

Highgate School - Dyne House

Stage 2
Combined MEP Report

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1 Executive Summary

AECOM have been appointed to carry out a planning update to the existing Dyne House Stage 2 design which was issued August 2018.

The scope of the MEP engineering works is limited to supporting and inputting to the planning documents as well as items which have a visual impact on the planning submittal, such as openable windows. Input into spatial planning has been limited to revising the plant and area schedules incorporated in this report. These sizes are themselves a development of the schedules issued in the Design Update Report issued January 2022. These schedules incorporated the full electrification of primary energy, principally increasing the geothermal heat pump system to provide all the heating and cooling and the removal of boilers.

No updates to drawings were required in this scope or working through internal space planning to incorporate the revised MEP requirements into the architectural as well as structural designs, and is therefore not a full BSRIA BG6 package.

This report sets out the agreed changes in strategy, areas and updated design criteria and reference documentation by way of record to form the basis of a stage 2 plus design period which it has agreed to be carried out prior to stage 3 design activities commencement as a separate period of work.

2 Basis of Design

2.1 Basis of Design

The following engineering services systems shall be provided;

Mechanical Engineering Services

- T10 Primary Heating Systems
- T14 Heat Pumps / Geothermal Systems
- T20 LTHW heating Distribution
- T61 Chilled Water Distribution
- T70 Local cooling units / Heat pumps
- U10 Supply and Extract Ventilation Systems
- U30 Air Conditioning

Public Health Services

- R10 Rainwater Pipework and Gutters
- R11 Foul Drainage Above Ground
- S10 Domestic Cold Water Services
- S11 Domestic Hot Water Systems

Electrical Engineering Services

- V10 Electricity Generation
- V11 Utilities Supplies
- V20 Low Voltage Distribution
- V21 General Lighting
- V22 General Power
- V40 Emergency Lighting
- W41 Security Systems
- W50 Fire Detection and Alarms
- W51 Earthing and Bonding

- W52 Lightning Protection

Fire Protection Services

- S61 Dry Risers

Vertical Transportation

- X10 Lifts

Building Management System

- W60 Automatic Control Systems/Monitoring

British Standards and Codes of Practices

Compliance shall be provided with all statutory requirements and the following:

- CIBSE Guide, CIBSE Lighting Guides, CIBSE TM52
- IEE Regulations 18th Edition (BS 7671:2018+A2:2022)
- HSE, COSHH.
- British Standards
- BB101
- GLA planning requirements 2021

Standards shall be current at the commencement of Stage 2 design September 2022

2.2 Design Criteria

The following tables summarise the design criteria, parameters and principles that shall be applied to the design of the Engineering Services for the building.

2.2.1 Environment Conditions

London has a temperate oceanic climate, with warm summers and cool winters and is famous for its long periods of overcast skies and frequent light mist-type precipitation. London's large built area creates an "urban heat island" effect that keeps the centre significantly warmer than the surrounding area. For our Design we use the following parameters:

2.2.2 Common Design Criteria

Table 1 - Common Design Criteria

Parameters	Proposed Value/ Criteria
External Conditions	
Temperature	
Winter	-4°C DB Saturated (Full Load Sizing) -10°C DB Saturated (Frost Protection)
Summer	31°C DB. 22°C WB (Comfort) 35°C DB. 23°C WB (Plant Sizing)
Internal Conditions	
Temperature	
Seminar Classrooms	Summer: Adaptive (TM52) ... Winter: 21°C
General Classrooms	Summer: Adaptive (TM52) ... Winter: 21°C
Music Classrooms/Teaching Rooms (and associated break out spaces)	Summer: Adaptive (TM52) ... Winter: 21°C
Open Collaborative Area, Quite Study Area	Summer: Adaptive (TM52) ... Winter: 21°C
Cellular Office, Staff Base	Summer: Adaptive (TM52) ... Winter: 21°C
IT Study Area/Classroom	Summer: 25+/-2°C ... Winter: 21°C
Computer Studies Area	Summer: 25+/-2°C ... Winter: 21°C
Common Room	Summer: Adaptive (TM52) ... Winter: 21°C
Café/Food Court	Summer: Adaptive (TM52) ... Winter: 21°C
Front Entrance	Summer: Adaptive (TM52) ... Winter: 21°C
Informal Assembly Area	Summer: Adaptive (TM52) ... Winter: 21°C
Existing Retained areas	As existing
Control Room	Summer: 25+/-2°C ... Winter: 21°C
Circulation	Summer: Uncontrolled ... Winter: 18°C
Plant	Summer: Uncontrolled ... Winter: 16°C
Toilets	Summer: Uncontrolled ... Winter: 18°C
Store rooms (general)	Summer: Uncontrolled ... Winter: 18°C

Humidity	Humidity control provided in existing retained services
Operating hours	Refer to Modelling section of report for occupancy hours
Building air tightness	3.0 m³/hr/m² @ 50Pa
Noise and vibration criteria	Refer to AJA acoustic report

2.2.3 Mechanical Design Criteria

Table 2 - Mechanical Design Criteria

Parameters	Proposed Value/ Criteria
T10 Low Temperature Hot Water Heating	
Design Water Temperatures:	
Low Temperature Hot Water (LTHW) GSHP	Flow 40°C, Return 35°C (note, heat pumps for heating only, DHW provided by local electric units)
System Redundancies:	
GSHP	Heat pumps: N plus 1 Boreholes: 10%
Spare Capacities:	
Risers	20%
T60 Chilled Water	
General Internal Heat Gains / Allowance in Cooling System	Refer to modelling report for detailed breakdown
Design Water Temperatures	Flow 6°C, Return 12°C
Diversities:	
Risers	None
Heat pumps	None
Borehole array	None
Boreholes	None
U10 Supply and Extract Ventilation	
Fresh Air & Ventilation Rates:	
Occupied areas (teaching, practice, office)	10l/s per person minimum fresh air
Naturally ventilated areas	As required to meet conditions
Toilet and shower areas	8 ACH
Store rooms	1 ACH

Plant rooms	1 ACH
Circulation	As required to balance system
Filtration standards	
General AHU	Pre-filter Grade EU3 panel type After-filter Grade EU7 bag type
Ductwork cleaning	In accordance with the requirements of TR/19 guidance document issued by the B&ES Association; British and European Standard BSEN:15780; and BSRIA guide BG49/2015 (BSRIA's guide on Commissioning Air Systems).
Redundancies:	
General AHU	None
Toilet extract fans	Twin extract fan (n+1)
Spare capacities:	
Risers	None
Plant	None

2.2.4 Electrical Services Design Criteria

Table 3 - Electrical Design Criteria

1. Parameters	Proposed Value/ Criteria
V10 Electricity Generation	
Standby/Life Safety generator	None
Photovoltaic cells	Expected to cover approximately 25% of the Front Building's roof area
V11 Utilities Supplies	
Source	Mains, derived from Distribution Network Operator (DNO) at 400 V.
Voltage	400V +10%/-6%
Target Power factor	0.95 min (cos φ lagging). No compensation for leading power factors
Power Factor Correction	Provision at main LV switchboards
Harmonic filtration	Provision at main LV switchboards
Service resilience	None
Basis of assessment of Service Rating (Reserved Max Demand)	Maximum demand over 30 min period. Building occupied.
Spare capacity	15% included in max demand
V20 Low Voltage Distribution	

Voltage drop limits (steady state):					
Mains and Sub-mains distribution	4% (of the fundamental)				
Final distribution	2%				
	Note: Voltage drops are expressed at 50 Hz				
Main switchboard	Form 4 Type 6, front access and top entry/exit. Fault current withstand (kA) to suit incoming supply rating as advised by the DNO.				
Distribution board	Standard lighting and power DB. Additional DBs serving individual rooms, as per the Room Data Sheets. Size and rating to suit.				
Rising busbars	None				
Containment	Steel ladders, trays, and trunking to suit				
Sub main cabling	XLPE/ SWA/ LSOH copper cables				
Spare capacities					
Main switchboard	15% spare ways				
Distribution board	25% spare ways				
Space on Containment for future sub-main cables	15%				
Lighting and small power allowances					
Area	Power Allowance (W/m2)	Small Power		Lighting	
		p.f. (cos Φ)	Diversity	p.f. (cos Φ)	Diversity
Auditorium	45	0.8	80%	0.95	80%
Auditorium Foyer / Assembly Area	22	0.8	80%	0.95	80%
Circulation	15	0.8	50%	0.95	50%
Classroom / Practice Room	24	0.8	90%	0.95	90%
Collaborative Area	27	0.8	80%	0.95	80%
Computer Studies	42	0.8	90%	0.95	90%
Electronic Library	42	0.8	90%	0.95	90%
Entrance/Lobby	15	0.8	60%	0.95	60%
IT Classroom	42	0.8	90%	0.95	90%
IT Study Area	42	0.8	90%	0.95	90%
Meeting Room	27	0.8	90%	0.95	90%
Offices	37	0.8	90%	0.95	90%
Plantroom	22	0.8	50%	0.95	50%
Recital Hall	45	0.8	80%	0.95	80%
Recording Studio	55	0.8	70%	0.95	70%
Sixth Form Café	42	0.8	80%	0.95	80%
Sixth Form Common Room	27	0.8	90%	0.95	90%
Storage	18	0.8	50%	0.95	50%
Study Area	37	0.8	90%	0.95	90%
Toilets	22	0.8	70%	0.95	70%
V21 Lighting					
Lighting to SLL LG 5: Lighting for education (2011)					

Area	Maintained Average Illuminance in lux	Glare (UGRL)	Overall Uniformity (Uo)	
Classrooms, tutorial rooms, Study Areas	300 on working plane	19	0.6	
Classroom for evening classes and adults education	500 on working plane	19	0.6	
Auditorium, lecture halls, Recital Hall	500 on working plane 750 on Blackboards	19	0.6	
Blackboards	500	19	0.7	
IT rooms	300 on working plane	19	0.6	
Entrance hall	200	22	0.6	
Circulation Areas, Corridors, Foyers, Bridges	100	22	0.4	
Stairs	150	25	0.4	
Common Rooms and Break Out Spaces	200	22	0.4	
Staff Room/ Office	300 on working plane	19	0.6	
Café/ Food Court	200	22	0.4	
Conference and meeting rooms	500 on working plane	19	0.6	
Assembly Halls	200	22	0.4	
Jewish Circle	300 on working plane	19	0.6	
Electronic Library	Bookshelves: 200 on vertical surface Reading Areas: 500 on working plane	19	0.6	
Plantrooms	200	25	0.4	
Store/ Storage	100	25	0.4	
Toilets	200	25	0.4	
External Social Seating Area/ Terraces	0-5	-	-	
V22 Small Power				
Circuit protection	All circuits RCD protected, excluding fixed equipment supplies.			
Cleaners sockets	Outlets incorporate 30mA trip RCD			
Minimum final circuit conductor sizes:				
Small power circuits	4 mm2			
V32 Uninterruptible Power Supplies	N/A			
V40 Emergency Lighting	Lighting to BS 5266:2016 and BS EN 1838:2013. Self-contained Integrated 3 hour emergency battery backup.			

	Emergency Exit signage to BS EN 1838:2013 which requires that the luminaires sited at points of emphasis must comply with BS EN 60598-2-22:2014+A1:2020
W30 Telecoms & Data	Design by client IT team
W20/40/41 Security	Design by client security team
W50 Fire Detection and Alarms Installation	System to BS 5839-1:2017
Categories of Protection	
Category L2	Areas protected by automatic detection:
	- Escape routes
	- Rooms accessed off escape routes
	- High risk areas as defined by the Fire Engineer
	- Plantrooms
Disabled Alarms	
Disabled Refuge alarms	To be provided in refuge areas
Disabled WC alarms	To be provided in each disabled toilet/ shower
Voice Alarm	N/A
W51 Earthing and Bonding	In accordance with BS 7671:2018+A2:2022 Wiring Regulations
W52 Lightning Protection System	System to BS 62305-1:2011
Loss risks to be considered	Human life & economic value
Lightning Protection Level	IV
X10 Lifts	
Staff transport, disable access and evacuation lifts	2 No.
Staff transport, disable access, evacuation and goods/plant replacement lifts	1 No.

2.2.5 Public Health Services Design Criteria

Table 4 - Public Health Design Criteria

Parameters	Proposed Value/ Criteria
R10 Rainwater Pipework and Gutters	
Design storm rainfall intensity	1 in 50 year event @ 0.056 l/s/m2
R11 Foul Drainage Above Ground	
Foul drainage k factor	0.7 frequent use
S10 Domestic Cold Water Services	
Cold water storage	1/2 day storage, based on daily demand of 20 litres per person and 775 pupils and staff members (based on Accommodation Schedule dated 16.07.2018).
S11 Domestic Hot Water Systems	
Domestic hot water temperatures	Flow 60°C
Minimum Domestic Hot Water Generation Temperatures	
Storage systems:	60°C
Instantaneous systems:	55°C
S61 Dry Risers	
Design standard	BS 9990:2015

2.3 Life Expectancy

Table 5 - Plant Life Expectancy

Equipment	Life expectancy (years)
Water Storage Tanks (sectional GRP)	30-35
Ductwork (galvanised)	40
Heat recovery ventilation units	10-15
Closed pipework systems (steel)	35
Pumps (base mounted)	15-20
Internal drainage cast iron (SWP and rainwater)	30-35
Smoke detectors	10-15
Electrical switchgear and distribution equipment	20-25
Transformers (dry)	25-30
Mains cables	25-30
Lighting installations (internal)	20-25

Controls (BMS operating system)	5-10
Controls network (hardwiring)	24
Control valves/dampers	10
Controls general (electric)	15-20
PA systems	25-25
CCTV systems	10-15
Lightning protection systems	25-30
Boilers	25-20
Emergency Lighting (batteries)	5
Fire Alarms (Main System)	20
Heat Pumps	15

3 Incoming Utilities

It is proposed that all existing utilities connections will be stripped out and new provided. Refer to drawing 60580302-DH3-V-VAR-PLN-XX-001 for location diagrammatic summary.

3.1 (R10) Storm Water Disposal

The surface water runoff from the upper site including Dyne House, retained Auditorium, Recital Room, and the new Auditorium Store shall discharge to the main TWA sewer crossing the site. The lower site new buildings roofs and external areas shall be connected to a common storm water drainage system from levels -3 to -4 and pass through external stormwater attenuation storage prior to connecting to sewer.

The storm water system shall discharge by gravity into the combined public sewer system, refer to Structural Engineers report.

3.2 (R11) Domestic Foul Water Disposal

The foul drainage discharge from Dyne House and the retained auditorium building's sanitary appliances and plantroom floor gullies shall connect to the existing combined underground drainage at Level -1 and discharges by gravity via existing connection to the TWA sewer crossing the site.

Foul drainage from sanitary fittings and plantroom gullies from the rear new buildings shall discharge to a foul drainage underground system at level -4 and connect to existing foul drainage at the rear of the site.

The details of underground foul drainage across the site into the combined public sewer connection, refer to Structural Engineers report.

