project leader: CB; scale at A1: NTS		
status code and description: S4 - Suitable for Stage Approval	issue date: 14/10/24; revision: P01; classification: Ss_55_70_00_00	project code: J7562 - orig.: MXF - volume: GH - level: ZZ - type: DR - role: P - number: 50201

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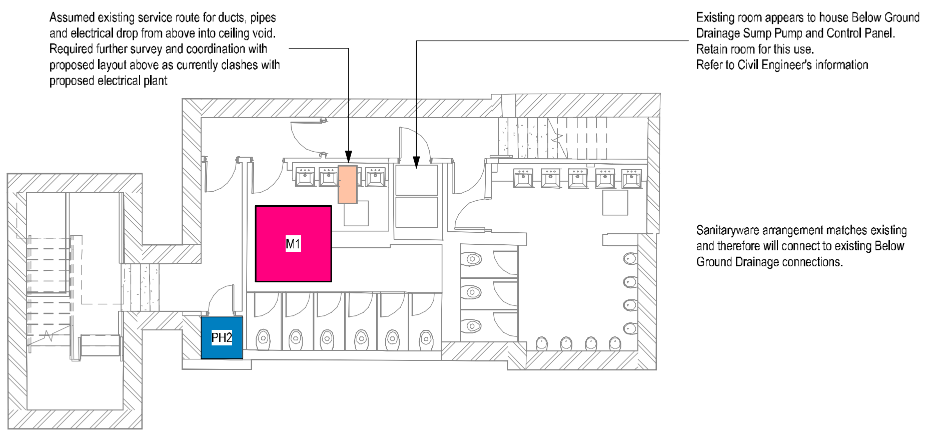
APPENDIX V – CORN EXCHANGE MEP DRAWINGS & SCHEDULE

Drawings included in this appendix have been printed at A3 paper size for the convenience of the report. Original A1 paper size drawings issued alongside this report as separate documents.



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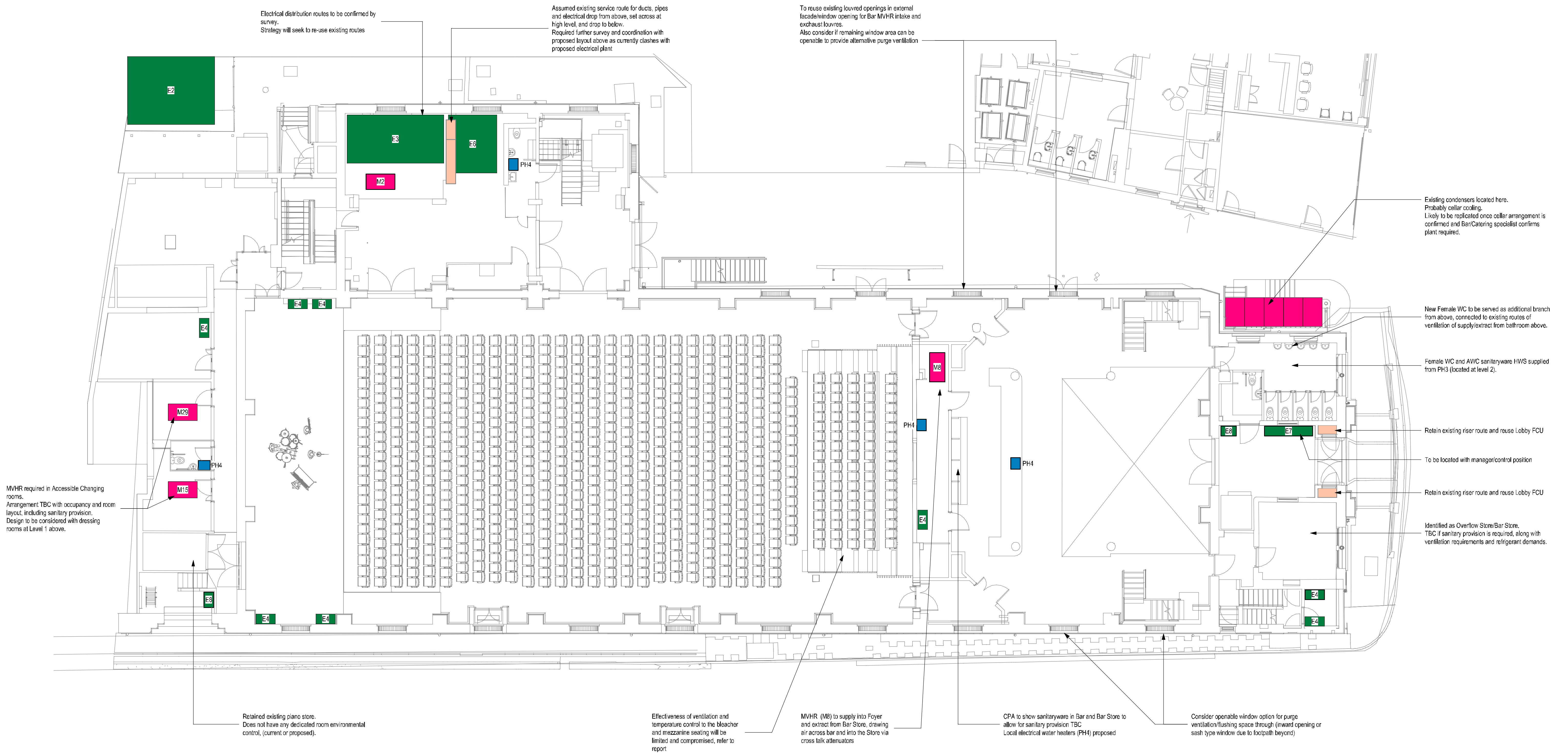
client **Cartwright Pickard Architects**	project name **Cambridge Civic Quarter** **Corn Exchange**		drawing title **Combined Services Layout** **Level B1**
job no. **J7562** · project leader **CB** · scale at A1 **1 : 100**			
status code and description **S3 - Suitable for Review and Comment**	issue date **14/10/24** · revision **P01**	classification **PM_40_40_15**	project code - orig. - volume - level - type - role - number **J7562 - MXF - CE - B1 - DR - J - 30101**



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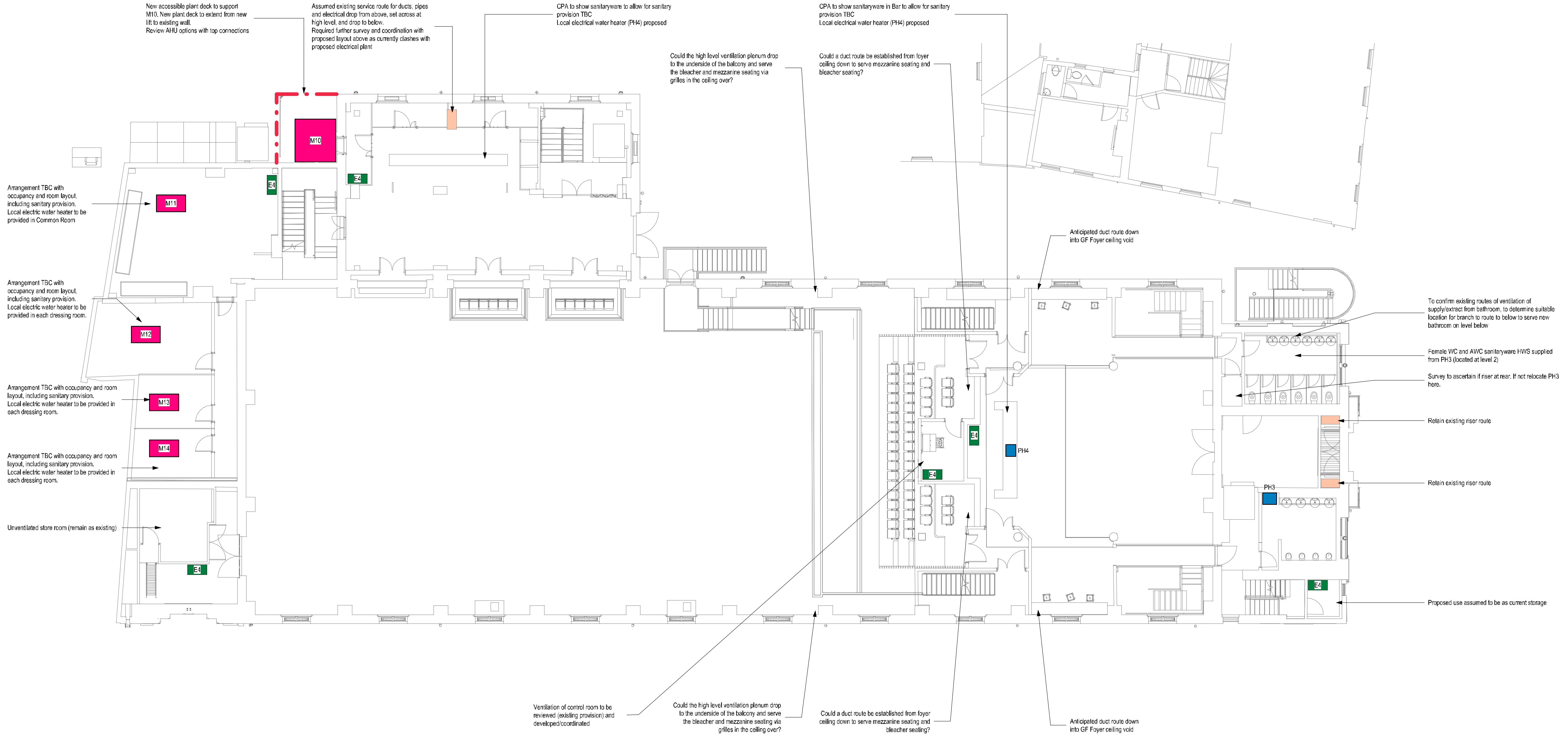
client **Cartwright Pickard Architects**	project name **Cambridge Civic Quarter** **Corn Exchange**		drawing title **Combined Services Layout** **Level 00**
job no. **J7562** project leader **CB** scale at A1 **1 : 100**			
status code and description **S3 - Suitable for Review and Comment**	issue date **14/10/24**	revision **P01** classification **PM_40_40_15**	project code **J7562** - orig. **MXF** - volume **CE** - level **00** - type **DR** - role **J** - number **30101**



