Pallant House Gallery

Pallant House Gallery Coach House Extension works

Stage 1 report

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Contents

1 Introduction

Arup were the designers of the original Pallant House Gallery extension in 2003. Arup have now been commissioned to support the options appraisal (RIBA Stage 1) for a new extension to the Pallant House Gallery.

This report covers work to support the RIBA stage 1 design, as well as an initial review of the existing building energy use (based on available information from utility bills). This gathers information provided over the course of the project.

More detailed analysis of building performance and capacity can be provided if we can obtain more detailed data from the BMS. Conclusions from this analysis could impact the proposals for the new building as well as an overall approach to maintenance and upgrade of the existing plant.

We have accessed the original design information from archive and can also provide structural support if required in the future.

2 Project objectives

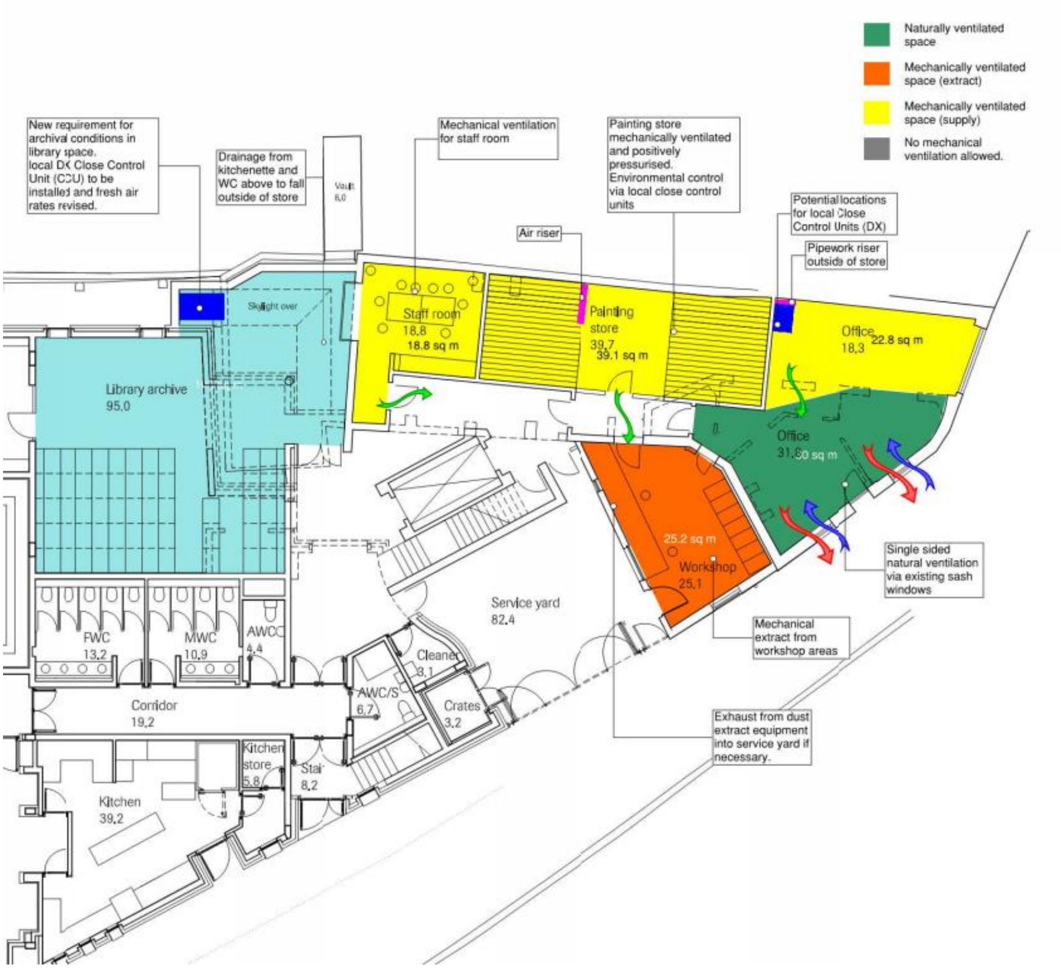
The Arup team visited site and held a project inception meeting with Jasper Richmond, Beth Troakes and Rolfe Kentish on 30th November 2017. The following objectives were discussed for the extension:

- Maximise occupiable space
- Energy efficiency
- Ease of maintenance
- Passive fire protection

3 Building Services Proposals for new development

The following describes advice provided to support the options appraisal.