3.3 (R10) Domestic Water Supply

A single, metered MDPE (barrier pipe) service pipe shall be provided from the existing town's water network.

The service shall enter the Dyne House Front Extension meter room at level -1 and is routed to the water storage tankroom at level -5 via purpose made services distribution routes and risers. Where the new service enters the building through the structure, a suitable water barrier or flange to prevent ingress of ground water from outside shall be pre-positioned and cast into structure.

A water meters with pulsed output (to allow linkage to a BMS) shall also be installed on the mains supply to the building^{BREEAM.WAT2} to allow reading and BMS logging and reporting and to provide detection of water leaks.

3.4 (S32) Natural Gas Service

No gas supplied to this site.

3.5 (V11) Electricity Services

Dyne House will have two new 3-phase incoming low voltage supplies; one to serve Dyne House, Dyne House Front Extension and the Bridge Link and one to serve the Rear Block. The 400 V supplies will originate from the LV Switchroom located next to the proposed UKPN substation on the Island Site above the tunnel entrance (refer to Substation Study in section 2.5.1)

3.5.1 Substation Study

3.5.2 Introduction

Major refurbishment works are due to be undertaken on the Dyne House as part of an extensive programme of works. Highgate School also has a desire to consolidate the electrical supplies for the buildings on the Island Site (Big School, Charter Building, Garner Block and Science Block) onto a single substation. The substation is intended to be located next to the entrance to the foot tunnel currently connecting the Island Site to Dyne House. Due to Dyne House requiring a new electrical supply to meet the additional demand of the new scheme, the installation of the new substation is to coincide with the construction of Dyne House, with the supply to the Island Site buildings being transferred to the new substation at a future date.

The purpose of this study is to establish the size of the substation required and assess possible configuration options.

3.5.3 Load Analysis

A load survey was previously conducted on the Island Site buildings by Peter Deer and Associates (PD&A) in March 2015; the data from this has been used for the maximum demand values for the related buildings. A 25% future expansion factor has been applied to all of these values to provide a provision for any improvements that may be made at a later date. The two exceptions to this are:

- Old Garner Building LHS – New meter: There is planned refurbishment work to the Science Block within the next few years. During this period, the Old Garner Building will provide temporary accommodation, and a provision for a larger electricity supply will be required to account for this.
- Science Block – Staff room SPN meter: No load has been shown in PD&A's survey so the load has been assumed to be 80% of the capacity of the installed service head.

Table 6 - Maximum demands of individual buildings. Island Site buildings highlighted in green.

Load Type	Max Demand (kVA)	Item	Notes
Big School - Undercroft	66.25	A	PD&A data + 25% future expansion
Science Block - Staff room TPN meter	22.5		PD&A data + 25% future expansion
Charter Building	101.25		PD&A data + 25% future expansion
Old Garner Building LHS - New meter	66.25		(PD&A data + Science Block TPN load) + 25% future expansion
Old Garner Building RHS - Old meter	45		PD&A data + 25% future expansion
Science Block - Staff room SPN meter	18.5		No load shown in PD&A report; assumed max. load is 80% of the 100A SPN supply
Dyne House - Old block	165	B	
Dyne House - New block	200		
Temporary accommodation	100	C	From PD&A data: likely to reduce as the new RMC will also be used for temporary accommodation
TBS	285	D	

Table 7 - Electrical demands of different scenarios

Scenario	Max Demand (kVA)	Items	Notes
1. Dyne House under construction	443	C + D	
2. Dyne House commissioning/handover	808	B + C + D	Worst case: commissioning during peak school hours in winter
3. Island Site consolidation	684.75	A + B	

Scenario 2 requires the greatest demand; for which a 1 MVA substation would sufficiently serve the loads. Scenario 3 will be the final load on the transformer after consolidation of the electrical supplies on the Island site have been completed and removal of any temporary builders accommodation required for Dyne House. Therefore a 1 MVA substation is the most appropriate selection, as it can serve all loads whilst leaving surplus capacity for further refurbishment works in the future (providing Highgate School reserves the full 1 MVA capacity).

3.5.4 Substation Options

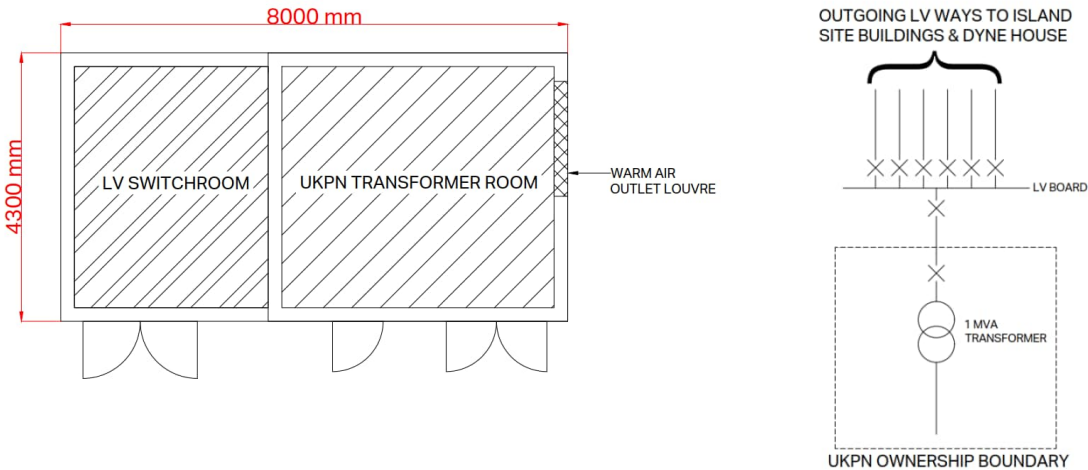
A new HV service from UKPN will be required for all three options. The cost implication and installation time required for this will be dependent on the proximity of existing HV infrastructure in the area surrounding the proposed location of the new substation.

All dimensions and configurations shown in the options are subject to approval by UKPN. 24 hour access is required by UKPN to any plant within their ownership boundary. Dimensions related to any UKPN owned areas are from UKPN's standard design guidance (drawing nos. EDS 07-3102.21). Earthing pits and other below ground trench/ducting is also required which will need considering by the Structural Engineer if the substation is to be situated above the tunnel entrance.

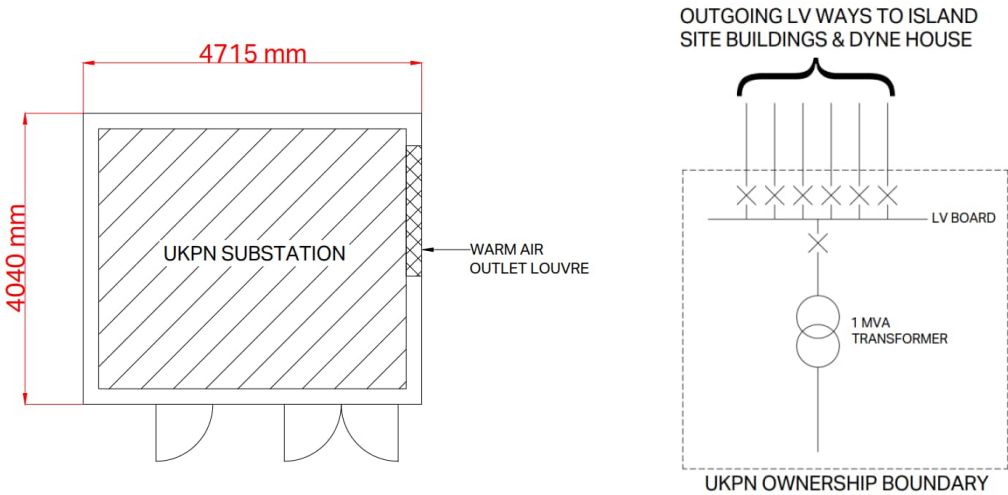
3.5.5 Option 1 UKPN Owned Substation

For Option 1, UKPN will own and install all of the electrical plant required. Due to this, the configuration is simplified in comparison to the other options, resulting in a much smaller footprint.

Advantages	Disadvantages
Smallest footprint of three options	An intake service head will be required for each supply to the areas served
Lowest cost of three options	An application to UKPN will need to be made for each connection during the consolidation process
No ongoing maintenance to UKPN-owned equipment	Each supply will have an individual metering point



Advantages	Disadvantages
Single UKPN revenue metering point	Larger footprint compared with Option 1
Engagement with UKPN during consolidation process not necessary	Higher capital cost due to additional electrical plant and building



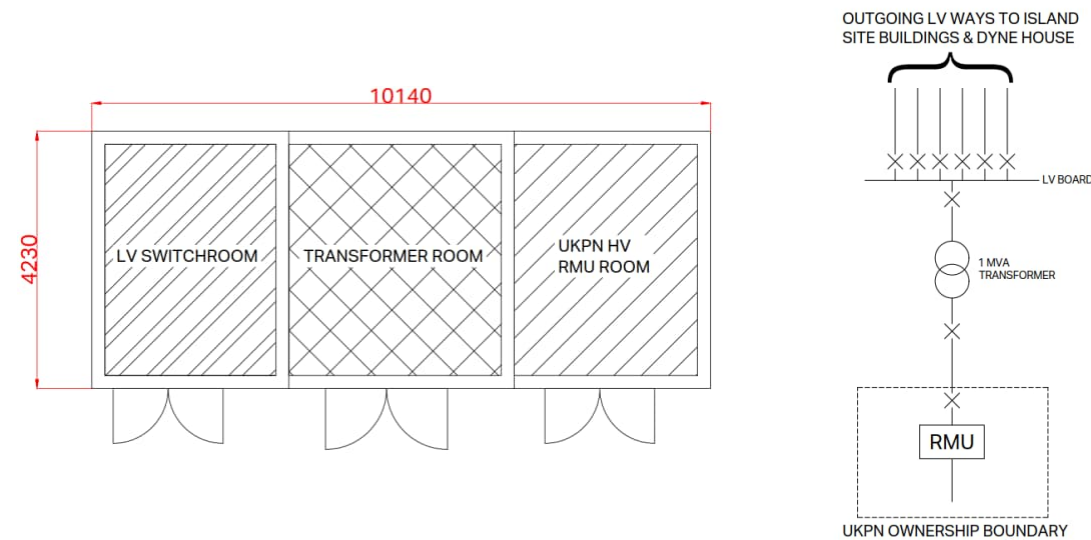
3.5.7 Option 3 UKPN Ring Main Unit & Privately Owned Transformer & LV Switchroom

With Option 3, Highgate School will be purchasing power at High Voltage, compared to Low Voltage with the other two options. This results in UKPN owning only the HV Ring Main Unit.

Advantages	Disadvantages
Single UKPN revenue metering point	Largest footprint of all three options
Engagement with UKPN during consolidation process not necessary	Largest capital cost due to additional electrical plant and buildings
Long-term running cost saving through purchasing power from UKPN at HV	HV maintenance will be required due to client ownership of transformer
Greater flexibility; client may select a transformer of their choice with respect to type and rating	
Transformer may be upgraded at a later date if deemed necessary (e.g. due to significant expansion of school campus)	

3.5.6 Option 2 UKPN Transformer Single LV connection

The LV Switchroom will be owned, operated and installed by Highgate School. A single 1600A (1MVA) LV connection would be taken from the UKPN substation there will be a single revenue meter UKPN metering point within this main LV Switchroom. A client owned switchboard would then distribute to the individual buildings. The two rooms do not necessarily need to be adjacent as shown; if required they can be situated a short distance apart (the larger the distance, the more costly the cable installation between the two buildings).



3.5.8 Aspects Still to be considered

- Still need to allow for how the cables will be connected (buried/ducts etc.)

3.5.9 Summary

Option 2 represents the best compromise between the three options, with respect to overall footprint of the installation, and flexibility available in the future for additional connections and upgrades. The viability of this option is dependent on the architect and structural engineer finding suitable locations for the building(s).

3.6 (W10) Communications

The building shall be served by two incoming fibre optic cables, each terminating into an IT Patch Panel Room; one situated in Dyne House and another in the Rear Block. The design of the communications and AV systems is to be carried out in house by Highgate school.

4 Engineering Services Strategy

4.1 Summary

Dyne House is being designed as a low energy building solution to meet the client's needs and tie in holistically with architecture. This is designed to achieve a balance of low energy and low maintenance while still meeting the standards expected from a modern building.

Where possible a passive approach to the building design is utilised together with low specific fan power ventilation. A closed loop geothermal system for those areas where cooling is required will provide the building with a sustainable solution and low carbon emissions.

All primary services are centralised, with the exception of the LV panels where the horizontal distances prohibit, to maximise the spatial efficiency of the available floor area. Local ventilation units will be utilised as far as possible to further minimise the central plant areas and distribution zones.

All technologies employed are well proven and reliable. Design fundamentals, such as underfloor and ceiling void distribution and spare capacity on the primary wet distribution allow flexibility for future alterations to suit alternative learning requirements.

Note sketches demonstrating strategy included in this report were developed during the stage 2 design process and may not reflect the very latest architectural backgrounds if strategy remains unaffected.

Mechanical smoke ventilation or sprinkler protection is not provided as natural smoke clearance is being provided as part of the architectural design. Escape staircase pressurisation or venting is not being provided as it is understood that the building does not meet the criteria requiring this treatment. This is to be finalised with Building Control however, so remains a risk that it may have to be provided at a later stage in the design.

This report is an update to the 2018 report to reflect and record the new energy strategy and align with the latest planning requirements, specifically the following documents:

- Energy strategy, Inc Part L 2021 assessment
- Sustainability statement
- Overheating report
- BREEAM 2021 pre-assessment
- Be seen report
- Circular economy statement
- Whole life carbon report

No updated engineering drawings have been produced.

4.2 Plant Strategy

The building services plant is centralised in the following primary locations (new unless otherwise stated):

- L00/L-01 Substation
- L-01 AHU Plantroom (existing and retained)
- L-01 AHU Plantroom (serving Informal Assembly Area)

- L-01 LV Switchroom
- L-04 Geothermal System and Boiler Plantroom
- L-04 DW Tank and Pump Room
- L-05 AHU Plantroom (Serving Back Building)
- L-05 LV Switchroom

4.3 Distribution of Services

Generally services shall be distributed vertically in risers located in the Rear Block and Dyne House with primary services connecting the buildings. Horizontal distribution will be exposed at high level in the front building and in floor voids in the rear building. Level -05 has additional floor void to accommodate the geothermal pipework (100mm zone) as well as local dropped slab to provide a trench for primary ductwork.

Cabling systems shall be run on cable ladder, tray or baskets throughout the building, which in turn shall be fixed to the building fabric.

Where services pass through building fabric identified to be a fire barrier, fire stopping and dampers in ductwork will be provided to maintain the integrity of the fire barrier.

4.4 Access to Plant and Distribution of Services

Building services vertical risers will be provided with access by provision of double or single leaf hinged doors at each level. Accessible risers will be provided with an infill slab or metal deck grillage to allow walk in access.

Where doors are not feasible, access shall be provided by removable access panels. Removable access panels are appropriate for access to water services and drainage at the rear of WC cores.