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client
Cartwright Pickard Architects
job no. **J7562** project leader **CB** scale at A1 **1 : 100**
status code and description **S3 - Suitable for Review and Comment**

project name
Cambridge Civic Quarter
Corn Exchange
issue date **14/10/24** revision **P01** classification **PM_40_40_15**

drawing title
Combined Services Layout
Level 01
project code **J7562** - orig. **MXF** - volume **CE** - level **01** - type **DR** - role **J** - number **30101**

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client: **Cartwright Pickard Architects**	project name: **Cambridge Civic Quarter Corn Exchange**	drawing title: **Combined Services Layout Level 02**
job no. **J7562** project leader **CB** scale at A1 **1 : 100**		
status code and description: **S3 - Suitable for Review and Comment**	issue date **14/10/24** revision **P01** classification **PM_40_40_15**	project code **J7562** - orig. **MXF** - volume **CE** - level **02** - type **DR** - role **J** - number **30101**

Roof acces for maintenance to be provided. To be coordinated with developed design stage plant layouts.
Preference for part of staircase to be extended up.
Alternative is for ladder from level below (as existing but relocated to suit)

Likely to require DX cooling for Sound/AV/Dimmer rooms but not currently on plans.

E5 and M25 are internal plant rooms. Construct as separate rooms with separate external access but as one form.
Extend M25 south to allow access route onto roof aligning with M26 access space in front of condensers.
Route also provides maintenance access to M4b

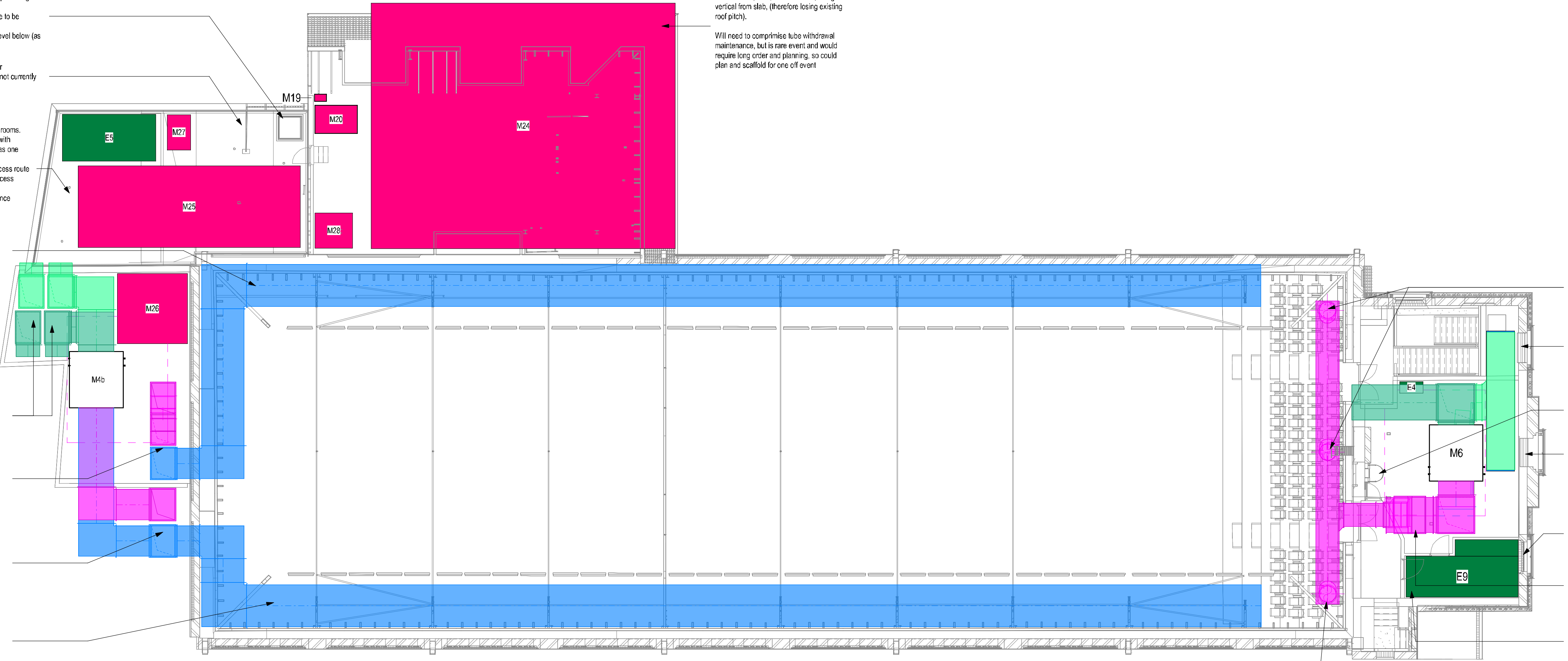
Proposed duct plenum around perimeter of auditorium for supply air.

Proposed duct route to for air intake and exhaust, set up to above

Proposed duct route to serve one side of auditorium, rise to above

Proposed duct route to serve one side of auditorium, rise to high level

Proposed duct plenum around perimeter of auditorium for supply air.



Acoustic louvred screen around perimeter to enclose M19, M20, M24 and M28, being vertical from slab, (therefore losing existing roof pitch).

Will need to comprimise tube withdrawal maintenance, but is rare event and would require long order and planning, so could plan and scaffold for one off event

Proposed duct route for extract air path from below, within concealed columns rise to high level. (previously thought to be structural)

Existing louvre arrangement and size?

Review and look to improve existing roof access

Existing louvre arrangement and size?

Can we get duct to where AHU over sails window/louvre?

