CUERDEN HALL

CHORLEY.

PR5 6AZ

STAGE 2 REPORT

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CONTENTS

1 THE PROJECT

1.1 Introduction

TGA have been commissioned to provide professional services associated with the design of the building services associated with the Cuerden Hall Residential project at Chorley, nr Preston.

1.2 The Development

Cuerden Hall lies within the tranquil landscape of Cuerden Valley Nr Preston. It is proposed that the 18th century Grade II listed building will be subject to full interior remodelling and renovation, including a a "roof over" extension in a courtyard area. The large-scale single occupancy residential building will comprise living and private guest accommodation, vehicle garage area, swimming pool and leisure facilities, along with separate (from the main building) guest and staff accommodation within existing cottages, workshops and stables.

To facilitate the development, the existing basement will be partly infilled/remodelled to accommodate new leisure pool, plant and equipment. Demolition/remodelling will take place in a phased manner to suit construction activity on site.

Phasing of the works will be established and will consider the Clients' aspiration to occupy parts of the property during the works once early-stage construction is completed and habitable.

1.3 Project Roles

TGA Consulting Engineers have been engaged to provide professional design services associated with the mechanical and electrical services associated with Cuerden Hall, as well as fulfilling the role of Specialist Lighting Designer.

1.4 Thermal Energy Generation Proposals

The selection of suitable thermal energy generation plant has been considered from a technical perspective throughout early concept discussions with the client and architectural teams. Energy conservation and sustainability considerations have also been considered alongside early engineering assessments and will continue to inform the development of the services strategy as part of the design process.

This document considers the early proposed services provision that has been developed in conjunction with the design team and the client.

1.5 Planning Conditions

Negotiations and applications for planning permission and listed building consent will be made. Conditions associated with any planning requirements will be considered through the design process in order to discharge any planning requirements.

2 Design Parameters

The following section presents the design criteria informing this Stage 2 proposal. All Design Criteria are subject to Approved Document Part L 2013 compliance. At the earliest opportunity, a Building Control Officer will be appointed and will provide guidance on the requirements of the relevant compliance route.

2.1 Design Criteria:

Mechanical and electrical services installations will:-

- Be designed and installed in accordance with good current practice;
- Provide all materials and works in accordance with the appropriate British Standard or Code of Practice and where no BS or CP is applicable the Agreement Certificate for the particular item;
- Comply with the requirements of the Local Authority Building Inspector;
- Comply with all Statutory Obligations arising from the current legislations and regulations, together with other requirements.

This report does not show or describe all aspects of the design to show full compliance. The following approved documents relate specifically to the building services design. Services will be designed, during the detailed design phases which will follow, to comply with the latest version and agreed method of these regulations.

2.2 Design Conditions

2.2.1 External Conditions

Winter Temperature: -5°C (Adjustment for location)

Summer Temperature: 28°C db, 19°C wb

2.2.2 Internal Temperature Criteria (Proposed at this stage and subject to thermal modelling and further specific client requirements)

Table 2.1: Internal Temperature Parameters (Adjustable for comfort conditions)

Room	Winter Temperature	Summer Temperature
Living Rooms	23°C	n/a
Bedrooms	20°C	n/a
Kitchens	19°C	n/a
Bathrooms	24°C	n/a
Circulation	20°C	n/a
WC's	22°C	n/a
Garage	10-15°C 40-60%RH	10-15°C 40-60%RH
Gym	18°C	24°C
Pool/Arcade/Dining	31°C	To Maintain Humidity
Spa	25°C	n/a

Study	23°C	n/a
Library	23°C	n/a
Yoga Studio	Subject to specialist	Subject to specialist
Relaxation Room	Subject to specialist	Subject to specialist
Changing Rooms	24°C	n/a
Ballroom	21°C	n/a
Laundry	18°C	n/a
Stores	15°C	n/a
Billiard Room	23°C	n/a
Gardeners Workshop	15°C	n/a
Offices	22°C	TBC
Stables	n/a	n/a
Sauna/Steam/Snow Rooms	Subject to specialist	Subject to specialist

2.2.3 Vibration
Plant shall be designed and installed to avoid excessive vibration and noise transfer to the building structure.

2.2.4 Noise Criteria
Background noise can emanate from building services systems and plant. A common example of external sources is from air conditioning systems. On some sites some background noise is perceived as beneficial because it disguises general conversation noise, enhances concentration and provides privacy.

It is important to define the acceptable levels of background noise accordingly. Careful consideration for the attenuation of noise from local plant positioned within the building is required.

Information presented in the following table shows example noise criteria Compliant with CIBSE Guidance. During design development, this will be confirmed by Architect and an appointed Acoustic Consultant for all areas.

Table 2.2: Noise Criteria

Room	Internal Services Noise Limit
Living Rooms	NR30
Bedrooms	NR25
Kitchens	NR40
Bathrooms	NR35
Circulation	NR30
WC's	NR35
Garage	NR55
Pool/Fitness/leisure Areas	NR35 – NR50
Library	NR30 – NR35
Cinema	NR30
Offices	NR35
Gym	NR45

2.2.5 Ventilation
Natural ventilation strategy shall be adopted throughout the building where achievable. Where mechanical systems are required, the design shall comply with Approved Document Part F minimum requirements.

2.2.6 Building Fabric Leakage (new build element)
To comply with Part L of the Building Regulations requirements.

2.2.7 Air Movement
Air velocity near occupants is recommended to be in the range of 0.15 m/s (winter) and 0.25 m/s in summer. Higher air velocities can be perceived as draughts.

2.2.8 Indoor Air Quality
Fresh air is required to remove contaminants and excessive moisture in wet areas such as bathrooms, shower rooms and the pool area. It is also required to assist in removing odours and diluting levels of CO_2.

2.2.9 Resilience
Provide duty and standby arrangement for main plant.

2.2.10 Electrical Installations
All electrical services will be required to comply with the relevant Codes of Practice, British Standards and Building Regulations.

2.2.11 Lighting
Lighting - Appropriate lighting is required to achieve the tasks in specific areas, health and safety and security reasons.

3 Site Infrastructure and Utilities

3.1 Utility Connections

TGA have requested site plans to determine the existing utility services gas, electricity, water and telecommunications.

Following the initial enquiries, where applicable, preliminary applications for new connections will be made. All available installations will be fully compliant with the Statutory Authorities requirements and co-ordinated to ensure that where necessary mains below ground are installed generally in accordance with the National Joint Utilities Group recommendations.

3.1.1 Natural Gas and Liquid Petroleum Gas (LPG)

It is understood, from reviewing current utility maps, that, no natural gas service is currently provided to the property. However, further consultation with the local utility provider (Cadent Gas) has realised a potential opportunity of providing a new service to both the Main House building and the separate buildings of the Guest/Staff Cottages. An initial application has been made to Cadent Gas in order to assist with understanding the cost of bring new services to Cuerden Hall and to determine if such costs can be accommodated within the project budget.

A single new low pressure main, sized to meet the demand of the site could be taken from an agreed position and location as near to the site as possible. It is envisaged that the gas main would follow the entrance roadway to the site. Suitable trenching and bedding material would need to be considered and phased appropriately with the overall site development and phasing plan.

The gas main would enter the boundary of the grounds where it is assumed it would need to split into 3 separate pipelines:

- Supply to the Main House building
- Supplies to the Guest/Staff cottages and apartments
- Supply to the Garages and Gardens' Workshops / Stores

It is suggested that separate connections to individual properties would be provided complete with external meters and meter boxes. Positioning, type of meter housing and aesthetics will need to be considered in line with the landscaping/architectural plans.

Should the provision of Natural Gas be discounted, a second option would be the use of Liquid Petroleum Gas (LPG).

This system could incorporate either buried or above ground storage tanks on the site in an agreed location with the client and the architect. An area north of the approach road to the entrance is identified as a potential suitable area.

A single new connection point from the buried tanks will be required to serve proposed thermal energy generation equipment located in an above ground plant room as LPG systems will not be permitted within basement/below ground rooms.

It is envisaged that the distribution company would terminate the connection in an agreed position on the site complete with an emergency control valve. The gas supply to the plant room would be metered to allow for energy monitoring, targeting and have the ability to place and order automatically to replenish the discharged tanks. The chosen gas supplier would provide all the appropriate tanks, regulators, pipework and equipment associated with the standalone service.

Downstream of the emergency control valve, gas pipework would be distributed to the plant room to serve plant and cooking appliances within the building as and where required.