Access to all services running horizontally in floor voids shall generally be provided through the removable floor tiles. Where solid (non-accessible floorings are provided) access panels shall be provided to facilitate access to services for maintenance.

Access to all services running horizontally in ceiling voids shall generally be provided through the removable ceiling tiles. Where ceilings are solid, access panels will be provided to facilitate access to services for maintenance.

4.5 Plant Replacement Strategy

Plant replacement from the new plantrooms will be as set out in the sketches below. Large items of replacement plant will be of a maximum weight and size as to be accommodated in the lift of 1600 kg and 1300x2200mm door opening. Plant items outside of this specification must be modularised to fit into this strategy.

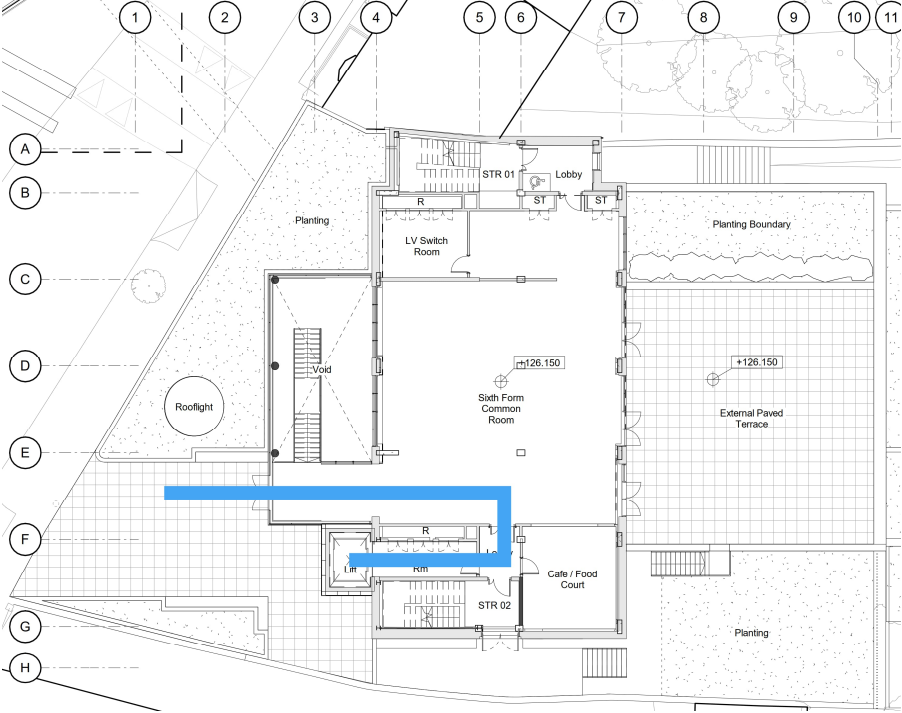


Figure 1 - Plant replacement for Dyne House, Level 0

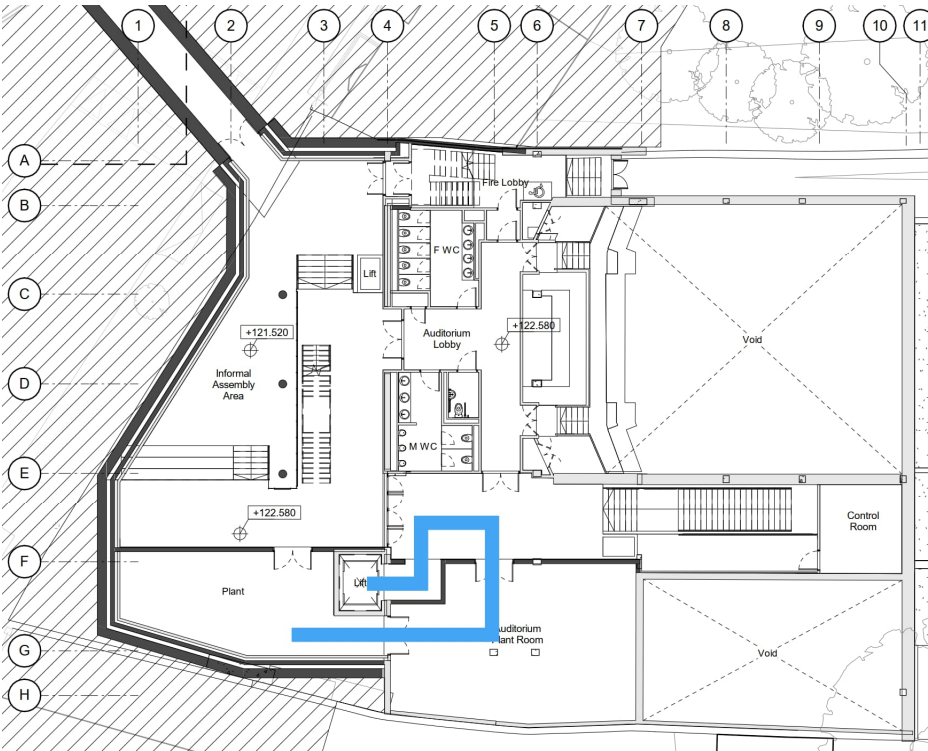


Figure 2 - Plant replacement for Dyne House, Level -1

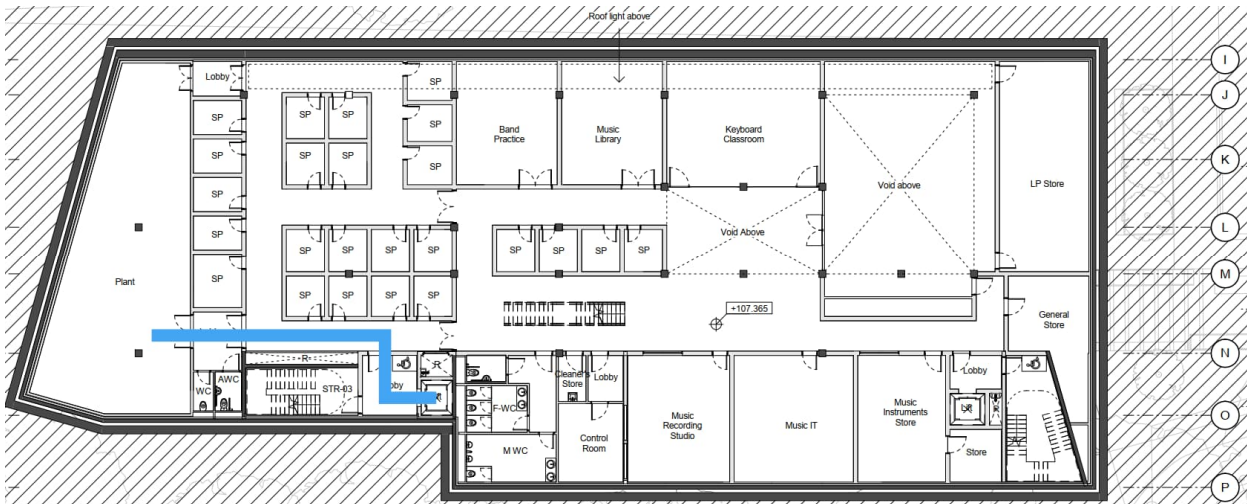


Figure 3

- Plant replacement for Rear Block, Level -5

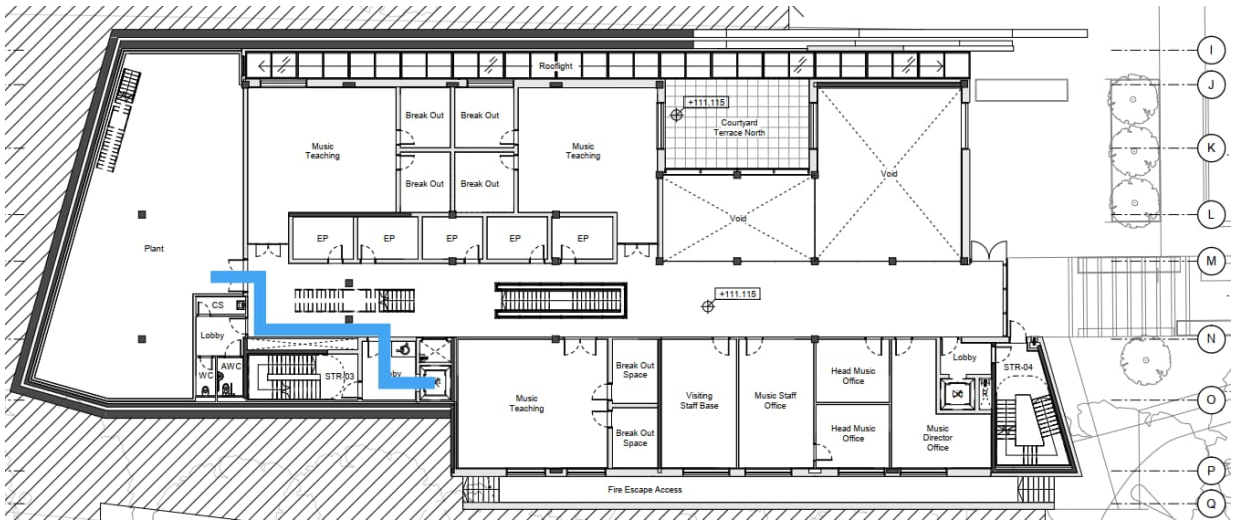


Figure 4 - Plant replacement for Rear Block, Level -4

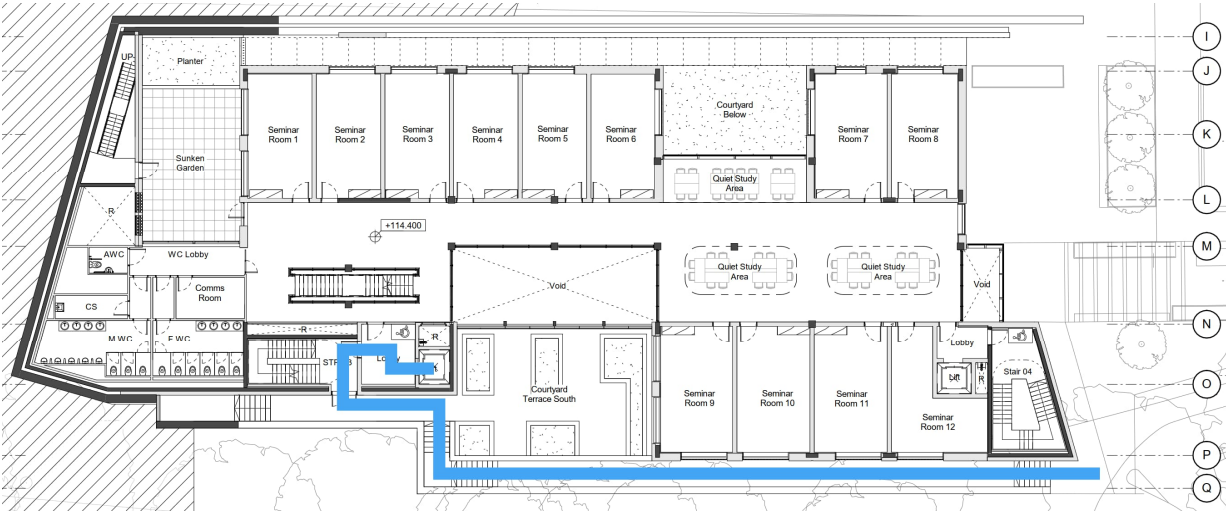


Figure 5 -

Plant replacement for Rear Block, Level -3

4.6 Primary Plant and Riser Schedules Plant

Highgate DH scheme Stage 2 update			
Sep-22			
L-05 Basement plant room			
	New Area (m ²)	Clear height (m)	Comments
District heat network sub-station space allowance	10	3.5	Space allowance identified only. Interium use for other purposes allowed
Air handling plant (new block)	66	3.7	10% size increase allowed in case additional efficiency required from air handling plant
Switchroom No.2 (Back Building)	30	3.5	10 x 3 x 3.5(H), based on SWBD 9 x 0.8 x 2.3(H). Estimated from LV schematic, reserve space for PFC and AHF. SWBD size dominated by the sheer no. of classroom / seminar room and actual site layout plan.
MCC	4.5	3	
Cold water transfer tank and pump set	4	3.5	
Cold water storage tank & Cat 5 tank, booster & water treat	40	3.5	39.65m2 round up
Hot water generation plant - Elec	1	1.5	Local at point of use
	155.5		
L-04			
	Area (m ²)	Clear height (m)	
Area for AHU distribution (ducts servin glandlocked AHU)	30	3.5	
Geothermal (closed loop borehole system)	80	3	Heat pump area approximatley equivalent to previous boiler and heat pump. Possible change highlighted upon optimisation
	110		
L-2 Roof level			
	Area (m ²)	Clear height (m)	
Dirty extract fan inc attenuation (mounted in ceiling bulkhe	6	0.5	
	6		

L-01			
	Area (m ²)	Clear height (m)	
IT/Comms intake	6	3.5	
Incoming water meter	4	3	
Air handling plant (Informal assembly area) AHU01	48.3	3.5	Highlighted as possible, however plant room constrained by site extents, therefore limited scope in reality. Area shown is as existing design
	58.3		
L00			
	Area (m ²)	Clear height (m)	
UKPN Substation	18	2.5	3.61m x 4.715m. Refer to UKPN's standard design guidance (drawing nos. EDS 07-3102.21)
Switchroom No.1	30	3.5	10 x 3 x 3.5(H), based on SWBD 9 x 0.8 x 2.3(H). Estimated from LV schematic, reserve space for PFC and AHF. SWBD size dominated by the sheer no. of classroom / seminar room and actual site layout plan.
	48		

L01			
	Area (m ²)	Clear height (m)	
	0		
L04			
	Area (m ²)	Clear height (m)	
Dirty extract fan inc attenuation (mounted in ceiling bulk)	6	0.5	
	6		
L05/Roof			
	Area (m ²)	Clear height (m)	
Solar PV	Max		PV area to be maximised on top of Front Building
	0		
Total (ex solar PV)	384		

Dyne House 2 Main riser Summary - August 2022					
Front building					
Main risers		width	depth	Levels served	
Riser 1 - Elec					
				Riser width largely dominated by the sheer no. of classroom/seminar room etc DB cables emanating onto individual floors from Main Swbd (location for Main Swbd - TBC).	
Elec		2700	600		
Comms/Data/FA/Sec/BMS		1000	600	L-1 HL to L04	
Dry riser		550	600	Size may vary depending on dry riser cabinet chosen	
				TBC following LV switch room location on Front Building/Island Site Final arrangement. Assume 600mm until then.	
Primary incoming to Back Building		600	600		
Riser 2					
Mech (CHW<HW)		800	600	L-01 HL to L04,	
Dry riser		550	600	Size may vary depending on dry riser cabinet chosen	
				From transfer service trench to roof (cat-5, BCWS end on high level 4)	
PH (BCW)		400	600		
Total		1750			

Risers 4 - Main riser						
						Riser width largely dominated by the sheer no. of classroom/seminar room etc DB cables emanating onto individual floors from Main Swbd (located provisionally at Level -5).
Elec				2700	600	
Comms/FA/Sec/BMS				600	600	
Elec (Primary to back building LV board)				600	400	Possible alternate route through seminar room
Mech (CHW<HW, Local)				400	1000	
						Rise from -05 through -03. DHW generated locally, no riser space allocated
PH (DW)				400	600	
Dry riser				550	600	Sizes may vary depending on Dry Riser cabinet chosen
PH (MCW)				250	400	
Total				5500		

Transfer between front and back building (also called Riser 3)						
						Location between front and back building
Elec (primary to Back building board)				600	400	TBC following final location of Front Building LV Switchboard/Island Site Final arrangement. With ductwork at HL -01 exact location TBD, require confirmation of void depth
Elec (serving local such as lighting and power sockets)				400	400	
Comms/Data/FA/Sec/BMS		1600		600	400	
Mech (CHW)				500	400	In service trench L-02 HL, L-03 HL and under stairs
Mech (LTHW)				500	400	
PH (MCW)				250	400	
PH (BCW)				400	400	
Total				3250		

Vent. Distribution									
Horizontally from plant room via floor voids, however floor voids currently don't have enough space, so additional sub-risers may be required when strategy is finalised									
Riser 7									
Incoming services									
Elec					450		200	2 sets of 2 cables - High level in road underpass -01	
Data								Client to advise - High level in road underpass -01	
Water					200		200	(size of opening required, does not allow for sleeve)	

5 Mechanical Services

5.1 (S32) Natural Gas Distribution

No gas supplied to this site.

