Royal Veterinary College
University of London

STAGE 3 APPENDIX
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APPENDIX 1
AECOM

MEP Services Stage 3 Report

November 2018

Project number: 60562867

Quality information

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Revision History

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Table of Contents

Figures

Tables

1. Introduction

1.1 General

This section of the report summarises the developed design stage (RIBA Stage 3) proposals for Mechanical, Electrical and Public Health (MEPH) services for the Hawkshead redevelopment scheme proposed on the Royal Veterinary College, Hawkshead Lane, Hatfield AL9 7TA.

1.2 Objectives

This section of the report is intended to:

- Develop in further detail the strategies outlined at stage 2
- communicate the MEPH system proposals to the design team, client and QS
- Illustrate the design development that has taken place to date, confirming that sufficient consideration has been given to the space requirements and cost implications of the MEP scheme requirements.
- Allow the Architect and other Design Team members to understand the implications of the building services proposals and make suitable allowances for the requirements in their design such that these can be developed in the next stage of works.
- Provoke further discussion and identify any client decisions required to move the proposals forward to the next stage.
- Identify where further input from the Client or other stakeholders is required
- Identify any abnormal items (which may not otherwise have been included in the preliminary cost plan)
- Allow the QS to provide an updated order of cost for the project to present to the project board.

1.3 Building Services Design at RIBA Stage 3

BSRIA Guide BG6/2018 *A Design Framework for Building Services 5th edition* sets out the design activities and level of design development typically expected at RIBA Stage 3. In summary these include:

- Carry out ongoing checks for compliance with Building Regulations
- Negotiate with public and other utility authorities for the provision of incoming services and agree spatial requirements.
- Monitor compliance of the developing design with regards the design philosophies and project brief
- Confirm the design criteria, scope and extent of mechanical, electrical and public health services.
- Review architectural and structural designs to identify exiting or potential conflicts with indicative plant-room, plant and riser locations and sizes and in relation to the building weight allowances.
- Review design risk assessments and update to reflect developing design.
- Advise on access routes and plant size and weight in relation to future plant removal and replacement.
- Obtain room data and populate room data with building services information
- Planning considerations **-** including agreeing plant heights, (renewable) energy strategy, BREEAM requirements and other MEP matters required to be covered in the planning application.
- Interaction with other disciplines (architect, structures, fire and landscape architect)
- Review specialist design inputs and incorporate into building services proposals.
- Cost – refining, agreeing and then designed to the cost plan. It should be noted that BSRIA BG6/2018 – based on the Gower Handbook of Project Management gives guidance on the precision of cost estimates that can be achieved at the end of each stage (+/-15% for Stage 3), however it is expected that this can be improved on, with closer collaboration between the design team and the Quantity Surveyor, ensuring that the cost plan reflects the evolving design and the design reflects the cost plan.
- This report, together with the regular design team workshops, presentations and correspondence, is believed to address all of the above items.

2. Basis of Design

2.1 Scope of Services to be designed

The following building services systems are anticipated to be required within the building:

Public Health Systems
- R10 Rainwater Disposal
- R11 Above Ground Foul Water Drainage
- R14 Laboratory Drainage
- S10 Cold Water Services
- S11 Hot Water Systems

Specialist Systems
- S32 Natural Gas Distribution
- S34 Laboratory Gases

Heating Systems
- T10 Low Temperature Hot Water Heating
- T14 Air Source Heat Pump

Cooling Systems
- T60 Chilled Water
- T70 Comfort Cooling
- T71 Cold Room

Ventilation Systems
- U10 Supply and Extract Ventilation
- U15 Equipment or Fume Extract systems

Controls, Monitoring & Metering
- W60 Automatic Control Systems/Monitoring
- W60B Local Monitoring Systems
- W54 Liquid Detection Alarm

Electrical Supply and Distribution
- V20 Low Voltage Distribution
- W51 Earthing and Bonding

Uninterruptable Power Supplies
- V32 Uninterruptable Power Supplies

Electrical Distribution and Small Power
- V22 General Power Installation

Lighting & Emergency Lighting
- V21 General Lighting Installation
- V40 Emergency Lighting

Communication Systems
- W21 Audio Visual Systems
- W30 Telecommunications/Data Installations (passive elements only)

Fire & Life Safety Systems
- W50 Fire Detection and Alarm Systems
- W15 Facilities for the Disabled

Electronic Security Systems
- W40 Access Control
- W42 CCTV

Protection against Lightning
- W52 Lighting Protection

Transportation Systems
- X10 Lift Installations

2.2 Reference Documents and Design Standards

As a minimum, the MEPH design shall meet requirements of all current and relevant British Standards, Building Regulations and Codes of Practice.

The MEPH design will also abide to local and Regional planning policies. The Local Authority for RVC Hawkshead is Welwyn Hatfield.

All proposals are subject to agreement with the Local Authorities (including Building Control) and the client's insurers.

2.3 Client Standard Specifications

No particular Client standards have been identified. Specifications for specialist systems will be developed with the user groups.

2.4 Insurers Requirements

No significant requirements that impact on the MEP services have been identified at this stage.

2.5 Environmental Criteria

The MEP installation will be designed to comply with the following common design criteria:

External design conditions:	Cooling (Fabric)	31.2 °C db 20.7 °C wb
	Cooling Heat Rejection	36 °C db 22.5 °C wb
	Heating (Fabric)	-3 °C db 100% RH
	Heating Intake	-7.6 °C db 100% RH
	Noise levels:	>10 dB(A) below existing background
Thermal design criteria	Small power heat gain	Laboratory: 60 W/m^2; Equipment room: 120 W/m^2; Teaching area: 15 W/m^2; Lecture theatre: 10 W/ m^2; Teaching Lab: 30 W/m^2; Other area: 15 W/ m^2
	Occupancy Heat Gain (Sensible)	75 W/person
	Occupancy Heat Gain (Latent)	55 W/person

Lighting heat gain	10 W/m^2 (Lab, office, teaching & learning area) 6 W/m^2 (Other areas)

Table 1: Internal Design Criteria

Room type	Summer Temp (°C)	Winter Temp (°C)	Minimum ventilation rate		Lighting level (lux)	Noise criteria
			air changes /hour	litres/s/ person		
Lecture theatre	22ºC db +5ºC / -2ºC	20ºC +/- 2ºC	-	12	300-500	NR 30
Teaching Areas	22ºC db +5ºC / -2ºC	20ºC +/- 2ºC	-	12	300-500	NR 30-35
Labs (teaching)	22ºC db +5ºC / -2ºC	20ºC +/- 2ºC	6 min.	12	500	NR 40
Laboratories	21ºC db +2ºC / -2ºC	20ºC +/- 2ºC	8 min. for central plant 10 min. for room connection	12	500	NR 40
Naturally Ventilated (Library/Open plan office/ office)	less than 3 °C above peak external when ambient temperature is over 25ºC	20ºC +/- 2ºC	-	12	300-500	NR 35
Social Learning	less than 3 °C above peak external when ambient temperature is over 25ºC	20ºC +/- 2ºC	-	12	300-500	NR 40
Mechanically ventilated (Offices/meeting room)	22ºC db +5ºC / -2ºC	20ºC +/- 2ºC	-	12	400 (LG7)	NR 35
Visiting lounge	22ºC db +5ºC / -2ºC	20ºC +/- 2ºC	-	12	200	NR 35
Stairs	N/A	16 min.	-	-	150	NR 45
Circulation	N/A	16 min.	-	-	100	NR 45
Toilets	N/A	18 min.	6	-	150	NR 45
Stores (general)	N/A	16 min.	2	-	100	NR 45
Plant room	N/A	10 min.	see note 3	see note 3	200	NR 60

Notes:

1. Depending on the design of the reception area, the use of supplementary under counter heating for the reception desk may be considered.
2. Ventilation rates in areas with fume extract will be higher than the base air exchange rate or occupancy
3. Ventilation of plantroom areas will be designed in accordance with relevant British Standards to provide sufficient air for combustion
4. Average illumination levels to be measured at working plane
5. Lux levels at working plane of desk height 750mm in office, 750mm and/or 900mm in laboratories and floor level in circulation spaces. No part of any area is to have an illumination level more than 20% below the average value stated in the list above
6. Maximum noise levels to be confirmed by the acoustic consultant. Values given are only a guide.
7. No humidity control is provided
8. Filtration standard: G4
9. Suggested summer temperature range is a compromise between user comfort and sustainability
10. NR criteria for laboratories assumes no equipment or fume extract systems operating, these levels have been used in the design

2.6 Engineering Systems Bases of Design and Resilience

The following bases of design for resilience of engineering systems are noted where these impact on the sizing or spatial planning of systems

Table 2: Engineering Systems Bases of Design

System	Basis of Design	Resilience
R10 Rainwater Disposal	Rainwater system design based on BS EN 12056 part 3 and rainfall intensity suitable for the type of the roof of the new development.	
R11 Above Ground Foul Water Drainage	Above ground soil and waste drainage design based on BS EN 12056:2 system III and frequency factor k; Office spaces – k= 0.5 Public toilets – k= 1.0 Laboratories – k= 1.2	
S10 Cold Water Services	Existing storage tank in TARC – to remain unchanged, New storage tank sized based on 180L per Lab Sink. Mains Water Pressure will be guaranteed by Local Authority Supplier to be min. 1.0bar. Water pressure at any outlet – 2.0bar	50% split division tank
S11 Hot Water Systems	Local electric heating	
S32 Natural Gas Distribution	Pressure at gas meter /governor 21mBar	
S34 Laboratory Gases Carbon Dioxide	Purity Grade 4 (compressed air) Distribution Pressure 10 bar Room Pressure Reduction, as details on	Duty/standby Manifolds

System	Basis of Design	Resilience
Nitrogen Oxygen compatible systems	architects definition drawings Point of user Regulators,	
S41 Fuel Storage	Fuel storage shall be provided for 24hours of emergency standby generator operation at full load	1 day tank only
S50 Vacuum	Local vacuum to be provided by users	
T10 Low Temperature Hot Water Heating	LTHW Secondary: Flow 45°C, Return 35°C LTHW ASHP: Flow 45°C, Return 40°C	3 x Boilers (N+1) + 1 x ASHP sized at minimum 25% of design heat load
T60 Chilled Water (AHU's)	Flow 6°C, Return 12°C	1 x chiller + 1 x ASHP at 50% load each
U10 Ventilation	Refer to Environmental Criteria	N only provision
U15 Equipment or Fume Extract systems	Discharge velocities variable 7-15 m/s (max 15 m/s) Flue height 25% of building height above building or 3.0m minimum Microbiological safety cabinets are recirc type – Fumigation by local recovery units Fume cupboard face velocity 0.4 m/s at 400mm sash working height	Single extract fans per fume cupboard
V10 Electrical generation (Standby Power)	Substation A will be provided with a new 1800kVA standby low voltage generator. This will ensure all buildings powered from Substation A will be backed by the standby generator including the new build/TaRC and Eclipse	Single 1800kVA generator at Substation A
V20 Low Voltage Distribution	Electrical Characteristics: Voltage : 400V Frequency : 50Hz Electrical Load for the new build based on the following criteria; Lighting : 8-12 W/m2 Small Power: 5-40 W/m2 Power Factor :0.95 Diversity Factor: 90%	No redundancy in distribution paths.
V21 General Lighting	See environmental criteria for desired illumination levels. A DALI lighting control system to be adopted	Lighting control system will be web based as oppose to a dedicated headend computer.
	External Lighting - foot paths -10 lux	
V40 Emergency Lighting	Typically 1 lux on the centre line of the escape route. To comply with the Building Regulations and BS 5266.	N/A
W30 Telecommunications/Data Installations	Comms room required on every floor of the new build and will be within 90m of the furthest data point in the new build.	Main comms room to have an optic fibre connection to the data centre in Eclipse and a separate diverse optic fibre connection to the data centre in the Queen Mother Hospital
W40 Access Control	Existing system in TaRC to be expanded	Power supply units to have integral 4hr batteries
W42 CCTV	Existing system in TaRC to be expanded	
W50 Fire Detection and Alarms Installation	Category L2 automatic fire detection and alarm system required. Existing fire detection and alarm detectors and cabling will be reused. Existing 4 Loop fire alarm panel to be replaced with a new fire alarm panel and interfaced with the fire alarm panel in the Eclipse Building.	The new main fire alarm panel will be fed directly from the main switchboard and shall integral battery for 24hrs back up.
W52 Lightning Protection System	A Level II LPS in accordance with BS EN 62305 will be provided. The new LPS will be connected to the existing LPS on the TaRC and Eclipse buildings	
W60 Automatic Control Systems/Monitoring	Existing system in TaRC to be expanded	
X10 Lift Installations	1 no. passenger lift and 1 no goods lift for new build area.	All lifts will be single fed.

Air Changes

Local Exhaust Ventilation make up may comprise local exhaust hoods/arms, Fume Cupboards or MBSC's

Office/meeting room/ teaching spaces occupancy defined by Architect's mark-up

External Acoustic Criteria

Break-out from externally mounted plant or dedicated plant rooms shall not, under any operating conditions, exceed a background sound level set out by planning.

2.7 Spare Capacity and Flexibility of Engineering Systems

MEPH systems will be designed to incorporate spare capacity and flexibility to allow for a degree of in-house reconfiguration over the lifetime of the building without the need of major or complete plant replacement.

The following spare capacity allowances have been provisionally allocated to the new plant and main distribution systems:

- 25% Spare Capacity on Electrical Distribution Boards
- 25% Spare Capacity (By Number of Points) on Building Energy Management Systems (BEMS)
- 10% Spare Capacity on Heating Plant – excluding back up boiler provision

3. Planning & Building Regulations

3.1 Energy Strategy & LZC Approach

Performance against Planning Criteria

Welwyn Hatfield Borough Council is currently updating the Council's planning requirements. The previous 2005 planning documents do not have specific requirements on renewable energy provision.

Considerations have been given to energy efficient design before the incorporation of renewables, as summarised in the steps below:

a) Be Lean - Performance without Renewables or CHP should be equal to or better than building regulations

b) Be Clean – CHP should be incorporated where feasible

c) Be Green - Renewables provided as appropriate to offset carbon emissions.

The preliminary performance is summarised in the graph below.

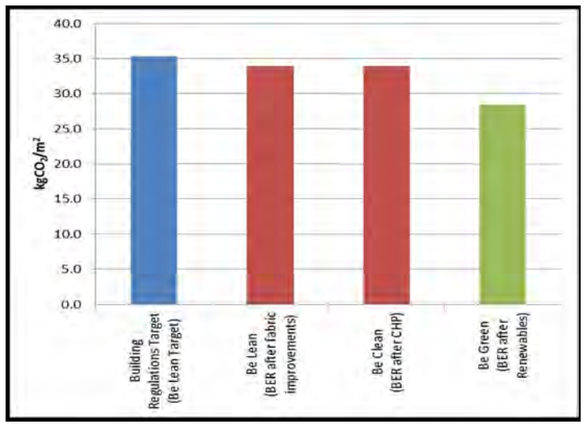


Figure 1: Carbon Emission Reduction Hierarchy Performance

Without any renewables or CHP the concept design achieves the target requirement of improving over the building regulations base line.

For the Be Clean target it is not currently anticipated that a standalone CHP will be viable for this building. Therefore no reduction in carbon emissions is achieved in this section. It may however be feasible to connect this building to existing or future CHP to achieve further carbon emission reductions.

For the Be Green performance, an Air Source Heat Pump (ASHP) has been proposed as part of heating and cooling system.

The following commentaries are made in respect of the requirements for planning and building regulations on the design and provision of mechanical and electrical engineering services.

3.2 Part L Strategy

The new build areas will be required to comply with Building Regulation Part L2A 2013. Part L compliance involves a comparison between carbon emissions from the actual proposed design, building emission rate (BER) and emissions from a notional building as a target performance, target emission rate (TER).

IES dynamic simulation modelling has been utilised to demonstrate the compliance considering the atrium in the building, natural ventilation, and thermal mass strategy.

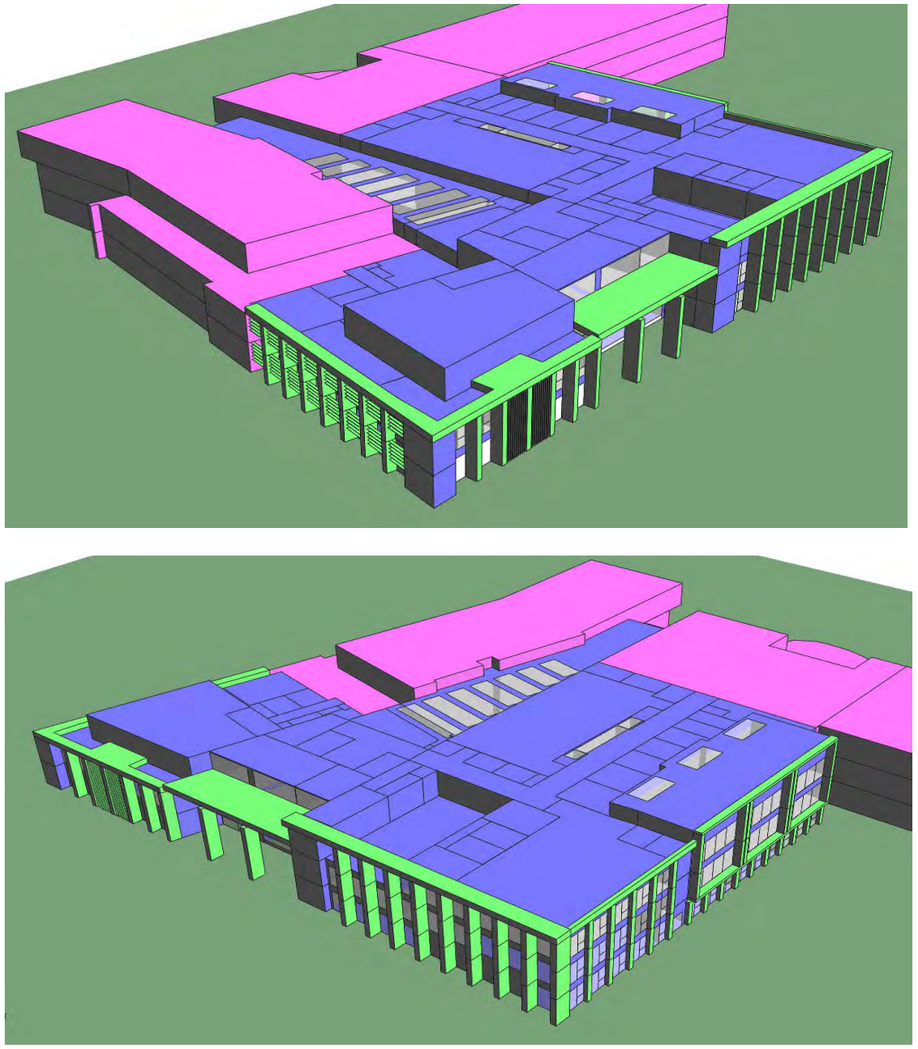


Figure 2: Images from the energy model

The model has been based on Architectural Revit model, RVCH-NOR-03-XX-M3-A-0001, Rev P11 dated on 23/10/2018. The new building is directly connected to existing building, Eclipse and TaRC, to the west.

Input summary for Part L baseline compliance Modelling

This section summarises the key input data and assumptions for the base line compliance results.

Table 3: Thermal Model – Construction and Thermal Elements

Wall U-value or construction	0.20 W/m^{2}K wall /opaque panel
Roof U-value or construction	0.18 W/m^{2}K
Floor U-value or construction	0.22 W/m^{2}K
Window U-value	1.60 W/m^{2}K
Window g-value	0.40; (0.34 for Visiting Lounge and Meeting room only)
Door U-value or construction	2.20 W/m^{2}K
Roof light U-value	1.90 W/m^{2}K
Roof light g-value	0.35
Air permeability	3 m^3/h/m^2
Thermal mass	Exposed soffit
Shading	North and east façade: vertical structural fins South façade: vertical structural fins & brise soleil

Table 4: Thermal Model – Mechanical Systems

System type	• NV + heating: Social learning / Library / Open plan offices • Displacement Ventilation: Lecture theatre / Group learning • Central AHU + FCU: Laboratory rooms / Offices / Study rooms / Meeting room / Visiting lounge • Local HRUV: DL Rooms / Teaching lab • All air system: Small teaching rooms / TC labs
Heat source	Boilers
Effective heat generating seasonal efficiency	95%
Cooling source	Chillers
Generator seasonal energy efficiency ratio (SEER)	5.0
Ventilation type 1	Central AHU
Ventilation heat recovery type & efficiency	Thermal Wheel / Plate heat exchanger: 75%
Specific fan power for main AHU	1.6 W/(l/s)
Ventilation type 2	Local HRVU
Ventilation heat recovery type & efficiency	Plate heat exchanger: 80%
Specific fan power for main AHU	1.1 W/(l/s)
Specific fan power and flow rate for extract fans	Fume extract: 0.6 W/l/s (Remote)
Specific fan power for FCU	0.3 W/(l/s)
Specific fan power for extract only system	0.4 W/(l/s)
Does AHU meet CEN leakage standards? Which class?	L2
Has ductwork been leakage tested? Which class?	Class A
Variable Speed Pump? Multiple sensors?	Variable speed pump with multiple sensors

Table 5: Thermal Model – Domestic Hot Water System

DHW generator type	Local under sink electric heater without storage

Table 6: Thermal Model – Lighting System

Lighting design	Large rooms: 1.8 W/m^2/100lux Medium-size rooms: 3.0 W/m^2/100lux Small rooms: 3.5 W/m^2/100lux Lighting lux level as per notional building
Lighting control (local switches, PIR, daylighting sensor)	PIR and daylight sensors for perimeter areas PIR for all other areas
Photoelectric switching or dimming?	Dimming
Stand alone or addressable	Addressable
Parasitic power of photoelectric device?	0.1 W/m^2 for PIR and daylight sensors

Note:

The Lux levels are affected by the requirements of the part L model and do not necessarily reflect the design lux levels for these spaces.

Table 7: Control and Metering

Does lighting system have provision for metering?	Yes
Is Monitor & Target equipment provided for lighting with alarm for "out of range values"?	Yes
What is the electric power factor of the building?	>0.95
Does HVAC system have provision for metering?	Yes
Is Monitor & Target equipment provided for the plants with alarm for "out of range values"?	BMS

Building Regulations Compliance Performance

With the above inputs the building achieves a building regulations performance as detailed below.

Table 8: Summary of Building Regulations Performance

Building Regulations Performance Summary	
Actual Building Performance	18.7 $kgCO_2/m^2$
Notional (Comparison Building) Performance	20.9 $kgCO_2/m^2$
Improvement Against Comparison Building	10.5%

The chart below shows the relative carbon emissions for the different building services in the building. It can be seen that the biggest carbon emissions are related to electricity consumption by the lighting, with the second biggest being the carbon emissions associated with heating.

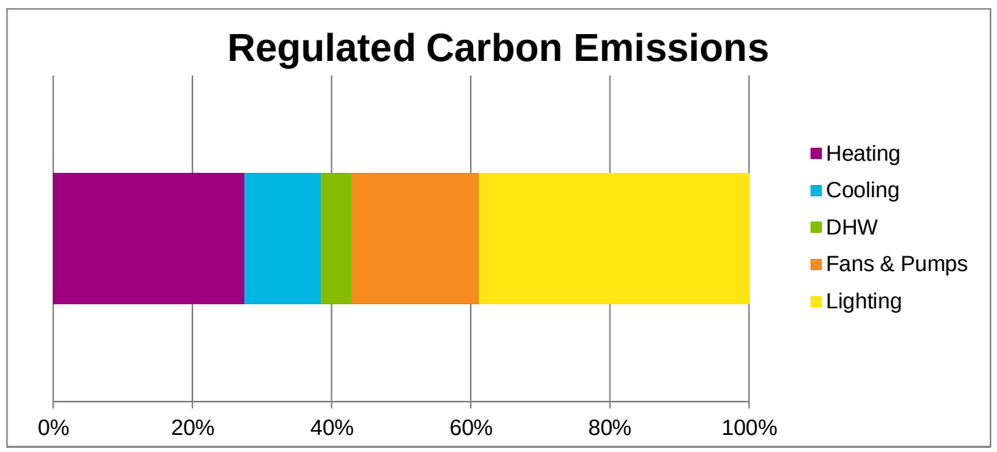


Figure 3: Relative Carbon Emissions for the Actual Building

Target Areas for Improvement

The building design at this stage complies with the required design criteria. However as the building design progresses, the definition of the façade by the architect and the design of the building services will enable a more accurate result.

Renewables

Table 9: Summary of Renewables

Renewables	
Air Source Heat Pump	Heating SCOP: 2.8; Cooling SEER: 4.0

It is estimated that these will provide an 11.5% carbon emission saving from baseline carbon emission.

Criterion 3 Passive Control Measures to Limit Solar Gains

The building design at this stage complies with the criterion.

3.3 BREEAM Strategy for Engineering Services

Although there is no requirement for BREEAM from a planning perspective, in October 2018 AECOM's sustainability group were instructed by the College to carry out a BREEAM Pre Assessment exercise to establish the likely rating for the project to establish which credits could be easily achieved without major impact to current design, programme and budget. The Pre-Assessment was based on the BREEAM New Construction 2018 Education – Fully Fitted Outer Higher Education type assessment. It was concluded that current scheme for the project would yield a pass rating however there was potential to achieve a Very Good Rating with some additional work. As the MEP design progress onto stage 4 the design will be carried to ensure all the available credits can be achieved for the following;

Hea 01 – Internal and External Lighting Levels, Zoning and Control

Hea 02 - Ventilation

Ene 05 - Part A: Refrigeration Energy consumption and Part B: Indirect Greenhouse Gas Emissions

Ene 06 - Part a: Energy consumption and Part B Energy Efficient Features

Wat 01 – Water Consumption

4. Engineering Service Strategies

4.1 Incoming Services and Site Utilities

This section of the report should be read in conjunction with external services drawings included in the appendices of this document.

Electrical Supplies

The UK Power Networks (UKPN) local11kV network traverses the site via a combination of overhead lines and underground cables connecting to three main substations (Sub A, Sub B and Sub C).
Majority of the site including the TaRC is fed from sub A as shown in the figure 4 below.

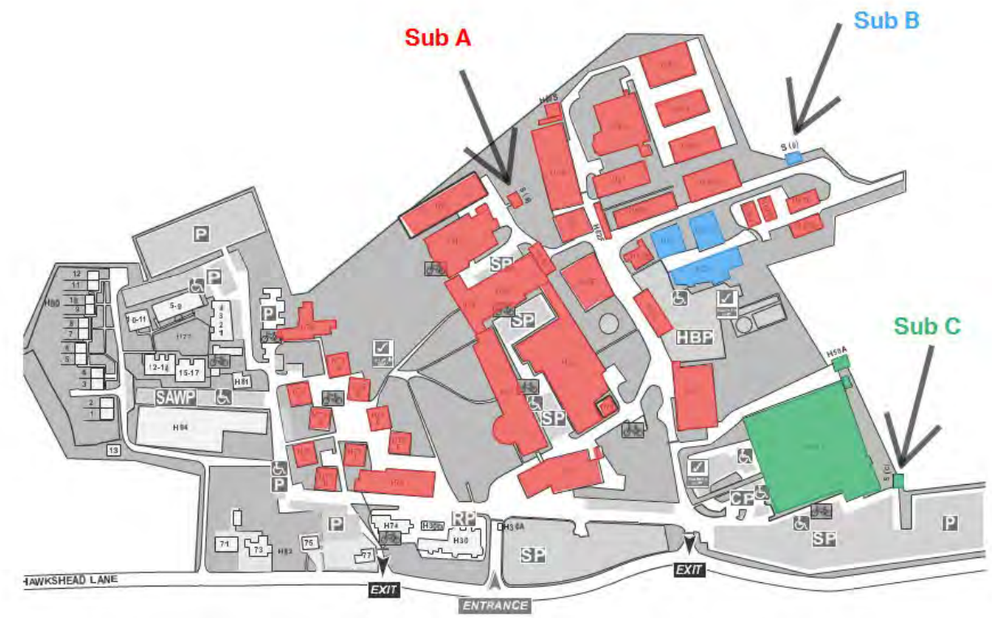


Figure 4: Site Existing Electrical Supplies

The ratings, loads and potential spare capacity of each substation are given in the table below.

Table 10: Information on Site Substations

SUB	Capacity (kVA)	UKPN agreed availability (kVA)	UKPN recorded Maximum Demand Value (kVA)	Potential Spare Capacity (kVA)
A	800	400	448 (Jun 17)	352
B	500	155	120 (Jul 17)	380
C	1000	270	263 (Jul 17)	737

During a design team meeting on 05/07/2018 the project engineer from UKPN advised that the TaRC/new build have to be fed from the same substation as the Eclipse, Mill Reef building and Link building because they are physically linked. He advised that it is UKPN policy to ensure that when they supply customers at low voltage they do not provide multiply supplies to a single building to avoid the risk of having more than one earth reference within the building.

Therefore the supply for new build would have to originate from substation A and Substations B and C would not be viable options to provide an electrical supply for the new build.

Substation A

Substation A has a single medium voltage feed from the overhead lines running through the site as shown in figure 5.

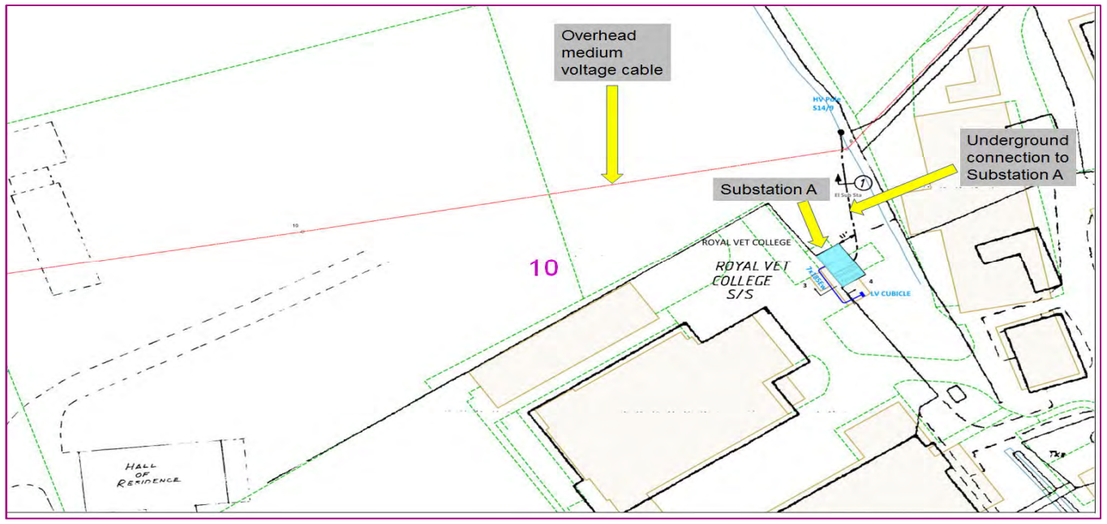


Figure 5: Substation A existing 11kV Connection

The medium voltage feed terminates into an 800kVA rated oil filled transformer that provides a dedicated low voltage supply to the site via a 25 year old 1600A Dorman Smith low voltage switchboard located in a brick built LV switch room adjacent to the UKPN substation. From this switchboard there are connections to most of the buildings highlighted in red in figure 4.

Figure 6: Existing 1600A Dorman Smith LV Switchboard

Also connected to the 1600A Dorman smith panel is an 800kVA emergency standby generator which supports the buildings highlighted in red during a mains failure.

New Build Electrical Load

The estimated load for the new build at stage 3 is 530 kVA however the potential spare capacity on the existing substation A is 352kVA. When demolition of the Clinical block (H20 South) is taken into consideration the potential spare capacity on substation A is 464kVA which is still less than what is required for the new build. Therefore substation A needs to be upgraded to be able to power the additional load (The new build). Taking in to consideration the size of load for the new build and the client's future plans to redevelop old buildings around substation A, it was concluded that upgrading the substation A to 1500kVA would be the most appropriate strategy

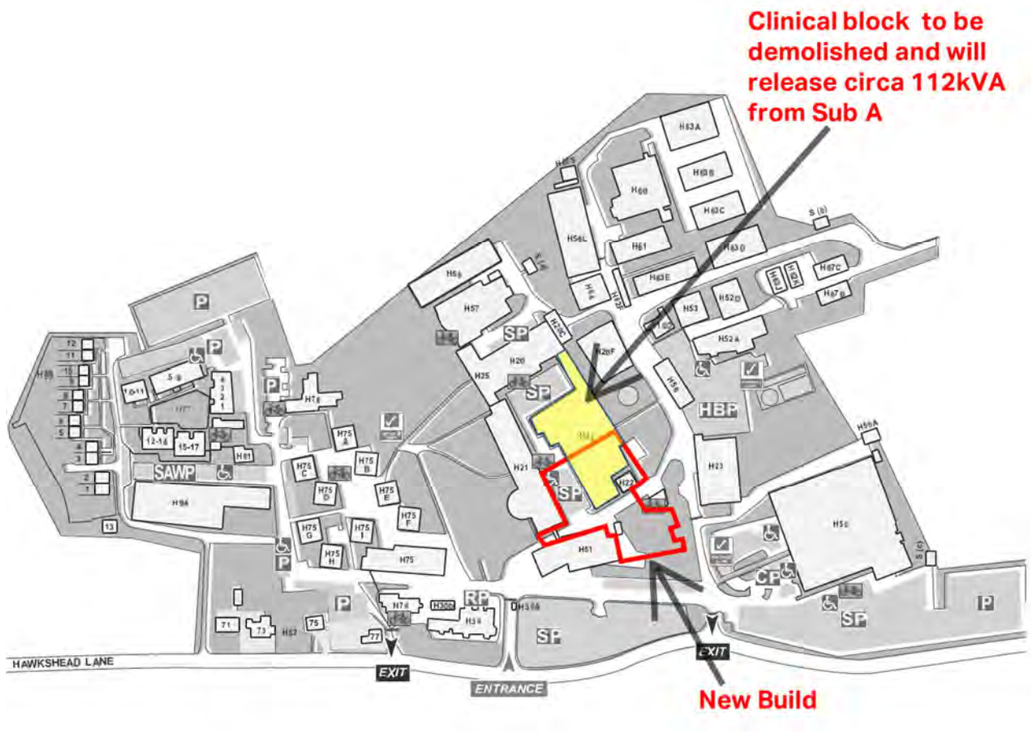


Figure 7: Site Layout showing footprint of new build and H20 South building which will be demolished

Upgrade of Substation A

In order to upgrade substation A, a new 1500kVA substation will have to be built near the existing substation A and the MPAN number of the existing substation transferred across to the new substation. The new substation will be brick built and will be close to the overhead lines and have vehicular access. The minimum area UKPN require for the new substation is 5m x 5m. The proposed location for the new substation is shown in figure 8.

Figure 8: UKPN Standard Brick Built Substation Options

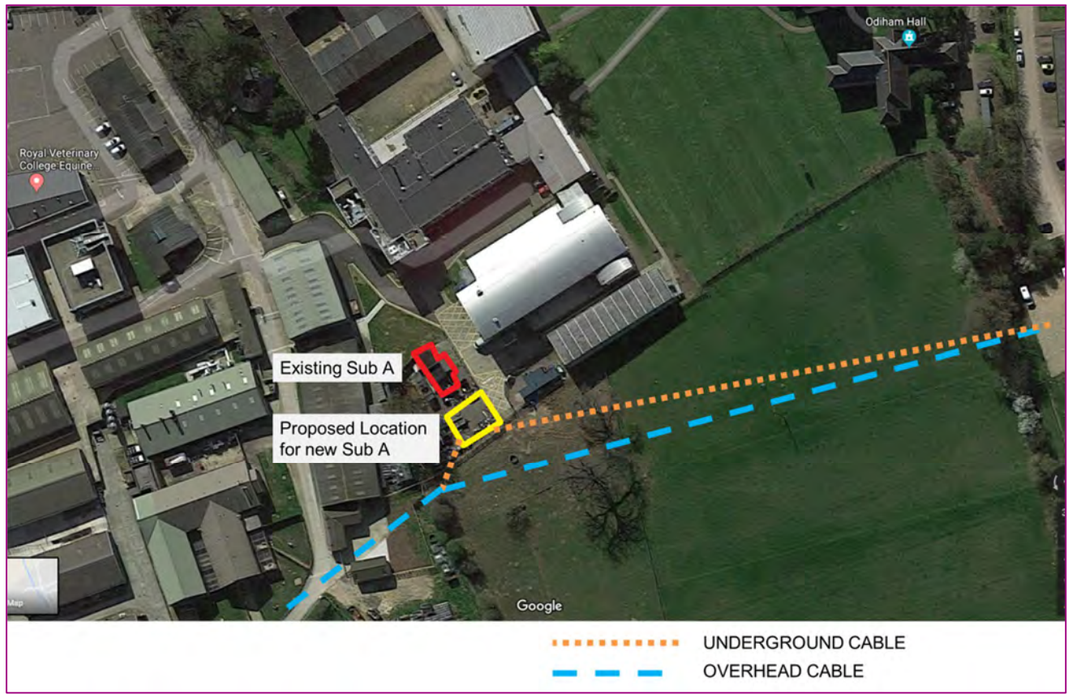


Figure 9: Proposed location for new substation A

As part of the upgrade of substation A, two 11kV connections will be provided to the new substation A via a ring main unit. These will be underground connections taken from the overhead line that runs close to proposed location for the new substation A. See figure 8 above. These connections will be from separate medium voltage power poles and will enhance the overall resilience of the new substation A. The existing substation A only has one 11kV connection as shown in figure 5.

It is proposed that a new LV switch room is built joint to the UKPN substation as shown in the substation A layout drawing in the appendices of this document. The Switch room will house a new 2500A low voltage switchboard which will be connected to the new substation. The new switchboard will also provide a connection to the TaRC/new build as well as 1600A connection to the existing Dorman Smith switchboard as shown in figure 9.

The new switchboard will be afforded spare cubicles with plugin bases for future use.

The existing Dorman Smith switchboard is circa 25 years old and will need to be replaced in the near future as part of a standalone project.

Extensive ground works will be required to provide a suitable cable route from the new substation A to the TaRC/new build. As the cable feeding the TaRC runs through the Clinical block a temporary connection will be required to supply the TaRC that avoids the foot print of the new build and is outside the construction area for the project. The temporary connection for the TaRC will be adequately sized capable of supporting the TaRC and the new build. Once the new build is in place and is ready to be energised the temporary cables to the TaRC will be cut back to a suitable location jointed and taken into the new build's low voltage switch room.

Low Voltage Generation

The existing LV distribution at substation is currently backed up by an 800 kVA containerised emergency standby generator set with a local bulk fuel tank with 3 days fuel storage capacity. It is the understanding of the design team that during power outages this generator is not capable of supporting the load on Substation A and occasional stalls as a result. Therefore as part of the substation upgrade works two options will be explored with regards the generator provision for substation A.

Figure 10: Existing 800 kVA containerised emergency standby generator set at Substation A

Option 1: Provide a new 1800 kVA containerised emergency standby generator set with local bulk tank with 3 days fuel storage to replace the existing 800kVA. The new 1800 kVA generator set will be capable of supporting the existing and future load on substation A. The existing 800 kVA generator set including bulk tank will be relocated to the Queen Mother Hospital for Animals (QMHA) to replace the existing generator serving that building. The design team understand that existing QMHA generator is currently undersized as the load for the building has increased over the years.

Option 2: Retain the existing 800 kVA containerised emergency standby generator set however as we know it will not be able to support the full load of substation A, introduce a means of load shedding to ensure the generator supports only the essential loads as oppose to the whole substation A. This option will require the existing Doorman Smith switchboard to be replaced to with a new switchboard that has circuit breakers that can be controlled remotely by the generator control system. Also the generator control will have to be modified to initiate the load shedding sequence prior to start up. The College will have to identify which buildings will classed as essential loads to go onto the generator

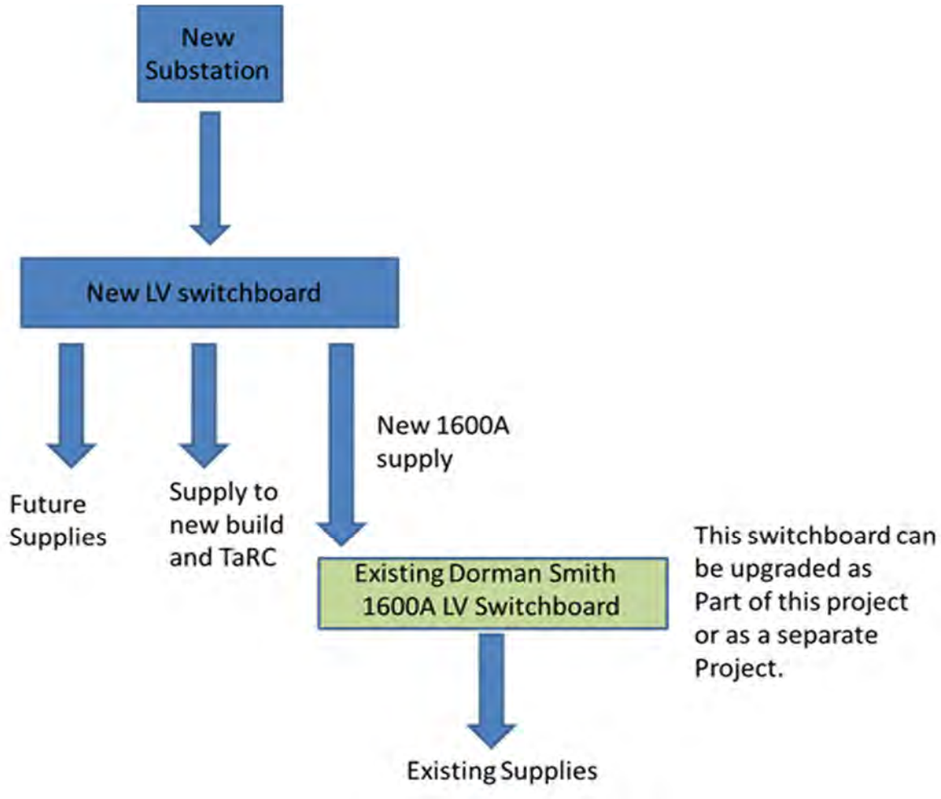


Figure 11: Proposed LV Schematic for the new Substation A

Natural Gas

The existing low pressure natural gas supply for the TaRC will have to be diverted because it runs through the area allocated for the new build. A new metered low pressure gas supply will be provided to serve the New Build. The existing medium pressure natural gas supply that serves the Eclipse Building will also have to be diverted to make way for the new build. New low pressure gas mains will be used to Eclipse Building.

Water Main

It is proposed that the new water supply will be provided from the existing capped off connection located to the south of the TaRC building. The new connection shall be fitted with an external water meter and used as a main metered connection to the TaRC and new build. The existing water connection to the TaRC building will be disconnected, once the new supply is fully operational.

IT/ Comms

The TaRC has a fibre optic connection to the data centre in Eclipse. This is an internal connection which runs through the link bridge between the two buildings. Currently there are no ducts for a fibre optic connection from the TaRC to the data centre in the Queen Mother Hospital for Animals. This will be required for the redevelopment to enhance the resilience of the network connection in the TaRC/new build. The preferred route for the ducts is currently being reviewed by the client's IT infrastructure team and will be incorporated as part of the enabling works package.

4.2 Building Interfaces

The TaRC and new build will have the following interfaces to other buildings on site

- Low Voltage Electrical Connection

  The Low voltage supply for TaRC/new build will be derived from the new Substation A low voltage switch room as described above.

- Fire detection and alarm system

  There will be an interface between the fire detection and alarm system in the TaRC/new build and the fire detection and alarm system in the Eclipse building.

- IT/Comms

  Fibre optic cable connections from the main comms room in the TaRC/new build to the data centre in Eclipse and to the data centre in the Queen Mother Hospital for Animals.

4.3 Central Plant and Resilience

Refer to bases of design & resilience

4.4 Plant Locations, Maintenance & Access / Residual Risks

All items of plant and equipment will be installed and located in such a manner that access for servicing and maintenance is achieved in accordance with the manufacturer's minimum requirements. In addition, relevant guidance from other good practice documents will be followed, including CIBSE Guide to ownership, operation and maintenance of building services.

Refer following documents included in the appendices of this report.

- Plant Replacement Strategy Drawings
- Safety in Design Risk Register
- Major Plant schedule.

4.5 Commissioning and Testing

Commissioning works for MEPH installation shall be undertaken in accordance to all CIBSE, BSRIA and HVAC guides of good practice.

Commissioning will be carried out to encourage a properly planned handover and commissioning process that reflects the needs of the building occupant. It is strongly recommended that the following requirements are met:

- The appointment of a specialist commissioning manager by the Main Contractor.
- Inspection and checking of the final works carried out to ensure that they meet with the requirements of the specification and design. This will include a thermographic survey and building air leakage test.

5. Scope of Works

5.1 Public Health Services

S10 – Cold Water Services

Mains Cold Water Service

A new main metered water connection will be provided to the TaRC and new build, as described under site utilities section.

The new incoming main will enter the TaRC building below ground floor level, and into the meter room located at the back of the lift shaft, where it will be then extended to serve:

a) The existing cold water storage tank, located in TaRC roof plantroom

b) The existing rainwater harvesting tank, located in TaRC building,

c) CAT 5 Laboratory storage tank, located in the New Build roof plantroom

It is proposed that the existing domestic water storage tank located in TaRC roof plantroom remains unchanged, whereas the existing reclaimed water storage tank will be disconnected from the rainwater harvesting tank supply and provided with upgraded mains water supply.
The new cold water storage tank in new building will be approx.3000L. The new tank will incorporate internal division plate to facilitate draining down and cleaning without interruption of service to the buildings. The water tank float valves will be adjustable to maintain a twice-a-day water turnover. This is in line with Institute of Plumbers' recommendations.

Domestic Cold Water Service

It is proposed that the domestic cold water service will be provided from the existing storage tank within TaRC building, and be extended to the new domestic water draw off points within New Building.
The existing boosted cold water supply to the laboratory outlets within TaRC building shall be disconnected and capped off at main branches, and new laboratory water supply shall be provided from Laboratory tank and pump set – see Laboratory Cold Water services section.

In general, boosted cold water distribution within TaRC will remain unchanged, except supply to laboratory outlets, as described above. Boosted water will be extended to new building and distributed via vertical pipework risers to all floors. Water pressure at lower floors will be regulated by pressure regulating valves to ensure that 2.0bar at each outlet is achieved.
At this stage it is proposed that all toilet areas are provided with automatic sanitary water shut-off to prevent water misuse such as WC overflows or leaking taps. The system will be controlled by local PIR's and central controllers for each toilet area.
It is assumed that the non-potable water distribution pipework from a dedicated tank, located in the TaRC roof plantroom, remains unchanged; however, potential option for system extension to feed new toilet core in Eclipse building shall be discussed with the client.
All new domestic water services (hot and cold water) will be installed in copper pipework to BS EN 1057 R 250

Laboratory Cold Water Services

A dedicated Laboratory CAT 5 cold water storage tank and variable speed booster pump set will be provided within the New Building roof plantroom.
It is proposed that prior distribution, the Laboratory cold water will pass through base-exchange water softener, located in the roof plantroom, in order to reduce water hardness and extend the life of laboratory equipment, such as autoclaves and local electric water heaters.

From the water softener, the Lab water will then be distributed via vertical risers throughout the building to all outlets within laboratory and teaching rooms.
Laboratory water services will also be extended to serve new and existing lab areas within TaRC building (previously served off the domestic water supply).
Where hot water is required for laboratory purposes, this should be supplied from the laboratory cold water supply.

S11 - Hot Water Service

Domestic Hot Water

In general, the domestic hot water for the New Building will be generated locally via small capacity (10 – 15L) electric water heaters, generally located adjacent to the appliance served.

It is proposed that the existing hot water generation plant located in TaRC and Eclipse building will remain unchanged and the hot water distribution pipework will be extended to serve relocated toilet core within Eclipse building.
The hot water distribution service will consist of a flow and return pipework system with circulation pump, routed within dedicated mechanical risers and ceiling voids to feed the various sanitary fittings throughout the building.
Wash hand basins will be provided with individual thermostatic mixer valves to ensure a safe deliverable temperature (41-43°C) is provided and to avoid scalding.
The distribution system will be fully insulated and designed in accordance with BS 8558, BS EN 806, Parts G3 and Part L of The Building Regulations and the water regulations.

Laboratory Hot Water

Where required, the laboratory hot water will be generated locally, via point of use electric water heaters. These will be located to suit laboratory equipment and furniture layout, generally under the sink bench.

R10 – Rainwater Disposal

Gutters and Rainwater Outlets for the New Building will be detailed by the Architect. Surface water will be collected from the roof outlets and routed vertically down via mixture of internal and external downpipes, to a series of connections at ground floor level, into below ground system. It is proposed that the rainwater system is based on gravity principles, not siphonic.
All external rainwater downpipes and rainwater hoppers will be detailed by the Architect.
The internal rainwater system will be designed and installed in accordance with BS EN 12056 Part 3 and Approved Document H as a minimum.
The existing rainwater system within the TaRC and Eclipse building will remain largely unchanged, with minor modifications expected in areas where new building will be linked to the existing TaRC and Eclipse buildings.
Details of surface water drainage system below ground level are not covered by this document, as these form part of the civil and structural engineer's scope. Relocation of the existing rainwater harvesting components any rainwater attenuation systems will be described within civil / structural engineering report.

R11 – Above Ground Foul Water Drainage

A full system of gravity drainage pipework will be provided throughout the new building. New drainage stacks will be located within dedicated ducts or in adjacent to the columns, and routed vertically down to ground floor slab level, where they will connect to the external below ground drainage system.

Generally, main soil / waste vent pipes will rise to roof level and terminate with a vent cowl / wire balloon before discharging to atmosphere. Anti-siphon pipework will not be provided, instead anti-vacuum traps are proposed to be installed on the sanitary appliances.
It is anticipated that the existing drainage stacks within TaRC building will remain unchanged; however some modifications will be required for the new toilet area within Eclipse building.
The system will be designed and installed in accordance with BS EN 12056 Part 2 and Approved Document H as a minimum.
Access will be provided at all branches and changes of direction and at connections to the below ground foul drainage system. All soil stacks will be provided with access for cleaning / rodding purposes positioned above the flood level of the adjacent sanitary fitting and located at each floor level.
Condensate from the fan coils and AHU's will connect to the foul water drainage system with trapped connections via HEPVO drain valves in accessible locations.
A number of internally bunded floor gullies will be provided at roof level, where mechanical plant is located such as AHUs, collecting condensate discharge from these units.

All plastic pipework penetrations through fire compartments will be fire sleeved.

All above ground sanitary pipework will be provided as follows:

a) Cast Iron to BS EN 877 for main drainage stacks
b) PVC for lateral run outs

All main vertical stacks, offsets and horizontal runs will be acoustically insulated.

R14 - Laboratory Drainage

An applicable chemical resistant drainage pipework such as Vulcathene or similar, will be provided locally to laboratory areas with potential hazardous discharges. Dilution pots will be provided on the outlets to sinks and fume/safety cabinets.
Where required, floor drainage in the form of floor gullies will be provided to the lab areas at ground floor for wash down purposes.
It is anticipated that some laboratory areas might be generating radioactive waste. These shall be discharged via chemically resistant pipework and connect either to decay containers (high radioactive concentration), or connect to dedicated drain points (low radioactive concentration). All radioactive pipework shall be clearly labelled and shielded if required.

5.2 Mechanical Services

The internal environment will be designed to maximise the occupants' comfort. This will be achieved by utilizing knowledge and relevant literature to provide the best fit system to ensure that the occupants' comfort, health, and energy efficiency are optimised.

Design information has been taken from CIBSE guide A: Environmental Design which is 'the primary reference source for designers of low energy sustainable buildings'.

5.2.1 Heating Systems

The temperatures listed in the '*Environmental Criteria'* will provide an environment to achieve satisfaction of the occupants:

It is proposed that primary heating is provided by a central LTHW heating system using an air source heat pump (ASHP), and gas fired boilers located at roof level. The LTHW heating system will provide space heating and assist the heat recovery in tempering cold fresh air before it enters the building.

T10 Low Temperature Hot Water Heating

Heating for the new facility will be provided via a combination of air source heat pump system supported by high efficiency gas fired condensing boiler plant. It is envisaged that the building will have a simultaneous heating and cooling requirement in some periods of the year and the heat pumps will be configured to take maximum benefit from this.

A roof mounted air-source heat-pump (ASHP) will be the primary heat-source for the heating circuit. The ASHP will be sized to meet 25% of the peak building heating demand.

Roof mounted air-source heat-pumps will redistribute any rejected heat where and when able.

The heating solutions proposed for the building are as follows:

Underfloor Heating
To suit the high ceiling areas underfloor heating will be provided at the ground floor atrium, reception area and flexible indoor space.

Radiant Panels
Radiant panels will be provided for open plan social learning area in ground and first floor, Library and teaching labs to suit open plan design. Small teaching rooms will also be provided with radiant panels for winter space pre-heating.

Radiators
Radiators will be provided at bottom of the stair cases.

Trench Heating
Trench heating will be provided at the perimeter around library, open plan offices, flexible indoor space, lecture theatres and DL rooms to offset fabric loss and prevent cold down draught.

Air Curtains
The main entry doors will be provided with over-door air curtains in combination with a draft lobby to minimize draught in Reception area.

Fan Coil Units
Heating via fan coil units will be provided for laboratory and office areas where insufficient heating capacity from the supply air.

Reheat Batteries
Reheat batteries will be provided in laboratory areas for mid-season temperature control

T19 Combined heat and Power

CHP is not currently proposed for this project.

T20 Primary Heat Distribution

New primary systems will be provided to serve air handling plant and various terminal heating devices via variable volume pumping controlled with multiple pressure sensors.

LTHW from the roof plant will be distributed to air handling plant and the mechanical risers. Valved branches will be provided at each floor. Pipework will run at high level in the ceiling void/in a service zone along the corridors to serve the local heat recovery ventilation units, fan coil units, underfloor heating, radiant panels, radiators, reheat batteries, trench heating and air curtains. It will drop to low level to serve underfloor heating and trench heating.

5.2.2 Cooling Systems

The temperatures listed in the '*Environmental Criteria'* will provide an environment to achieve satisfaction of the occupants:

It is proposed that primary cooling is provided by a central CHW cooling system using an air source heat pump (ASHP), and air cooled chiller located at roof level.

T60 Central Refrigeration Plant

The air source heat-pump will provide the primary source of cooling and will be sized to meet 50% of the peak cooling load. During periods when heat recovery is not required, it will be more economical to run separate high efficiency chillers such as a Turbocor to meet the cooling load of the building.

T61 Primary / Secondary Cooling Distribution

New primary and secondary systems will be provided to serve air handling plant, cooling batteries, fan coil units via variable volume pumping with multiple pressure sensors. There is a potential option to provide some cooling through the radiant panels, but this is not currently required.

CHW from the roof plant will be distributed to air handling plant and the mechanical risers. Valved branches will be provided at each floor. Pipework will run at high level in the ceiling void/in a service zone to serve the fan coil units, cooling coils, and radiant panels (if required).

Cooling to the new IT Comms room may be required subject to IT department's confirmation of their load and temperature requirements.

T70 Comfort Cooling

Cooling will be provided by 4 pipe heating & cooling fan coil units (FCUs) for perimeter study room, visiting lounge, meeting room, small offices, and new laboratory extension along with the surrounding office area.

The DL rooms served by local heat recovery ventilation units will be equipped with cooling batteries to offset heat gain from high density of occupancy.

Additional cooling will be achieved through night cooling of the exposed thermal mass.

T71 Cold Room

The cold room cooling packaged plant shall reject heat to atmosphere. Under normal operation, the cold room remains closed with minimal load to maintain an internal condition of 4°C.

5.2.3 Ventilation Systems

The following systems have been proposed for the various occupied areas in the building.

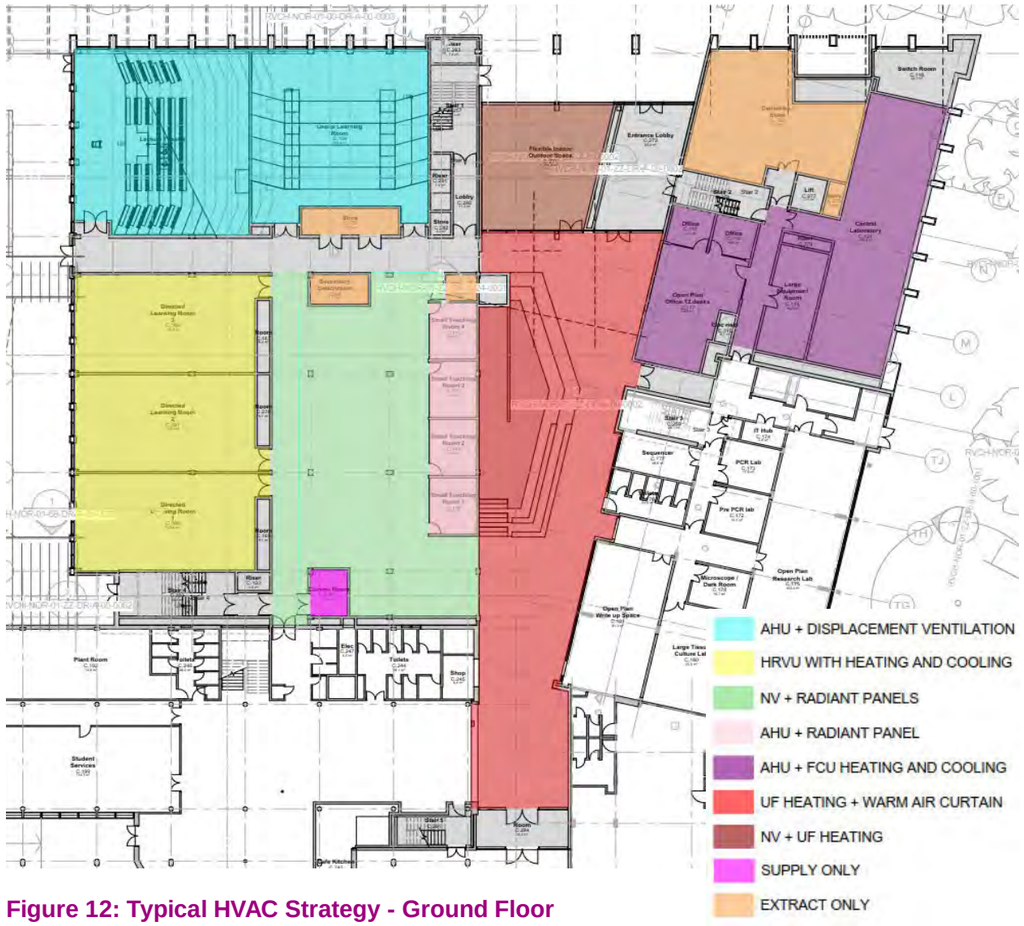


Figure 12: Typical HVAC Strategy - Ground Floor

Figure 13: Typical HVAC Strategy - First Floor

Figure 14: Typical HVAC Strategy - Second Floor

U10 Ventilation Supply/Extract

Air Handling Units

Air handling units will comprise typically supply and extract fans, filters, thermal wheel / plate heat exchanger, attenuators, LTHW heater battery, and CHW cooling battery. It is anticipated that re-circulation facility will be provided on the lecture theatre AHUs to assist with energy efficient operation during periods of low occupancy.

New ventilation systems will be provided to suit requirements. AHUs will be provided for the lecture theatre (lower level), lecture theatre (upper level), group learning, laboratory & surrounding area, and collective spaces such as small teaching rooms / offices / /meeting room / visiting lounge.

All AHUs will be located in the roof external plant area except the AHU serving collective teaching area which is to be located in the roof plant room. The AHU's will be enabled and speed controlled via the BMS to meet the required air flow in each area as dictated by temperature, CO_2, make up air demand and time clock settings.

Laboratory and Surrounding Spaces

The air handling plant will be located in the external plant area at roof level. Supply ducts will be distributed via vertical risers. At each floor level, supply ductwork will be distributed within the corridor ceiling void to all occupied areas with air supplied to the space via variable air volume (VAV) boxes and diffusers as required.

Return air will generally be extracted from occupied laboratory areas via ductwork bell mouths mounted in extract plenums. The air will then follow a similar path to the supply air back to the air handling units at roof level. Within the air handling units the heat in the return air will be recovered using plate heat exchanger before it is exhausted to atmosphere.

The central AHU plant will be sized based on 8 ACH for the laboratory areas where the room connection will be sized based on 10 ACH to allow for room clearance the room in the event of a gas leak from the equipment.

Lecture Theatre / Group Learning

Displacement ventilation will be provided for lecture theatre and group learning area. The supply air from AHUs will be served via ductwork and diffusers under the seats and return air via extract grilles at high level.