3.1 Ground Floor



Ground floor plan

3.1.1 Existing library

This space has new requirements for archival conditions.

A local Close Control Unit with integral DX is proposed.

It appears that an existing in-duct electric heater battery is failing to temper the incoming air (and may therefore be faulty) which is causing uncomfortable conditions in the space. Fresh air rates in this space could potentially be reduced.

3.1.2 Staff Room

It is proposed that this space will be heated by LTHW radiators and mechanically ventilated as has no windows.

3.1.3 Painting store

Mechanical ventilation is proposed for this space which will keep the area positively pressurised.

A DX Close Control Unit has been located external to the space, but alternative archive approaches could be investigated to simplify system requirements depending on precise requirements of the space.

3.1.4 Ground floor offices

It is proposed that his space shall be naturally ventilated through opening windows.

Some mechanical ventilation is recommended where for the deep plan areas of office which are further from the opening windows.

Heating to be provided by LTHW radiators.

3.1.5 Workshop

This space is proposed to be negatively pressurised by a mechanical extract system which will exhaust into the adjacent service yard.

A supplementary dust extraction system may be required depending on the use of this space.

Heating to be provided by LTHW radiators.

3.2 1st floor

First Floor plan

3.2.1 New First Floor Gallery

The new first floor gallery space proposed for above the library will be require the same environmental controls as the rest of the galleries.

As per the original design specification, this is

- *Air Temperature 20.5 degC to 21.5 degC +/- 0.5K*
- *Relative Humidity 50% to 55% +/- 3%*

The new gallery is adjacent and directly connected to the existing highly conditioned first floor galleries.

It is proposed that it may be possible to extend the existing gallery system into the new accommodation if the lighting is changed wholesale to LED which will reduce the system sensible cooling load. A more detailed review of system capacity, present and future lighting and occupancy levels is needed to develop this concept. This would be informed by historical BMS data.

If extending the existing system to include the new gallery is not viable, a new rooftop AHU with humidity control will be required. This has been indicated on the plans to be conservative.

3.2.2 First floor meeting room

This is currently naturally ventilated through openable windows on one side. The space is quite deep and could be densely occupied, therefore opening rooflights are advised to improve ventilation rates. Alternatively, some mechanical ventilation could be introduced. Heating to be provided by LTHW radiators.

3.2.3 First floor offices

Naturally ventilated offices through opening windows. Heating to be provided by LTHW radiators.