(T10 & T60) Primary Heating and Cooling Systems

The heating and cooling shall be provided by the closed loop GSHP system. The heat pump will be sized and configured in an n plus 1 strategy. All heating and cooling plant will be located within the Plant Room at Level -04 in the Rear Block. Pressurisation and expansion equipment will be provided, and the primary circuit will incorporate a deaerator and dirt separator.

Heat pump control and sequencing will be via an integral heat pump controls package with weather compensation to maximise efficiency. The BMS will provide an enable / disable signal, together with common fault alarms.

The GSHP system will be designed in conjunction with the MEP design package to ensure performance and efficiency is maximised. Peak and annual heating and cooling demand will be modelled and designs coordinated and detailed to produce a specific geothermal borehole specification.

Control will be by two port control valves to the air handling plant and heat emitters, and heat pump flow temperature regulation.

Plant and equipment shall be isolated from the building structure by appropriate means of anti-vibration mountings.

Heating for the Island site toilets will be by way of electric heaters.

5.2 (T14) Heat Pumps

The full cooling and heating load will be provided by Geothermal Heat Pumps located at Level -04 in the Rear Block. This will consist of a closed loop geothermal system using a geothermal borefield as detailed in the Stage 4 tender package.

A ground source heat pump specialist sub-contractor shall be employed for the installation design, supply, delivery, installation, testing, commissioning and setting to work of a closed loop ground coupled, borehole based, heat exchanger, generally comprising of the following:

- Supply of heat pumps
- Supply of buffer tanks (if required)
- Supply of ground loop circulation pumps
- Supply and installation of ground loop pipework including boreholes
- Supply and installation of flow and return pipework between manifolds and plant room
- Supply and installation of manifolds and manholes
- Supply and installation of any other component (e.g. valves) required for the system to operate as per the design.
- Initial filling of system
- Testing and commissioning

Refer to schematics for scope of geothermal package.

The ground loops will be run back individually to manifolds in the plantroom which shall connect all loop pipes complete with isolating valves.

The flow and return pipes shall run underground and shall rise into the plantroom where it shall be terminated with isolating valves.

Unless otherwise specified the heat pump shall be complete with microprocessor controller capable of the following:

- Complete autonomous operation, with all appropriate integral protection devices, fault indication and logging, with facility to output common fault alarm.
- Provision for remote heat pump enable and remote heating or cooling control inputs.
- Provision for controlling ground loop and primary circulating pumps
- Provision of all internal and / or external sensors, programmable weather compensated set points for heating and / or cooling.
- Provision for BMS communication via open protocol / busnet type connection

The ground source heat pump specialist shall include all elements considered necessary to affect a complete package, including the following:

- Geological review of site conditions
- Ground loop thermal modelling and hydraulic design
- The drilling and grouting of boreholes
- The provision and installation of all ground heat exchanger pipework, terminating in the plantroom.
- Selection and supply of heat pump(s), ground loop circulator(s) and buffer tank(s) (if required)
- The provision of relevant installation instructions, schematics and wiring diagrams.
- The testing, commissioning and setting to work of the ground loop and heat pumps.
- The provision of test and commissioning data.
- The provision of Operation and Maintenance Manuals

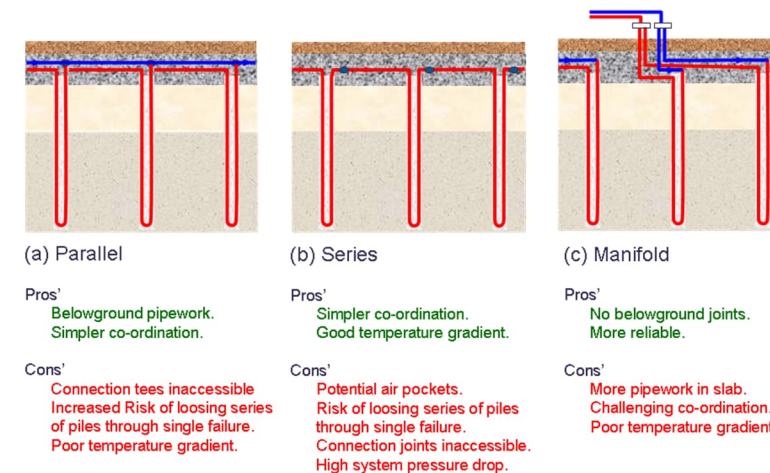


Figure 6 - Ground Source Heat Pump Loop Connections

Ground loop heat exchangers shall be arranged as per option (c) in groups of manifolds connected in parallel arrangement. Systems should be designed as per VDI 4640, part 3, item 6.4.5 page 38:

The circuitry should be designed so that as few joints as possible are inaccessibly located in the ground. All joints below ground shall be electro fused.

Each circuit shall be provided with a constant flow valve, orifice plate and isolation valves.

The system shall comprise a de-aerator and good level of water filtration.

At commissioning, the system shall be flushed at velocities of no less than 0.6m/s to remove air bubbles.

5.2.1 Testing and Monitoring

On all vertical borehole project and energy pile project, temperature sensors shall be located in the ground. These temperature sensors shall be located at the foot of the pile and half way down the pile on the exterior of the borehole.

Alternatively, the monitoring could be done by isolating hydraulically a test pile at times of measurement and measuring the flow and return temperature of that individual circuit.

The monitoring probes shall be distributed in a straight line from the centre of the borehole array towards the outside (It shall be assumed that the heat distribution will be symmetrical across the array).

All buried joints should be pressure tested before being covered.

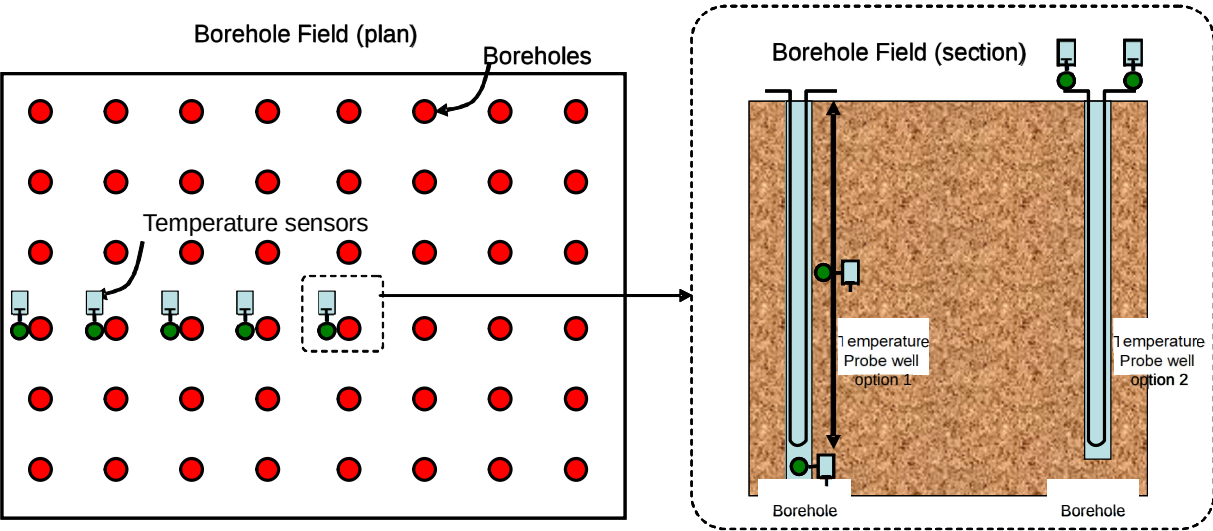


Figure 7 - Borehole Testing and Monitoring

5.2.2 Pipework

General pipework shall be as per PE100 SDR11 rated for 16 bar pressure as per BS EN 12201-part 1 to 3 (2003).

For use in application with waste heat recharge of borehole with solar collection and recharge of borehole, use:

PE-Xa to EN ISO 15875-2:2003: Plastics piping systems for hot and cold water installations - Crosslinked polyethylene (PE-X) - Part 2: Pipes

Durability (safety factor SF=1,25)

Pipe type: SDR 11 rated to PN16 (see below)

Cross-linked Polyethylene (PE-Xa) is more durable and heat resistant than PE100. It is also more flexible and should be used in some applications in particular >40°C.

5.2.3 Fittings for Ground Source Heat Pump Pipework

Installer shall use proprietary pipework fittings on all projects.

			
Use proprietary Probe in PE-Xa with no jointing	Use proprietary probe weights	Use proprietary probe weights	Use proprietary Polyethylene pipe spacers
			High quality thermal grout to be used conductivity >= 1.5 W.m ⁻¹ .K ⁻¹

Use proprietary Manifolds	Use matching Y-pipe to allow multiple circuit per pile	Use Pipework protection sleeve at top of borehole	
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Figure 8 - Ground Source Heat Pump Fittings

The geothermal Contractor shall provide all necessary controls valves, sensors and meters for a complete system. The heat pumps control shall be from the main building control system and the geothermal Contractor shall liaise with them to develop the complete system.

The system shall be developed to meet the performance requirements in terms of anticipated kWhr loads and peak kW duties. The specialist sub contractor shall develop as part of their detailed design a set of sensitivity studies looking at a range of scenarios to be developed through the next design stage.

On this project the owner of the installation wishes to claim RHI subsidy for the installation.

The specialist sub contractor shall undertake, on behalf of the owner, all procurement, installation, and commissioning of the facilities and provide all necessary documentation to enable the owner to apply to Ofgem for accreditation of the installation in accordance with the RHI Regulations and the latest version of Ofgem's guidance documents.

The equipment and installation shall meet the requirements of the following:

- The Renewable Heat Incentive Regulations.
- Volume 1 of Ofgem Renewable Heat Incentive Guidance: Eligibility and how to apply.

Heat meters to be complete with integrator, flow sensor, matched pair of temperature sensors and interconnecting cables and calculator / digital integrator calibrated as a single unit at manufacturer's works. Installation to be in accordance with manufacturer's recommendations.

Meter accuracy class for RHI eligibility to be class 2 as defined in Annex MI-004 of the MID / BS EN 1434-1

5.3 (T20) LTHW Distribution

The LTHW heating distribution system shall comprise of a heating circuit, with circulation pumps located in the plant room at level -04. The pumps shall operate on a variable volume basis to promote energy savings at part load operation, and speed controlled by differential pressure sensors provided in the index circuits.

LTHW heating circuit shall be provided to serve heating coils in the AHU plant and low level radiators. Store rooms, WC's and back of house areas shall be provided with space heating as required to satisfy the design temperature criteria.

Thermal energy metering shall be provided on the LTHW heating circuits as set out in the BREEAM criteria.

All pipework systems which are to be routed externally, and therefore exposed to the risk of freezing, shall be protected by electrical trace heating, pipework lagging and frost protection cycles on the circulating pumps. All plant and equipment shall be isolated from the building structure by appropriate means of anti-vibration mountings.

5.4 (T60) CHW distribution

The CHW distribution system shall comprise of a cooling circuit, with circulation pumps located in the main plant room. The pumps shall operate on a variable volume basis to promote energy savings at part load operation, and speed controlled by differential pressure sensors provided in the index circuits.

Thermal energy metering shall be provided on the CHW cooling circuits as set out in the BREEAM criteria.

External heat rejection is prohibited on this scheme, therefore a secondary CHW circuit and thermal store will need to be considered for the 24/7 cooling requirements alongside the operating requirements of the IT equipment rooms and Power Factor Correction equipment.

5.5 (U10) Supply and Extract Ventilation Systems

5.5.1 General

The ventilation systems are generally dictated by the constraints placed upon them. Fundamentally the building is to be assisted natural ventilation (openable windows during summer, local heat recovery unit during Winter) wherever possible, with mechanical cooling and ventilation provided where heat gains, geometry and noise criteria dictate.

Generally the ventilation strategy can be split into the strategies summarised below. Refer to the inserted ventilation Strategy Sketches below.

Where present, HVAC systems must incorporate suitable filtration to minimise external air pollution, as defined in BS EN 13779:2007 Annex A3.

All ventilation ductwork services shall be fabricated from galvanised sheet steel, and constructed in accordance with DW 144.

All plant and equipment shall be isolated from the building structure by appropriate means of anti-vibration mountings.

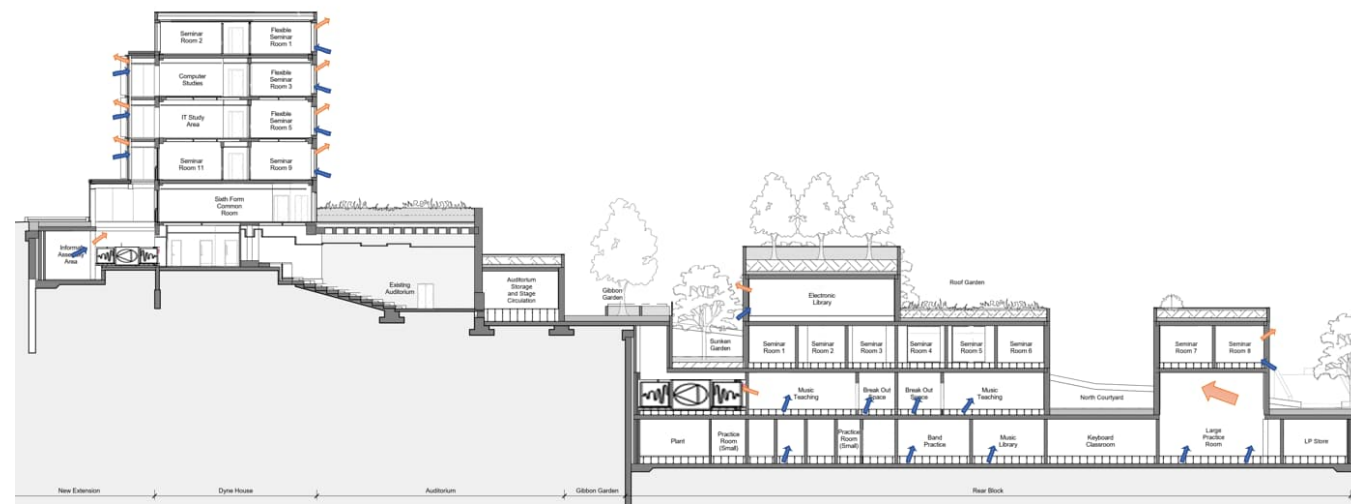


Figure 9 - Building Ventilation Strategy

Free cooling utilising a night time purge is currently part of the strategy. Linked to the BMS provides a delay in the warm up of the building during the day in Summer months, taking greater advantage of the buildings thermal mass, ultimately reducing the peak temperatures experienced in the rooms. All window positions will be reported back to the BMS.