Where fixed seating isn't provided wall mounted displacement diffusers will be provided due to flexible seating design for the upper level lecture theatre.

Figure 15: Typical ventilation strategy for lecture theatres

DL Rooms

Local packaged heat recovery ventilation units will be provided for DL rooms (under soffit) and teaching labs (on the roof above the space) considering high occupant density and flexible operation of the rooms. Intake and exhaust louvres will be required with proper separation.

Natural Ventilation

Figure 16 shows the natural ventilation provision for library, open plan offices, social learning areas and flexible indoor space.

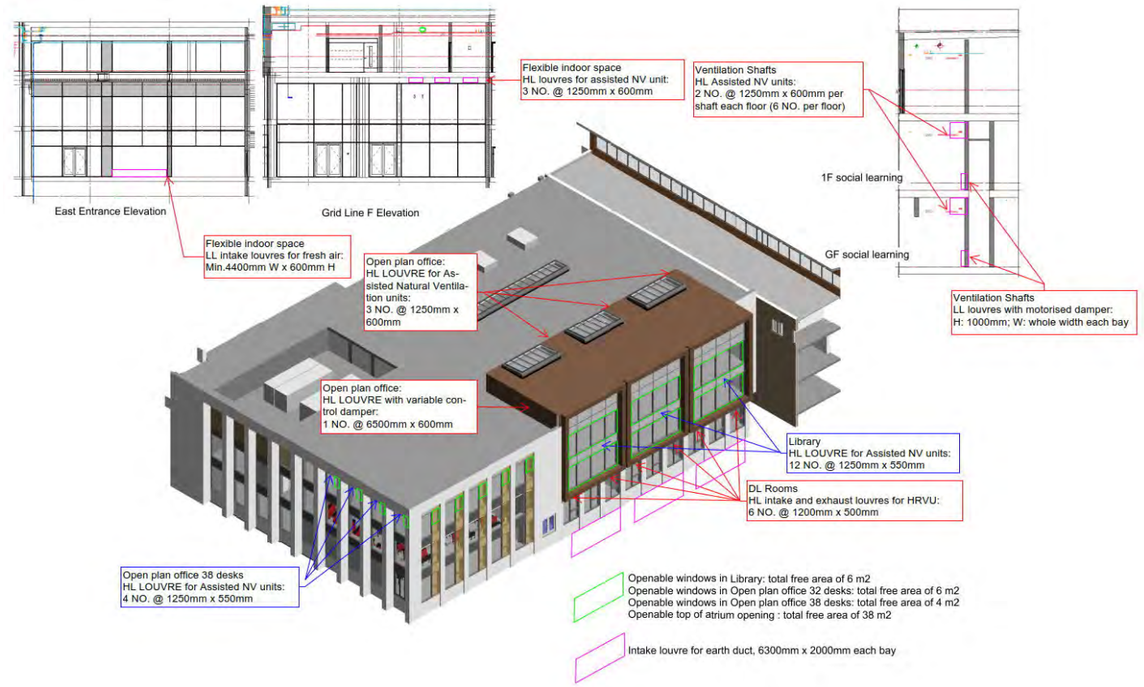


Figure 16: Natural Ventilation Provision

Library

Natural ventilation has been proposed for the open-plan library via openable windows and assisted natural ventilation units for fresh air requirement in winter. The air will flow into adjacent social learning area and leave the building from the roof openings of the atrium.

Open plan offices

Natural ventilation has been proposed for the open-plan offices via openable windows and assisted natural ventilation units for fresh air requirement in winter. The air will flow into the space and leave the building from high level variable control damper.

Social Learning Area

Natural ventilation has been proposed for the open-plan social learning area in ground and first floor via concrete earth ducts below DL rooms. The air will move along three vertical shafts, pass through high level assisted natural ventilation units and low level grilles for each floor, and leave the building from the roof openings of the atrium

Flexible Indoor Space

Natural ventilation is proposed for the space with low level intake louvre on the east façade and high level assisted natural ventilation units to the atrium.

Circulation and atrium spaces

No means of ventilation will be provided for circulation and atrium spaces.

Ventilation controls

Ventilation rates to each space will be controlled via proprietary duct mounted VAV controllers located in the branch serving each individual area. Duct mounted attenuators will be provided downstream of VAV controllers to meet the room noise criteria.

VAV controllers will be capable of full shut off so that when areas are unoccupied the ventilation system can be switched off. When areas area occupied, the required ventilation rate will be determined by a combination of temperature and CO_2 sensors in each space or to suit make up air demands from specialist extract systems. Override with time switch will be provided for the laboratory areas where normal ventilation rate is less than 10 ACH to boost the ventilation rate for the set period.

The demand based ventilation will be via variable air volume (VAV) ventilation as this is an energy efficient method of providing ventilation (CIBSE TM50 recommended).

Ventilation strategy in other areas

The principle ventilation strategies outside of the teaching and laboratory accommodation will be as follows:

Toilets
Toilets will be provided with mechanical extract ventilation. Make up air will be provided via transfer grilles located above doors or transfer ducts at high level for larger WC areas, and undercut doors for single WC cubicles.

Atrium Smoke Extract
In line with the Fire Strategy smoke ventilation louvres / openings will be provided in the roof of the atrium.

Boiler Plant Room
Boilers require a source of fresh air for the combustion of gas. These will be via fire rated louvres on the plant room walls to the outside.

Flue discharge will be individual boiler flues approximately 3m above the highest point of that section of roof.

U15 Equipment or Fume Extract systems

Fume Cupboard Extract systems
Dedicated fume cupboard extract system will be provided to the fume cupboard in large equipment and central lab in the ground floor with make-up air from air handling plant at roof level.

Make up air will be partly directly delivered into spaces as part of the minimum fresh air requirement with additional make up air transferred from adjacent circulation areas.

Fume cupboard extracts will be the variable air volume type with individual VAV control for each fume cupboard.

The effect of fume cupboard extract discharges on surrounding higher buildings will need careful consideration; typically discharge points will be at 125% of the building height and taking due consideration for adjacent air intakes.

Discharge velocities will be between 7m/s and 15 m/s the use of variable discharge velocity will minimise the need for additional controls associated with bleed exhaust dampers.

5.2.4 Specialist Systems

S32 Natural Gas

A new metered natural gas supply will be installed to serve new roof mounted boilers with gas distributed via ventilated riser to the roof plant room.

The existing incoming gas supplies to TaRC and Eclipse building will need to be diverted as part of enabling works. A common incoming low pressure gas main is proposed to supply the New Build and existing TaRC.

. **S34 – Medical / Laboratory Gases**

Gas cylinders, change-over manifolds, monitoring and alarm systems shall be designed in accordance with BCGA codes of practice.

Based on the various equipment requirements, new laboratory gases installations will be provided.
These will be as follows:

- Carbon Dioxide (external compound)
- Nitrogen (specialist system detailed by BOC)

The new CO2 and N2 gas pipework will be extended to supply new and existing points within TARC building and laboratory equipment in the new building.

At this stage a provisional location for gas bottle store has been made by the architect, at ground floor level, externally to the building, however, the spatial requirements will be subject to type and quantities of gases required, and specific system requirements such as liquid nitrogen vessels.

Where small quantities of specialist gases (Helium, Argon, Methane etc.) are used in the research laboratory areas, these will be stored locally in a cupboard outside the laboratory as opposed to providing a piped system from a central bottle store.

It has been noted that the vacuum system will be required for some laboratory areas. This shall be provided locally via in room containers. Specific requirements for vacuum system shall be confirmed by the client.

Gas leak detection system shall be provided by a specialist such as Safety Gas Detection (or equal and approved), to all laboratory areas within new building, with CO2 sensors at low level and oxygen depletion sensors at mid-level, close to terminal point. Sensors shall be connected to the alarm panel. The final location of panels shall be agreed with client and the architect. The alarm panel shall be then connected to the solenoid valve located in the main CO2 gas riser, which will disconnect the CO2 supply to the floor.

5.2.5 Controls, Monitoring & Metering

W60 Automatic Control Systems/Monitoring

A Building Management System (BMS) will be provided to control and monitor the building services installations and monitor the metering installations in the building. The existing BMS system in the TaRC building will be expanded to cover the New Build.

The BMS provides a powerful tool for monitoring energy usage, providing warnings when patterns of use fall outside normal parameters. Routine maintenance, coupled with investigation of any BMS fault warnings will assist in avoiding unnecessary energy usage.

BMS outstations will be located within Motor Control Centres (MCCs) related to the plant served and will interface with the building wide head-end system. It is intended that the BMS system will control and monitor the operation of all M&E plant and systems, other than where packaged plant with integral controls is used. Here the BMS will be used only to monitor operation/alarm.

Energy metering will be provided on each incoming utility supply and be supplemented with sub-metering of the principal loads within the building, in accordance with the requirements of the Building Regulations Part L2 and BREEAM.

Metering is provided to all major end uses for water, gas, electricity with sub-metering to segregate different end uses.

Types of meter and any specific metering requirements are to be agreed with the College.

All cold water mains at entry to building must have a metric flow meter installed reading in litres x10 or litres by 100. Whichever meter system is installed it must be capable of being interrogated by electronic loggers.

The BMS shall be set up to provide trend logs of all meters and environmental conditions.

The BMS shall be set up to provide a dash board graphic to identify carbon consumption and savings of end uses.

W60B Local Monitoring Systems

Where monitoring systems are required for fridges/freezers it is suggested that a wireless base station is provided which could be linked to the BMS or a paging system as required and transmitters used at each fridge/freezer.

Ventilation system, such as AHUs, HRVUs, Assisted Natural Ventilation units & motorised dampers, and VAV boxes, will be controlled by BMS linked to local CO_2 sensors and temperature sensors.

Heating and cooling system will be controlled by BMS linked to local temperature sensor and controller where required.

A single BMS compatible control point will be provided in each of the 3 LEP labs for a future gas detection system.

W54 Liquid Detection Alarm

Leak detection alarms will be provided as follows;

- Bunded wet areas within plant rooms
- Detection of a leak will shut off the water supply to the tank / tanks.
- At the bottom of lift shafts

5.3 Electrical Services

5.3.1 Electrical Supply Distribution

V11 Utility Supply

Substation A will be upgraded to 1500kVA. Please refer to the utilities section of this report.

V20 LV Distribution

A new low voltage (400V) distribution system will be provided in the new build incorporating the existing low voltage distribution system in the TaRC (H51). The new build and existing TaRC will become a single low voltage distribution system and will be electrically isolated from the existing Eclipse building (H21). Refer to LV Schematic in the appendices of this document

Main Switchboard

At the heart of the new low voltage distribution will be a new main low voltage three phase switchboard located in the main switch room on the ground floor of the new build. The new main low voltage switchboard will be compartmentalised to Form 4 Type 6 standard and will be front access only equipped with surge protection and circuit breakers with integral electronic trip units. A dedicated route will be required for cables from the new substation A LV switch room to the main switch room. These cables will enter the main switch room in either a trench or in ducts and will enter the main switchboard from the bottom.

Secondary Switchboard

A new floor mounted low voltage switchboard will be required to act as a secondary point of distribution in the system and will be located in a secondary switch room on the ground floor of the new build. This switchboard will be fed from the main low voltage switchboard and will be compartmentalised to Form 4 Type 6 standard and will be front access only equipped with surge protection and circuit breakers with integral electronic trip units

From the new switchboard and panel board the low voltage system will branch out to distribution boards, motor control centres (MCCs) and connections to the chiller and air source heat pump etc. All distribution boards will be located within dedicated electrical services cupboards or in plantrooms. There are electrical services cupboards on each floor from which final circuits will emanate from the distribution boards to the various rooms and spaces.

Distribution Boards

Split lighting and power distribution boards will be provided complete with energy consumption metering in accordance with the requirements of Part L of the Building Regulations. All distribution boards will have 25% physical spare capacity to allow for future expansion/reconfiguration and will be lockable with a key.

Motor Control Centres

Motor Control Centres will be required to power and control mechanical plant items and will be located in the second floor plant room.

Cable Distribution

Sub mains cabling will be routed from the main and secondary switchboards on the ground floor to the relevant distribution boards on cable management systems located at high level on each floor. In addition sub-main cable connections will be distributed to serve the chillers, MCCs, lifts and other primary loads.

Final circuits from distribution boards will be routed either at high level with containment or under floor. It envisaged that no underfloor containment will be provided. Cables will be either directly clipped to the slab or routed on data cable matting.

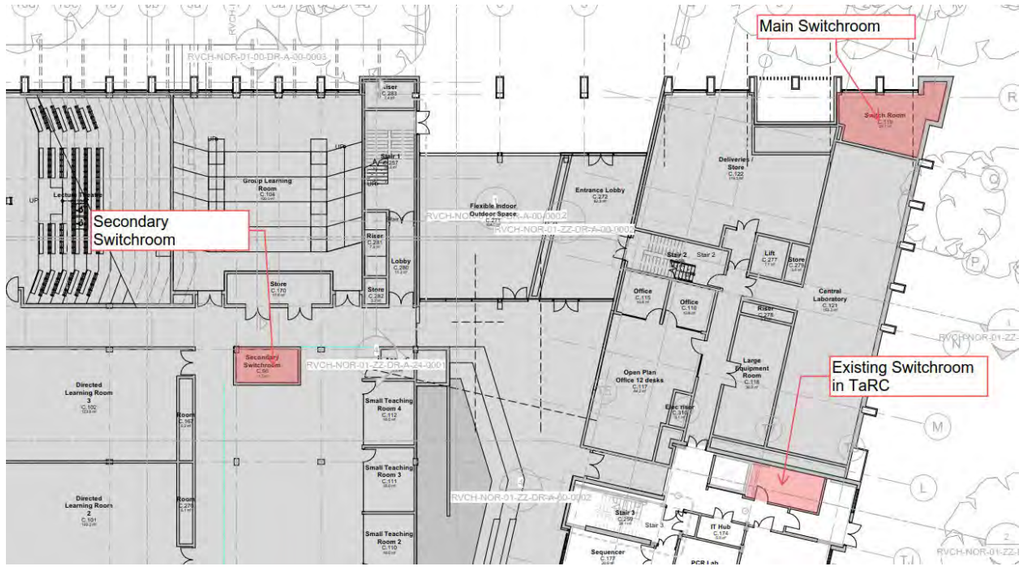


Figure 17: Ground floor layout showing existing and proposed electrical switch rooms

Containment

Containment and cable management will be required for the following systems as shown on the containment drawings in the appendices of this document.

- Low voltage sub mains cables
- Fire detection and alarm system cables
- Earthing cables
- IT/AV system cables
- General lighting and power cables
- Energy monitoring cables
- Lighting control system cables
- Building Management System Cables

Power Factor Correction

No power factor correction unit will be provided within the main switch room as there will be power factor correction within the low voltage switch room at substation A. However local power factor correction will be required to the chiller.

Metering

Systems will be provided with energy meters to ensure at least 90% of the estimated energy consumption of each fuel is metered. The electrical metering will be provided in accordance with Part L of the Building Regulations and EU Energy Efficiency Directive – Article 9 (Metering). All meters will be connected to an Energy Management System. This could be a stand-alone system or be provided as part of the BMS.

W51 Earthing and Bonding

Earthing and bonding will be provided in accordance with the BS 7430:2011, the IET Wiring Regulations (BS 7671:2008) and local electricity supply authority regulations.

General earthing requirements (excluding supplementary earthing) will be carried out utilising local earth bars contained within the distribution boards. Supplementary bonding will be provided from a separate earth bar.

A clean telecommunications earth bar will be installed within all equipment rooms (ER and SERs).

5.3.2 Electrical Generation

V10 Generator Power

The entire building load will be supported by the new substation A emergency standby generator. Refer to the utilities section of this report.

5.3.3 Uninterruptable Power Supplies

V32 Uninterruptable Power Supply

No centralised UPS systems will be required. Rack mounted UPS units will be provided in the equipment rooms to support IT and controls systems as required.

5.3.4 Lighting and Emergency Lighting

Refer the lighting design report in the appendices

5.3.5 Electrical Distribution and Small Power

V22 General Power

This section of the report describes the small power distribution strategy for certain areas in the building. It is should be noted that the small power provision and strategy is mainly driven by the client brief for these areas however that briefing exercise was still ongoing at the time this report was compiled. The small power layouts will completed as part of the stage 4 design prior to which the client briefing would have been completed

Laboratories

Power outlets will typically be provided in white PVC dado trunking mounted along the walls or on the fixed work benches.

Twin socket outlets will be provided at a frequency of two every meter of dado trunking. Large equipment will be fed via isolators or commando sockets.

Where under bench fridges or freezers will be installed they will be provided with un-switched single socket outlets at low level remotely switched from a switched fused connection unit mounted within dado trunking above the work bench.

Cleaners' socket outlets will be provided at 10m intervals in every laboratory as applicable.

Power poles will be provided in the tissue culture laboratory to service the class II safety cabinets which will be located in the centre of the room.

Dado trunking, socket outlets and other service outlets in the microscope room will be required to be black as this laboratory will be a dark room.

The mounting height for all service outlets for large equipment in the laboratories will be coordinated with the equipment

Lecture Theatre

Socket outlets will be provided at the fixed seating in the lecture theatre. A twin socket outlet will be provided per two seats. This will ensure each student in the Group Learning will have the ability to charge their laptops or tablet during lectures. It is envisaged that the socket outlets will be incorporated into the furniture by means of proprietary trunking system. Typically in these areas the distribution of final circuits will be from below.

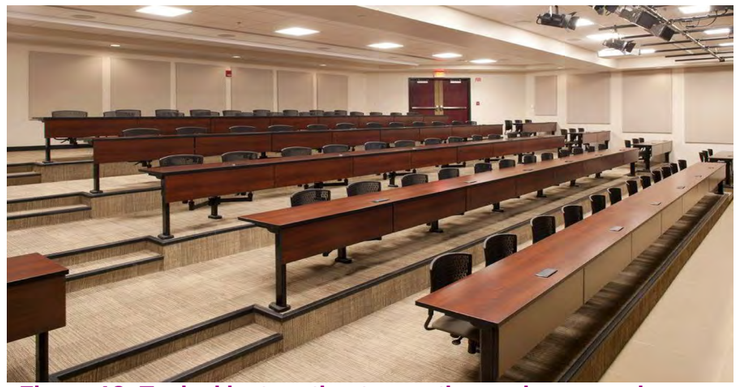


Figure 18: Typical lecture theatre seating and proposed power distribution strategy

Open Plan Offices/ Social Learning Spaces/ Library

General small power provision in the open plan offices will be through a combination of floor boxes and under desk power modules plugged in to underfloor power track. This strategy will offer the maximum flexibility to these spaces. It is envisage the furniture in the social learning area will have integrated 13A socket outlets and USB outlets. Cleaner's sockets will be provided incorporated in floor grommets at 10m intervals as applicable. All socket outlets in these areas will be protected by 30mA RCDs either locally or remotely back at the distribution board. The small power provision in the open offices will be two (2) twin socket outlets per desk. This strategy will be further developed at the next stage to suit the furniture layout in these areas.

Small Teaching Room

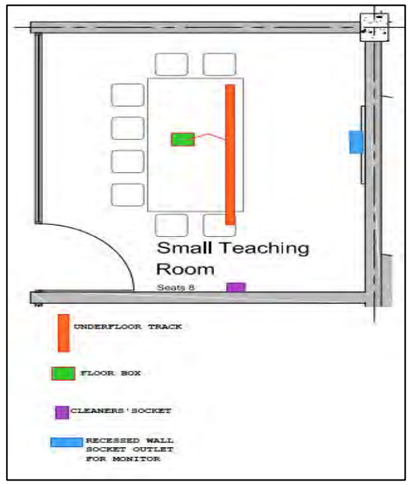


Figure 19: Small Teaching Room power distribution strategy

Small power to the small teaching rooms will be delivered by the use of floor boxes plugged into underfloor track. It is envisaged that the furniture in these rooms will have integrated 13A socket outlets and USB sockets. Each student will require a 13A socket and USB socket. It is envisage that the desk will plug into the floor box. The floor box will also have spare compartments for data and AV outlets as required.

Direct Learning

Figure 20: Direct Learning Room power distribution strategy

Small power to the Direct Learning rooms will be delivered by the use of floor boxes plugged into underfloor track. It is envisaged that the furniture in these rooms will have integrated 13A socket outlets and USB sockets. Each student will require a 13A socket and USB socket. It is envisage that the desk will plug into the floor box. It is also envisaged that the monitor required at the end of each work table will plug into the floor box. The floor box will also have spare compartments for data and AV outlets as required. Cleaner's sockets will be provided at 10m intervals as applicable.

Group Learning

Floor box

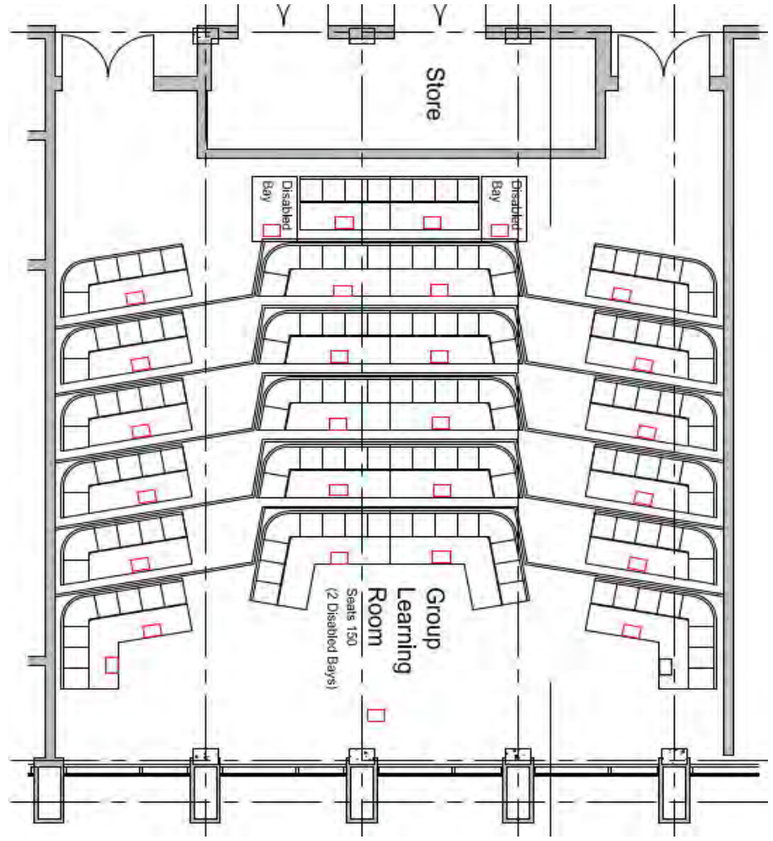


Figure 21: Group Learning Room power distribution strategy

Socket outlets will be provided at the fixed seating in the Group Learning via floor boxes. A twin socket outlet will be provided per two seats. This will ensure each student in the Group Learning will have the ability to charge their laptops or tablet during lectures. Floor boxes will also be provided at the front of the room for AV equipment as required. Cleaner's sockets will be provided at 10m intervals as required.

Power Supplies for Ancillary Systems

In addition, power supplies will be provided to ancillary services including, but not limited to, the following:

a) Office equipment, including multi-function devices
b) AV Equipment
c) Lighting control system
d) Access control system
e) CCTV & security
f) IT Communications
g) HVAC controls
h) Fire alarm panels
i) Disabled WC alarm system
j) Door hold open devices
k) Electric Vehicle Charging Points
l) Power assisted doors
m) Multimedia installations,
n) Gas shut-off valves

Electric vehicle charging points will be provided in the car park for 10% spaces. This will developed further in detail at the next design stage.

In the equipment rooms two (2) 16 A commando socket outlets will be provided at high level for each rack.

5.3.6 Communication Systems

W21 Audio Visual

The audio visual design will be developed by a specialist consultant at stage 4

W15 Facilities for the disabled

Facilities for disabled such as disabled toilet alarms, emergency voice communication points and induction loops will be provided throughout the TaRC and new build as shown on the layout drawings.

W30 Telecommunications/Data Installations

Overview

This section relates to the provision of the ICT Structured Cabling Systems and associated passive Infrastructure to support IP and Analogue based applications required

This report also details the backbone requirements between the Royal Veterinary College (RVC) existing data Centre's and new building.

The structured cabling system described in this report shall support the deployment of

- Data
    - Active hardware provided by RVC, including LAN switches, PC's, laptops, printers, etc.
- Voice Services
    - Via dedicated handsets, soft phones or handsets; provided by RVC
- External Telecom Services
    - Coordinated and ordered by RVC, delivered by the appointed Telecom Service Provider
- Wi-Fi
    - Access Points and Controllers provided by RVC
- CCTV & Access Control
- AV and Multimedia Services

All communication cables within the scope of this document and which are to be permanently installed inside the building must comply with BS6701 2016 + A1:2017 in relation to the reaction and performance in the event of a fire, meaning a minimum of Cca-S1b-d2-a2.

All cabling must be correctly supported in order to prevent premature collapse in the event of a fire as detailed in BS7671 chapter 52, section 521.200.

ICT Spaces Overview

As part of the Royal Veterinary College (RVC) project the new building Infrastructure will be connected to existing Data Centres located in the Eclipse and Queen Mother Hospital Building.

The following Communications Spaces are to be provided:

Building Entrance Facilities (BEFs)

Spaces to accommodate the duct entry points for external fibre cables to enter the new building

- 2 No BEFs (i.e. the locations where ducts enter the building)
- Diversely located at Ground level with routes to ground floor Comms room and risers.

Data Centres

A further workshop will be required during the next design stage to detail the space requirement and specific equipment to be located in the existing Data Centres.

It is assumed that space will be available in cabinets located within the existing Data Centres to house new fibre optic backbone cable and connectivity to connect to the new building.

Ducts will be provided externally from the existing Data Centres to diversely located entry points in the new building.

Equipment Rooms

An existing equipment room in the TARC building is likely to be utilised to serve parts of the new building. The existing space is to be reviewed during the next design stage.

Ground, First and Second Floor in the new building shall each contain an equipment room. The location and dimensions of each room are to be detailed during the next design stage. Each equipment room shall accommodate the ICT services, active LAN, and passive structured cabling for its dedicated floor and shall:

- Support space for up to 3 cabinets (47U) 2300mm high , 800mm wide x 1000mm deep
- The physical layout of the equipment room will be detailed during the next design stage.
- Include provision for cohabitation space for AV and security equipment
- Provide an interface location for incoming backbone circuits and horizontal cabling infrastructure
- House RVC Edge LAN Switches
- House RVC supplied and installed UPSs

The Ground Floor Equipment Room shall accommodate the following:

- Termination of Class E_A F/FTP CAT6A horizontal cables for the high level data outlets
- Termination of Class E UTP CAT6 horizontal cables for the low level data outlets

- Termination of 24 Fibre OS2 Single mode and 24 Fibre OM4 Multimode Fibre optic campus backbone cabling for connections to each Data Centre
- Termination of 24 FIBRE OM4 Multimode Fibre optic building backbone cabling for connections to the first, second floor and existing ground floor TARC equipment rooms
- Termination of multipair copper backbone cabling to the Eclipse Data Centre
- RVC supplied and installed Lan Edge switches, Security Devices and AV devices
- Mechanical and Electrical equipment including to support the equipment rooms
-
- Dual Supplied 16 amp single phase commando power connections provided above each cabinet

The First and Second Floor Equipment Room shall accommodate the following:

- Termination of Class EA F/FTP CAT6A horizontal cables for the high level data outlets
- Termination of Class E UTP CAT6 horizontal cables for the low level data outlets
- Termination of 24 Fibre OM4 Multimode Fibre optic building backbone cabling for connections to the ground floor equipment room
- RVC supplied and installed Lan Edge switches, Security Devices and AV devices
- Mechanical and Electrical equipment including to support the equipment rooms
- Dual Supplied 16 amp single phase commando power connections provided above each cabinet

Cabinets

Each 19 inch cabinet shall:

- Be 47U usable - 19 inch panel mounting
- Be metal construction
- Have front and rear adjustable mounting posts suit
- Have split front and rear ‘wardrobe’ meshed doors, hinged opening with lift-off capability, quick release opening, lockable with uniquely configurable combination locks and override key.
- Have side panels: lift-off, quick release panels, key lockable (end of bays only, no side panels internally between standard cabinets)
- Be fitted (where required) with baying-up kits as per the manufacturer’s instructions
- Be fitted with 2 No. 12 Way power strips with 16A Commando Plugs mounted on each side at the rear of the cabinet PDU’s. Output connector types to be confirmed at next design stage.
- Be fitted with appropriately sized full height earth bars x 2 with fast-on type connectors mounted towards the front of the cabinet to allow short earth bonding connections to patch panels
- Have suitable cable management components fitted for full installation of cable and patch cords/leads for the cabling systems that they contain, i.e. Class E, Class EA & Optical Fibre. 1 No cable management bar per 2 No patch panels, copper and fibre.
- Allow management of patch cords between cabinets
- Vertical cable management at the front of cabinet (both sides) appropriate for the cabling type specified
- Earth Bonded
- 90/100mm deep horizontal and vertical cable management shall be used
-

Comms Spaces Routes

The following shall be required:

- Duct route from the Eclipse Data Centre to New building BEF 1
- Duct route from the Queen Mother Hospital Data Centre to New building BEF 2
- Containment route from BEF1 (Eclipse DC duct) to Ground Floor equipment room and Primary riser
- Containment route from BEF2 (Queen Mother Hospital duct) to Ground Floor equipment room and Secondary riser
- Two diverse containment routes are required from the Ground floor equipment room to existing TARC equipment room, new Ground floor and new First floor equipment rooms.

Structured Cabling System

The structured cabling system shall be distributed from dedicated, floor specific, equipment rooms. Part of the new building disconnected by the atrium will be supplied from the existing TARC ground floor equipment room.

Telecommunication Outlets (TOs) will be presented in a number of formats, coordinated with the appropriate service users

- GOPs/GAPs (Grid outlet Points/Grid Anchor Points) to desks on raised floors (accessed via floor grommets)
- Floor boxes
- Slab boxes (accessed via floor grommets)
- Dado mounted face plates
- Wall mounted face plates
- High level face plates and back boxes

At low level, Category 6 Class E UTP copper cable and connectivity shall emanate from patch panels located in the equipment room cabinets to all Telecommunication Outlets (TOs) located on each floor to support:

Cables at low level will be installed on protective cable matting.

- Data
- Voice
- AV
- Security (Access Control)

At high level each floor shall be wired on a 7.5m x 7.5m grid system with Category 6_A FFTP copper cable and connectivity emanating from patch panels located in the equipment room cabinets to TO’s terminating in the ceiling l to support:

- Data (Wi-Fi)
- Security

Additional high level cables will be required for AV devices, to be detailed during the next design stage.

Cables at high level shall be installed on cable basket.

Copper and fibre patch and fly leads to be supplied as required. Colour, length and configuration to be determined at next design stage.

Telecommunication Outlet locations are to be developed at Stage 4.

The above shall support the connection of:

- RVC connected devices and systems
- RVC shared devices (shared printers)
- AV and Multimedia devices
- CCTV IP cameras
- Access Control IP-enabled devices

Structured Cabling Patching

Day 1 patching will be carried out by the specialist contractor and shall include

- Creation of patching schedules
- Liaison with other trades
- Liaison with RVC network team

Optical Fibre Backbone

The ground floor equipment room in the new building shall be connected to each existing RVC Data Centre with 24 core Single mode OS2 grade and 24 core Multimode OM4 grade Fibre optic campus backbone cabling.

The first, second floor and existing ground floor TARC equipment rooms shall each be connected to the new buildings ground floor equipment room via diversely fed 24 Core OM4 Multimode fibre optic backbone cabling. Each of the cables shall be routed in separate risers.

Multipair Voice Copper Backbone

Voice backbone cabling consisting of 20 Pairs shall be provided to connect the Eclipse Data Centre the new buildings ground floor equipment room.

Within the Eclipse Data Centre multipair copper cable shall be terminated with 237A. Terminal strips onto the existing Test Jack Frame (TJF). Within the new building ground floor equipment room the multipair copper cables shall be terminated onto a 19 inch sub rack.

Cabinet interlinks

Copper and fibre interlinks between cabinets will be defined at the next design stage.

RVC Active Network Equipment

All active LAN and WAN networking equipment shall be designed, selected, supplied, configured, installed and commissioned by RVC or ICT Contractors appointed on their behalf.

Security Active Networking Equipment

The RVC ICT/Security Contractor shall design, select, configure, program, supply, install and commission the active LAN Edge switches to support the IP connected security equipment.

Telecommunication Outlet requirements for CCTV and Access control are to be detailed at the next design stage.

AV Active Networking Equipment

AV equipment is to be defined by the AV consultant during the next design stage.

Telecommunication Outlet requirements for AV are to be detailed at the next design stage.

UPS to support RVC network

UPS(s) shall be designed, selected, supplied, configured, installed and commissioned by RVC or ICT Contractors appointed on their behalf.

Wi-Fi –

RVC shall:

- Provide all active equipment (Controllers/LAN PoE Ports/Access Points)
- Configure and commission the overall system

The Specialist contractor shall:

- Conduct Initial desktop survey to inform infrastructure requirements based on RVC prescribed coverage stipulations
- Conduct physical survey to inform data outlet locations
- Conduct final complete system coverage survey
- Install Access Points provided by the client including mounting brackets or other associated hardware
- Provide fly lead connection at the AP end
- Provide patch lead connection at the switch end

Telephony

The ordering, procurement, supply, fitting, configuration of any telephony systems and handsets shall remain the responsibility of RVC.

5.3.7 Electronic Security Systems

W40/W42 Access Control/CCTV

This section of the report should be read in conjunction with the following documents in the appendices

- Layout drawings

The existing security systems in the TaRC building will be expanded to cover areas in the new build and will comply with all relevant standards including: BS EN 50134, BS EN 50131 and BS EN 50132. These security systems include CCTV and Access Control systems.

5.3.8 Fire and Life Safety Systems

W50 - Fire Detection and Alarm

This section of the report should be read in conjunction with the following documents in the appendices

- Layout drawings
- Cause and Effect matrix,

- Detection zones drawings
- Fire alarm schematic

A new addressable open protocol fire detection and alarm system will be provided for the TaRC/new build in accordance with the fire strategy requirements. The system will consist of a new 8 loop fire alarm panel at the main entrance of the building and it will utilise the existing cabling and detectors in the TaRC. The new fire alarm panel will be interface with the fire alarm panel in the eclipse to ensure there is a simultaneously evacuation from both buildings.

The new fire detection and alarm system will be a category L2 system according to BS 5839 part 1 and will consist of the following;

a) Main fire alarm panel
b) Automatic detectors
c) Manual call points
d) Interconnecting wiring
e) Interfaces
f) Combined beacons and sounders
g) Firefighter's key switch

In order to avoid unwanted alarms a 'double-knock' system is to be designed to provide a period of investigation time upon activation of a smoke detector. Upon activation of a second smoke detector, a heat detector, beam detector, a manual call point, staff confirmation of a fire or expiration of the investigation period, the 2nd knock shall be triggered. The investigation period shall be agreed with the Building Control Officer and the Fire Officer.

Main Fire Alarm Panel

The main fire alarm panel will be an 8 loop addressable open protocol panel located at the main entrance to the building. The fire alarm panel will be fed from the main switchboard and supplied with batteries to provide 24 hour standby in the quiescent state followed by 30 minutes in full alarm / operational mode. The fire alarm panel will have the facility to remotely isolate the interface units to the mechanical plant to facilitate periodic testing of the fire alarm panel.

Automatic detectors/ Manual call points

Detection devices will include a mixture of Ionisation, optical smoke detectors and manual call points. Devices will be chosen to suit specific locations taking account of environmental conditions and room use. Automatic optical beam detection will be utilised in the Atrium as shown on the drawings. Aspiration detection systems will be utilised in the lift shafts

Typically smoke detectors throughout the building will be provided with sounder bases. In open plan areas and plant rooms with increased ambient noise combined flashing beacon and sounder bases will be provided.

All devices installed externally will be provided with ingress protection to IP65

Interconnecting wiring

All wiring will be carried out utilising LSF insulated soft skinned, 'enhanced' fire rated cables to BS 5839. Cabling shall generally be installed on medium duty cable trays. Where one or two cables are routed separately from other fire alarm cables these will be clipped direct to the building fabric

Interfaces

The fire alarm system will be interfaced with the following systems

- Lifts
- MCC Panels
- Access control system
- Door Hold Open Units
- Lighting Control System
- Gas Solenoid Valve

Firefighter's Key switch

A fireman's key switch will be provided adjacent to the main fire alarm panel to control the automatic opening vents in the atrium as required for smoke control.

5.3.9 Protection against Lightning

W52 -Lightning Protection

The new build will be provided with a lightning protection system (LPS) to class II as outlined in BS EN 62305. The LPS for the new build will be bonded to the existing LPS on the TaRC and Eclipse buildings. The main low voltage switchboard will be provided with a type 1/2 surge protective device. Type 2/3 surge protection devices will also be provided to all the distribution boards in the equipment rooms.

The system will comprise of an air termination work, downward conductors and earth rods. The downward conductors can either be copper tape or can be the buildings steel structure subject to suitability.
All metallic elements of the building structure will be bonded to the lightning protection system. All external plant will be connected onto the LPS.

The LPS will be bonded to the main earth bar which will be located within main low voltage switch room.

5.3.10 Transportation Systems

A new passenger lift and goods lift will be provided for the new build. A lift study will be carried out prior to the start of stage 4 to confirm the sizes of these lifts.

6. Enabling Works

In order to construct the New Build a number of enabling works are required and this section of the report gives an outline of what is required taking into consideration the proposed phasing plan for the project. The engineering services enabling works can be identified as follows;

- Upgrade of Substation A
- Diversion of existing underground services
- Works Associated with phase 1 demolition of the Clinical block (H20 South)
- Works associated with phase 2 demolition of the Clinical block (H20 South)

This section should be read in conjunction with the external services drawings included in the appendices of this report.

6.1 Upgrade of Substation A

Substation will need to be upgraded as part of the enabling works as described under the utilities section of this report.

6.2 Diversion of Underground Services

In order for the New Build to be constructed all underground services within the foot print of New Build and general project area have to be diverted. Figure 29 gives a list of services within the project area that need to be diverted. For further detail refer to the Site Constraints Drawing.

Diversion of existing underground services feeding the TARC and ECLIPSE buildings.
These include:

- Gas mains
- Drainage and RW harvesting tank
- Water mains
- Low voltage electrical Cables
- Telecommunication ducts
- Fire hydrant

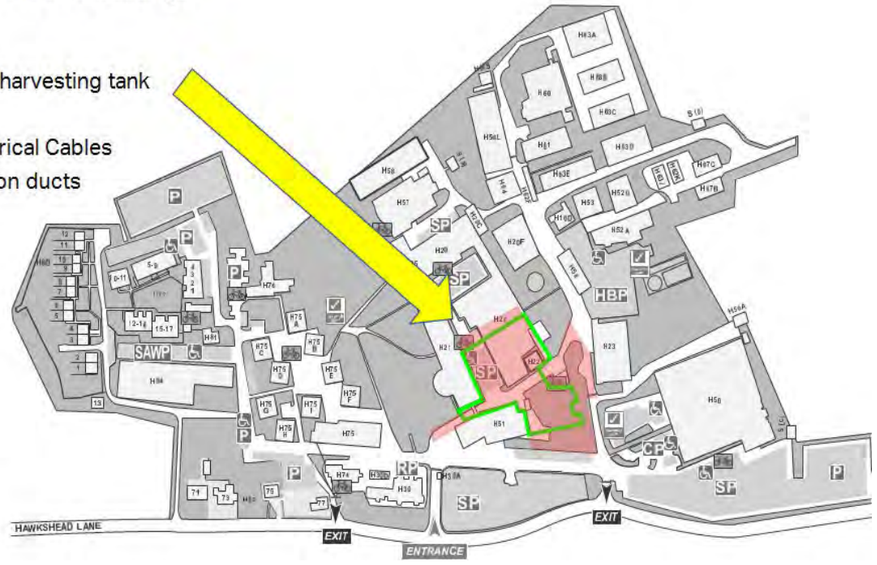


Figure 22: Overview of underground services within project area

Electrical Supplies to TaRC and Eclipse

The low voltage cables serving the Eclipse building and the TaRC run through the area designated for the New Build and therefore have to be diverted. The Cables serving the Eclipse run predominantly in the ground while the cables serving the TaRC run through a distribution floor void in the Clinical block. Both buildings are fed from substation A as previously discussed. A new supply will be taken from the new Substation A to create a temporary connection to the TaRC. This will enable the TaRC's existing electrical connection to be disconnected. Once the New Build is ready for energisation, the temporary cables to the TaRC will be cut back and used to feed the TaRC/New Build electrical installation via the main low voltage switch room.

The supply cables for the Eclipse building will have to be diverted to run within the building where it is not possible to be run below ground in the forecourt. This will reviewed in further detail as part of the enabling works package.

Gas Mains

The existing medium pressure gas mains into the Eclipse will have to be diverted to make way for the New Build. The medium pressure gas mains also feds the main boiler plantroom in the Clinical block (H20 North).

The low pressure gas supply to the TaRC will be diverted as previously described under the utilities section of this report.

Water Mains

The existing water mains for the TaRC will be diverted as previously described under the utilities section of this report. Equally the water supply for the Eclipse building will also be diverted and an alternative water supply will be taken from a water connection at front of the building.

Telecommunication Ducts

The telecoms ducts that run through the project area will be diverted. The client's IT infrastructure team will advise on preferred diversion routes. This will be reviewed further as part of the enabling works package.

6.3 Works associated with the demolition of Clinical block (H20 South).

The clinical block (H20 South) will be demolished to make way for the New Build. The existing 1000A low voltage switchboard in H20 South currently serves a number of buildings which include the freezer barn that will have to be refed from a new location prior to the Clinical block being demolished.

7. Outstanding Items

The following outstanding items will need be completed prior to the commence of stage 4

1. Room Data Sheet briefing to be completed early November 2018
2. Room Data Sheet sign off
3. Diversion scheme from the utility with regards the medium pressure gas mains
4. A lift study for the passenger and goods lift. To be completed by AECOM MEP.
5. A decision on the generator strategy to be adopted for substation A
6. Access Control and CCTV brief will need to be confirmed.
7. The AV brief needs to be confirmed.

Appendices

Appendix A – Lighting/Emergency Lighting Strategy Report

Lighting and Emergency Lighting Strategy Report

November 2018

Quality information

Document name	Ref	Prepared for	Prepared by	Date	Reviewed by
Stage 3 - Lighting Report	AE-LTG-RP-00-100	Royal Veterinary College	CY	05/10/2018	LBF

Revision history

Revision	Revision date	Details	Authorised	Name	Position
0	01/11/2018	Stage 3	KF	Kenneth Fonso	Associate Director

Introduction

This report includes stage 3 lighting design development for the atrium, lecture theatre, typical areas and external spaces for Royal Veterinary College (RVC) in London.

Report objectives:

- Establish a master lighting aesthetic and underpinning concepts
- Communicate and coordinate lighting design strategies with the architectural vision and landscape strategies
- Summarise context factors and technical parameters that influence the lighting design
- Indicate through precedent examples, diagrams and graphical representations of the design approach and desired lighting effects

Lighting Requirements

Introduction

This report is intended to show in a conceptually schematic way the application of lighting and luminaires proposed for the school. Lighting layouts are indicative and should be developed once more architectural information is provided including: the finishes, colour palette, acoustic treatment and ceiling types. The number of luminaires, as well as emergency lighting layouts, will be determined during the Detailed Design stage and coordinate closely with architectural development.

A suitable design solution shall be provided in each typical type of space. The design requirements are summarised in the adjacent table.

Internal Lighting

The internal lighting design aims to create lighting solutions which provide 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 local statutory legislation.

Proposed lighting will be designed in accordance with the current British Standard. The designs also look to implement good practice guidance from relevant CIBSE documents and Building Bulletin 90 – Lighting Design for Schools. These guidance documents provide lighting characteristics and qualitative aspects such as: lighting levels, uniformity of light, glare, and colour temperature.

The following areas will be included within Internal Lighting Design:

Lecture Theatre and Atrium

In the lecture theatre and atrium area, special attention will be given to provide visual interest by using decorative light fittings with some task lighting as necessary. The final lighting design will depend much on the interior design in order to create harmonised ambiance.

Offices

Lighting in the offices will generally be provided by suspended linear LED luminaires with direct/indirect components.

Atrium / Reception Area

This area is intended to provide a relaxing and informal atmosphere. Proposed lighting includes the use of decorative pendants for a flexible and layered lighting solution. The final lighting design will respond to the interior design in order to create harmonised ambiance.

Circulation

Circulation area lighting will be comprised of recessed downlights and utilise either fluorescent or LED lamps. Each level of the school corresponds to a different age group and the lighting design will respond to each group through different arrangements and selection of luminaires, budget permitting.

Toilets and Changing Areas

Toilet and changing area lighting shall comprise of general illumination to common or shared areas, vanity lighting, and cubicle lighting. General ambient lighting will be provided by recessed downlights utilising compact fluorescent or LED lamps and provide a uniform solution.

Plant and Store Rooms

Lighting to plant and store rooms will consist of surface mounted fluorescent luminaires with appropriate impact resistant ratings.

Feature Lighting

It is anticipated that decorative object lighting will be used in break-out spaces, external play areas, the swimming pool and other identified strategic open area and circulation locations to create visual interest.

External Lighting

External lighting will be designed to complement the architecture and provide a sense of safety and security. The design will follow good practice guidance for lighting characteristics and qualitative aspects such as: lighting levels, uniformity of light, glare, and colour temperature.

External lighting will be provided in key areas. The approach to lighting shall be carefully considered so that adverse environmental impacts due to new lighting are minimised or 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

A suitable design solution shall be provided for each external space. The design approach is described in this report with images of typical luminaires. The designs have been somewhat rationalised and coordinated with the architectural design intent, however, there are luminaires shown which may not be within the final cost plan and budget. In these instances, the designs should be considered as potential opportunities which can be explored further, providing their inclusion can be balanced within the project scope and budget.

Drop-off area and entrance area

External lighting is required under the building overhang adjacent the entrance. It is envisioned a basic level of illumination meeting safety recommendations will be provided by recessed downlights.

Escape Routes

Emergency lighting is required for final exits and will be located immediately adjacent to egress doors. This lighting is envisiged to be building mounted and may be located to the side or above the doors, as necessary, to delivering this statutory requirement.

Lamps

Lighting throughout the building will be provided by energy-efficient LED luminaires.

The implemented design will look to minimise the variety and quantity of lamp sources used to ease future maintenance.

All lighting to be provided with “neutral white” light (4000K) in lecture theatres, offices, circulation areas.

Daylighting

Inclusion of daylight is recommended for earning and teaching environments and in general area perimeter zones, reducing the overall artificial lighting requirement where conditions permit. It is recommended that daylight penetration be achieved by optimising ceiling height, window size and glazing type. The use of intelligent internal blinds and lighting controls is also recommended so that the best use of daylight is achieved automatically in spaces where daylight as a primary light source is recommended.

The design philosophy for the general teaching spaces utilises natural lighting as the primary light source during daylight hours whilst providing appropriate control of glare and solar heat gain.

Daylight sensors will be provided to luminaires located adjacent to the windows. These will monitor and control artificial lighting to only be used where it is needed to provide uniform light levels, automatically reduceing when adequate sunlight is provided through dimming or switching off, as appropriate. This reduces the electrical load created by the lighting design and ultimately provides a more efficient building by reducing power requirements associated with electric lighting.

Lighting Control

Internal Lighting Control

Lighting will be controlled via a central lighting control system linked to a Building Management System (BMS). Typically all lighting will be controlled in groups, or pre-selected zones, ensuring that unnecessary lighting is not in use. General lighting in common areas will be switched using occupancy detection (and associated control equipment) to reduce overall electrical consumption. Teaching areas and offices will be controlled via local switching with occupancy detected override.

Additional lighting controls for classrooms and offices will be provided so that:

Lighting Requirements

- Functional local lighting shall be manually controlled via an on/off switch, to be located near the door.

- Functional lighting adjacent to the teaching wall shall have a separate manual on/off switch.

- Functional lighting adjacent to windows shall be dimmed or switched ‘off’ when sufficient daylight is available via daylight sensor.

- All lighting to be controlled by local presence detection and switch ‘off’ when rooms are no longer occupied.

All other internal spaces with window to be controlled by combined daylight/ presence detectors with override light switches to suit.

External Lighting Control

All external lighting will be separately controlled from interior lighting via a combination of photocell control and time clock with manual override. Roof plant lighting shall be controlled via a local switch with a timer override. The external lighting will be programmed to comply with client requirements and local curfew regulations.

All external lighting such as car park and landscape lighting shall be controlled by photocell and time clock.

Emergency Lighting

Exit and emergency lighting will be provided in all areas in accordance with British Standard. Emergency and exit lighting shall be installed in compliance to BS requirements. Exit lights shall consist of low energy LED luminaires.

Emergency and exit luminaries shall be self-contained, with individual luminaires incorporating a miniature sealed nickel cadmium battery capable of operating the light for a period of 3 hours.

All external exits shall be provided with appropriate emergency lighting to provide required illuminance at ground level adjacent to the exit. Testing of emergency lighting shall be provided by manual test key switches located adjacent to the distribution supply board.

The architect shall develop an emergency exit signage strategy which repsonds to the approved fire exit strategy. It is recommended to use self-illuminated emergency exit signs installed over all doors and at all changes of direction along identfied escape routes up to and including final exit locations.

Energy Efficiency

Luminaire selection and arrangements will be developed in line with power consumption targets that have been established throughout the design process. Unless otherwise confirmed, the following targets are envisiged:

General Interior (includes classrooms, circulation, offices, etc): 10 watts/m^2

General Exterior (includes access roads, pedestrian path, car park, arrivals area, etc): TBC

It is accepted that some areas will result in a higher energy use, such as toilets and changing rooms, however, the full floors will be designed so the targets are not exceeded.

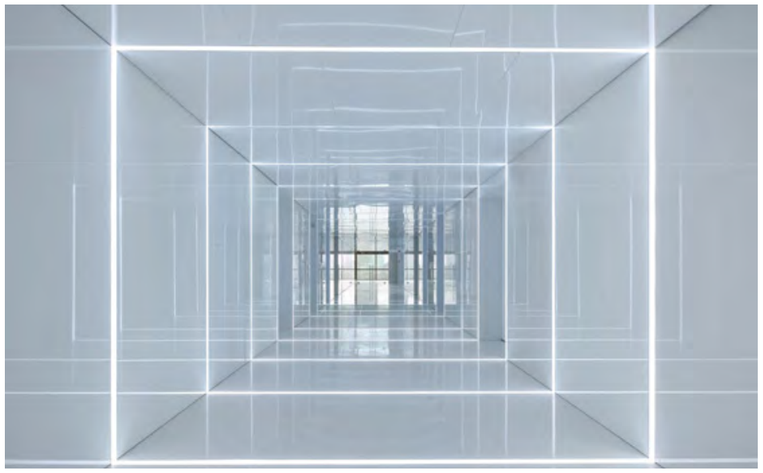
Atrium

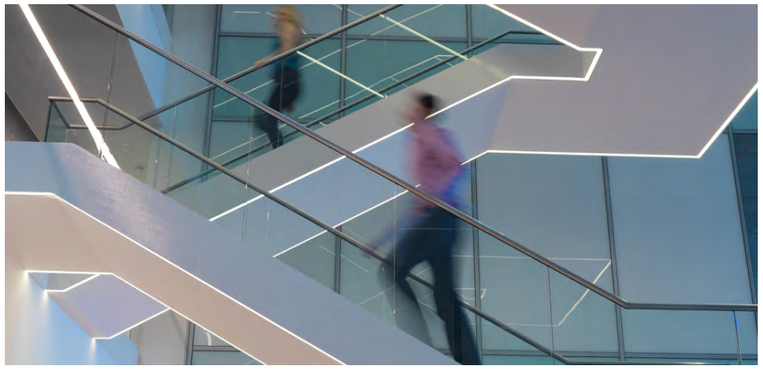
Overview

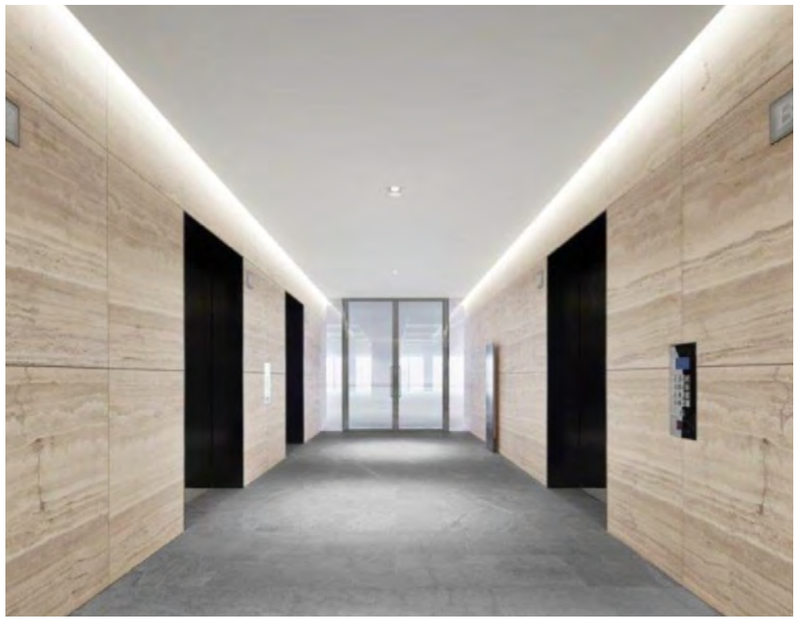
Lighting of the atrium is subtle and integrated with the architectural forms of the development. Architectural lighting of the atrium is the culmination of the arrivals experience, providing visual focus and navigational cues to adjacent spaces and creating a sense of welcome.

Light patterns are strategically designed to articulate the building. The general ambient lighting will be provided with diffuse slot lights integrated at the perimeter of skylights. The in-ground wall washer will illuminated the vertical surface to frame the atrium space. Additional downlights and handrail lighting will supplement circulation illuminations.

Precedent Image







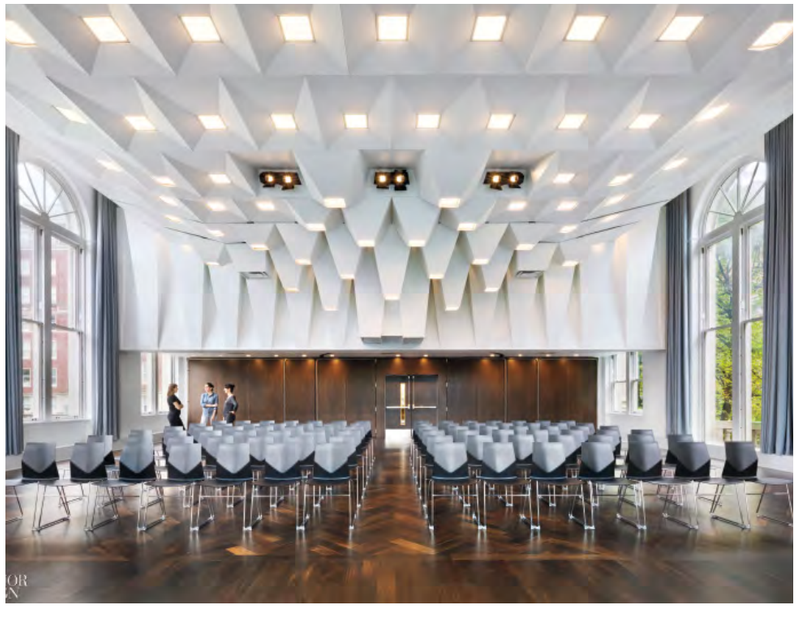
Lecture Theatre

Overview

Lighting of the lecture theatre enhances the architectural forms providing a professional learning environment. The directional and diffuse lighting elements will be balanced to achieve a visual comfortable environment.

The general ambient lighting will be provided with diffuse slot lights integrated into the ceiling. Adjustable gimbals in a cluster of three will provide directional lighting for facial rendering.