Consider louvring existing windor as an alternative to serve M9 (level 2)

Return air duct from auditorium high level and void beneath balcony seating combines into single duct

Reuse existing emergency lighting central battery room

Proposed duct route for extract air path from below, within concealed columns rise to high level. (previously thought to be structural)

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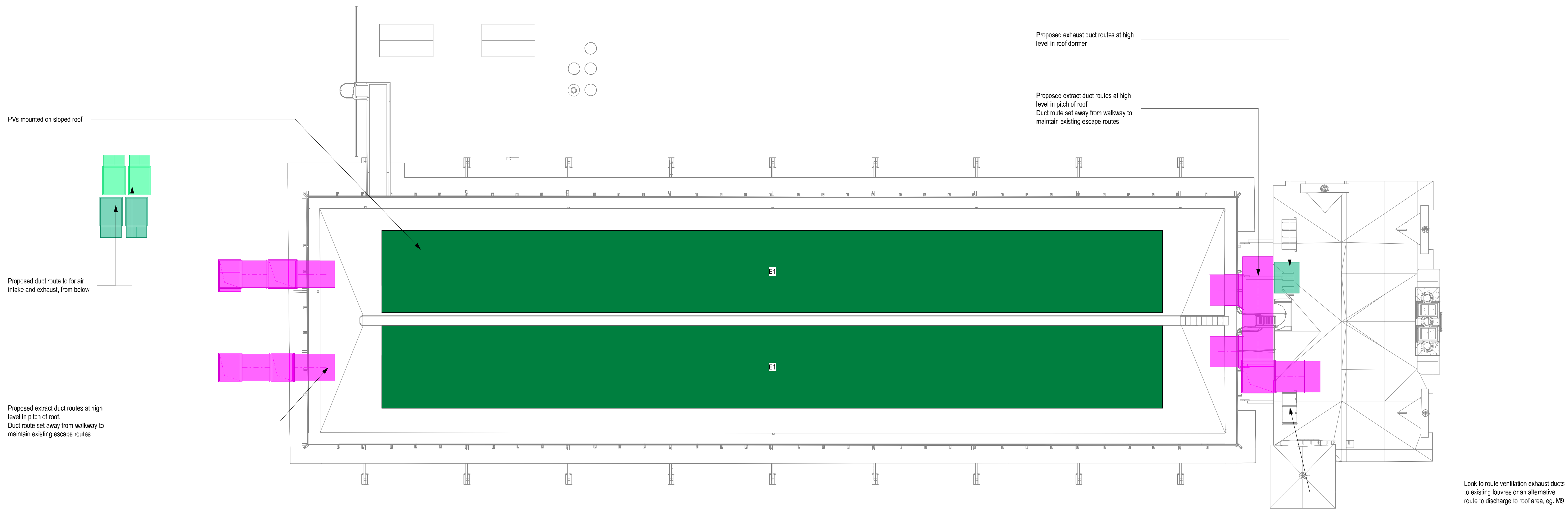
client **Cartwright Pickard Architects**	project name **Cambridge Civic Quarter** **Corn Exchange**	drawing title **Combined Services Layout** **Level 03**
job no. **J7562** · project leader **CB** · scale at A1 **1 : 100**		
status code and description **S3 - Suitable for Review and Comment**	issue date **14/10/24** · revision **P01** · classification **PM_40_40_15**	project code **J7562** - orig. **MXF** - volume **CE** - level **03** - type **DR** - role **J** - number **30101**



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client: Cartwright Pickard Architects	project name: Cambridge Civic Quarter Corn Exchange	drawing title: Combined Services Layout Level RF	
job no.: J7562	project leader: CB	scale at A1: 1 : 100	
status code and description: S3 - Suitable for Review and Comment	issue date: 14/10/24	revision: P01	classification: PM_40_40_15

project code / orig / volume / level / type / role / number: J7562 - MXF - CE - RF - DR - J - 30101

Cambridge Civic Quarter – Corn Exchange

Architect: **Cartwright Pickard Architects**
Issue Status: S3 – Suitable for Review and Comment

SCHEDULE OF CORN EXCHANGE PLANT SPACE REQUIREMENTS

REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
PH1	Cold Water Services Plant Room	Ideal : Ground floor (internal). Proposed due to spatial constraints : Level 2 North plant room (internal).	Incoming cold-water supply (utility metering in public footpath). Potable cold water storage tank (5.16m^3 storage capacity TEF sectional tank). Booster set (duty/assist/ standby). ~~CAT V Booster set~~. **Omitted** as plant room location does not suit external watering. Water leak detection system. FoH FWC 170l hot water cylinder and pump. Motor control panel.	5.3 x 6.5 x 2.7(h) 2.7 clear height is under ductwork setting down from above and into foyer ceiling /rake under balcony. Room height is more. 5.3 room depth is as existing meeting room.	Large single or leaf and one-half doors (for plant delivery and replacement). Extend existing meeting room door opening to match existing external escape doors at this level that lead onto external stair. Maintenance access via north east BoH stair. Plant install and replacement via Parsons Court escape stair which serves this level (2). Lift onto landing and use existing door (approx. 1200 clear opening). **Requires extension of existing door way** into plant room (existing meeting room). Alternative is to lift onto balcony from Wheeler St and trolley into room.	Ventilated tank room to ensure suitable room temperature to avoid stored water warming. Use (open) North facing windows. Monitor room and external temperature to signal need to open.	Minimum clearance of 750mm clear required above the tank. Tank based on 600mm pier walls. Consider bunding room. Floor gulley required (for overflow). High level of insulation on HWS cylinder and related pipework to reduce heat transfer into room.
PH2	Basement domestic hot water cupboard	Ideal : Basement centralised within served sanitary accommodation (internal).	Highly insulated 145l direct electric hot water storage cylinder, expansion vessel, circulation pump, in line water conditioner and associated controls.	1.1 x 1.1 x 2.2(h) To suit existing cupboard.	**Requires extension of existing cupboard door** to provide minimum 700 clear into cupboard. Maintenance access via general circulation route to sanitary accommodation. Plant install and replacement via Parsons Court and either stage entrance (Get in or back of stage). Suitably rated (50kg/600dia) stair climbing trolley required to transfer cylinder down to basement.	Consider ventilating via WC system.	Locate cylinder on plinth. Floor gulley required for expansion relief.
PH3	Second Floor Male FoH domestic hot water cupboard	Ideal : Second floor within served sanitary accommodation (internal).	Highly insulated 80l direct electric hot water storage cylinder, expansion vessel in line water conditioner and associated controls.	0.7 x 0.6 x 2.0(h) With single door or removeable /demountable front.	Maintenance access via general circulation route to sanitary accommodation. Plant install and replacement via main entrance and use of lift in conjunction with suitably rated 30kg trolley.	Consider ventilating via WC system.	Locate cylinder on plinth. Floor gulley required for expansion relief.

Corn Exchange Plant Schedule
J7562-MXF-CE-ZZ-SH-J-30001 Rev P02

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Cambridge Civic Quarter – Corn Exchange

Architect: **Cartwright Pickard Architects**
Issue Status: S3 – Suitable for Review and Comment

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REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
PH4 various	Local domestic hot water heater cupboards (distributed)	Local to served outlets; GF : Bar sinks; Bar store sink; AWC (south); BoH sinks & BOH Changing. 1F : Bar sinks; Bar store sink; Common room sink & Dressing room WHBs (all). 2F : Unisex WC WHBs; Laundry sink(s) & kitchen sink.	Local electric hot water heater and associated expansion relief. Size to suit outlets served. Assumes all showers are direct electric. Assumes kitchen and laundry whitegoods have integral electric water heaters.	TBC, dependent on number of outlets served.	Lockable cupboard to be fully accessible for maintenance and inspection.	To consider heat dissipation.	Layouts/requirements TBC before details can be provided. Heaters to be local, in close proximity to outlets served. Local drainage for expansion relief to integrate with assocaited served sanitaryware (drainage of).
M1	Mechanical Ventilation with Heat Recovery – Basement Sanitary Accom	Ideal : Internal with close proximity to served WCs and also external wall for intake and exhaust duct routes. Anticipated : Internal in ceiling void over female WC. Intake and exhaust ducts and louvres to be surveyed to establish routes and locations.	1 No. MVHR in ceiling void unit with end connections. 240l/s. Coordination with louvre locations and duct route may dictate better energy performance and/or need (spatially) for floor mounted remote MVHR.	2.0 x 2.0 x 0.55h. + access to side (from below), additional 0.5m See notes.	Access for regular maintenance and inspection from space below (use of step ladder). Unit width (2m) includes minimum access space (unit width is 1.4m) so can fit through doorway on its side. Fully accessible ceiling required. See notes re coordination.	None required to ceiling void.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Assume exhaust at high (roof?) level but can we route outside thermal envelope. Voids to be reviewed for suitability for intake/exhaust in conjunction with other local systems and routes in and out of basement. Proposed ceiling void unit but duct routes to intake and exhaust must be minimised to achieve NZC. Coordination of RCP will be constrained by MVHR and assocaited ducting. Ceiling void depth to be minimum of 700mm (more will reduce constraints).
M2	Mechanical Ventilation with Heat Recovery – Ground Floor AWC	Ideal : Internal with close proximity to AWC and also external wall for intake and exhaust duct routes. Current : Located in flexible storage space surrounding AWC (particularly if this does not require ceiling).	1 No. MVHR in ceiling void unit with end connections. 30l/s.	1.5 x 0.8 x 0.4(h) + access from below (hinged door on underside).	Access for regular maintenance and inspection from room. Ideally flexible storage space does not have a ceiling to provide full access. Will need to check acoustics but not anticipated to be problematic (storage area).	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Assume exhaust at high (roof?) level but can we route outside thermal envelope. Proposed ceiling void unit but duct routes to intake and exhaust must be minimised to achieve NZC. Coordination of AWC RCP will be constrained if MVHR is located within AWC. Must coordinate with electrical services as current incoming main/meter and switchgear sub mains route across this store room.