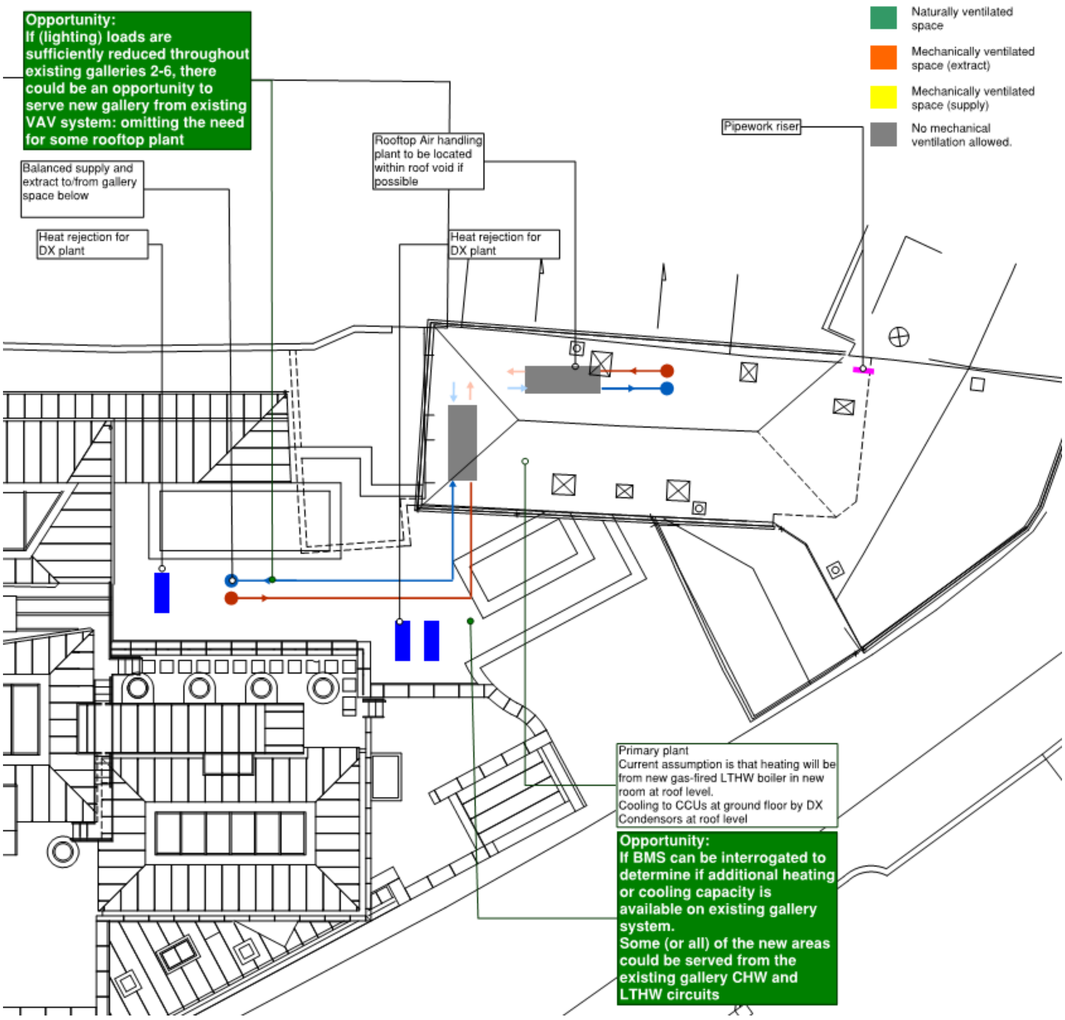
4 Approach to Services

Due to a lack of detailed data about the current operational capacity of existing plant, a stand-alone solution has been proposed that does not rely on it. This is therefore a worst-case space take option.

Further study is recommended following data collection to investigate the following opportunities:

- Using cooling or heating from the ground source heat pump system if additional capacity is available
- Extending gallery systems to new gallery

4.1 Roof plant



4.2 Drainage

It is expected that the Coach House will be able to use the existing rainwater drainage as there is only minimal change in roof area. The existing sewer outfall connection should also be reusable, pending more detailed surveys.

4.3 Electrical

At the next stage, a more detailed review of electrical utilities and capacities will be required to define the best source for additional power requirements.

5 Review of existing utility bills

We have reviewed the utility bills provided from 2010 to 2014.

This information is quite high level so it is difficult to draw detailed conclusions. There is one electrical meter for the whole of the 'New wing'

In 2013/14 the 'New Wing' used 370,000kWh of electricity, which over a 2400m^2 area is 150kWh/m^2.

Taking into account the energy benchmark of CIBSE TM46 (2008) this is a good value for the time of construction, as it also includes energy that would normally be from fossil fuels.

Name and description			Energy benchmarks	
Category	Name	Brief description	Electricity typical benchmark (kW·h/m^2)	Fossil-thermal typical benchmark (kW·h/m^2)
10	Cultural activities	Museum, art gallery or other public building with normal occupancy	70	200

We can therefore tentatively conclude that the heat pump is operating at a reasonable Coefficient of Performance, however we would need more data to truly assess.

5.1 BMS data opportunities

With more detailed information on the current building services operation, further conclusions could be drawn. We have requested BMS data to

- Help understand the energy consumption (kWh) in more detail to assess performance of the systems
- Understand how heavily the systems are being loaded (kW peaks) and opportunities to add more capacity

The more data we can get the better. The most helpful data would be the historic logs of:

- Outputs from all heat meters for the Low Temperature Hot water (LTHW) and Chilled Water (CHW) systems in kWh and kW
- Outputs from all electrical meters serving major plant – the Chiller and Ground source heat pump in kWh and kW
- Outputs from Gas meter serving boilers and gas-fired humidifiers.
- Space temperature readings (including outdoor air temp if available).

5.2 Opportunities for using spare capacity

The first opportunity would be to extend the existing all-air heating, cooling and ventilation system within the first floor gallery spaces to serve the new gallery. The reduction in cooling loads associated with the proposed switch to LED lighting could provide enough spare capacity to facilitate this.

A further opportunity would be to use any spare capacity in the heat pump (CHW and/or LTHW) to serve the new coach house, including the proposed Close Control Units (CCUs).

These further opportunities for utilising the existing gallery heating (LTHW), cooling (CHW) and electrical supplies require interrogation of data from the BMS to verify availability of capacity.