Precedent Image

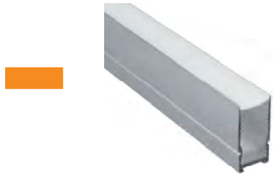


GF Atrium

Proposed Lighting Strategy

High output downlight

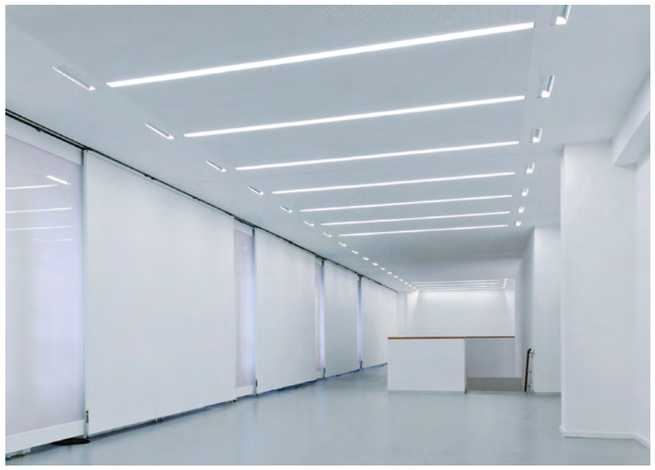
High output linear in-ground wall-washer



In-ground linear wall-washer

Handrail lighting

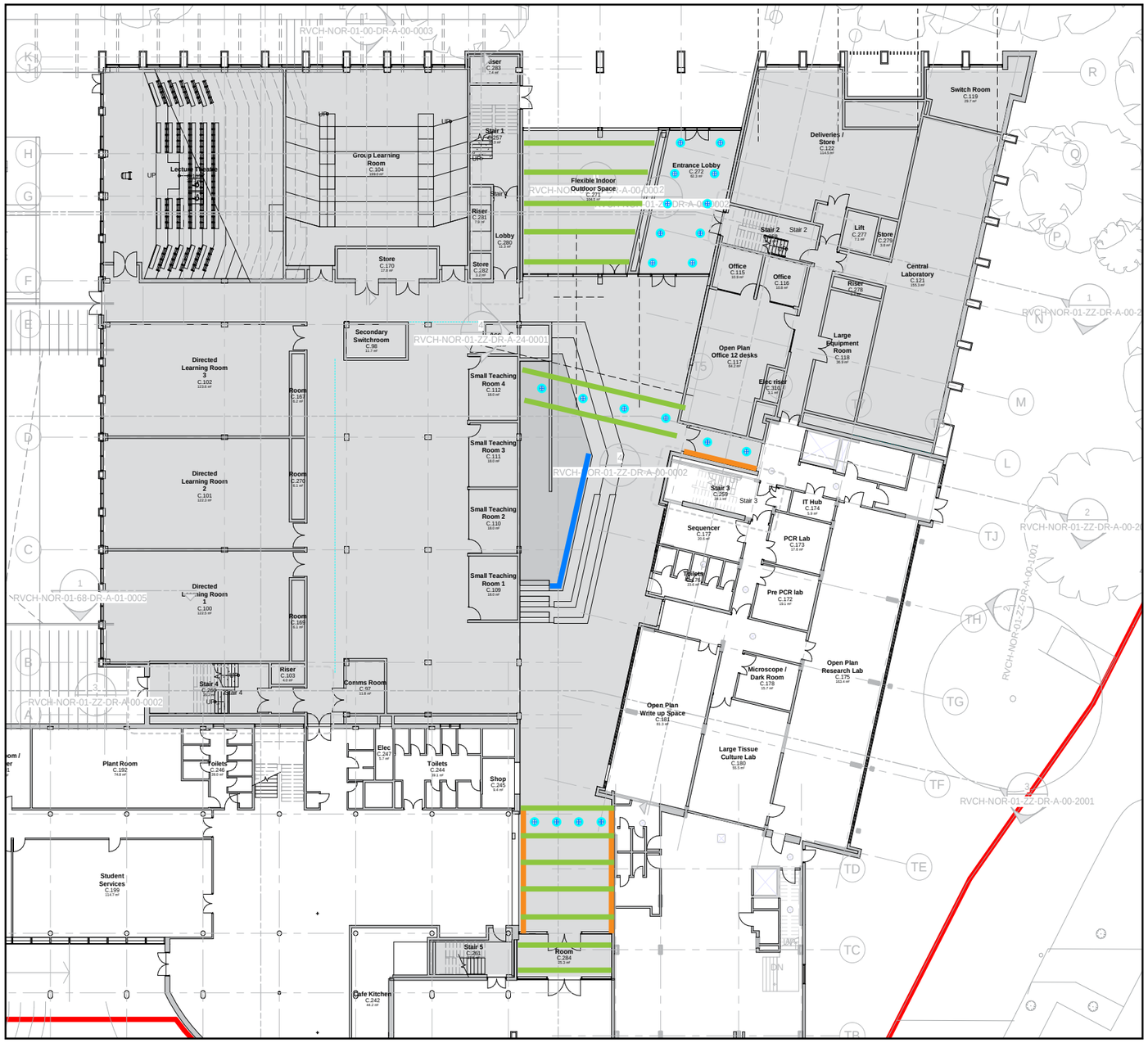
Precedent Image



Notes:

- The lighting layout is illustrative. Exact quantities of light fittings will be confirmed during the detail design stage

Illustrative Lighting Layout - GF

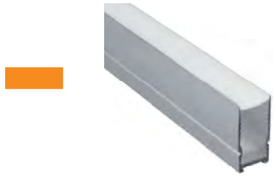


1F Atrium & Lecture Theatre

Proposed Lighting Strategy

High output downlight

High output linear in-ground wall-washer



In-ground linear wall-washer

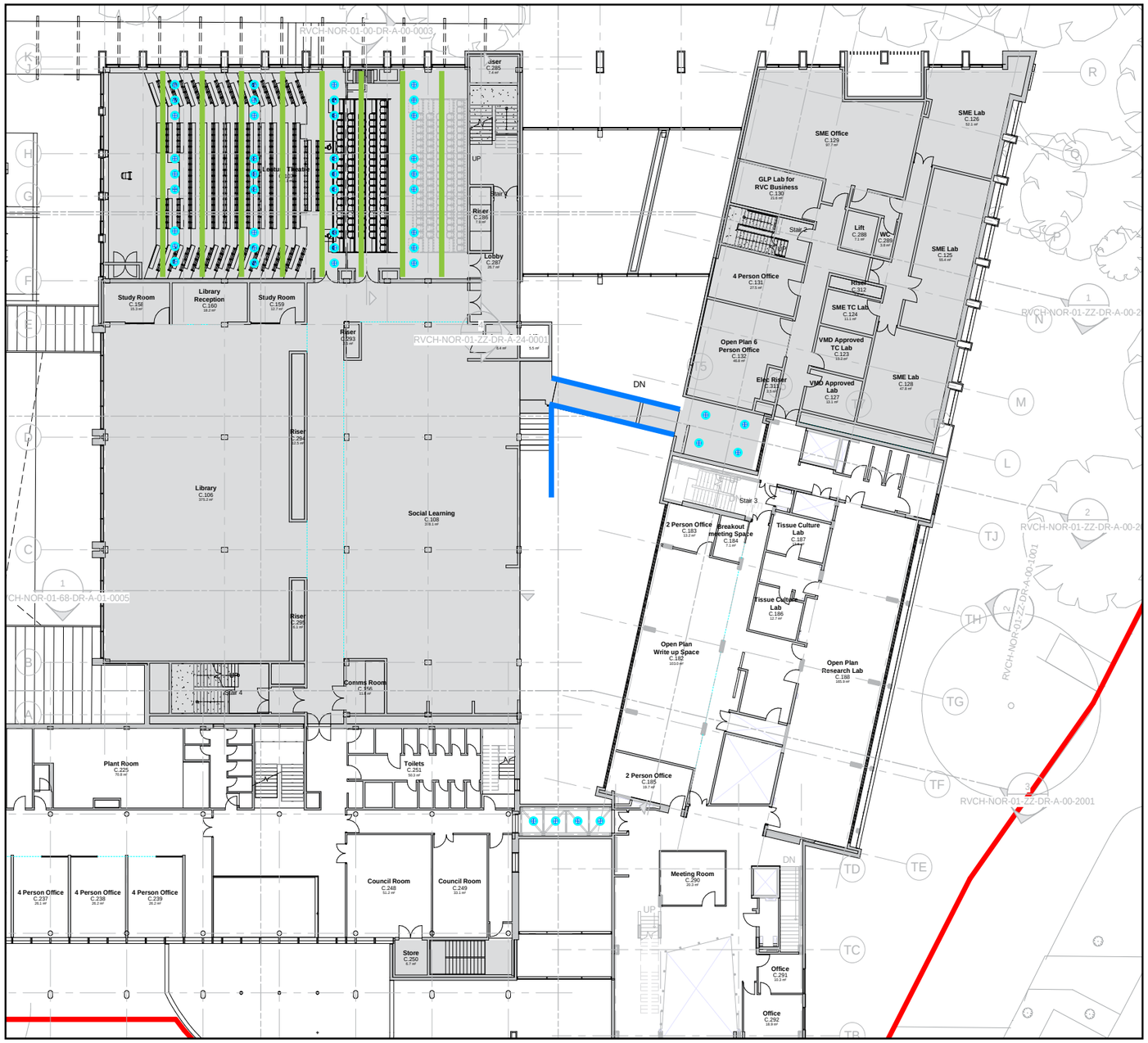
Handrail lighting

Precedent Image

Notes:

- The lighting layout is illustrative. Exact quantities of light fittings will be confirmed during the detail design stage

Illustrative Lighting Layout - 1F

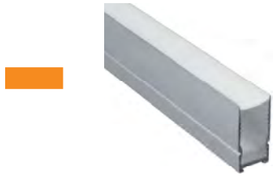


2F Atrium

Proposed Lighting Strategy

High output downlight

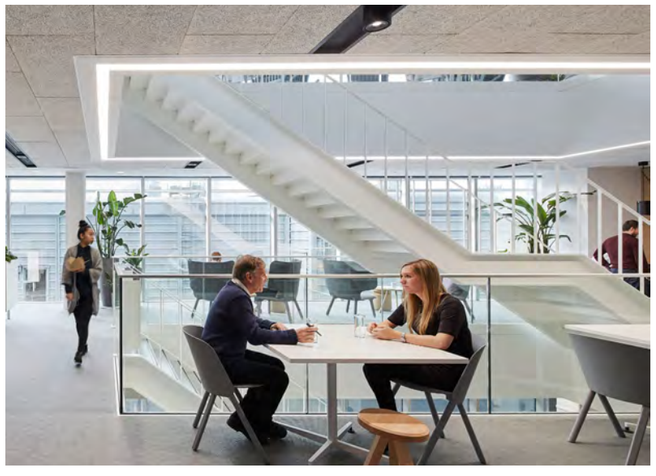
High output linear in-ground wall-washer



In-ground linear wall-washer

Handrail lighting

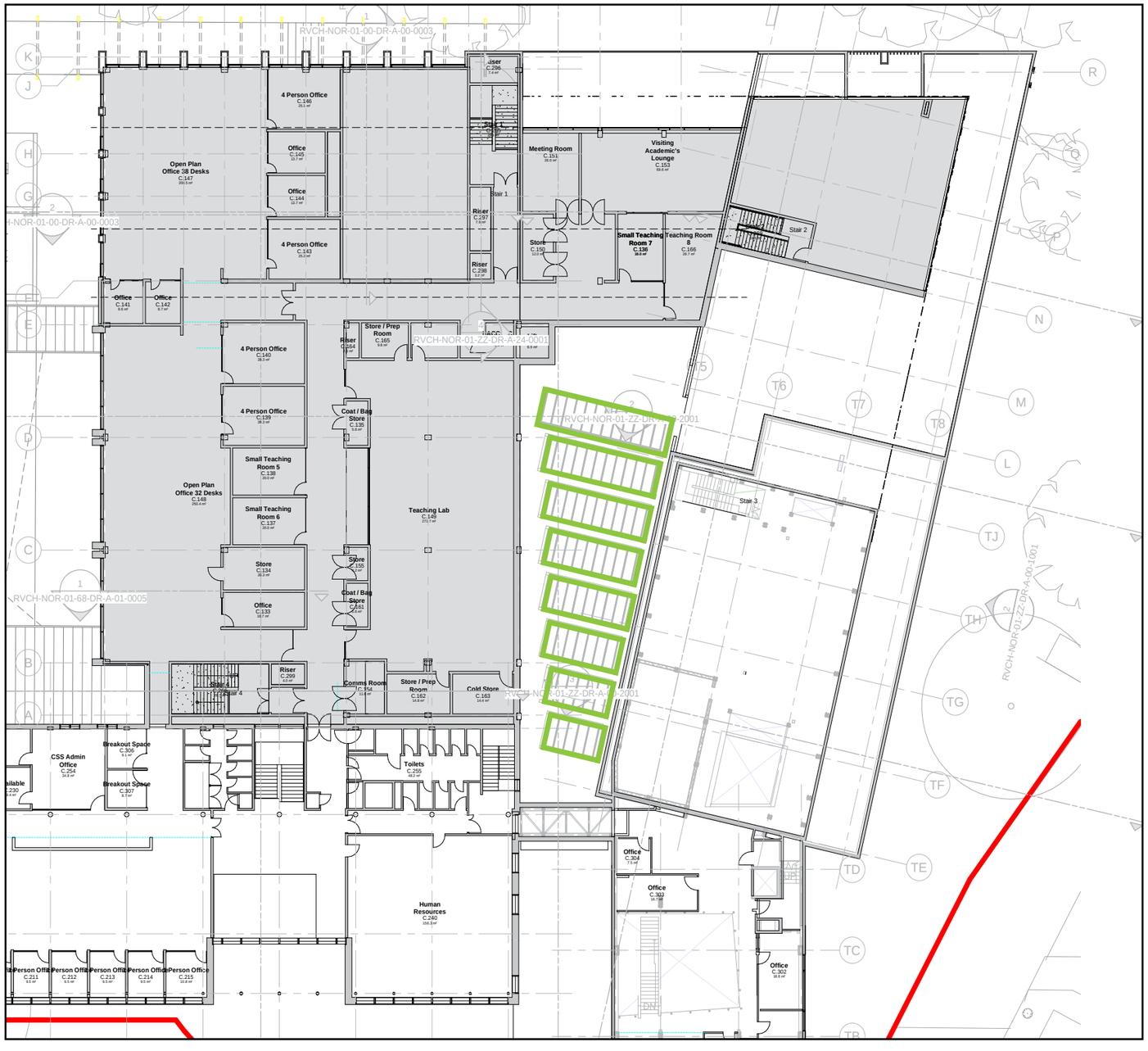
Precedent Image



Notes:

- The lighting layout is illustrative. Exact quantities of light fittings will be confirmed during the detail design stage

Illustrative Lighting Layout - 2F



GF Typical Areas

Proposed Lighting Strategy

High output downlight

Suspended linear fitting

Suspended linear fitting

Suspended light panel

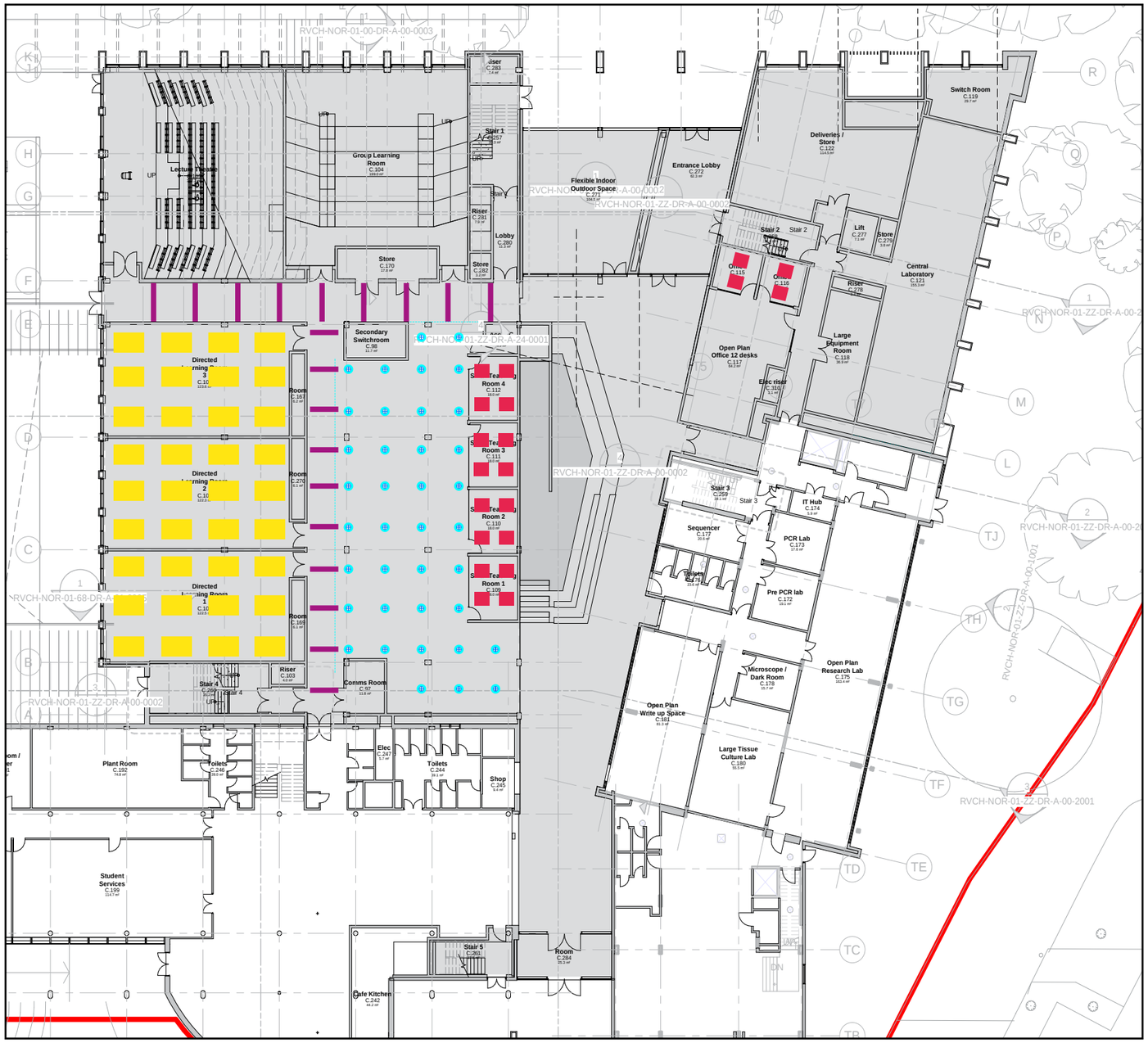
Suspended fitting

Surface mounted linear fitting

Notes:

- The lighting layout is illustrative. Exact quantities of light fittings will be confirmed during the detail design stage

Illustrative Lighting Layout - GF



1F Typical Areas

Proposed Lighting Strategy

High output downlight

Suspended linear fitting

Suspended linear fitting

Suspended light panel

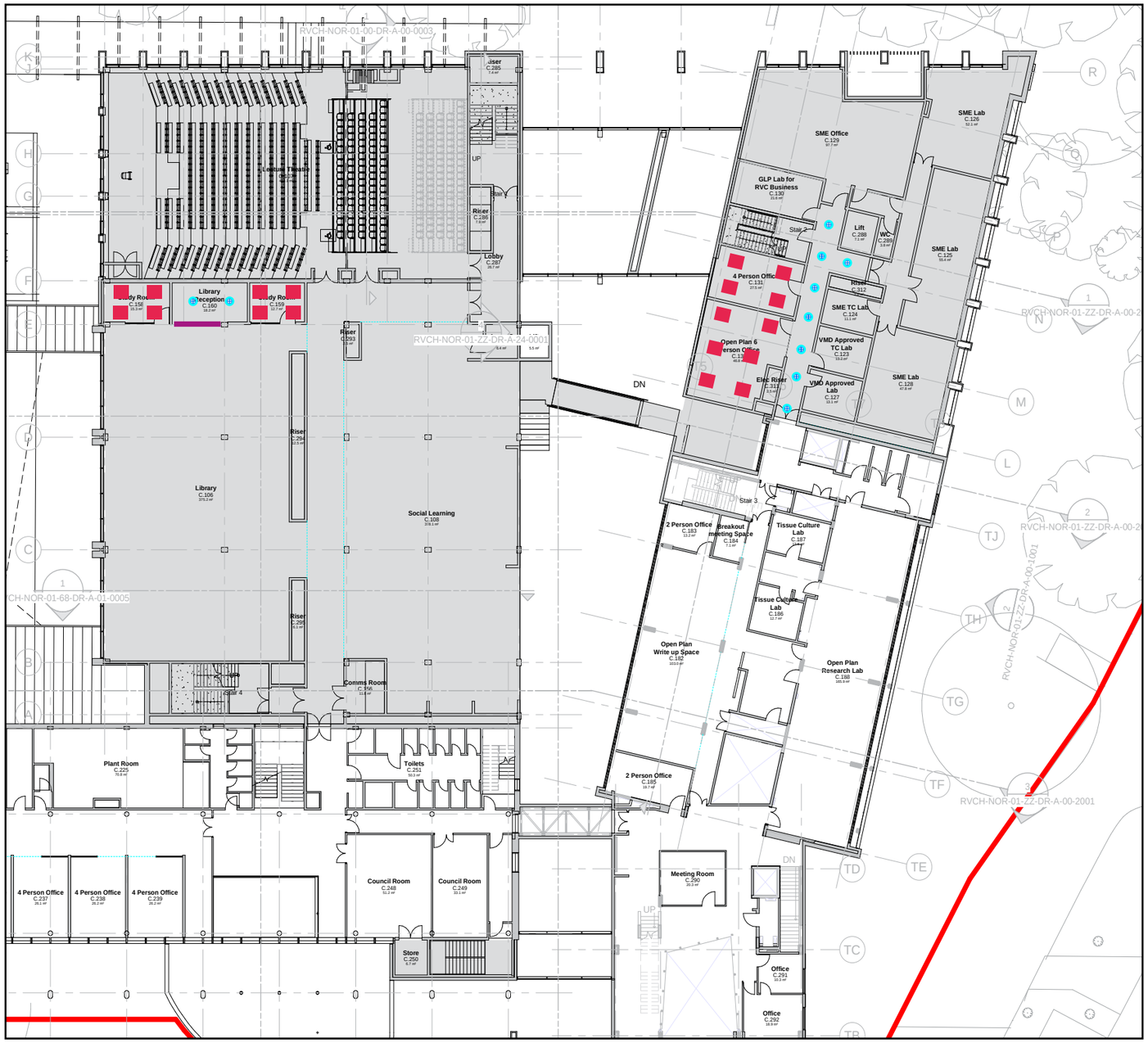
Suspended fitting

Surface mounted linear fitting

Notes:

- The lighting layout is illustrative. Exact quantities of light fittings will be confirmed during the detail design stage

Illustrative Lighting Layout - 1F



2F Typical Areas

Proposed Lighting Strategy

High output downlight

Suspended linear fitting

Suspended linear fitting

Suspended light panel

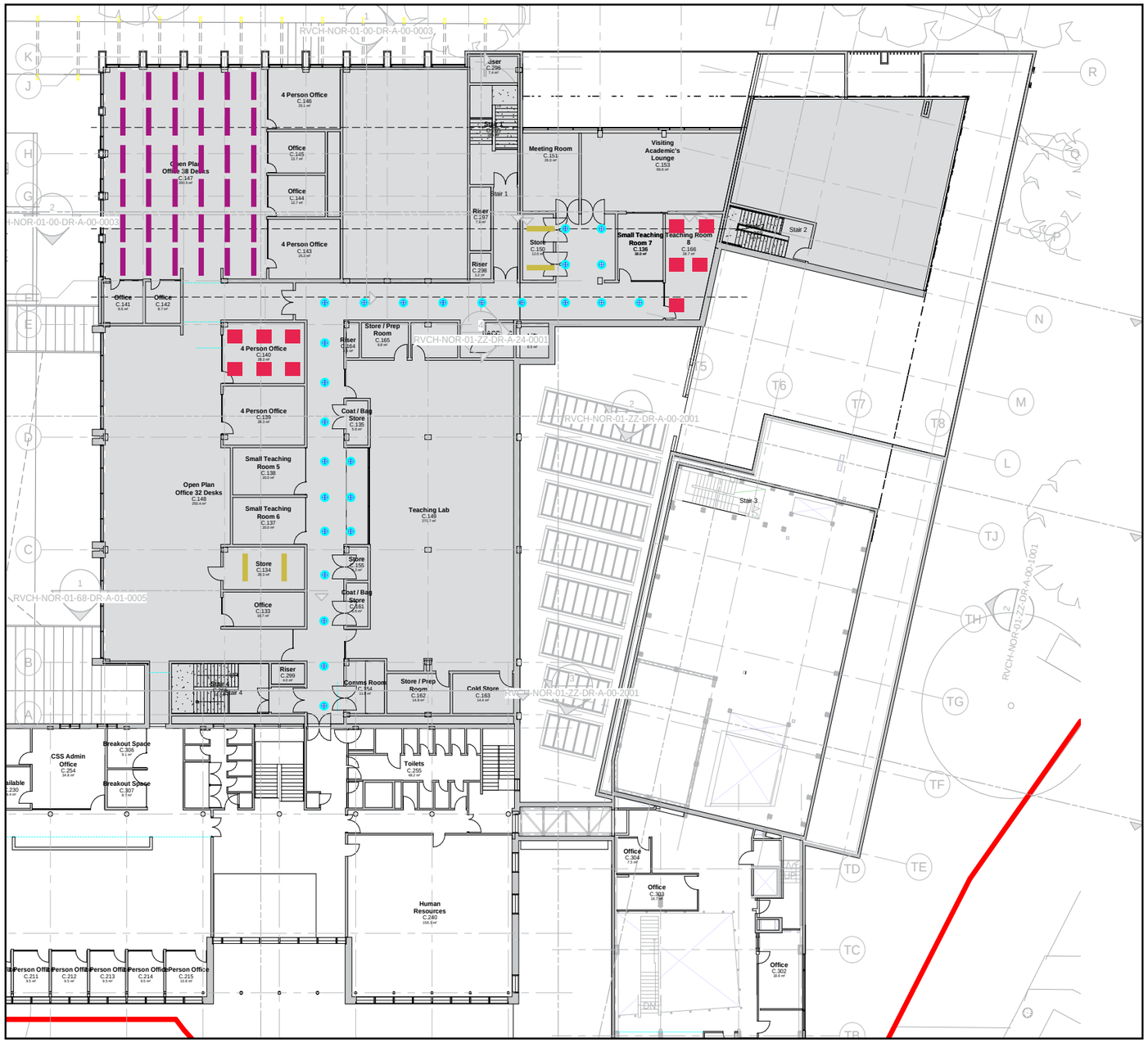
Suspended fitting

Surface mounted linear fitting

Notes:

- The lighting layout is illustrative. Exact quantities of light fittings will be confirmed during the detail design stage

Illustrative Lighting Layout - 2F



External Lighting

Entrance Facade & Landscape

The facade frames the first social space that allows users to interact informally and the lighting design will reinforce the sense of arrival at night in conjunction with the landscape lighting. The architectural lighting will accentuate the building envelope and entry into the building, whereas the landscape lighting is intentionally subtle to create visual contrast.

The lower facade is up-lit from in-ground up lights. The uplit trees and illuminated street furniture will provide a relaxed atmosphere and visual interest.

High output linear in-ground wall-washer

High output linear profile

In-ground uplighter

Lighting Control

Overview

Lighting control shall be provided via a headend lighting control system with distributed intelligence.

Lighting control and interface equipment shall be strategically located throughout the development to facilitate effective installation management from designated facilities management spaces.

Primary lighting control will be provided via PIR and lighting will turn off after 30 minutes in the majority of areas excluding circulation which will dim to 30%. A provision for remote or wireless control via desktop stations or laptop units may be considered for enclosed areas such as cellular offices, small meeting rooms or training spaces.

All spaces that are found within 6m of glazed facades will use daylight / occupancy sensors for incorporation of daylight dimming control.

The head-end lighting control interface equipment shall include all components required to facilitate programming of lighting scenes, testing and monitoring of the lighting system.

The lighting control system shall be connected to emergency lighting luminaires and facilitate monitoring and testing of them.

All accent lighting and functional lighting luminaires are individually addressable or addressable in groups depending on the control resolution required in individual spaces to achieve the required lighting effects and functional control.

The lighting control system shall be connected to the life safety systems, AV systems and BMS systems.

The connections between the lighting control headend PC and the lighting control boards shall be LON over IP or similar

The control protocol shall be coordinated with the BMS system and other services systems for effective interfacing.

The lighting control system incorporates stable hard and software ensuring no loss of data in the event of a system power failure.

System components and allowances

DALI multi address gateways to be used generally in front of house areas.

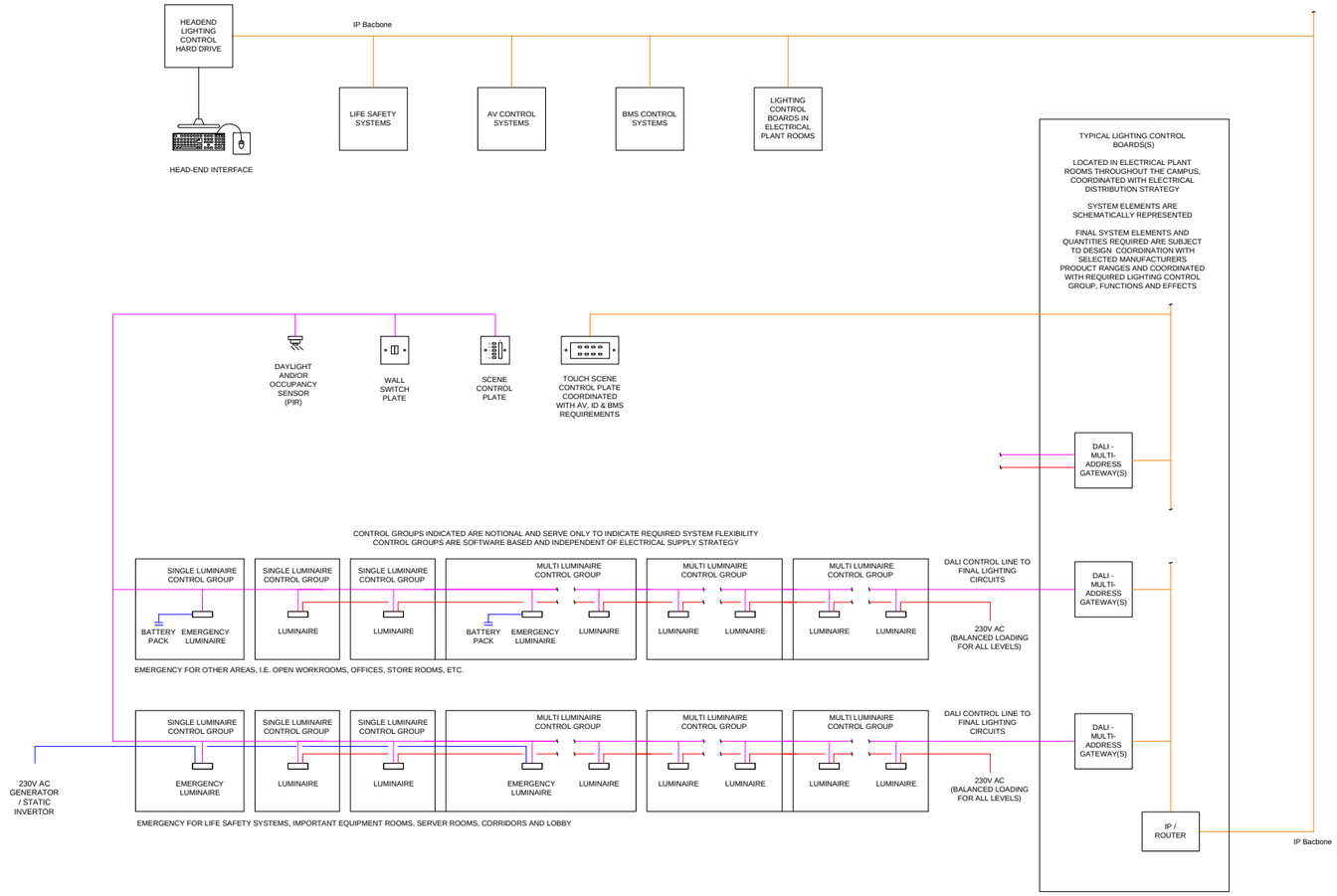
DALI single address multi luminaire gateways to be used only where large quantities of luminaires are to be controlled together and will not require future separation into subgroups.

DALI 230v actuators to be used only where large quantities of luminaires are to be controlled together, will not require future separation into subgroups and dimming is not required.

The quantity of addresses and control groups that can be controlled by DALI gateways from different manufacturers varies. The required amount of DALI gateways is to be determined by the electrical contractor and submitted to the design team for verification once the preferred manufacturer is selected .

The electrical contractor is to ensure the functionality and effects are achieved by the control system components.

In addition to the above a further 20% spare (address/gateway) capacity is to be provided for future potential control group subdivision.



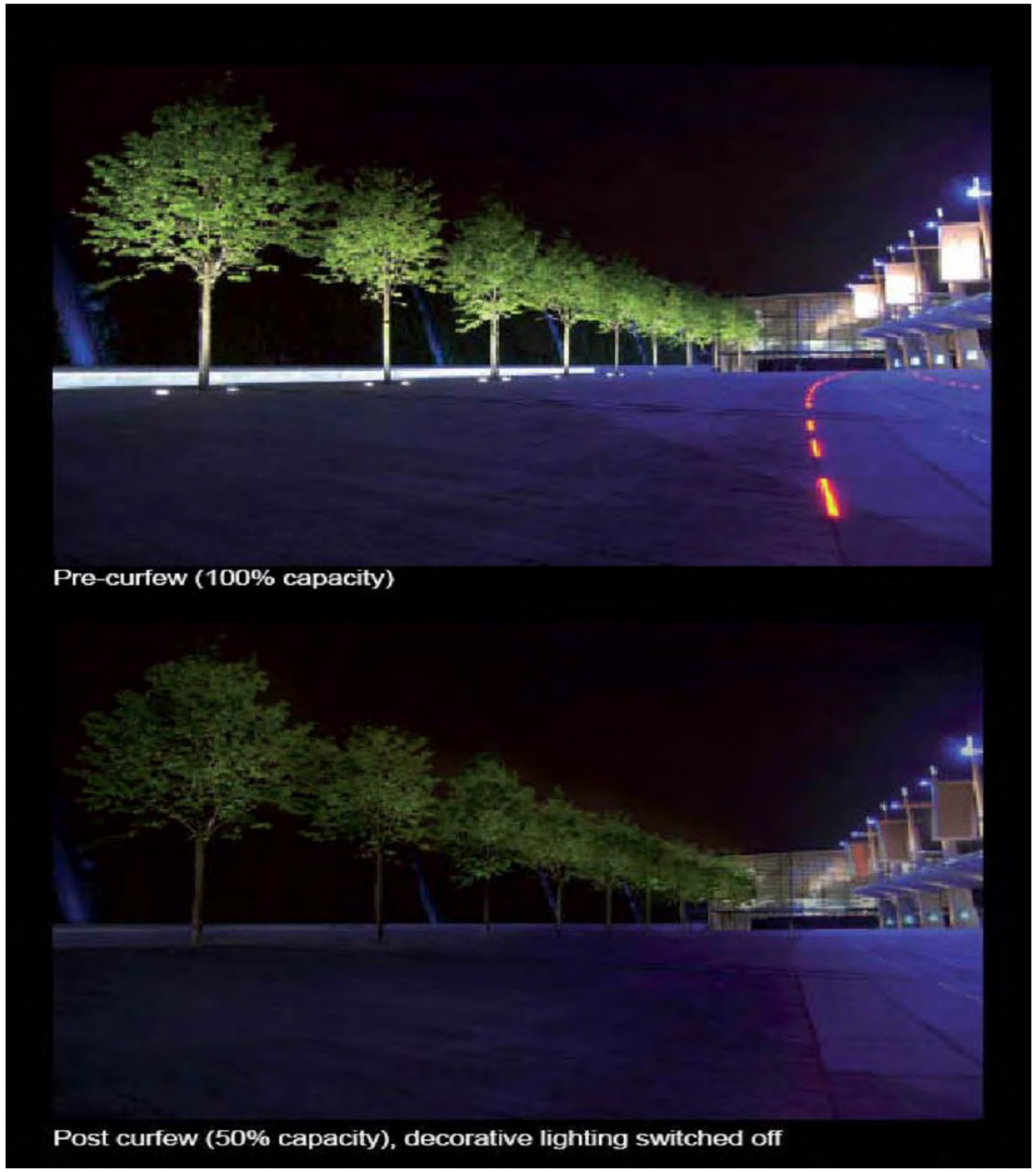
INDICATIVE CONTROL SCHEMATIC

Lighting Control

All external lighting will be switched via a remote photocell mounted to the building roof or other unobstructed location with timeclock override. The lighting controls will allow for the external lighting to adapt to pre-curfew (typically prior to 23.00) and post-curfew conditions (after 23.00).

Typically canopy lighting will be controlled from the building management system.

The majority of the lighting on ground level and first level provides the safety/ security lighting which is controlled by photocell.



Appendix B – Drawings

Project number: 60562867

Appendix B.1 - Drawing Issue Sheet

RVC Hawkshead Redevelopment

PROJECT	RVCH
NUMBER	60562867
ORIGIN	AECOM
CREATED	25/09/2018
UPDATED	25/09/2018
OWNER	MP

AECOM

RVC Hawkshead Redevelopment | ISSUE SHEET

QA COUNT	
A	0
B	0
C	0
REVIEW	0

DD	01
MM	11
YY	18

MEP	DESCRIPTION	NUMBER	OWNER	QA STATUS	REV	JGB	PDF	DWG	OTHER
MECH	Ventilation Layout - Ground Floor	RVCH-ACM-XX-GF-DR-M-310000	P01	WORKING	P01	X	X		
MECH	Ventilation Layout - First Floor	RVCH-ACM-XX-01-DR-M-310000	P01	WORKING	P01	X	X		
MECH	Ventilation Layout - Second Floor	RVCH-ACM-XX-02-DR-M-310000	P01	WORKING	P01	X	X		
MECH	Ventilation Layout - Roof	RVCH-ACM-XX-RF-DR-M-310000	P01	WORKING	P01	X	X		
MECH	Heating and Cooling Layout - Ground Floor	RVCH-ACM-XX-GF-DR-M-340000	P01	WORKING	P01	X	X		
MECH	Heating and Cooling Layout - First Floor	RVCH-ACM-XX-01-DR-M-340000	P01	WORKING	P01	X	X		
MECH	Heating and Cooling Layout - Second Floor	RVCH-ACM-XX-02-DR-M-340000	P01	WORKING	P01	X	X		
MECH	Heating and Cooling Layout - Roof	RVCH-ACM-XX-RF-DR-M-340000	P01	WORKING	P01	X	X		
MECH	Vent Schematic Sheet 1 of 3	RVCH-ACM-XX-XX-DR-M-310100	P01	WORKING	P01	X	X		
MECH	Vent Schematic Sheet 2 of 3	RVCH-ACM-XX-XX-DR-M-310101	P01	WORKING	P01	X	X		
MECH	Vent Schematic Sheet 3 of 3	RVCH-ACM-XX-XX-DR-M-310102	P01	WORKING	P01	X	X		
MECH	Heating Schematic	RVCH-ACM-XX-XX-DR-M-340100	P01	WORKING	P01	X	X		
MECH	Cooling Schematic	RVCH-ACM-XX-XX-DR-M-350100	P01	WORKING	P01	X	X		
ELEC	Containment Layout - Ground Floor	RVCH-ACM-XX-GF-DR-E-410000	P01	WORKING	P01	X	X		
ELEC	Containment Layout - First Floor	RVCH-ACM-XX-01-DR-E-410000	P01	WORKING	P01	X	X		
ELEC	Containment Layout - Second Floor	RVCH-ACM-XX-02-DR-E-410000	P01	WORKING	P01	X	X		
ELEC	Fire Alarm Layout - Ground Floor	RVCH-ACM-XX-GF-DR-E-440000	P01	WORKING	P01	X	X		
ELEC	Fire Alarm Layout - First Floor	RVCH-ACM-XX-01-DR-E-440000	P01	WORKING	P01	X	X		
ELEC	Fire Alarm Layout - Second Floor	RVCH-ACM-XX-02-DR-E-440000	P01	WORKING	P01	X	X		
ELEC	Lightning Protection Layout	RVCH-ACM-XX-ZZ-DR-E-450000	P01	WORKING	P01	X	X		
ELEC	Fire Alarm Zones Layout - Ground Floor	RVCH-ACM-XX-GF-DR-E-440001	P01	WORKING	P01	X	X		
ELEC	Fire Alarm Zones Layout - First Floor	RVCH-ACM-XX-01-DR-E-440001	P01	WORKING	P01	X	X		
ELEC	Fire Alarm Zones Layout - Second Floor	RVCH-ACM-XX-02-DR-E-440001	P01	WORKING	P01	X	X		
ELEC	Security Layouts - Ground Floor	RVCH-ACM-XX-GF-DR-E-700000	P01	WORKING	P01	X	X		
ELEC	Security Layouts - First Floor	RVCH-ACM-XX-01-DR-E-700000	P01	WORKING	P01	X	X		
ELEC	Security Layouts - Second Floor	RVCH-ACM-XX-02-DR-E-700000	P01	WORKING	P01	X	X		
ELEC	ICT Equipment Room - Ground Floor	RVCH-ACM-XX-GF-DR-E-470200	P01	WORKING	P01	X	X		
ELEC	ICT Equipment Room - First Floor	RVCH-ACM-XX-01-DR-E-470200	P01	WORKING	P01	X	X		
ELEC	ICT Equipment Room - Second Floor	RVCH-ACM-XX-02-DR-E-470200	P01	WORKING	P01	X	X		
ELEC	LV Schematic	RVCH-ACM-XX-XX-DR-E-410100	P01	WORKING	P01	X	X		
ELEC	Substation LV Schematic	RVCH-ACM-XX-XX-DR-E-410101	P01	WORKING	P01	X	X		
ELEC	Fire Alarm Schematic	RVCH-ACM-XX-XX-DR-E-440100	P01	WORKING	P01	X	X		
ELEC	Emergency Voice Communication Schematic	RVCH-ACM-XX-XX-DR-E-440101	P01	WORKING	P01	X	X		
ELEC	Fire Alarm Cause and Effect Schematic	RVCH-ACM-XX-XX-DR-E-440102	P01	WORKING	P01	X	X		
ELEC	Fibre Backbone Schematic	RVCH-ACM-XX-XX-DR-E-470100	P01	WORKING	P01	X	X		
ELEC	Earthing Schematic	RVCH-ACM-XX-XX-DR-E-450100	P01	WORKING	P01	X	X		
PHE	Water Layout - Ground Floor	RVCH-ACM-XX-GF-DR-P-510000	P01	WORKING	P01	X	X		
PHE	Water Layout First Floor	RVCH-ACM-XX-01-DR-P-510000	P01	WORKING	P01	X	X		
PHE	Water Layout Second Floor	RVCH-ACM-XX-02-DR-P-510000	P01	WORKING	P01	X	X		
PHE	Drainage Layout - Ground Floor	RVCH-ACM-XX-GF-DR-P-520000	P01	WORKING	P01	X	X		
PHE	Drainage Layout - First Floor	RVCH-ACM-XX-01-DR-P-520000	P01	WORKING	P01	X	X		
PHE	Drainage Layout - Second Floor	RVCH-ACM-XX-02-DR-P-520000	P01	WORKING	P01	X	X		
PHE	Drainage Layout - Roof	RVCH-ACM-XX-RF-DR-P-520000	P01	WORKING	P01	X	X		
PHE	Laboratory Gas Layout - Ground Floor	RVCH-ACM-XX-GF-DR-P-540000	P01	WORKING	P01	X	X		
PHE	Laboratory Gas Layout - First Floor	RVCH-ACM-XX-01-DR-P-540000	P01	WORKING	P01	X	X		
PHE	Laboratory Gas Layout - Second Floor	RVCH-ACM-XX-02-DR-P-540000	P01	WORKING	P01	X	X		
PHE	Domestic Water Services Schematic	RVCH-ACM-XX-XX-DR-P-510100	P01	WORKING	P01	X	X		
PHE	Sanitation Schematic	RVCH-ACM-XX-XX-DR-P-520100	P01	WORKING	P01	X	X		

PHE	Laboratory Gas Schematic	RVCH-ACM-XX-XX-DR-P-540100	P01	WORKING	P01	X											X			
MEP	External Services Sheet 1 of 2	RVCH-ACM-XX-ZZ-DR-MEP-200000	P01	WORKING	P01	X											X			
MEP	External Services Sheet 2 of 2	RCVH-ACM-XX-ZZ-DR-MEP-200001	P01	WORKING	P01	X											X			
MEP	Plant Replacement Strategy - Ground Floor	RVCH-ACM-XX-GF-DR-MEP-010000	P01	WORKING	P01	X											X			
MEP	Plant Replacement Strategy - First Floor	RVCH-ACM-XX-01-DR-MEP-010000	P01	WORKING	P01	X											X			
MEP	Plant Replacement Strategy - Second Floor	RVCH-ACM-XX-02-DR-MEP-010000	P01	WORKING	P01	X											X			
MEP	Plant Replacement Strategy - Roof	RVCH-ACM-XX-RF-DR-MEP-010000	P01	WORKING	P01	X											X			
MEP	Combined Services Plantroom Layout Second Floor	RVCH-ACM-XX-02-DR-MEP-040200	P01	WORKING	P01	X														
Distribution																				
PMS	PROJECT TEAM	Project Managers		OFFLINE																
ARCH	ARCHITECTS	Architects		OFFLINE																
STRUCT	STRUCTURES	Structures		OFFLINE																
CLIENT	CLIENT	Client		OFFLINE																
ALL	ENTIRE PROJECT TEAM	ALL		ONLINE		X														

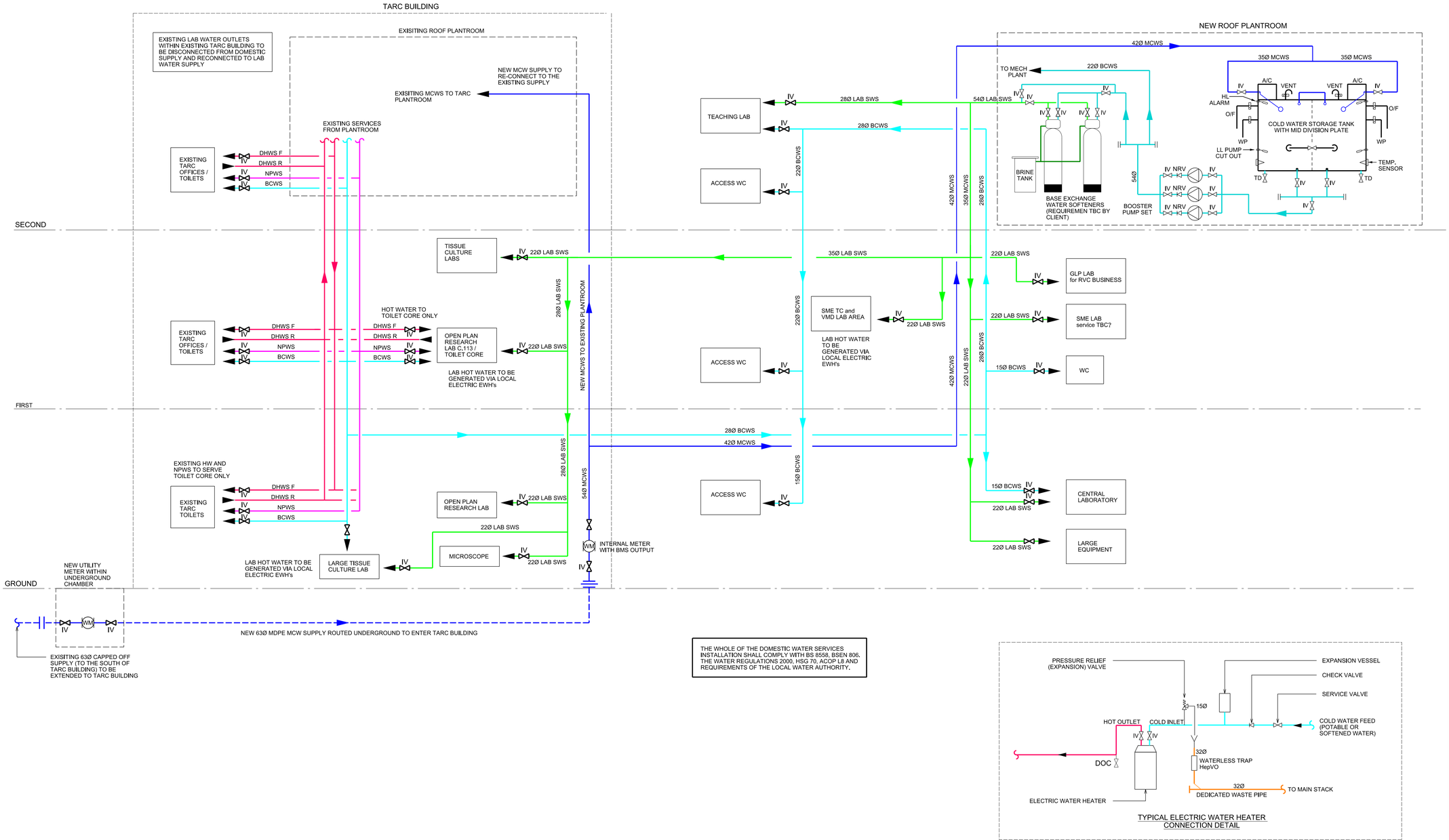
Appendix B.2 - Schematics

Project Management Initials: Designer: SO Checked: AN Approved: AF Drawn by:SO ISO A0 841mm x 1189mm

LEGEND

IV ISOLATION VALVE

MCWS	MAINS COLD WATER SUPPLY
BCWS	BOOSTED COLD WATER SUPPLY
NPWS	NON POTABLE WATER SUPPLY
LAB SWS	LAB SOFTENED WATER SUPPLY (CAT 5)
DHWS F	DOMESTIC HOT WATER SERVICE - FLOW
DHWS R	DOMESTIC HOT WATER SERVICE - RETURN



Project

Hawkshead Campus Redevelopment

UK & IRELAND

Client

Royal Veterinary College
Hawkshead Lane
Hatfield
AL9 7TA

Consultant

AECOM
Aecom House
63-77 Victoria Street
St Albans,Herts
AL1 3ER
United Kingdom
Tel +44 (0)1727 535000
www.aecom.com

Notes

1. THE DOMESTIC WATER SERVICES INSTALLATION SHALL BE IN STRICT ACCORDANCE WITH THE REQUIREMENT OF BS EN 806, BS 8558, THE WATER SUPPLY (WATER FITTINGS) REGULATIONS, THE WATER SUPPLY (WATER QUALITY) REGULATIONS, HSE ACOP L8, HSG274 PART 2, THE BUILDING REGULATIONS PART G AND L AND THE LOCAL WATER AUTHORITY.
2. THIS SCHEMATIC SHALL BE READ IN CONJUNCTION WITH THE AECOM SERVICES LAYOUT DRAWINGS.
3. THIS SCHEMATIC SHOULD BE READ IN CONJUNCTION WITH THE ARCHITECT'S SANITARY FITTINGS SCHEDULE.
4. ALL PIPEWORK TO BE THERMALLY INSULATED.
5. DEAD LEGS SHALL BE AVOIDED AND MINIMISED WHERE PRACTICAL.
6. LOW POINTS SHALL BE FITTED WITH DRAIN COCKS FOR DRAIN DOWN PURPOSES.
7. BRANCH PIPEWORK THAT PASSES THROUGH A FIRE BARRIER OR WALL SHALL BE METALLIC OR INTUMESCENT SEALED.
8. THERMOSTATIC MIXING VALVES SHALL BE UTILISED FOR WASHBASINS AND SHALL BE TMV2 COMPLIANT (TMV3 FOR ACCESSIBLE TOILETS)

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Domestic Water Services Schematic

Sheet Number

RVCH-ACM-XX-XX-DR-P-510100

Scale: NTS @ A1 **Rev:** P01

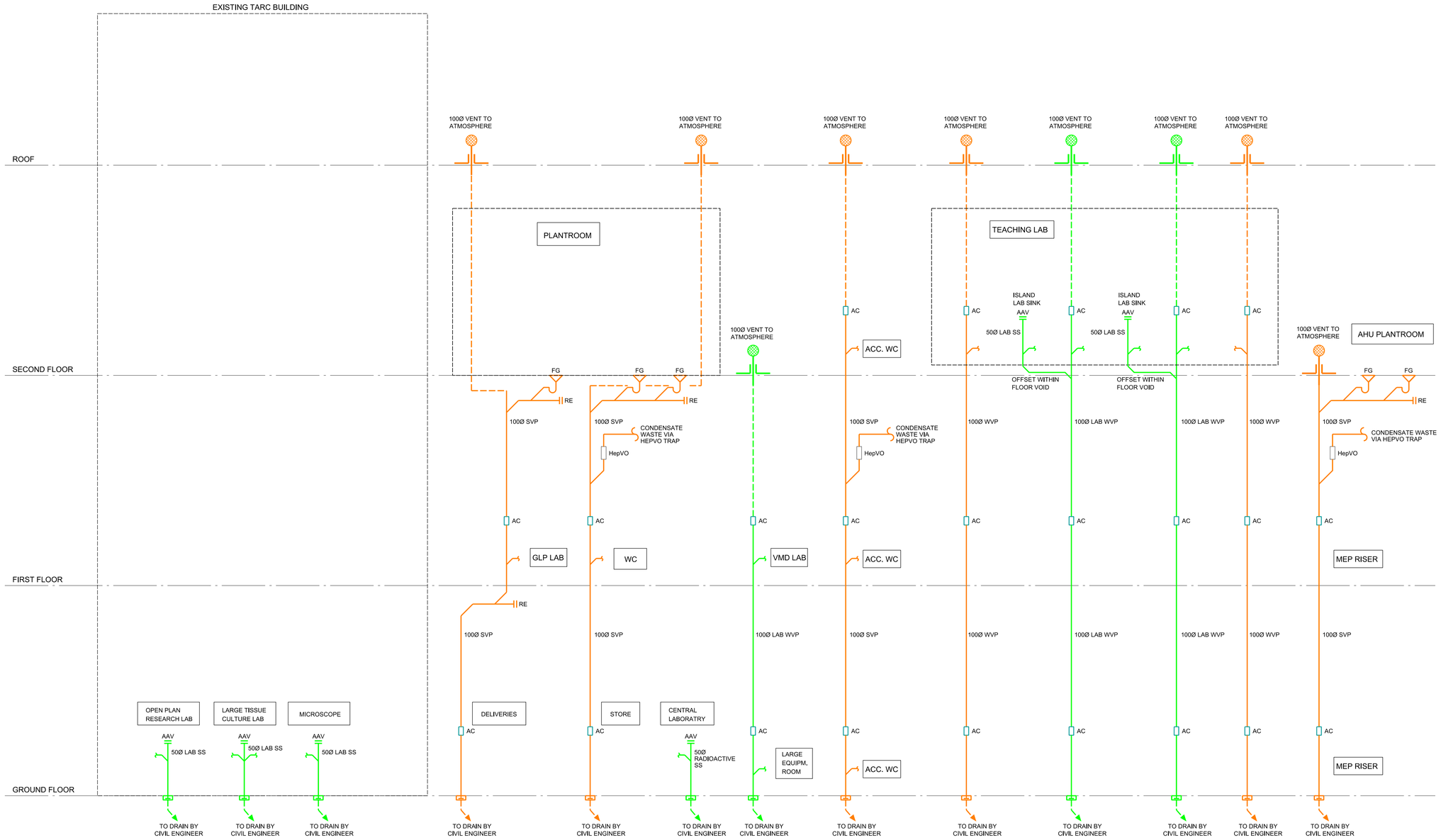
Last Plotted:

Project Management Initials: Designer: AN Checked: MB Approved: AF Drawn by:AN ISO A0 841mm x 1189mm

Last Plotted:

LEGEND

WHB	WASH HAND BASIN
EWH	ELECTRIC WATER HEATER
SRV	SAFETY RELIEF VALVE
TD	TUNDISH
AC	ACCESS DOOR
RE	RODDING EYE
AAV	AIR ADMITTANCE VALVE
HepVO	WATERLESS TRAP
SVP	SOIL VENT PIPE
WVP	WASTE VENT PIPE
WP	WASTE PIPE
VP	VENT PIPE
SS	STUB STACK



AECOM

Project

Hawkshead Campus Redevelopment

UK & IRELAND

Client

Royal Veterinary College
Hawkshead Lane
Hatfield
AL9 7TA

Consultant

AECOM
Aecom House
63-77 Victoria Street
St Albans,Herts
AL1 3ER
United Kingdom
Tel +44 (0)1727 535000
www.aecom.com

Notes

1. THE ABOVE GROUND DRAINAGE INSTALLATION SHALL BE IN STRICT ACCORDANCE WITH THE REQUIREMENTS OF BS EN 12056 PART 2 AND 3, AND THE BUILDING REGULATIONS PART H.
2. THIS SCHEMATIC SHALL BE READ IN CONJUNCTION WITH THE AECOM ABOVE GROUND DRAINAGE LAYOUT DRAWINGS.
3. THIS SCHEMATIC SHOULD BE READ IN CONJUNCTION WITH THE ARCHITECT'S SANITARY FITTINGS SCHEDULE.
4. RODDING ACCESS POINTS TO BE PROVIDED AT ALL CHANGES OF DIRECTION AND ON VERTICAL STACK CONNECTION TO DRAIN AND EVERY FLOOR THEREAFTER.
5. ACCESS POINTS TO BE PROVIDED 1200mm AFFL.
6. ALL LABORATORY DRAINAGE TO BE INSTALLED IN CHEMICALLY RESISTANT PIPEWORK SUCH AS VULCATHENE.
7. ALL RADIOACTIVE DRAINAGE TO BE CLEARLY IDENTIFIED AND LABELLED.

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Sanitation Schematic

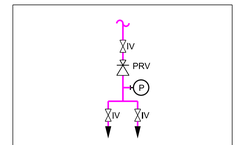
Sheet Number

RVCH-ACM-XX-XX-DR-P-520100

Scale: NTS @ A1 **Rev:** P01

Project Management Initials: Designer: AN Checked: DM Approved: AF Drawn by:AN ISO A0 841mm x 1189mm

NOTE:
CO2 GAS LEAK DETECTION SYSTEM WITH OXYGEN DEPLETION SYSTEM TO BE PROVIDED BY SPECIALLIST. FINAL LOCATION OF PANELS TO BE AGREED WITH ARCHITECT.



TYPICAL CO2 TERMINAL WALL OUTLET DETAIL WITH 6mm COMPRESSION FITTING ADAPTOR

NOTE:
REQUIREMENT FOR OTHER LAB GASES TO BE CONFIRMED BY THE CLIENT

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Notes

1. THIS SCHEMATIC SHALL BE READ IN CONJUNCTION WITH THE AECOM LABORATORY GASES LAYOUT DRAWINGS.
2. THIS SCHEMATIC SHALL BE READ IN CONJUNCTION WITH THE ROOM DATASHEETS AND EQUIPMENT SCHEDULES.
3. THE LABORATORY GAS DESIGN AND INSTALLATION SHALL BE CARRIED OUT BY A SPECIALIST LABORATORY GAS CONTRACTOR.
4. ANY PIPE SIZES SHOWN ARE INDICATIVE ONLY. FINAL PIPE SIZES TO BE DETERMINED BY THE SPECIALIST GAS CONTRACTOR.
5. ALL LABORATORY GAS PIPEWORK IS TO BE INSTALLED IN COPPER TO BS EN 1057 R250 DEGREASED TUBE WITH BRAZED JOINTS.
6. MANIFOLD ROOMS SHALL BE ADEQUATELY VENTILATED IN LINE WITH HTM REQUIREMENTS, COMPLETE WITH HIGH AND LOW LEVEL VENTS.

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Laboratory Gas Schematic

Sheet Number

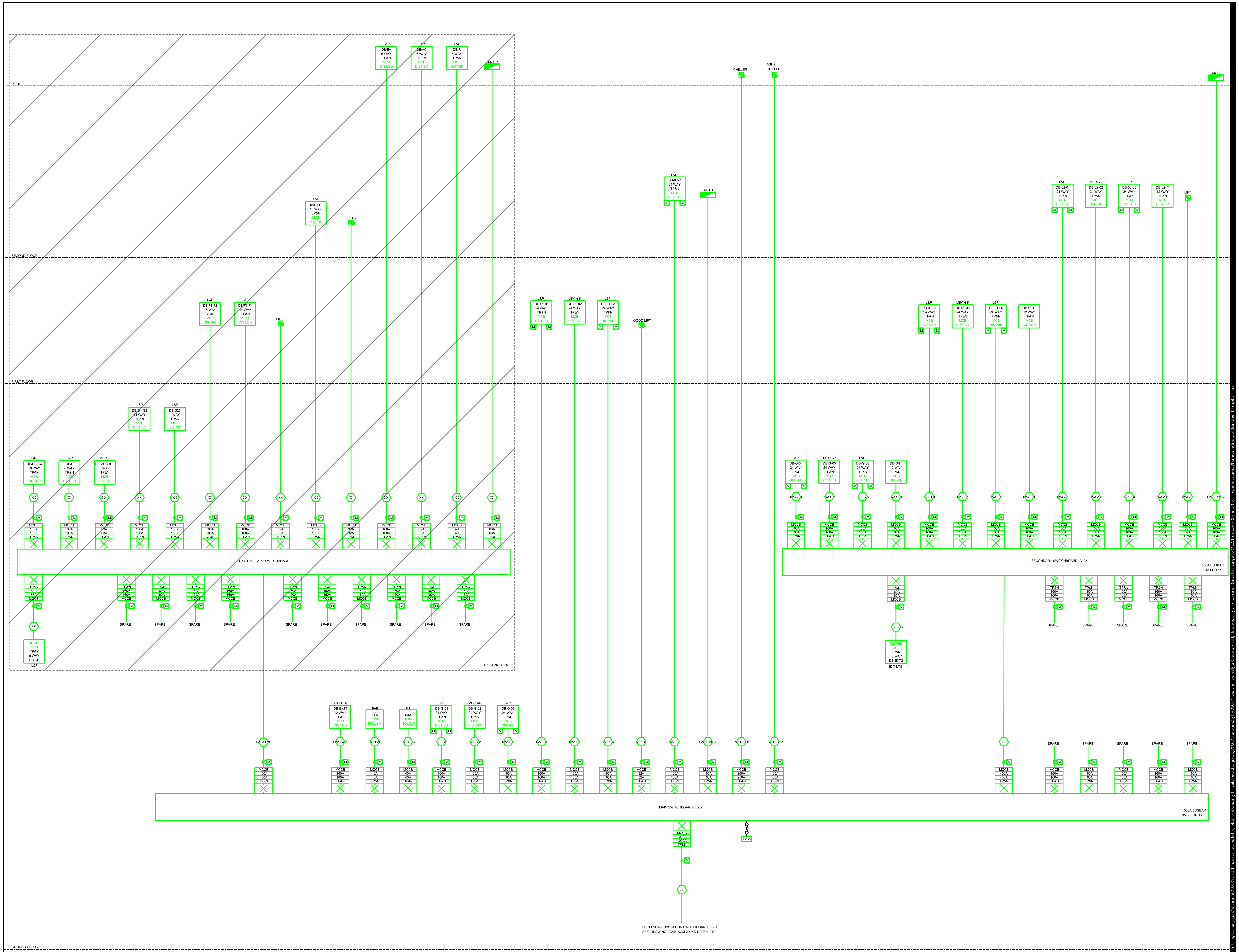
RVCH-ACM-XX-XX-DR-P-540100

Scale: NTS @ A1 **Rev:** P01

Last Plotted:

Project Management Initials: Designer: CMc Checked: KF Approved: AF Drawn by: CMc ISO A0 841mm x 1189mm

Last Plotted:



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Notes

1. THE INFORMATION SHOWN IS IN LINE WITH RIBA STAGE 3.
2. QUANTITY AND SIZE OF PLANT SHOWN IS SUBJECT TO CHANGE AS PART OF THE DETAILED DESIGN PROCESS.
3. SWITCHGEAR SHALL BE PROVIDED WITH INTEGRAL METERS & DISPLAYS WITHIN THEIR MCCB RANGES.
4. FOR GENERAL MCB TYPES, TYPE D SHALL BE USED FOR MOTOR LOADS, TYPE C FOR LIGHTING AND TYPE B FOR SMALL POWER.
5. DISTRIBUTION BOARDS SHALL HAVE AN ALLOWANCE OF 25% SPARE CAPACITY.
6. CPC LOCATED WITHIN BUSBAR TO BE OF EQUAL CSA TO NEUTRAL WITHIN THE BUSBAR.
7. ALL SPARE WAYS ON SWITCHBOARD SHALL INCLUDE CTS FOR FUTURE METERING.
8. THE BREAKER RATINGS INDICATED IN THE DRAWING ARE INDICATIVE AND THEY ARE REFERING TO FRAME SIZE ONLY.
9. METERS LOCATED IN THE MAIN BREAKERS OF PRIMARY SWITCHBOARDS ARE POWER QUALITY METERS.
10. ALL SWITCHBOARDS SHALL BE CONSTRUCTED TO ENABLE THERMOGRAPHIC SURVERYS / TESTING TO TAKE PLACE.
11. ENERGY METERING SHALL BE PROVIDED IN FULL ACCORDANCE WITH PART L OF THE BUILDING REGULATIONS.
12. ALL SPLIT DISTRIBUTION BOARDS ARE SPLIT INTO SEPARATE POWER AND LIGHTING SECTIONS WITH INDEPENDENT METERS AND SEPARATE BMS CONNECTIONS.
13. ALL SWITCHBOARD AND PANEL BOARDS SHALL BE FORM 4 TYPE 6 CONFIGURATION AND AS A MINIMUM IP31 RATED.
14. EACH MAIN LV PANEL SHALL BE PROVIDED WITH BMS CONNECTION TERMINAL BOX TO SUIT THIRD PARTY CONNECTIONS.