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M3	Mechanical Ventilation with Heat Recovery – Stage	Ideal : Internal with close proximity to stage but outside of stage/auditorium compartment (for acoustic reasons). Ideally close to external wall for intake and exhaust duct routes.	No longer proposed . See Notes				No longer proposed due to spatial constraints of existing building. Proposal is to utilise auditorium ventilation which utilises two separate units (M4A & 4B), each of which will utilise demand control (reduced fan speed).
M4A & M4B	Mechanical Ventilation with Heat Recovery – Auditorium flat floor area.	Ideal : Internal with close proximity to but outside of stage/auditorium compartment (for acoustic reasons). Ideally close to external wall for intake and exhaust duct routes. Current : As above but one AHU internal and one external	2 No. horizontal floor mounted AHUs with heat recovery. 4.5-5M3/s each. Bespoke made AHUs so dims TBC with manufacturer proposals. Cooling coils ideally to be incorporated in unit, subject to design development/ coordination. May differ between two units (rooms)	2.5 (+1 cooling) x 4.5 x 2.5(h) See plant re bespoke nature. 4.5m depth includes side access space to AHU and conns see note.	Access required for regular maintenance and inspection including filter cleaning and replacement. Available on level 2 via BoH staircase (**new door to plant room to be as wide as can fit in existing structure**). Roof (level 3) access required. Design team to review and coordinate with proposals (stair extension of replacement of existing vertical ladder). Will require crane lift onto/off roof from Corn Exchange St for initial installation and replacement. Level 2 unit to be positioned prior to new roof being formed. New roof to incorporate opening hatch to facilitate future replacement. Consider if unit specification can be sectional to be constructed on site.	None required to plant room.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the length. Cooling coils to increase length of lower supply section only. Bypass arrangement to be provided around the cooling coil.
M5	Mechanical Ventilation with Heat Recovery – Auditorium Bleacher.	Ideal : Internal with close proximity to but outside of auditorium compartment (for acoustic reasons). Ideally close to external wall for intake and exhaust duct routes. Need to establish existing provision/arrangement (refer to notes).	No longer proposed . See Notes				No longer proposed due to spatial constraints of existing building. Proposal is to utilise auditorium or balcony ventilation systems. Refer to stage 2 report. Need to establish existing provision/arrangement (if provided, potentially louvres in rear mezzanine wall).

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M6	Mechanical Ventilation with Heat Recovery – Auditorium Balcony Seating.	Ideal : Internal with close proximity to but outside of auditorium compartment (for acoustic reasons). Ideally close to external wall for intake and exhaust duct routes. Proposed in level 3 plant room. Does require external duct routing.	1 No. horizontal floor mounted AHU with heat recovery. 4.9-5.5M3/s each. Bespoke made AHU so dims TBC with manufacturer proposals.	3.5 x 4.5 x 2.5(h) See plant re bespoke nature. 4.5m depth includes side access space to AHU and conns see note.	Access via existing east stair for regular maintenance and inspection including filter cleaning and replacement. Initial installation requires crane lift into plant room with roof removed. Replacement would require the same however individual component replacement is more likely which would be via the strategy described for regular maintenance. Allow for unit to be delivered in sections and build in situ.	None required to plant room.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 5m length. Cooling coils to increase length of lower supply section only. **Requires repositioning of existing internal plant/central battery room wall.** Bypass arrangement to be provided around the cooling coil.
M7	Mechanical Ventilation with Heat Recovery – Foyer.	Ideal : Internal with close proximity to foyer. Ideally close to external wall for intake and exhaust duct routes.	No longer proposed . See Notes				No longer proposed due to spatial constraints of existing building. Proposal is to utilise shared foyer/auditorium balcony MVHR. Refer to stage 2 report.
M8	Mechanical Ventilation with Heat Recovery – Foyer Bar Store	Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes. Look to locate in store towards end near existing louvres.	1 No. MVHR in ceiling void/off soffit unit with end connections. 65l/s. Provides store ventilation and supply to staff when foyer is not in use.	1.5x 0.85x 0.45h + access from below (hinged door on underside). MF to review controls / electrics access.	Access for regular maintenance and inspection from room. Ideally store does not have a ceiling to provide full access. Installation and replacement via main entrance.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Proposed ceiling void unit but duct routes to intake and exhaust must be minimised to achieve NZC. To supply air into foyer and draw across bar and into store to assist with staffing/prep work allowing foyer AHU to be off during 'prep' periods.
M9	Mechanical Ventilation with Heat Recovery – Foyer WCs	Ideal : Internal with close proximity to WCs. Ideally close to external wall for intake and exhaust duct routes.	1 No. horizontal floor mounted MVHR unit. 340 l/s. Serves GF & 1F sanitary accommodation. Currently has capacity to serve GF bar store (was MWC).	1.9 x 1.8 x 1.5(h) 1.8m depth includes side access space to AHU and conns see note.	Regular maintenance and inspection access for filter cleaning and replacement via north east BoH stair. Plant install and replacement is as PH2, via Parsons Court escape stair. Lift onto landing and use existing door (approx. 1200 clear opening). **Requires extension of existing door way** into plant room (existing meeting room). Alternative to lift onto balcony from Wheeler St and trolley into room would suit initial install but would be constrained by water tank for future replacement.	None required to plant room.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 1.9m length. 1.8m room depth is only required opposite AHU components approx. 1.5m length.

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M10	Mechanical Ventilation with Heat Recovery – First floor bar	Ideal : Internal with close proximity to new bar. Ideally close to external wall for intake and exhaust duct routes. Proposed : External on first floor plant deck outside bar	1 No. horizontal floor mounted MVHR unit. 512 l/s. Requires occupancy TBC. Top connection MVHR likely to better suit deck arrangement.	2.1 x 2.2 x 1.6(h) 2.2m depth includes side access space to AHU and conns see note.	Access required for regular maintenance and inspection including filter cleaning and replacement. **Review existing internal access door (lift door?)** and look to use. Alternatively consider new door off stair landing. Initial installation and future replacement strategy to be via MEWP/cherry picker .	Is external	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Attenuator and ductwork connections will add to the 2.1m length. 2.2 room depth is only required opposite AHU components approx. 1.7m length.
M11	Mechanical Ventilation with Heat Recovery – First floor Common Room	Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes. See notes re intake and exhaust ducts.	1 No. MVHR in ceiling void unit with end connections. 60l/s.	1.5x 0.85x 0.45h + access from below (hinged door on underside). MF to review controls / electrics access.	Access for regular maintenance and inspection from room. Fully accessible ceiling required. See notes re coordination.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Proposed ceiling void unit but duct routes to intake and exhaust must be minimised to achieve NZC. Coordination of RCP will be constrained by MVHR and assocaited ducting. Ceiling void depth to be minimum of 550mm which will require routing and recessing around MVHR and connecting ductwork (more will reduce constraints).
M12	Mechanical Ventilation with Heat Recovery – First floor Dressing Rm 1	Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes. See notes re intake and exhaust ducts.	1 No. MVHR in ceiling void unit with end connections. 60l/s.	1.5x 0.85x 0.45h + access from below (hinged door on underside). MF to review controls / electrics access.	Access for regular maintenance and inspection from room. Fully accessible ceiling required. See notes re coordination.	None required.	As notes for M11.
M13	Mechanical Ventilation with Heat Recovery – First floor Dressing Rm 2	As M12	1 No. MVHR in ceiling void unit with end connections. 76l/s.	1.5x 0.85x 0.45h + access from below (hinged door on underside). MF to review controls / electrics access.	Access for regular maintenance and inspection from room. Fully accessible ceiling required. See notes re coordination.	None required.	As notes for M11.