Although LPG could be a viable option for the main building, we would suggest the staff/guest cottages take a different approach. Although practically, the cottages could be served via LPG, the independent billing/user requirement of each property would make this difficult to implement. A bulk storage solution would be necessary, with typical contract obligations required to the supplier.

Another option would be to provide separate LPG storage tanks to each property. This option is considered to be impractical due to external constraints of the site and potential planning issues. It is thus discounted at this stage.

Subject to the decision on the use of Natural Gas, an all-electric solution could also be considered. A further assessment will be required considering the required electrical supply to the site and any required re-enforcement. Please see the electrical section of this document for further details.

3.1.2 Water

Network provided mains cold water service (MCWS) is currently available within close proximity of the property boundary.

A 50mm dia incoming main is currently utilised to provide potable water to the Main House building. An early application has been made to United Utilities to determine whether there is sufficient capacity in the main in support of the proposed development. Should the capacity of the main and the supply branch to the boundary of the site be inadequate, reinforcement will be necessary, and an application made.

It has been suggested that the water supply to the adjacent housing development is interwoven with that of Cuerden Hall, but this has not yet been confirmed by record information obtained from United Utilities. This situation will be clarified and, if necessary and possible, corrected as part of the design development and subsequent construction works.

New suitably sized pipelines would deliver potable water to the Main House building but also separately to each of the Staff/Guest Cottages and Apartments and to the Garages, Stables and Gardiners Workshops / Stores. The supplies would be individually metered via multiple below ground meters and chambers. The agreed position of the meters would need to be in conjunction with the water authority and the architect.

For the Main House building, a cold water storage tank and distribution equipment would be installed within the basement plant room such that a new boosted cold water service will serve the extremes of the property providing adequate pressure and flow.

Distribution pipework shall route internally from the basement to serve the existing building. A buried service branched off from the basement plantroom will be provided to serve the requirements of any of the outbuildings.

3.1.3 Electricity

The existing electrical arrangement to the site comprises 2 No separate low voltage three phase connections. One connection is terminated in an existing basement switchroom below the south side of the Main House and appears to serve the existing main building. A second connection appears to terminate in the existing garage building in the Stable Courtyard.

It is understood that single developments / properties provided with multiple connections are no longer considered acceptable by the Statutory Authority. It is suggested, however, that the site be treated as two separate buildings plus a series of independently supplied properties, namely:

- The Main House
- The Garages, Stables and Gardener's workshop and stores (these are physically separated from the Main House)
- Cottages 1..10 and Apartments 1..4

Prior to applying for new connections, an assessment will be required with regard to the revised capacity requirements in addition to details of particular plant / equipment that is to be installed. This includes for example, details of energy generating equipment such as photovoltaic panels which may be mounted on the roof of the garages and will be dependent on the final choice of thermal energy generation, be it gas (natural or LPG) fired boilers, ground source heat pumps or a bivalent system which utilises both technologies.

The new connections will be provided by the Regional Electric Company (Electricity North West). It is possible that they will require new connections to be installed at ground floor level. This will be determined in the design stages which follow, and suggested locations have thus been described in both the Basement (preferred) or the Ground Floor Bike Store, for the new Main House supply should this be necessary.

It is proposed that a second supply to the Stable Courtyard will be used to feed this building (i.e. The Garages, Stables and Gardener's workshop and stores) and to provide separately metered supplies to the Cottages and Apartments. This would involve bringing a new low voltage supply into the Energy Centre area and using it to feed a multi-service distribution unit (MSDU) which will be used to provide supply points to each of the individual buildings described above.

This arrangement would result in a metered supply being provided for the Garages, Stables and Gardener's workshop and stores within the Energy Centre as well as 14 No. individual metered supplies for the Cottages and Apartments with their meters located within each individual property. This process may involve the introduction of a Building Network Operator (BNO) arrangement allowing the occupant of each Cottage or Apartment the flexibility to select their own energy provider. Cables between the MSDU and the individual meters would be routed via below ground ducts running through the two courtyards before entering each individual property. The building owner would, however, be responsible for the operation and maintenance of these cables and equipment. The implications of this approach can be discussed further.

Main switchgear and distribution equipment will be strategically positioned throughout the development in both the Main House (proposed to be in the basement below the Wyatt Wing) and in the Energy Centre within the Stable Courtyard area.

3.1.4 Telecoms

Information obtained from Openreach suggests that the existing telecoms arrangements to the property take the form of a number of traditional analogue BT connections served from underground cables routed both up the main drive and from the rear of the property.

It is proposed that these arrangements will be rationalised as part of the project subject to further investigations to establish the exact requirements for a new incoming telecommunications connection, which will be in accordance with specific Client requirements.

4 Building Performance

4.1 Thermal Modelling

A dynamic thermal model has been created in IES VE (Figure 4.1). The model has been utilised to assist in the development of the energy strategy.

The aim of the strategy is to remove or reduce the need for fuel delivery, reduce energy costs, and future proof the building. A secondary benefit of the energy strategy is a consequential saving in Carbon Emissions.

Building performance data has been added including heating set points, internal gains, operational profiles and building fabric performance.

A workshop was first held with Purcell to explore opportunities to improve the performance of the building fabric. Fabric improvement scenarios were then proposed for each area of the development. The scenarios have varied degrees of invasiveness and cost associated, but are all considered to be appropriate for the historic nature of the buildings involved.

The fabric improvement scenarios were input to the thermal model and dynamic energy and peak load calculations performed. These calculations then allowed the savings in annual energy consumption and peak demand to be explored, and the feasibility of different heating methods to be assessed.

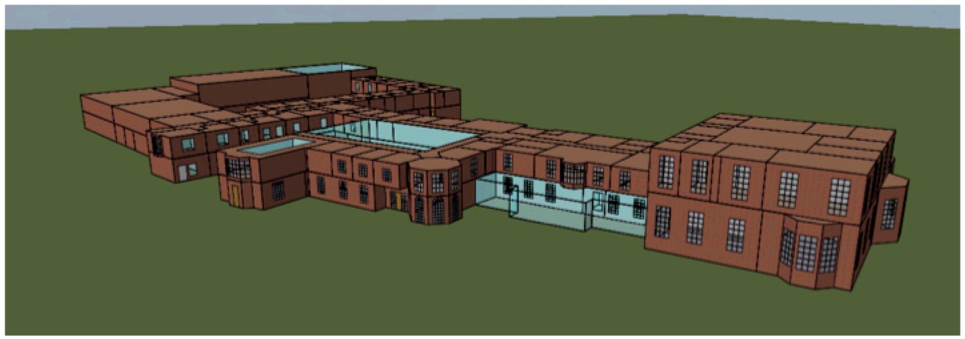


Figure 4.1 Stage 2 IES VE Model, Cuerden Hall

4.2 Fabric Scenarios

The fabric improvement scenarios for each building area are presented in table 4.2 at the end of this section.

The Baseline fabric scenario is the current building fabric if no improvements are made and represents the performance of the existing building.

Scenario 1 are improvements that are expected to be carried out.

Scenario 2 are further enhancements that can be considered to further limit heat loss from the building and minimise energy consumption but are more invasive or expensive improvements.

4.3 Energy Modelling Results

Figure 4.3.1 presents the savings in annual space heating energy consumption for the fabric scenarios for each building area. Figure 4.3.2 then presents the associated savings in running costs.

The results demonstrate the magnitude of the reduction is impacted by the extent of the fabric improvements for each building, and the area of fabric to be improved.

Introducing Scenario 1 fabric improvements reduces the annual space heating energy consumption and costs[1] by up to 50%, and further fabric improvements provide an additional saving, with reductions in energy and cost[1] between 55% and 88% from baseline.

Figure 4.3.3 demonstrates the reduction in the peak demand as the fabric performance is improved and heat loss reduced. This reduction in peak demand leads to options of how the heating demand of the building can be met.

A lower peak demand allows low temperature systems to be explored. Low temperature systems work hand-in-hand with a number of LZC (Low or Zero Carbon) heating sources, such as Air Source or Ground Source Heat Pumps (ASHP or GSHP), which can help to future proof the building against potential measures to discourage the use of carbon intensive fuels, such as the introduction of additional taxes, and further save energy costs and carbon emissions.

Areas (m^2) for each proposed fabric enhancement have been provided to Thornton Firkin, who will allocate a cost to each scenario to allow us to assess payback periods during the next stage of design.

It is recommended that a minimum of proposed fabric Scenario 1 is implemented, and that further analysis is carried out to look into the benefits and feasibility of Scenario 2.