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

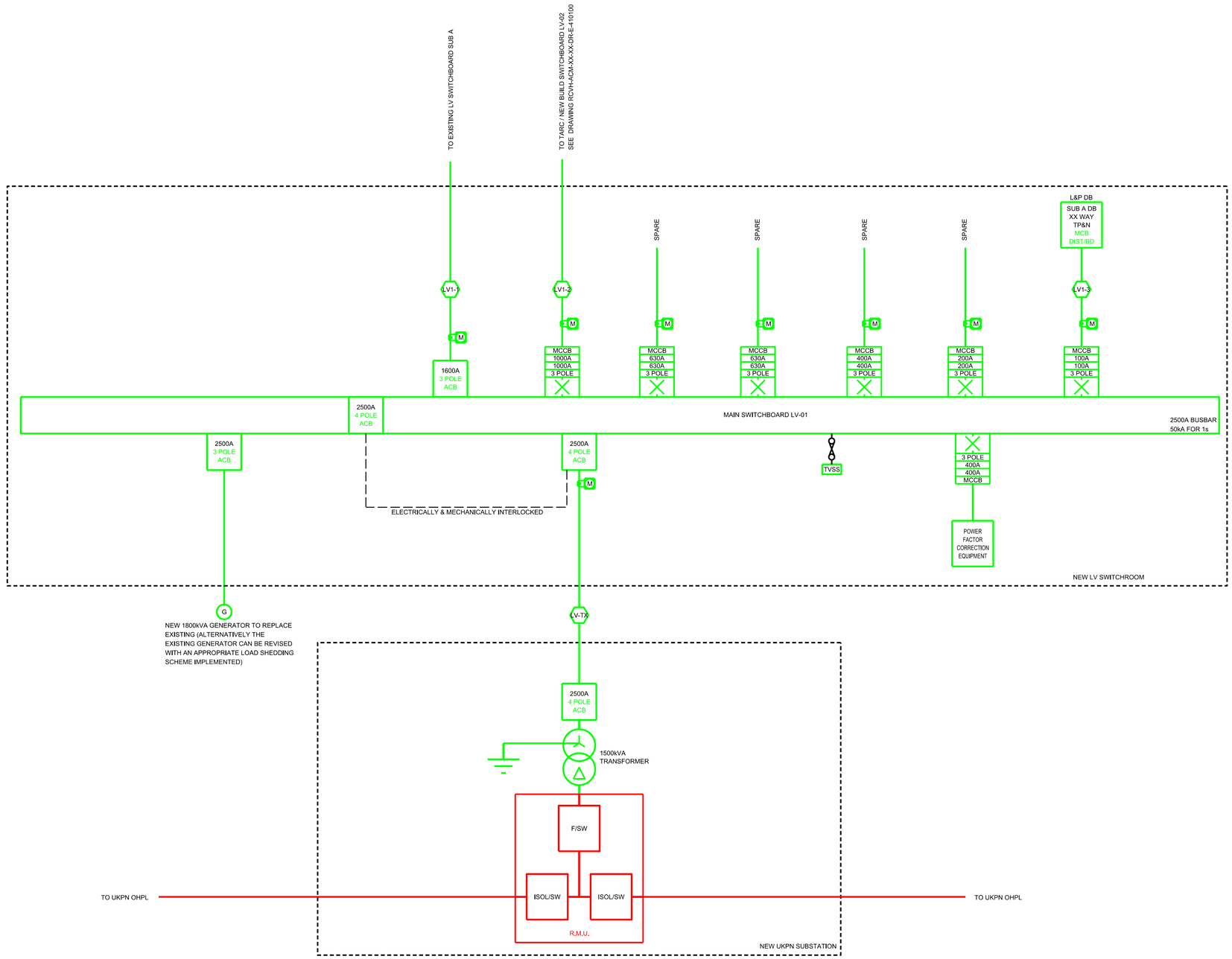
Sheet Title

LV Schematic

Sheet Number

RVCH-ACM-XX-XX-DR-E-410100

Scale: NTS **Rev:** P01



Project Management Initials: Designer: CMc Checked: KF Approved: AF Drawn by:CMc ISO A0 841mm x 1189mm

Last Plotted:

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Notes

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2. QUANTITY AND SIZE OF PLANT SHOWN IS SUBJECT TO CHANGE AS PART OF THE DETAILED DESIGN PROCESS.
3. SWITCHGEAR SHALL BE PROVIDED WITH INTEGRAL METERS & DISPLAYS WITHIN THEIR MCCB RANGES.
4. FOR GENERAL MCB TYPES, TYPE D SHALL BE USED FOR MOTOR LOADS, TYPE C FOR LIGHTING AND TYPE B FOR SMALL POWER.
5. DISTRIBUTION BOARDS SHALL HAVE AN ALLOWANCE OF 25% SPARE CAPACITY.
6. CPC LOCATED WITHIN BUSBAR TO BE OF EQUAL CSA TO NEUTRAL WITHIN THE BUSBAR.
7. ALL SPARE WAYS ON SWITCHBOARD SHALL INCLUDE CTS FOR FUTURE METERING.
8. THE BREAKER RATINGS INDICATED IN THE DRAWING ARE INDICATIVE AND THEY ARE REFERING TO FRAME SIZE ONLY.
9. METERS LOCATED IN THE MAIN BREAKERS OF PRIMARY SWITCHBOARDS ARE POWER QUALITY METERS.
10. ALL SWITCHBOARDS SHALL BE CONSTRUCTED TO ENABLE THERMOGRAPHIC SURVERYS / TESTING TO TAKE PLACE.
11. ENERGY METERING SHALL BE PROVIDED IN FULL ACCORDANCE WITH PART L OF THE BUILDING REGULATIONS.
12. ALL SWITCHBOARD AND PANEL BOARDS SHALL BE FORM 4 TYPE 6 CONFIGURATION AND AS A MINIMUM IP31 RATED.
13. THE GENERATOR CONTROL SYSTEM SHALL PROVIDE THE FACILITY (SIGNAL) TO DISCONNECT THE POWER FACTOR CORRECTION AND HARMONIC FILTERING EQUIPMENT UPON START UP OF THE GENERATOR / FAILURE OF THE MAINS.

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

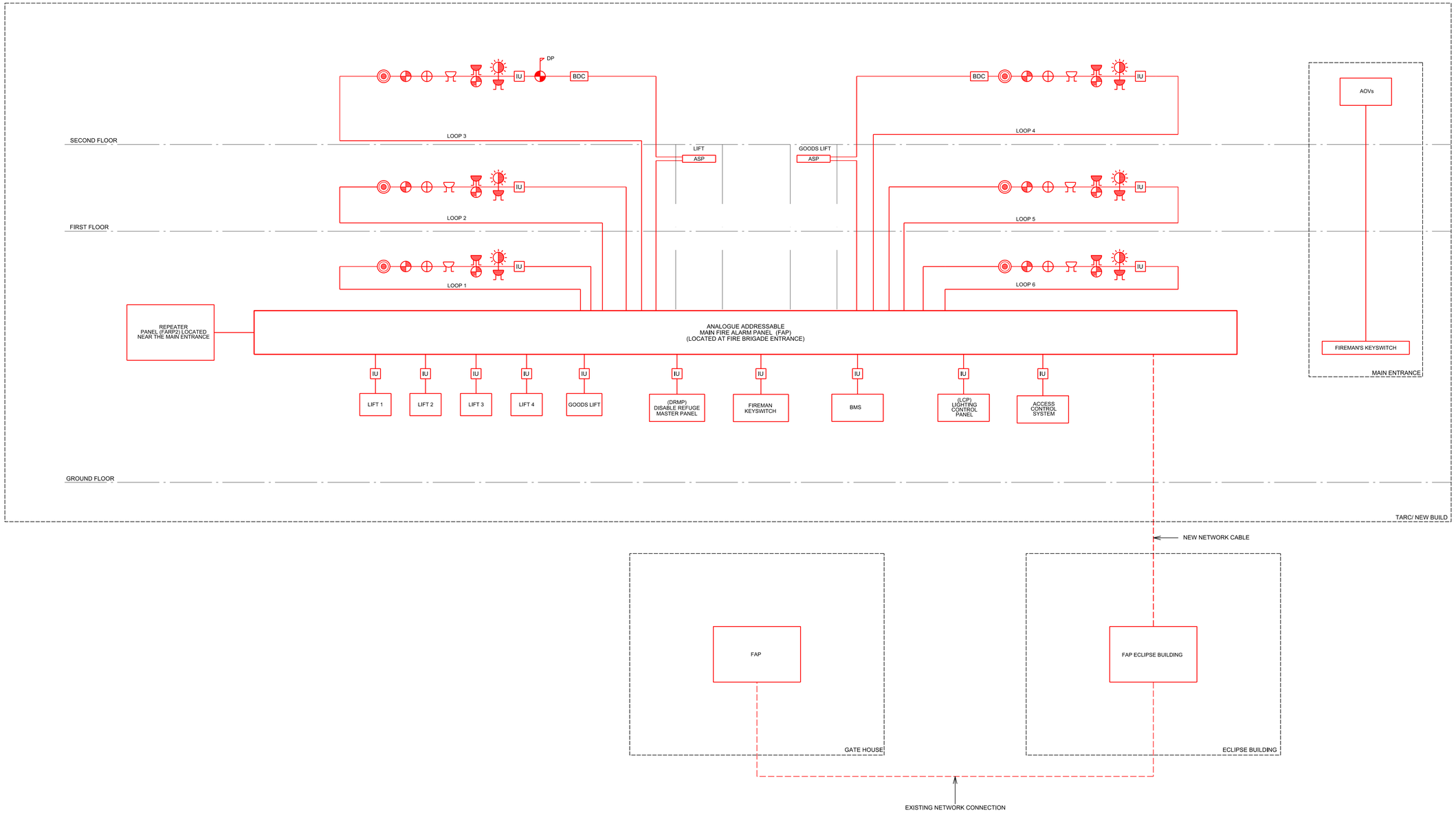
Substation LV Schematic

Sheet Number

RVCH-ACM-XX-XX-DR-E-410101

Scale: NTS **Rev:** P01

Project Management Initials: Designer: TC Checked: KF Approved: AF Drawn by:TC ISO A0 841mm x 1189mm



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Notes

1. THE INFORMATION SHOWN IS IN LINE WITH RIBA STAGE 3 AND IS SUBJECT TO CHANGE IN STAGE 4.
2. CORRECT NUMBER OF LOOPS TO BE CONFIRMED IN THE NEXT STAGE.
3. CONTROL EQUIPMENT AND DEVICES SHOWN ARE INDICATIVE ONLY AND DO NOT REPRESENT THE TRUE NUMBERS AND TYPES.
4. THE FIRE ALARM SPECIALIST / SUB CONTRACTOR WILL BE RESPONSIBLE FOR FINAL DESIGN, INSTALLATION, COMISSIONING AND DEMONSTRATING CORRECT OPERATION OF THE WHOLE SYSTEM AND ALL INTERFACED DEVICES.
5. LOCAL WIRING PER LEVEL SHALL BE IN STANDARD FIRE RATED CABLE. NETWORK CABLE TO BE ENHANCED FIRE RATED TYPE.
6. THE ELECTRICAL SUBCONTRACTOR IS RESPONSIBLE FOR ALL FINAL ELECTRICAL CONNECTIONS BETWEEN FUSE CONNECTION UNITS AND DEVICES.

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

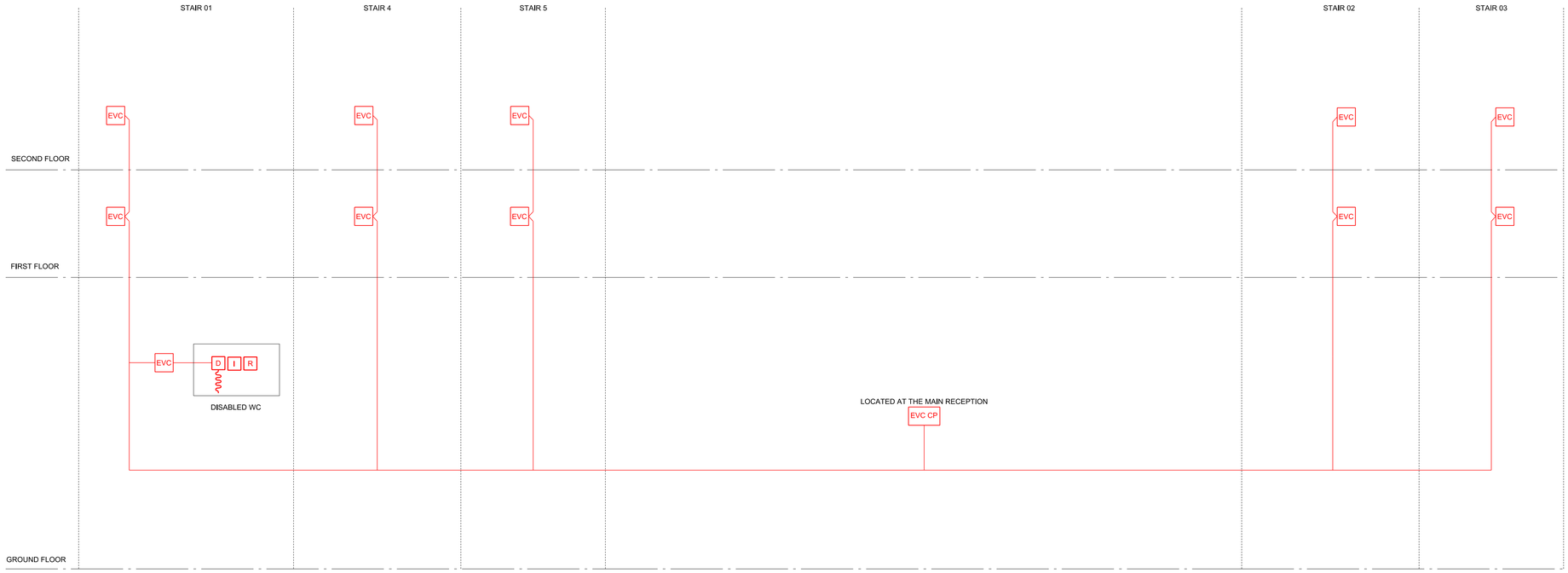
Sheet Title

Fire Alarm Schematic

Sheet Number

RVCH-ACM-XX-XX-DR-E-440100

Scale: NTS **Rev:** P01



Project Management Initials: Designer: TC Checked: KF Approved: AF Drawn by:TC ISO A0 841mm x 1189mm

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Notes

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE STAGE 3 REPORT
2. THE MAIN VOICE COMMUNOCATION PANEL WILL BE LOCATED ALONG SIDE THE FIRE ALARM PANEL ON THE GROUND FLOOR
3. THE EMERGENCY VOICE COMMUNICATION SYSTEM SHALL BE INTERFACED WITH THE FIRE DETECTION AND ALARM SYSTEM.

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

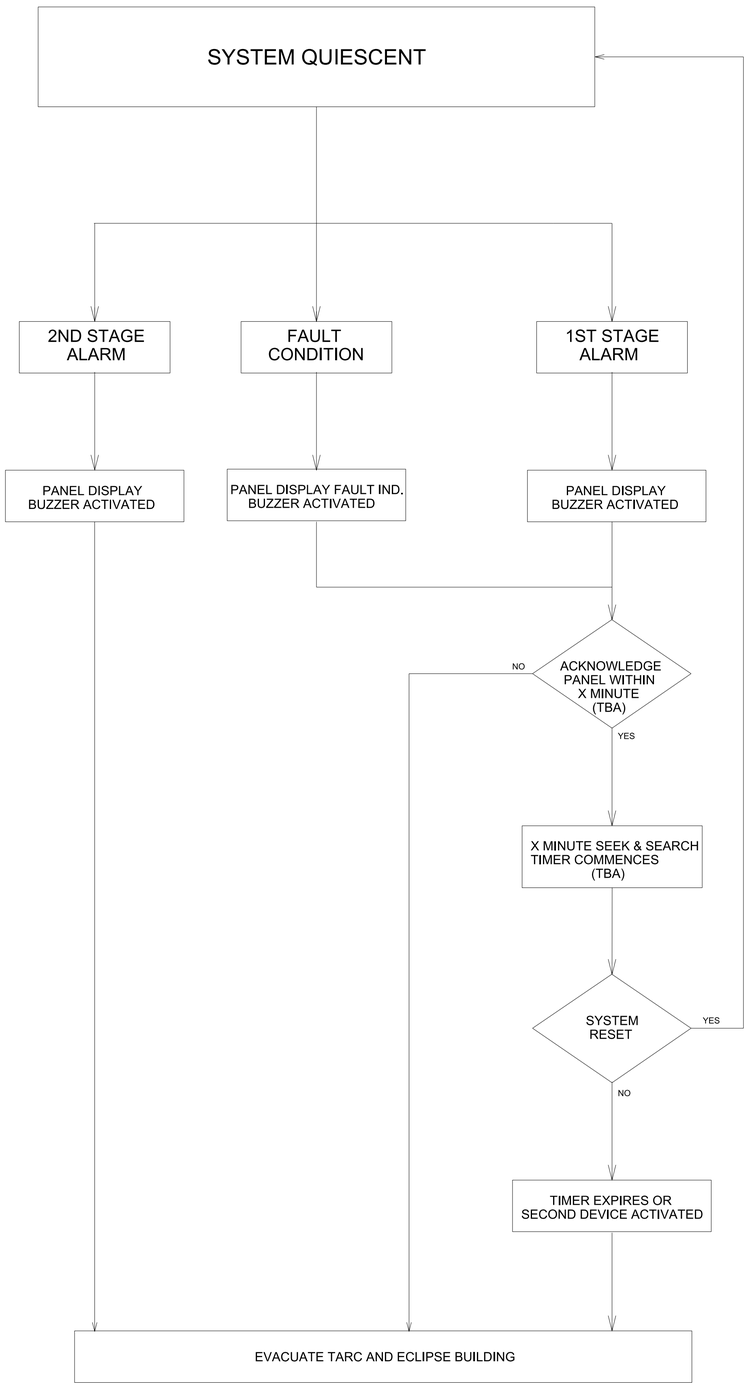
Emergency Voice Communication Schematic

Sheet Number

RVCH-ACM-XX-XX-DR-E-440101

Scale: NTS **Rev:** P01

Zones		Fire Outputs																		
			Signal to FAP	Signal to FAP/RFAPS (1st stage Alarm)	Signal to FAP/RFAPS (2nd stage Alarm)	Lifts to go to Ground Floor and Stop	Lifts to go to First Floor and Stop	Access Control Doors Release	Shut off Gas Valve	Lighting Control System	Flashing Beacon	Sounders -Second Stage Alarm	Signal To MCC Panel	Signal Sent To Eclipse FAP	Signal Sent To Eclipse To Evacuate	AOVs Closed	AOVs Opened
		Fire Inputs																		
Zone 1	First Detector Activated			X																
Ground Floor Existing TARC	Second Detector Activated				X		X	X	X	X	X	X	X	X	X	X				
	Manual Call Point Activated				X		X	X	X	X	X	X	X	X	X	X				
Zone 2	First Detector Activated			X																
1st Floor Existing TARC	Second Detector Activated				X	X		X	X	X	X	X	X	X	X	X				
	Manual Call Point Activated				X	X		X	X	X	X	X	X	X	X	X				
Zone 3:	First Detector Activated			X																
2nd Floor Existing TARC	Second Detector Activated				X	X		X	X	X	X	X	X	X	X	X				
	Manual Call Point Activated				X	X		X	X	X	X	X	X	X	X	X				
Zone 4: Lift Existing TARC	First Stage Alarm			X																
Zone 5	First Detector Activated			X																
Ground Floor Existing TARC	Second Detector Activated				X	X		X	X	X	X	X	X	X	X	X				
	Manual Call Point Activated				X	X		X	X	X	X	X	X	X	X	X				
Zone 6	First Detector Activated			X																
2nd Floor Existing TARC	Second Detector Activated				X	X		X	X	X	X	X	X	X	X	X				
	Manual Call Point Activated				X	X		X	X	X	X	X	X	X	X	X				
Zone 7	First Detector Activated			X																
Link Bridge 1st Floor	Second Detector Activated				X	X		X	X	X	X	X	X	X	X	X				
	Manual Call Point Activated				X	X		X	X	X	X	X	X	X	X	X				
Zone 8	First Detector Activated			X																
2nd Floor Existing TARC	Second Detector Activated				X	X		X	X	X	X	X	X	X	X	X				
	Manual Call Point Activated				X	X		X	X	X	X	X	X	X	X	X				
Zone 9	First Detector Activated			X																
Link Bridge 1st Floor	Second Detector Activated				X	X		X	X	X	X	X	X	X	X	X				
	Manual Call Point Activated				X	X		X	X	X	X	X	X	X	X	X				
Zone 10	First Detector Activated			X																
Stair 3 Existing TARC	Second Detector Activated				X	X		X	X	X	X	X	X	X	X	X				
	Manual Call Point Activated				X	X		X	X	X	X	X	X	X	X	X				
Zone 11	First Detector Activated			X																
Staircase	Second Detector Activated				X	X		X	X	X	X	X	X	X	X	X				
	Manual Call Point Activated				X	X		X	X	X	X	X	X	X	X	X				
Zone 12: Lift	First Detector Activated			X																
Zone 13	First Detector Activated			X																
Ground Floor New TARC	Second Detector Activated				X		X	X	X	X	X	X	X	X	X	X				
	Manual Call Point Activated				X		X	X	X	X	X	X	X	X	X	X				
Zone 14	First Detector Activated			X																
Atrium	Second Detector Activated				X	X		X	X	X	X	X	X	X	X	X				
	Manual Call Point Activated				X	X		X	X	X	X	X	X	X	X	X				
Zone 15	First Detector Activated			X																
Ground Floor New TARC	Second Detector Activated				X		X	X	X	X	X	X	X	X	X	X				
	Manual Call Point Activated				X		X	X	X	X	X	X	X	X	X	X				
Zone 16	First Detector Activated			X																
Stair 4	Second Detector Activated				X	X		X	X	X	X	X	X	X	X	X				
	Manual Call Point Activated				X	X		X	X	X	X	X	X	X	X	X				
Zone 17: Riser	First Detector Activated			X																
Zone 18	First Detector Activated			X																
Stair Core New TARC	Second Detector Activated				X	X		X	X	X	X	X	X	X	X	X				
	Manual Call Point Activated				X	X		X	X	X	X	X	X	X	X	X				
Zone 19	First Detector Activated			X																
Stair 2	Second Detector Activated				X	X		X	X	X	X	X	X	X	X	X				
	Manual Call Point Activated				X	X		X	X	X	X	X	X	X	X	X				
Zone 20: Goods Lift	First Detector Activated			X																
Zone 21: Passenger Lift	First Detector Activated			X																
Zone 22	First Detector Activated			X																
Stair 1	Second Detector Activated				X	X		X	X	X	X	X	X	X	X	X				
	Manual Call Point Activated				X	X		X	X	X	X	X	X	X	X	X				
Zone 23	First Detector Activated			X																
1st Floor New TARC	Second Detector Activated				X	X		X	X	X	X	X	X	X	X	X				
	Manual Call Point Activated				X	X		X	X	X	X	X	X	X	X	X				
Zone 24 Mech + Ph Riser	First Detector Activated			X																
Zone 25	First Detector Activated			X																
New TARC: 1st Floor	Second Detector Activated				X	X		X	X	X	X	X	X	X	X	X				
	Manual Call Point Activated				X	X		X	X	X	X	X	X	X	X	X				
Zone 26	First Detector Activated			X																
2nd Floor New TARC	Second Detector Activated				X	X		X	X	X	X	X	X	X	X	X				
	Manual Call Point Activated				X	X		X	X	X	X	X	X	X	X	X				
Zone 27	First Detector Activated			X																
2nd Floor New TARC	Second Detector Activated				X	X		X	X	X	X	X	X	X	X	X				
	Manual Call Point Activated				X	X		X	X	X	X	X	X	X	X	X				
Zone 28	First Detector Activated			X																
2nd Floor New TARC Plant	Second Detector Activated				X	X		X	X	X	X	X	X	X	X	X				
	Manual Call Point Activated				X	X		X	X	X	X	X	X	X	X	X				
Zone 29: Elec Riser	First Detector Activated			X																
Zone 30: Elec Riser	First Detector Activated			X																
Zone 31: Elec Riser	First Detector Activated			X																
Zone 32: Mech + Ph Riser	First Detector Activated			X																
	Fireman's Keyswitch		X																	
	FAP In Eclipse		X																	
	Fireman's Keyswitch For AOVs		X																	X



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Notes

1. THE INFORMATION SHOWN IS IN LINE WITH RIBA STAGE 3 AND IS SUBJECT TO CHANGE IN STAGE 4.
2. CORRECT NUMBER OF LOOPS TO BE CONFIRMED IN THE NEXT STAGE.
3. CONTROL EQUIPMENT AND DEVICES SHOWN ARE INDICATIVE ONLY AND DO NOT REPRESENT THE TRUE NUMBERS AND TYPES.
4. THE FIRE ALARM SPECIALIST / SUB CONTRACTOR WILL BE RESPONSIBLE FOR FINAL DESIGN, INSTALLATION, COMISSIONING AND DEMONSTRATING CORRECT OPERATION OF THE WHOLE SYSTEM AND ALL INTERFACED DEVICES.
5. LOCAL WIRING PER LEVEL SHALL BE IN STANDARD FIRE RATED CABLE. NETWORK CABLE TO BE ENHANCED FIRE RATED TYPE.
6. THE ELECTRICAL SUBCONTRACTOR IS RESPONSIBLE FOR ALL FINAL ELECTRICAL CONNECTIONS BETWEEN FUSE CONNECTION UNITS AND DEVICES.

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Fire Alarm Cause And Effect Schematic

Sheet Number

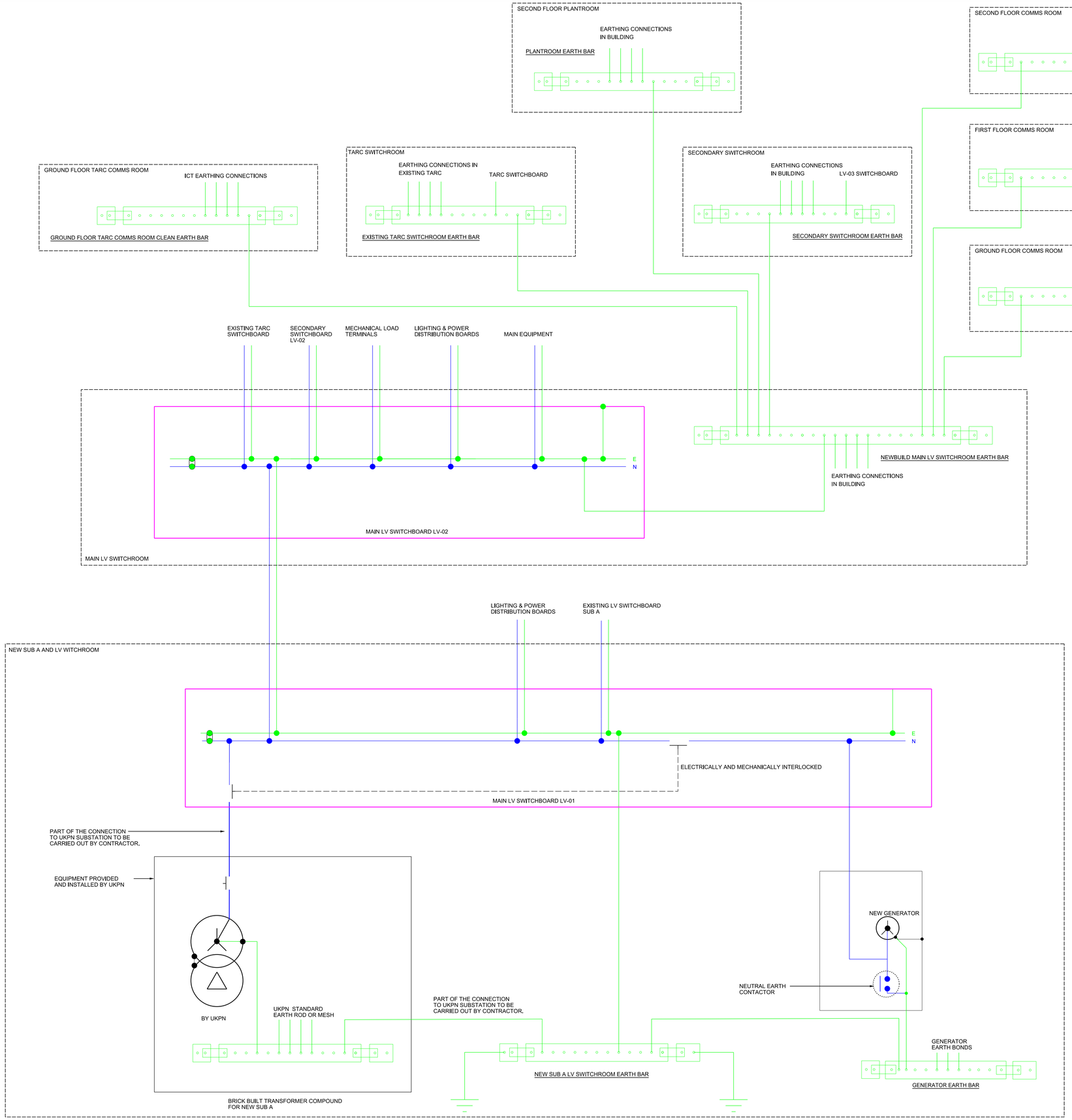
RVCH-ACM-XX-XX-DR-E-440102

Scale: NTS **Rev:** P01

Project Management Initials: Designer: TC Checked: KF Approved: AF Drawn by:TC ISO A0 841mm x 1189mm

Last Plotted:

Project Management Initials: Designer: CMc Checked: KF Approved: AF Drawn by:CMc ISO A0 841mm x 1189mm



LEGEND

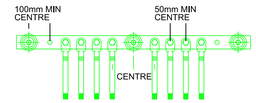
- EARTH
- NEUTRAL
- LV SWITCHBOARD
- 4P CIRCUIT BRAKER
- EARTH ROD OR MESH

EARTH CONNECTIONS REQUIRED TO:

SWITCHPANEL NEUTRAL BUSBAR
SWITCHPANEL ENCLOSURES
GENERATOR ALTERNATORS
GENERATOR ENCLOSURES
GENERATOR CONTROL PANELS
GENERATOR ATTENUATOR
GENERATOR FUEL PIPE WORK
GENERATOR BULK TANKS
ELEC DISTRIBUTION SWITCHBOARDS
BUILDING STEEL WORK
LIGHTNING PROTECTION SYSTEM
ROOM STEELWORK
INCOMING GAS
INCOMING WATER

(NOTE THIS LIST IS NOT EXHAUSTIVE)

ALL BARS TO HAVE MINIMUM 40% SPARE CAPACITY FOR FUTURE CONNECTIONS AT COMPLETION.



TYPICAL DETAIL OF EARTH BARS

ALL EARTH BARS TO BE MOUNTED ON INSULATED SUPPORTS. BUSBAR INSULATED SUPPORTS TO BE AT 450mm CENTRES. ALL CABLES TO BE CLEARLY LABELED.

EARTH BARS SHALL BE FIXED VIA LONG STUDS. TO ENABLE BARS AND CABLES TO BE SECURED USING SEPARATE NUTS AND WASHERS.

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Notes

1. THE GENERATOR CONTROL SYSTEM SHALL OPEN AND CLOSE THE RELEVANT CIRCUIT BREAKERS/SWITCHES/ CONTACTORS AS REQUIRED.
2. WHEN THE GENERATOR OPERATES IN PARALLEL WITH THE TRANSFORMER, THE NEUTRAL POINT ON THE GENERATOR WINDINGS SHOULD NOT BE EARTHED, AS DETAILED IN BS7430 AND CONNECTED TO THE LOAD.
3. ELECTRICAL & MECHANICAL INTERLOCKS SHOULD ENSURE INTEGRITY OF THE NEUTRAL/EARTH CONNECTION AT ALL TIMES AND UNDER ALL POSSIBLE OPERATING CONDITIONS.
4. WHEN THE GENERATOR OPERATES INDEPENDENTLY FROM THE TRANSFORMER, THE SWITCH USED TO ISOLATE SYSTEMS MUST DISCONNECT EACH PHASE AND NEUTRAL, AS HIGHLIGHTED IN EREC G59/3-1.
5. THE ARRANGEMENT SHOWN IS SUBJECT TO GENERATOR MANUFACTURE G59 DETAILED APPLICATION APPROVAL BY UKPN.
6. THIS DRAWING IS A STAGE 3 DESIGN DEVELOPMENT DRAWING AND IS SUBJECT TO CHANGE IN STAGE 4.
7. METAL LOUVRES, METAL DOORS, CABLE LADDER AND ANY ADDITIONAL EXTRANEOUS CONDUCTIVE PARTS WILL BE BONDED TO RESPECTIVE ROOM EARTHING BAR. (EXAMPLES SHOWN ON DRAWING ARE NOT EXHAUSTIVE)
8. EARTH BARS SHALL BE MOUNTED ADJACENT TO LOCAL EQUIPMENT AND SWITCHGEAR.

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

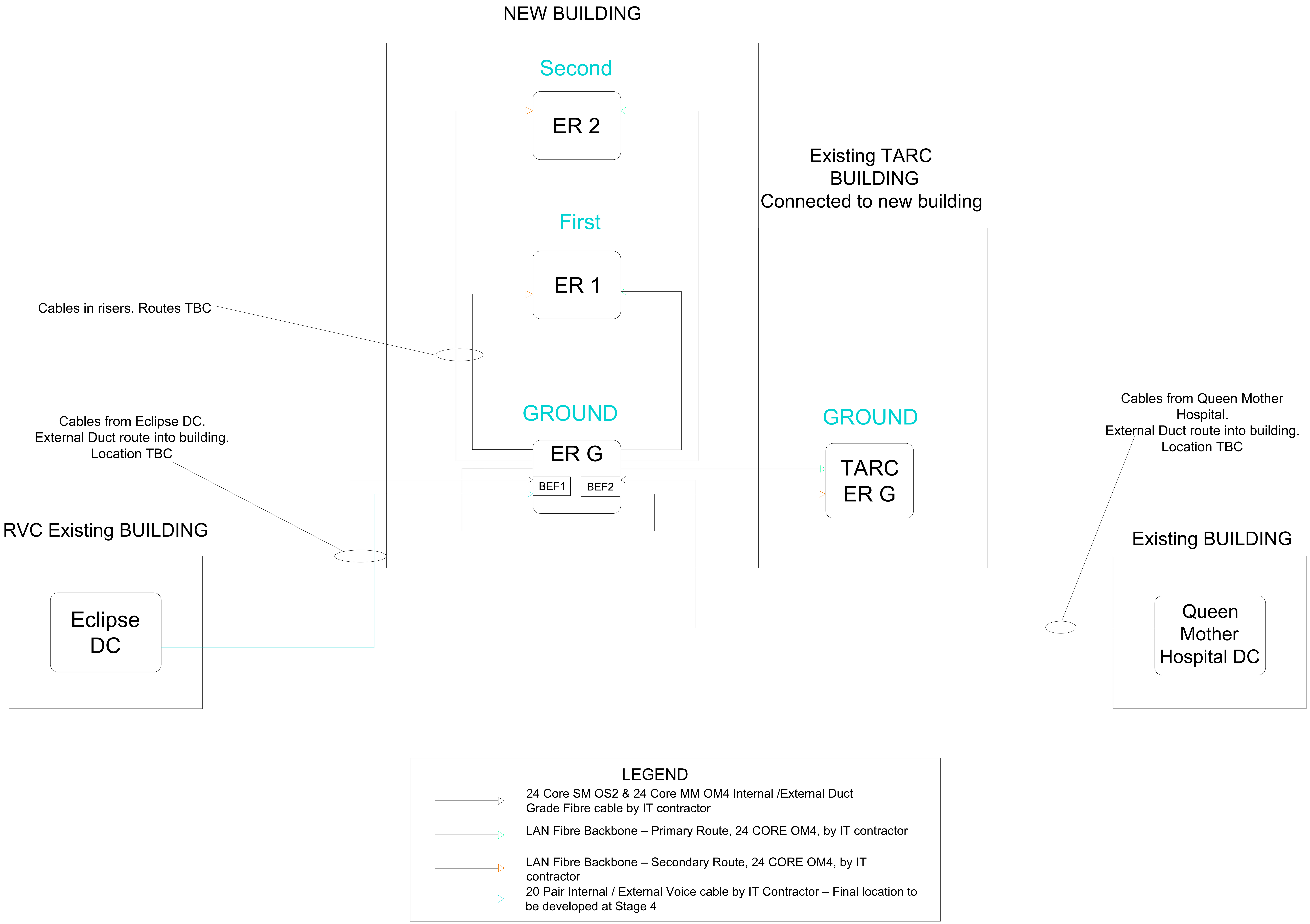
Earthing Schematic

Sheet Number

RVCH-ACM-XX-XX-DR-E-450100

Scale: NTS **Rev:** P01

Last Plotted:



Project Management Initials: Designer: DR Checked: KF Approved: AF Drawn by:CMc ISO A0 841mm x 1189mm

Last Plotted:

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UK & IRELAND

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Notes

1. DIMENSIONS APPROXIMATE
2. DUCTS PROVIDED BY OTHERS
3. RISER ROUTE LOCATIONS TO BE CONFIRMED AT NEXT DESIGN STAGE

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

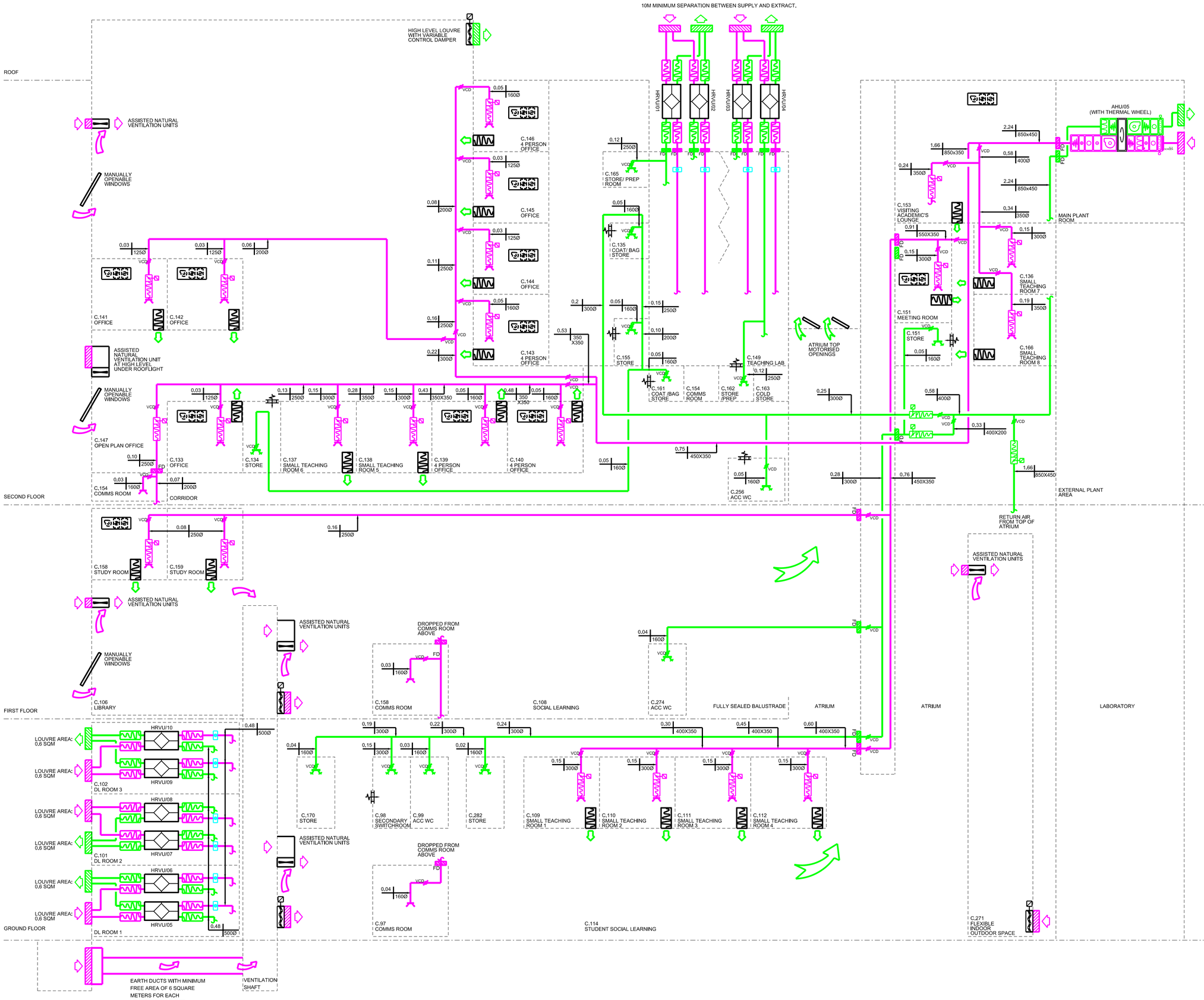
Sheet Title

Fibre Backbone Schematic

Sheet Number

RVCH-ACM-XX-XX-DR-E-470100

Scale: NTS **Rev:** P01



Project Management Initials: Designer: CY Checked: MB Approved: AF Drawn by:CY ISO A0 841mm x 1189mm

Last Plotted:

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Notes

1. NUMBER OF ASSISTED NATURAL VENTILATION UNITS ARE INDICTIVE.
2. NUMBER OF FAN COIL UNITS ARE INDICTIVE.
3. FROST COILS NOT PROVIDED FOR LOCAL HEAT RECOVERY VENTILATION UNITS TO MAXIMISE ENERGY EFFICIENCY.
4. ALL VAV BOXES ARE CONTROLLED VIA BMS LINKED TO CO2 AND TEMPERATURE SENSOR WITH CAPABILITY OF SHUT OFF WHEN THE ROOMS ARE NOT IN USE.

ACOUSTICLLY INSULATED TRANSFER GRILLE

ASSISTED NATURAL VENTILATION UNIT

VARIABLE AIR VOLUME CONTROL BOX

FAN COIL UNIT

TRANSFER GRILLE

HEAT RECOVERY VENTILATION UNIT

MOTORISED DAMPER

FLOW RATE (M3/S) / SIZE (MM)

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Ventilation Schematic
Sheet 1 of 3

Sheet Number

RVCH-ACM-XX-XX-DR-M-310100

Scale: NTS **Rev:** P01

Project Management Initials: Designer: CY Checked: MB Approved: AF Drawn by:CY ISO A0 841mm x 1189mm

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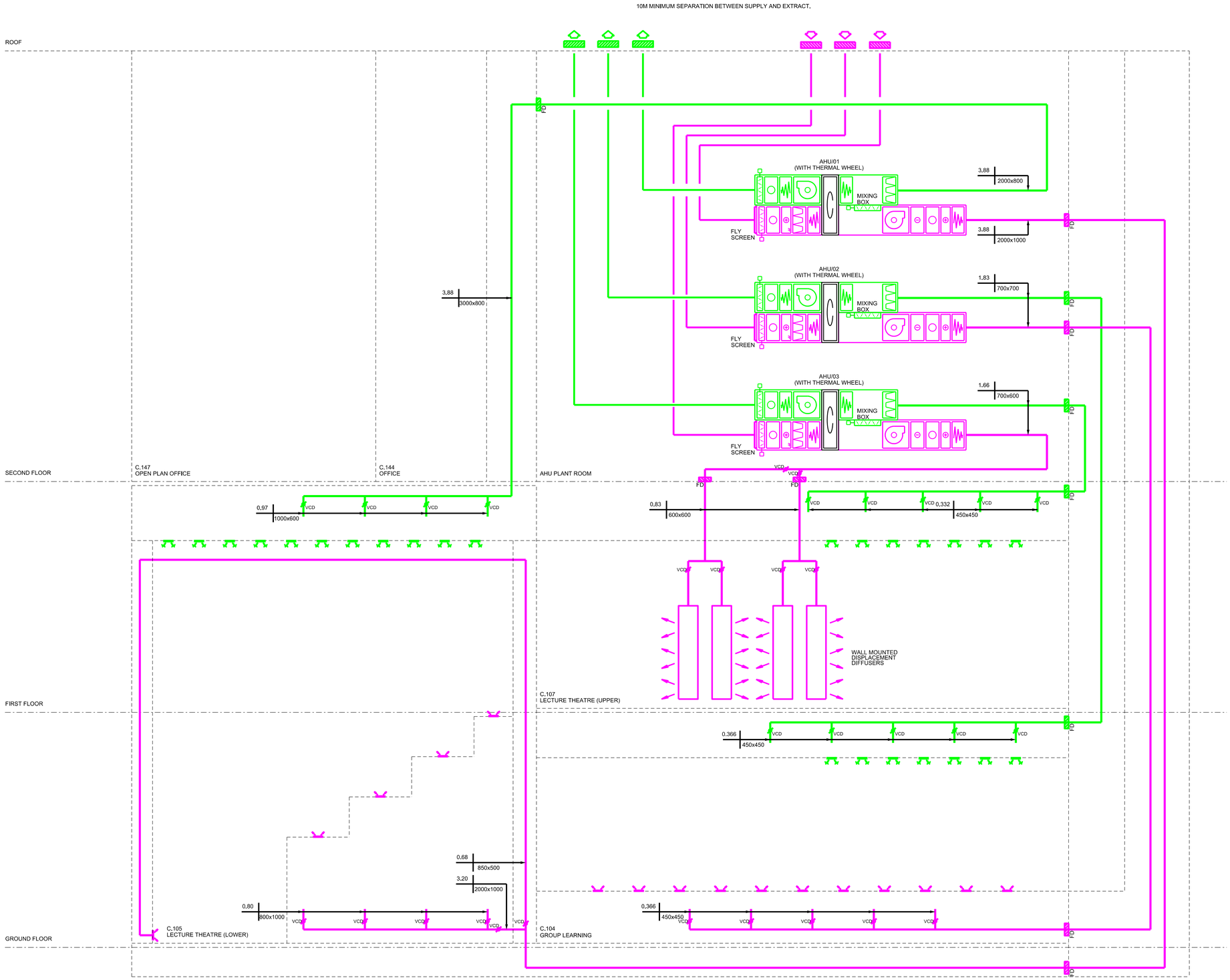

VARIABLE AIR VOLUME CONTROL BOX

FAN COIL UNIT

TRANSFER GRILLE

HEAT RECOVERY VENTILATION UNIT

MOTORISED DAMPER

FLOW RATE (M3/S)
SIZE (MM)

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Notes

1. THE DUCTWORK DISTRIBUTION AND PROVISION OF GRILLES AND DIFFUSERS ARE INDICATIVE
2. FLOOR DIFFUSER IS BASED ON ONE DIFFUSER PER SEAT

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Ventilation Schematic
Sheet 2 of 3

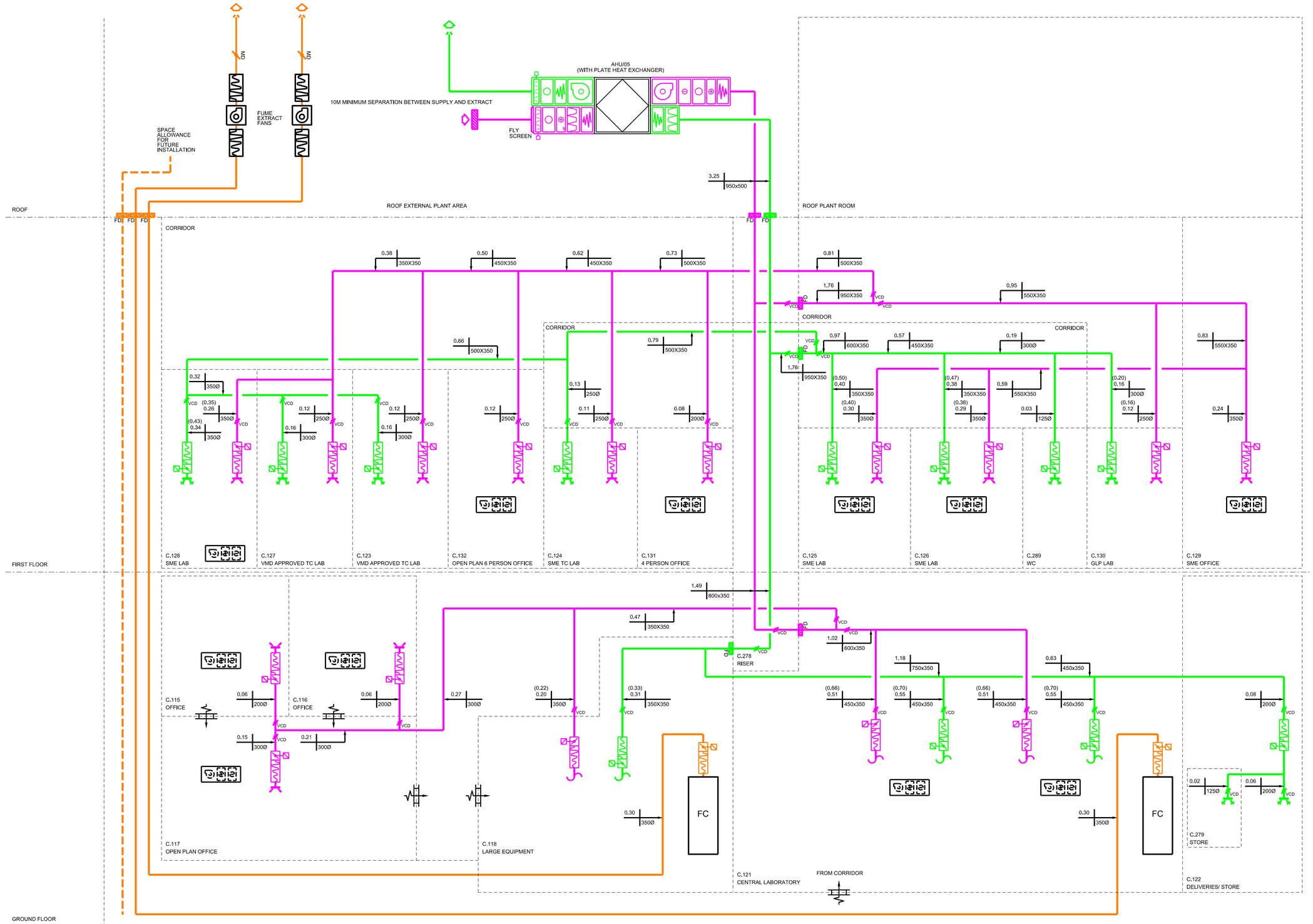
Sheet Number

RVCH-ACM-XX-XX-DR-M-310101

Scale: NTS **Rev:** P01

Project Management Initials: Designer: CY Checked: MB Approved: AF Drawn by:CY ISO A0 841mm x 1189mm

Last Plotted:



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Notes

1. NUMBER OF FAN COIL UNITS ARE INDICTIVE.
2. TERMINAL VAV BOXES AND GRILLE TO BE PROVIDED BASED ON 10 ACH FOR LABORATORY
3. ALL VAV BOXES ARE CONTROLLED VIA BMS LINKED TO CO2 AND TEMPERATURE SENSOR WITH CAPABILITY OF SHUT OFF WHEN THE ROOMS ARE NOT IN USE.
4. EXTRACT DUCTWORK CONNECTED TO FUME CUPBOARD SHOULD BE PLASTIC DUCT WITH INTUMESCENT COLLARS PROVIDED WHEN DUCTWORK PENETRATES FIRE COMPARTMENT.

ACOUSTICLLY INSULATED TRANSFER GRILLE

VARIABLE AIR VOLUME CONTROL BOX

FAN COIL UNIT

TRANSFER GRILLE

HEAT RECOVERY VENTILATION UNIT

MOTORISED DAMPER

(10 ACH) FLOW RATE (M3/S) / SIZE (MM)

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Ventilation Schematic
Sheet 3 of 3

Sheet Number

RVCH-ACM-XX-XX-DR-M-310102

Scale: NTS **Rev:** P01

Project Management Initials: Designer: CY Checked: MB Approved: AF Drawn by: CY ISO A0 841mm x 1189mm

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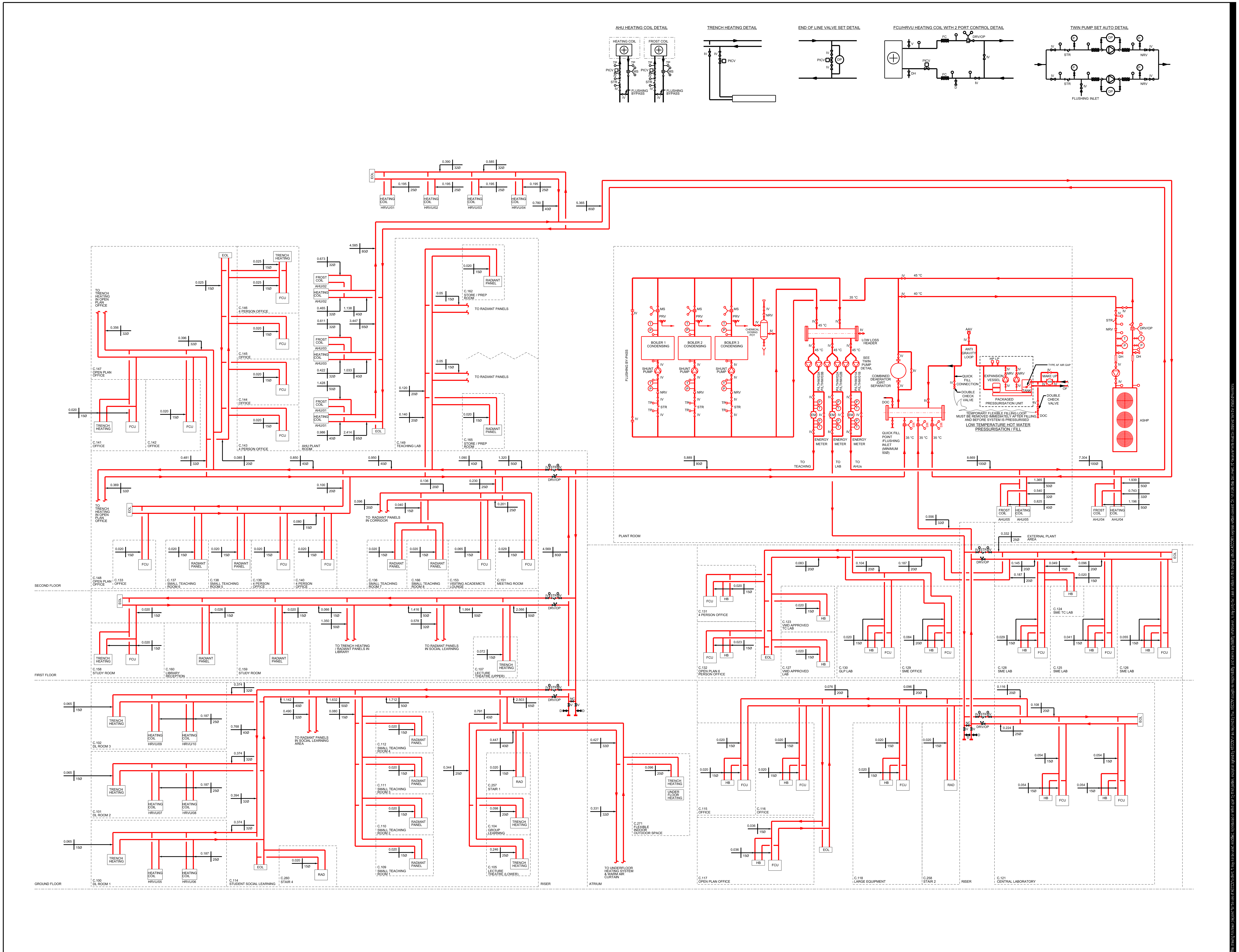

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Notes

1. FLOW RATES ARE SUBJECT TO CHANGE IN ACCORDANCE WITH RDS SIGN OFF.

FLOW RATE (KG/S) | SIZE (MM)

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

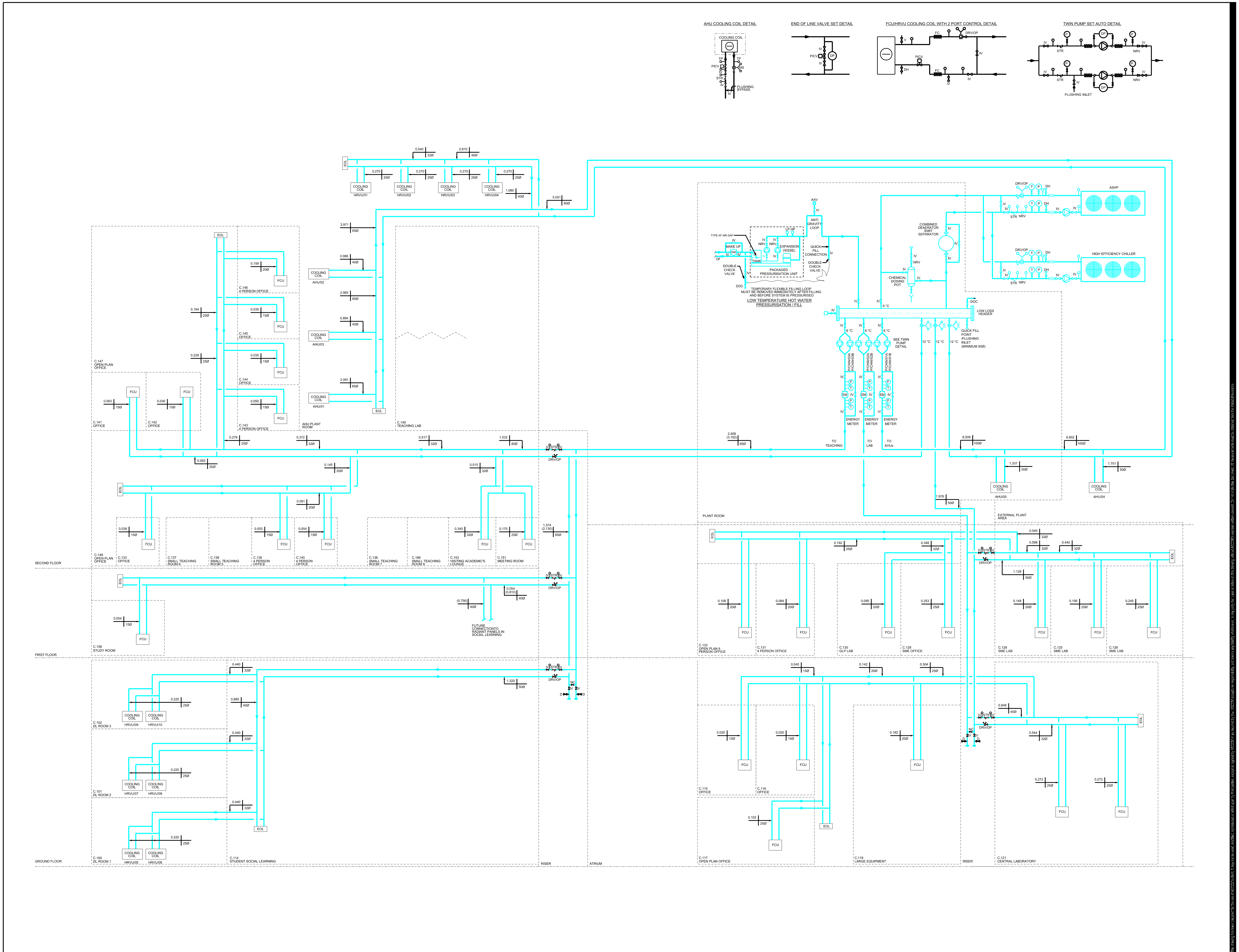
Sheet Title

Heating Schematic

Sheet Number

RVCH-ACM-XX-XX-DR-M-340100

Scale: NTS **Rev:** P01



![AECOM logo]

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Notes

1. FLOW RATES ARE SUBJECT TO CHANGE IN ACCORDANCE WITH RDS SIGN OFF.

FLOW RATE (WITH FUTURE CAPACITY) (KG/S)
SIZE (MM)

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Cooling Schematic

Sheet Number

RVCH-ACM-XX-XX-DR-M-350100

Scale: NTS Rev: P01

Appendix B.3 - Mechanical Services Drawings

Project Management Initials: Designed: CY Checked: MB Approved: AF Drawn by: MP ISO A0 841mm x 1189mm

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Notes

1. THE INFORMATION SHOWN IS IN LINE WITH RIBA STAGE 3.
2. REFER TO HEATING SCHEMATIC AND COOLING SCHEMATIC FOR TERMINAL HEATING AND COOLING EQUIPMENT.