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M14	Mechanical Ventilation with Heat Recovery – First floor Dressing Rm 3	As M13	As M13	As M13.	As M13.	None required.	As notes for M11.
M15	Mechanical Ventilation with Heat Recovery – Ground floor Accessible Changing room and AWC	As M13	1 No. MVHR in ceiling void unit with end connections. 55l/s.	As M13.	As M13.	None required.	As notes for M11.
M16	Mechanical Ventilation with Heat Recovery – Performer BoH Sanitary Accom	Ideal : Internal with close proximity to served sanitary accommodation and also external wall for intake and exhaust duct routes. Anticipated : Internal in ceiling void over unisex WC. Intake and exhaust louvres to be reviewed. Coordination with louvre locations and duct routes may dictate better energy performance and/or need (spatially) for remote MVHR(s) in roof plant space.	1 No. MVHR in ceiling void unit with end connections. 180l/s.	2.0 x 2.0 x 0.55h. + access to side (from below), additional 0.5m See notes.	Access for regular maintenance and inspection from space below (use of step ladder). Unit width (2m) includes minimum access space (unit width is 1.4m) so can fit through doorway on its side. Fully accessible ceiling required. See notes re coordination.	None required to ceiling void.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Assume exhaust at high (roof?), can we route outside thermal envelope? Voids to be reviewed for suitability for intake/exhaust in conjunction with other local systems and routes. Proposed ceiling void unit but duct routes to intake and exhaust must be minimised to achieve NZC. Coordination of RCP will be constrained by MVHR and assocaited ducting. Ceiling void depth to be minimum of 700mm (more will reduce constraints).
M17	Mechanical Ventilation with Heat Recovery – Visitor 2F locker room.	Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes. See notes re intake and exhaust ducts.	1 No. MVHR in ceiling void unit with end connections. 25l/s.	1.5 x 0.8 x 0.4(h) + access from below (hinged door on underside). MF to review controls / electrics access.	Access for regular maintenance and inspection from room. Fully accessible ceiling required. See notes re coordination.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Proposed ceiling void unit but duct routes to intake and exhaust must be minimised to achieve NZC. Coordination of RCP will be constrained by MVHR and assocaited ducting. Ceiling void depth to be minimum of 550mm which will require routing and recessing around MVHR and connecting ductwork (more will reduce constraints).

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M18	Mechanical Ventilation with Heat Recovery – Visitor Laundry room.	Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes. See notes re intake and exhaust ducts.	1 No. MVHR in ceiling void unit with end connections. 98l/s.	1.5x 0.85x 0.45h + access from below (hinged door on underside). MF to review controls / electrics access.	Access for regular maintenance and inspection from room. Fully accessible ceiling required. See notes re coordination.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Proposed ceiling void unit but duct routes to intake and exhaust must be minimised to achieve NZC. Coordination of RCP will be constrained by MVHR and assocaited ducting. Ceiling void depth to be minimum of 550mm which will require routing and recessing around MVHR and connecting ductwork (more will reduce constraints).
M19	Mechanical Ventilation – 2F Kitchen Extract fan.	Ideal : External near to point of discharge. Proposed : level 3 plant area over. See notes re discharge/ exhaust.	Kitchen Extract fan. 320l/s. Estimate only requires catering consultant to specify hood and confirm required ventilation rates.	0.5 x 0.3Ø (+access to) See notes.	Access for regular maintenance and inspection via roof access strategy. Kitchen extract ductwork to be accessible throughout its length (in room and on roof). Cleaning access panels required every 3m. Many need to crane/cherry picker on/off roof.	None required.	Discharge (exhaust) to be above highest point of roof and any neighbouring buildings that are higher and within 20m. **Will need to review neighbouring buildings.** Attenuator and ductwork connections will add to the 0.5m length (but can go in vertical ductwork). Consider acoustics/noise from fan (kitchen extract by nature are noisy)
M20	Mechanical Ventilation – 2F Kitchen Supply AHU.	Ideal : Internal with close proximity to served kitchen and also external wall for intake duct route. Proposed : level 3 plant area over.	Kitchen Supply AHU. 300l/s. Estimate only requires M19 TBC.	1.8 x 1.2 x 0.6(h) See notes.	Access for regular maintenance and inspection. Crane on/off roof.	None required for AHU itself.	Supply intake louvre location to minimise risk of entraining any pollutants, including discharge from any local exhaust ducts. Attenuator and ductwork connections will add to the 1.8m length. 1.2m room depth is only required opposite AHU. To be coordinated with M19 (refer to M19 notes).

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M21	Mechanical Ventilation with Heat Recovery – Second Floor Office	Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes. Proposed : in void MVHR. See notes re intake and exhaust ducts.	1 No. MVHR in ceiling void unit with end connections. 80l/s.	1.5x 0.85x 0.45h + access from below (hinged door on underside). MF to review controls / electrics access.	Access for regular maintenance and inspection from room. Fully accessible ceiling required. See notes re coordination.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Proposed ceiling void unit but duct routes to intake and exhaust must be minimised to achieve NZC. Review acoustic performance to ensure suitable for office working environment. Coordination of RCP will be constrained by MVHR and assocaited ducting. Ceiling void depth to be minimum of 550mm which will require routing and recessing around MVHR and connecting ductwork (more will reduce constraints).
M22	Mechanical Ventilation with Heat Recovery – Second Floor Common Room	Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes.	No longer proposed . See Notes				Room omitted to incorporate plant room.
M23	Mechanical Extract Ventilation – Staff WC Extract only due to limited space (MVHR won't fit).	Ideal : Internal within served WC. Establish existing arrangement and look to reuse louvre.	1 No. in line extract fan. 23l/s.	TBC in line WC extract fan (domestic scale) + access from below	Access for regular maintenance and inspection from room. Accessible ceiling required.	None required.	Establish existing arrangement and look to reuse louvre.
M24	Heat Pump Acoustic Enclosure	Roof (over level 3, will require opening up of existing plant room to form external plant area but will be necessary anyway to get existing plant out and new in.). (External). Fully open to above.	2 no. 420kW Cooling & 360kW Heating 2pipe Air Source Heat Pumps (2PASHP). Size does not allow for RH control. Assumed acoustic louvred enclosure required around (TBC by acoustician). Integrated primary pumps.	Side by side; 13.0 x 10.5x3.0h Above allows tube with drawl at rear of units but likely to over sails existing roof (3m clearance).	Regular maintenance access via doorway within acoustic enclosure. Major replacement works may require demounting of North screen. ASHP access provided within enclosure (walking on paving slabs laid on finished roof). Related power and pipework to be routed on inside face of acoustic enclosure only setting across ground level to route to related condenser (step overs required). Plant removal strategy requires crane lift onto/off of roof from Parsons Court.	External for heat rejection. Consider acoustics (see note under plant).	Must be completely clear above to allow heat rejection/discharge from top. Enclosure dimensions includes clearance to sides of units to allow air flow. Acoustic criteria and assessment may influence selection, size and requirement for acoustic screening or louvres. If DEN is provided this space can be allocated for chiller plant.

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M25	LTHW/CHW Plant room.	Ideal : Internal close to ASHPs (M24) and risers.	For LTHW Plant; Buffer vessel (highly insulated). Run/standby distribution pumps. Pressurisation unit Expansion vessel Dosing pot For CHW Plant; As listed for LTHW plant. Control panel & Energy metering for LTHW&CHW plant.	9.5 x 3.5 x 3.0h.	Leaf and one-half doors (for plant delivery and replacement). Initial and replacement crane lift from Parsons court, over and across ASHP enclosure.	To consider heat dissipation but avoid 'cold room'.	Locate plant on plinths. Floor gulleys required for expansion relief and general water treatment processes. Will ne heating or cooling so can contain all in one room without high risk of reduced efficiency.
M26	Main Comms /Server Room Heat Rejection Plant	Ideal : Roof location in close proximity to served room.	Allow for 2No. outdoor condensers (run and standby). 5kW UK sensible cooling each.	3 x 3 x 2.0(h) Heat rejected horizontally so equivalent area won't be suitable.	Access for maintenance single door to external. Initial and replacement crane lift from Parsons court, over and across ASHP enclosure.	Must be completely clear above to allow heat rejection to dissipate (not recirculate).	Acoustic criteria and assessment may dictate requirement to enclose/screen area.
M27	Office VRF Heating/ Cooling Heat Rejection Plant	Ideal : Roof location in close proximity to served room. Anticipated : Roof area directly above.	Allow for 1No. outdoor condenser. 6kW UK sensible cooling or heating (split system).	1.5 x 1 x 1.5(h) 1m depth does not include clear space to front as there already (footpath). Heat rejected horizontally.	Access for maintenance from surrounding footpath (replicate existing). Initial and replacement crane lift from Parsons court, over and across ASHP enclosure.	Must be completely clear above and to front to allow heat rejection to dissipate (not recirculate).	Acoustic criteria and assessment may dictate requirement to enclose/screen area but assumed not as replicating existing.
M28	Mechanical Ventilation with Heat Recovery – Second floor Dimmer Room	Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes. Proposed : Roof area directly above (due to limited head height in room).	1 No. MVHR external unit with end connections. 60l/s.	1.6x 1.5x 1.6(h)	Access for regular maintenance and inspection from roof space. Initial and replacement crane lift from Parsons court, over and across ASHP enclosure.	Is located externally	Dimensions include access space in front of unit and to end. Supply and extract ducts will need to set down and through roof into dimmer room under.