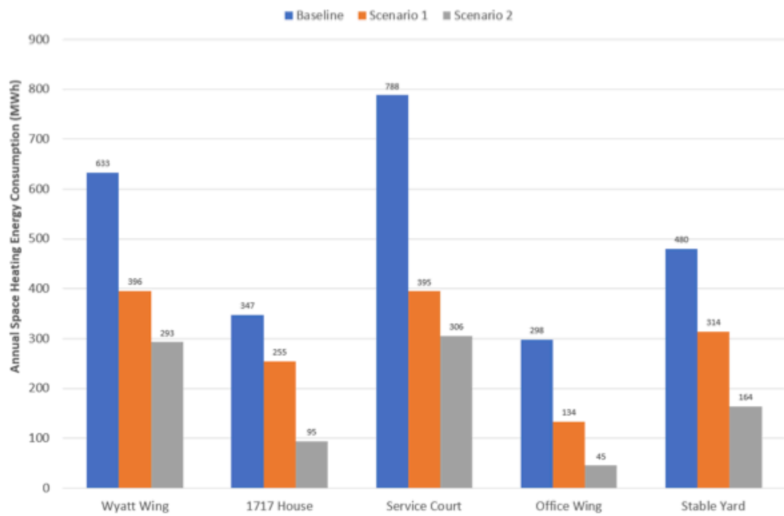


Figure 4.3.1 Annual Space Heating Energy Consumption

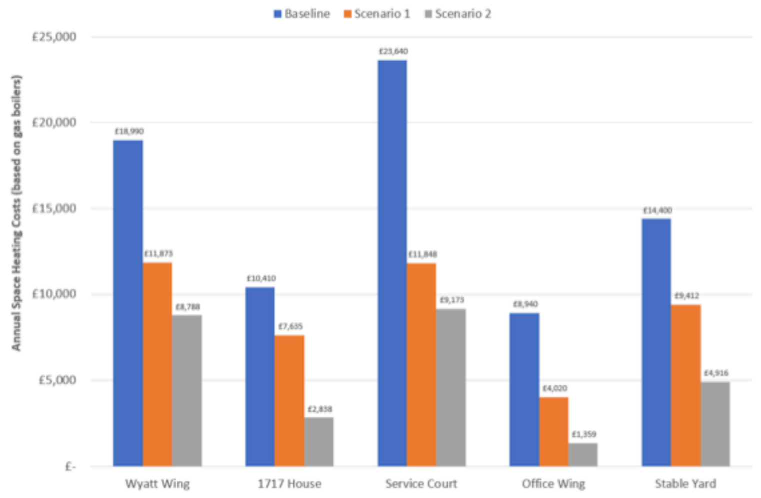


Figure 4.3.2 Annual Space Heating Costs
[1] Based on a standard gas boiler and gas price £0.03/kWh

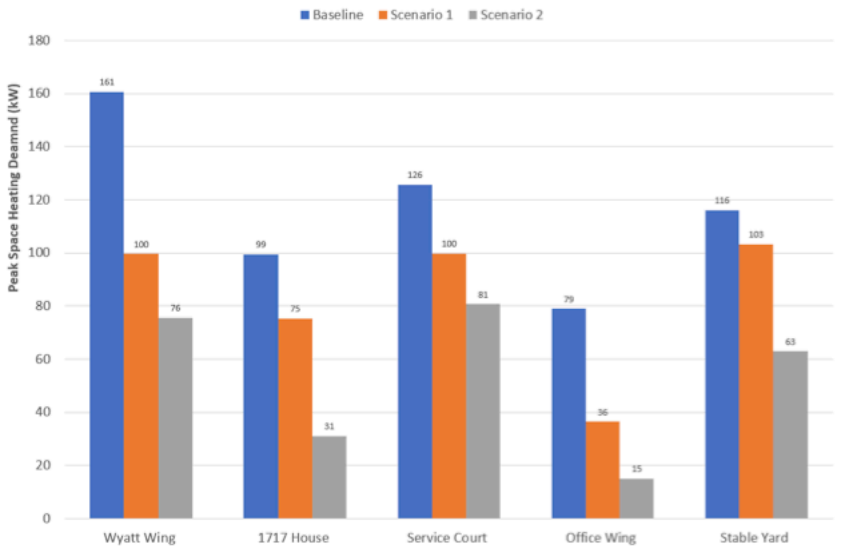


Figure 4.3.3 Reduction in the peak demand with progressive fabric improvement scenarios

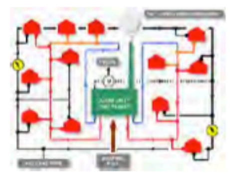
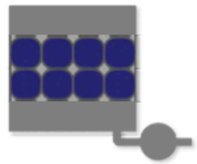
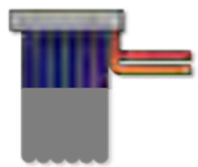
4.4 Low and zero carbon technologies

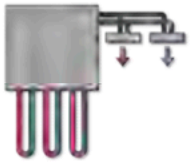
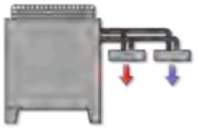
A preliminary quantitative assessment of Low and Zero Carbon (LZC) technologies has been undertaken, identify potentially suitable technologies for the development (Table 4.4).

It is recommended that photovoltaic cells (PV) is considered further, but that this be sized to ensure all energy generated can be utilised on site. Further analysis will be performed at the next stage, but it is anticipated that this is likely to result in a 5-10 kW array (approx. 25-30m^2). It is suggested that the PV could be mounted on the south facing pitched of the northlight roof of the garage, as illustrated on the enclosed sketches.

The use of ASHP and GSHP will also be explored further during the next stage to determine the optimum size to reduce capital costs and maximise payback. This is expected to result in a bivalent system with any proposed heat pump sized to provide the base load only, with gas/LPG fired boiler plant providing peak demand.

Table 4.4 Preliminary LZC Review

Technology	Description	Feasibility
Community Heating 	Community heating schemes lend themselves to large-scale, centralised plant, which allows heat and electricity to be generated simultaneously and at high efficiency.	 No Option for distract heating due to the loads and location of the development.
Photovoltaics 	Photovoltaic generate electricity from solar radiation. This is fed into the building's electrical system.	 PV panels could be mounted on the garage roof to offset the electrical demand for lighting and small power.
Solar Hot Water 	Solar thermal panels capture solar radiation. This is transferred to circulating hot water than can then be used to provide space heating and/or domestic hot water.	 The low typical hot water demand across the site would not justify the installation of solar hot water.

Biomass 	Biomass boilers burn plant waste (usually wood chip or wood pellets) to provide heat for space heating and/or domestic hot water.	 Frequent delivery of fuel will cause noise pollution. Furthermore, biomass can have a negative impact on air quality. Plant space and maintenance is also an issue.
Combined Heat & Power (CHP) 	Combined Heat & Power (CHP) burns gas to simultaneous generate heat and electricity. The heat is used to provide space heating and/or domestic hot water and the electricity is fed into the building's electrical system.	 With the greening of the electric grid, they no longer achieve the benefits previously achieved. The burning of gas can also result in issues with local air quality.
Ground Source Heat Pumps 	Ground Source Heat Pumps (GSHP) use a ground loop to extract heat from the ground. The two main ground loop options are: 1. Slinkies – a horizontal ground loop located in shallow trenches. 2. Boreholes – a vertical loop located in vertical boreholes. The pumps can be run in reverse to provide cooling.	 GSHPs generate heat efficiently at low grade, and land is available for the bore holes required. This option could be feasible if peak demand is reduced.
Air Source Heat Pumps 	Air Source Heat Pumps (ASHPs) use a heat pump to generate heating and cooling. The heat generated is typically low grade and is used to provide space heating. Higher grade heat can be generated, but efficiencies are much lower.	 ASHPs generate heat efficiently at low grade. They could be explored further for the development.

Wind 	Wind turbines use natural wind currents to turn their blades, which in turn produces electricity from a generator. This is fed into the building's electrical system. Output is dependent on the average wind flow rate, therefore high-speed undisturbed currents are the best.	 Planning for a wind turbine would be extremely difficult. Wind turbines would also create potential issues with noise, shadow flicker and tv/radio signal interference. Furthermore, noise from wind turbines may be considered unacceptable, particularly for local residential areas.