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Heating and Cooling Layout
First Floor

Sheet Number

RVCH-ACM-XX-01-DR-M-340000

Scale: 1 : 100@A0 **Rev:** P01

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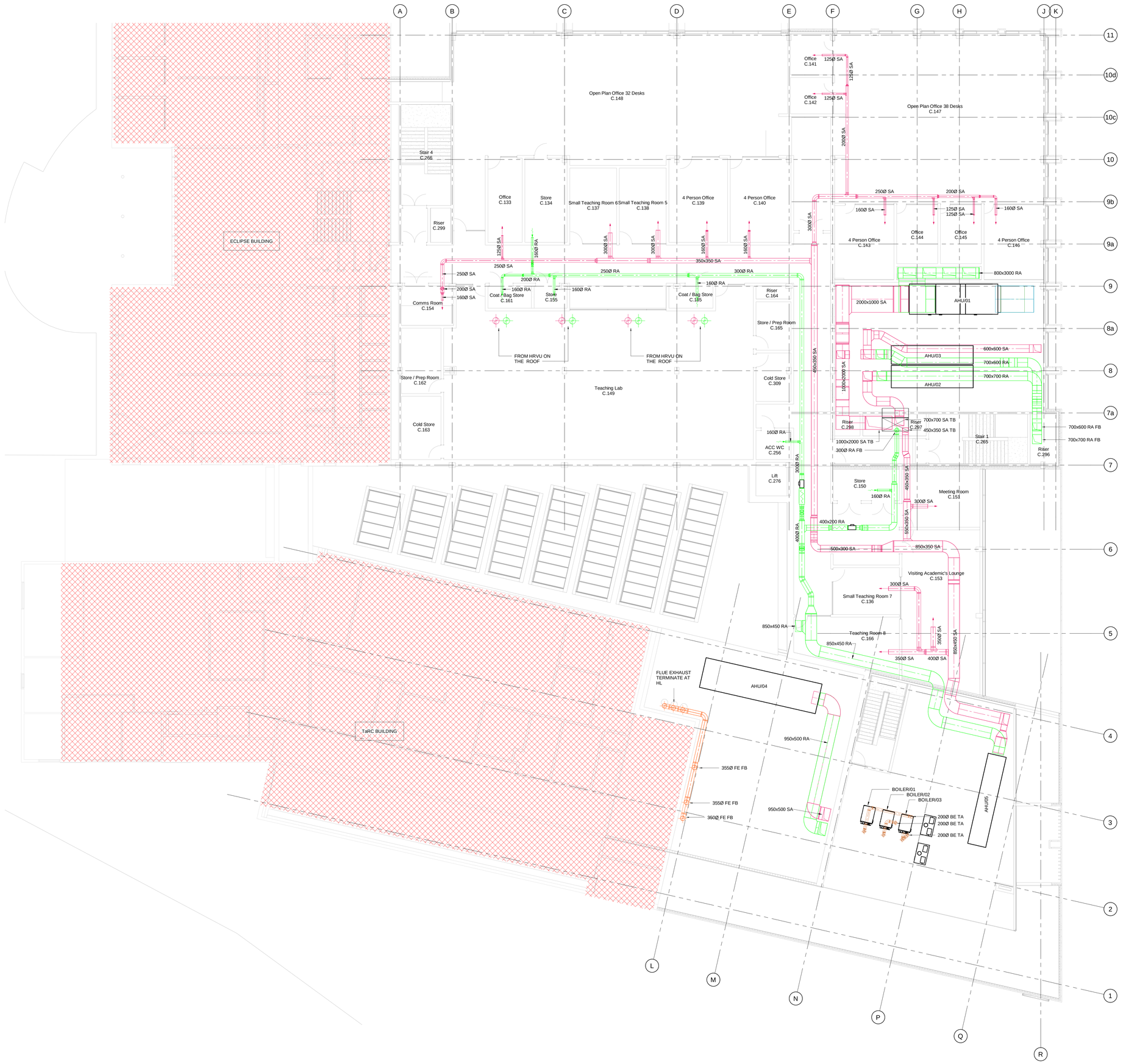

Last Plotted: 01/11/2018 13:53:52

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Notes

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3. REFER TO VENTILATION SCHEMATICS FOR NATURAL VENTILATION STRATEGY.
4. REFER TO VENTILATION SCHEMATICS FOR FIRE DAMPER PROVISION.

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

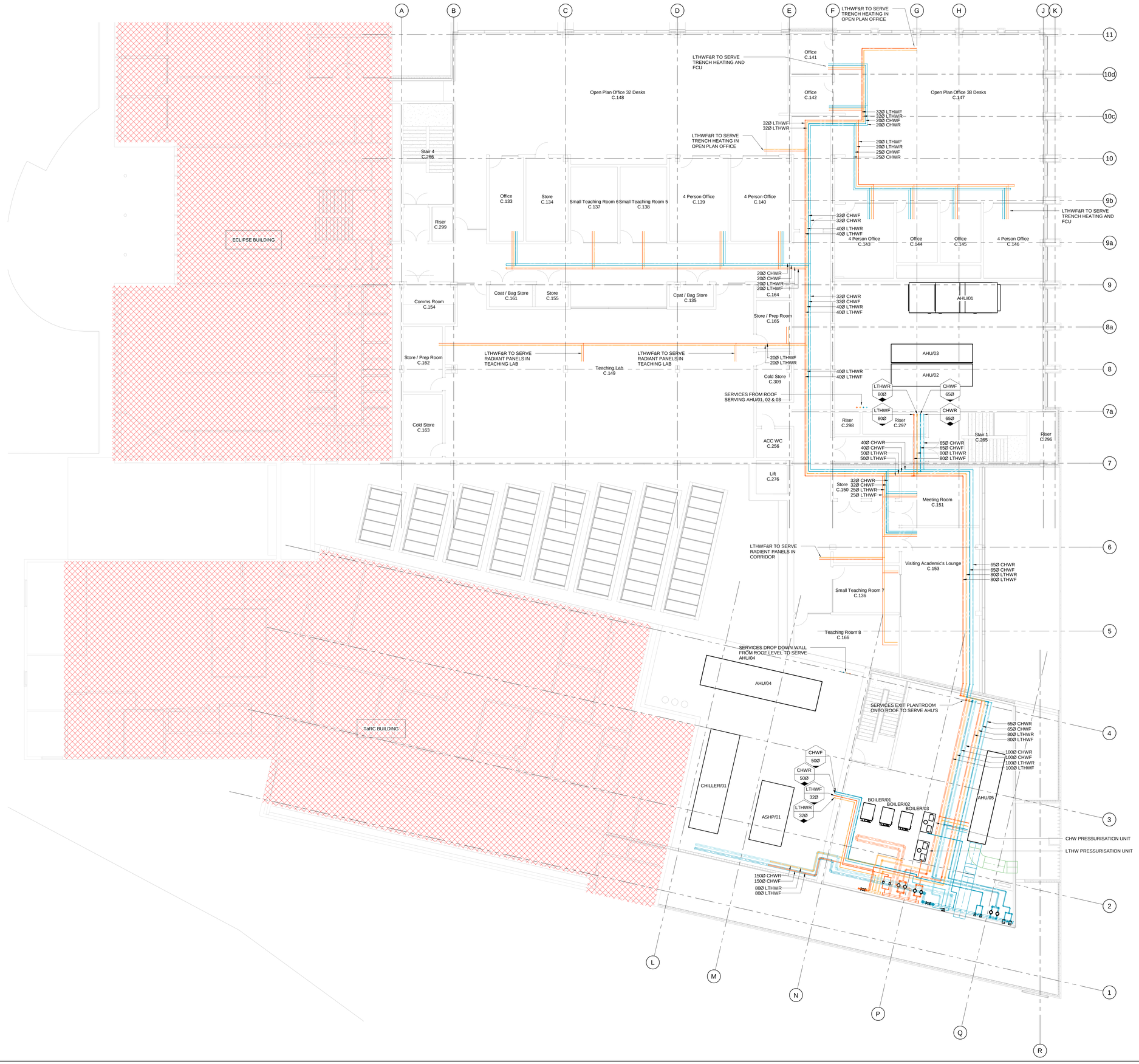
Sheet Title

Ventilation Layout
Second Floor

Sheet Number

RVCH-ACM-XX-02-DR-M-310000

Scale: 1 : 100@A0 **Rev:** P01



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Notes

1. THE INFORMATION SHOWN IS IN LINE WITH RIBA STAGE 3.
2. REFER TO HEATING SCHEMATIC AND COOLING SCHEMATIC FOR TERMINAL HEATING AND COOLING EQUIPMENT.

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

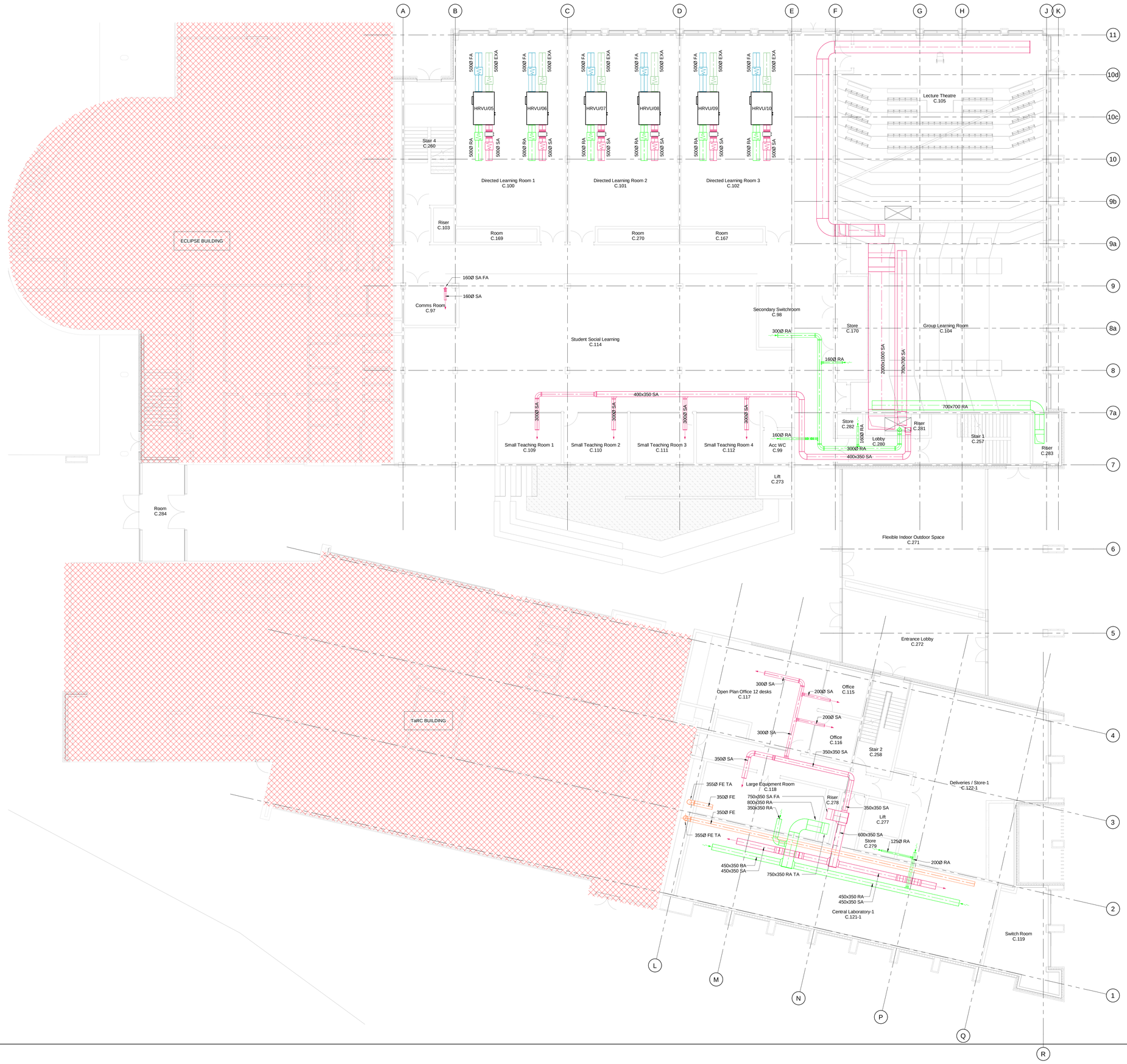
Sheet Title

Heating and Cooling Layout
Second Floor

Sheet Number

RVCH-ACM-XX-02-DR-M-340000

Scale: 1 : 100@A0 **Rev:** P01



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3. REFER TO VENTILATION SCHEMATICS FOR NATURAL VENTILATION STRATEGY.
4. REFER TO VENTILATION SCHEMATICS FOR FIRE DAMPER PROVISION.

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Ventilation Layout
Ground Floor

Sheet Number

RVCH-ACM-XX-GF-DR-M-310000

Scale: 1 : 100@A0 **Rev:** P01

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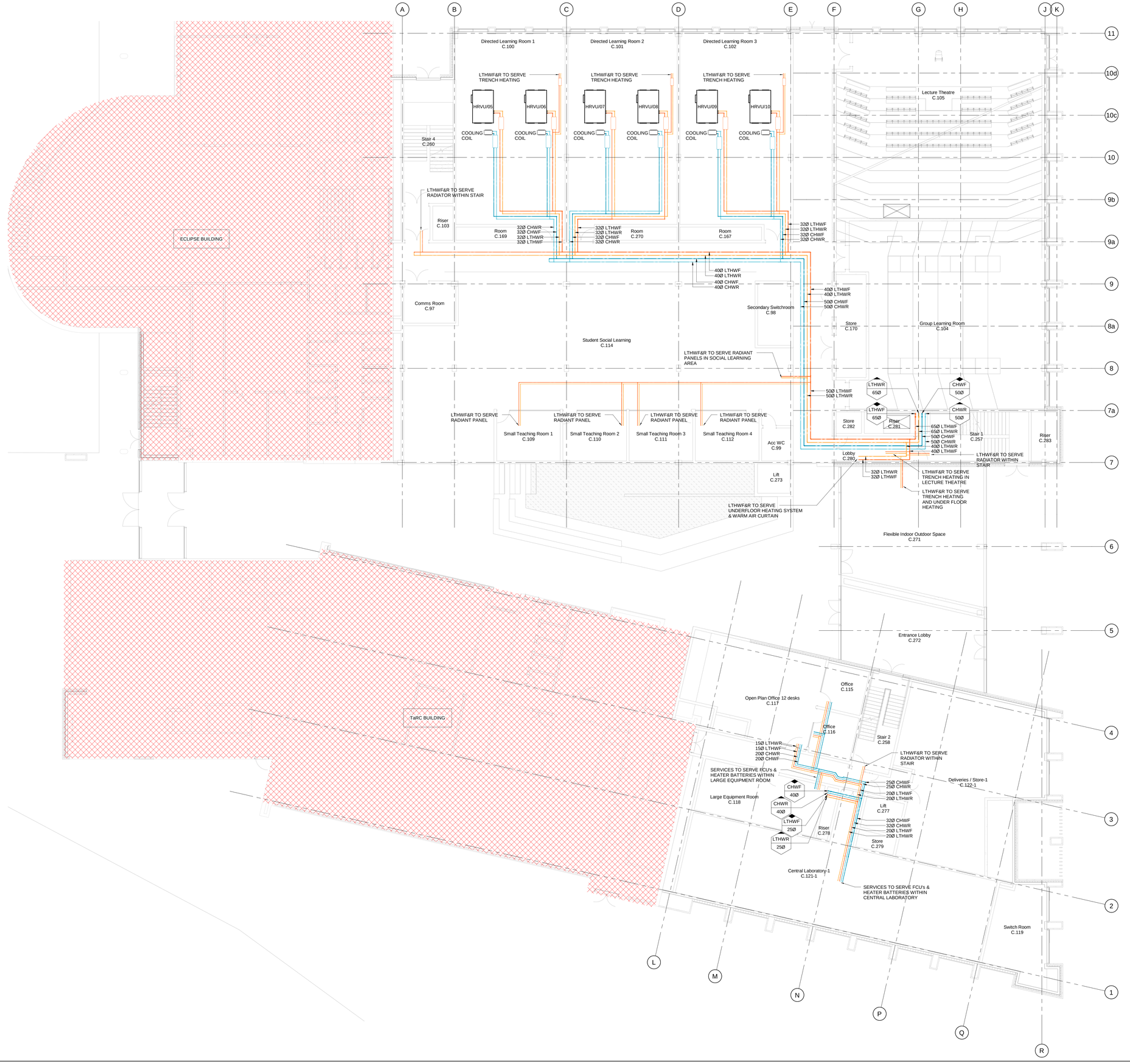

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Notes

1. THE INFORMATION SHOWN IS IN LINE WITH RIBA STAGE 3.
2. REFER TO HEATING SCHEMATIC AND COOLING SCHEMATIC FOR TERMINAL HEATING AND COOLING EQUIPMENT.

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Heating and Cooling Layout
Ground Floor

Sheet Number

RVCH-ACM-XX-GF-DR-M-340000

Scale: 1 : 100@A0 **Rev:** P01

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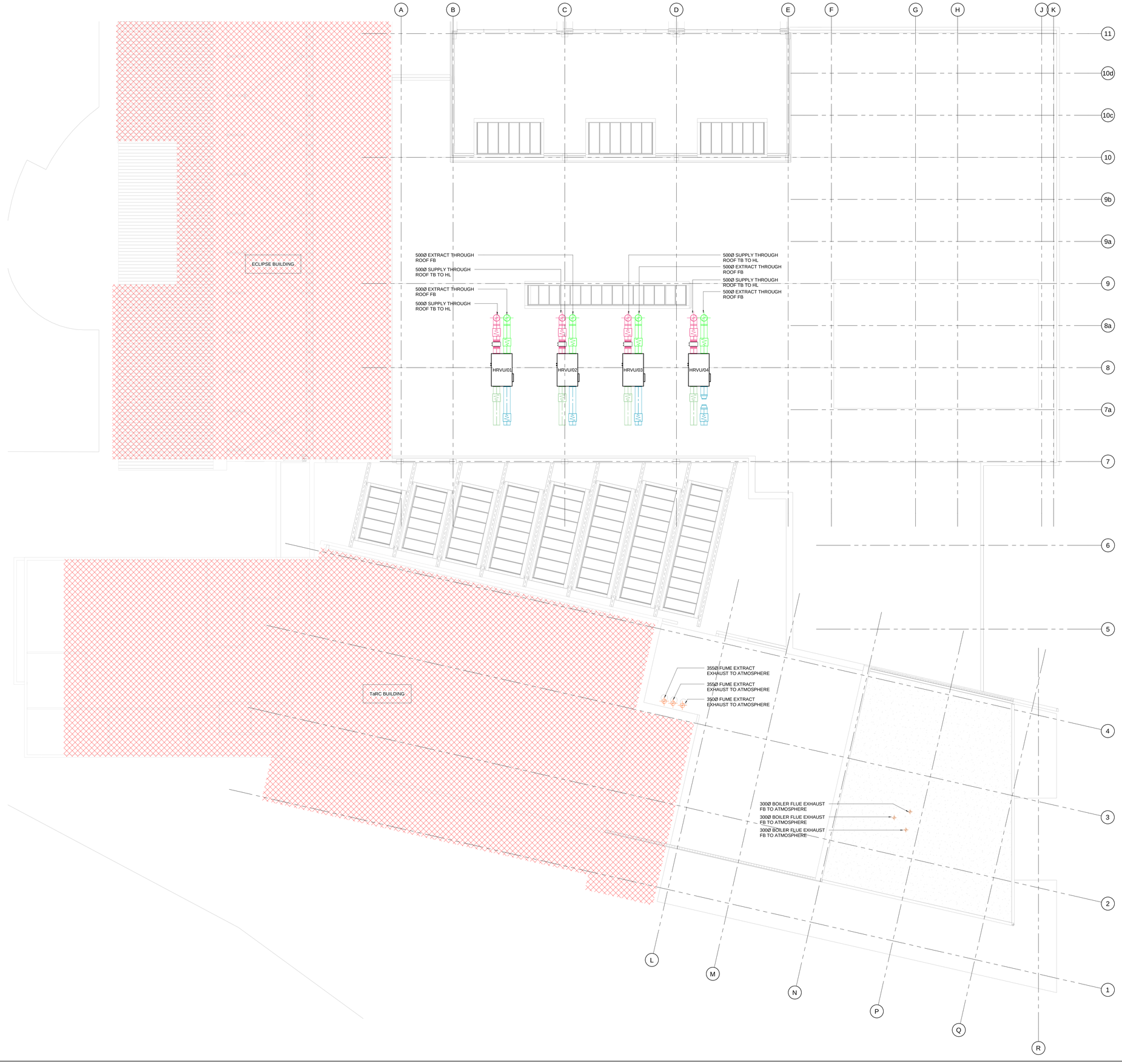

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Notes

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3. REFER TO VENTILATION SCHEMATICS FOR NATURAL VENTILATION STRATEGY.
4. REFER TO VENTILATION SCHEMATICS FOR FIRE DAMPER PROVISION.

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

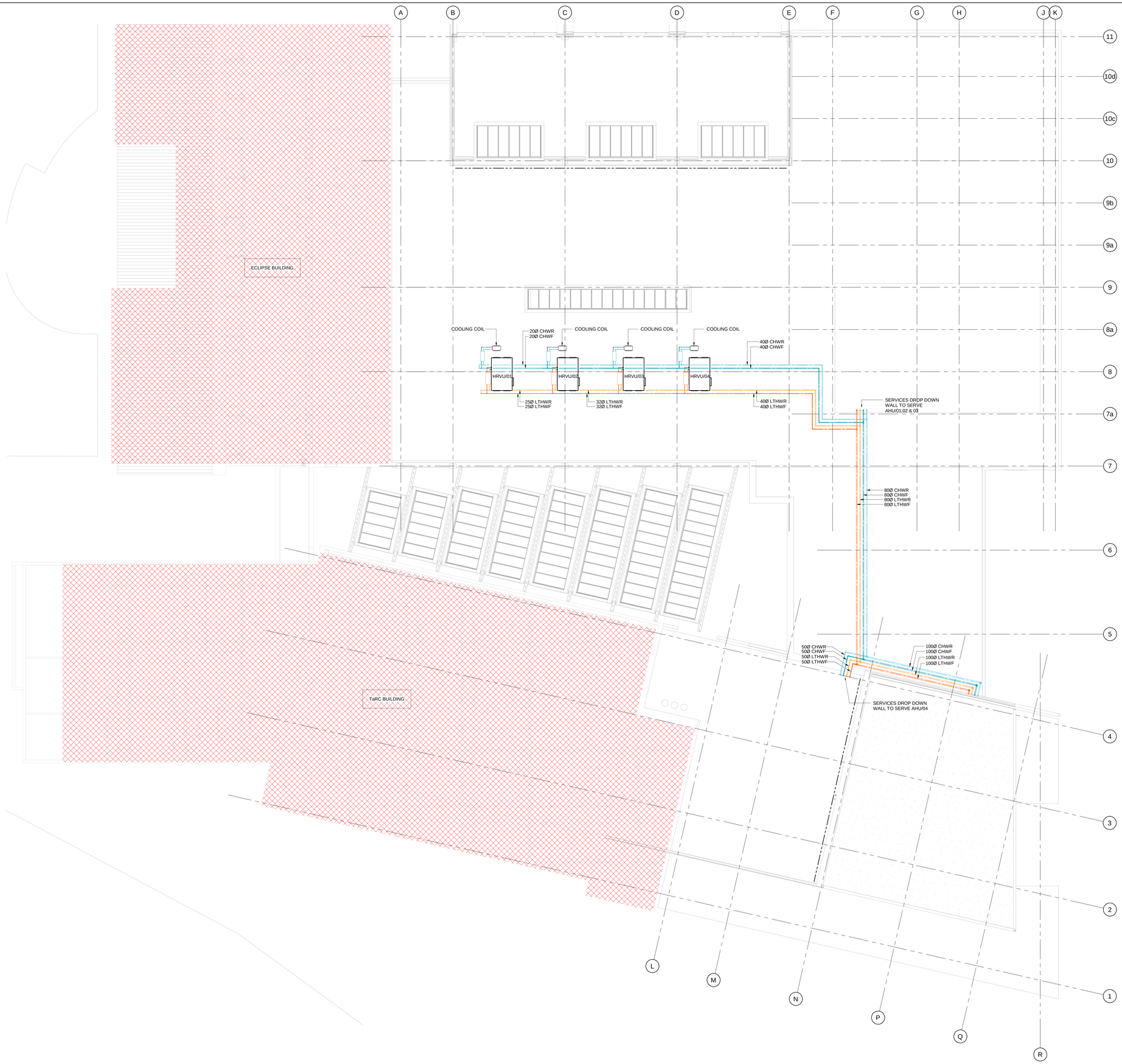
Ventilation Layout
Roof

Sheet Number

RVCH-ACM-XX-RF-DR-M-310000

Scale: 1 : 100@A0 **Rev:** P01

Project Management Initials: Designer: CY Checked: MB Approved: AF Drawn by: MP ISO A0 841mm x 1189mm



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Notes

1. THE INFORMATION SHOWN IS IN LINE WITH RIBA STAGE 3.
2. REFER TO HEATING SCHEMATIC AND COOLING SCHEMATIC FOR TERMINAL HEATING AND COOLING EQUIPMENT.

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Heating and Cooling Layout
Roof

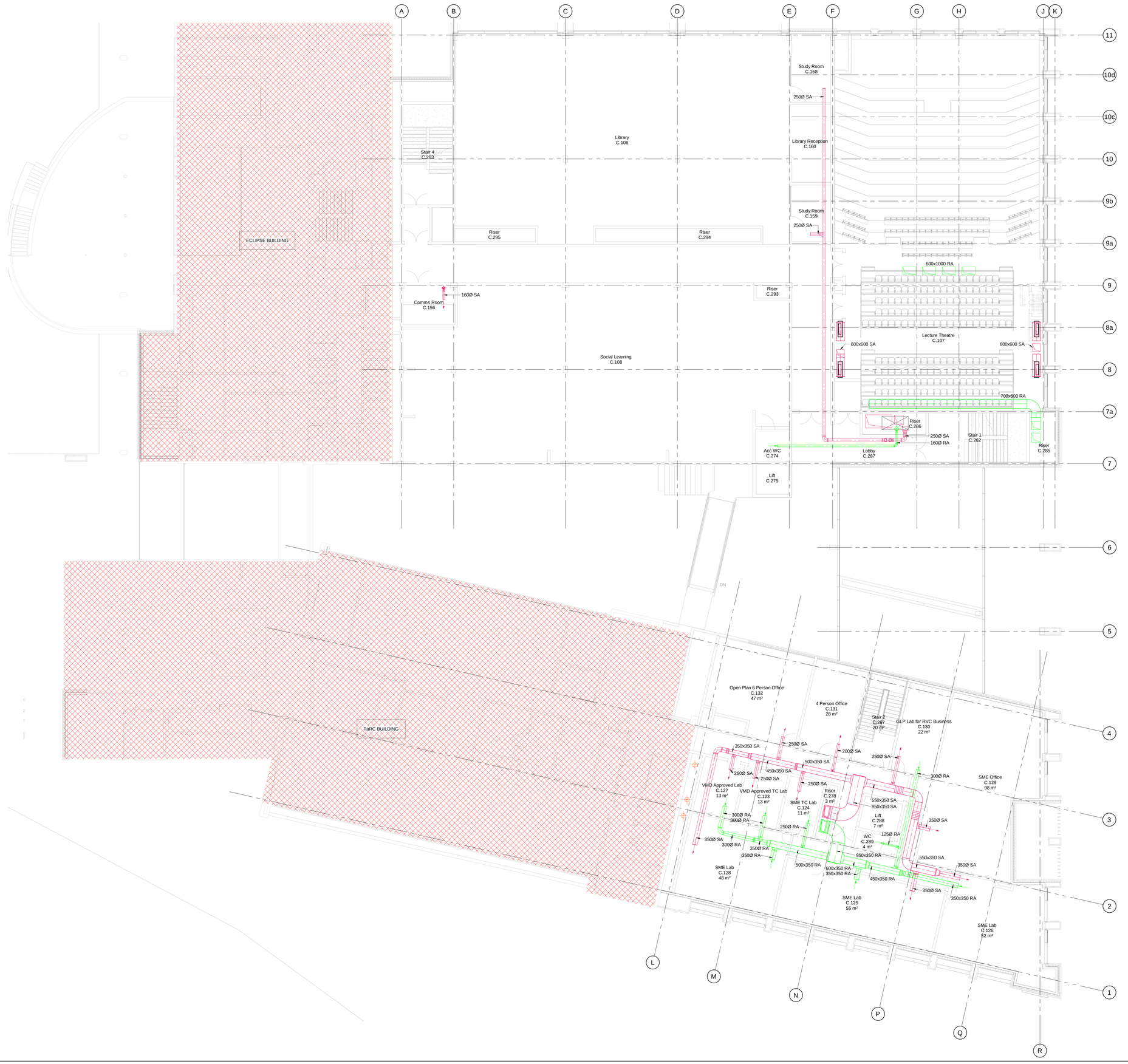
Sheet Number

RVCH-ACM-XX-RF-DR-M-340000

Scale: 1 : 100@A0 **Rev:** P01

Last Plotted: 01/11/2018 16:50:53

Project Management Initials: Designed: CY | Checked: MB | Approved: AF | Drawn by: MP | ISO A0 841mm x 1189mm



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Notes

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3. REFER TO VENTILATION SCHEMATICS FOR NATURAL VENTILATION STRATEGY.
4. REFER TO VENTILATION SCHEMATICS FOR FIRE DAMPER PROVISION.

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Ventilation Layout
First Floor

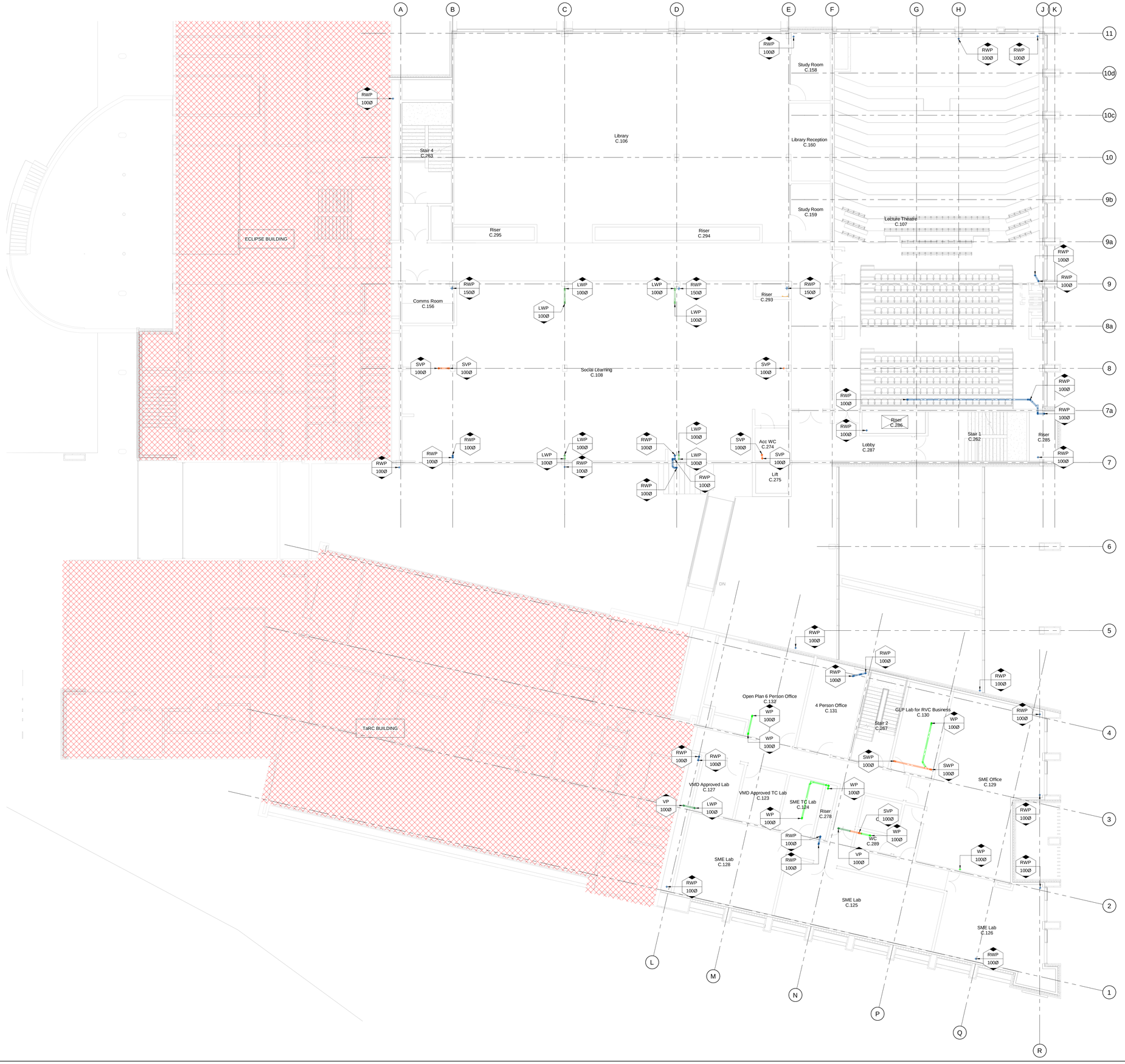
Sheet Number

RVCH-ACM-XX-01-DR-M-310000

Scale: 1 : 100@A0 **Rev:** P01

Appendix B.4 - Public Health Services Drawings

Project Management Initials: Designed: SO | Checked: AN | Approved: AF | Drawn by: MP | ISO A0 841mm x 1189mm



LEGEND

FROM ABOVE	HL HIGH LEVEL
XXX SYSTEM TYPE	LL LOW LEVEL
XXX SIZE	PD PUMPED DISCHARGE
FROM BELOW	SVP SOIL VENT PIPE
TO ABOVE	LWP LAB WASTE PIPE
XXX SYSTEM TYPE	WVP WASTE VENT PIPE
XXX SIZE	RWP RAINWATER PIPE
TO BELOW	RWO RAINWATER OUTLET
	SS STUB STACK
	WP WASTE PIPE
	SP SOIL PIPE
	VP VENT PIPE
	TFG TRAPPED FLOOR GULLY

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Notes

1. THE ABOVE GROUND DRAINAGE INSTALLATION SHALL BE IN STRICT ACCORDANCE WITH THE REQUIREMENTS OF BS EN 12056 PART 2 AND 3, AND THE BUILDING REGULATIONS PART H.
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE AECOM ABOVE GROUND DRAINAGE SCHEMATIC DRAWING.
3. ACCESS POINTS SHALL BE PROVIDED ON ALL SOIL AND WASTE WATER STACKS, 1200mm ABOVE FFL AT EACH FLOOR. ALL BRANCHES AND CHANGES IN DIRECTION.
4. VENTILATION OF SANITARY PIPEWORK SHALL TERMINATE TO ATMOSPHERE IN ACCORDANCE WITH BS EN 12056:2, BUILDING REGULATIONS PART H AND LOCAL AUTHORITIES CODES AND REGULATIONS.
5. ALL LABORATORY DRAINAGE SHALL BE INSTALLED AS CHEMICALLY RESISTANT PIPEWORK.
6. ALL INTERNAL RAINWATER PIPEWORK TO BE INSULATED TO PREVENT CONDENSATION AND NOISE BREAKOUT.
7. ALL SANITARY PIPEWORK SHALL BE ACOUSTICALLY INSULATED.
8. RAINWATER OUTLETS ARE SHOWN INDICATIVELY AND SHALL BE DETAILED WITHIN ARCHITECTURAL PACKAGE

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Drainage Layout
First Floor

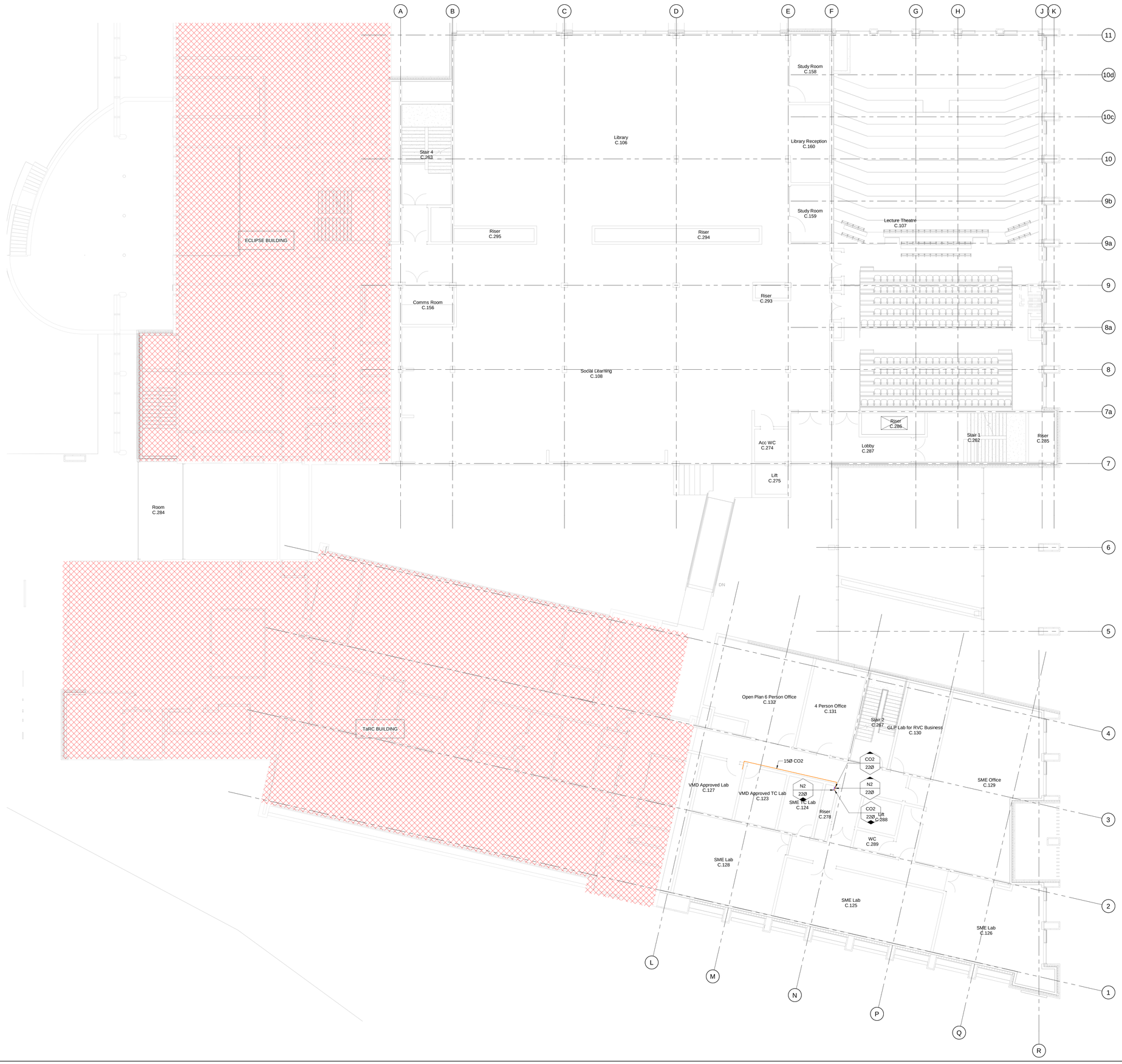
Sheet Number

RVCH-ACM-XX-01-DR-P-520000

Scale: 1 : 100@A0 **Rev:** P01

Last Plotted: 01/11/2018 10:19:24

Project Management Initials: Designer: SO Checked: AN Approved: AF Drawn by: MP ISO A0 841mm x 1189mm



LEGEND

XXX	FROM ABOVE	HL	HIGH LEVEL
XXX	SYSTEM TYPE	LL	LOW LEVEL
XXX	SIZE	N2	NITROGEN
XXX	FROM BELOW	CO2	CARBON DIOXIDE
XXX	TO ABOVE		
XXX	SYSTEM TYPE		
XXX	SIZE		
XXX	TO BELOW		

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Notes

1. THE LABORATORY GAS DESIGN AND INSTALLATION SHALL BE CARRIED OUT BY A SPECIALIST LABORATORY GAS CONTRACTOR.
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE AECOM LABORATORY GASES SCHEMATIC DRAWING.
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE ROOM DATASHEETS AND EQUIPMENT SCHEDULES.
4. THE LABORATORY GAS DESIGN AND INSTALLATION SHALL BE CARRIED OUT BY A SPECIALIST LABORATORY GAS CONTRACTOR.
5. ANY PIPE SIZES SHOWN ARE INDICATIVE ONLY. FINAL PIPE SIZES TO BE DETERMINED BY THE SPECIALIST GAS CONTRACTOR.
6. ALL LABORATORY GAS PIPEWORK IS TO BE INSTALLED IN COPPER TO BS EN 1057 R250 DEGREASED TUBE WITH BRAZED JOINTS.
7. FOR LOCATION OF TERMINAL GAS OUTLETS REFER TO ARCHITECT'S DETAILED DRAWINGS.

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Laboratory Gases Layout
First Floor

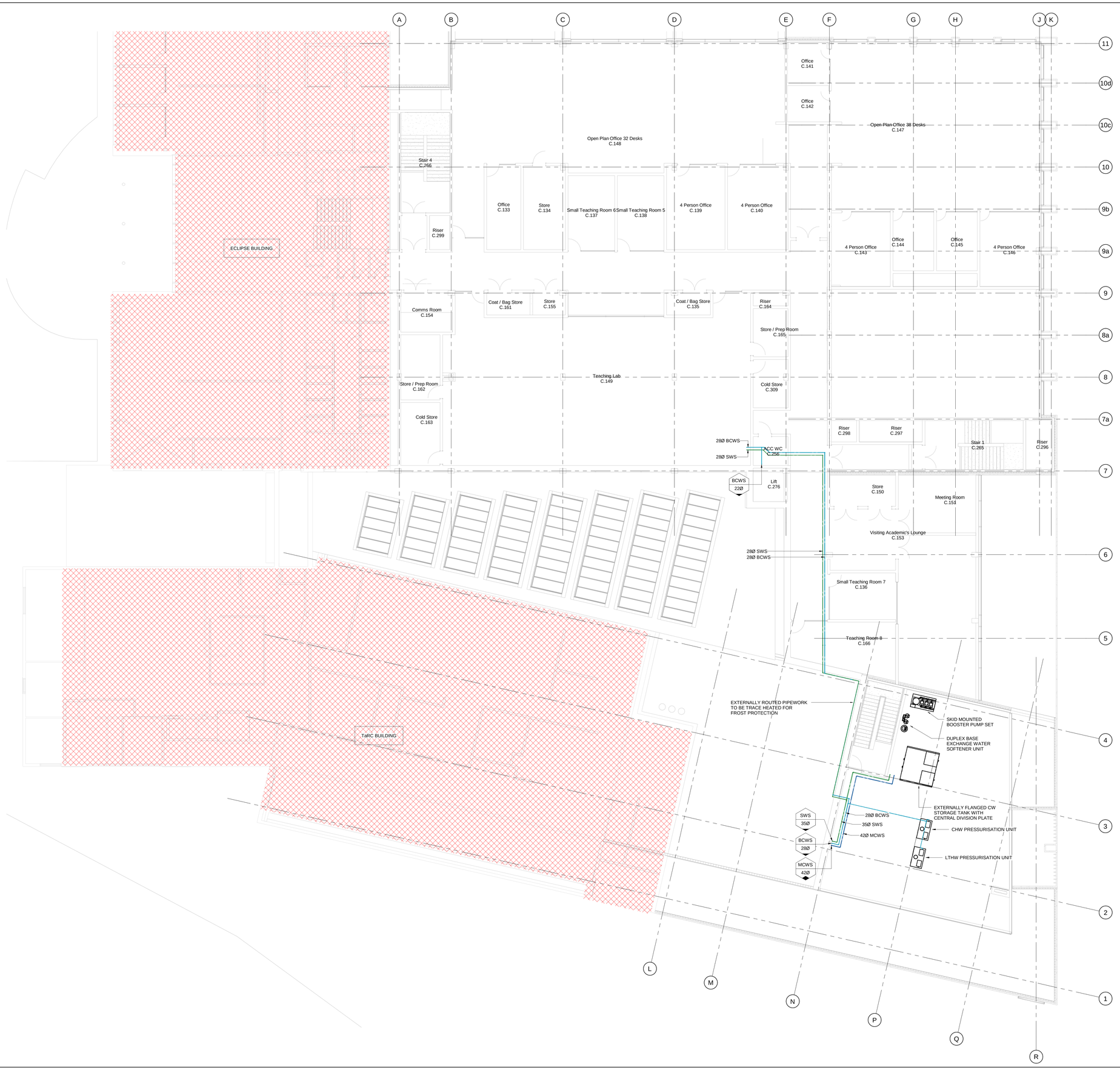
Sheet Number

RVCH-ACM-XX-01-DR-P-540000

Scale: 1 : 100@A0 **Rev:** P01

Last Plotted: 01/11/2018 10:19:32

Project Management Initials: Designer: SO Checked: AN Approved: AF Drawn by: MP ISO A0 841mm x 1189mm



LEGEND

FROM ABOVE
XXX SYSTEM TYPE
XXX SIZE
FROM BELOW

TO ABOVE
XXX SYSTEM TYPE
XXX SIZE
TO BELOW

HL	HIGH LEVEL
LL	LOW LEVEL
ML	MID-LEVEL
MCWS	MAINS COLD WATER SUPPLY
BCWS	BOOSTED COLD WATER SERVICE
HWS	HOT WATER SERVICE
SWS	SOFTENED WATER SERVICES

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Project

Hawkshead Campus Redevelopment

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Notes

1. THE DOMESTIC WATER SERVICES INSTALLATION SHALL BE IN STRICT ACCORDANCE WITH THE REQUIREMENT OF BS EN 806, BS 8558, THE WATER SUPPLY (WATER FITTINGS) REGULATIONS, THE WATER SUPPLY (WATER QUALITY) REGULATIONS, HSE ACOP L8, HSG274 PART 2, THE BUILDING REGULATIONS PART G AND L AND THE LOCAL WATER AUTHORITY.
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE AECOM WATER SERVICES SCHEMATIC DRAWING.
3. ALL PIPEWORK TO BE THERMALLY INSULATED.
4. DEAD LEGS SHALL BE AVOIDED AND MINIMISED WHERE PRACTICAL.
5. LOW POINTS SHALL BE FITTED WITH DRAIN COCKS FOR DRAIN DOWN PURPOSES.
6. BRANCH PIPEWORK THAT PASSES THROUGH A FIRE BARRIER OR WALL SHALL BE METALLIC OR INTUMESCENT SEALED.
7. THERMOSTATIC MIXING VALVES SHALL BE UTILISED FOR WASHBASINS AND SHALL BE TMV3 COMPLIANT FOR ACCESSIBLE TOILETS, TMV2 COMPLIANT FOR WASHBASINS IN OTHER LOCATIONS
8. TRACE HEATING SHALL BE PROVIDED FOR PIPEWORK ROUTED EXTERNALLY FOR FROST PROTECTION.

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Water Services Layout
Second Floor

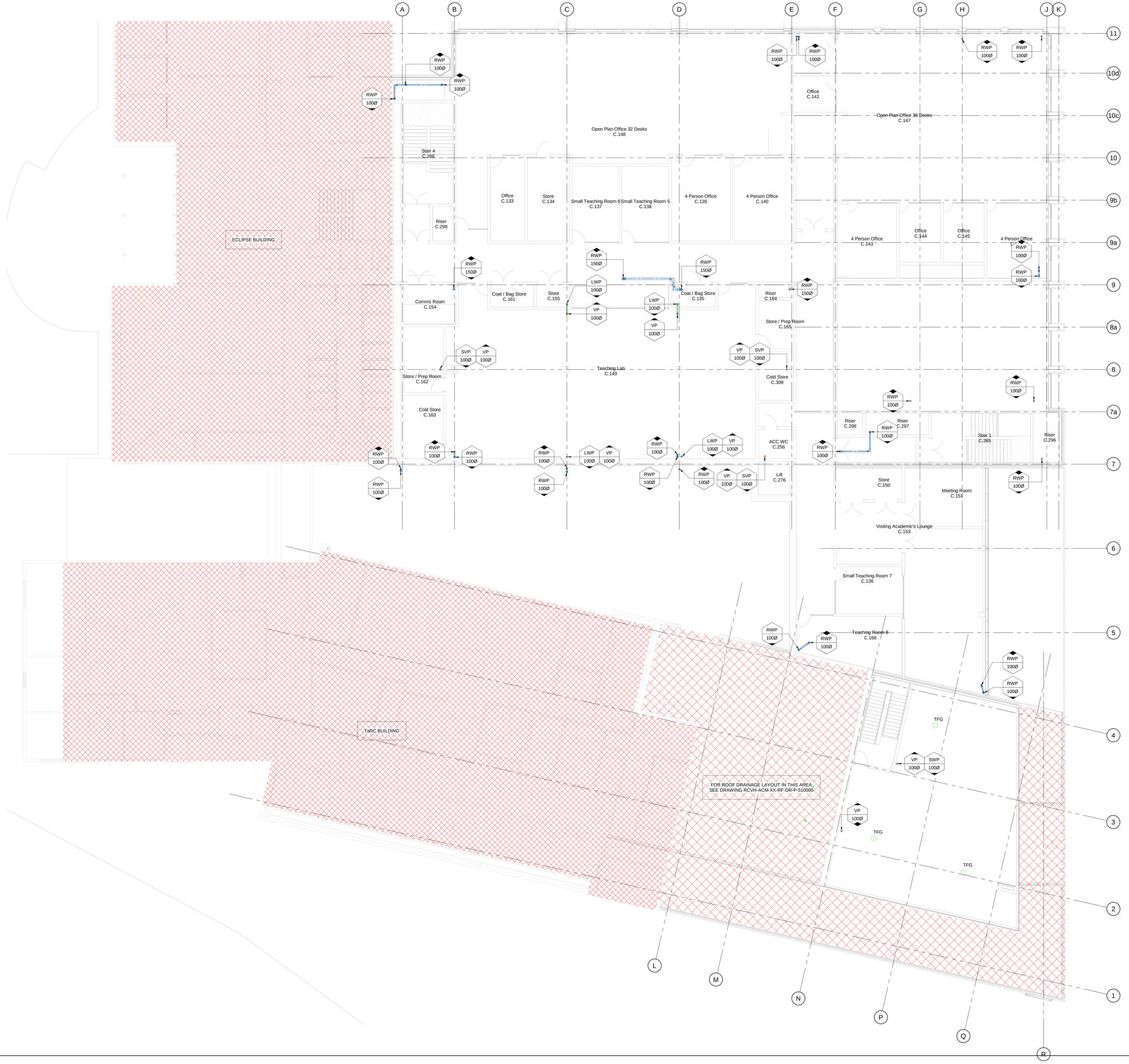
Sheet Number

RVCH-ACM-XX-02-DR-P-510000

Scale: 1 : 100@A0 **Rev:** P01

Last Plotted: 01/11/2018 10:20:12

Project Management Initials: Designed: SO Checked: AN Approved: AF Drawn by: MP ISO A0 841mm x 1189mm



LEGEND

XXX	FROM ABOVE	HL	HIGH LEVEL
XXX	SYSTEM TYPE	LL	LOW LEVEL
XXX	SIZE	PD	PUMPED DISCHARGE
	FROM BELOW	SVP	SOIL VENT PIPE
		LWP	LAB WASTE PIPE
XXX	TO ABOVE	WVP	WASTE VENT PIPE
XXX	SYSTEM TYPE	RWP	RAINWATER PIPE
XXX	SIZE	RWO	RAINWATER OUTLET
	TO BELOW	SS	STUB STACK
		WP	WASTE PIPE
		SP	SOIL PIPE
		VP	VENT PIPE
		TFG	TRAPPED FLOOR GULLY

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3. ACCESS POINTS SHALL BE PROVIDED ON ALL SOIL AND WASTE WATER STACKS, 1200mm ABOVE FFL AT EACH FLOOR, ALL BRANCHES AND CHANGES IN DIRECTION.
4. VENTILATION OF SANITARY PIPEWORK SHALL TERMINATE TO ATMOSPHERE IN ACCORDANCE WITH BS EN 12056.2, BUILDING REGULATIONS PART H AND LOCAL AUTHORITIES CODES AND REGULATIONS.
5. ALL LABORATORY DRAINAGE SHALL BE INSTALLED AS CHEMICALLY RESISTANT PIPEWORK.
6. ALL INTERNAL RAINWATER PIPEWORK TO BE INSULATED TO PREVENT CONDENSATION AND NOISE BREAKOUT.
7. ALL SANITARY PIPEWORK SHALL BE ACOUSTICALLY INSULATED.
8. RAINWATER OUTLETS ARE SHOWN INDICATIVELY AND SHALL BE DETAILED WITHIN ARCHITECTURAL PACKAGE

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Drainage Layout
Second Floor

Sheet Number

RVCH-ACM-XX-02-DR-P-520000

Scale: 1 : 100@A0 **Rev:** P01

Last Plotted: 01/11/2018 10:20:09

Project Management Initials: Designer: SO Checked: AN Approved: AF Drawn by: MP ISO A0 841mm x 1189mm

LEGEND

FROM ABOVE	HL	HIGH LEVEL
XXX SYSTEM TYPE	LL	LOW LEVEL
XXX SIZE	N2	NITROGEN
FROM BELOW	CO2	CARBON DIOXIDE
TO ABOVE		
XXX SYSTEM TYPE		
XXX SIZE		
TO BELOW		

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Notes

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7. FOR LOCATION OF TERMINAL GAS OUTLETS REFER TO ARCHITECT'S DETAILED DRAWINGS.