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M29	Mechanical Ventilation with Heat Recovery – Ground floor Changing Room	Ideal : Internal with close proximity to served areas and also external wall for intake and exhaust duct routes. See notes re intake and exhaust ducts.	1 No. MVHR in ceiling void unit with end connections. 50l/s.	1.5x 0.85x 0.45h + access from below (hinged door on underside). MF to review controls / electrics access.	Access for regular maintenance and inspection from room. Fully accessible ceiling required. See notes re coordination.	None required.	Supply intake to be suitably positioned to minimise risk of entraining any pollutants, including discharge from the exhaust duct. Proposed ceiling void unit but duct routes to intake and exhaust must be minimised to achieve NZC. Coordination of RCP will be constrained by MVHR and assocaited ducting. Ceiling void depth to be minimum of 550mm which will require routing and recessing around MVHR and connecting ductwork (more will reduce constraints).
E1	Photovoltaic Panels	PVs mounted externally.	PV Panels mounted on upper SW pitched roof, possibly NE (subject to understanding how shallow/steep the pitch is which will dictate benefit). TBCkWe total consisting of TBC No. of 2??W panels	Total PV array area is XXm^2.	All PVs to be accessible for regular inspection and cleaning. Roof access to be provided. Review existing roof access walkway around to ensure suitable for cleaning and inspection. Provide local water supply/supplies.	External.	To be developed with energy strategy. Inverters and related electrical equipment to be located internally in roof electrical switch rooms (E5)
E2	UKPN Substation	Ideal : Reprovision of external substation at ground floor with direct access from Parsons Court.	UKPN owned transformer / CT chamber. 1No. 500kVA assumed (if dedicated to Corn Exchange). Theatre Consultant to confirm equipment performance loads.	As existing. TBC by UKPN	To be agreed with UKPN but existing sets precedent for accessing and replacing transformer 24/7 (via Parsons Court and walk/passageway).	As existing. Open to outside air.	Requirement to be confirmed by UKPN. If not increasing maximum demand then can retain existing arrangement as not requesting upgrade/change. Substation will serve Corn Exchange. May also serve local buildings or external provisions e.g. street lighting. Client decision on district heating/heat pumps required prior to progressing application checks.
E3	Main Switch Room	Ground floor (Internal) immediately beside the substation (E2).	Incoming UKPN supply head and utility metering. Main Switchgear Local distribution board. Energy metering equipment External lighting board/control.	5 x 2.5 x 3(h)	One and a half leaf door access. Ideally from outside and inside of the building. Basement location likely to dictate the need for the panel to be delivered in sections and formed on site/in situ.	Background Infiltration	Depending on UKPN head/metering arrangement. Assumes UKPN happy to route cabling into switch room via basement (should be).

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E4x Vario us	Electrical Cupboards (dispersed)	Ideal : Internal cupboard/room local to area served and riser containing sub main power distribution. Vertically stacked (between floors) and central to served areas (to reduce cable lengths).	Distribution Boards (power and lighting) Electrical Sub Meters & logging devices. Lighting Controls	1.0 x 0.5 x 2.5(h) Dims are for DB only (not rising sub mains. See notes.	Must be fully accessible but secured (locked). Can be a locked board in a secure staff room/area or riser.	Background infiltration	Locations to be developed with risers and layouts. Stage and Auditorium requirements to be confirmed by theatre consultant. Likely to require larger panel boards to suit stage equipment, performance systems , motors, winches etc.
E5	Electrical Switch Room – Roof plant	On new roof (to West).	Panel board. Control panel (MCP). Local small power/lighting board. Electrical Meters & logging devices PV inverters.	4 x 2 x 2.7 (h) Subject to confirmation with developing roof plant layout	Single door.	High and low level louvres for summer heat dissipation.	Location to relate to served plant and sub main riser routing up from below. Dispersed plant power cabling strategy to be developed with routing through existing building.
E6	Incoming Comms Room	Ideal : Secure ground floor room located off public footpath.	Incoming utility service and associated boards/distribution. Building comms rack.	3 x 2.5 x 3.0(h) Appears may only achieve 2.2 width.	Direct external access for utility provider is preferred. Constraints of existing building unlikely to allow.	Will need cooling. Ideally some background ventilation if in basement.	Subject to briefing and Theatre consultant details on using building data/IT networks (assumed wont)
E7	Building Management Equipment room	Assumed that all related building management staff interface equipment will be located within the stage managers room/reception hub (not currently sown on GAs). UPS systems for these (if required) to be in comms rack (E6).	AWC alarm system equipment Refuge alarm system equipment Access control system equipment Security system equipment	Subject to briefing. Consider behind front desk work top/cupboards (appears quite open)	Access to all equipment for maintenance.	Likely to require ventilation/cooling particularly if in small room.	Management systems requiring regular staff monitoring/use will often have related accessories at the staff desk positions. Some may be accessible via the web (subject to agreed briefing). Assumes a number of rack mounted systems (contained within E6).

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E8	Fire Alarm Panel (s)	Visible from main entrance (as defined for fire access) (Internal) May require repeater panels if back stage has management position	Fire alarm panel. Potentially repeater panel.	0.8 x 0.4 x 0.6(h) estimated.	Fully accessible to front of panel/s	Have some ventilation openings into surrounding space.	Fire strategy TBC by fire engineer Required to be visible so if enclosed should have a glazed front.
E9	Central Battery Room.	Second Floor, as existing (Internal).	Inverter, batteries and assocaited switchgear/distribution boards	Reuse existing room/space. Design to be developed with lighting proposals.	Double doors. Access for regular testing and inspection and battery replacement. Install and replacement in sections/ transfer batteries independently and use suitably rated stair climber.	Vents at high and low level.	Fire strategy to confirm requirements. Assumed requirement as existing building utilises a central battery. Consider ventilation/heat build up with fabric proposals and existing window in room. May require additional DX cooling (roof plant), though existing does not have.

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Additional Plant rooms that may be required in response to further assessments and/or fire strategy and/or detailed briefing

REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
PHx	Sprinkler Tank Room. **See note re provision.**	Ideal : Ground floor (internal). Anticipated : Basement (internal)	Sprinkler system water storage tank. Sprinkler Pumps. Power and controls.	?.? x ?.? x ?.?(h)	Double doors accessible from inside or outside (preferred) of the building. **Fireman to have direct access from outside of the building**	Background Infiltration	Requirement TBC by fire engineer. Estimated size based on OH?? category and minimum flow duration of mins. Consider bunding room. Floor gulleys required. **Would/could this also serve the hotel?**
PHX	Rain Water Recycling Plant Room. **See note re provision.**	Ideal : Internal above served WCs so as to supply by gravity. Anticipated : ??No obvious location (may make unviable but will be a planning discussion). See notes.	??m^3 Rainwater recycling storage tank and filtration system. If pumped : Booster set (duty/standby).	?.? x ?.? x ?.?(h)	Double doors (for plant delivery and replacement). If ground floor location access from both inside and outside preferred to aid maintenance (inspections) and delivery of plant respectively. If basement location ensure lift and route to/from room are suitable for plant transfer.	Background Infiltration	Anticipated to be beneficial to support planning requirement. Rainwater downpipes to be routed to inlet of tank. Centralising tank to downpipe locations maximises roof catchment and minimises potential height impact of pipework setting under gravity. Can this be achieved with existing pipework routes/roof drainage provisions/arrangements. Tank to be based on 600mm pier walls. Consider bunding room. Floor gulley required.
PHX	External Water Plant Room.	Ideal : Ground floor (internal), local to external taps served.	CAT V Packaged booster set.	1.5 x 1.5 x 2.0(h)	Access to front of unit (included in 1.5m depth). Replacement can be by trolley through standard doors/circulation route.	Via room.	Size dependent on number of taps served and pressure/flow requirements. If landscape design specified a plan irrigation system this will also be fed from this type of break tank.
Mx	Smoke Extract Fans	In separate fire compartment to that served	Mechanical smoke extract fans (run/standby). ??M3/s each.	?.? x ?.? x ?.?(h)	Regular inspection and testing. Crane lift in/out ~(heavy)	Open to surroundings for motor heat release.	Requirement to be confirmed by fire engineer/ strategy including compartmentation. Discharge to be away from all exits. Ideally at roof level to allow dispersal of smoke. Consider; - make up air (how/from where) - attenuation? - interfaces with fire alarm, sprinklers etc. - secondary power.