Table 4.2 Building Fabric Scenarios

KEY	
(green)	Improvement made in this Scenario

Wyatt Wing

Element	Allocation	Baseline Build Up	U-Value	Source	Scenario 1 Build Up	U-Value	Source	Scenario 2 Build Up	U-Value	Source
External Wall	All	Uninsulated Brickwork (original 1816-1848)	1.01	IES	Uninsulated Brickwork (original 1816-1848)	1.01	IES	Uninsulated Brickwork (original 1816-1848)	1.01	IES
Ground Floor	Without Basement	Timber (original 1816-1848)	0.58	EPC Conventions	Timber (original 1816-1848)	0.58	EPC Conventions	Timber Kingspan Insulation	0.22	L1B
	With Basement	Timber (original 1816-1848)	0.58	EPC Conventions	Timber (original 1816-1848)	0.58	EPC Conventions	Timber (original 1816-1848)	0.58	EPC Conventions
Glazing	All	Timber Single Glazing (original 1816-1848)	4.96	EPC Conventions	Timber Single Glazing (original 1816-1848)	4.96	EPC Conventions	Timber Single Glazing Resealed	4.96	
Roof	Remaining inc Bedrooms	Timber/Slate Uninsulated (original 1816-1848)	2.50	EPC Conventions	Timber/Slate + 300mm Rock wool Insulation	0.11	IES	Timber/Slate + 300mm Rockwool Insulation	0.11	IES
	Entrance	Flat Lead Uninsulated	2.50	EPC Conventions	Flat Lead Rockwool Insulation	0.18	L1B	Flat Lead Rockwool Insulation	0.15	L1B + 20%
	Staircase	Cement Roof Uninsulated	2.50	EPC Conventions	Cement Roof Rockwool Insulation	0.18	L1B	Cement Roof Rockwool Insulation	0.15	L1B + 20%
Doors	All	Wooden (original 1816-1848)	3.00	EPC Conventions	Wooden (original 1816-1848)	3.00	EPC Conventions	Wooden (original 1816-1848)	3.00	EPC Conventions
Infiltration	All	40			30			20		

1717 House

Element	Allocation	Baseline Build Up	U-Value	Source	Scenario 1 Build Up	U-Value	Source	Scenario 2 Build Up	U-Value	Source
External Wall	All	Uninsulated Brickwork (original 1717)	1.01	IES	Uninsulated Brickwork (original 1717)	1.01	IES	Uninsulated Brickwork (original 1717)	1.01	IES
Ground Floor	All	Timber Uninsulated (original 1717)	0.58	EPC Conventions	Insulated Timber/Stone + 50mm Kingspan Insulation	0.37	IES	Insulated Timber/Stone + 100mm Kingspan Insulation	0.20	IES
Glazing	Ground Floor	Timber Frame Single Glazing (original 1717)	4.96	EPC Conventions	Timber Frame Single Glazing (original 1717)	4.96	EPC Conventions	Timber Single Glazing Resealed	4.96	EPC Conventions
	First Floor	Timber Frame Single Glazing (original 1717)	4.96	EPC Conventions	Timber Frame Single Glazing (original 1717)	4.96	EPC Conventions	Timber Single Glazed Resealed with Secondary Glazing	2.57	EPC Conventions
	Conservatory	Single Glazed Conservatory	4.96	EPC Conventions	Double Glazed Conservatory	1.60	L1B	Double Glazed Conservatory	1.28	L1B + 20%
Doors		Wooden (original 1717)	3.00	EPC Conventions	Wooden (original 1717)	3.00	EPC Conventions	Wooden (original 1717)	3.00	EPC Conventions
Roof	All	Timber/Slate Uninsulated (original 1717)	2.50	EPC Conventions	Timber/Slate Uninsulated (original 1717)	2.50	EPC Conventions	Timber/Slate + 300mm Rockwool Insulation	0.11	IES
Air Perm	All	40			30			15		

Service Court

Element	Allocation	Baseline Build Up	U-Value	Source	Scenario 1 Build Up	U-Value	Source	Scenario 2		
External Wall	All	Brick Unisulated (original 1816/1819)	1.35	IES	Brick Unisulated (original 1816/1819)	1.35	IES	Brick Unisulated (original 1816/1819)	1.35	IES
		Brick Unisulated (original 1848/1893)	1.35	IES	Brick Unisulated (original 1848/1893)	1.35	IES	Brick Unisulated (original 1848/1893)	1.35	IES
Ground Floor	Existing	Solid Uninsulated (original 1816/1819)	0.58	EPC Conventions	Solid (original 1816/1819) + 75mm Kingspan Insulation	0.24	IES	Insulated Solid Concrete + 100mm Kingspan Insulation	0.19	IES
	New	Insulated solid Limecrete	0.22	Part L1B	Insulated solid Limecrete	0.22	Part L1B	Insulated solid Limecrete	0.22	Part L1B
Glazing	Internal Courtyard	Timber Frame Single Glazed (original 1816/1819)	4.96	EPC Conventions	Timber Frame Single Glazed with Secondary Glazing	2.57	TGA	Double Glazed	1.60	Part L1B
	External Courtyard	Timber Frame Single Glazed (original 1848/1893)	4.96	EPC Conventions	Timber Frame Single Glazed Resealed	4.96	EPC Conventions	Timber Frame Single Glazed with Secondary Glazing	2.57	TGA
	Pool Roof	Pool Glazed/Steel Structure	1.60	L1B	Pool Glazed/Steel Structure	1.44	L1B + 10%	Pool Glazed/Steel Structure	1.28	L1B + 20%
	Pool Windows & Doors into Courtyard	Pool Glazed/Steel Structure	1.60	L1B	Pool Glazed/Steel Structure	1.44	L1B + 10%	Pool Glazed/Steel Structure	1.28	L1B + 20%
	Billard Room	Original Rooflight	4.96	L1B	Original Rooflight	4.96	L1B	Secondary Glazing at Ceiling Level	2.84	TGA
Doors	All	Timber (original 1816/1819)	3.00	EPC Conventions	Timber (original 1816/1819)	3.00	EPC Conventions	Timber (original 1816/1819)	3.00	EPC Conventions
		Timber (original 1848/1893)	3.00	EPC Conventions	Timber (original 1848/1893)	3.00	EPC Conventions	Timber (original 1848/1893)	3.00	EPC Conventions
Roof	Staircase/Staff WC/Corridor	Flat Lead/Felt Roof Uninsulated (1848-1893)	2.50	EPC Conventions	Flat Lead Rockwool Insulation	0.18	L2B	Flat Lead Rockwool Insulation	0.15	L1B + 20%
	Remaing	Timber/Slate Uninsulated (1816-1819)	2.50	EPC Conventions	Timber/Slate + 300mm Rockwool Insulation	0.11	IES	Timber/Slate + 300mm Rockwool Insulation	0.11	IES
Air Perm	All	40			20			15		

Table 4.2 Building Fabric Scenarios contd..

Office Wing

Element	Allocation	Baseline			Scenario 1			Scenario 2		
		Build Up	U-Value	Source	Build Up	U-Value	Source	Build Up	U-Value	Source
External Wall	All	Brick Uninsulated (original 1848/1893)	1.54	IES	Brick Unisulated (original 1848/1893)	1.54	IES	Brick Insulated (original 1848/1893) + 50mm Kingspan Insulation	0.47	IES
Ground Floor	All	Solid Uninsulated (original 1848/1893)	0.58	EPC Conventions	Solid Kingspan Insulation	0.22	L1B	Solid Kingspan Insulation	0.18	L1B + 20%
Glazing	All	Timber Frame Single Glazed (original 1848/1893)	4.96	EPC Conventions	Timber Frame Single Glazed Resealed	4.96	EPC Conventions	Double Glazing	1.28	L1B + 20%
Doors	All	Timber (original 1848/1893)	3.00	EPC Conventions	Timber	1.80	L1B	Timber	1.80	L1B
Roof	All	Timber/Slate Uninsulated (1948-1893)	2.50	EPC Conventions	Timber/Slate + 300mm Rockwool Insulation	0.11	IES	Timber/Slate + 300mm Rockwool Insulation	0.11	IES
Air Perm	All	40			20			10		