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Laboratory Gases Layout
Second Floor

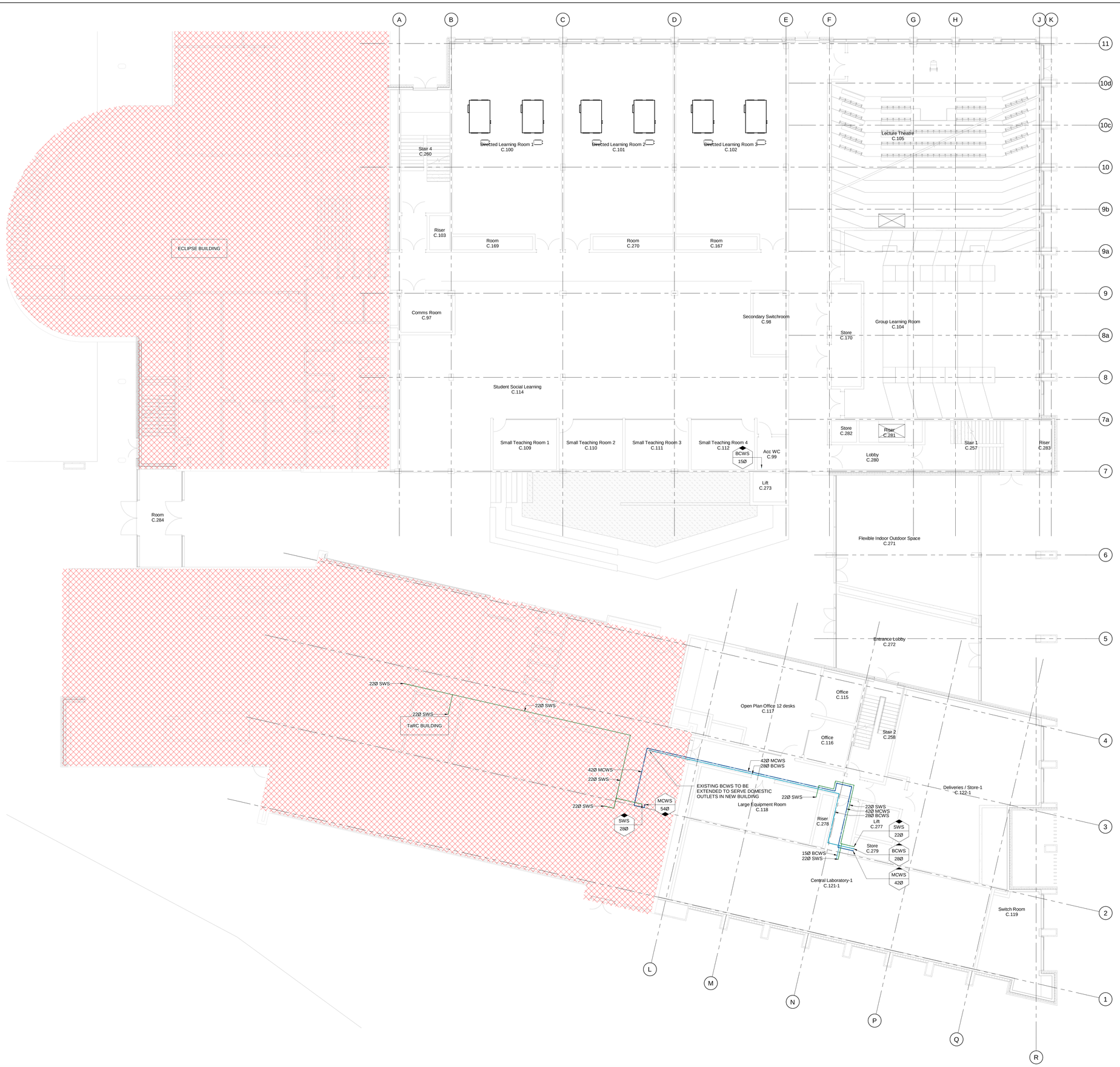
Sheet Number

RVCH-ACM-XX-02-DR-P-540000

Scale: 1 : 100@A0 **Rev:** P01

Last Plotted: 01/11/2018 10:20:16

Project Management Initials: Designer: SO Checked: AN Approved: AF Drawn by: MP ISO A0 841mm x 1189mm



LEGEND

XXX	FROM ABOVE	HL	HIGH LEVEL
XXX	SYSTEM TYPE	LL	LOW LEVEL
XXX	SIZE	ML	MID-LEVEL
XXX	FROM BELOW	MCWS	MAINS COLD WATER SUPPLY
XXX	TO ABOVE	BCWS	BOOSTED COLD WATER SERVICE
XXX	SYSTEM TYPE	HWS	HOT WATER SERVICE
XXX	SIZE	SWS	SOFTENED WATER SERVICES
XXX	TO BELOW		

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Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Water Services Layout
Ground Floor

Sheet Number

RVCH-ACM-XX-GF-DR-P-510000

Scale: 1 : 100@A0 **Rev:** P01

Last Plotted: 01/11/2018 10:20:44

LEGEND

XXX	FROM ABOVE	HL	HIGH LEVEL
XXX	SYSTEM TYPE	LL	LOW LEVEL
	SIZE	PD	PUMPED DISCHARGE
	FROM BELOW	SVP	SOIL VENT PIPE
		LWP	LAB WASTE PIPE
	TO ABOVE	WVP	WASTE VENT PIPE
XXX	SYSTEM TYPE	RWP	RAINWATER PIPE
XXX	SIZE	RWO	RAINWATER OUTLET
	TO BELOW	SS	STUB STACK
		WP	WASTE PIPE
		SP	SOIL PIPE
		VP	VENT PIPE
		TFG	TRAPPED FLOOR GULLY

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Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Drainage Layout
Ground Floor

Sheet Number

RVCH-ACM-XX-GF-DR-P-520000

Scale: 1 : 100@A0 **Rev:** P01

Project Management Initials: Designer: SO Checked: AN Approved: AF Drawn by: MP ISO A0 841mm x 1189mm

Last Plotted: 01/11/2018 10:20:41

LEGEND

XXX	FROM ABOVE	HL	HIGH LEVEL
XXX	SYSTEM TYPE	LL	LOW LEVEL
XXX	SIZE	N2	NITROGEN
XXX	FROM BELOW	CO2	CARBON DIOXIDE
XXX	TO ABOVE		
XXX	SYSTEM TYPE		
XXX	SIZE		
XXX	TO BELOW		

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Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

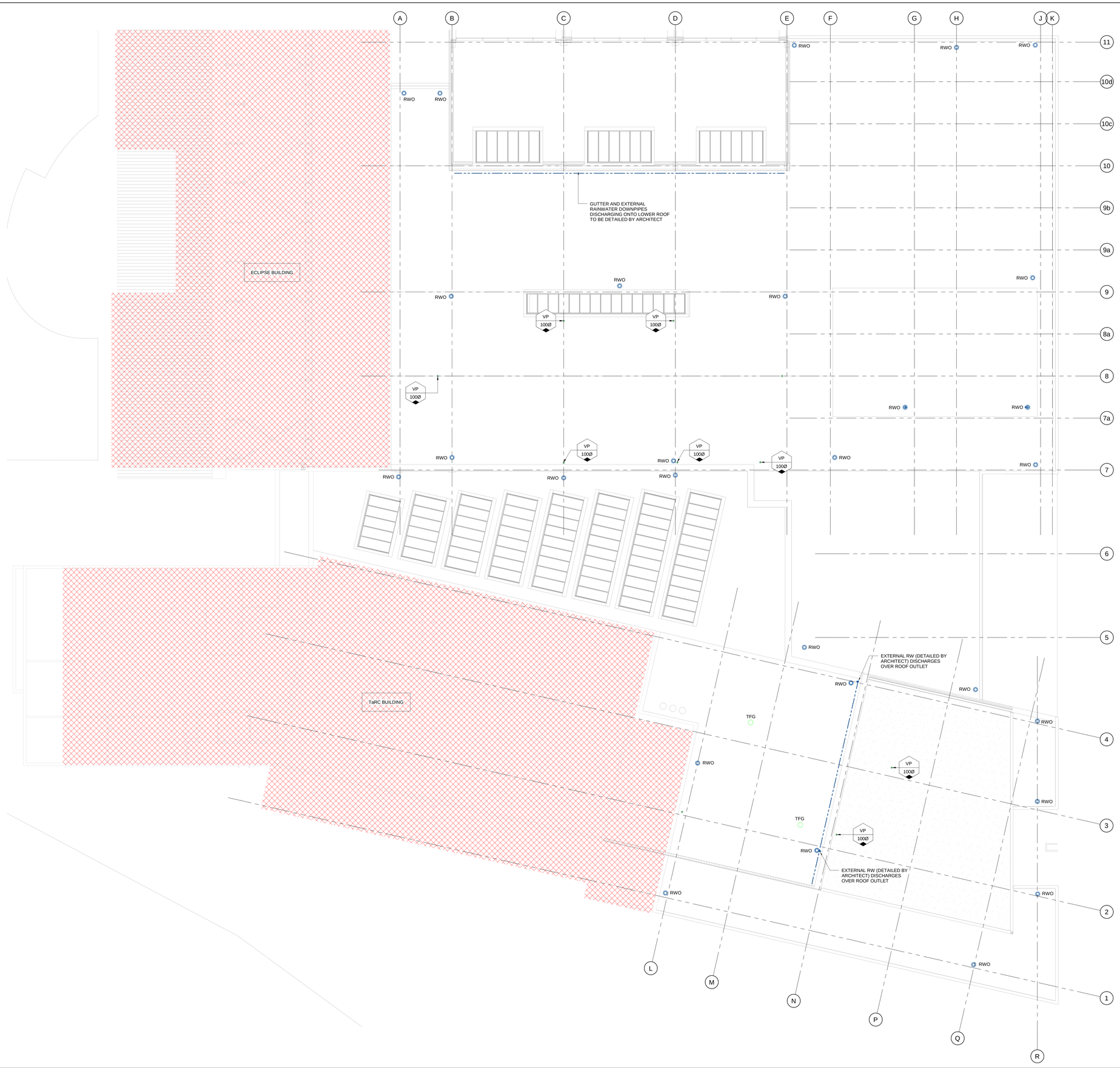
Laboratory Gases Layout
Ground Floor

Sheet Number

RVCH-ACM-XX-GF-DR-P-540000

Scale: 1 : 100@A0 **Rev:** P01

Project Management Initials: Designer: SO Checked: AN Approved: AF Drawn by: MP ISO A0 841mm x 1189mm



LEGEND

FROM ABOVE
XXX SYSTEM TYPE
XXX SIZE
FROM BELOW

TO ABOVE
XXX SYSTEM TYPE
XXX SIZE
TO BELOW

HL	HIGH LEVEL
LL	LOW LEVEL
PD	PUMPED DISCHARGE
SVP	SOIL VENT PIPE
LWP	LAB WASTE PIPE
WVP	WASTE VENT PIPE
RWP	RAINWATER PIPE
RWO	RAINWATER OUTLET
SS	STUB STACK
WP	WASTE PIPE
SP	SOIL PIPE
VP	VENT PIPE
TFG	TRAPPED FLOOR GULLY

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Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Drainage Layout
Roof

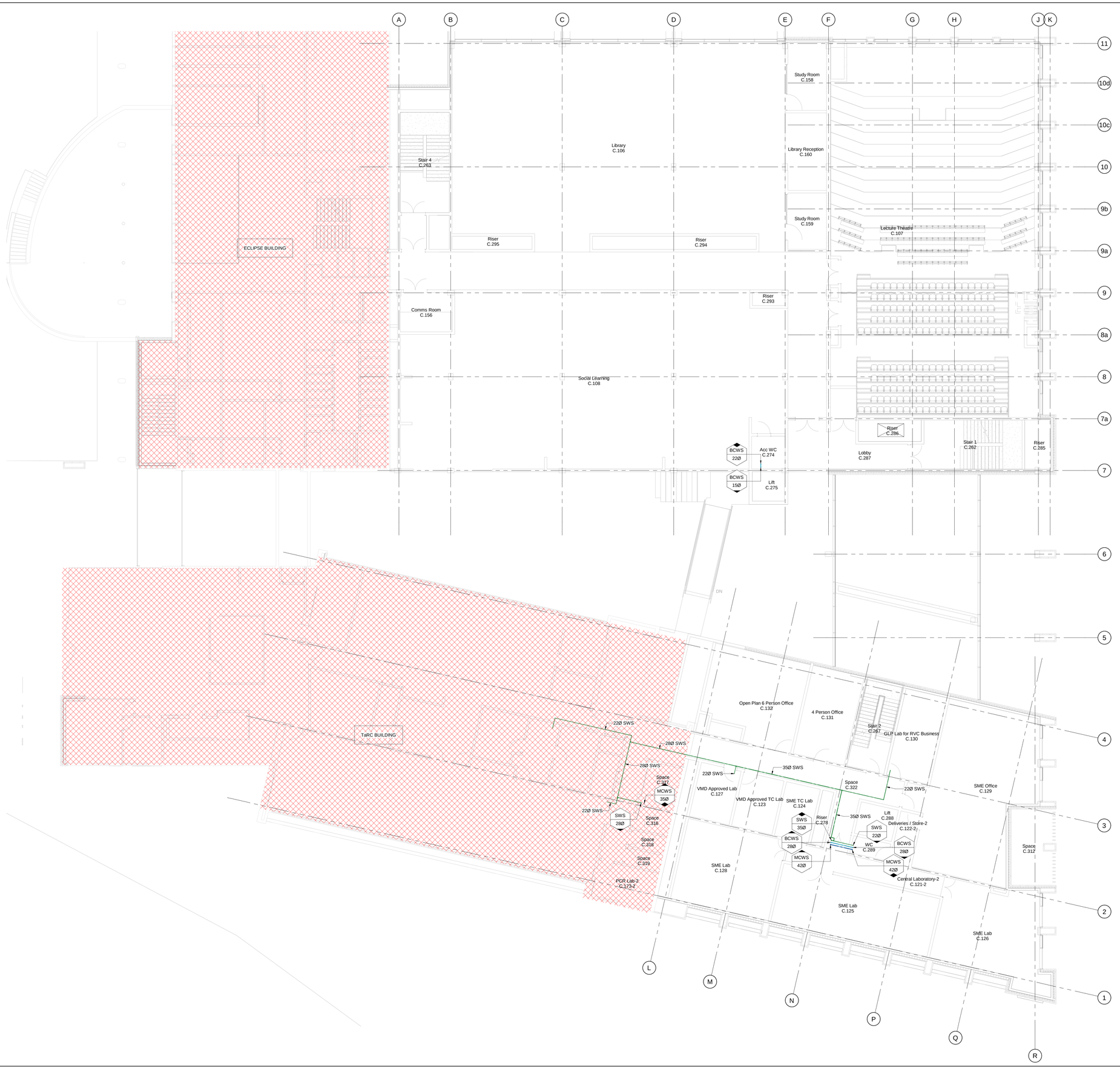
Sheet Number

RVCH-ACM-XX-RF-DR-P-520000

Scale: 1 : 100@A0 **Rev:** P01

Last Plotted: 01/11/2018 17:15:57

Project Management Initials: Designed: SO | Checked: AN | Approved: AF | Drawn by: MP | ISO A0 841mm x 1189mm



LEGEND

XXX	FROM ABOVE SYSTEM TYPE SIZE FROM BELOW	HL	HIGH LEVEL
XXX		LL	LOW LEVEL
XXX		ML	MID-LEVEL
		MCWS	MAINS COLD WATER SUPPLY
XXX	TO ABOVE SYSTEM TYPE SIZE TO BELOW	BCWS	BOOSTED COLD WATER SERVICE
		HWS	HOT WATER SERVICE
		SWS	SOFTENED WATER SERVICES

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Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Water Services Layout
First Floor

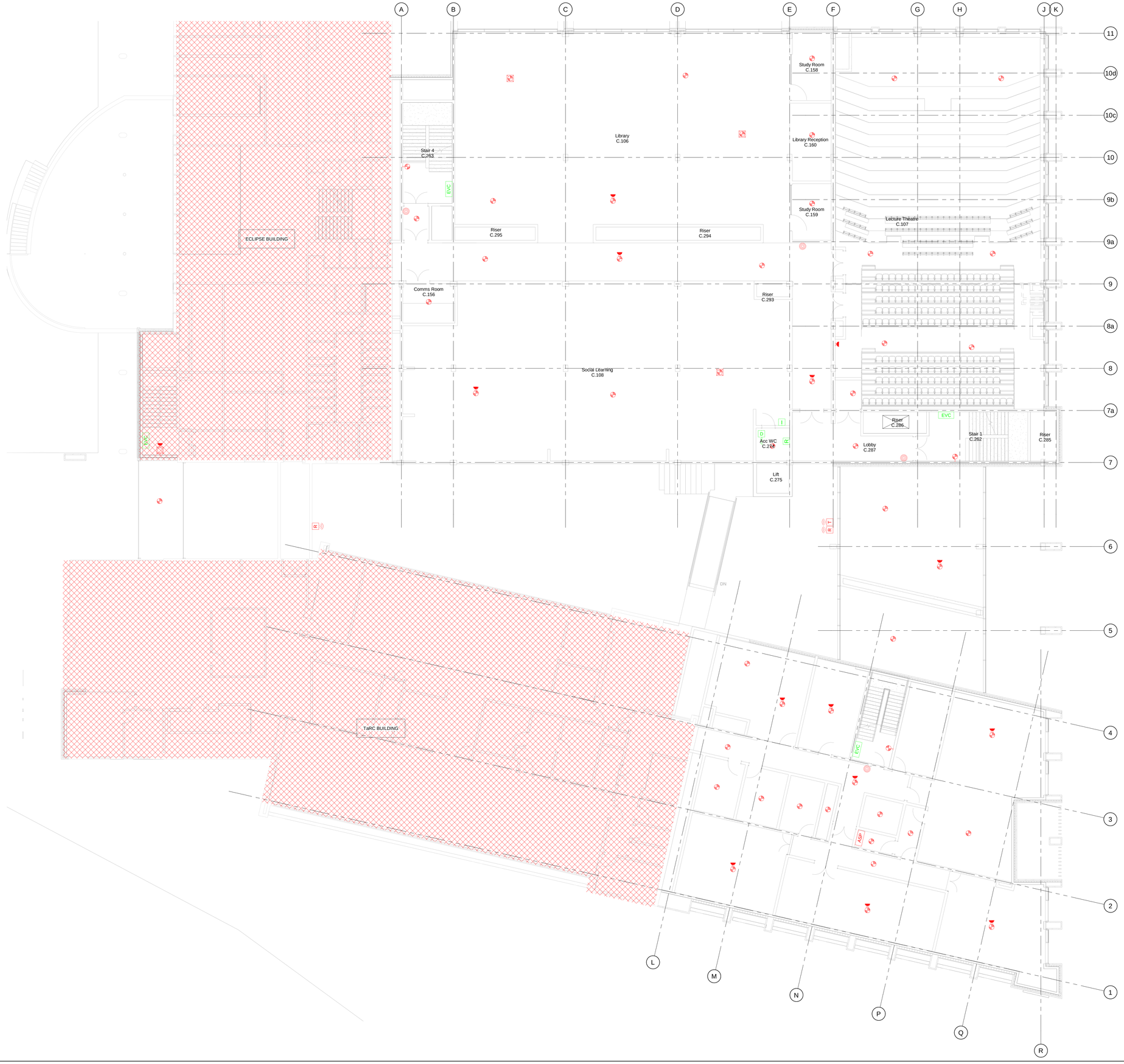
Sheet Number

RVCH-ACM-XX-01-DR-P-510000

Scale: 1 : 100@A0 **Rev:** P01

Last Plotted: 01/11/2018 10:19:28

Appendix B.5 - Electrical Services Drawings



LEGEND

- SMOKE DETECTOR
- SMOKE DETECTOR (WALL MOUNTED)
- SMOKE DETECTOR AND BEACON
- SMOKE DETECTOR AND SOUNDER
- SMOKE DETECTOR AND SOUNDER (WALL MOUNTED)
- SOUNDER AND BEACON (WALL MOUNTED)
- SOUNDER
- T — BEAM DETECTION TRANSMITTER
- R — BEAM DETECTION RECEIVER
- BREAK GLASS
- FAP — FIRE ALARM PANEL
- EVC — EMERGENCY VOICE COMMUNICATIONS PANEL
- ASP — ASPIRATION PANEL
- I — DISABLED ALARM INDICATOR
- R — DISABLED ALARM RESET SWITCH
- DISABLED ALARM PULL CHORD

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Notes

1. THE INFORMATION SHOWN IS IN LINE WITH RIBA STAGE 3 AND IS SUBJECT TO CHANGE IN STAGE 4.
2. THE FIRE ALARM SHALL INCORPORATE A MINIMUM 24 HOUR STANDBY BATTERY BACK-UP.
3. CONTROL EQUIPMENT AND DEVICES SHOWN ARE INDICATIVE ONLY AND DO NOT REPRESENT THE TRUE NUMBERS AND TYPES.
4. THE FIRE ALARM SPECIALIST / SUB CONTRACTOR WILL BE RESPONSIBLE FOR FINAL DESIGN, INSTALLATION, COMISSIONING AND DEMONSTRATING CORRECT OPERATION OF THE WHOLE SYSTEM AND ALL INTERFACED DEVICES.
5. LOCAL WIRING PER LEVEL SHALL BE IN STANDARD FIRE RATED CABLE. NETWORK CABLE TO BE ENHANCED FIRE RATED TYPE.
6. THE ELECTRICAL SUBCONTRACTOR IS RESPONSIBLE FOR ALL FINAL ELECTRICAL CONNECTIONS BETWEEN FUSE CONNECTION UNITS AND DEVICES.
7. THE EXISTING FIRE DETECTION SYSTEM IN THE TORC SHALL BE RETAINED AND INCORPORATED INTO A LARGER SYSTEM TO ALSO COVER THE NEW BUILDING

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Fire Alarm Layout
First Floor

Sheet Number

RVCH-ACM-XX-01-DR-E-440000

Scale: 1 : 100@A0 **Rev:** P01

Project Management Initials: Designed: CM Checked: KF Approved: AF Drawn by: MP ISO A0 841mm x 1189mm

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Notes

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Fire Alarm Zone Layout
First Floor

Sheet Number

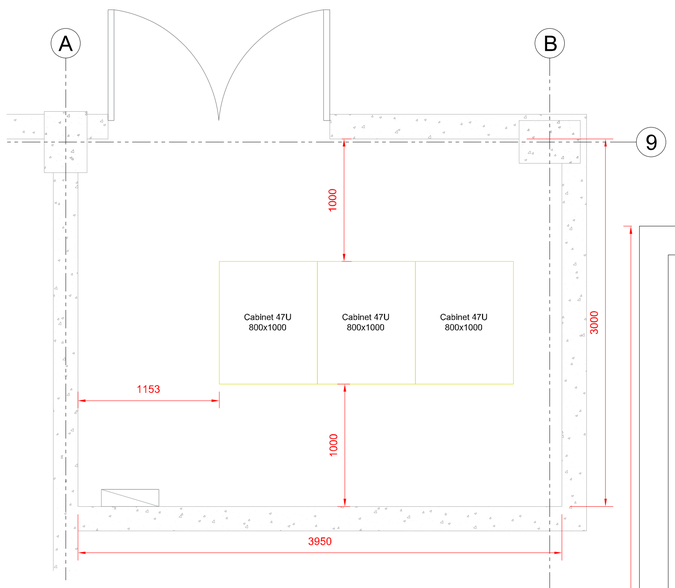
RVCH-ACM-XX-01-DR-E-440001

Scale: 1 : 100@A0 **Rev:** P01

Last Plotted: 01/11/2018 10:19:03

Project Management Initials: Designer: DR Checked: KF Approved: AF Drawn By: MP ISO A1 594mm x 841mm

EQUIPMENT ROOM
FIRST FLOOR



CABINET ER/1/XX/01
FRONT

CABINET ER/1/XX/02
FRONT

CABINET ER/1/XX/03
FRONT

47U 800x1000 CABINET

47U 800x1000 CABINET

47U 800x1000 CABINET

Last Plotted: 29/10/2018 14:45:29

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Notes

1. DIMENSIONS APPROXIMATE INDICATIVE LAYOUT TO SHOW ER SIZING REQUIREMENTS BASED ON 800 X 1000 DEEP RACKS FINAL LAYOUT TO BE CONFIRMED AT STAGE 4.CLEARANCE REQUIRED OF BETWEEN

2. 8M AND 1 MTR TO CABINET AT FRONT AND REAR.EACH CABINET POSITION SUPPLIED WITH 2 MAINS CONNECTIONS AT HIGH LEVEL TYPE TO BE DEVELOPED AT STAGE 4 DESIGN. EACH CABINET TO CONTAIN 2 X 12 WAY IEC 13 POWER STRIPS TYPE TO BE DEVELOPED AT STAGE 4 DESIGN. ALL CABINETS TO BE SUPPLIED WITH FRONT AND REAR MESH DOORS (WARDROBE STYLE)

3. 60MM DEEP 1U HORIZONTAL CABLE MANAGERS TO BE SUPPLIED, 1 PER 2 NO. 24 PORT PATCH PANELS. FINAL CABINET DESIGNATION AND LAYOUT TO BE CONFIRMED AT STAGE 4.

4. PDU/DIST BOARD BY EC.

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Purpose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

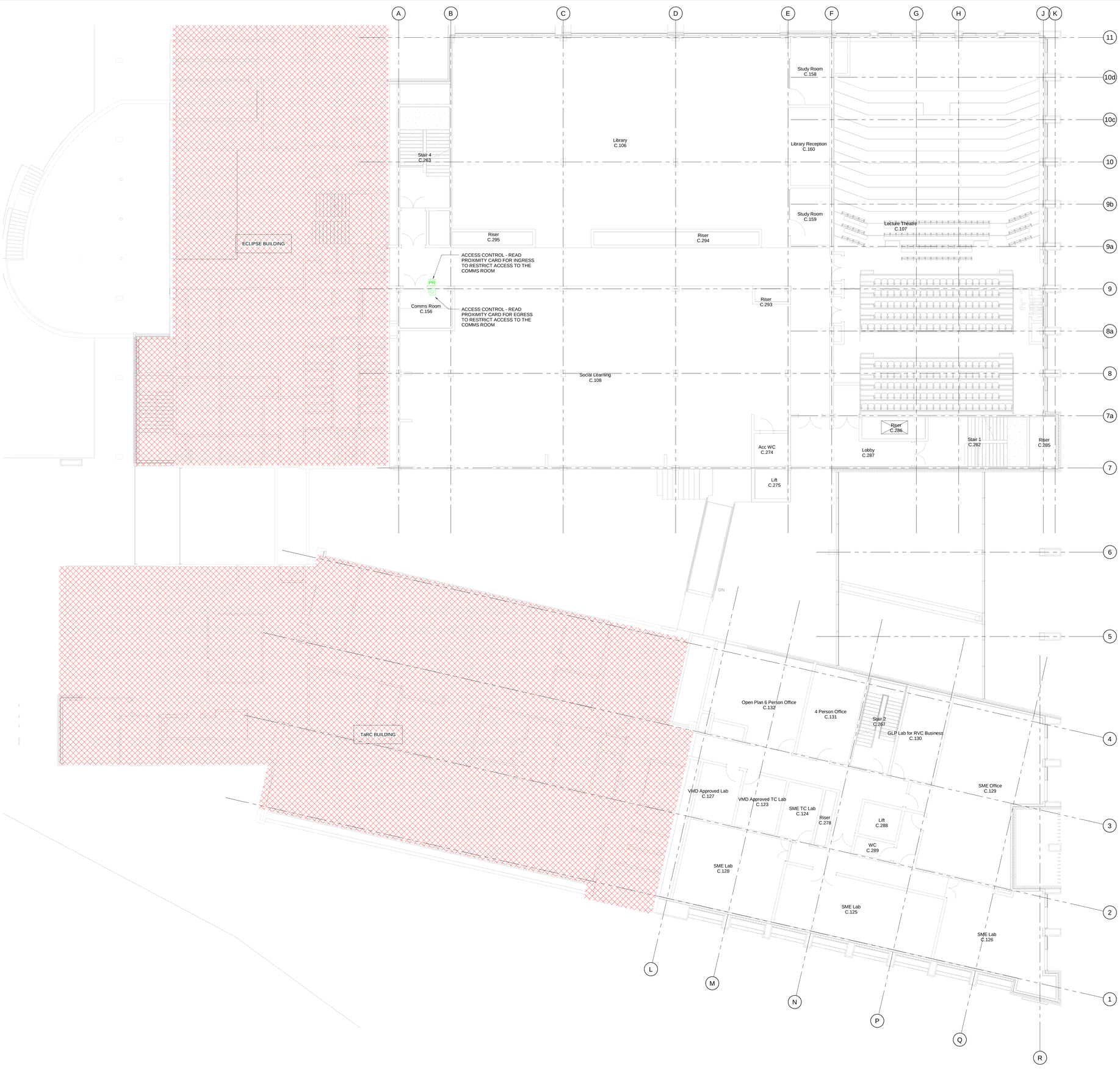
Equipment Room Layout
First Floor

Sheet Number

RVCH-ACM-XX-01-DR-E-470200

Scale: NTS @A1 **Rev:** P01

Project Management Initials: Designed: CM Checked: KF Approved: AF Drawn by: MP ISO A0 841mm x 1189mm



LEGEND

- CCTV CAMERA
- PR ACCESS CONTROL - PROXIMITY CARD READER
- ACCESS CONTROL - PUSH BUTTON

AECOM

Project

Hawkshead Campus Redevelopment

Client

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Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Security Layout
First Floor

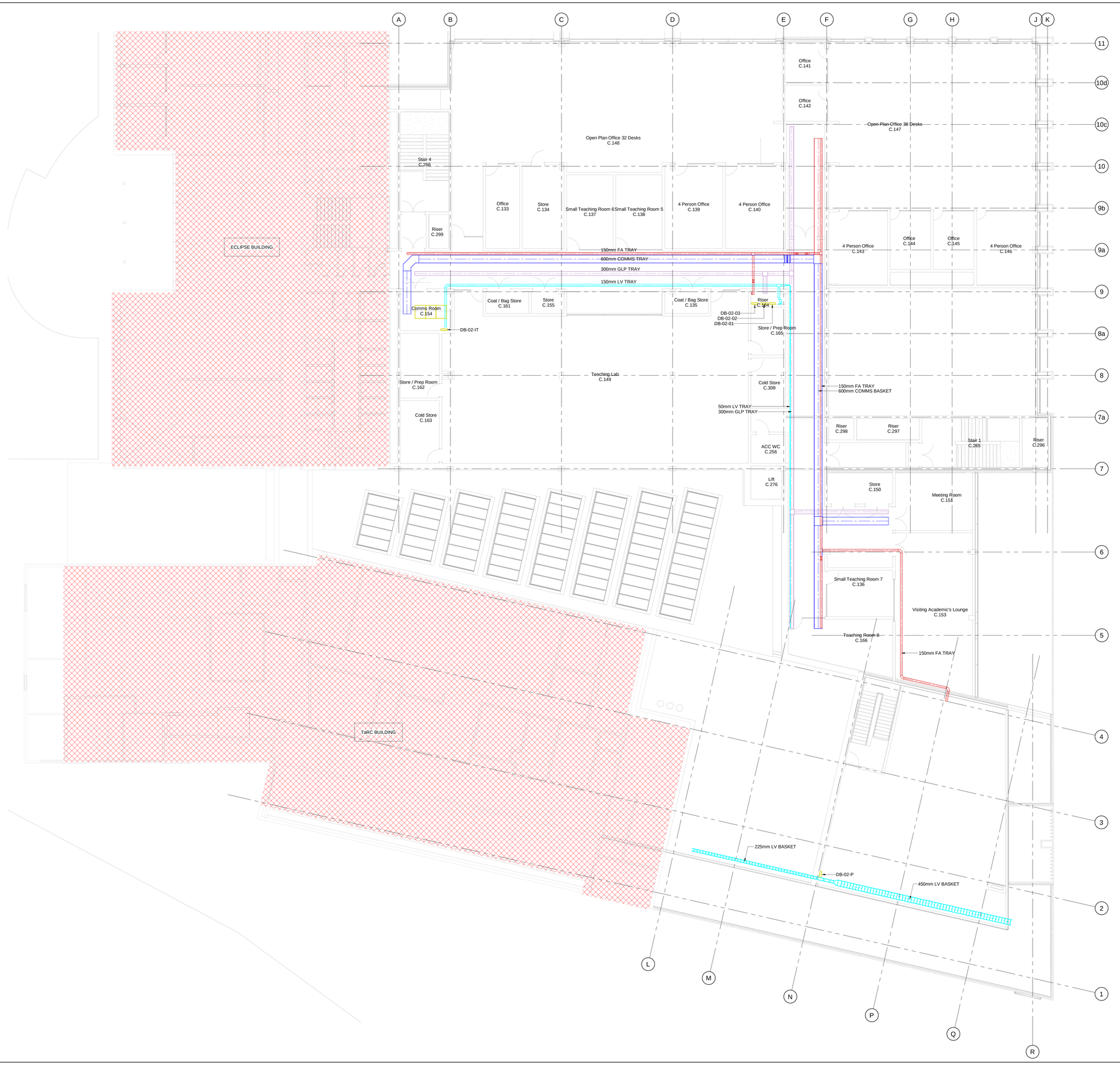
Sheet Number

RVCH-ACM-XX-01-DR-EL-700000

Scale: 1 : 100@A0 **Rev:** P01

Last Plotted: 01/11/2018 10:19:09

Project Management Initials: Designed: CM Checked: KF Approved: AF Drawn by: MP ISO A0 841mm x 1189mm



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Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Containment Distribution Layout Second Floor

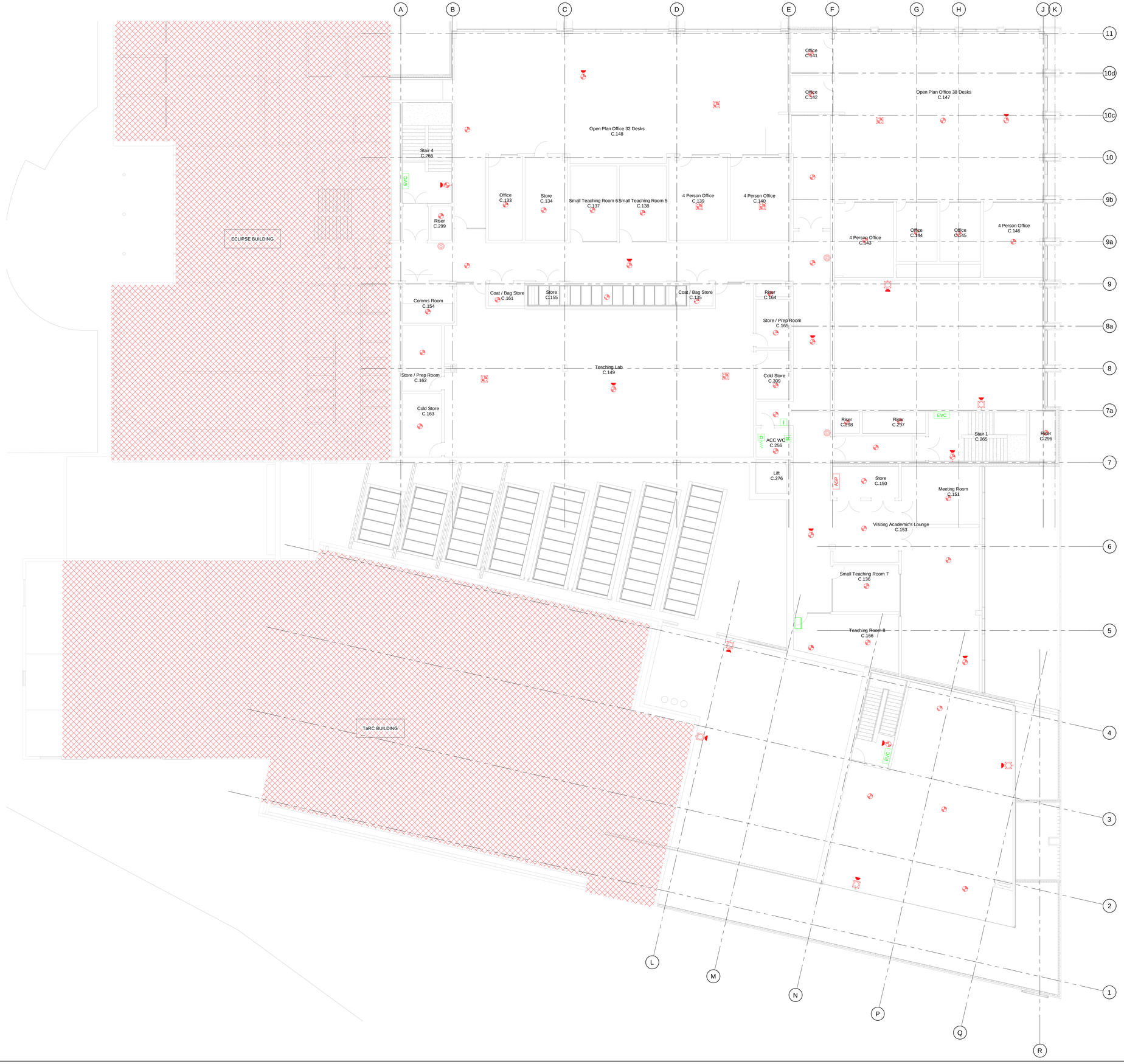
Sheet Number

RVCH-ACM-XX-02-DR-E-410000

Scale: 1 : 100@A0 **Rev:** P01

Last Plotted: 01/11/2018 10:19:36

ISO A0 841mm x 1189mm
Drawn by: MP
Approved: AF
Checked: KF
Designer: CM
Project Management Initials:



LEGEND

- SMOKE DETECTOR
- SMOKE DETECTOR (WALL MOUNTED)
- SMOKE DETECTOR AND BEACON
- SMOKE DETECTOR AND SOUNDER
- SMOKE DETECTOR AND SOUNDER (WALL MOUNTED)
- SOUNDER AND BEACON (WALL MOUNTED)
- SOUNDER
- T — BEAM DETECTION TRANSMITTER
- R — BEAM DETECTION RECEIVER
- BREAK GLASS
- FAP — FIRE ALARM PANEL
- EVC — EMERGENCY VOICE COMMUNICATIONS PANEL
- ASP — ASPIRATION PANEL
- I — DISABLED ALARM INDICATOR
- R — DISABLED ALARM RESET SWITCH
- W/C — DISABLED ALARM PULL CHORD

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7. THE EXISTING FIRE DETECTION SYSTEM IN THE TORC SHALL BE RETAINED AND INCORPORATED INTO A LARGER SYSTEM TO ALSO COVER THE NEW BUILDING

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Fire Alarm Layout
Second Floor

Sheet Number

RVCH-ACM-XX-02-DR-E-440000

Scale: 1 : 100@A0 **Rev:** P01

Last Plotted: 01/11/2018 10:19:39

CSS Admin Office C.254
1 Person Office C.213
1 Person Office C.214
1 Person Office C.215
Breakout Space C.307
Breakout Space C.306
ECLIPSE BUILDING
Human Resources C.240
Toilets C.255
Comms Room C.154
Coat / Bag Store C.161
Store C.155
Coat / Bag Store C.135
Store / Prep Room C.162
Cold Store C.163
Teaching Lab C.149
Riser C.164
Store / Prep Room C.165
Cold Store C.309
ACC WC C.256
Lift C.276
Riser C.299
Stair 4 C.266
Office C.133
Store C.134
Small Teaching Room 6 C.137
Small Teaching Room 5 C.138
4 Person Office C.139
4 Person Office C.140
Open Plan Office 32 Desks C.148
Office C.141
Office C.142
Open Plan Office 38 Desks C.147
4 Person Office C.143
Office C.144
Office C.145
4 Person Office C.146
Riser C.298
Riser C.297
Stair 1 C.265
Riser C.296
Store C.150
Meeting Room C.151
Visiting Academic's Lounge C.153
Small Teaching Room 7 C.136
Teaching Room 8 C.166
TaRC BUILDING
16
17
26
29
9
8
3
12
32
22
24
21
27
19
28
A B C D E F G H J K
11 10d 10c 10 9b 9a 9 8a 8 7a 7 6 5 4 3 2 1
L M N P Q R

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Notes

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Fire Alarm Zone Layout
Second Floor

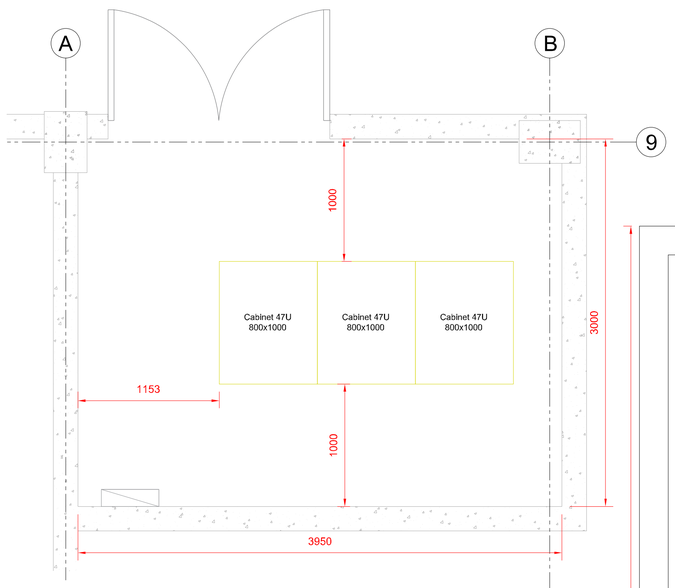
Sheet Number

RVCH-ACM-XX-02-DR-E-440001

Scale: 1 : 100@A0 **Rev:** P01

Project Management Initials: Designer: DR Checked: KF Approved: AF Drawn By: MP ISO A1 594mm x 841mm

EQUIPMENT ROOM
SECOND FLOOR



CABINET ER/2/XX/01
FRONT

CABINET ER/2/XX/02
FRONT

CABINET ER/2/XX/03
FRONT

47U 800x1000 CABINET

47U 800x1000 CABINET

47U 800x1000 CABINET

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3. 60MM DEEP 1U HORIZONTAL CABLE MANAGERS TO BE SUPPLIED, 1 PER 2 NO. 24 PORT PATCH PANELS. FINAL CABINET DESIGNATION AND LAYOUT TO BE CONFIRMED AT STAGE 4.

4. PDU/DIST BOARD BY EC.

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Purpose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

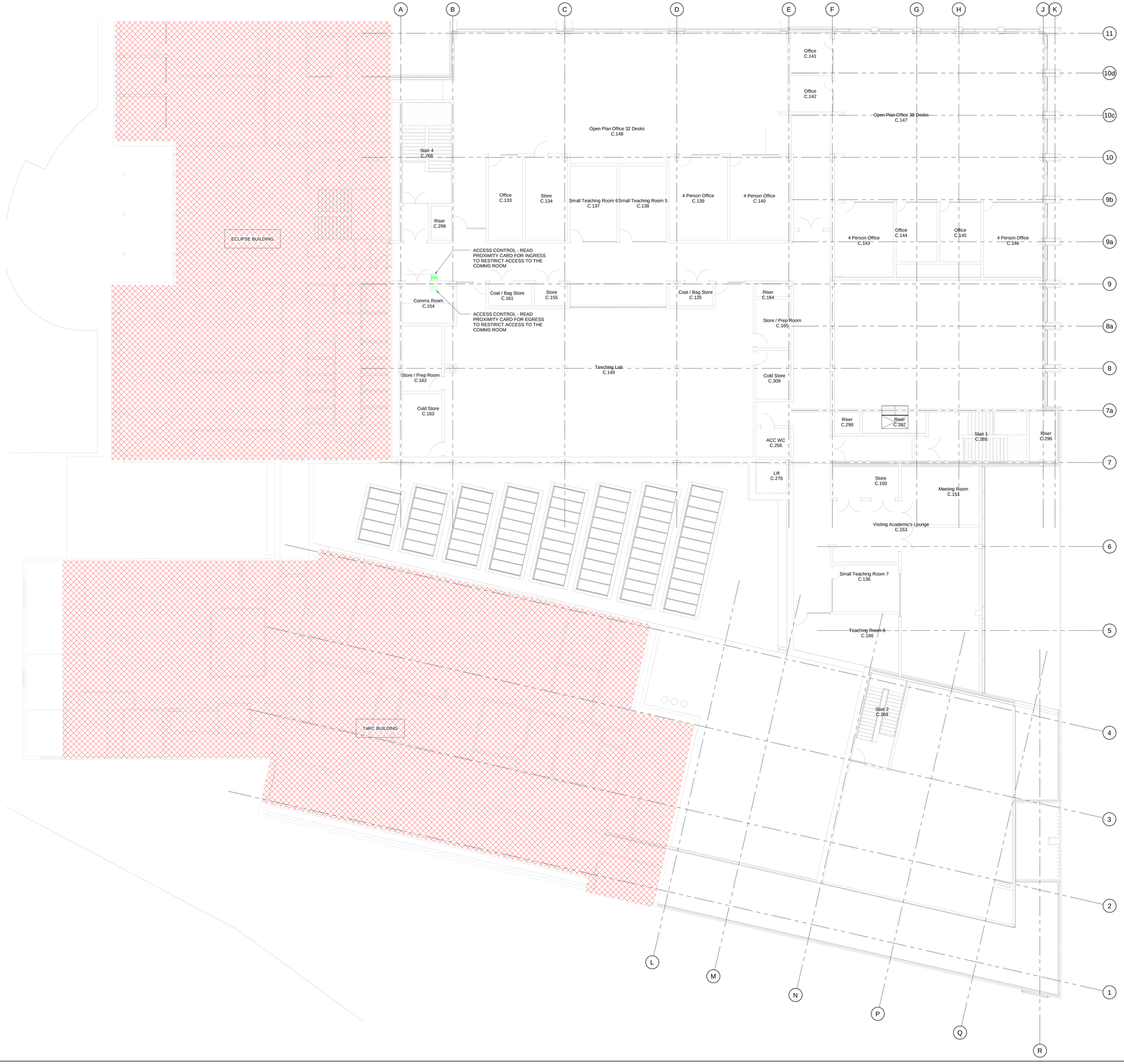
Equipment Room Layout
Second Floor

Sheet Number

RVCH-ACM-XX-02-DR-E-470200

Scale: NTS @A1 **Rev:** P01

Last Plotted: 29/10/2018 14:45:29



LEGEND

- CCTV CAMERA
- PR ACCESS CONTROL - PROXIMITY CARD READER
- ACCESS CONTROL - PUSH BUTTON

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Notes - Security
1 : 100

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

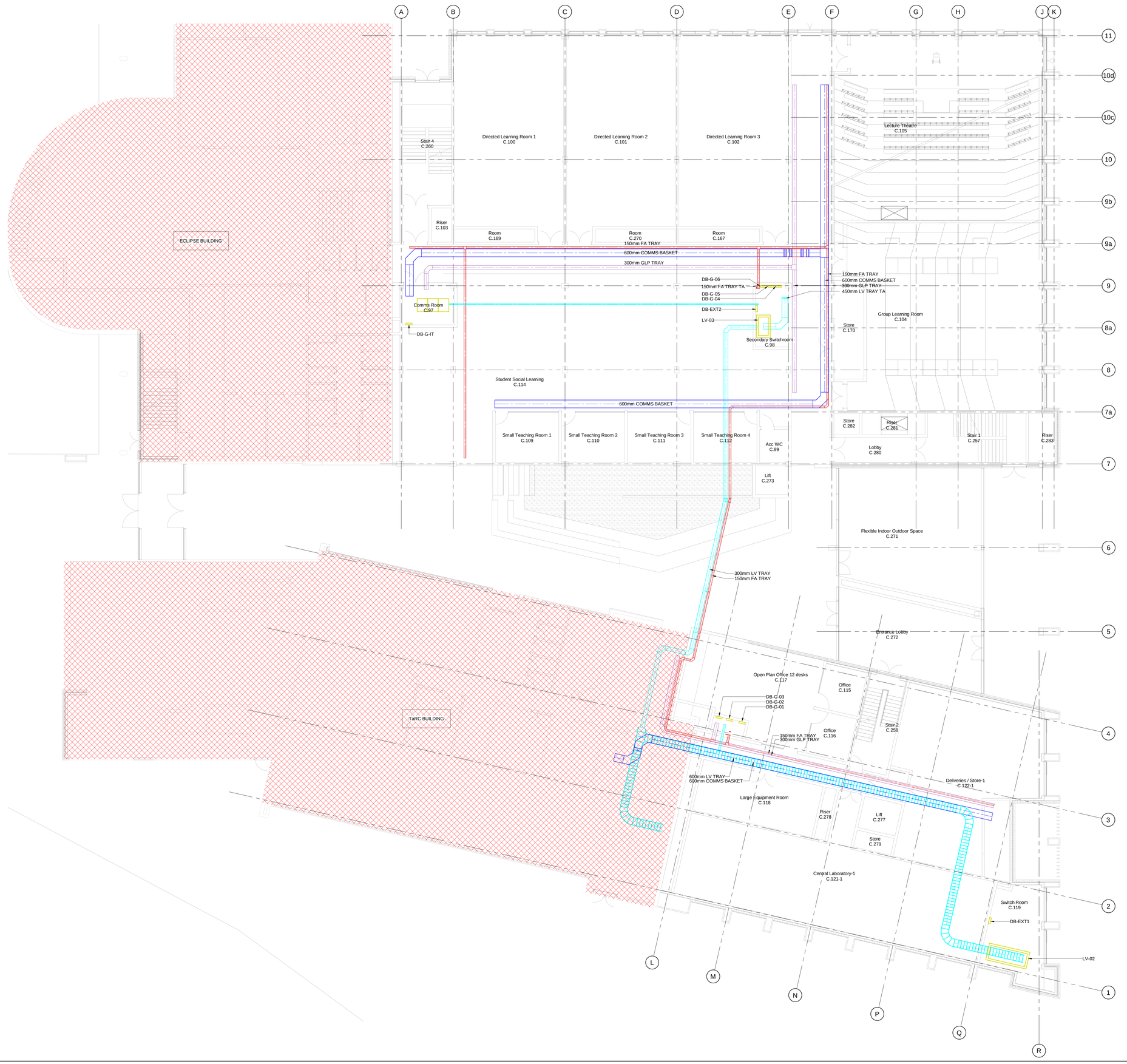
Security Layout
Second Floor

Sheet Number

RVCH-ACM-XX-02-DR-EL-700000

Scale: 1 : 100@A0 **Rev:** P01

Project Management Initials: Designed: CM Checked: KF Approved: AF Drawn by: MP ISO A0 841mm x 1189mm



Last Plotted: 01/11/2018 10:20:20

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Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

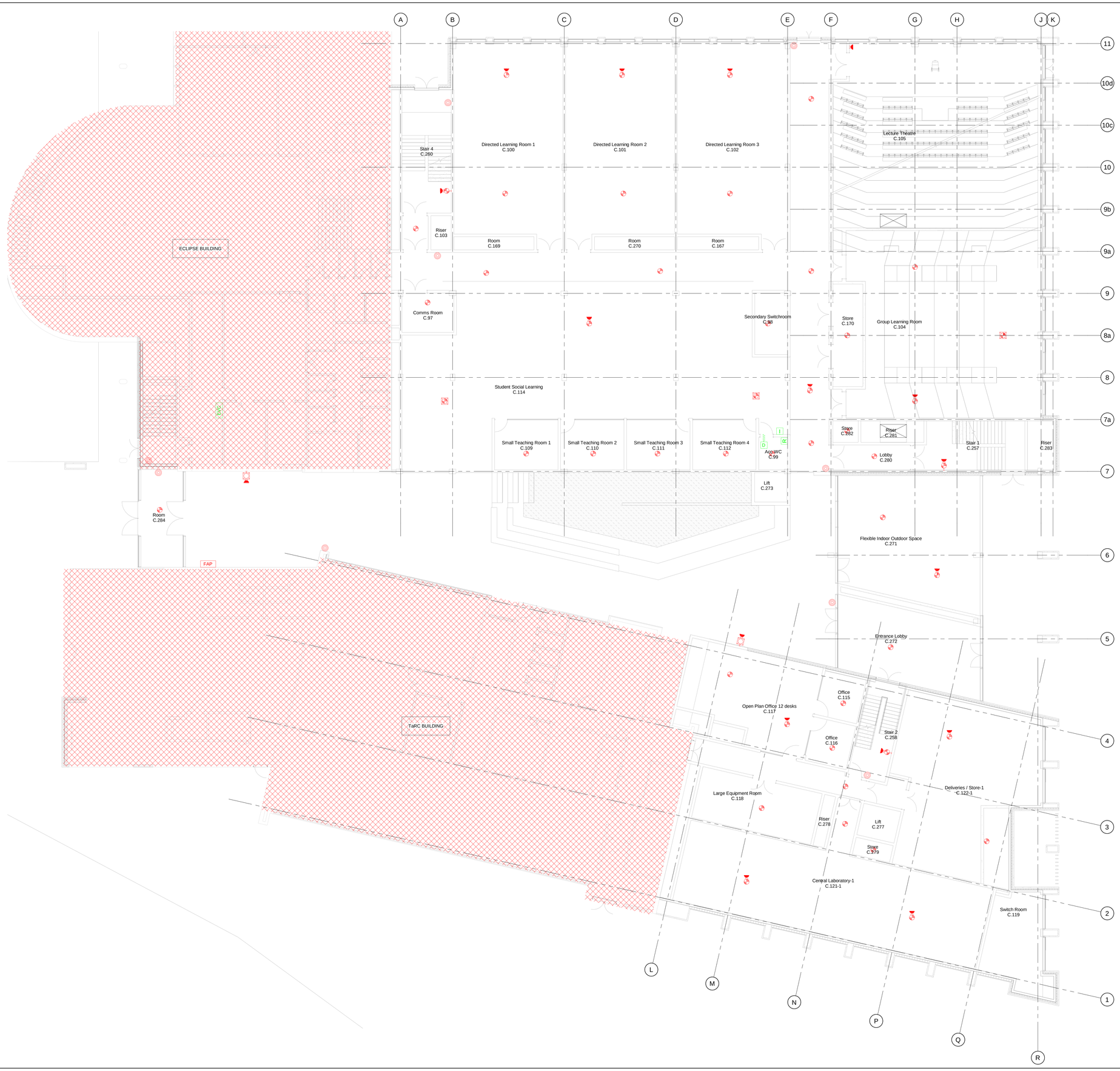
Containment Distribution Layout Ground Floor

Sheet Number

RVCH-ACM-XX-GF-DR-E-410000

Scale: 1 : 100@A0 **Rev:** P01

Project Management Initials: Designed: CM Checked: KF Approved: AF Drawn by: MP ISO A0 841mm x 1189mm



LEGEND

- SMOKE DETECTOR
- SMOKE DETECTOR (WALL MOUNTED)
- SMOKE DETECTOR AND BEACON
- SMOKE DETECTOR AND SOUNDER
- SMOKE DETECTOR AND SOUNDER (WALL MOUNTED)
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- BEAM DETECTION RECEIVER
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- DISABLED ALARM INDICATOR
- DISABLED ALARM RESET SWITCH
- DISABLED ALARM PULL CHORD

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Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Fire Alarm Layout
Ground Floor

Sheet Number

RVCH-ACM-XX-GF-DR-E-440000

Scale: 1 : 100@A0 **Rev:** P01

Last Plotted: 01/11/2018 10:20:23

Project Management Initials: Designed: CM Checked: KF Approved: AF Drawn by: MP ISO A0 841mm x 1189mm

Last Plotted: 01/11/2018 10:20:26

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Notes

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Fire Alarm Zone Layout
Ground Floor

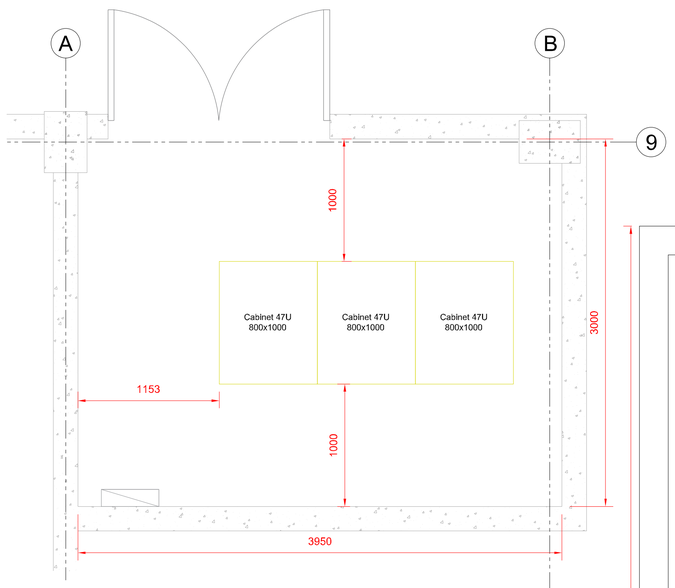
Sheet Number

RVCH-ACM-XX-GF-DR-E-440001

Scale: 1 : 100@A0 **Rev:** P01

Project Management Initials: Designer: DR Checked: KF Approved: AF Drawn By: MP ISO A1 594mm x 841mm

EQUIPMENT ROOM
GROUND FLOOR



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Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Purpose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Equipment Room Layout
Ground Floor

Sheet Number

RVCH-ACM-XX-GF-DR-E-470200

Scale: NTS @A1 **Rev:** P01

Last Plotted: 29/10/2018 14:45:29

Project Management Initials: Designed: CM | Checked: KF | Approved: AF | Drawn by: MP | ISO A0 841mm x 1189mm

LEGEND

- CCTV CAMERA
- PR ACCESS CONTROL - PROXIMITY CARD READER
- ACCESS CONTROL - PUSH BUTTON

KEYNOTES

1. EXTERNAL CCTV CAMERA - TO MONITOR INGRESS AND EGRESS FROM THE BUILDING
2. EXTERNAL CCTV CAMERA - TO MONITOR INGRESS AND EGRESS FROM DELIVERY YARD
3. INTERNAL CCTV CAMERA - TO MONITOR INGRESS AND EGRESS FROM DELIVERIES
4. INTERNAL CCTV CAMERA - TO MONITOR INGRESS AND EGRESS FROM LIQUID NITROGEN DEWARS ROOM.
5. ACCESS CONTROL ON GOODS LIFT TO RESTRICT ACCESS TO DELIVERIES STORE DURING OUT OF HOURS
6. ACCESS CONTROL - READ PROXIMITY CARD FOR INGRESS TO RESTRICT ACCESS TO DELIVERIES STORE DURING OUT OF HOURS
7. ACCESS CONTROL - READ PROXIMITY CARD FOR EGRESS TO RESTRICT ACCESS TO DELIVERIES STORE DURING OUT OF HOURS
8. ACCESS CONTROL - READ PROXIMITY CARD FOR INGRESS TO PREVENT USERS OF THE SME LABS ENTERING THESE SPACES
9. ACCESS CONTROL - PUSH BUTTON FOR EGRESS TO PREVENT USERS OF THE SME LABS ENTERING THESE SPACES
10. ACCESS CONTROL - READ PROXIMITY CARD FOR INGRESS TO RESTRICT ACCESS TO THE RESEARCH LABS
11. ACCESS CONTROL - PUSH BUTTON FOR EGRESS TO RESTRICT ACCESS TO THE RESEARCH LABS
12. ACCESS CONTROL - READ PROXIMITY CARD FOR INGRESS TO RESTRICT ACCESS TO THE COMMS ROOM
13. ACCESS CONTROL - PUSH BUTTON FOR EGRESS TO RESTRICT ACCESS TO THE COMMS ROOM

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Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Security Layout
Ground Floor

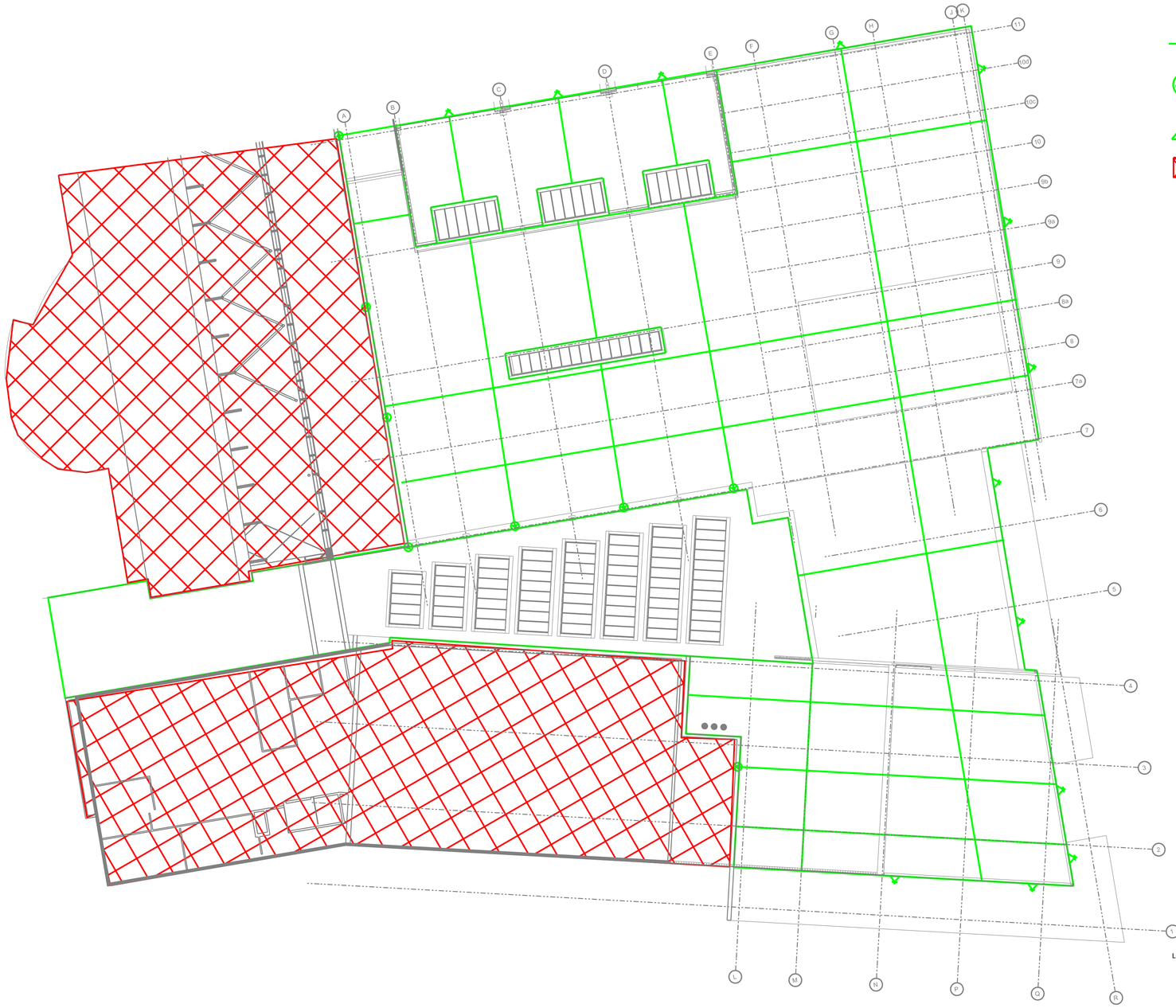
Sheet Number

RVCH-ACM-XX-GF-DR-EL-700000

Scale: 1 : 100@A0 **Rev:** P01

Last Plotted: 01/11/2018 10:20:30

Project Management Initials: Designer: TC Checked: KF Approved: AF Drawn by: TC ISO A0 841mm x 1189mm



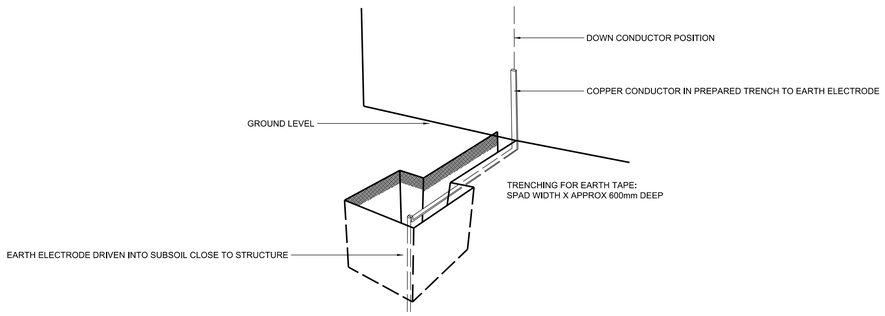
LEGEND

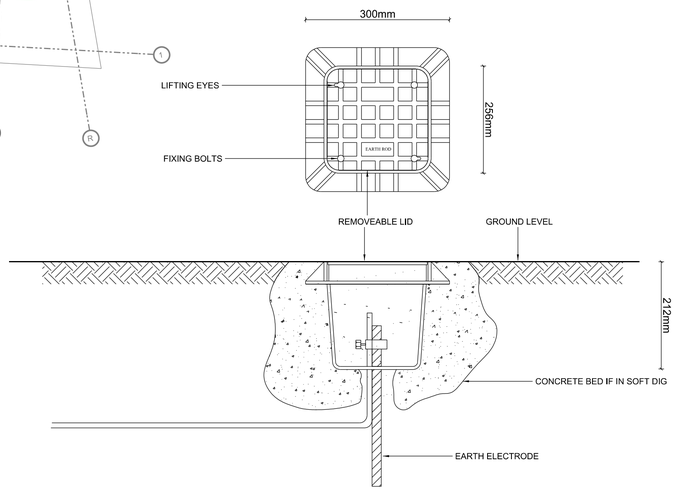
25mm BY 3mm PVC SHEATHED ALUMINIUM AS AIR TERMINTATION NETWORK

25mm BY 3mm PVC SHEATHED ALUMINIUM AS SHORT VERTICAL INTERCONNECTIONS

2.4m COPPER CLAD EARTH ELECTRODE

EXISTING TARC AND ECLIPSE LIGHTNING PROTECTION SYSTEM TO BE BONDED TO NEW SYSTEM





INSPECTION PIT CONSTRUCTED FROM HIGH PERFORMANCE POLYMER

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Notes

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE STAGE 3 REPORT.
2. BASED ON AN INITIAL RISK ASSESSMENT ACCORDING BS EN 62305 THE LEVEL OF SYSTEM REQUIRED IS A CLASS II SYSTEM.
3. LPS WILL BE IN ACCORDANCE WITH BS EN 62305
4. ANY PART OF THE ROOF WHERE METALLIC CLADDING, HADNSRIALS, CAPPING AND PLANT SCREENS ARE PRESENT WILL BE UTILISED AS PART OF THE ROOF CONDUCTOR NETWORK VIA CRILL AND TAPPED CROSS BODING OR DOUBLE REVIT JOINTS.
5. ALL EXTERNAL PLANT WILL BE BONDED TO THE LPS
6. EARTHING WILL BE VIA A MINIMUM 2.4m x 16mm EARTH ELECTRODES HOUSED IN POLYMER INSPECTION CHMABERS.
7. THE OVERALL RESISTANCE REQUIRED WILL BE A MAXIMUM OF 10 OHMS.