High level windows in circulation areas will be actuated on temperature control to purge warm air from the space.

Figure 10 - L04 Ventilation Strategy

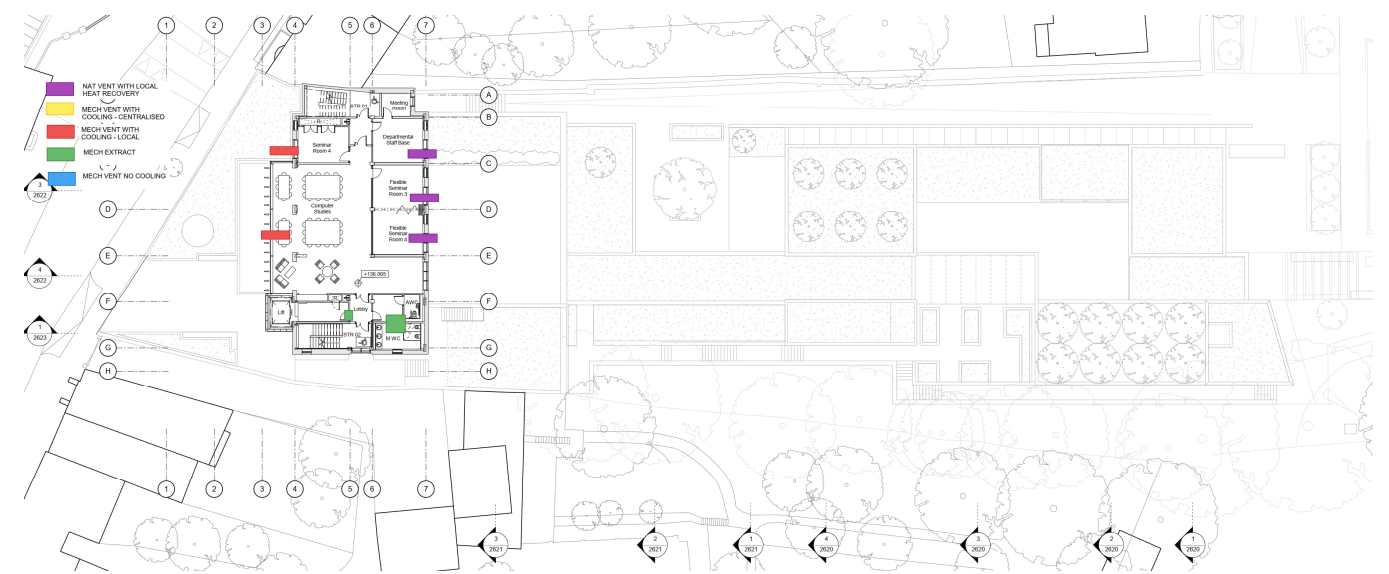


Figure 11 - L03 Ventilation Strategy

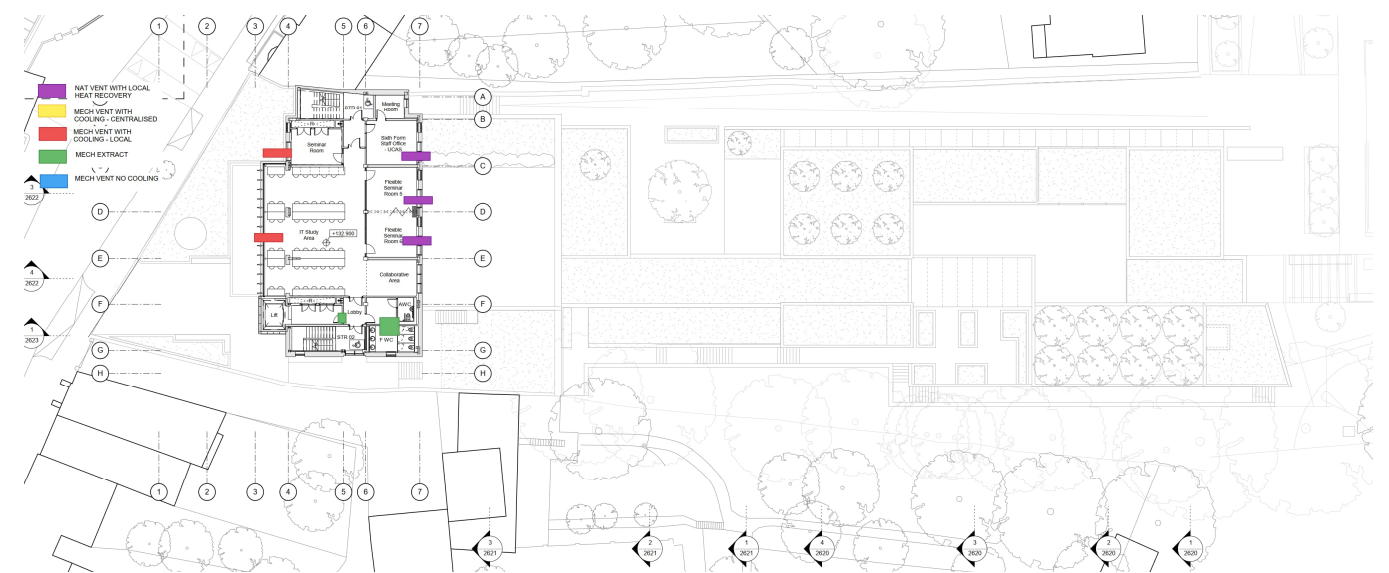


Figure 12 - L02 Ventilation Strategy

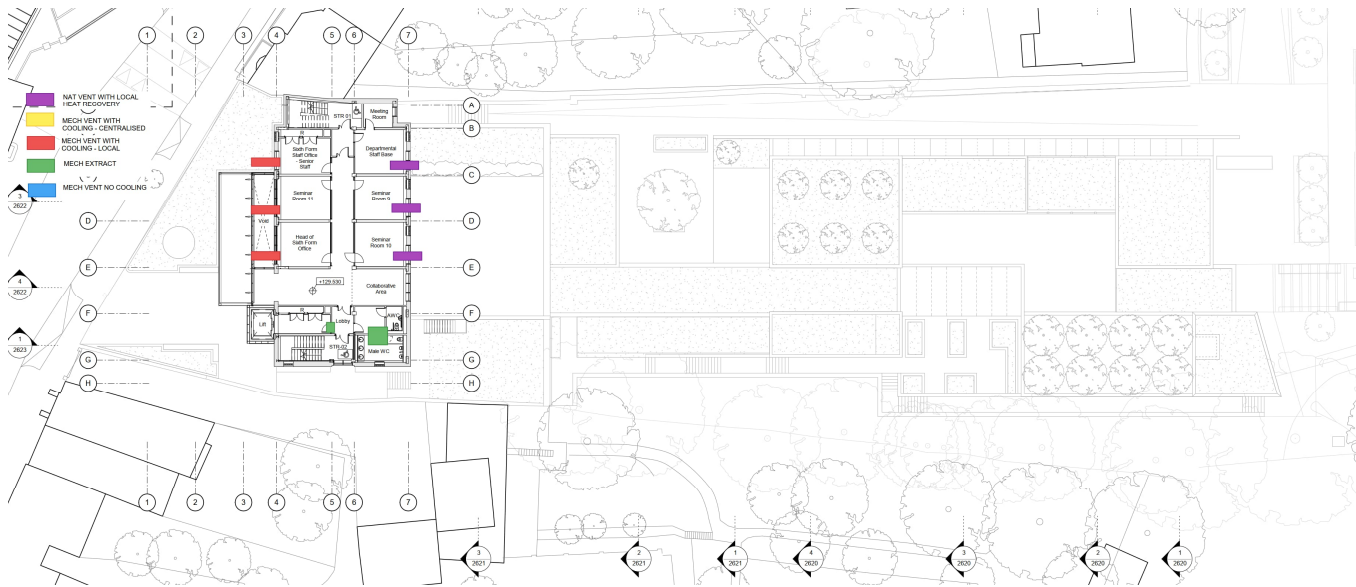


Figure 13 - L01 Ventilation Strategy

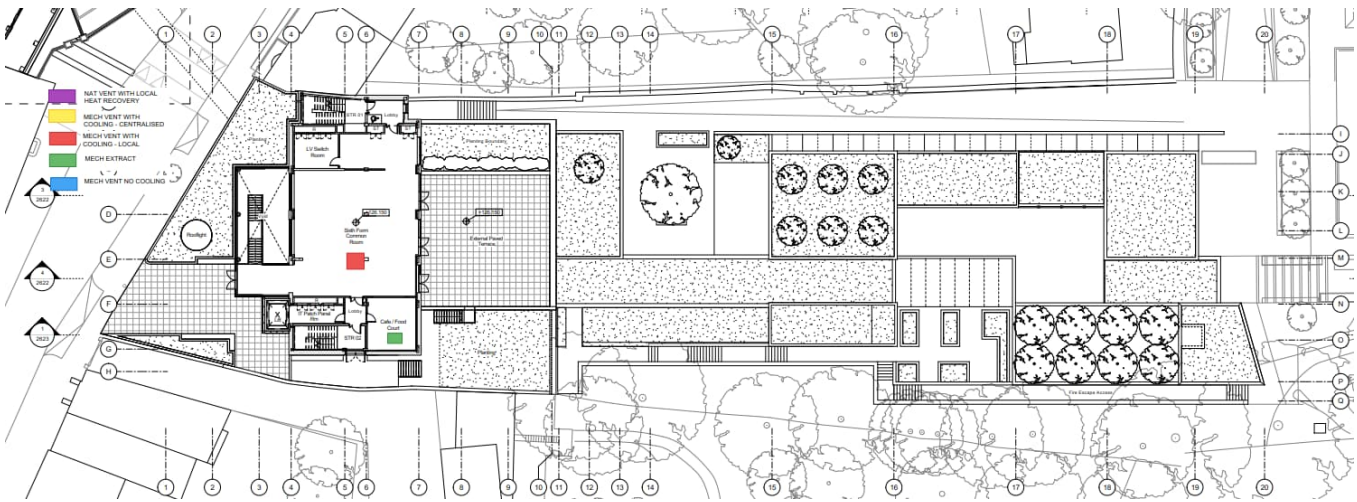


Figure 14 - L-00 Ventilation Strategy

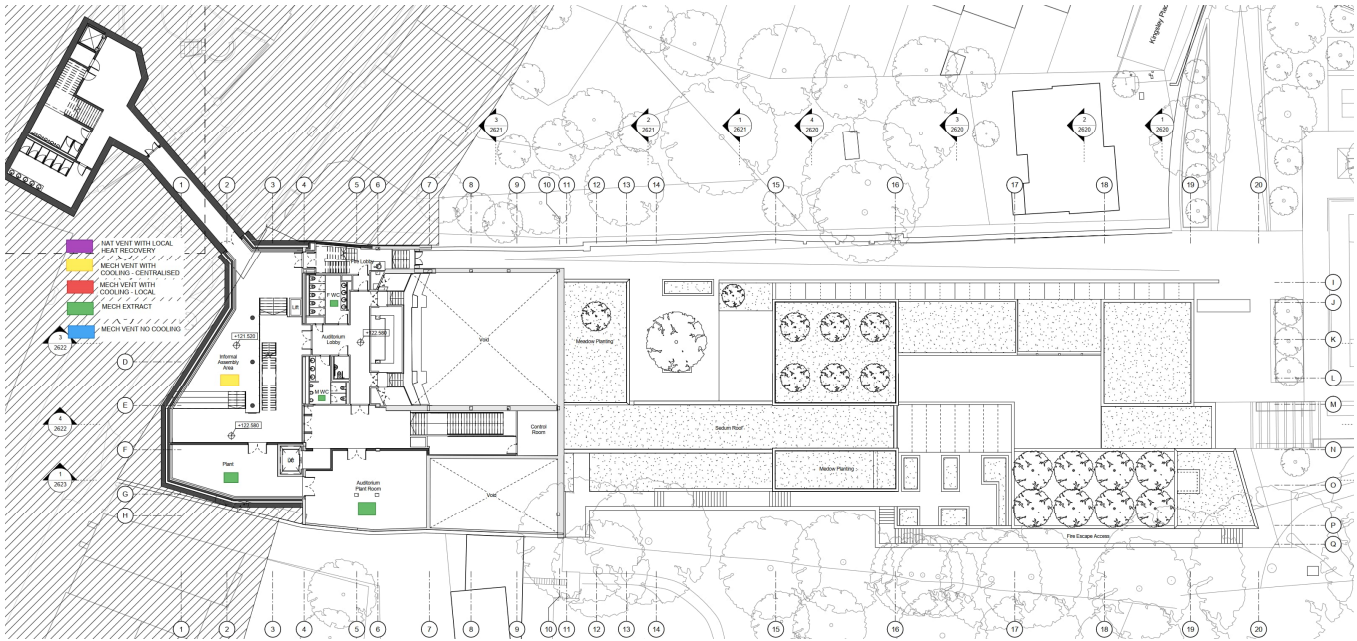


Figure 15 - L-01 Ventilation Strategy

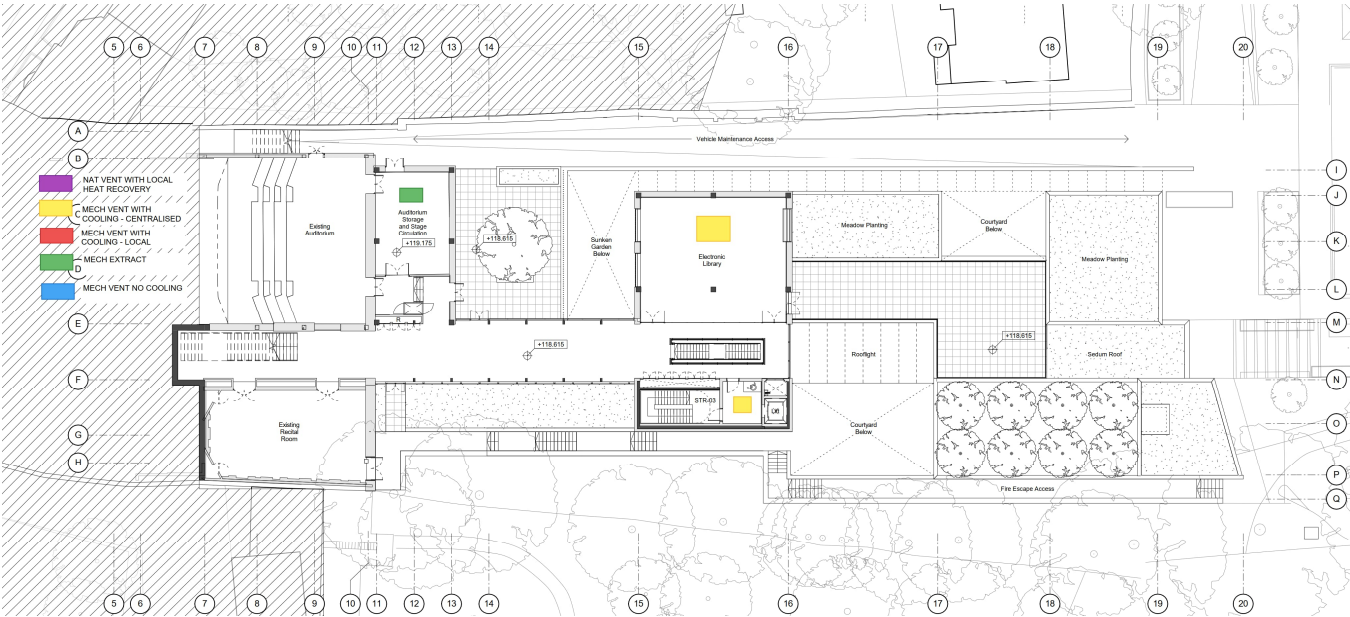


Figure 16 - L-02 Ventilation Strategy

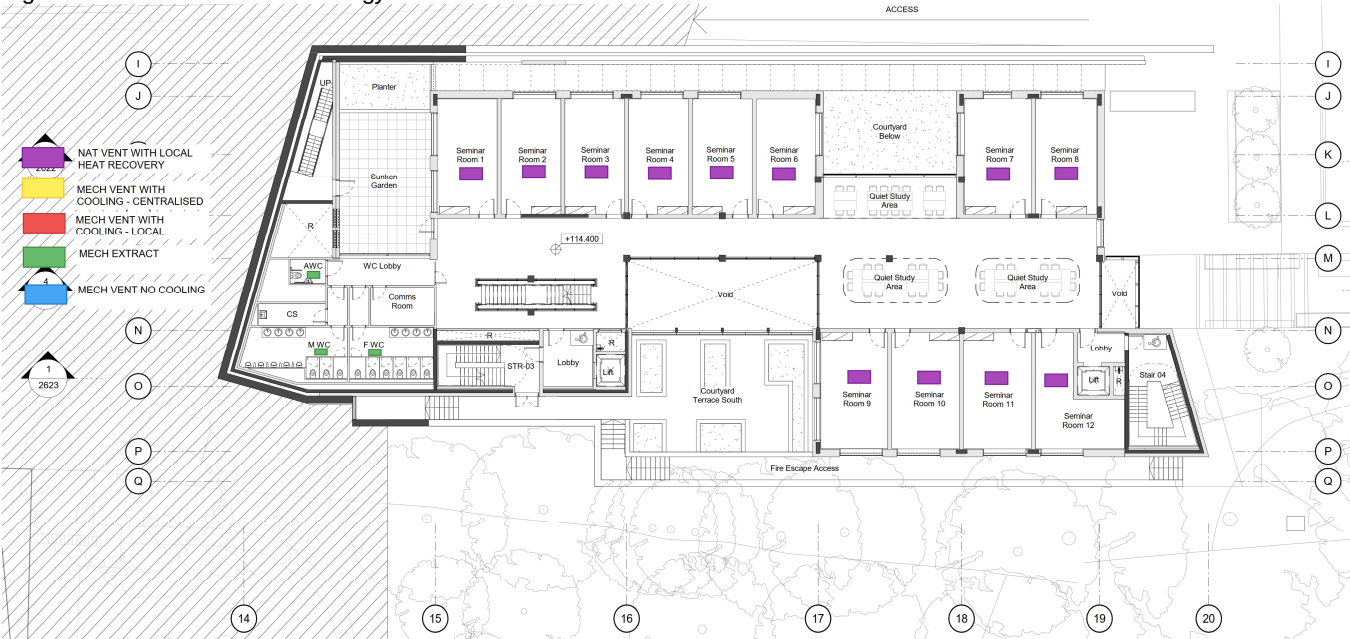


Figure 17 - L-03 Ventilation Strategy

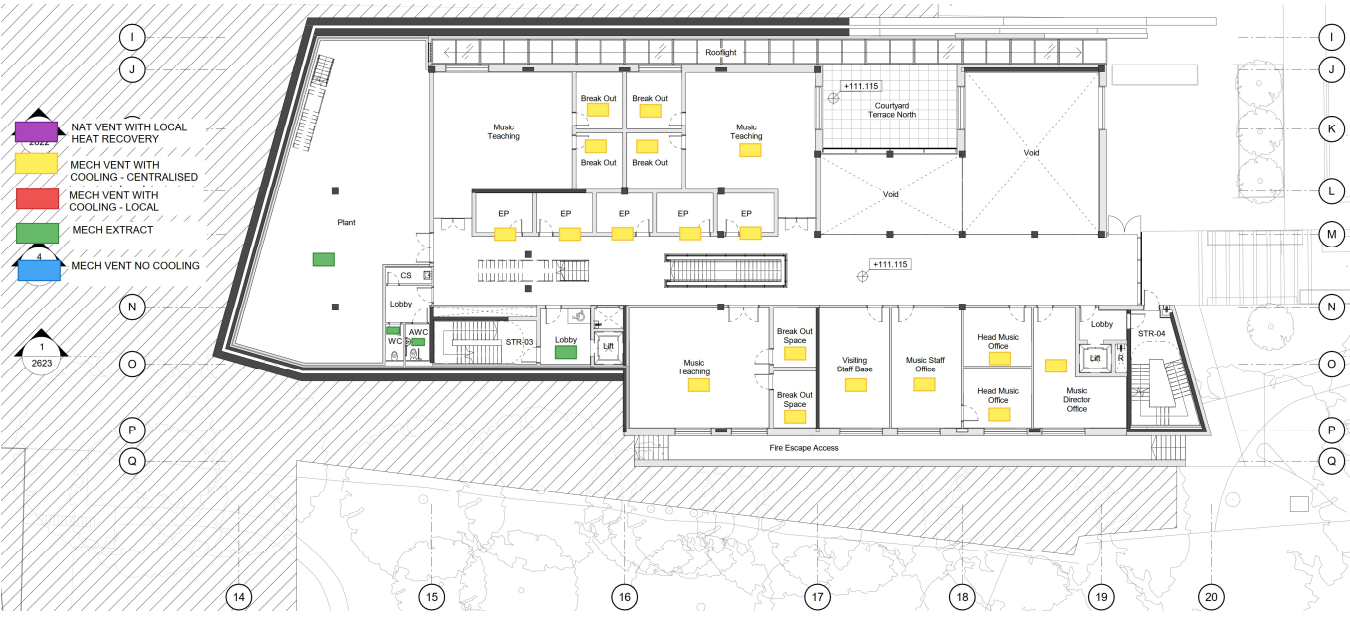


Figure 18 - L-04 Ventilation Strategy

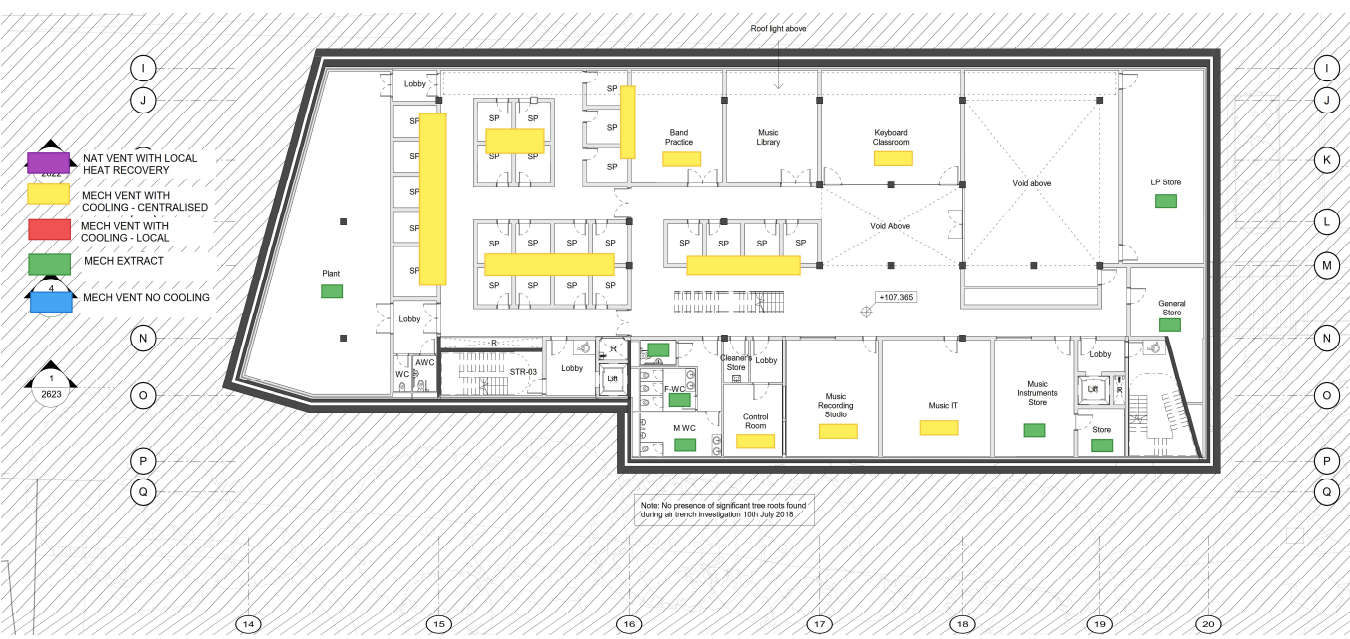


Figure 19 - L-05 Ventilation Strategy

5.5.2 Ventilation with Local Heat Recovery (purple)