Stable Yard

Element	Allocation	Baseline			Scenario 1			Scenario 2		
		Build Up	U-Value	Source	Build Up	U-Value	Source	Build Up	U-Value	Source
External Wall	Existing Staff Cottages	Brick Unisulated (original 1816/1848)	1.54	IES	Brick Unisulated (original 1816/1848)	IES	EPC Conventions	Brick (original 1816/1848) + 50mm Kingspan Insulation	0.47	IES
	Remaining Heated Spaces	Brick Unisulated (original 1848-1893)	1.54	IES	Brick Unisulated (original 1848-1893)	IES	EPC Conventions	Brick (original 1848-1893) + 50mm Kingspan Insulation	0.50	IES
	Burnt Out Rebuild	Cativty Wall	0.28	L1B	Cativty Wall	0.28	L1B	Cativty Wall	0.28	L1B
Ground Floor	Staff Cottages	Solid Uninsulated (original 1816/1848)	0.58	EPC Conventions	Solid Kingspan Insulation	0.22	L1B	Solid Kingspan Insulation	0.18	L1B + 20%
	Remianing	Solid Uninsulated (original 1848/1893)	0.58	EPC Conventions	Solid Uninsulated (original 1848/1893)	0.58	EPC Conventions	Solid Kingspan Insulation	0.22	L1B
	Burnt Out Rebuild	Solid Insulated	0.22	L1B	Solid Insulated	0.22	L1B	Solid Insulated	0.22	L1B
Glazing	Remaning	Timber Frame Single Glazed (original 1848/1893)	4.96	EPC Conventions	Timber Frame Single Glazed (original 1848/1893)	4.96	EPC Conventions	Timber Single Glazing Resealed	4.96	EPC Conventions
	Burnt Out Rebuild	Double Glazing	1.60	L1B	Double Glazing	1.44	L1B + 10%	Double Glazing	1.28	L1B + 20%
	Staff Cottages	Timber Frame Single Glazed (original 1848/1893)	4.96	EPC Conventions	Timber Frame Single Glazed Resealed	4.96	EPC Conventions	Double Glazing	1.28	L1B + 20%
Doors	All	Timber (original 1816/1848)	3.00	EPC Conventions	Timber (original 1816/1848)	3.00	EPC Conventions	Timber (original 1816/1848)	3.00	EPC Conventions
	Burnt Out Rebuild	Timber	1.80	L1B	Timber	1.80	L1B	Timber	1.80	L1B
Roof	Stores/Garage	Pitched Cement Roof (original 1848/1893)	2.50	EPC Conventions	Pitched Cement Roof + 50mm Rockwool Insulation	0.53	IES	Pitched Cement Roof + 100mm Rockwool Insulation	0.30	IES
	Stables	Pitched Wired Single Glazed (original 1848/1893)	4.96	EPC Conventions	Pitched Wired Single Glazed (original 1848/1893)	4.96	EPC Conventions	Pitched Wired Double Glazed (original 1848/1893)	1.60	L1B
	Cottages	Timber/Slate Uninsulated (original 1816/1848)	2.50	EPC Conventions	Timber/Slate + 300mm Rockwool Insulation	0.11	IES	Timber/Slate + 300mm Rockwool Insulation	0.11	IES
	Burnt Out Rebuild	Timber/Slate Insulated	0.16	L1B	Timber/Slate Insulated	0.16	L1B	Timber/Slate Insulated	0.16	L1B
Air Perm	Existing	40			20			15		
	Burnt Out Rebuild	10			10			10		

5 MECHANICAL ENIGNEERING SERVICES

5.1 Primary Plant Space and Distribution

5.1.1 Plant Rooms

Primary plant space is made up of, and houses the following:

Table 4.1: Plant Strategy

Plant Room	Location	Accommodates
Thermal energy plant rooms	Dedicated basement areas, leisure plantroom and courtyard plant room	Thermal energy generation plant (Boilers/Heat Pumps) Wet systems pump sets and primary distribution; Heating system pressurisation and expansion equipment; Motor control centre (main mechanical services panel); Cold water storage tank, water treatment and booster set. Primary electrical switchgear and metering Home automation system (if required)
Garage plant room	Dedicated plant area void over TBC	Close Control Equipment Ventilation plant
Swimming pool plant	Dedicated room in basement	Underfloor heating manifolds Swimming pool plant (TBC by specialist) Air Handling Equipment
Storage areas	Various	Underfloor heating manifolds/Distribution boards
Mechanical and Electrical services risers(potentially turrets)	Various	Distribution systems Electrical distribution panels Underfloor heating manifolds
Roof voids	Dedicated roof spaces (various)	Ventilation Plant Electrical distribution Mechanical distribution

5.1.2 External Plant

Plant located externally will be limited as far as practicable. There is an option to provide above ground LPG tanks subject to the agreed availability, or otherwise, of natural gas from the network provider.

External areas have also been identified for possible ground source borefield arrays. This would be in the form of closed loop vertical boreholes. The head of each borehole would be below ground level and not visible.

Manifold chambers located within accessible external areas would be required to conceal ground source manifolds and could be placed sensitively and co-ordinated to the landscape design. The access lids could be disguised so as not to be too intrusive on the local aesthetics of the areas in which they are located.

No other external plant is suggested at this stage.

5.1.3 Maintenance Requirements

General maintenance activities will be required for new items of plant installed as part of the servicing strategy. Access requirements will be obtained from equipment manufacturers wherever possible to ensure potential maintenance problems are designed out.

It is expected that all items of proposed plant will be capable of being transported to the basement plant rooms via the use of proprietary made openings suitable for the largest plant components. Further investigation will be required to determine the exact requirements for the initial install but also consideration for future plant maintenance and access.

Equipment belonging to localised systems, installed within ceiling or roof void plant spaces will be of modular design to allow transportation internally. Access panels, or other means of providing managed access, will be provided for all concealed plant and equipment (underfloor heating manifolds, local heat recovery units etc.), sized for maintenance and potential replacement.

Where equipment is placed within roof voids, suitable access will be required inclusive of ladders, hatches, power and lighting, suitable for used by maintenance personnel within the regulations for confined spaces.

5.1.4 General Service Distribution

Thermal energy and domestic hot and cold-water pipework will be routed horizontally within the basement before feeding into newly formed service risers and/or the existing turrets in the Wyatt Wing. New horizontal distribution routes shall be formed, in common with electrical services, following the principal corridors at first floor level, with pipework running in the depth of the floor.

It is important to appreciate that very little access has so far been afforded into floor structures. It is however proposed that main services distribution routes will include:

- The use of sub-floor voids at ground floor level in the Wyatt Wing in particular and, if necessary, in the 1771 House and the Service Court.
- A "spine route" running within the floor structure of the 1st floor main corridors in the main house. It is anticipated that the floor structure will be adapted within the corridor area, perhaps by the introduction of steel "letterboxes", or similar, to replace sections of joists, so as to enable pipework systems to run longitudinally along the corridor with pipes carrying final services from this spine then being routed between joists. Occasional access, in the event that a new service is required or a pipe fails, would then be possible by lifting the corridor floor, but access would not be required through the ground floor ceiling, allowing height to be maximised and a clean appearance to be achieved.
- Routing pipework systems through roof voids and providing access throughout via strategically placed access hatches and safely accessible routes through the voids. All accessible voids will be provided with lighting, emergency lighting and automatic fire detection and alarm systems.

Where plantrooms are at ground level, services will either drop into ducts or underfloor voids below, or distribute internally to connect to a designated riser.

Ductwork distribution associated with localised ventilation services serving their specific areas will be concealed where possible. Air handling plant will be accommodated within accessible plant spaces.

Common intake and exhaust positions will be utilised where possible. Localised ventilation systems will comprise concealed ductwork and equipment within ceiling/roof voids. Intake and exhaust terminals will be required and will generally be integrated into external facades at high level. Existing chimneys will be utilised (wherever possible and deemed out of service) for the benefit of distributing ductwork vertically to all levels.

Boiler plant flues are yet to be fully determined (dependant on final location) and will either distribute within existing turrets within the Wyatt Wing (as illustrated on the attached sketches), or if this cannot be achieved, via dedicated new vertical shafts/openings.

Pipelines from possible Ground Source arrays will typically be laid to rest within suitable trenches and backfilled. No visible signs of pipelines should be evident externally.

5.2 Thermal Model

A thermal model has been developed for use on the Cuerden Hall project. This is discussed in greater detail in Section 4 of this report, but its' use and impact on the design of mechanical services is outlined below.

The model will be utilised to perform heat loss calculations, energy calculations and to inform best options on selected plant.

The thermal model will also be used to determine whether openings within the building fabric can be used maintain room conditions within acceptable thermal comfort criteria vias natural ventilation. A comfort and indoor air quality study will be performed to establish the possible requirement for mechanical comfort cooling systems in any rooms identified with potential overheating issues.

It is good practice to maximise natural ventilation openings wherever possible. Further modelling will enable educated decisions to be made regarding the size and extent of openings.

5.3 Thermal Energy

5.3.1 Thermal Energy Generation Considerations

Consideration has been given as to the most appropriate means of thermal energy generation for the buildings in terms of suitability and practicality, given the specific requirements of the building form, the particular building services requirements and based on discussions with both the Client and the Architect. The Client has highlighted visual appearance, vehicular deliveries and noise as major factors when considering the appropriate method for energy generation.