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Lightning Protection Layout

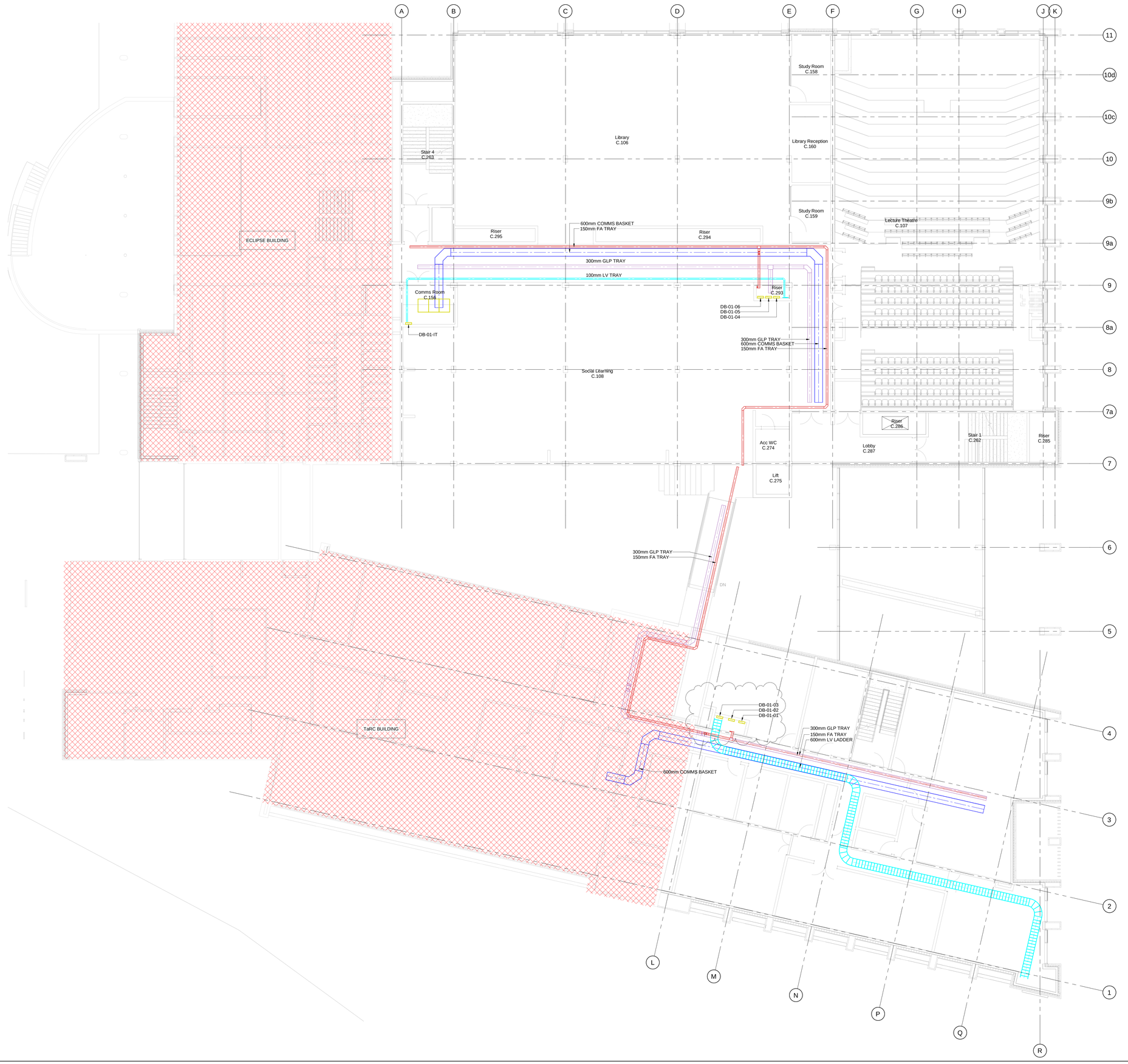
Sheet Number

RVCH-ACM-XX-ZZ-DR-E-450000

Scale: NTS **Rev:** P01

Last Plotted:

Project Management Initials: Designed: CM | Checked: KF | Approved: AF | Drawn by: MP | ISO A0 841mm x 1189mm



Last Plotted: 01/11/2018 10:18:57

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Notes

1. THE INFORMATION SHOWN IS IN LINE WITH RIBA STAGE 3.
2. THESE DRAWINGS SHOWS THE PRIMARY AND SECONDARY CONTAINMENT. FINAL CONTAINMENT/CONDUIT DROPS NOT SHOWN. THIS TERTIARY CONTAINMENT IS TO BE DEVELOPED AT LATER DESIGN STAGE.
3. ALL SERVICES PENETRATIONS THROUGH FIRE RATED COMPARTMENTS SHALL BE FIRE STOPPED TO ACHIEVE A RATING EQUIVALENT TO THE COMPARTMENT AND SHALL BE DESIGNED TO ACCOMMODATE THERMAL EXPANSION.
4. SIZES OF CONTAINMENT ARE INDICATIVE ONLY. TO BE DEFINED IN THE NEXT DESIGN STAGE.
5. DISTRIBUTION WITHIN EXISTING TARC TO BE MODIFIED TO SUIT NEW ROOMS. TO BE DEVELOPED AT NEXT DESIGN STAGE.

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Containment Distribution Layout
First Floor

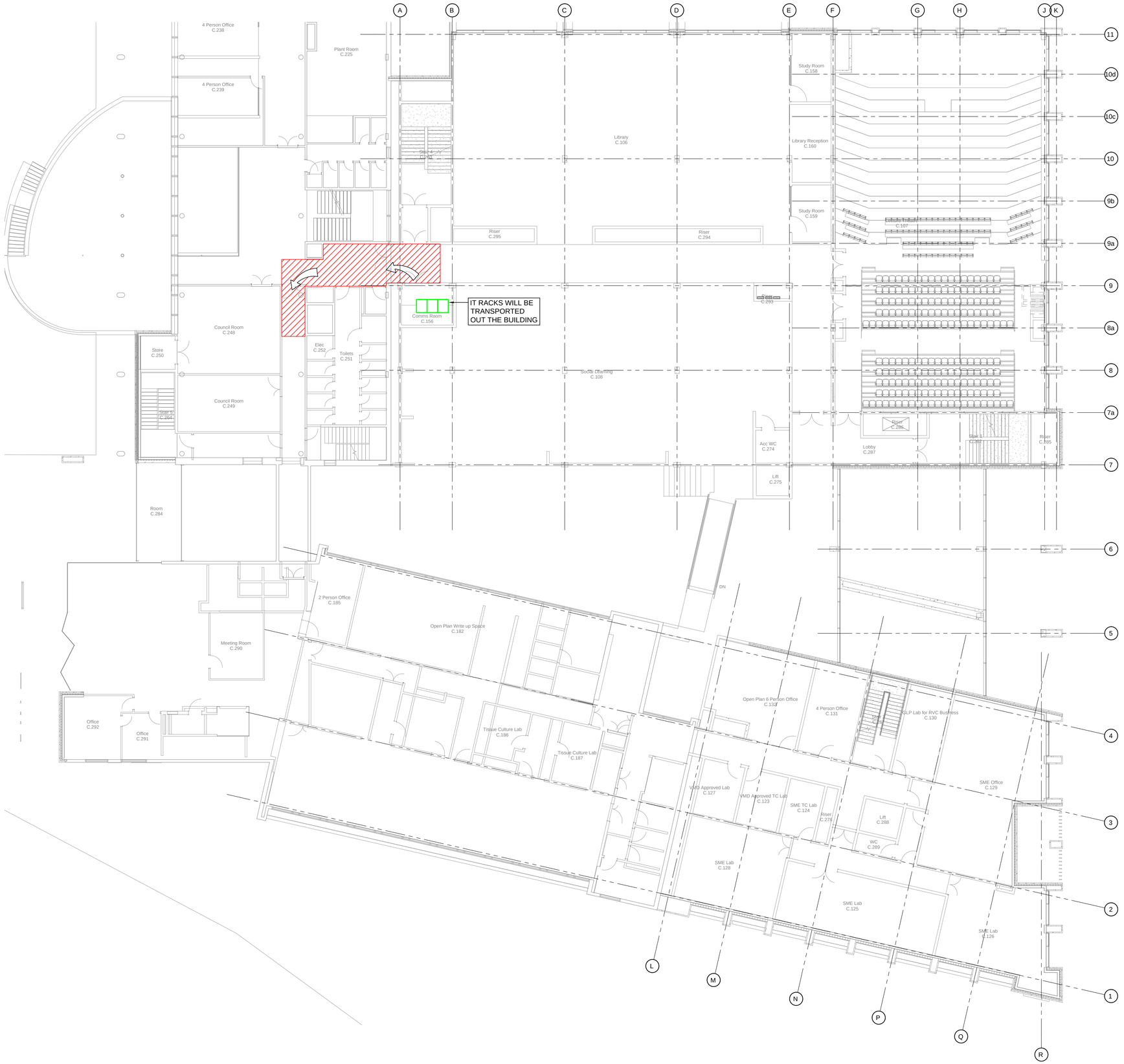
Sheet Number

RVCH-ACM-XX-01-DR-E-410000

Scale: 1 : 100@A0 **Rev:** P01

Appendix B.6 - MEP Services Drawings

Project Management Initials: Designer: DR Checked: KF Approved: AF Drawn By: MP ISO A1 594mm x 841mm



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LEGEND

ROUTE FOR PLANT REPLACEMENT

DIRECTION OF TRAVEL

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Purpose Of Issue

S3 - Suitable for Information

Project Number

60562867

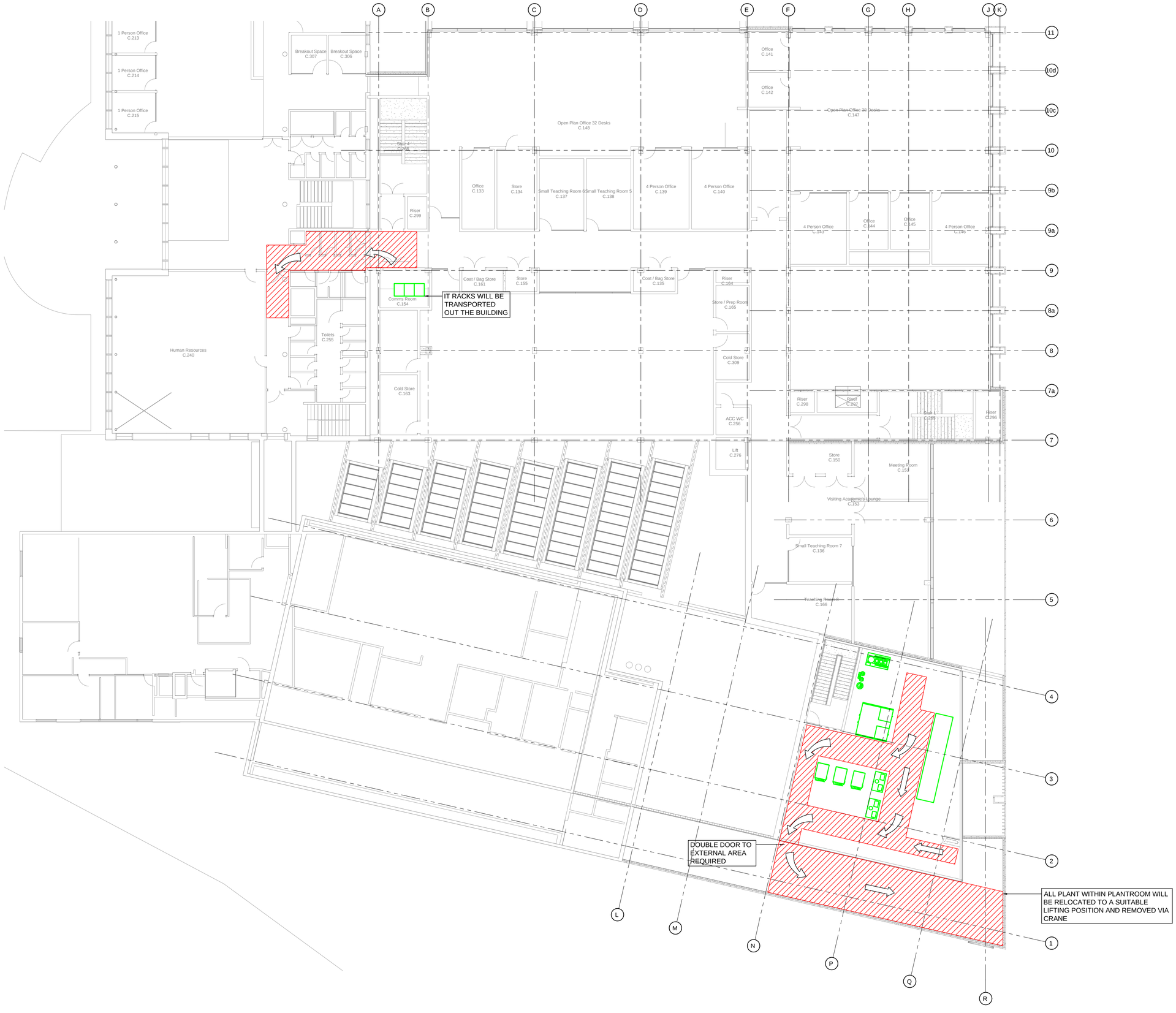
Sheet Title

Plant Replacement Strategy
First Floor

Sheet Number

RVCH-ACM-XX-01-DR-MEP-010000

Project Management Initials: Designer: DR Checked: KF Approved: AF Drawn By: MP ISO A1 594mm x 841mm



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ROUTE FOR PLANT REPLACEMENT

DIRECTION OF TRAVEL

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Purpose Of Issue

S3 - Suitable for Information

Project Number

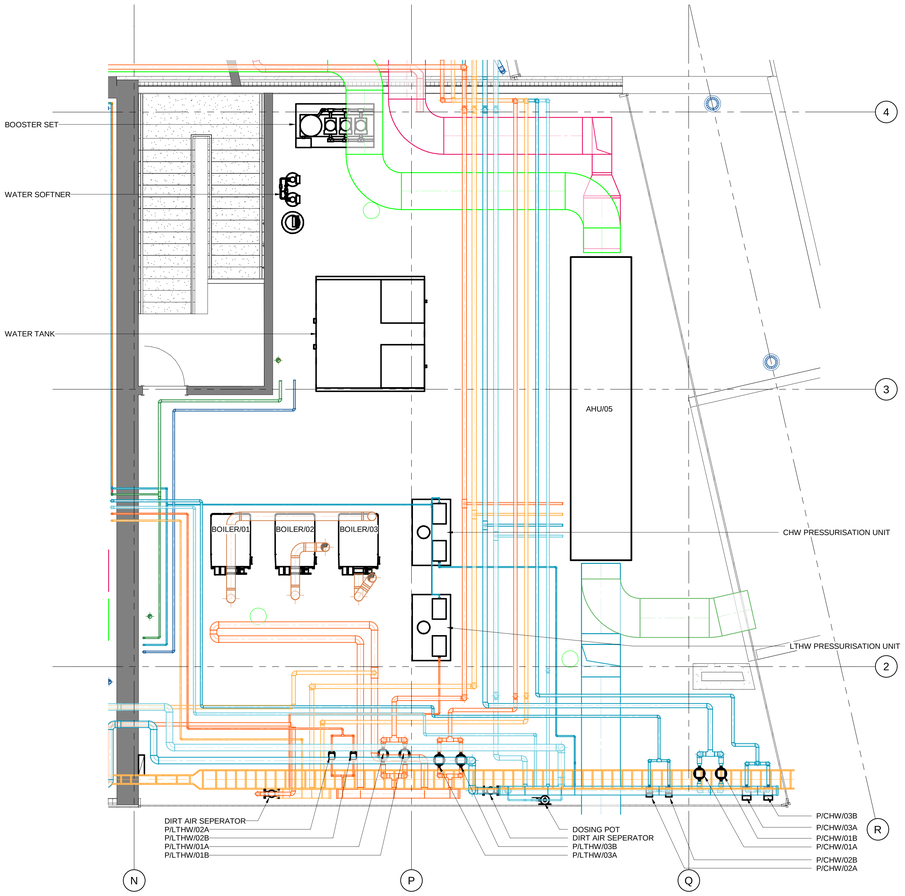
60562867

Sheet Title

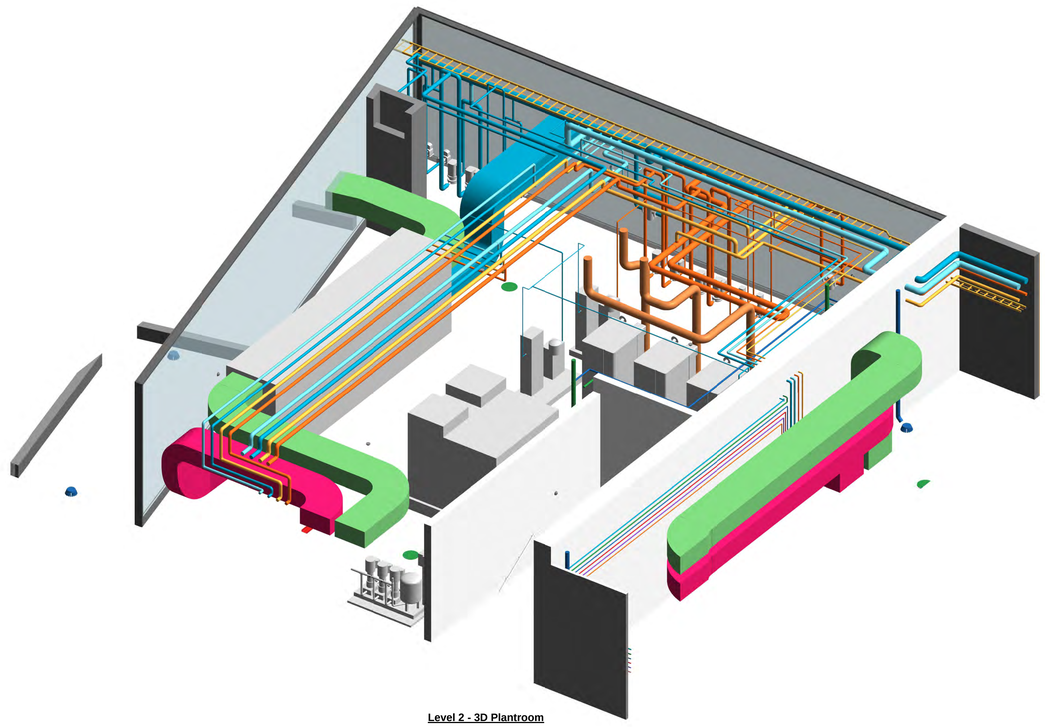
Plant Replacement Strategy
Second Floor

Sheet Number

RVCH-ACM-XX-02-DR-MEP-010000



Level 2 - PLANTROOM
1 : 50



Level 2 - 3D Plantroom

Project Management Initials: Designer: CY Checked: KF Approved: AF Drawn by: MP ISO A0 841mm x 1189mm

Last Plotted: 01/11/2018 10:20:05

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Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

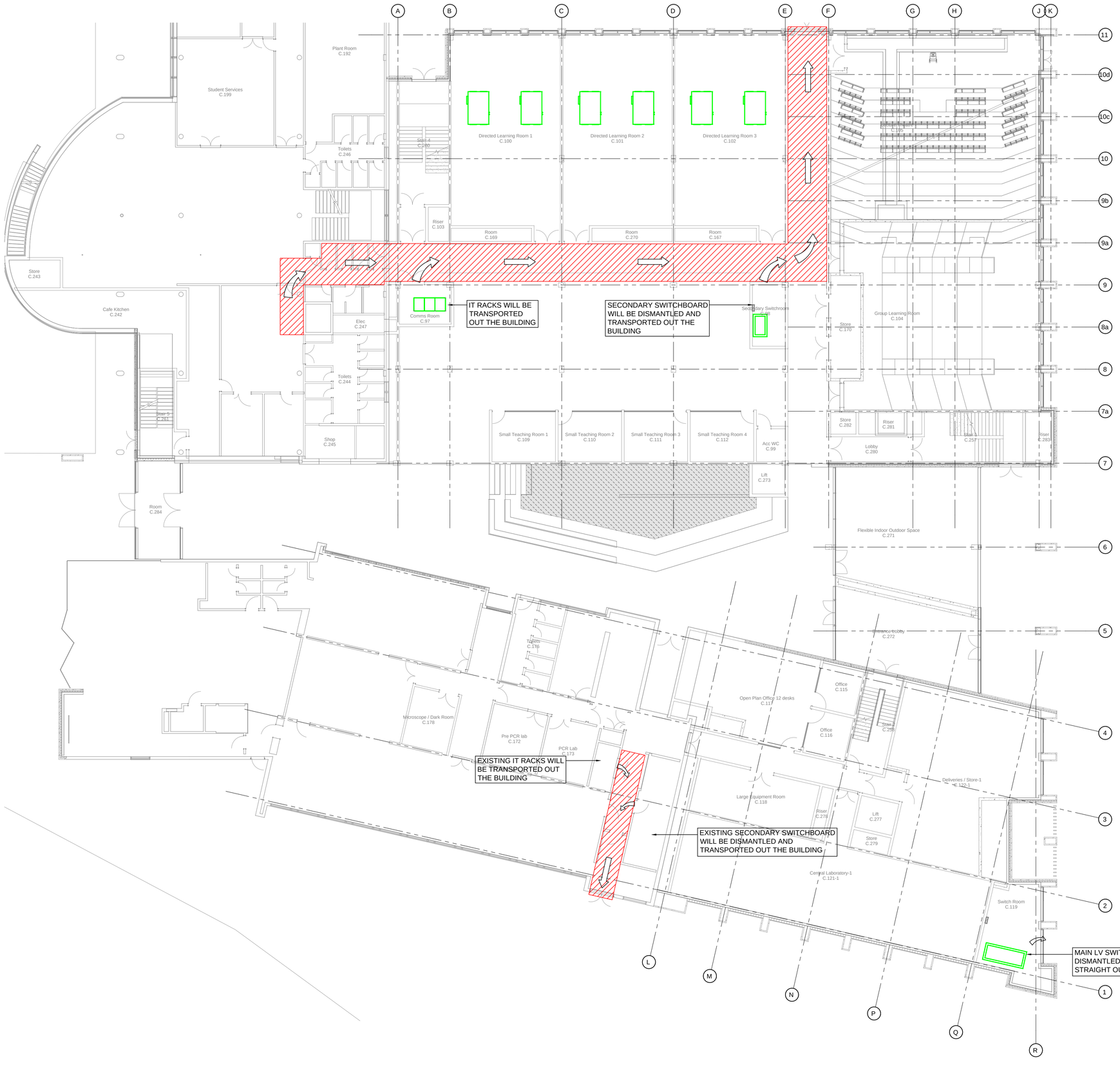
Combined Services
Plantroom Layout
Second Floor

Sheet Number

RVCH-ACM-XX-02-DR-MEP-040200

Scale: 1 : 50@A0 **Rev:** P01

Project Management Initials: Designer: DR Checked: KF Approved: AF Drawn By: MP ISO A1 594mm x 841mm



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ROUTE FOR PLANT REPLACEMENT

DIRECTION OF TRAVEL

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Purpose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Plant Replacement Strategy
Ground Floor

Sheet Number

RVCH-ACM-XX-GF-DR-MEP-010000

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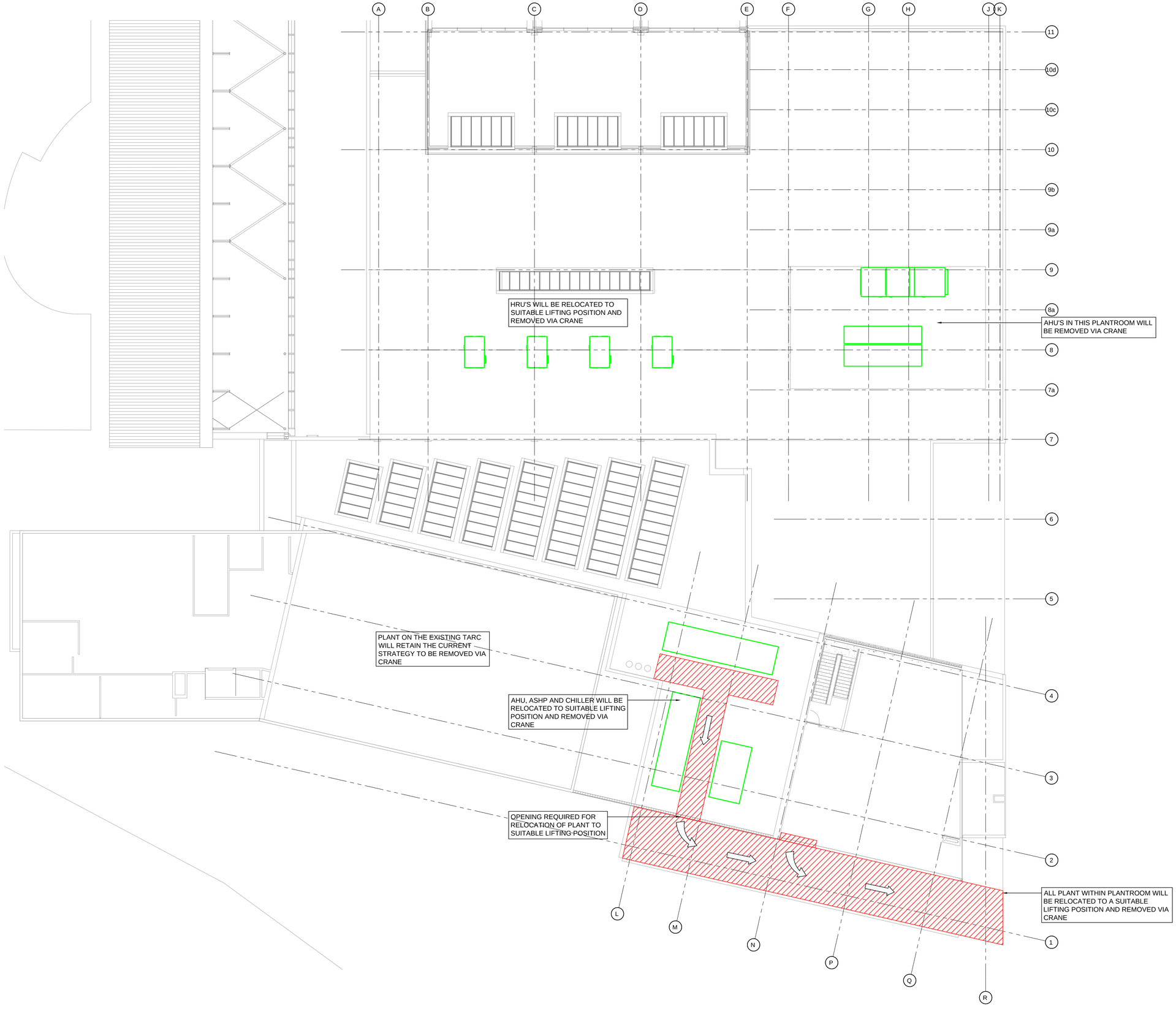

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ROUTE FOR PLANT REPLACEMENT

DIRECTION OF TRAVEL

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Key Plan

Purpose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

Plant Replacement Strategy
Roof

Sheet Number

RVCH-ACM-XX-RF-DR-MEP-010000

Project Management Initials: Designer: CMc Checked: KF Approved: AF Drawn by: CMc ISO A0 841mm x 1189mm

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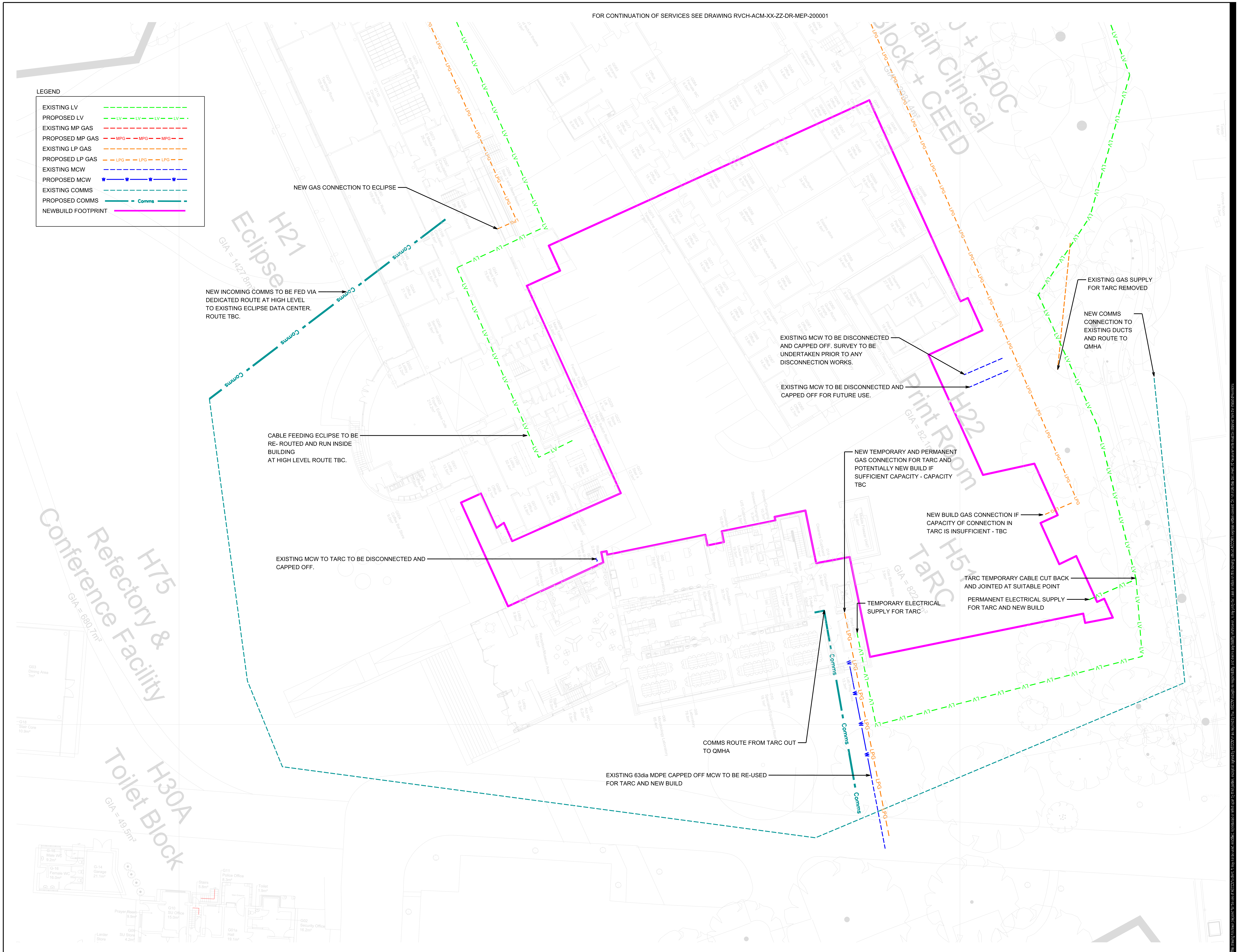

FOR CONTINUATION OF SERVICES SEE DRAWING RVCH-ACM-XX-ZZ-DR-MEP-200001
LEGEND
EXISTING LV
PROPOSED LV
EXISTING MP GAS
PROPOSED MP GAS
EXISTING LP GAS
PROPOSED LP GAS
EXISTING MCW
PROPOSED MCW
EXISTING COMMS
PROPOSED COMMS
NEWBUILD FOOTPRINT
NEW GAS CONNECTION TO ECLIPSE
NEW INCOMING COMMS TO BE FED VIA DEDICATED ROUTE AT HIGH LEVEL TO EXISTING ECLIPSE DATA CENTER. ROUTE TBC.
CABLE FEEDING ECLIPSE TO BE RE- ROUTED AND RUN INSIDE BUILDING AT HIGH LEVEL ROUTE TBC.
EXISTING MCW TO TARC TO BE DISCONNECTED AND CAPPED OFF.
EXISTING MCW TO BE DISCONNECTED AND CAPPED OFF. SURVEY TO BE UNDERTAKEN PRIOR TO ANY DISCONNECTION WORKS.
EXISTING MCW TO BE DISCONNECTED AND CAPPED OFF FOR FUTURE USE.
EXISTING GAS SUPPLY FOR TARC REMOVED
NEW COMMS CONNECTION TO EXISTING DUCTS AND ROUTE TO QMHA
NEW TEMPORARY AND PERMANENT GAS CONNECTION FOR TARC AND POTENTIALLY NEW BUILD IF SUFFICIENT CAPACITY - CAPACITY TBC
NEW BUILD GAS CONNECTION IF CAPACITY OF CONNECTION IN TARC IS INSUFFICIENT - TBC
TARC TEMPORARY CABLE CUT BACK AND JOINTED AT SUITABLE POINT
PERMANENT ELECTRICAL SUPPLY FOR TARC AND NEW BUILD
TEMPORARY ELECTRICAL SUPPLY FOR TARC
COMMS ROUTE FROM TARC OUT TO QMHA
EXISTING 63dia MDPE CAPPED OFF MCW TO BE RE-USED FOR TARC AND NEW BUILD
H21 Eclipse
H75 Refectory & Conference Facility
H30A Toilet Block
H22 Print Room
H5 TaRC

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Notes

1. THE DRAWING IS TO BE READ IN CONJUNCTION WITH THE STAGE 3 REPORT.
2. THE GAS ROUTE SHOWN IS INDICATIVE AND TO BE VERIFIED WITH CADENT (GAS UTILITY COMPANY).
3. AN INTERNAL ROUTE WILL NEED TO BE IDENTIFIED WITHIN THE ECLIPSE BUILDING FOR THE DIVERTED ELECTRICAL SUPPLY CABLES TO THE LV SWITCH ROOM IN ECLIPSE.
4. AN INTERNAL ROUTE WILL NEED TO BE IDENTIFIED WITHIN THE ECLIPSE BUILDING FOR THE DIVERTED FIBRE OPTIC CABLES TO THE ECLIPSE DATA CENTRE.
5. AN INTERNAL ROUTE WILL NEED TO BE IDENTIFIED WITHIN THE ECLIPSE BUILDING FOR THE WATER MAINS PIPEWORK TO THE COLD WATER STORAGE TANK.
6. ALL ROUTES SHOWN ARE INDICATIVE AND ARE SUBJECT TO SURVEY / CO-ORDINATION WITH EXISTING SERVICES AND SITE CONSTRAINTS.

Issue/Revision

Rev	Date	Description
P01	01/11/18	STAGE 3 ISSUE

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

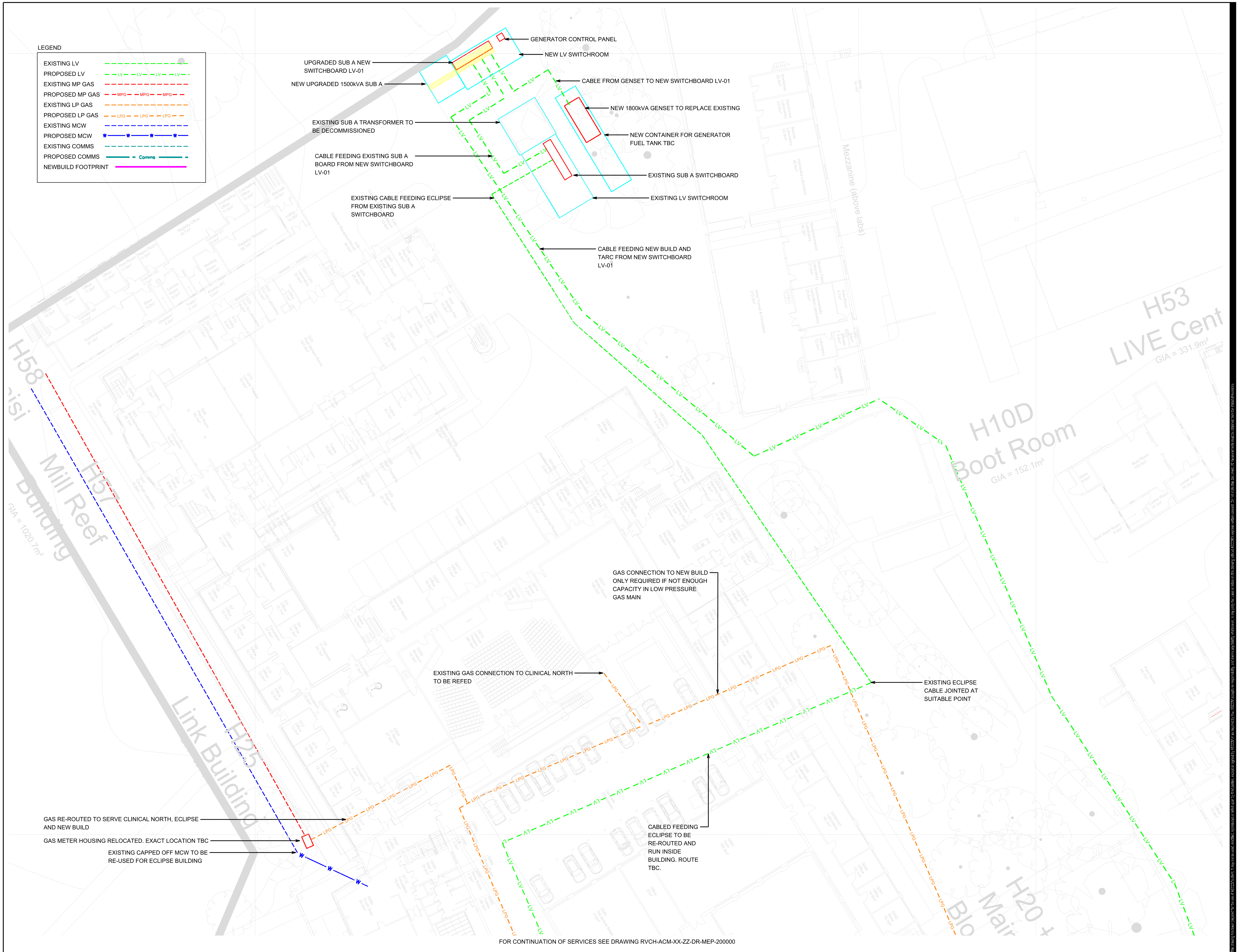
Sheet Title

External Services
Sheet 1 of 2

Sheet Number

RVCH-ACM-XX-ZZ-DR-MEP-200000

Scale: 1 : 150@A0 Rev: P01


LEGEND
EXISTING LV
PROPOSED LV
EXISTING MP GAS
PROPOSED MP GAS
EXISTING LP GAS
PROPOSED LP GAS
EXISTING MCW
PROPOSED MCW
EXISTING COMMS
PROPOSED COMMS
NEWBUILD FOOTPRINT
GENERATOR CONTROL PANEL
NEW LV SWITCHROOM
UPGRADED SUB A NEW SWITCHBOARD LV-01
NEW UPGRADED 1500kVA SUB A
CABLE FROM GENSET TO NEW SWITCHBOARD LV-01
NEW 1800kVA GENSET TO REPLACE EXISTING
EXISTING SUB A TRANSFORMER TO BE DECOMMISSIONED
NEW CONTAINER FOR GENERATOR FUEL TANK TBC
CABLE FEEDING EXISTING SUB A BOARD FROM NEW SWITCHBOARD LV-01
EXISTING SUB A SWITCHBOARD
EXISTING CABLE FEEDING ECLIPSE FROM EXISTING SUB A SWITCHBOARD
EXISTING LV SWITCHROOM
CABLE FEEDING NEW BUILD AND TARC FROM NEW SWITCHBOARD LV-01
H53
LIVE Cent
H10D
Boot Room
H58
Mill Reef
Link Building
GAS CONNECTION TO NEW BUILD ONLY REQUIRED IF NOT ENOUGH CAPACITY IN LOW PRESSURE GAS MAIN
EXISTING GAS CONNECTION TO CLINICAL NORTH TO BE REFED
EXISTING ECLIPSE CABLE JOINTED AT SUITABLE POINT
GAS RE-ROUTED TO SERVE CLINICAL NORTH, ECLIPSE AND NEW BUILD
GAS METER HOUSING RELOCATED. EXACT LOCATION TBC
EXISTING CAPPED OFF MCW TO BE RE-USED FOR ECLIPSE BUILDING
CABLED FEEDING ECLIPSE TO BE RE-ROUTED AND RUN INSIDE BUILDING. ROUTE TBC.
FOR CONTINUATION OF SERVICES SEE DRAWING RVCH-ACM-XX-ZZ-DR-MEP-200000

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Issue/Revision

P01	01/11/18	STAGE 3 ISSUE
Rev	Date	Description

Pupose Of Issue

S3 - Suitable for Information

Project Number

60562867

Sheet Title

External Services
Sheet 2 of 2

Sheet Number

RVCH-ACM-XX-ZZ-DR-MEP-200001

Scale: 1 : 150@A0 **Rev:** P01

Appendix C – Major Plant Schedule

MAJOR PLANT SCHEDULE

Electrical Equipment

Item	Location	Number Required	Approx. Duty	Electrical Load per unit	Approx Size (mm) (LxWxH)	Weight (kg)	Notes
Switchboard LV-02	Ground Floor - Main Switchroom	1	N/A	1000A Board	2850 x 1000 x 2300	TBC	
Switchboard LV-03	Ground Floor - Main Switchroom	1	N/A	400A Board	1400 x 750 x 2300	TBC	
Comms Racks	Ground , 1st, 2nd Comms Area	9 (3 Per Room)	N/A		1000 x 800 x 2300	TBC	
Existing TARC Switchboard	Existing TARC Switchroom	1	N/A	400A Board	As Existing	TBC	
Switchboard LV-01	Substation	1	N/A	2500A Board	4200 x 1115 x 2300	TBC	
MCC 1	2nd Floor Plantroom	1	N/A	TBC	TBC	TBC	
MCC2	Roof external plant area	1	N/A	TBC	TBC	TBC	
Generator	Container Near substation	1	N/A	1800 KVA	5491 x 2160 x 2755	TBC	14000 x 3000 x 3500 size of new container

Public Health Equipment

CW Storage Tank	2nd Floor Plantroom	1	~4000L	N/A	2000 x 2000 x 1500	TBC	Sectional externally flanged tank with central division plate
Booster Pump Set (Triplex)	2nd Floor Plantroom	1	2.0L/sec at 3.0bar	2.2kW per pump	1600 x 1200 x 1500	TBC	Packaged, skid mounted, variable speed, booster pump set, comprising 3No of pumps, set up as Duty/Assist/Standby, with hydraulic accumulator and control panel
Base exchange Water Softener	2nd Floor Plantroom	1	4000L / day	11W (control panel)	2100 x 650 x 2000	TBC	Duplex Softener configured as Duty / Standby, with Brine tank approx. 350L, delivering softened water between 25 to 60ppm CaCO3.

Mechanical Equipment

Gas Fired Boiler	Roof plantroom	3	350 kW each	0.6 kW each	1400 x 1000 x 2100	TBC	2 duty 1 standby
Air Cooling Chiller	Roof external plant area	1	320 kW	102 kW	7700 x 2200 x 2800	TBC	
Air Source Heat Pump	Roof external plant area	1	320 kW	113 kW	4600 x 2500 x 2400	TBC	
Air Handling Unit	Roof external plant area	1	4.3 m3/s	5.5 kW per fan	8000 x 2300 x 2600	TBC	
Air Handling Unit	Roof external plant area	1	2.0 m3/s	2.2 kW per fan	7200 x 1700 x 1900	TBC	
Air Handling Unit	Roof external plant area	1	1.9 m3/s	2.2 kW per fan	7200 x 1400 x 1900	TBC	
Air Handling Unit	Roof external plant area	1	3.6 m3/s	5.5 kW per fan	9000 x 2300 x 2600	TBC	
Air Handling Unit	Roof plantroom	1	2.5 m3/s	5.5 kW per fan	7000 x 1700 x 2200	TBC	
Heat Recovery Ventilation unit	Roof above teaching lab	4	0.55 m3/s each	1.02 kW each	2500 x 1800 x 850	TBC	All duty
Heat Recovery Ventilation unit	Direct learning rooms	6	0.55 m3/s each	1.02 kW each	2500 x 1800 x 850	TBC	All duty
LTHW pumps	Roof plantroom	2	9.5 l/s each	4 kW Each	300 x 400 x 400	TBC	1 duty 1 standby
LTHW pumps	Roof plantroom	2	0.6 l/s each	0.75 kW Each	200 x 300 x300	TBC	1 duty 1 standby
LTHW pumps	Roof plantroom	2	6.5 l/s each	3 kW Each	300 x 400 x 400	TBC	1 duty 1 standby
CHW pumps	Roof plantroom	2	8.8 l/s each	3 kW Each	300 x 400 x 400	TBC	1 duty 1 standby
CHW pumps	Roof plantroom	2	2.2 l/s each	1.1 kW Each	200 x 300 x300	TBC	1 duty 1 standby
CHW pumps	Roof plantroom	2	3.5 l/s each	2.2 kW Each	300 x 400 x 400	TBC	1 duty 1 standby

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APPENDIX 2
CONSIBEE

conisbee

RVC Hawkshead Campus

Stage 3 Report - Civil & Structural

Ref: 170344 / IP
Date: October 2018
Version: 1

conisbee

Table of Contents

1.0 Introduction

This report presents the outline civil and structural designs (RIBA Stage 3) for the proposed development at the Royal Veterinary Colleges Hawkshead campus.

The proposed development consists of a new building to provide teaching and lecture rooms as well as laboratories and academic staff offices. A two store atrium will be created where the new building adjoins two existing buildings.

As part of the works, alterations to a number of existing buildings will also need to be made as well as major works to existing services crossing under the proposed site..

This report should be read in conjunction with the appended drawings and reports prepared by other members of the design team.

2.0 Existing Site and Ground Conditions

2.1 Location

The proposed building is located on the Royal Veterinary Colleges, Hawkshead Campus, Hawkshead Lane, North Mymms, Hertfordshire.

2.2 Existing Site

The site of the proposed building is located centrally within the college campus. The site is bounded to the east by the Eclipse building which is three storeys in height and which was constructed in the mid 1990's. To the south is the three storey TaRC building constructed around 2011. To the east is the Clinical block which is predominantly single storey and probably dates from around the 1960's. Refer to figure 1 opposite.

The proposed building will be positioned over an area currently used as a car park as well as a grassed area to the east of the TaRC Building and over the Clinical block which is to be demolished.

Existing ground levels fall from the east to west and from south to north. The fall is around 1.3m from the highest to the lowest point which is at the north east corner of the proposed building.

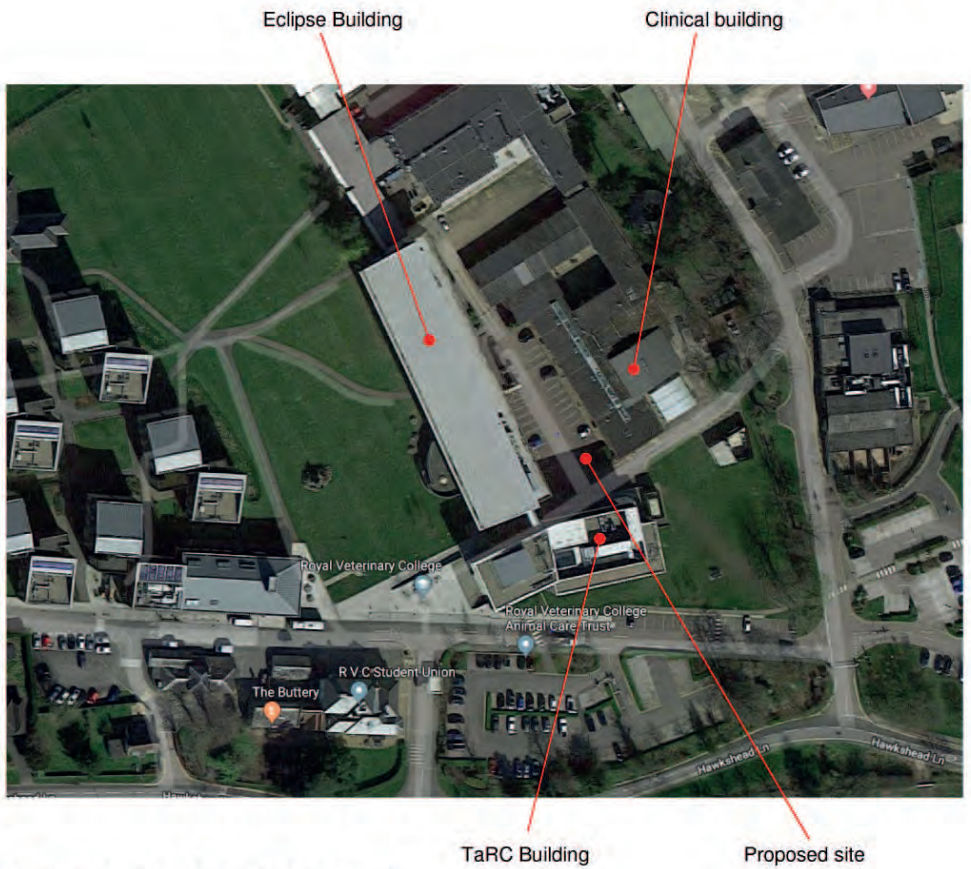


Figure 1 - Location of site within the campus

2.3 Ground Conditions

A site investigation was been carried out by Geotechnical and Environmental Associates Ltd. in June 2018 and the findings are contained within their report dated August 2018. Reference should be made to this document for detailed information on the ground conditions as well as their findings and recommendations.

Seven trial pits and three boreholes were excavated during the investigation works and these indicated that the ground conditions beneath the site were variable. However they generally comprise of fill over brown clay over sands and gravels to depths of between 3.7m to around 6.0m. These overlay clay with chalk which is inter layered with bands of sands and gravels. Chalk was encounter in two of the boreholes at a depth of around 13.5m and proven to a depth of 20m. In the other borehole, chalk was not encountered although the borehole only extended to a depth of around 17m. The strata encountered are representative of the strata found during previous site investigations carried out in other areas of the college campus.

Ground water was encountered in the granular material at depths of one of the boreholes at a depth of around 1.7m (87.6m OD) and 3.9m (85.1m OD) a standpipe has been installed to monitor levels. The need for measures for dealing with ground water during the construction phase in any deep excavations and any waterproofing of the building will need to be assessed during the detailed design stage (Stage 4) once levels of the building / structure have been established.

With regard to contamination, the findings indicate the site does not have a potentially contaminative history. However traces of hydrocarbons and asbestos were found during the investigation works, albeit at relatively low concentrations. These are thought to be localised issues. For further information regarding contamination reference should be made to the site investigation report.

It should be noted that the site investigation works and contamination testing only coved the open areas of the site. The proposed building along with associated landscaping will sit over the foot print of the current Clinical block which is to be demolished. Further testing will be required in this area once this block has been demolished.

The site sits above a Source Protection zone and as such, the bottom of any piled foundations would need to stop above the chalk strata unless agreed otherwise with the Environment Agency.

A preliminary Unexploded Ordnance (UXO) assessment was been carried out for the site which classified it as being medium risk. It is recommended that a more detailed assessment is carried out. If the findings of this are similar , then consideration may need to be given to specialist supervision during excavation works and magnetometer scanning during any piling works.

2.4 Site constraints / enabling works

There are a number of existing services crossing under the proposed site. These include a medium pressure gas main, fibre optic communications cables, and drainage runs. An attenuation tank and grey water tank serving the TaRC building are sited under the foot print of the proposed building in the current car park – refer to the appended site constraints drawing for further details.

These services as well as the attenuation tank will need to be moved as part of the proposed works and alternative routes / locations found for them. This will not be a straight forward exercise as the existing buildings that they serve need to stay in operation while the proposed works are carried.

Enabling works are to be carried out ahead of the constructing of the new building. It is understood that these may include installation of the new attenuation tank, a new staircase and alterations to the toilets in the Eclipse building. A programme for these works along with relevant designs will need to be worked up during the next design stage..

3.0 Structural proposals

3.1 Super structure

Given the proposed architectural layouts and the relatively large spans required over the lecture theatre and entrance area, a framed solution is to be adopted. It has been decided to proceed with primarily a concrete framed solution consisting of flat slabs supported on concrete columns and walls. There are a number of reasons for the choice of a concrete frame which is as follows:

- It continues the aesthetic of the existing Eclipse and TaRC buildings.
- The soffits of the slabs can be exposed and the thermal mass of the slabs used as part of the M&E Engineers ventilation / cooling strategy for the building.

- Flat soffits will aid service distribution
- It will provide a robust monolithic frame which will be simpler to detail as opposed to a steel frame say.
- More readily deal with services openings and penetrations.
- Provides inherent sound and fire protection.
- Provides a flexible structure if layout or use changes in future
- Less lead in time than a steel frame.
- Simplified fixing and support of the proposed pre-cast concrete cladding system – cast in fixing system can be used.

Column grids which are generally dictated by room layouts vary across the building with the maximum being approximately 9.5m x 8.5m. This leads to the slabs having large spans which will required slabs up to 350mm deep.

A live load of 5 kN / m2 on all of the floors has been assumed at present which will deal with all of the proposed usages. The exception will be the plant areas where 7.5 kN / m2 has been used.

Within the main lecture theatre deep reinforced concrete beams will be required to span 16m to support the second floor slab. These beams will also act as transfer beams in certain locations supporting columns carrying the roof. The proposed size of these beams is 700mm wide by 1200mm deep.

Due to the difference in ground levels across the site, ground floor slabs will consist of either suspended cast insitu rc slabs or precast concrete hollow core slabs with a concrete topping supported on stub walls.

The roof over the main body of the atrium is to be constructed from proprietary glazing units and it is proposed that these are supported using steel beams spanning between the north section of the proposed building and the existing TaRC building.

It is proposed that the new flat roof to the west of the atrium be constructed from steel beams, spanning between the existing Eclipse and Tarc buildings with light gauge steel purlins to support the roof decking. Connection details to the existing buildings will need to be worked out during the next design phase.

A new staircase to access the first floor of the Eclipse building is proposed to the west of the building in the area of the current entrance which may form part of the enabling works. This will need to be inserted under the existing over hanging second floor and external columns supporting it and the roof. This is to be constructed a steel framed structure for ease of construction. This will also be used to support the new flat roof between the Eclipse and TaRC building.

The pre-cast concrete vertical cladding elements that project from the face the building as well as other cladding elements will require structural steelwork supports and additional / secondary steelwork fixed back to the main frame or existing buildings. The detailing of these elements will need to be carefully co-ordinate with the cladding suppliers / installers.

Fixed seating is required in the main lecture theatre. The stepped tiers required for the seating will need to be constructed from special pre-cast concrete elements supported on a steel framework.

Within the Group Learning room, the tiered seating is to be constructed in timber and the design of this will need to be worked up in detail during the next design phase.

3.2 Sub-Structure / Foundations

Given the column spacings, loading requirements and the use of a concrete frame, column loads will be quite large and as such piled foundations will need to be used.. As previously noted the site is located over a source protection zone and as such the length of the piles will be limited by the depth of the chalk strata. Therefore a larger diameter pile will be required to achieve the required load capacity over that which would normally be used. It is proposed that 600mm diameter piles are used.

The piles will support either reinforced concrete pile caps or ground beams which in turn will support the supper structure.

A number of below ground ventilation ducts as well as a lowered slab to the Group learning room will require the foundations to be at a greater depth in the areas where they are located and will result in some excavation being required. Below ground retaining walls will also be required as part of the foundation works in these areas..

4.0 Civils

4.1 Introduction

This section of the report sets out some of the general principles that will be followed in the drainage design. The level of detail presented here is consistent with that known about the operation of the existing drainage.

4.2 Investigations / existing drainage

Information about the operation of the existing site drainage has been obtained from the site topographic survey undertaken by Cube Surveys at the end of February 2018 (Ref: CUB-RBS-RVC-001/002) and CCTV Survey drawings and report undertaken by Laser Surveys Ltd from June 2018 (Ref: G 9018/1)

The site CCTV survey identified existing foul and surface water sewers and inspection manholes within the area of the proposed site. This drainage is exclusively associated with the current buildings and the use of existing rainwater harvesting and attenuation tanks currently serving the existing TaRC building.

Furthermore, the surveys indicate a ditch to the east of the proposed building. This ditch collects surface water from the existing adjacent buildings / site and discharges to the north into the Mimmshall Brook.

There are parts of the existing drainage system serving the retained buildings that are located underneath the proposed building which will need to be kept live during the construction phase and be diverted as required. This will need to be coordinated with the rest of the design team.

Reference should be made to Conisbee drawing 170344-X-00-DR-C-C1200 & 1201 in the appendix for details of the existing drainage on the site and runs that need to diverted or made redundant etc.

Conisbee are responsible for below ground drainage design and will work in collaboration with the rest of the design team to co-ordinate drainage from above (soil and rain water) to ensure they are in suitable locations to connect to the below ground drainage.

4.3 Surface Water Drainage

According to the Environment Agency maps the site is located within Flood Zone 1. This indicates that there is less than a 0.1% annual probability of the site flooding from rivers or sea during a typical year.

However, Environment Agency maps indicate the existing buildings could be affected by the risk of flooding from surface water. The proposed finished ground floor level will therefore need to match the level of the existing TaRC building to avoid being at risk. The proposed drainage system and the introduction of SUDS features such as attenuation tanks will help to reduce the existing surface water runoff and reducing the risk of flooding. .

From a previous site investigation carried out by GEA (February 2009 – Report No: J08280) soak away test undertaken found a very low soak away rate within the area. Therefore, infiltration methods have been dismissed.

In accordance with Welwyn Hatfield Borough Council and Hertfordshire County Council regulations, any new developments drainage system should not increase the surface water runoff from the existing site. The proposed development results in a reduction of impermeable area. Therefore the post development run-off volume, over the development lifetime, is no greater than it would have been prior to the assessed site's development, which is in accordance with BREEAM requirements.

If BREEAM approval is to be obtained, there is a requirement that the peak rate of run-off from the site is to be no greater than it was pre-development for all the events up to the 1 in 100 year plus 40% climate change storm events. This requirement is more onerous than Welwyn Hatfield Borough Councils requirements.

The LLFA local authority will insist on implementing planning conditions that seek to reduce surface water flows to 'Greenfield' rates and implement more SuDS than proposed, notwithstanding that there is a reduction of total impermeable area as a result of the proposed site. This will need to be clarified during the planning consultation.

Based on the existing site impermeable area of 4730m^2, we have calculated the total existing 1 in 1 year storm runoff rate to be 11.7l/s. The proposed discharge rates will be restricted to this value for all storms up to and including the 1 in 100 year storm event plus 40% for climate change.

The incorporation of SUDs utilizing underground tanks and porous pavements will be used for the surface water strategy for the development. Based on the site greenfield Qbar rate of 2.7 l/s and the additional 9l/s for the existing TArc building. The proposed building area of 3100m2 and the existing building area of 700m2. Therefore the proposed attenuation will have a total volume of 147.5 @ 11.7l/s

Refer to Conisbee drawing 170344-X-00-DR-C-1000 for further details of the attenuation tank locations and proposed drainage

4.4 Foul Water Drainage

It is proposed to connect the new foul water drainage from the proposed building into the existing on site drainage system. The foul water flows generated from the new scheme are considered low (approx < 10.0 l/s) and therefore we do not anticipate capacity issues with Thames Water, albeit this will need to be confirmed.

4.5 Constraints and Coordination

Some investigation works may be required to ascertain details of the construction of the Eclipse building where the proposed atrium roof and staircase interface with it. The requirement for these works will become apparent once the design of these interfaces is worked up during the next stage.

The site services plan indicates that there is a huge number of services located within the proposed main atrium area. In addition there are also additional services that are proposed in this area. All these services need careful coordination with the drainage proposals. Further coordination is required during the next stage of design. Other constraints that have come to light include the trees with TPOs that run along the ditch, which have resulted in the need to reposition the attenuation tank into the new landscaped quad area.

In order to facilitate the installation of the new delivery bay, it will be necessary to culvert the ditch at this location to facilitate crossing it. These works will require approval by the Local Lead Flood Authority. The culvert will need to be significantly large in order to match the profile of the ditch and not to reduce capacity of it. Care will also need to be taken regarding trees that will be affected by these works. There are a number of pipes that discharge into the ditch and those in the area of the proposed culvert will need to be investigated and may require works to divert them.

5.0 Further investigations

Some investigation works may be required to ascertain details of the construction of the Eclipse building where the proposed atrium roof and staircase interface with it. The requirement for these works will become apparent once the design of these interfaces is worked up during the next stage.

Additional contamination testing will be required in the area of the existing Clinical block when it is demolished.