5.2.1 Capacity of heat pump

Record information indicates that the heat installed heat pump unit (CATT385Z) could provide an instantaneous heating/cooling capacity of 120/110kW respectively. This could be compared with historic peak demand data from the BMS to assess if any space capacity is available.

5.2.2 Capacity of energy piles

The output of system is limited by the heat absorbing and rejection capacity of the Enercrete energy piles. The quantum of building heat which can be drawn from, (and rejected to) the energy piles over time is limited. Excessive and imbalanced use of this system will result in the ground overheating or freezing- thereby reducing the system performance.

Record information shows that simulations of pile performance over time were previously carried out to validate the system capacity (and redundancy). A similar exercise could be undertaken to simulate the performance of the piles over time under increased loading, to verify the available capacity.

5.3 Replacement of heat pump/ refrigerant

The heat pump which was installed as part of the 2003 extension uses R407C as refrigerant (according to the Arup specification). This refrigerant is a blend of R-32/125/134a. As such this HFC is regulated by the EU F-Gas regulations and is part of a planned phase down.

The gallery facilities manager should note that such refrigerants are also subject to mandatory leak checks- the frequency of which depends on the size of refrigerant charge, and some also require the retrofitting of leak detection systems.

6 Old House

We understand there is an aspiration for the 'Old House' to improve conditions in terms of environment, aesthetic and noise.

We believe the best approach to the problem would be to add a Variable Refrigerant Volume (VRV) system to provide heating and cooling.

This would involve replacing the fan convector heaters with floor standing vertical fan coil units. This might require moving the seat 100mm up by approximately to fit the units in.

We understand the floor is being taken up for works so refrigerant pipework could run beneath. There would need to be outdoor units for heat rejection, location TBD.

With some intelligent specification and controls, we could use a fairly standard system to provide a significant improvement to what is there now. When dehumidification is required, we can use the cooling function of a portion of the indoor units to provide it.

We do not initially think that significant humidification is a good idea in an old building, due to fabric condensation risk/ leakiness, but we could carry further studies of what is there to assess in more detail if necessary.

7 Heritage Lottery Funding Application

We provided the following narrative for support of the lottery funding application:

The original Pallant House gallery extension (opened in 2006) took a leading approach of its time, with insulated high mass construction designed to protect the art. Air conditioning is largely powered by heating and cooling stored seasonally in the ground. This heat pump system was innovative (only the 2nd in the UK at the time), using pipework embedded in the building foundation piles to exchange heat. It also enabled minimal plant to be installed on the roof, reduced risers running through the building, maximising the site potential. An initial review of energy bills suggests that the energy consumption of the New Wing is lower than industry benchmarks (CIBSE TM 46 2008) for similar building types.

The new proposed extension and update is an opportunity to evaluate, refine and update the building services to further improve performance.

It is proposed to upgrade the BMS system to enable data collection which will allow us to study the performance of the systems in more detail and refine the building operation to save energy and running costs and therefore reduce carbon emissions.

For example, converting to new LED lighting systems means that electrical loads can be reduced across the existing galleries, reducing energy demand and cooling *loads which could potentially allow the proposed new gallery to be added with minimal additional plant.*

The ground source heat pump system will be evaluated in detail to assess if there is potential to further reduce energy consumption or serve additional spaces with it.

The new proposed accommodation in the Coach House will be designed to use minimal additional energy, using natural light and ventilation as far as possible. The spaces will be zoned according to the conditions required to reduce demand - Offices are located where there is the best access to natural ventilation.

The 'Old House' conditioning and lighting will be updated to improve visitor experience of the art works and conditions in a manner sensitive to the listed building. This will reduce the energy consumption and integrate systems into the existing fabric.

We also suggested consideration of biodiversity in the scheme. It may be possible to consider some green roof area/ bat boxes/ insect habitats.

8 Part L2B of the Building regulations

8.1 Consequential Improvements

Part L2B of the Building Regulations encourages the improvement of existing building performance when extensions or alternations are delivered. We recommend early engagement with the local building control officer (BCO) to understand minimum energy efficiency standards and the requirement for consequential improvements (measured by a % of project cost) in the main building.

It is important to understand how the new works will be classified and it is possible that some currently proposed works (such as the improved lighting scheme) could form part of this.