The thermal modelling section of this report (Section 4) suggests that ground source heat pumps connected to an array of vertical boreholes could be utilised to generate thermal energy for Cuerden Hall, probably in the form of a bivalent system with the GSHP providing output to meet the base load of the building and with peak demands over and above this load being met by alternative means, for example by LPG fired boiler plant. Peak demands might arise from cold periods of the year, or else periods when the house is fully occupied by guests / visitors.

Alternatively, if a new network gas connection can be economically brought to the property then it would be possible to provide all thermal energy generation using gas fired boilers.

The choice to utilise GSHPs or gas fired boilers is thus driven by:

- The cost and acceptability of steps to improve the performance of the building fabric. Such steps will be beneficial in terms of comfort and energy consumption in both circumstances, but are a necessary precondition of a heating system which utilises heat pump technologies
- The cost of creating the bore holes associated with a GSHP solution
- The cost of bringing a new network gas connection to the site
- The potential benefits of reduced exposure to energy price volatility associated with carbon based fuels, e.g. future taxes imposed to discourage the use of gas as key Government carbon reduction commitment dates come closer
- At present Listed Buildings are exempt from requiring an EPC. (Energy Performance Certificate) There is currently a consultation underway, however, questioning if this should be the case, potentially including the need for Listed Buildings to achieve an EPC F rating or above. As part of the UK Governments target for Net Zero Carbon by 2050, the Climate Change Committee is advising the UK government that after 2028 to sell a home it will need to achieve an EPC C rating or above.

5.3.2 Central Plant

Although the mode of generating thermal energy generation is yet to be finalised, the strategy for servicing the Main House building would ideally be low grade (50°C/40°C flow and return) and/or high grade (80°C/60°C flow and return) heating systems, serving a mixture of underfloor heating, trench heaters, radiators, and plant heating coils where required.

Both grades of heating medium would be at low pressure distributed at a variable flow rate in response to demand. **It must be noted that the outcome of the agreed fabric improvements may influence the servicing strategy as noted, where only a high-grade heating solution would be chosen and dependant on the final analysis regarding capital cost and payback of a bivalent solution (Gas boilers and GSHP's).**

Thermal energy generation plant will be equipped with a suitably sized shunt pump to ensure the correct water circulation at constant volume is maintained at all times. The shunt pump will circulate water to a thermal store/buffer vessel or a low loss header via automatic mixing valves.

Primary circulation pumps will need to maintain a constant head pressure over a wide range of variable volume flow. At full flow they must be able to circulate the full duty of the central heating systems to each of the heating emitters/emitter systems, and under minimum flow conditions they must be able to circulate only as much water is required to off-set the losses from the primary system and to maintain flow temperature at the extremities of the system. To this end, the extremities will be fitted with adjustable by-pass loops so that a minimum volume of water will circulate at all times.

All pumps shall be equipped with flexible couplings and anti-vibration mountings as required.

The plantrooms shall be adequately ventilated using natural ventilation of a design and appearance to be approved by the architect. Similarly, any boiler flues shall terminate in a position and style approved by the architect for the agreement of the planning department.

It is proposed that one, or possibly two, of the existing turrets within the Wyatt Wing could be utilised for the purpose of boiler flue gas discharge. Further site investigation will be required to confirm the suitability of the turrets for this purpose. Should the turrets prove to be unsuitable, it is proposed that a new vertical shaft/riser be created internally from basement level and exit above roof level. Once at roof level, a concealed brickwork surround could encapsulate the flue on the internal elevation of the existing turret structure. Further review with the architectural team will be necessary.

An automatic control panel will be provided local to the main boiler plant to control all the aforementioned equipment as well as the cold-water booster set and any other mechanical plant in the boiler room. The control panel will be fully equipped with a BMS out-station as well as all necessary manual controls and visual indicators.

The control panel will allow each item of equipment to be selected in HAND/OFF/AUTO mode as well as allowing manual duty rotation of duplicated equipment.

Similarly, small outstations could be placed within other plant areas, controlling the localised plant to that room/area. Connection to the main panel over a data network would allow for a combined control system.

Staff/Guest cottages and apartments will undertake a slightly different approach in that these will be fully divorced from any central plant within the Main House building. It is proposed that each cottage be provided with individual heating plant likely to be a gas fired combination boiler, or an electric combination boiler, the former dependant on the availability of natural gas from the network supplier.

Note, that Air Source Heat Pumps have been discounted due to the typically low flow operating temperatures delivered by these systems plus, the issues with providing each dwelling with an external plant area suitable to conceal an external condenser unit. Noise would also be a major factor.

5.3.3 Heating Modes

The agreed strategy for heating is summarised in the following table:

Table 4.2: Heating Strategy

Level/Area	Primary Means	Supplementary Means
Guest/Staff Cottages/Flats	Radiators	Towel rails
Garage	Close Control System	None
Main House Basement	Radiators	None
Main House Ground floor	Under floor heating/Radiators	Trench Heaters / Radiators
Main House First floor	Radiators	Towel Rails
Main House Cinema	Radiators	MVHR
Main House Swimming Pool/Arcade	Underfloor Heating/Air Handling Unit	Heat Recovery/Trench Heaters
Main House Yoga Room	Specialist Input	Specialist Input
Steam/Sauna	Specialist Input	Specialist Input

5.3.4 Underfloor Heating Systems

Low grade heating will be distributed around the Main House building, serving individual under floor heating manifolds. Each room/area will be served by a particular pipework loop, or loops, forming a single zone. The number of pipework loops connected to each underfloor heating system will determine the physical size of each manifold.

Manifolds will be positioned in concealed, accessible locations throughout, complete with associated controls. Manifolds will be pre-assembled onto a back plate which can be mounted directly into position to save installation time. Each manifold will comprise the following:-

- Hot water service return connection and integral secondary circulating pump;
- Connections for low grade heating flow and return;
- Modulating controls to regulate the temperature in the under-floor heating circuit;
- Under floor heating circulation pump;
- Zone control valves for each under floor heating circuit;
- Under floor heating wiring and control centre.

5.3.5 Radiators and Trench Heaters

Low temperature hot water (LTHW) will serve a number of radiators and / or trench heaters as appropriate. Pipework will be routed within the basement at high level or within underfloor voids and enter designated vertical risers.

Radiators will be mounted on internal walls in positions suited to the room layout. Typically, an allowance of 25mm should be made for bracketry and 50 – 75mm radiator depth and tolerance zone. A 150mm clear space beneath and above the radiator will be required to maintain convection from the radiator surface.

5.3.6 Swimming Pool/Arcade

The exact nature of plant associated with the pool systems is unclear at this stage, as this is to be designed by others. TGA will review the "handshake" position in determining the M&E services provision and requirements for this area subject to when details are available from the specialist supplier.

The preferred heating option for the pool water would be to utilise LTHW with a flow and return connection to serve heating elements. An alternative approach would be the use of an electrical heating element as specified and provided by the pool specialist.

An LTHW connection to an AHU heating coil for the purpose heating a fresh air supply could be utilised. Alternatively, an electrical element may be deemed appropriate subject to further analysis at the next stage.

5.3.7 Garage

It is understood that the Client intends to hold a collection of specialist vehicles to be stored within a stable environment in the Garage area. It has been suggested that the conditions to be met would be in the range of 10-15°C and 40-60%RH. It is thus proposed that a close control system would be required to provide both a stable temperature and relative humidity in these ranges.

Due to the low target temperature, a heating only systems may not provide sufficient RH control over the varying seasonal transitions.

Note that the building fabric will need to be capable of maintaining the required conditions.

5.4 Ventilation Services

5.4.1 Natural Ventilation

The building is to be predominantly naturally ventilated.

The architectural design will allow for both natural ventilation and free cooling to be maximised. The Grade 2 listed construction has a medium/heavy thermal mass that will provide good levels of thermal storage, floor to ceiling heights of mainly 2.5 - 3m in the naturally ventilated zones for a good temperature gradient and large window opening for high levels of fresh air at ambient condition.

The new build element would be built to modern standards and in line with the required building regulations and thus, be thermally and energy efficient. The new build will incorporate openable window sections to external, providing natural ventilation to the pool hall area. This ventilation strategy will need further development considering the requirements for suitable dehumidification of the pool hall. Interlocking of the pool plant/controls with the opening fenestration may be deemed necessary to prevent unnecessary energy wastage.