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REF	DESCRIPTION	LOCATION (INTERNAL/EXTERNAL)	PLANT	APPROX. DIMENSIONS (refer to note 2)	ACCESS (INC CDM CONSIDERATIONS)	VENTILATION	NOTES
Mx	Dry risers	Incoming valve on external façade. Dry riser cabinets off firefighting stairs.	Valve boxes/cabinets.	See note	Access from firefighting lobby.	None required.	Requirement to be confirmed by fire strategy
Mx	DEN Interface Plant Room.	Ideal : Internal on Ground floor perimeter of building onto Wheeler Street (proposed DEN route).	District Heating incoming pit. District Heating PHX substation (skid mounted duty/standby). Duty/standby Office Primary Heating pumps, Pressurisation set and Expansion vessels (replacing those in OM2) & Dosing Pot Mechanical Control panel, District Heating Control Panel? & Central Energy Logger TBC by DEN designer	7.0 x 5.0 x 3.0h. TBC by DEN designer	DEN will want direct access from public footpath with double doors (for plant delivery and replacement). Listing will prevent this. Will need to review how plant installation and maintenance can be achieved (likely to require breaking down of skid equipment into components and use of rear escape door). TBC by DEN designer	To consider heat dissipation but avoid 'cold room'. TBC by DEN designer	Building spaces fronting onto Wheeler St and Parsons Ct are operationally critical for main entrance and 'Get in'. Similarly Foyer and Auditorium off Corn Exchange Street can not be compromised. A behind stage room does not appear possible (as PH1 proposed there already compromises back stage storage). Corn Exchange and Theatre consultant would have to review and confirm is this area can facilitate the DEN interface plant room, it appears not. **Therefore a ground floor location for this room does not appear practical/possible.**
Mx	Distributed (local) Comms Room Heat Rejection Plant	Roof over	Allow for single condenser. 5kW UK sensible cooling TBC by Theatre consultant.	1.5 x 3 x 2.0(h) per room served Heat rejected horizontally so equivalent area won't be suitable.	Access for maintenance single door to external.	Must be completely clear above to allow heat rejection to dissipate (not recirculate).	Acoustic criteria and assessment may dictate requirement to enclose/screen area. Potentially investigate roof space over small hall (off East stair).
Mx	Sound/AV/ Dimmer room- Heat Rejection Plant (per room)	Roof over	Allow for single condenser. 5kW UK sensible cooling TBC by Theatre consultant.	1.5 x 3 x 2.0(h) per room served Heat rejected horizontally so equivalent area won't be suitable.	Access for maintenance single door to external.	Must be completely clear above to allow heat rejection to dissipate (not recirculate).	Acoustic criteria and assessment may dictate requirement to enclose/screen area. Room, equipment and assocaited cooling requirements TBC by Theatre Consultant.

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Mx	Catering heat rejection condensers (cellars?)	Ideal : Roof over Anticipated : Replication of assumed existing condensers at GF level on building corner of Parsons Court and Wheeler St	TBC by catering specialist.	TBC by catering specialist.	TBC by catering specialist.	Must be completely clear above and to front to allow heat rejection to dissipate (not recirculate).	Acoustic criteria and assessment may dictate requirement to enclose/screen area but assumed not as replicating existing.
OMx	Gas/Foam fire suppression for critical electrical rooms.	Local to served critical electrical room, typically a data/comms room (internal).	Specialist suppression cylinders and related control, monitoring and (if required) ventilation systems.	TBC, if required size dependent on served room.	Internal door (single anticipated)	Dependent on suppression system/gasses used.	May require pressurisation/ventilation system. Consider subsequent removal of sasses/foam after use.
Ex	PV Battery Storage Room.	Local to PV inverters.	Batteries.	TBC, if required.	Double doors. Access for regular testing and inspection and battery replacement.	Vents at high and low level.	To be developed with PV design and energy strategy.
Ex	Generator Enclosure	Assumed to be on roof due to limited internal space available. Also internal generator would require room to be acoustically treated and generator to be ventilated (with attenuation) which will be complex in listed building.	Generator in acoustic enclosure. (if required size TBC once fire strategy is agreed)	?.? x?.? x ?.?(h) TBC see notes	Access for regular inspection and testing. Acoustic enclosure to allow suitable access. Diesel fill from location where barrels can be trolleyed to. Typically use lift to transfer to highest floor and provide diesel pump and pipework from that location.	Generator exhaust flue out of enclosure. Louvres in acoustic enclosure.	Generator requirement/size subject to receipt and implementation of fire strategy. In particularly the any requirement for sprinkler pumps, smoke extract fans and firefighting or evacuation lifts. Consider noise breakout. Generator exhaust flue to discharges at highest point aware from all ventilation air intakes.
Ex	Essential power switch room	Ideal : Close to, ideally next to but separate from the generator room/enclosure and close to served equipment. Internal room	Essential power switchgear and automatic changeover devices.	?.? x?.? x ?.?(h) TBC see notes	One and a half leaf door accessible from the inside or outside of the building	Louvres to external space (louvred doors to service road)	Dependent on fire strategy.
Ex	UPS Plant Room.	Near Server Room. (Internal).	Uninterruptable power supply.	TBC, if required.	Double doors.	Vents at high and low level.	If required, to be provided as part of ICT fit out. Can be installed in comms/server rooms Likely to require additional DX cooling (roof plant).
Ex	Central Emergency Lighting Monitoring Panel	Close to/in areas served (Internal).	Central monitoring panel	TBC, if required.	Single door access for regular testing and inspection.	Vents at high and low level.	Alternative to using local test key switches. Can also consider web based intelligent systems.
Ex	External Lighting pillars	External to suit lighting installations	Feeder pillar and electrical distribution equipment/protective devices	TBC with lighting design.	Direct access from surrounding external space	None as external installation	To be developed with external lighting design.

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Ex	Auditorium Lighting Dimmer Room	Locate room close to stage and lighting bars	Dimmer racks detailed by Theatre Consultant	4 x 3 x 2.7(h) TBC by Theatre Consultant	Leaf and a half door to allow installation and removal of rack.	TBC by Theatre Consultant Often require cooling.	TBC by Theatre Consultant. Will require room cooling (dedicated split system located on nearby roof).
Ex	Auditorium AV rack room	Locate room close to performance space	Equipment detailed by Theatre Consultant.	3 x 3 x 2.7(h) TBC by Theatre Consultant	Leaf and a half door to allow installation and removal of rack.	TBC by Theatre Consultant Often require cooling.	TBC by Theatre Consultant. Will require room cooling (dedicated split system located on nearby roof).
Ex	Auditorium Sound equipment.	Locate room close to performance space	Equipment detailed by Theatre Consultant.	3 x 3 x 2.7(h) TBC by Theatre Consultant	Leaf and a half door to allow installation and removal of rack.	TBC by Theatre Consultant Often require cooling.	TBC by Theatre Consultant. Will require room cooling (dedicated split system located on nearby roof).

Notes

1. Based on CPA design drawings.
2. All dimensions are clear internal dimensions. There should not be any structural columns or down stand beams within the clear dimensions/areas defined. If this can not be the case the areas will require review, development and likely increase to coordinate accordingly.
3. Vertical transportation is not included in this schedule, refer to separate advice for this.
4. For storage(attenuation), pumping or any other plant that may be required by the below ground drainage design refer to information provided by civil engineer.
5. For plant/equipment that is associated with any irrigation systems or water features refer to information provided by landscape architect.
6. For plant/equipment that is associated with the waste or recycling refer to information provided by transport consultant e.g. compactor.