Window openings sized to provide the required ventilation in peak Summer conditions during the school term. Note as per previous scheme this building is scoped to perform during school term time only and may not meet internal conditions during the summer holidays as is usual for most naturally ventilated school schemes. During Winter and cooler shoulder months a localised heat recovery system connected through the façade will provide background ventilation to maintain CO2 levels, remove odours, moisture and prevent mould build up.

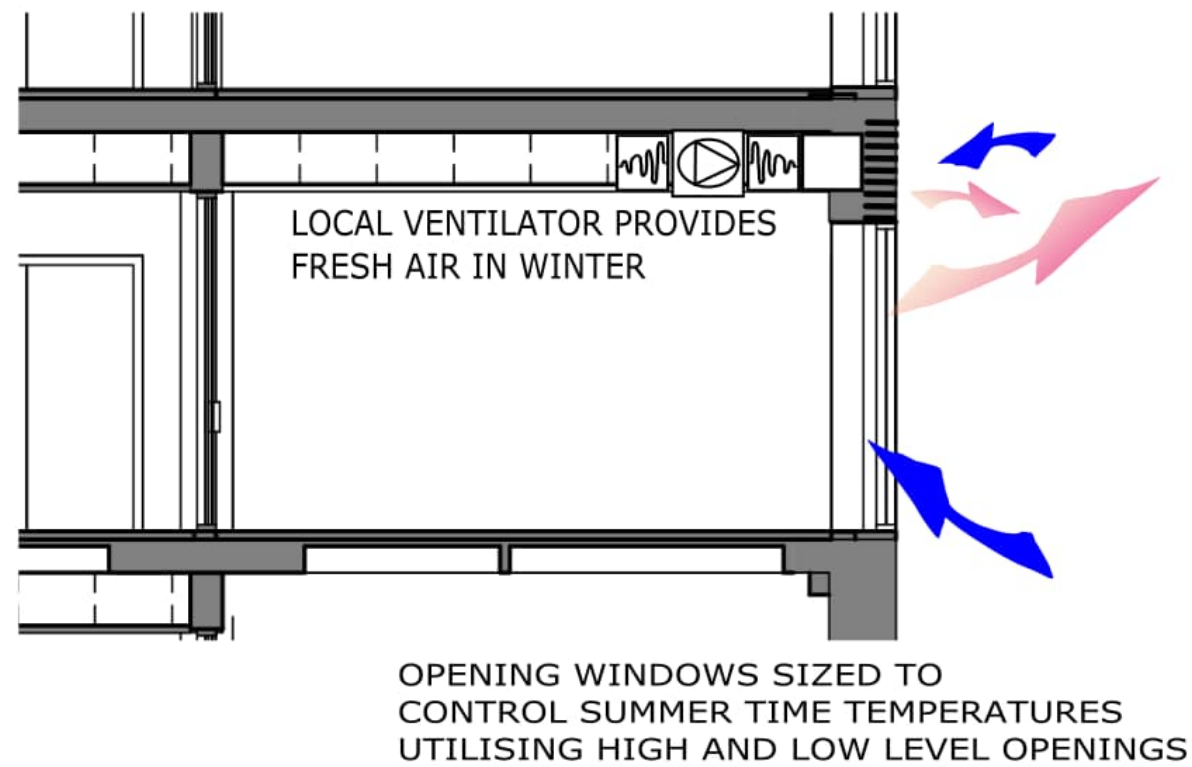


Figure 20 - Natural Ventilation with Heat Recovery Strategy(Front Building)

The local ventilation system will provide night time purge during summer to cool the building fabric.
The system will utilise the fabric of the exposed slabs to maintain thermal comfort.
A traffic light system will be provided local to the teacher to alert to the opportunity to open the windows.

The windows will be interlocked with the local ventilation system to minimise energy use, ie fans will not continue running when windows are opened.