8.2 Coach House Thermal elements

Note requirements from Part L2B of the Building Regulations for upgrading of retained thermal elements:

Table 5 **Upgrading retained thermal elements**

Element[1]	**U-value W/(m².K)**	
	(a) Threshold	**(b) Improved**
Wall – cavity insulation	0.70	0.55[2]
Wall – external or internal insulation	0.70	0.30[3]
Floors[4,5]	0.70	0.25
Pitched roof – insulation at ceiling level	0.35	0.16
Pitched roof – insulation at rafter level[6]	0.35	0.18
Flat roof or roof with integral insulation[7]	0.35	0.18

Notes:

1 'Roof' includes the roof parts of dormer windows, and 'wall' includes the wall parts (cheeks) of dormer windows.

2 This applies only in the case of a cavity wall capable of accepting insulation. Where this is not the case it should be treated as for 'wall – external or internal insulation'.

3 A lesser provision may be appropriate where meeting such a standard would result in a reduction of more than 5% in the internal floor area of the room bounded by the wall.

4 The U-value of the floor of an extension can be calculated using the exposed perimeter and floor area of the whole enlarged building.

5 A lesser provision may be appropriate where meeting such a standard would create significant problems in relation to adjoining floor levels.

6 A lesser provision may be appropriate where meeting such a standard would create limitations on head room. In such cases, the depth of the insulation plus any required air gap should be at least to the depth of the rafters, and the thermal performance of the chosen insulant should be such as to achieve the best practicable U-value.

7 A lesser provision may be appropriate if there are particular problems associated with the load-bearing capacity of the frame or the upstand height.

Section 6: Consequential improvements

6.1 Regulation 28 of the Building Regulations may require additional work to be undertaken to make an existing building more energy efficient when certain types of building work are proposed.

6.2 This requirement arises in existing buildings with a ***total useful floor area*** of over 1,000 m^2 where the proposed work consists of or includes:

a. an extension;

b. the initial provision of any ***fixed building service*** (other than a renewable energy generator);

c. an increase to the installed capacity of any ***fixed building service*** (other than a renewable energy generator).

6.3 Where regulation 28 applies, ***consequential improvements***, in addition to the proposed building work (the ***principal works***), should be made to ensure that the building complies with Part L, to the extent that such improvements are technically, functionally and economically feasible. Paragraphs 6.4 to 6.11 below set out guidance on what will constitute technically, functionally and economically feasible ***consequential improvements*** in various circumstances.

*The **principal works** must comply with the **energy efficiency requirements** in the normal way.*

6.4 Where improvement works other than the 'trigger activities' listed in regulation 28(1) are planned as part of the building work, owners can use these as contributing to the ***consequential improvements***. The exception to this is if additional work is being done to the existing building to compensate for a poorer standard of an extension (see paragraphs 4.9 to 4.11).

*For example, if, as well as extending the building, the proposals included total window replacement, then the window replacement work would satisfy the requirement for **consequential improvements**, provided the cost was at least 10 per cent of the cost of the extension.*

6.5 Measures such as those listed in Table 6 that achieve a ***simple payback*** not exceeding 15 years will be economically feasible unless there are unusual circumstances.

For example, if the remaining life of the building is less than 15 years it would be economic to carry out only improvements with payback periods within that life.

Table 6 Improvements that in ordinary circumstances are practical and economically feasible

Items 1 to 7 will usually meet the economic feasibility criterion set out in paragraph 6.5. A shorter payback period is given in item 8 because such measures are likely to be more capital intensive or more risky than the others.

No.	Improvement measure
1	Upgrading heating systems more than 15 years old by the provision of new plant or improved controls
2	Upgrading cooling systems more than 15 years old by the provision of new plant or improved controls
3	Upgrading air-handling systems more than 15 years old by the provision of new plant or improved controls
4	Upgrading general lighting systems that have an average lamp efficacy of less than 40 lamp-lumens per circuit-watt and that serve areas greater than 100 m^2 by the provision of new luminaires or improved controls
5	Installing energy metering following the guidance given in CIBSE TM 39
6	Upgrading ***thermal elements*** which have U-values worse than those set out in column (a) of Table 5 following the guidance in paragraphs 5.12 and 5.13
7	Replacing existing windows, roof windows or rooflights (but excluding display windows) or doors (but excluding high-usage entrance doors) which have a U-value worse than 3.3 $W/m^2.K$ following the guidance in paragraphs 4.23 to 4.28
8	Increasing the on-site low and zero carbon (LZC) energy-generating systems if the existing on-site systems provide less than 10% of on-site energy demand, provided the increase would achieve a simple payback of 7 years or less
9	Measures specified in the Recommendations Report produced in parallel with a valid Energy Performance Certificate

Consequential improvements on extending a building

Constructing a new free-standing building on an existing site (e.g. a new out-patients building at an existing hospital site, or a new classroom block at a school) is not an extension. These should be treated as new buildings.