Rev	Date	Status	Description	Engineer	Project Leader
P02	14/10/2024	Status S3	Suitable for Review and Comment	RF	CB
WIP	30/08/2024	Status S1	Suitable for Coordination	RF	CB
P01	16/08/2024	Status S0	For coordination/information	RF	CB

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Corn Exchange Plant Schedule
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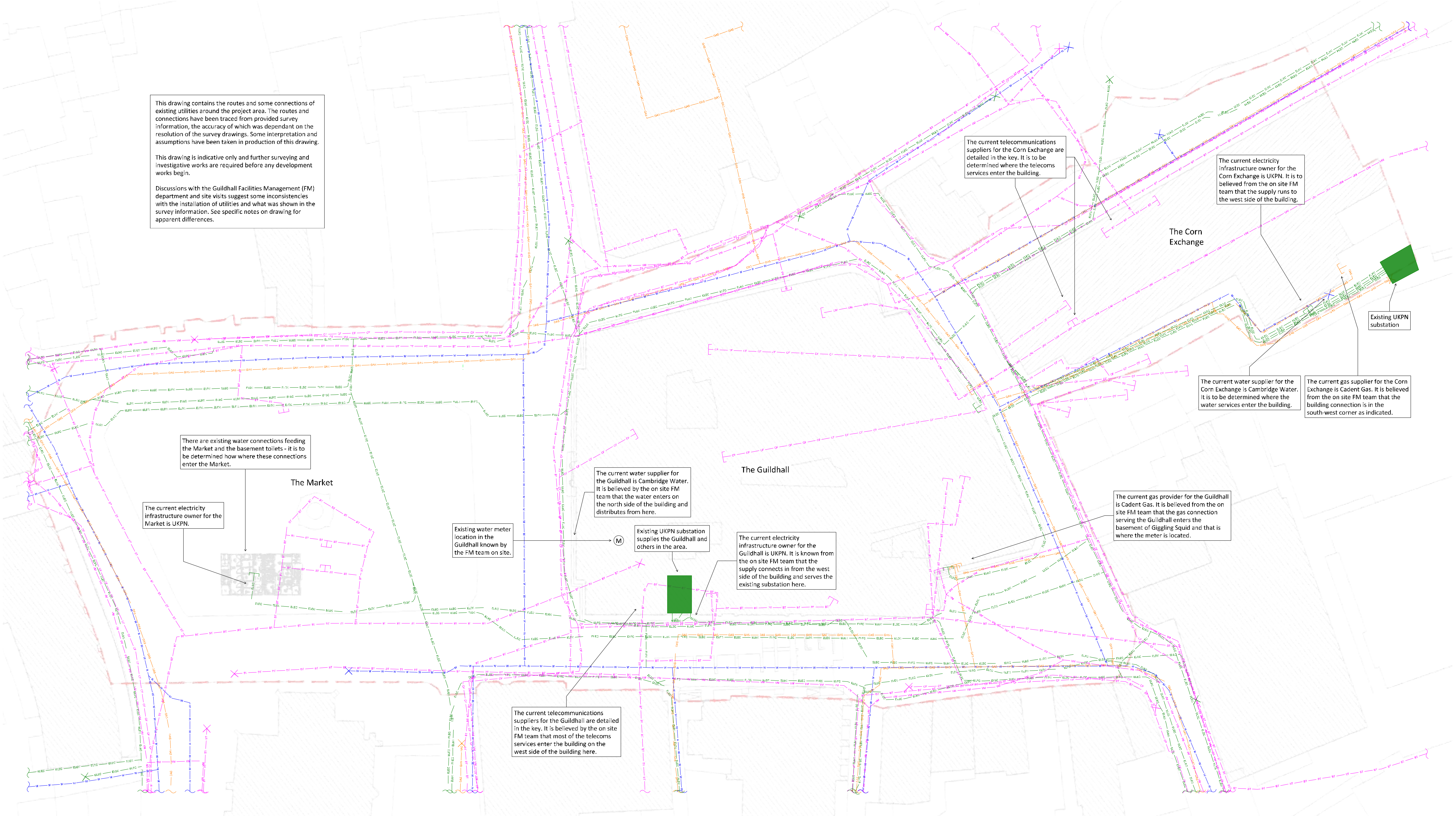
APPENDIX VI – SITE WIDE UTILITY DRAWINGS

Drawings included in this appendix have been printed at A3 paper size for the convenience of the report. Original A0 paper size drawings issued alongside this report as separate documents.



KEY

New Water Distribution	New Telecomms including fibreoptics and BT Distribution
Existing Water Distribution	Existing British Telecommunication Distribution
Existing Gas Distribution	Existing Virgin Media Distribution
New Electrical Distribution	Existing Cityfibre Distribution
Existing Electrical Distribution	Existing University Owned Distribution
Apparent End of Utility Route	Existing Utility Connection to Areas Associated with Project

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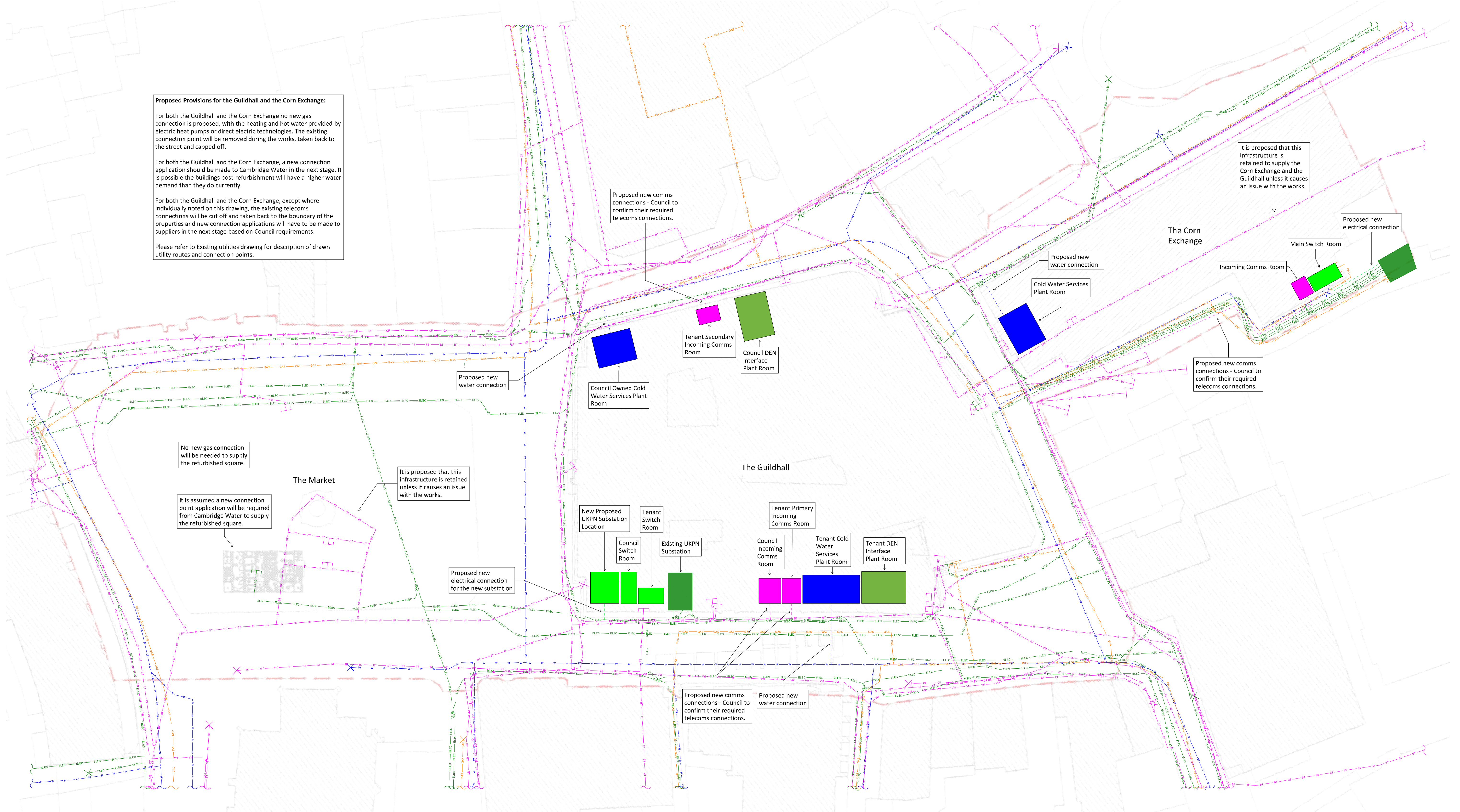
client: **Cartwright Pickard Architects**	project: **Cambridge Civic Quarter**	drawing title: **Utilities and Services Existing Site Layout**
job no. **7562** / project leader **CB** / scale at A0 **1:200**		
status code and description: **S4 - Suitable for Stage Approval**	issue date **14/10/24** / revision **P01** / classification **PM_30_10_93**	project code **J7562** - orig. **MXF** - volume **ZZ** - level **XX** - type **DR** - role **J** - number **55001**



KEY

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New Electrical Distribution	Existing Cityfibre Distribution
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client	project	drawing title
Cartwright Pickard Architects	Cambridge Civic Quarter	Utilities and Services Proposed Site Layout
job no. 7562 / project leader CB / scale at A0 1:200		
status code and description: S4 - Suitable for Stage Approval	issue date 14/10/24 / revision P01 / classification PM_30_10_93	project code J7562 - orig. MXF - volume ZZ - level XX - type DR - role J - number 55002