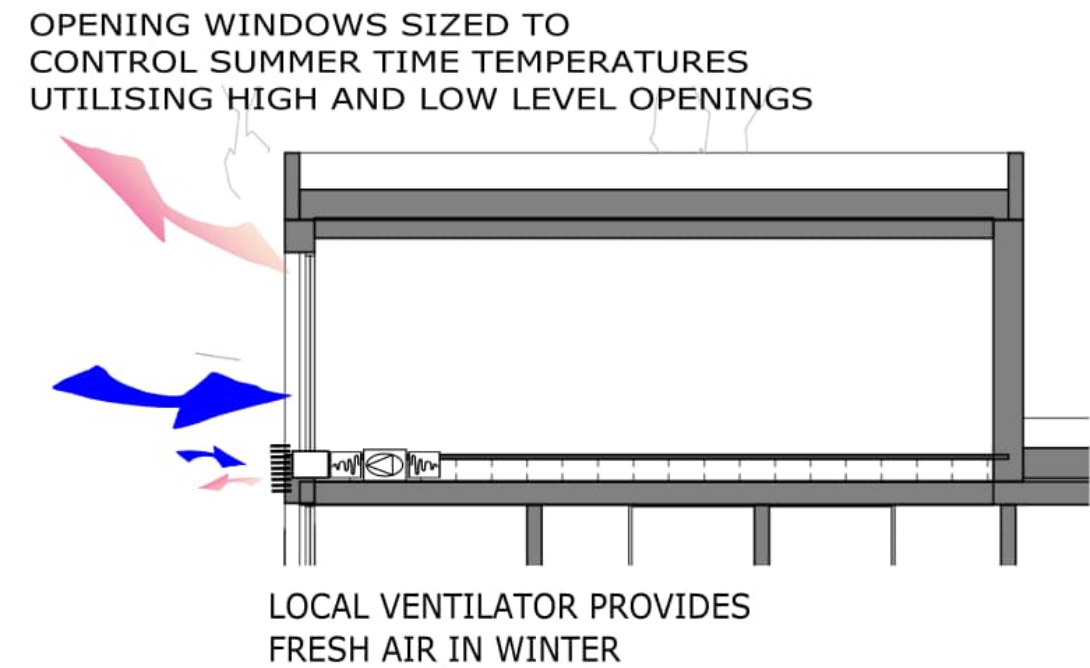


Figure 21 - Natural Ventilation with Heat Recovery Strategy (Rear Building)

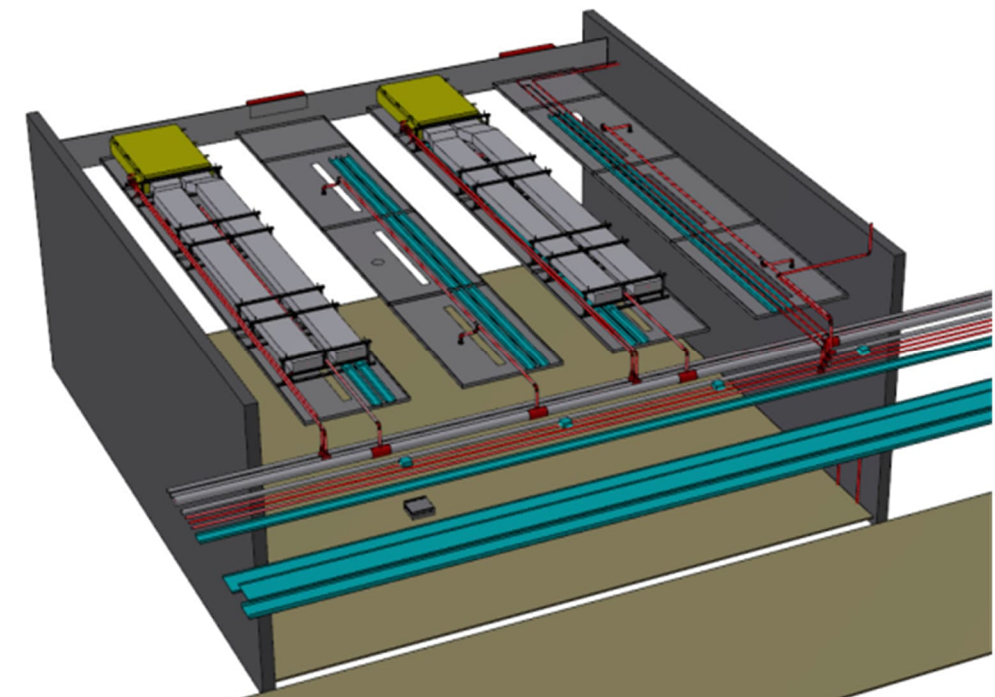


Figure 22 - Typical Coordinated Exposed Services Classroom

5.5.3 Centralised Mechanical Ventilation with Cooling (Yellow)

Mechanical ventilation is provided to areas where heat gains dictate mechanical cooling or architecturally openable windows are not possible (internal rooms or basement areas).

New Air Handling Units (AHU) will be provided in the front building at L-01 to serve the Informal Assembly area and L-04 in the back building to serve rooms on L-04 and L-05 which have no access to atmosphere or are constrained by acoustic requirements. The routes to atmosphere are still to be determined.

It is proposed that these will be variable air volume (VAV) controlled on temperature and CO2 to minimise energy use. The incoming air will be temperature lopped during Summer months to deliver tempered air. Areas of high heat gains will have additional local cooling units, such as Fan Coil Units (FCU's) as required.

5.5.4 Local Mechanical Ventilation with Cooling (Red)

As with the centralised mechanical ventilation above, mechanical ventilation is provided to areas where heat gains dictate mechanical cooling or architecturally openable windows are not possible (internal rooms or basement areas).

However, to minimise riser and primary plant space local heat recovery ventilation units will be provided to provide fresh air, intaking and exhausting directly through the façade, mounted at high level, working in conjunction with local fan coil units.

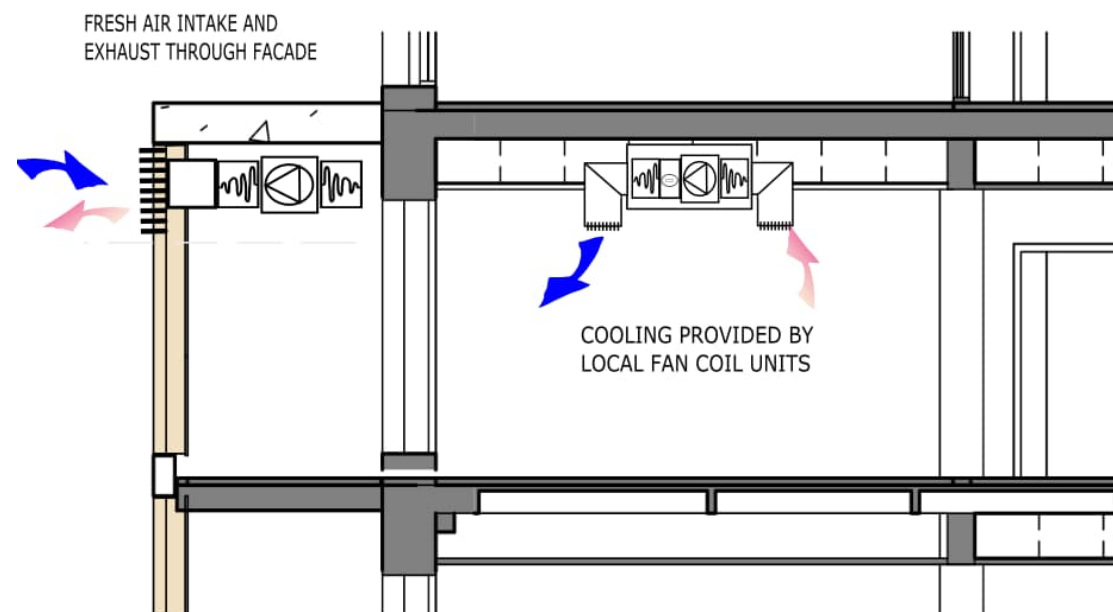


Figure 23 - Local Mechanical Ventilation with Local Cooling Strategy (Front Building)

5.5.5 Dedicated Extract - Green

Dedicated extract will be provided to remove odours from areas such as toilets and cleaners stores.

5.5.6 Retained - Red

Areas recently refurbished and upgraded with their own dedicated AHU's will be retained as far as possible. Upgrades to their heating and cooling coils will be required to meet the performance of the new water temperatures. Other components such as inverters on the fans may require upgrade.

5.5.7 Circulation Areas

Circulation areas, while uncontrolled spaces in terms of maximum temperature will be provided with actuated openable windows in order to purge hot air, should modelling determine their requirement. This is particularly relevant to the Bridge Link walkways with high levels of glazing.

5.5.8 Island Site

Ventilation for the Island site will be by way of locally mounted supply and extract ventilator units with heat recovery and attenuation as required.

6 Electrical Services

6.1 (V10) Electricity Generation(T20)

6.1.1 Standby Power Generation

There are no essential or life safety systems within the building, and as such there is no provision for a secondary power source such as a standby generator.

6.1.2 Photovoltaic (PV) Systems

A roof mounted photo-voltaic (PV) cell electrical generation system shall be provided to the Front Building. The system shall be a grid connected installation meeting the G83 or G59 requirements of the local distribution network operator (DNO).

The PV panels shall comprise a roof-mounted system, securely attached to structure. The design detail of the panel fixings shall allow for future removal and shall permit any differential expansion.

The PV panels chosen shall be approved products for Feed-in-Tariffs. The system shall be provided with inverters connected into a dedicated PV TP&N distribution board (location to be agreed during next stage).

The electrical generation capability of the PV array will be determined during the next stage.

6.2 (V11) Utilities Supplies

Dyne House will have two new 3-phase incoming low voltage supplies; one to serve Dyne House, Dyne House Front Extension and the Bridge Link and one to serve the Rear Block. The 400 V supplies will originate from the LV Switchroom located next to the proposed UKPN substation on the Island Site above the tunnel entrance (refer to Substation Study in section 2.5.1.)

The supply serving Dyne House, Dyne House Front Extension and the Bridge Link will terminate in LV Switchboard SB-DH1 at Level -01, while the supply serving the Rear Block will terminate in LV Switchboard SB-SH2 at Level -04. The preliminary maximum demand for the new facility is estimated at 380 kVA (~550 A/ph).

6.3 (V20) LV Distribution

LV switchboard SB-LV 1 will be located in the LV Switchroom at Level -01 and serve Dyne House. Dyne House Front Extension and the Bridge Link, and LV switchboard SB-LV 2 will be located in the LV Switchroom at Level -05 and serve the Rear Block.

The main LV switchboards SB-LV 1 and SB-LV 2 shall be Form 4 Type 6 (front access, top entry/exit) and incorporate a combination of moulded case circuit breakers (MCCB's) and fused switch disconnectors. All circuit breakers shall be of one manufacturer. Each MCCB will generally be of the fixed type and will be provided with adjustable electronic overload and short circuit protection.

The switchboard will be provided with 15% spare outgoing ways.

Three phase surge suppression and remote status display panels will be mounted on the main LV switchboards. The surge protection device will be provided with volt free contacts hard wired to terminals in a common controls section of the switchboard and interfaced with the site BMS.

Provision for remote bulk detuned automatic power factor correction (PFC) will be provided at the main LV switchboard. It is recommended that this be procured only when the building is in operation to ensure only the necessary correction is purchased. As such the CTs shall be installed in the main switchboard to facilitate the future connection.

PFC will also be provided local to all large items of plant, via integral PFC equipment supplied by the plant/equipment suppliers.

The main meter at the main switchboard shall be able to provide harmonic content monitoring. The provision for a remote connection of an active harmonic filter will be provided. The CTs shall be installed and connections suitable marshalled to a central section in the panel.

6.4 (V21) Lighting

The lighting design will aim to create solutions providing a visually comfortable environment and complement the interior design and architecture, harnessing both natural and artificial lighting techniques. The design will strive to achieve the architectural vision and provide technical compliance with all relevant good practice lighting design guidance documents and statutory legislation.

Generally, the lighting throughout the building will be provided by energy-efficient luminaires using high output LEDs with the majority of them being cool white 4000K.

The lighting installation should be designed to comply with Part L and all other legislative requirements. In particular, the provision of lighting controls, automatic power factor correction, lighting zoning, and designing to the bases of design will assist in passing Part L by a substantial margin (which will be required to achieve BREEAM credit Ene1).

The lighting design will follow recommendations provided in the following guidance documents. These documents provide lighting characteristics and qualitative aspects such as lighting levels, uniformity of light, glare, and colour temperature.

- BS EN 12464-1 (2021) - Lighting of Indoor Workplaces
- CIBSE Code for Lighting 2018
- CIBSE Lighting Guide 7 - Office Lighting
- CIBSE Lighting Guide 5 – Lighting for education

The lighting design shall reflect the requirements for lighting stated in BREEAM 2011: Hea1(C), Ene3, and Pol4.

Generally, a LED lighting solution is proposed throughout the building. All luminaires will be provided with DALI (Digital Addressable Lighting Interface) enabling control.

A suitable design solution shall be provided in each of the following typical type of space:

6.4.1 Main entrance

The lighting for the main entrance will provide a subtle balance between the daylight and electrical lighting when the users enter the space. The reception area will have decorative and functional lighting. The final lighting design will depend much on the interior design in order to create harmonised ambiance.

6.4.2 Offices, staff rooms, meeting rooms, classrooms, tutorial rooms, study areas, conference rooms

Rooms with high and exposed ceilings should utilize suspended linear fittings with direct and indirect lighting component. Fittings may be mounted individually or as a continuous system with integral emergency lighting, presence detectors, daylight sensors, and smoke detectors. Possible benefits include:

- Easier installation
- Reduce installation costs
- Less visual clutter (more clean space)

Special attention should be paid to blackboard lighting where applicable. Blackboards will be lit using directional wallwashers that will provide adequate light levels.

The lighting should be dimmable. The lighting controls shall be a combination of daylight linking, absence control and manual overrides. PIR controlled lighting with manual override will be provided in Classrooms as per the Client's request.

6.4.3 Toilets

Lighting shall comprise of general illumination to the common areas, vanity lighting, and cubicle lighting. The general and cubicle lighting will be provided by a recessed LED downlights and/or linear LED strip lighting concealed within architectural details. The vanity lighting will be provided by either concealed LED strip lighting, wall mounted decorative luminaires, or a recessed/soffit mounted lighting solution.

Vanity areas and showers shall be provided with the appropriate ingress protection rating (IP) luminaires, and be fit-for-purpose for water vapour.

The lighting control shall facilitate presence detectors and/or time clock controls.

6.4.4 Auditorium, lecture hall, recital hall

The lighting for the auditorium, lecture hall, recital hall will complement the interior design and finishes. The design will satisfy the functional requirements. The fittings will use glare control and provide visual comfort to the users of the aforementioned spaces.

6.4.5 Circulation Areas, Corridors, Foyers, Bridges, Stairs

Lighting for general circulation areas and stairs will be provided by recessed or surface mounted LED light fittings. Control will be provided by presence/absence detection.

6.4.6 Common Rooms, Break Out Spaces

The common rooms and break out spaces will have decorative pendants that will allow the staff and students to feel comfortable and relaxed. The lighting controls shall provide daylight linking where applicable and absence control.

6.4.7 Café and Tuck Shop

The Café and Tuck Shop will feature accent lighting, decorative pendants and linear lighting to complement the interior and make the space look vibrant. Lighting should be controllable to allow for maximum flexibility in the space.

6.4.8 Assembly Hall

The assembly hall will be used with functional downlights. Ambience lighting will be added to enhance interior features.

6.4.9 Electronic Library

The electronic library will feature task lighting and directional lighting. The general and task lighting can be achieved using LED downlights. Task lighting mounted on the bookshelves can provide directional lighting onto the

bookshelves so that the staff and students will have no difficulties in reading the back of the books. Control will be via presence and absence detection.