6.6 Where a building is extended, or the habitable area is increased, a way of complying with regulation 28 would be to adopt measures such as those in Table 6 to the extent that their value is not less than 10 per cent of the value of the ***principal works***. The value of the ***principal works*** and the value of the ***consequential improvements*** should be established using prices current at the date the proposals are made known to the ***BCB***. They should be made known by way of a report signed by a suitably qualified person as part of the initial notice or deposit of plans.

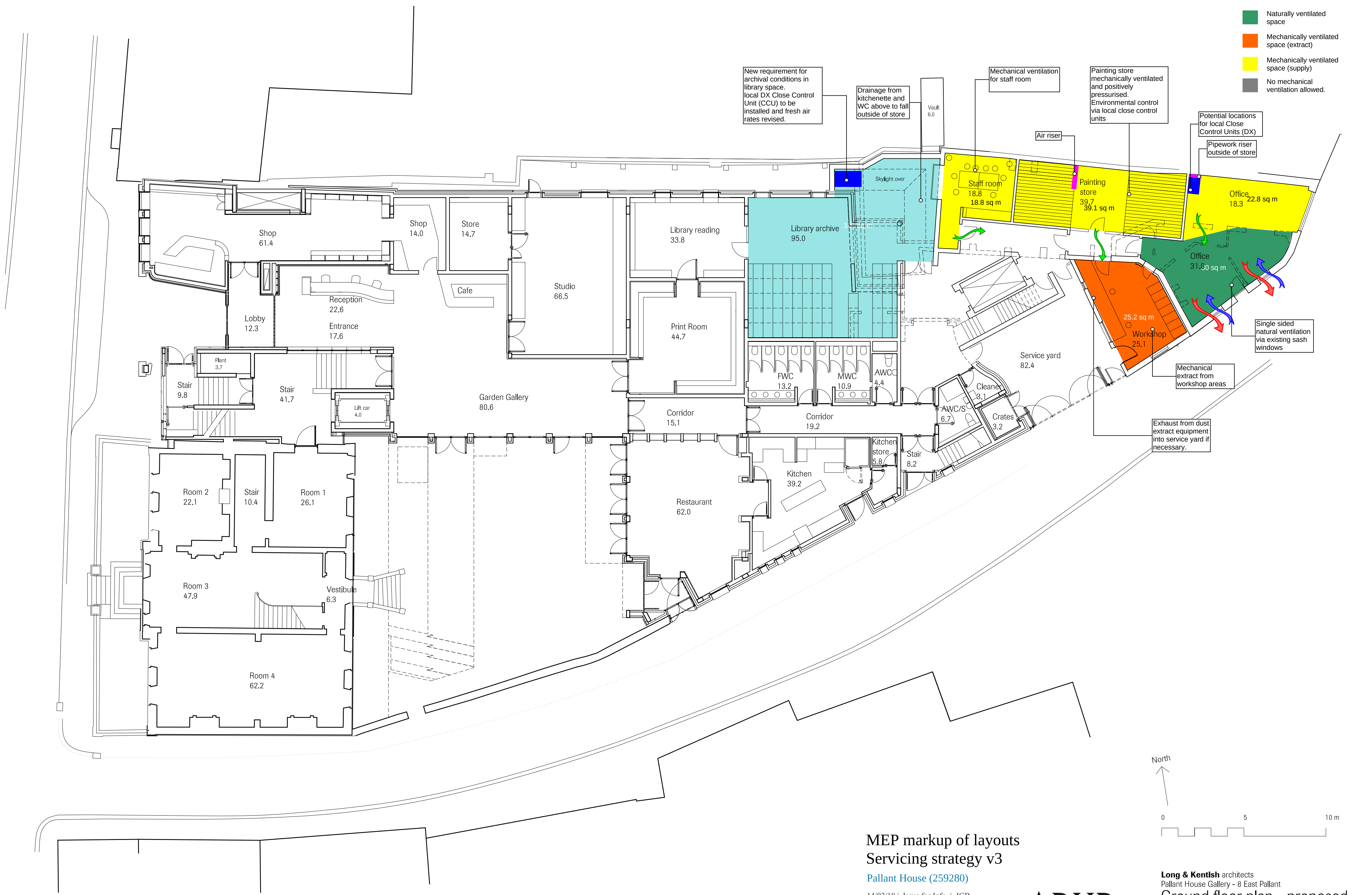
An example of a suitably qualified person would be a chartered quantity surveyor.