The methodology for background ventilation provision is still to be developed and will be resolved with the design team, in the wider context of both the mechanical and natural strategies. Further overheating analysis of all areas will be undertaken and will establish the requirements for mechanical comfort cooling systems within identified areas, such as the gymnasium and the cinema.

5.4.2 Mechanical Ventilation

Ventilation systems will be designed in accordance with CIBSE guidance. The ductwork installations will be class A low velocity, in accordance with HVCA specification DW144.

Mechanical ventilation will be provided to the following areas:

WC Areas

Individual WC areas will be served by local extract systems operating continuously to maintain the required background rate. Upon occupation of the WC, the extract system will switch to boost mode. The WC extract will be controlled via a PIR input, either a dedicated PIR or combined with the lighting system. An option to not provide trickle ventilation will also be considered.

Bedroom Bathroom/En-Suites

Bathroom/En-Suites will be equipped with local extract systems. These systems will be in the form of either inline duct mounted or potentially wall/window/ceiling fans dependant on room and practicality of installation.

Changing Areas

The changing area will be equipped with a local heat recovery ventilation system. The system will provide extract to the changing rooms whilst supplying fresh, make-up air to the rooms. The supply air will be pre-heated by the warm extracted air by an integrated plate heat exchanger.

Local heat recovery systems will operate continuously to maintain the required background rate. Upon occupation of the changing area, the system will switch to boost mode, controlled via a PIR input.

Kitchen/Living

The Kitchen/Living will be equipped with a dedicated heat recovery system. This system will enable fresh air to be delivered to the space whilst extracting vitiated air. The supply air will be pre-heated by the warm extracted air by an integrated plate heat exchanger.

This room will require further overheating analysis as it is central with no dedicated openings to external.

Hall

It is envisaged this space could become densely populated during functions or events. In order to maintain suitable fresh air levels in the room, local heat recovery is proposed. Indoor air quality sensors located in the extract stream would switch the system from background to boost should CO_2 levels increase beyond prescribed limits.

Catering Kitchen

The catering kitchen is understood to require the ability to be operated as commercial type of kitchen and thus would be provided with dedicated supply and extract ventilation systems. The ventilation system will have variable speed control, manually operated to suit cooking activity. Assuming the cooking equipment will be gas driven, the system will have a gas interlock such that in the event of extract fan failure the gas is isolated.

Access requirements to the ventilation systems will be carefully considered so that equipment and ductwork can be suitably cleaned and maintained.

Hair Salon/Wet Treatment/Steam/Sauna/Snow Rooms

In order to eliminate odours/moisture and stale air from these areas, local heat recovery system would be proposed. A background supply/extract rate would be maintained at all times during a time scheduled period of operation. Note that the systems proposed will be subject to further specialist input on the requirements for spaces such as the wet/sauna areas.

Swimming Pool/ Plant Room

A ventilation system to negatively pressurise the swimming pool plant room will be provided to prevent corrosive particulates passing to the adjacent areas within the basement. The pool area will be provided with ventilation plant suitable for dehumidification and fresh air requirements to remove stale air and contaminants.

Garage

Ventilation provision to the garage area will be considering with the requirements for the close control system. A minimum amount of fresh air could be provided to maintain air quality and reduce odour from vehicles. The system will not be designed to maintain indoor air quality during the use of motor vehicles entering or existing the garage.

Carbon monoxide detection could be provided within the garage such that in the event of increased CO being detected, the ventilation system will operate to control dilution.

A further assessment on the function and benefits of the above-mentioned systems will be performed.

Cinema

It is understood that a dedicated cinema room will be provided. Cinema systems themselves require dedicated plant therefore additional plant space may be required. In terms of ventilation, space may be required for a heat recovery system to provide seated occupants minimum fresh air whilst vitiated air is extracted.

Indoor air quality sensors located in the extract stream would switch the system from background to boost should CO_2 levels increase beyond prescribed limits. Further analysis would be required should the need to mitigate the use of mechanical plant in favour of natural ventilation.

5.4.3 Acoustic Performance

Ventilation systems will be designed and installed such that internal acoustic requirements are not compromised. Ductwork velocities will be maintained as low as practicable, with due regard for spatial constraints, and air terminal devices sized to achieve good air distribution and acoustic performance.

Attenuators will be provided to the central plant systems intake, exhaust, supply, and extract connections to prevent in duct noise transmission to both the internal and external environments. Plant will be selected to avoid excessive noise breakout and local equipment will be accommodated within acoustic enclosures. It is recommended that an Acoustic specialist be appointed to advise throughout each design stage.

5.5 Cooling Services

Generally, cooling systems will not be a favoured approach due to the requirement of external plant space, energy use and the production of noise. Where natural ventilation methods are not feasible or restricted, the use of chilled water or refrigerant based cooling systems may be considered. Cooling coils may be incorporated into the air handling equipment to trim excessive temperatures should the overheating analysis provides justification in doing so.

Gym

The Gym is to be provided with dedicated comfort cooling, utilising a refrigerant based multi split system. The system will be controlled via a localised wall mounted controller, which will feed back to the BMS. Further specialist input will be required, to determine the fit-out of gym equipment and the expected internal gains within the space.

5.6 Building Management System

An Open Protocol Building Management and Home Automation System will carry out the operation, monitoring and control of the building services systems. It is proposed that the BMS will consist of a number of outstations located in motor control centre (MCC) or stand-alone panels interconnected on a communications bus system (Local area network LAN), enabling two-way transfer of information between outstations and a PC unit.

The Home Automation system will provide basic functionality associated with the heating, cooling and ventilation systems. The BMS will therefore be the primary sequencing system.

6 Public Health Services

6.1 Design Basis (General)

Distribution capacity and flow rates will be based upon the Institute of Plumbing (IOP), Plumbing Design Guide Simultaneous demand data for high usage. Respective pipe sizes will be determined from CIBSE Guide C.

Domestic water services installation will be installed using Friatherm CPVC plastic pipework. Friatherm offers technical, installation potential cost benefits over traditional copper installations.

6.2 Boosted Water Supply (Main Building)

Incoming mains water will serve a cold-water storage tank through an appropriate filtration system as previously described. From the tank, the cold water down service will be extended to all domestic water outlets and fittings via a packaged multi-stage booster assembly.

6.3 Cold Water Storage Tanks (Main Building)

A cold-water storage tank will be located within the plant room and will be of GRP modular hot press moulded panel construction.

The tank will be fitted with a raised ball valve chamber to provide a type A air gap. The float operated valve will be compliant with BS1212: Part 2:1990: Specification for piston type float operated valves (copper and alloy body) (excluding floats). The valve float will be fitted with an easily adjustable device for setting the water level to allow reduced storage.

The tank will be fitted with a screened warning and overflow pipe, screened breather vent, outlet connections and a balance pipe. The warning pipe will be routed to discharge in a conspicuous position, to be agreed with the Architect and the Local Authority.

The water storage tank will have labels fitted identifying the tank and its capacity together with an analogue contents gauge.

Design of the mains and tanked cold-water systems will be fully compliant with Water Supply (Water Fittings) Regulations and CIBSE TM13. In particular the tank will be fully compliant with the Water Supply (Water Fittings) Regulation G16.

6.4 Swimming Pool Cold Water Feed

A permanent cold-water feed to the swimming pool will be required. This will provide water to top up water lost by evaporation and general use. The cold-water feed will also enable the pool water to be replaced during swimming pool maintenance and cleaning.

6.5 Domestic Hot Water Service (DHWS) (Main House Building)

Domestic hot water shall be derived from central indirect hot water cylinders located adjacent boiler plant within the plant room or in separate rooms. A domestic hot water return circuit and pump designed to maintain return water temperature shall be provided. Double regulating valves with accurate low flow settings will be installed on all return legs to ensure the return circulation system operates effectively throughout the system.

6.6 Sanitaryware (General)

The sanitaryware and fixtures will be specified within the Architectural package and be supplied under the main contract package.

6.7 Above Ground Drainage (General)

The above ground drainage services will be designed and specified in accordance with the following:

- EN BS 12056, Gravity Drainage Systems Inside Buildings, (Current Edition)
- EN BS752-7, Drainage and Sewer Systems Outside Buildings, (Current Edition)
- Building Regulations, (Current Editions)
- Local planning and building control ordinance, (Current Edition)
- DIN 4109/A1: 2001-01 (Noise control in residential buildings) (Current Edition)

Drainage will be provided to all Sanitaryware as specified by the architect.

6.8 Septic Tank

The capacity of the below ground drainage network is not yet fully confirmed. It is not envisaged that a septic tank will be required, however, should a need be required, MCWS and power requirements will be considered.