6.4.10 Plant spaces, storage spaces

Energy efficient surface mounted LED luminaires should be provided, with presence detectors and/or time clock controls.

6.4.11 Lighting control

For energy conservation purposes, compliance with statutory legislation, and BREEAM energy targets, lighting circuits should be automatically switched off/dimmed for daylight energy-saving and automatically switched off for areas that are not being used. Intelligent digital architectural lighting control system (DALI) with individually addressable DALI luminaires will be used throughout the building, which can be controlled and monitored separately. The control system should also be capable of controlling exterior lighting circuits via photocell and/or astronomic timeclock override input.

The lighting control system will include a head end PC. The head end will be connected to local DALI area controllers via a dedicated network cable.

6.4.12 External Lighting

The external lighting design will be designed to complement the architecture and provide a safe and secure ambience. The design will follow good practice guidance documents for lighting characteristics and qualitative aspects such as lighting levels, uniformity of light, glare, and colour temperature. The following guides are relevant for our design.

- BS 5489-1:2020 – Lighting of Roads and Public Amenity Areas
- BS EN 12464-2 (2014) – Lighting of Outdoor Workplaces
- CIBSE Lighting Guide 6 – The Outdoor Environment
- SLL Institute of Lighting Engineers (ILE) Guidance Notes for the Reduction of Obtrusive Light.

The lighting shall be planned and designed carefully so that the adverse impact of lighting on the environment will be avoided. The external lighting will be designed to ensure that:

- all night-time lighting is concentrated in the appropriate areas
- upward lighting is minimised
- light pollution is minimised
- energy consumption is minimised

External lighting will be required under the building overhang adjacent the back entrance. It is envisioned a base level of safe illumination will be provided by recessed downlights. The lighting control will be controlled by daylight photocell and/or astronomic digital timeclock.

6.5 (V22) General Power

Distribution boards (DBs) shall be provided comprising of split metered for general power & lighting building loads. One DB shall serve 2 or 3 floors.

Additionally, rooms such as classrooms will be served via a dedicated DB (as indicated in the Room Data Sheets). These will generally be single phase DBs to reduce the space and cost implication of implementing this strategy. The DB is to be located within a full height enclosure and situated in a corner of the room being served; final location and dimensions to be agreed with the architect at the next stage.

All small power circuits shall be protected with an RCD or RCBO. Fused switched connection units shall be provided to serve fixed appliances, e.g., hand dryers, trace heating tapes etc. Supplies to fire alarm interfaces or security equipment shall be terminated in un-switched fused connection units. Higher ratings fixed equipment such as HWS water heaters shall be supplied by dedicated circuits via switched disconnectors. Power shall also be provided to fixed mechanical equipment. Fast-Charge type Electric Vehicle Charging points will be provided external to the building, final quantity to be confirmed at the next stage, assuming 10 charging points in calculation at this stage.

It is recommended to provide AFDD to all single-phase AC circuits supplying socket outlets with a rating not exceeding 32A in accordance with BS 7671:2018+A2:2022.

High integrity earthing shall be provided to the IT server racks if deemed necessary by the Client IT team.

RCD protected waterproof outlets shall be provided in external areas (external power requirements to be confirmed during the next stage).

Power supplies shall be provided from Motor Control Centres (MCCs) or local starter panels which shall be to items of mechanical plant. The MCCs / Local starter panels shall be of Form 4 construction. All equipment fed from MCCs / Local starter panels shall be provided with lockable isolating facilities to enable safe maintenance operations.

6.6 (V40) Emergency Lighting

A system of emergency lighting shall be provided throughout the building utilising self-contained emergency luminaires to permit safe movement and escape from the building during power interruptions. Emergency luminaires shall be either self-contained or proprietary conversion units fitted to the normal luminaires. The battery units shall provide emergency lighting for a period of 3 hours.

The lighting control system shall provide central testing, monitoring and reporting of all emergency luminaires within the building. All emergency luminaires shall be fitting with DALI inverters to enable the control and feedback from each emergency luminaire to lighting control system head end and PC.

Emergency lighting will generally be provided within the electrical risers.

Self-illuminated exit signs and fixed signage below emergency luminaires shall be provided along escape routes and above final exits from the buildings.

Emergency luminaires shall highlight safety equipment and signs, in addition to providing illumination to assist safe travel along the escape route in accordance with BS 5266:2016 and BS EN 1838:2013 which requires that the luminaires sited at points of emphasis must comply with BS EN 60598-2-22:2014+A1:2020.

6.7 (W10) Communications

Incoming fibre optic comms services to the building shall be terminated in the IT Patch Panel Rooms.

Provisions for comms containment are based upon information provided in the Room Data Sheets; to be developed in the next stage.

ICT design is by the Client IT team.

6.8 (W15) Facilities for the Disabled

Each disabled WC shall be provided with an attendance alarm system comprising of a local power supply unit, an alarm call pull cord switch, alarm indicator / sounder located outside of the WC and an alarm accept / reset switch located inside the WC.

Facilities to install induction hearing loops will be provided.

6.9 (W41) Security Systems

Security design is by the Client security team. A site-wide School Lockdown Alarm system will be provided.

Electrical provisions to security systems will be developed in the next stage in liaison with the Client brief.

6.10 (W50) Fire Detection and Alarm

A fire alarm system will be provided for the building to category L2 standard. Fire alarm interfaces will be provided to lifts, security systems, theatre AV system, and mechanical ventilation. A main fire alarm panel will be located in the entrance to Dyne House, with a repeater panel located in the Rear Block; final locations to be agreed on during the next stage.

Generally, fire detection and alarm scheme will be designed in accordance with BS 5839-1:2017 and BS EN 54. Visual alarms will be provided in spaces where an alarm may be inaudible to occupants. All devices shall be addressable within an open protocol system.

The fire detection and alarm system shall comprise of the following types of devices / detectors to provide the category of protection:

- Manual Call Points
- Point type smoke detectors (optical)
- Duct mounted smoke detectors
- Photo-electric beam type smoke detectors
- Point type heat detectors
- Internal or external sounders
- Visual fire alarm units
- Interfacing for security and BMS

6.10.1 Emergency Voice Communications (EVC) System – Fire Telephones

Emergency voice communication systems shall be provided to facilitate communication between the master panel and disabled refuge points in accordance with BS 5839-9:2021.

6.11 (W51) Earthing & Bonding

A complete earthing system shall be provided in accordance with BS 7671:2018+A2:2022 Wiring Regulations. The DNO will provide a TN-S connection from the substation, and a TN-S system will be used to distribute an earth supply within the buildings.

A local earth bar shall be provided within each electrical riser cupboard at each floor. Supplementary bonding conductors shall be provided from the local earth bar where automatic disconnection cannot be achieved and supplementary protection is required.

6.12 (W52) Lightning Protection

A risk assessment has been carried out and new Class IV lightning protection system will be provided in accordance with BS 62305-1:2011.

For Dyne House and Dyne House Front Extension, down conductor cables will be installed; locations to be agreed at the next stage. For the Rear Block and Bridge Link, the metallic reinforcement of the structure will be utilised as the down conductor. Reference earth pits shall be installed at ground level for testing. The system will be connected to the main earth terminal within the LV Switchrooms.

6.13 (X10) Lifts

3 No. lifts are to be installed within the buildings; the main usage envisaged is for staff transport and disabled access. 1 of the lifts in the Dyne House building will also be utilised for plant replacement and general transport of large goods and as such sized accordingly.

6.14 (W60) Automatic Control Systems/Monitoring (BMS)

The building shall be provided by a centralised BMS system to provide run and stop controls to all plant and provide fault reporting. General operation will be provided by localised control units, with reporting back to the central BMS position in the FM office of faults and window positions. All points being monitored by building BMS shall be available on central FM BMS.

A review of the central FM head end is required to determine capacity for expansion.

6.15 Metering Strategy

The BMS (rather than a separate EMS system) shall be used to monitor and report on the energy consumption within the building in accordance with Building Regulation Part L2 and BREEAM requirements (as detailed in BREEAM Credit ENE 02) and Be Seen criteria.

7 Public Health Services

7.1 (S10) Water

The wholesome mains water will enter the building and be transferred via a break tank and pump set to a centralised cold water storage tank in the rear building at level -5. From there, wholesome water will be boosted via a booster pump set to ensure adequate flow at all outlet points. The tank will be divided into two sections to allow for routine maintenance. The pump set shall consist of duplicate variable speed booster pumps to maintain a constant discharge pressure and efficient operation. The domestic cold-water plant shall be located within a dedicated tank room separated from all heat generating sources to prevent the rise of temperature of the water inside the tank.

A Chlorine Dioxide dosing unit for protection against Legionella and Pseudomonas bacteria within the domestic water system will be fitted upstream of the domestic water storage tank.

Packaged Category 5 tank and booster pump units will feed wash down points, mechanical plant fill systems, and roof level bib tap water supplies located in plantrooms. This shall be provided with a purge discharge to prevent stagnation in the event of non-use.

The domestic hot water shall be provided by local electric water heaters to serve each toilet area, cleaners cupboards and café/food court. The heaters shall be wall mounted.

Isolation via PIR sensors within each toilet area shall be provided on the cold water services to reduce the probability of water wasted due to leakage.

Domestic cold water shall run in the ceiling void within the existing Dyne House and Auditorium block and within the floor void to serve the new rear block.

All hot water outlets except those that are in areas not accessible to students (cleaner's sinks and the staff kitchen sink) shall be provided with TMV2 mixing valves. Any outlet without a TMV mixing valve shall have an appropriate warning notice.

Sanitary fittings will be selected by architect in line with BREEAM Wat01 requirements as water efficient fittings.

Water meter with major leak detection will be installed on the entry to the building to satisfy requirements of BREEAM Wat 03, as well as sub metered connected to BMS to any water consuming plant or area consuming more than 10% of the buildings total water demand (Wat02).

7.2 (W54) Liquid Detection Systems

Where pipework runs within the floor void a liquid detection alarm system shall be installed with liquid detection tape or probes. A central control panel shall be located within the level -5 Tank Room and shall be addressable to show where the liquid has been detected. From the main control panel leak detection cables shall run to all floor voids where there are wet pipework systems. As well as a local audible alarm the system shall be connected to the BMS shall to raise an alarm as required.

7.3 (R11) Sanitation

The above ground sanitation drainage shall be designed as a gravity system configured to permit foul solid and liquid waste materials to pass uninterrupted from the point of collection, i.e. from the sanitary appliance/fitting and equipment, to a point of discharge within the below ground system. Sanitary plumbing from Dyne House and the Auditorium WC's, café/food court and plantroom facilities shall discharge to a largely existing building underslab drainage and level -1 and -2 which discharges below level-2 into the public sewer crossing the site (subject to after the results of a CCTV survey being performed and feasibility of existing drainage re-use is confirmed).

Above ground drainage from the student WCs in the rear block at level -3 shall connect to an external underground drainage system at level -3 (existing the building at high level -4).

Above ground drainage from the WCs in the rear block at level -5 shall discharge to a foul water drainage sump locally. The pumped discharge main shall pump directly into to an external underground drainage system at level -4.

Drainage gullies for level -4 and -5 Plantrooms and level -4 cleaners cupboard shall be collected within a plant sump located at level -5 and pumped up to connect to the gravity system above at high level -4.

The below ground drainage system shall be design by the structural engineer/below ground drainage engineer.

The sanitation drainage system shall be a single discharge stack system vented to atmosphere above roof level.

Should the café/food court be established as a commercial cooking facility, grease traps shall be provided.

Access shall be provided on all sanitary drainage pipes at each level and all changes in direction of pipework in the above ground system.

Condensate drainage will be provided as required.

7.4 (R10) Rainwater

The above ground rainwater drainage system shall be gravity a system configured to permit surface water to pass from the point of collection, i.e. from the gutters, to a point of discharge to the underground drainage at levels -2 and -4.

Access shall be provided on all rainwater pipes at roof level, the point of connection with the below ground drainage and all changes in direction of pipework in the above ground system. Rainwater drainage from roofs and terraces shall be external to the building where possible. Where pipework is external the specification of the pipework shall be by the architect.

Existing roof drainage from Dyne House and the Auditorium is provided by parapet gutters with a series of downpipes within the existing brick facades. The routes and principals shall be retained, subject to architectural survey information, with minor modification to suit the new scheme. Roof drainage from the new rear blocks shall be provided by means of parapet gutters with hopper heads and a series of external down pipes

Due to the location of trees adjacent to the building the gutters shall be designed to allow them to be walkable for ease of clearance of leaves and foliage, therefore the minimum width of gutter shall be 500mm.

The SUDs/attenuation tank shall be by structural/below ground drainage engineer. The opportunity of rainwater harvesting will be further investigated at Stage 2+ to help with BREEAM Wat04 credits. Currently, rainwater harvesting is not included in MEP design or space planning.

7.5 (S61 & S63) Fire

A dry riser system shall be installed to serve 2No stair cores within Dyne House and the Rear Block as detailed in the fire strategy report.

Inlet breeching points shall be provided for each dry riser system.

2no inlets will be located externally at ground level adjacent to stair core 01. The pipework shall drop from each inlet run at high level -1 to each stair core to rise to each floor.

2No Inlet breeching points serving the new rear block shall be located on the building façade adjacent to the parade ground at level -4 and shall run underground to each stair core and rise to each floor. Landing valves shall be located within the lobby area of each floor.

The building is not sprinkler protected.

8 Appendices

A.1 Residual Design Risk

Category	Risk	Client dependant (Y/N)	Effect(s)	Before Mitigation			Mitigation Measure	After Mitigation			Comments / Current Status
				Likelihood	Impact	Risk Level		Likelihood	Impact	Risk Level	
	DH - Small PV area available	Y	The small number of PVs will, most likely, lead to difficulty meeting the London Plan 35% target.	High	High	High	Demonstrate scheme has done all reasonably can to maximise PV area. Roof on back block is shaded and likely not generate	Medium	Medium	Medium	
	DH - Overheating		The IT classroom is fully glazed and phasing south (on the main road) so potential overheating risk and increased cooling demand. The space may need mechanical cooling and the cooling demand of the notional building may be higher than the actual (MJ/m2).	High	Medium	Medium	We will try and minimise the cooling demand as far as possible and explain the limitations of the design.	High	Medium	Medium	
	DH: Final configuration of informal ass area louvres	N	To be coordinated with occulus	Medium	Medium	Low	Allowance made in plannign submission to resolve early stage 3	Low	Low	Low	
	DH: Front building extension louvre band not allowed for	N	Not possible to vent through façade. Alternative route required taking up space internally	Medium	Medium	Medium	Provide notional louvre band for planning to allow scope to design at stage 3	Low	Low	Low	
	Further regulation change for emissions compliance, Part L gets revised and emissions factors will change, which we will have to comply (pass only, not by 35%) if construction not commenced.	N	Remodelling costs, and and re-design if doesn't comply	Medium	Medium	Medium	Review revoded doc when released and advise	Medium	Medium	Medium	