Conservation of fuel and power

Approved Document L2B

Appendix A

MEP sketches



MEP markup of layouts
Servicing strategy v3

Pallant House (259280)

14/03/18 | Issue for Info | JGB

SK-CS-001 (1 of 3)

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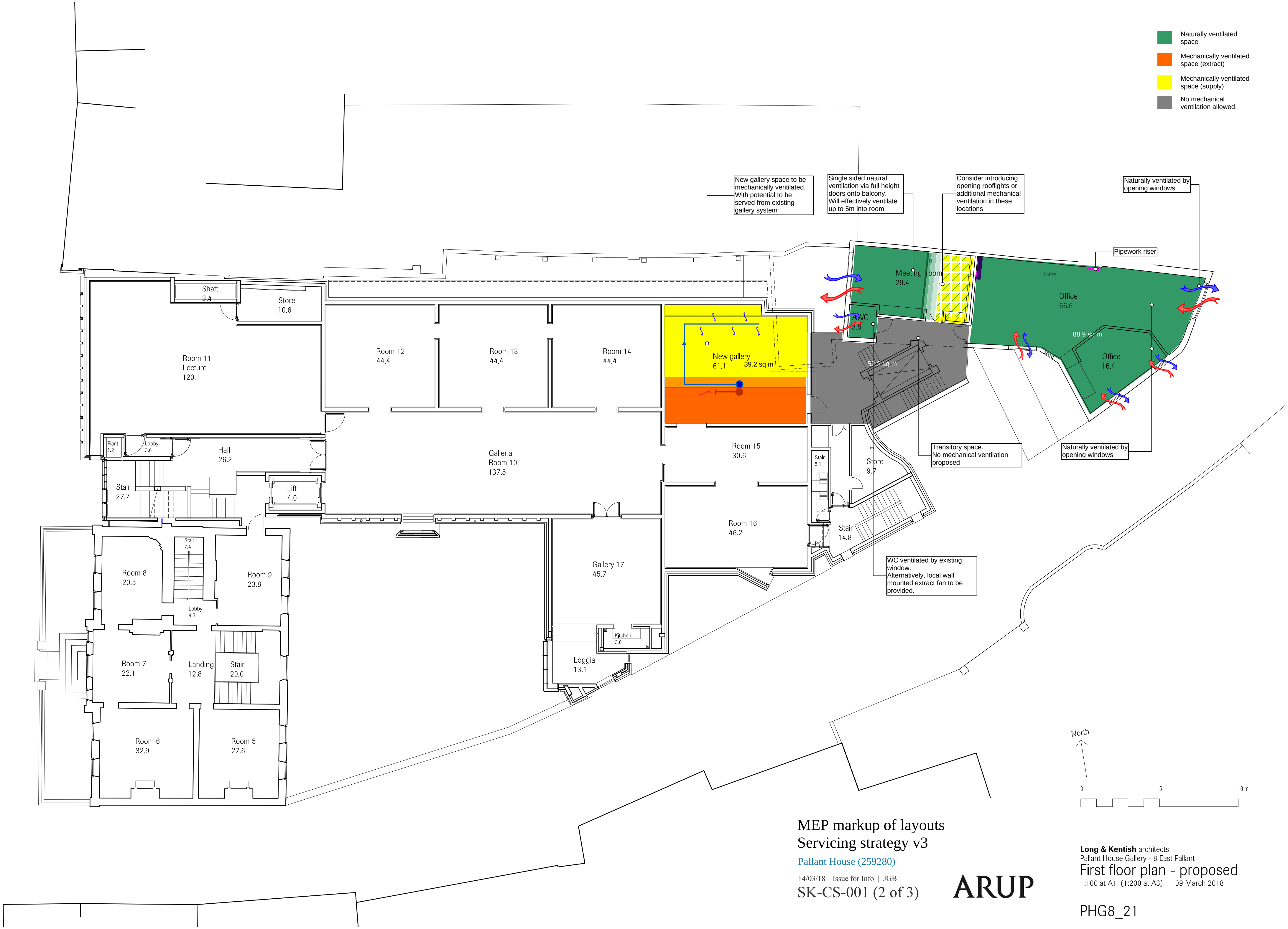
Long & Kentish architects
Pallant House Gallery - 8 East Pallant
Ground floor plan - proposed
1:100 at A1 (1:200 at A3) 09 March 2018