The below ground drainage services will be designed and specified within the Architectural package along with the Civil Engineering design.

7 Electrical Engineering Services

7.1 Primary Plant Space and Distribution

7.1.1 Switch Rooms

Primary plant space is made up of, and houses the following:

Table 4.1: Plant Strategy

Plant Room	Location	Accommodates
Incoming Electrical Supply Arrangements	Main House, option of: • Wyatt Wing Basement • Ground floor Bike Store Stable Courtyard – New Energy Centre Individual supplies to each Cottage / Apartment	Electricity North West cut-outs and metering arrangement requiring access, preferably from an external elevation.
Electrical services risers	Various – see Stage 2 drawings	Distribution systems Electrical distribution panels
Electrical services distribution equipment	Various dedicated electrical cupboards	Lighting & Power Distribution Boards Home Automation Panels Fire and Security systems panels
Roof and floor voids	Various	Distribution of electrical services including containment and individually clipped cabling Aspirating pipework Lighting control units and drivers

7.1.2 External Plant

It is not envisaged that external plant will be required for the electrical services.

7.1.3 Maintenance Requirements

General maintenance activities are required for items of plant installed as part of the servicing strategy. Access requirements will be obtained from equipment manufacturers wherever possible to ensure potential maintenance issues are designed out.

Access panels will be provided for all concealed equipment, including those located in roof / floor voids in order to ensure appropriate access for future maintenance including testing and replacement. Details of access requirements will be developed during the subsequent stages of the design.

7.1.4 General Service Distribution

Electrical distribution systems will consist of horizontal cable routes at each floor level using floor and roof voids. Horizontal distribution will be linked vertically by carefully positioned risers.

7.2 Electrical Services Distribution

The main incoming electrical supply (provided by the Regional Electric Company: Electricity North West) to the Main House will be located in the Wyatt Wing Basement if this is acceptable, or else at ground floor level. An appropriate area for this will have to be agreed as part of the design process, which will be required to be positioned on (or close to) an external wall. The RIBA Stage 2 drawings appended to this report show a potential ground floor intake position as being in the Bike Store.

It is proposed that the new supply to the Stables Courtyard, from which supplies will also be derived to feed the individual Cottages and Apartments, be provided in the new Energy Centre area.

Access to the incoming services equipment will be required by the Regional Electric Company, therefore consideration is required with regard to affording access to the Regional Electric Company's equipment. An option for external access is thus potentially beneficial and could be considered but would be difficult to achieve.

Main switchboards will be located in suitable locations, preferably utilising an external wall and near to the incoming electrical supply arrangements. The current proposal is for the main switch board to the Main House to be located at basement level, below the Wyatt Wing, whilst that in the Stables Courtyard could be located immediately adjacent the incoming supply in the Energy Centre area. If Electricity North West require the Main House supply position to be located at ground floor level,fl then the main switchboard will be a significant distance away from it and will require that a large sub-main cable be routed through the 1st floor containment system the full length of the house. This is undesirable and, in such circumstances, alternative locations for either the main switchboard or the incoming supply will be sought.

Sub-main cabling will be provided to connect the main switch board to the various load centres that will be located around the buildings. Load centres include control panels, distribution boards and other, fixed power services such as the lift.

In terms of the main services distribution strategy within the Main House, it is important to appreciate that very little access has so far been afforded into floor structures. It is however proposed that main services distribution routes will include:

- The use of sub-floor voids at ground floor level in the Wyatt Wing in particular and, if necessary, in the 1771 House and the Service Court.
- A "spine route" running within the floor structure of the 1st floor main corridors in the main house. It is anticipated that the floor structure will be adapted within the corridor area, perhaps by the introduction of steel "letterboxes" to replace sections of joists, so as to enable containment systems to run longitudinally along the corridor with cables and conduits carrying final services from this spine then being routed between joists. Occasional access, in the event that a new service is required or a cable fails, would then be possible by lifting the corridor floor, but access would not be required through the ground floor ceiling, allowing height to be maximised and a clean appearance to be achieved.
- Routing containment systems through floor and roof voids and providing access throughout via strategically placed access hatches and safely accessible routes through the voids. All accessible roof voids will be provided with lighting, emergency lighting and automatic fire detection and alarm systems.

7.3 General and Small Power Systems

New general power systems will be provided to serve the buildings to suit the user's requirements generally as follows:

- Twin 13 Amp sockets strategically positioned to serve all portable equipment and provide adequate cover for general use as well as cleaning equipment; In spaces with historic wall finishes, inaccessible panelling or skirting treatments which cannot be removed, then socket outlets will be provided in flush fitting floor boxes rather than being recessed into walls. Elsewhere sockets will be flush mounted in walls fed by concealed wiring systems;
- Supplies to ancillary equipment i.e. AV systems, security systems, CCTV systems etc.;
- Fused connection units for fixed equipment including fixed kitchen appliances, fixed bathroom appliances including extract fans, illuminated and / or heated vanity mirrors, heated towel rails etc., security gates, automatic blinds, curtains, roof lights and other specialist equipment;
- External weatherproof socket outlets where required including for potential events, general use and future temporary entrance lighting (e.g. Christmas lights);
- Extra low voltage outlets in bathrooms for shavers, toothbrushes etc.;

Note that the small power provision will be developed during the detailed Design Stages in conjunction with the Client and the Design Team, including the Architect, Lighting Designer, AV Specialist, Spa / Leisure / Pool Speciialsts and Security Specialist.

7.4 General Lighting

Lighting provisions to general and back of house areas will be provided in accordance with current guidelines and industry recommendations.

Lighting to 'living' areas will be developed with TGA's Specialist Lighting Designer in conjunction with the the Architect and the Client and will be coordinated with the general lighting provisions.

7.4.1 Lighting

In general, the following minimum lighting levels will be achieved:

Table 6.1: Lighting Levels

Room Type	Lighting Level
Basement plant rooms	200 LUX
Basement stores and circulation areas	100 LUX
Stores and service risers	100 LUX
Staircase lobbies and corridors	150 LUX
Main Staircase	200 LUX
Garage	250 LUX
Car wash area / display	500 LUX
WC areas	100 LUX
Living Room	150 LUX
Spa/Pool/Leisure areas	To be agreed through Specialist Lighting Design
Kitchen	150 LUX
Study / office	300 LUX
Fitness Area / Gym	250 LUX
Bedrooms	100 LUX
Bathrooms	150 LUX
Treatment Rooms	500 LUX

Lighting installations will comply, where considered appropriate, with the current CIBSE Codes of Practice for interior and exterior lighting and all relevant Codes of Practice in relation to service illumination, limitation of glare index etc. for all areas.

The lighting installation shall also comply with Building Control Regulations Approved Documents as appropriate L1A, L2A & M.

Initial circuit efficacy will be calculated as Building Regulations AD L1A and AD L2A.

7.4.2 Specialist Lighting Proposals

A separate Specialist Lighting Report is appended to this document prepared by our Specialist Lighting Designer on the basis of site inspections and discussions with the Client and Architect.

The Specialist Lighting Report discusses how Cuerden Hall can be provided with specialist lighting design elements as part of the general refurbishment. It recognises that Cuerden Hall is a complex property which has evolved significantly from its initial construction in the early 1700s, that it has been expanded over the last three hundred years, has had multiple uses within this timescale and is now to be returned to its original purpose – as a private home. Essentially it is understood that Cuerden Hall is to be refurbished and remodelled to become a Country House for the 21st century and that specialist lighting design will play a major part in realising this ambition.

All lighting proposals will be sympathetic to the history and aesthetics of the buildings and will be designed in harmony with the architectural approach. Each area of the property will be considered on its' individual merits to attain its own defined identity whilst retaining a site-wide common language.

It is intention that the lighting design will provide a highly flexible scheme that will make use of a variety of pendants, ceiling fixtures, wall lights, table lamps and free-standing floor lamps. This multi-fixture, layered lighting approach means that the rooms can retain their period character whilst offering a modern, tuneable lighting solution. This type of lighting methodology ensures that the end user can tune the room to create the correct ambience for the task at hand.

The exact lighting installation will be considered on a room-by-room basis with the lighting specifically designed for each space, whilst retaining the overall country house aesthetic.

Ultimately being a domestic property, the colour temperature of the lighting installation should generally be towards the warmer end of the spectrum, typically 3000K, but also individually suited to the interior design and materials palette.

7.4.3 Leisure Area including Pool and surrounding spaces

To be determined through liaison of our Specialist Lighting Designer with the Architect and specialist designers / contractors for each particular facility.