PHG8_11



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Pallant House (259280)
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SK-CS-001 (2 of 3)

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Pallant House Gallery - 8 East Pallant
First floor plan - proposed
1:100 at A1 (1:200 at A3) 09 March 2018

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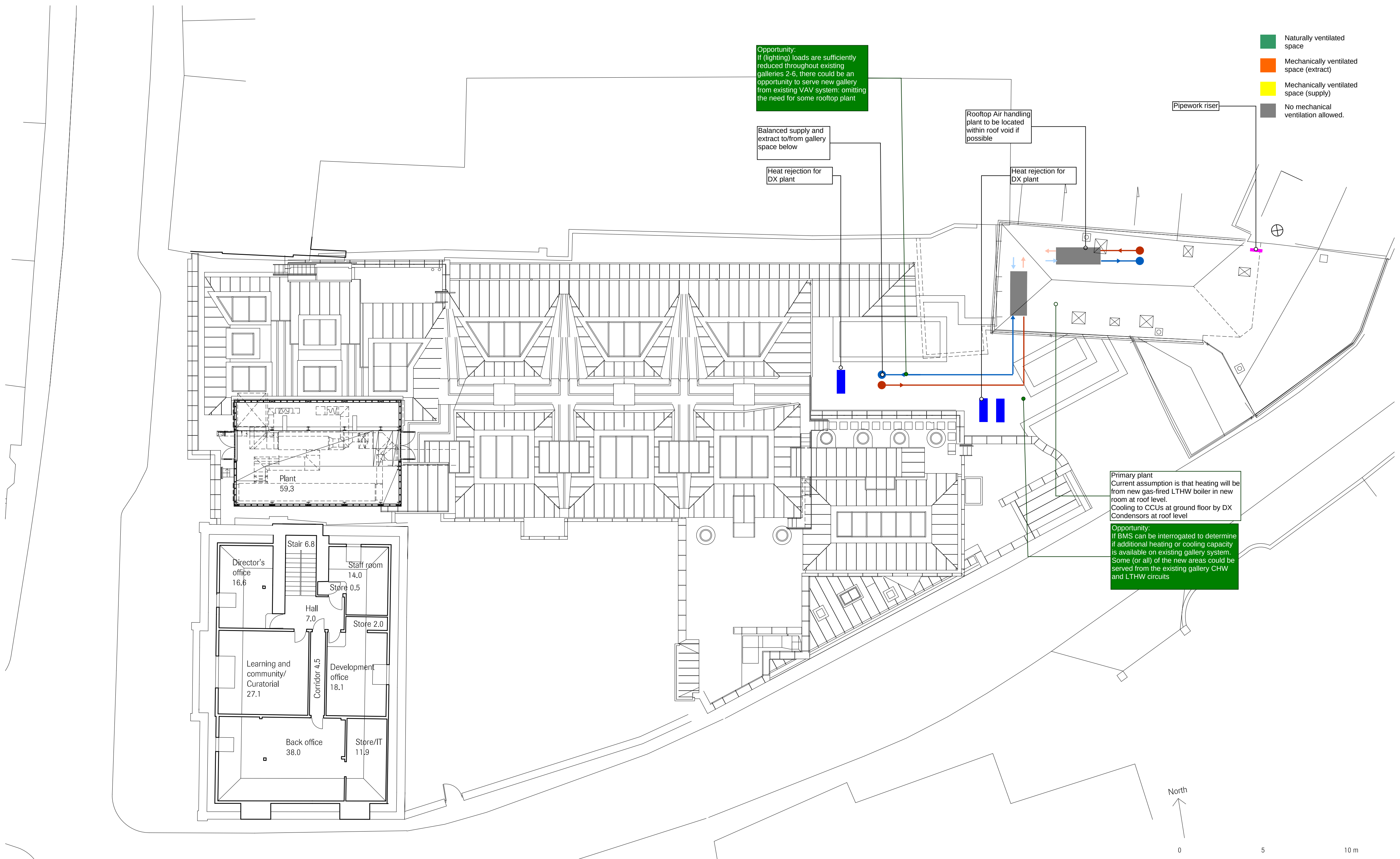

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Servicing strategy v3

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SK-CS-001 (3 of 3)

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Pallant House Gallery - 8 East Pallant

Second floor plan - proposed

1:100 at A1 (1:200 at A3) 09 March 2018

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