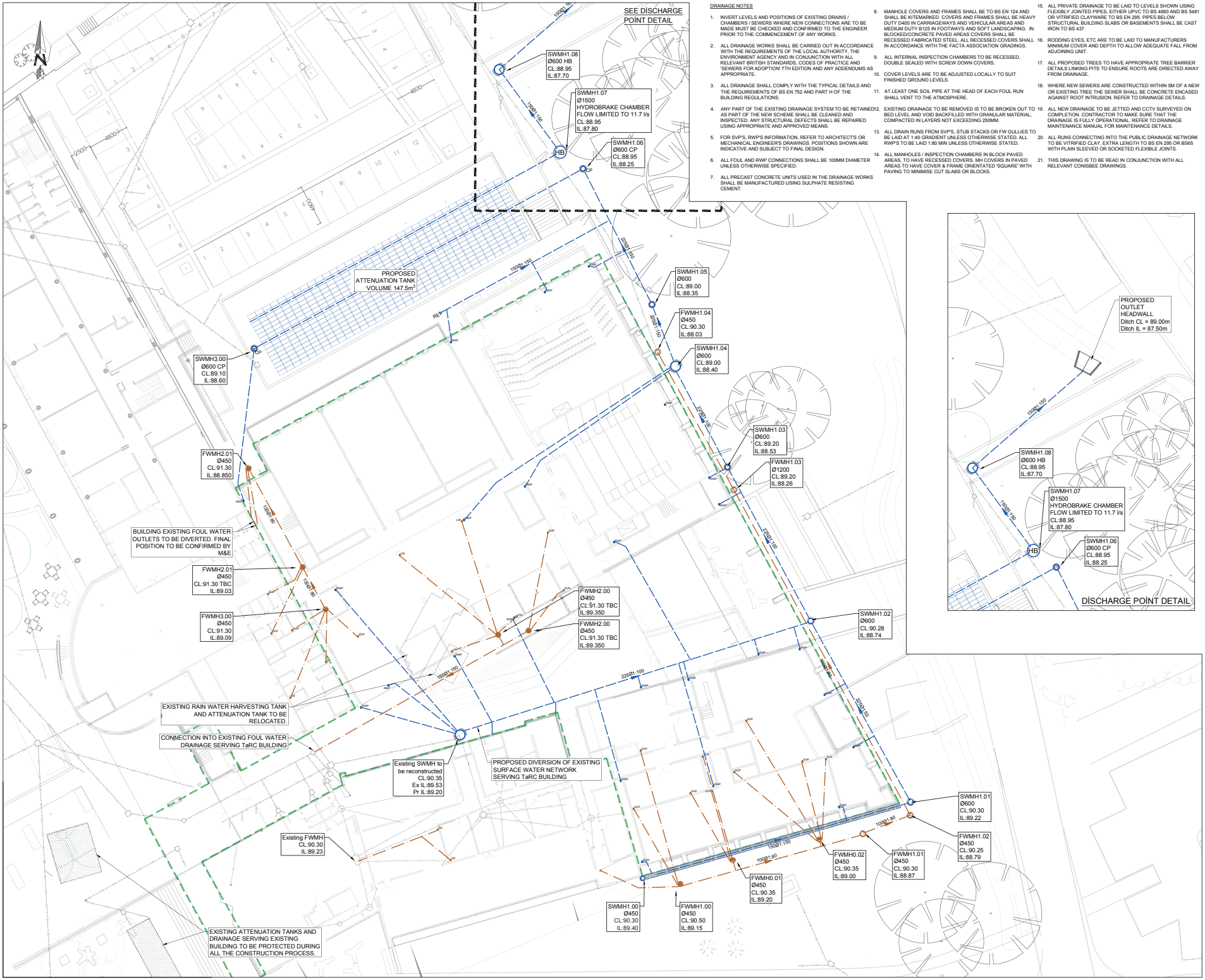
6.0 Next stage

Once the Stage 3 design has been approved and there is certainty over the layouts and design etc. the detailed design phase (Stage 4) will be carried out..

Checks on the existing Eclipse and TaRC buildings need to be made to ascertain if they are capable of supporting the additional loads from the atrium roof and support details for the roof worked out.

Phasing of the works and services diversions etc. will need to be worked out in detail and a strategy of how this can be achieved prepared. As part of this , the scope and designs for the enabling works will also need to be prepared.

Appendix A - Drawings



DRAINAGE NOTES

1. INVERT LEVELS AND POSITIONS OF EXISTING DRAINS / CHAMBERS / SEWERS WHERE NEW CONNECTIONS ARE TO BE MADE MUST BE CHECKED AND CONFIRMED TO THE ENGINEER PRIOR TO THE COMMENCEMENT OF ANY WORKS.
2. ALL DRAINAGE WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS OF THE LOCAL AUTHORITY, THE ENVIRONMENT AGENCY AND IN CONJUNCTION WITH ALL RELEVANT BRITISH STANDARDS, CODES OF PRACTICE AND 'SEWERS FOR ADOPTION' 7TH EDITION AND ANY ADDENDUMS AS APPROPRIATE.
3. ALL DRAINAGE SHALL COMPLY WITH THE TYPICAL DETAILS AND THE REQUIREMENTS OF BS EN 752 AND PART H OF THE BUILDING REGULATIONS.
4. ANY PART OF THE EXISTING DRAINAGE SYSTEM TO BE RETAINED AS PART OF THE NEW SCHEME SHALL BE CLEANED AND INSPECTED. ANY STRUCTURAL DEFECTS SHALL BE REPAIRED USING APPROPRIATE AND APPROVED MEANS.
5. FOR SVP'S, RWP'S INFORMATION, REFER TO ARCHITECT'S OR MECHANICAL ENGINEER'S DRAWINGS. POSITIONS SHOWN ARE INDICATIVE AND SUBJECT TO FINAL DESIGN.
6. ALL FOUL AND RWP CONNECTIONS SHALL BE 100MM DIAMETER UNLESS OTHERWISE SPECIFIED.
7. ALL PRECAST CONCRETE UNITS USED IN THE DRAINAGE WORKS SHALL BE MANUFACTURED USING SULPHATE RESISTING CEMENT.
8. MANHOLE COVERS AND FRAMES SHALL BE TO BS EN 124 AND SHALL BE KITEMARKED. COVERS AND FRAMES SHALL BE HEAVY DUTY D400 IN CARRIAGEWAYS AND VEHICULAR AREAS AND MEDIUM DUTY B125 IN FOOTWAYS AND SOFT LANDSCAPING. IN BLOCKED/CONCRETE PAVED AREAS COVERS SHALL BE RECESSED FABRICATED STEEL. ALL RECESSED COVERS SHALL IN ACCORDANCE WITH THE FACTA ASSOCIATION GRADINGS.
9. ALL INTERNAL INSPECTION CHAMBERS TO BE RECESSED, DOUBLE SEALED WITH SCREW DOWN COVERS.
10. COVER LEVELS ARE TO BE ADJUSTED LOCALLY TO SUIT FINISHED GROUND LEVELS.
11. AT LEAST ONE SOIL PIPE AT THE HEAD OF EACH FOUL RUN SHALL VENT TO THE ATMOSPHERE.
12. EXISTING DRAINAGE TO BE REMOVED IS TO BE BROKEN OUT TO BED LEVEL AND VOID BACKFILLED WITH GRANULAR MATERIAL, COMPACTED IN LAYERS NOT EXCEEDING 250MM.
13. ALL DRAIN RUNS FROM SVP'S, STUB STACKS OR FW GULLIES TO BE LAID AT 1:40 GRADIENT UNLESS OTHERWISE STATED. ALL RWP'S TO BE LAID 1:80 MIN UNLESS OTHERWISE STATED.
14. ALL MANHOLES / INSPECTION CHAMBERS IN BLOCK PAVED AREAS, TO HAVE RECESSED COVERS. MH COVERS IN PAVED AREAS TO HAVE COVER & FRAME ORIENTATED 'SQUARE' WITH PAVING TO MINIMISE CUT SLABS OR BLOCKS.
15. ALL PRIVATE DRAINAGE TO BE LAID TO LEVELS SHOWN USING FLEXIBLY JOINTED PIPES, EITHER UPVC TO BS 4660 AND BS 5481 OR VITRIFIED CLAYWARE TO BS EN 295. PIPES BELOW STRUCTURAL BUILDING SLABS OR BASEMENTS SHALL BE CAST IRON TO BS 437.
16. RODDING EYES, ETC ARE TO BE LAID TO MANUFACTURERS MINIMUM COVER AND DEPTH TO ALLOW ADEQUATE FALL FROM ADJOINING UNIT.
17. ALL PROPOSED TREES TO HAVE APPROPRIATE TREE BARRIER DETAILS LINKING PITS TO ENSURE ROOTS ARE DIRECTED AWAY FROM DRAINAGE.
18. WHERE NEW SEWERS ARE CONSTRUCTED WITHIN 5M OF A NEW OR EXISTING TREE THE SEWER SHALL BE CONCRETE ENCASED AGAINST ROOT INTRUSION. REFER TO DRAINAGE DETAILS.
19. ALL NEW DRAINAGE TO BE JETTED AND CCTV SURVEYED ON COMPLETION. CONTRACTOR TO MAKE SURE THAT THE DRAINAGE IS FULLY OPERATIONAL. REFER TO DRAINAGE MAINTENANCE MANUAL FOR MAINTENANCE DETAILS.
20. ALL RUNS CONNECTING INTO THE PUBLIC DRAINAGE NETWORK TO BE VITRIFIED CLAY, EXTRA LENGTH TO BS EN 295 OR BS65 WITH PLAIN SLEEVED OR SOCKETED FLEXIBLE JOINTS.
21. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT CONISBEE DRAWINGS.

GENERAL NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALIST DRAWINGS AND SPECIFICATIONS
2. DO NOT SCALE FROM THIS DRAWING IN EITHER PAPER OR DIGITAL FORM. USE WRITTEN DIMENSIONS ONLY.

LEGEND

- PROPOSED BUILDING OUTLINE
- SW — SW — EXISTING SURFACE WATER SEWER FROM CCTV SURVEY
- FW — FW — EXISTING FOUL WATER SEWER FROM CCTV SURVEY
- CW — CW — EXISTING COMBINED WATER SEWER FROM CCTV SURVEY
- SW FW CW — EXISTING SEWER TO BE REMOVED OR ABANDONED

EXISTING SITE FEATURES

- EXISTING TREE
- EXISTING ATTENUATION TANK TO BE RETAINED
- EXISTING ATTENUATION TANK TO BE REMOVED
- EXISTING DITCH

PRIVATE DRAINAGE LEGEND

- PRIVATE SURFACE WATER DRAIN
- PRIVATE FOUL WATER DRAIN
- PRIVATE SURFACE WATER INSPECTION CHAMBER
- PRIVATE FOUL WATER INSPECTION CHAMBER
- HB — MANHOLE WITH HYDRO-BRAKE
- CP — CATCHMENT PIT
- ATTENUATION TANK

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Rev	Date	Description	Drawn	Check
P2	02.11.18	STAGE 3 ISSUE	MO	TG
P1	19.07.18	STAGE 2 ISSUE	MO	TG

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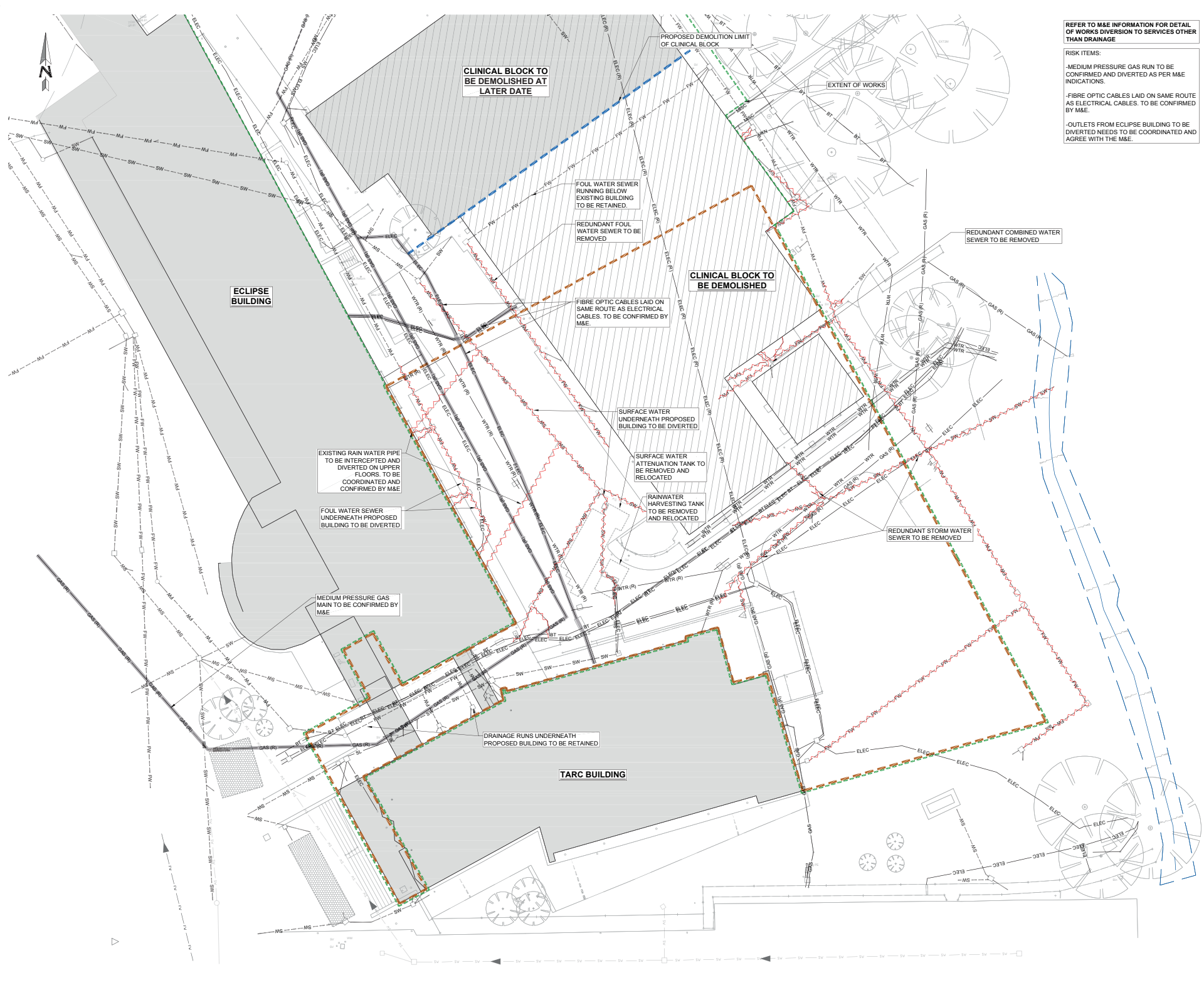
Drawing Status: PRELIMINARY

Project: ROYAL VETERINARY COLLEGE CAMPUS

Title: PROPOSED DRAINAGE LAYOUT

Drawing No: 170344-X-00-DR-C-1000

Date: MAY' 2018
Scale: 1:200
Drawn: RAD
Engineer: MO
Project No: 170344
Revision: P2



REFER TO M&E INFORMATION FOR DETAIL OF WORKS DIVERSION TO SERVICES OTHER THAN DRAINAGE

RISK ITEMS:

-MEDIUM PRESSURE GAS RUN TO BE CONFIRMED AND DIVERTED AS PER M&E INDICATIONS.

-FIBRE OPTIC CABLES LAID ON SAME ROUTE AS ELECTRICAL CABLES. TO BE CONFIRMED BY M&E.

-OUTLETS FROM ECLIPSE BUILDING TO BE DIVERTED NEEDS TO BE COORDINATED AND AGREE WITH THE M&E.

GENERAL NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALIST DRAWINGS AND SPECIFICATIONS
2. DO NOT SCALE FROM THIS DRAWING IN EITHER PAPER OR DIGITAL FORM. USE WRITTEN DIMENSIONS ONLY.
3. HEALTH AND SAFETY: THE WORKS SHALL BE CARRIED OUT BY SPECIALIST COMPETENT AND EXPERIENCED CONTRACTORS WHO ARE MEMBERS OF A RECOGNISED NATIONAL ORGANISATION.OPERATIVES SHALL HAVE RECEIVED FULL AND APPROPRIATE TRAINING FOR THE OPERATIONS THEY ARE TO UNDERTAKE. ALL WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH ALL PERTINENT HEALTH AND SAFETY REGULATIONS.
3. THIS DRAWING HAS BEEN BASED ON THE FOLLOWING INFORMATION:
   - AECOM IN JULY 2018 ADDED TO TOPOGRAPHICAL SURVEY INFORMATION CARRIED OUT BY CUBE SURVEYS. REF: CUB-RBS-RVC-001/002
   - IN FEBRUARY 2018 & CCTV SURVEY INFORMATION BY LASER SURVEYS IN JUNE 2018. REF:G 9018/1
   - REFERENCE TO CONISBEE TaRC BUILDING DRAINAGE LAYOUT REV C7, MAY 2011 HAS BEEN MADE.
4. GROUND CONDITIONS AND DETAILS OR ANY CONTAMINATION THAT MAY BE PRESENT TO BE CONFIRMED ONCE SITE INVESTIGATION REPORT HAS BEEN RECEIVED FROM GEA.

EXISTING SITE FEATURES

- EXISTING BUILDING TO BE RETAINED
- EXISTING BUILDING TO BE DEMOLISHED
- EXISTING BUILDING TO BE DEMOLISHED AT LATER DATE
- EXISTING TREE
- EXISTING TANK TO BE REMOVED
- EXISTING TANK TO BE KEPT
- EXISTING DITCH

LEGEND

- PROPOSED BUILDING OUTLINE
- PROPOSED WORKS EXTENSION
- PROPOSED DEMOLITION LIMIT
- ELEC — ELECTRIC FROM SURVEY
- ELEC (R) — ELECTRIC FROM RECORDS
- WTR — WATER FROM SURVEY
- WTR (R) — WATER FROM RECORDS
- GAS — GAS FROM SURVEY
- GAS (R) — GAS FROM RECORDS
- BT — BT FROM SURVEY
- BT (R) — BT FROM RECORDS
- SL — STREET LIGHTING FROM SURVEY
- SW — SW — EXISTING SURFACE WATER SEWER FROM CCTV SURVEY
- FW — FW — EXISTING FOUL WATER SEWER FROM CCTV SURVEY
- CW — CW — EXISTING COMBINED WATER SEWER FROM CCTV SURVEY
- EXISTING SEWER TO BE REMOVED OR ABANDONED

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Rev	Date	Description	Drawn	Check
P2	02.11.18	STAGE 3	MO	TG
P1	18.07.18	ISSUED FOR INFORMATION	MO	TG

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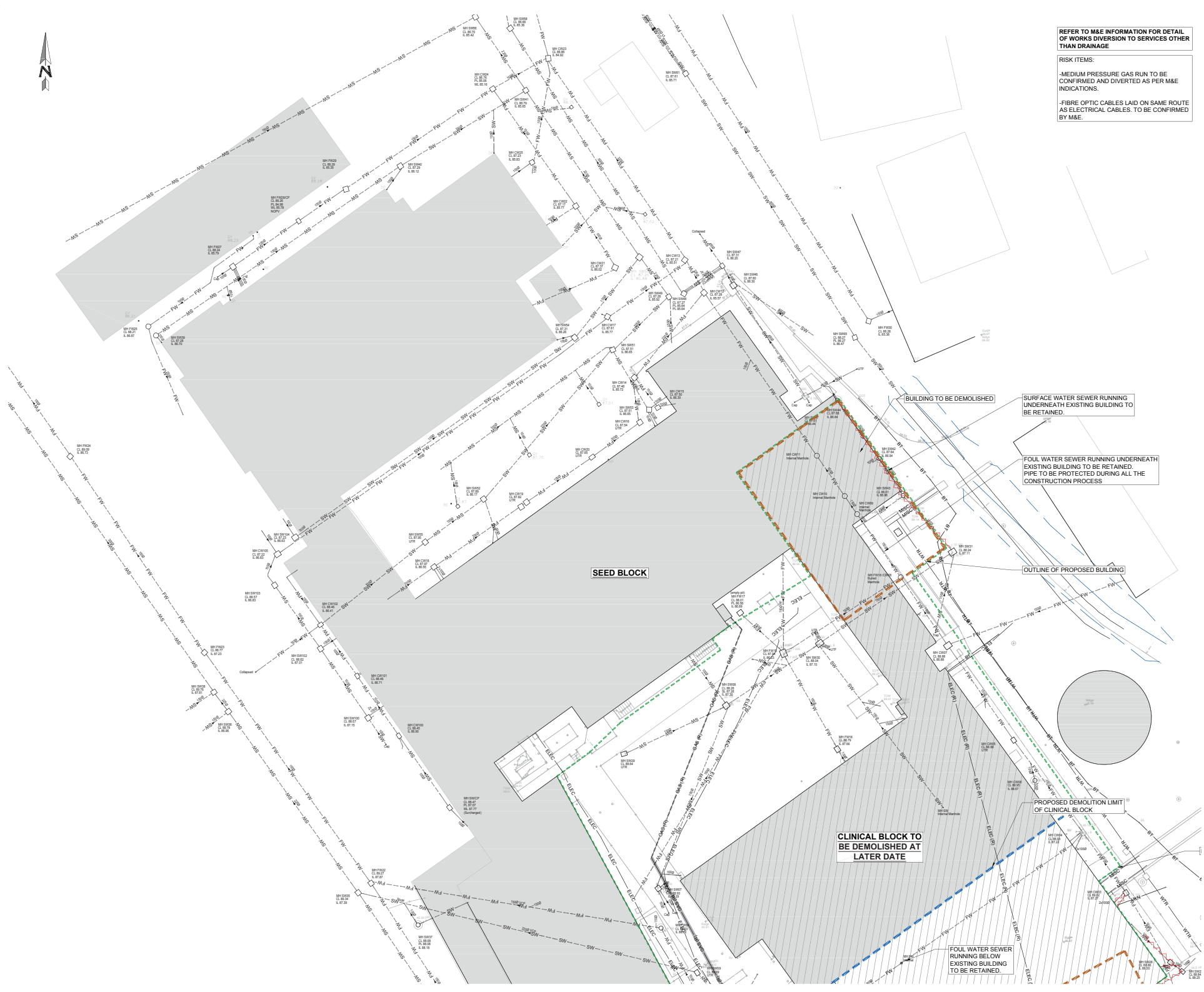
Drawing Status
PRELIMINARY

Project
ROYAL VETERINARY COLLAGE CAMPUS

Title
SITE CONSTRAINTS PLAN - SHEET 1

Drawing No
170344-X-00-DR-C-1200

Date MAY' 2018
Scale 1:200
Drawn RAD
Engineer MO
Project No 170344
Revision P2



REFER TO M&E INFORMATION FOR DETAIL OF WORKS DIVERSION TO SERVICES OTHER THAN DRAINAGE

RISK ITEMS:

-MEDIUM PRESSURE GAS RUN TO BE CONFIRMED AND DIVERTED AS PER M&E INDICATIONS.

-FIBRE OPTIC CABLES LAID ON SAME ROUTE AS ELECTRICAL CABLES. TO BE CONFIRMED BY M&E.

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   - IN FEBRUARY 2018 & CCTV SURVEY INFORMATION BY LASER SURVEYS IN JUNE 2018. REF:G 9018/1
   - REFERENCE TO CONISBEE TaRC BUILDING DRAINAGE LAYOUT REV C7, MAY 2011 HAS BEEN MADE.
4. GROUND CONDITIONS AND DETAILS OR ANY CONTAMINATION THAT MAY BE PRESENT TO BE CONFIRMED ONCE SITE INVESTIGATION REPORT HAS BEEN RECEIVED FROM GEA.

EXISTING SITE FEATURES

- EXISTING BUILDING TO BE RETAINED
- EXISTING BUILDING TO BE DEMOLISHED
- EXISTING BUILDING TO BE DEMOLISHED AT LATER DATE
- EXISTING TREE
- EXISTING TANK TO BE REMOVED
- EXISTING TANK TO BE KEPT
- EXISTING DITCH

LEGEND

- PROPOSED BUILDING OUTLINE
- PROPOSED WORKS EXTENSION
- PROPOSED DEMOLITION LIMIT
- ELEC — ELECTRIC FROM SURVEY
- ELEC (R) — ELECTRIC FROM RECORDS
- WTR — WATER FROM SURVEY
- WTR (R) — WATER FROM RECORDS
- GAS — GAS FROM SURVEY
- GAS (R) — GAS FROM RECORDS
- BT — BT FROM SURVEY
- BT (R) — BT FROM RECORDS
- SL — STREET LIGHTING FROM SURVEY
- SW — SW — EXISTING SURFACE WATER SEWER FROM CCTV SURVEY
- FW — FW — EXISTING FOUL WATER SEWER FROM CCTV SURVEY
- CW — CW — EXISTING COMBINED WATER SEWER FROM CCTV SURVEY
- EXISTING SEWER TO BE REMOVED OR ABANDONED

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Rev	Date	Description	Drawn	Check
P2	02.11.18	STAGE 3	MO	TG
P1	18.07.18	STAGE ISSUE	MO	TG

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Drawing Status: PRELIMINARY

Project: ROYAL VETERINARY COLLAGE CAMPUS

Title: SITE CONSTRAINTS PLAN - SHEET 2

Drawing No: 170344-X-00-DR-C-1201

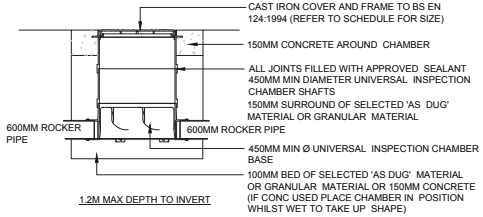
Date	JUL' 2018
Scale	1:200
Drawn	RAD
Engineer	MO
Project No	170344
Revision	P2

TABLE 11 MIN. DIMENSIONS FOR ACCESS FITTINGS AND INSPECTION CHAMBERS					
TYPE	DEPTH TO INVERT FROM COVER LEVEL (M)	INTERNAL SIZES		COVER SIZES	
		RECTANGULAR LENGTH AND WIDTH	CIRCULAR DIAMETER	RECTANGULAR LENGTH AND WIDTH	CIRCULAR DIAMETER
RODDING EYE		AS DRAIN BUT MIN 100			SAME SIZE AS PIPEWORK (1)
ACCESS FITTINGS	0.6 OR LESS, EXCEPT WHERE SITUATED IN A CHAMBER				
SMALL 150 DIA / 150X100		150X100	150	150X100 (1)	SAME SIZE AS ACCESS FITTING
LARGE 225X100		225X100	225	225X100 (1)	
INSPECTION CHAMBER SHALLOW	0.6 OR LESS	225X100	190 (2)	-	190 (1)
	1.2 OR LESS	450X450	450	MIN 430X430	430
DEEP	>1.2 BUT <3.0	450X450	450	MAX 300X300 (3)	ACCESS RESTRICTED TO MAX 350 (3)

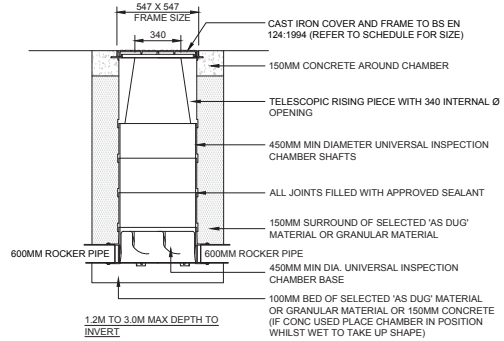
NOTES:
(1) THE CLEAR OPENING MAY BE REDUCED BY 20MM IN ORDER TO PROVIDE PROPER SUPPORT FOR THE COVER AND FRAME.
(2) DRAINS UPTO 150MM.
(3) A LARGER CLEAR OPENING MAY BE USED IN CONJUNCTION WITH A RESTRICTED ACCESS. THE SIZE IS RESTRICTED FOR HEALTH AND SAFETY REASONS TO DETER ENTRY.

TABLE 12 MINIMUM DIMENSIONS FOR MANHOLES					
TYPE	SIZE OF LARGEST PIPE (DN)	MIN. INTERNAL DIMENSIONS (1) RECTANGULAR LENGTH AND WIDTH	CIRCULAR DIAMETER	MIN. CLEAR OPENING SIZE (1) RECTANGULAR LENGTH AND WIDTH	CIRCULAR DIAMETER
MANHOLE <1.5M DEEP TO SOFFIT	<= 150	750 X 675 (7)	1000 (7)	750 X 675 (2)	NA (3)
	225	1200 X 675	1200	1200 X 675 (2)	
	300	1200 X 750	1200		
	>300	1800 X (DN+450)	THE LARGER OF 1800 OR (DN+450)		
>1.5M DEEP TO SOFFIT	<= 225	1200 X 1000	1200	600 X 600	600
	300	1200 X 1075	1200		
	375-450	1350 X 1225	1200		
	>450	1800 X (DN+775)	THE LARGER OF 1800 OR (DN+775)		
MANHOLE SHAFT (4)	STEPS (5)	1050 X 800	1050	600 X 600	600
>3.0M DEEP TO SOFFIT OF PIPE	LADDER (5)	1200 X 800	1200		
	WINCH (6)	900 X 800	900	600 X 600	600

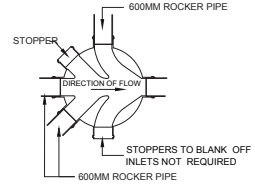
NOTES:
(1) LARGER SIZES MAY BE REQUIRED FOR MANHOLES ON BENDS OR WHERE THERE ARE JUNCTIONS.
(2) MAY BE REDUCED TO 600 BY 600 WHERE REQUIRED BY HIGHWAY LOADING CONSIDERATIONS, SUBJECT TO A SAFE SYSTEM OF WORK BEING SPECIFIED.
(3) NOT APPLICABLE DUE TO WORKING SPACE NEEDED.
(4) MINIMUM HEIGHT OF CHAMBER IN SHAFTED MANHOLE 2M FROM BENCHING TO UNDERSIDE OF REDUCING SLAB.
(5) MIN CLEAR SPACE BETWEEN LADDER OR STEPS AND THE OPPOSITE FACE OF THE SHAFT SHOULD BE APPROXIMATELY 900MM.
(6) WINCH ONLY - NO STEPS OF LADDERS, PERMANENT OR REMOVABLE.
(7) THE MINIMUM SIZE OF ANY MANHOLE SERVING A SEWER (I.E. ANY DRAIN SERVING MORE THAN ONE PROPERTY) SHOULD BE 1200MM X 675MM RECTANGULAR OR 1200MM DIAMETER.

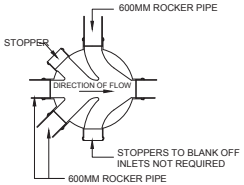


1.2M MAX DEPTH TO INVERT



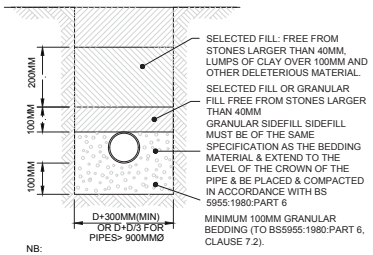
1.2M TO 3.0M MAX DEPTH TO INVERT





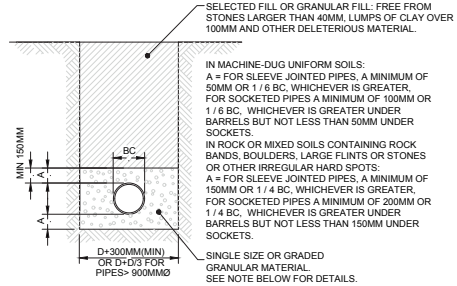
TYPICAL 450Ø PPIC INSPECTION CHAMBER DETAIL

SCALE 1:20



BEDDING DETAIL FOR FLEXIBLE PIPES

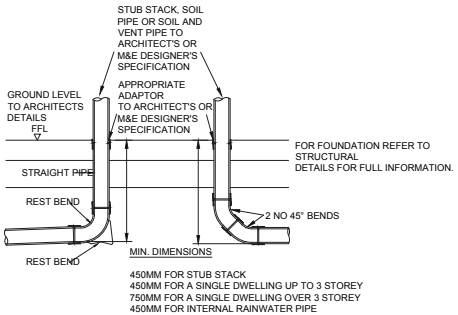
SCALE 1:20



NB:
GRANULAR MATERIAL - GRANULAR MATERIAL SHOULD CONFORM TO BS EN 1610 ANNEX B TABLE B.15 AND SHOULD BE SINGLE SIZE MATERIAL OR GRADED MATERIAL FROM 5MM UP TO A MAXIMUM SIZE 10MM FOR 100MM PIPES, 14MM FOR 150MM PIPES, 20MM FOR PIPES FROM 150MM UP TO 600MM DIAMETER. COMPACTION FRACTION MAXIMUM 0.3 FOR CLASS N OR B AND 0.15 FOR CLASS F.

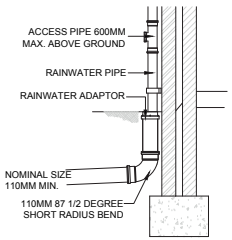
BEDDING TYPES DETAILS FOR RIGID PIPES

SCALE 1:20



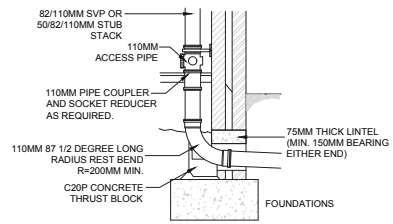
STUB STACK, SOIL VENT PIPE & INTERNAL RAINWATER PIPE DETAIL

SCALE 1:20



EXTERNAL RAINWATER PIPE TO DRAIN

SCALE 1:20



SOIL & VENT PIPE CONNECTION & STUB STACK CONNECTION

SCALE 1:20

GENERAL NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALIST DRAWINGS AND SPECIFICATIONS
2. DO NOT SCALE FROM THIS DRAWING IN EITHER PAPER OR DIGITAL FORM. USE WRITTEN DIMENSIONS ONLY.

DRAINAGE DETAIL NOTES

1. CDM NOTE: ALL PIPEWORK, SILT TRAPS, CATCHPITS, TRAPPED GULLIES, ATTENUATION TANKS AND PUMP CHAMBERS TO BE REGULARLY INSPECTED EVERY THREE MONTHS AND CLEARED OUT ON A REGULAR FREQUENCY FOR THE FIRST NINE MONTHS. AFTER THIS PERIOD THE FREQUENCY CAN BE REDUCED TO EVERY SIX MONTHS. PUMP SETS TO BE INSPECTED AND MAINTAINED IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE MANUFACTURER/PUMP PROVIDER. POROUS SURFACE TO BE REGULARLY SWEPT THREE TIMES A YEAR TO REMOVE THE SILT. GREASE TRAPS/INTERCEPTORS ARE TO BE INSTECTED/EMPTIED AT LEAST ONCE A MOTH AND, PREFERABLY, EVERY TWO WEEKS.
2. HEALTH AND SAFETY: THE WORKS SHALL BE CARRIED OUT BY SPECIALIST COMPETENT AND EXPERIENCED CONTRACTORS WHO ARE MEMBERS OF A RECOGNISED NATIONAL ORGANISATION.OPERATIVES SHALL HAVE RECEIVED FULL AND APPROPRIATE TRAINING FOR THE OPERATIONS THEY ARE TO UNDERTAKE. ALL WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH ALL PERTINENT HEALTH AND SAFETY REGULATIONS.
3. REFER TO THE MANUFACTURER'S INSTALLATION GUIDANCE FOR ALL SPECIFIED PRODUCTS.

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Rev	Date	Description	Drawn	Check
P1	02.11.18	PRELIMINARY ISSUE	TB	MO

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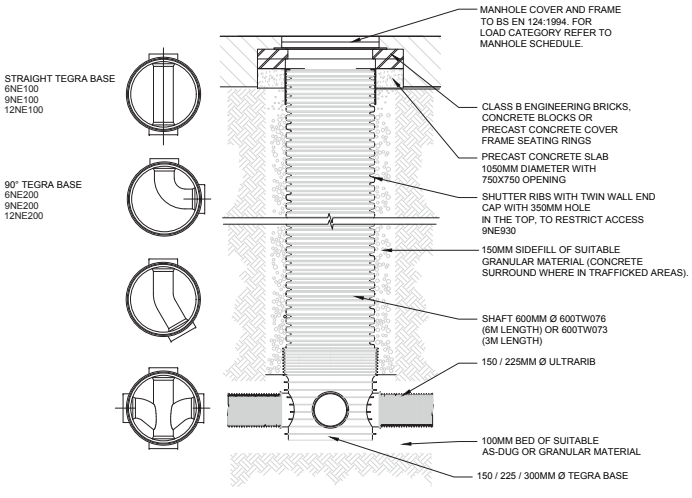
Drawing Status: PRELIMINARY

Project: ROYAL VETERINARY CAMPUS HATFIELD AL9 7TA

Title: DRAINAGE DETAILS SHEET 1

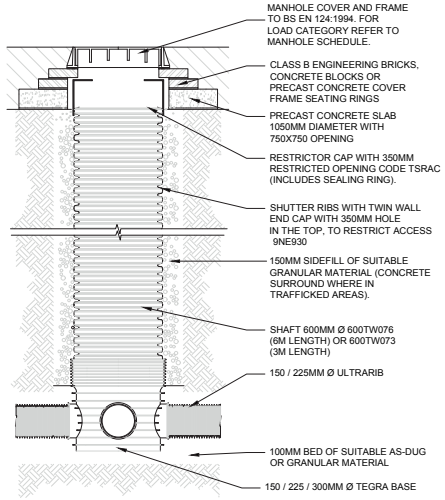
Drawing No: **170344-X-00-DR-C-1300**

Date: MAY 2018
Scale: AS SHOWN
Drawn: TB
Engineer: TG
Project No: **170344**
Revision: **01**



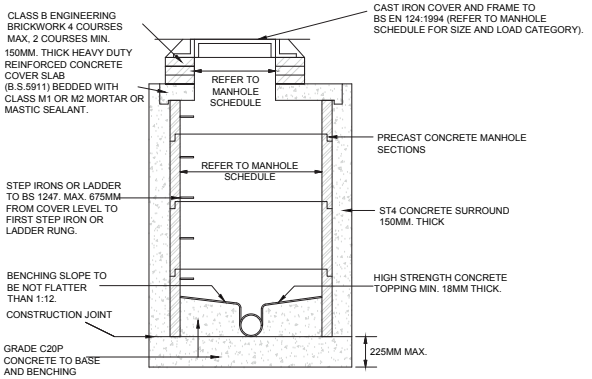
TYPICAL 600Ø PPIC INSPECTION CHAMBER DETAIL 1.2M - 5M DEPTH TO INVERT

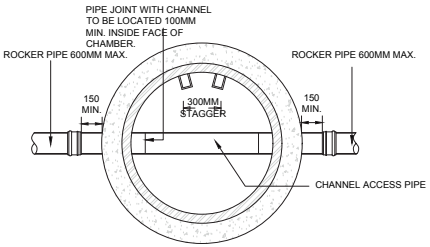
SCALE 1:20



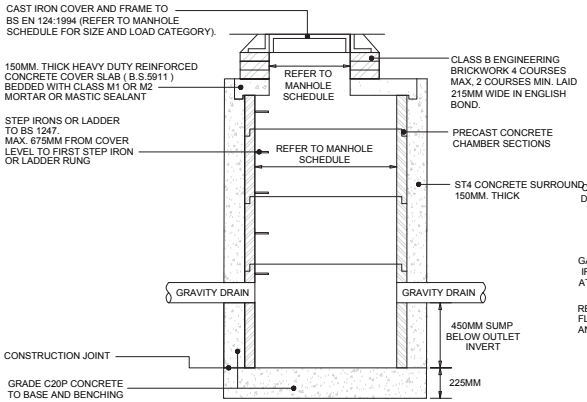
TYPICAL 600Ø PPIC INSPECTION CHAMBER DETAIL 1.2M MAX DEPTH TO INVERT

SCALE 1:20



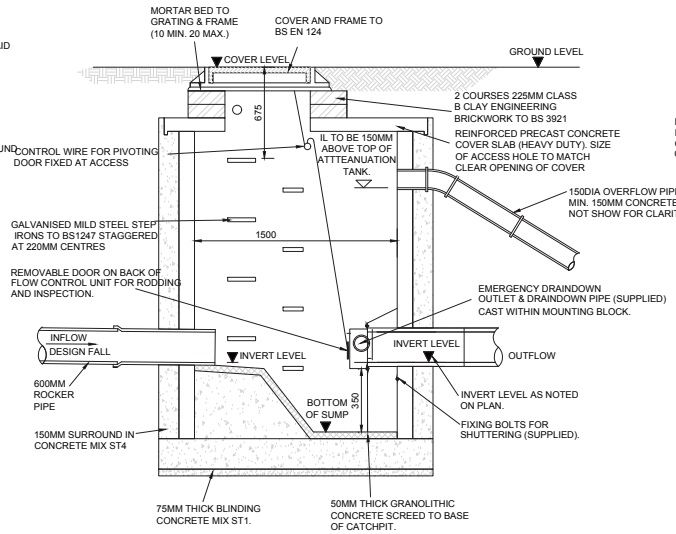


P.C.C. MANHOLE

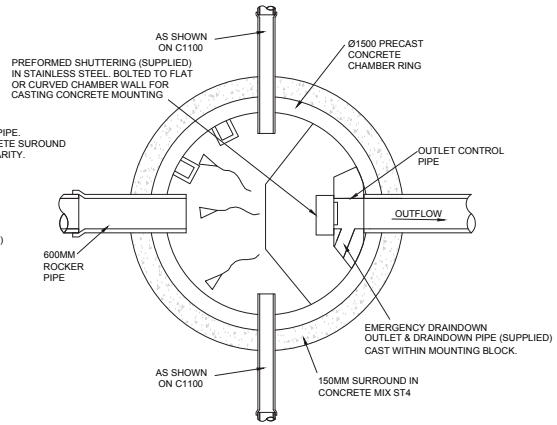


CATCHPIT MANHOLE

SCALE 1:20



SECTION



PLAN

Ø1500 PRIVATE HYDROBRAKE CONTROL CHAMBER

(N.T.S.)

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P1	02.11.18	PRELIMINARY ISSUE	TB	MO

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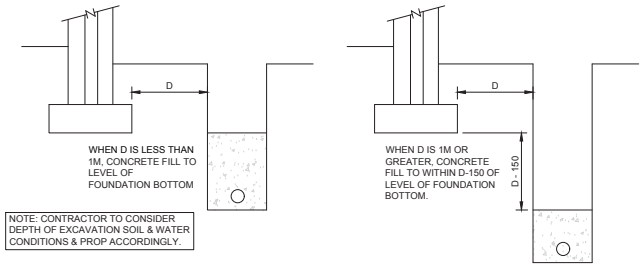
Drawing Status: PRELIMINARY

Project: ROYAL VETERINARY CAMPUS HATFIELD AL9 7TA

Title: DRAINAGE DETAILS SHEET 2

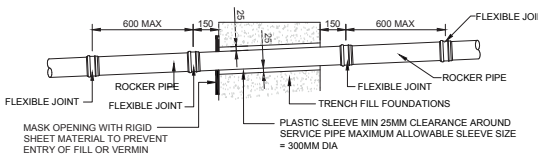
Drawing No: **170344-X-00-DR-C-1301**

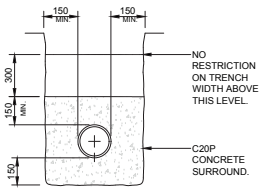
Date: MAY 2018
Scale: AS SHOWN
Drawn: TB
Engineer: TG
Project No: **170344**
Revision: **01**



PIPES NEAR BUILDINGS

SCALE NTS



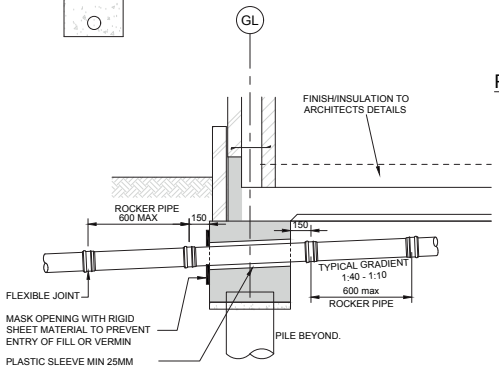


PIPE BEDDING (CLASS Z)

(FLEXIBLE JOINTS AT NOT GREATER THAN 8M CENTRES TO COINCIDE WITH OUTER FACE OF PIPE SOCKET)

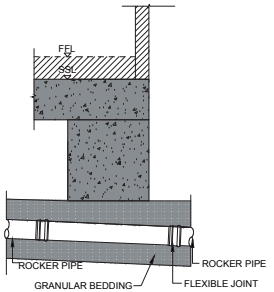
PIPES PASSING THROUGH FOUNDATIONS

SCALE 1:20



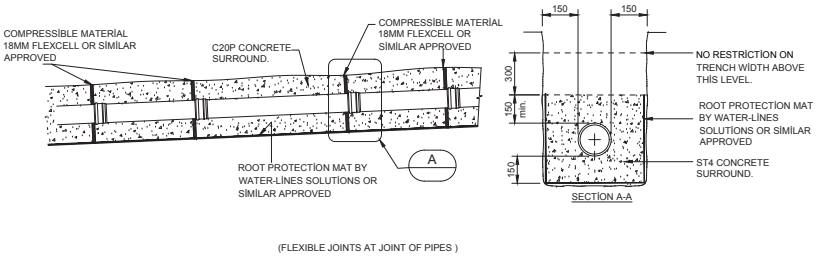
TYPICAL PIPE PASSING THROUGH GROUND BEAMS

SCALE 1:20



PIPE UNDER GROUND BEAM

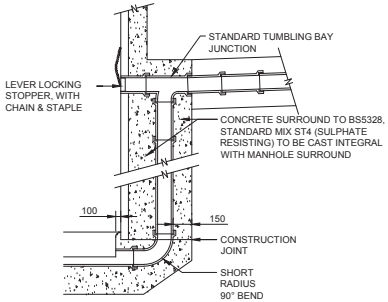
SCALE 1:20



(FLEXIBLE JOINTS AT JOINT OF PIPES)

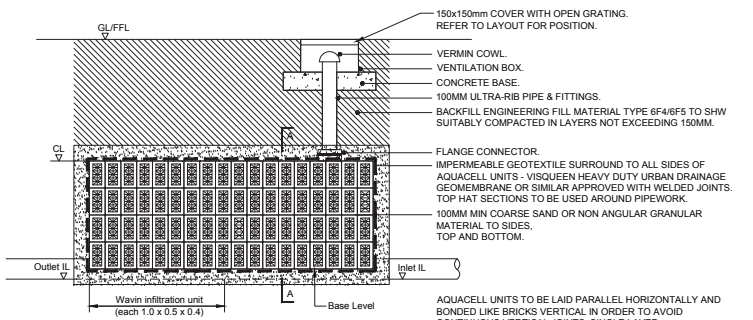
PIPE PROTECTION AGAINST ROOT INTRUSION

SCALE NTS



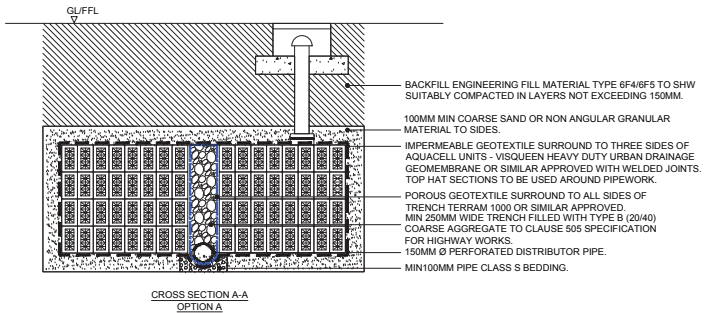
TYPICAL VERTICAL BACKDROP DETAIL

SCALE 1:20



For size and levels refer to Drainage Layout C100.

AQUACELL UNITS TO BE LAID PARALLEL HORIZONTALLY AND BONDED LIKE BRICKS VERTICAL IN ORDER TO AVOID CONTINUOUS VERTICAL JOINTS. SINGLE LAYER APPLICATIONS SHOULD BE FIXED USING WAVIN CLIPS AND MULTI LAYER APPLICATIONS SHOULD BE FIXED USING SHEAR CONNECTORS AND CLIPS. ALL IN ACCORDANCE WITH MANUFACTURERS DETAILS.



CROSS SECTION A-A
OPTION A

ATTENUATION TANK

NTS

GENERAL NOTES

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Drawing Status: PRELIMINARY

Project: ROYAL VETERINARY CAMPUS HATFIELD AL9 7TA

Title: DRAINAGE DETAILS SHEET 3

Drawing No: **170344-X-00-DR-C-1302**

Date: MAY 2018
Scale: AS SHOWN
Drawn: TB
Engineer: TG
Project No: **170344**
Revision: **01**

PILING SCHEDULE

REF.	DIAMETER (mm)	EASTINGS (m)	NORTHINGS (m)	CUT OFF LEVEL (m)	VERTICAL LOAD (kN)	HORIZONTAL LOAD (kN)
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P3	600				700	15
P4	600				700	15
P5	600				700	15
P6	600				700	15
P7	600				700	15
P8	600				700	15
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PILING SCHEDULE

REF.	DIAMETER (mm)	EASTINGS (m)	NORTHINGS (m)	CUT OFF LEVEL (m)	VERTICAL LOAD (kN)	HORIZONTAL LOAD (kN)
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P271	600				700	15
P272	600				700	15
P273	600				700	15
P274	600				700	15
P275	600				700	15
P276	600				700	15
P277	600				700	15
P278	600				700	15

PILING SCHEDULE

REF.	DIAMETER (mm)	EASTINGS (m)	NORTHINGS (m)	CUT OFF LEVEL (m)	VERTICAL LOAD (kN)	HORIZONTAL LOAD (kN)
P279	600				700	15
P280	600				700	15
P281	600				700	15
P282	600				700	15
P283	600				700	15
P284	600				700	15
P285	600				700	15
P286	600				700	15
P287	600				700	15
P288	600				700	15
P289	600				700	15
P290	600				700	15
P291	600				700	15
P292	600				700	15
P293	600				700	15
P294	600				700	15
P295	600				700	15
P296	600				700	15
P297	600				700	15
P298	600				700	15
P299	600				700	15
P300	600				700	15
P301	600				700	15
P302	600				700	15
P303	600				700	15
P304	600				700	15
P305	600				700	15

GENERAL NOTES

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PILING NOTES

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2. NO PILING SHOULD COMMENCE ON SITE UNTIL THE DESIGN IS REVIEWED BY CONISBEE.
3. THE CONTRACTOR SHOULD ALLOW TO PROBE EACH PILE POSITION TO ENSURE THERE ARE NO OBSTRUCTIONS THAT MAY DELAY THE PILING WORKS OR CAUSE PILING POSITIONS TO BE MOVED. IF NECESSARY, REMOVE OBSTRUCTIONS AND REPLACE THEM WITH SUITABLE BACKFILL.
4. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL SERVICES ON SITE BEFORE SITE WORKS COMMENCE.
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6. THE CONTRACTOR SHOULD ALLOW FOR PROVIDING A PILING MAT SUITABLE FOR THE GROUND CONDITIONS AND THE RIG PROPOSED TO CARRY OUT THE WORKS.
7. ALL PILING OPERATIONS ARE TO BE IN ACCORDANCE WITH BS 8004 : 1986, AND CONISBEE PILE SPECIFICATION.
8. ALL PILES TO BE MAXIMUM 600 DIAMETER.
9. PILE REINFORCEMENT SHALL PROJECT A MINIMUM OF 600mm OR 40x BAR DIA ABOVE PILE CUT OFF LEVEL, AND SHALL BE BENT OVER INTO ADJOINING RC STRUCTURE.
10. THE ENGINEER SHALL BE ADVISED IMMEDIATELY OF ANY PILE DISPLACEMENT, ON PLAN, OF GREATER THAN PLUS OR MINUS 75mm.
11. ALL PILES ARE TO BE DESIGNED FOR A FACTOR OF SAFETY OF 2.5 TO BS 8004 "CODE OF PRACTICE FOR FOUNDATIONS" UNLESS PILE LOAD TESTS ARE CARRIED OUT. THE SAFETY FACTOR MAY BE REDUCED IN ACCORDANCE WITH THE GUIDANCE IN LDSA FOUNDATIONS NO 1, SO LONG AS THE DESIGN AND SITE REQUIREMENTS ARE STRICTLY ADHERRED TO.
12. ALL PILES ARE TO BE INTEGRITY TESTED TO ENSURE THEY ARE FREE OF ANY SIGNIFICANT DEFECT. STATIC LOAD TEST ARE TO BE CARRIED AT A RATE OF ONE TEST PER 100 PILES.
13. A MINIMUM OF 2 CONCRETE TEST CUBES ARE TO BE TAKEN DAILY FROM EACH CONCRETE MIX IN USE THAT DAY, FOR CRUSHING AT 7 AND 28 DAYS.
14. CONCRETE BELOW GROUND TO COMFORM TO ACEC CLASS AC-2 AND DESIGN SULPHATE CLASS DS-2.
15. PILES TO BE DESIGNED TO RESIST POTENTIAL UPLIFT FORCES DUE TO HEAVE - SEE SITE INVESTIGATION REPORT FOR DETAILS OF GROUND CONDITIONS.
16. PILES TO HAVE 75mm EMBEDMENT INTO PILE CAPS & 50mm INTO GROUND BEAMS.

NOTE: THE ENVIRONMENT AGENCY (EA) WILL ONLY PERMIT CFA PILES ON THIS SITE AS IT LIES WITHIN SOURCE PROTECTION ZONE 1.

THE PILE DESIGN WILL NEED TO BE SUBMITTED TO THE EA FOR APPROVAL.

PILES MUST NOT EXTEND INTO THE CHALK STRATA AND MUST BE FOUNDED IN THE STRATA ABOVE IT.

NOT FOR CONSTRUCTION

Rev	Date	Description	Drawn	Check
P2	05.11.18	STAGE 3 ISSUE	BP	BP
P1	02.11.18	STAGE 3 ISSUE	JD	BP

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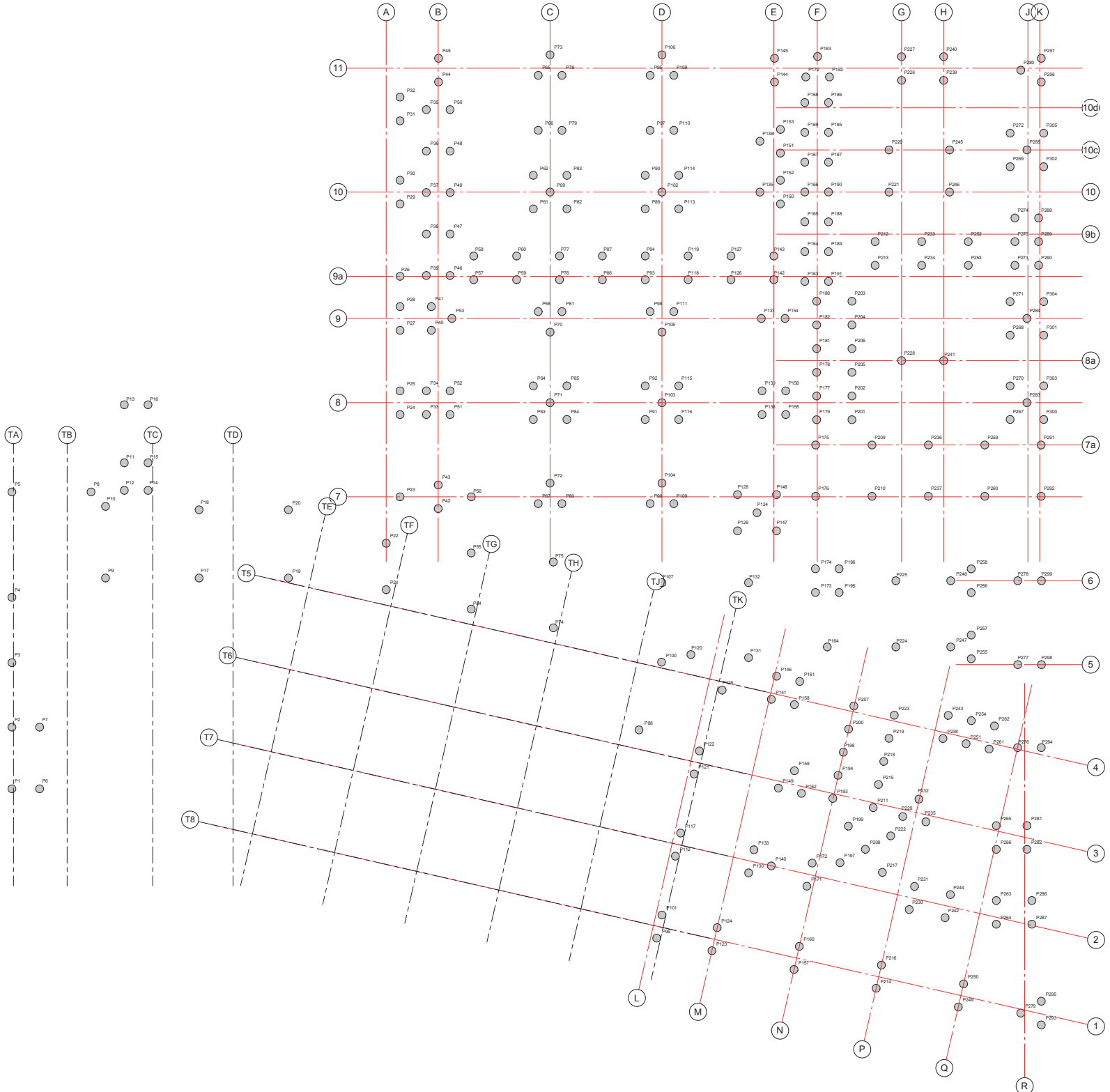
Drawing Status: STAGE 3

Project: RVC - HAWKSHEAD CAMPUS REDEVELOPMENT

Title: PILING SCHEDULE

Drawing No: 170344-CON-X-PL-SH-S-1096

Date: JULY 2018
Scale: @A0
Drawn: JD
Engineer: BP
Project No: 170344
Revision: P2



GENERAL NOTES

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8. ALL PILES TO BE MAXIMUM 600 DIAMETER.
9. PILE REINFORCEMENT SHALL PROJECT A MINIMUM OF 600mm OR 40x BAR DIA ABOVE PILE CUT OFF LEVEL, AND SHALL BE BENT OVER INTO ADJOINING RC STRUCTURE.
10. THE ENGINEER SHALL BE ADVISED IMMEDIATELY OF ANY PILE DISPLACEMENT, ON PLAN, OF GREATER THAN PLUS OR MINUS 75mm.
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NOT FOR CONSTRUCTION

Rev	Date	Description	Drawn	Check
P2	05.11.18	STAGE 3 ISSUE	BP	BP
P1	02.11.18	STAGE 3 ISSUE	JD	BP

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Drawing Status: STAGE 3

Project: RVC - HAWKSHEAD CAMPUS REDEVELOPMENT

Date: JULY 2018

Scale: 1 : 100@A0

Drawn: JD

Engineer: BP

Title: PROPOSED PILING PLAN

Project No: **170344**

Drawing No: **170344-CON-X-PL-DR-S-1097**

Revision: **P2**

GENERAL NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALIST DRAWINGS AND SPECIFICATIONS.
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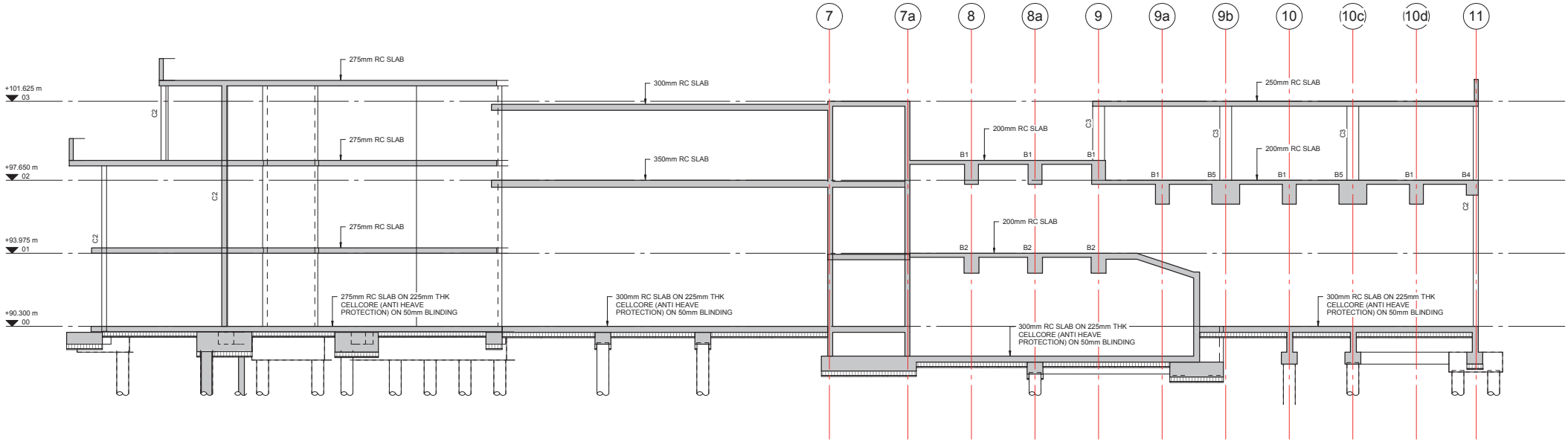
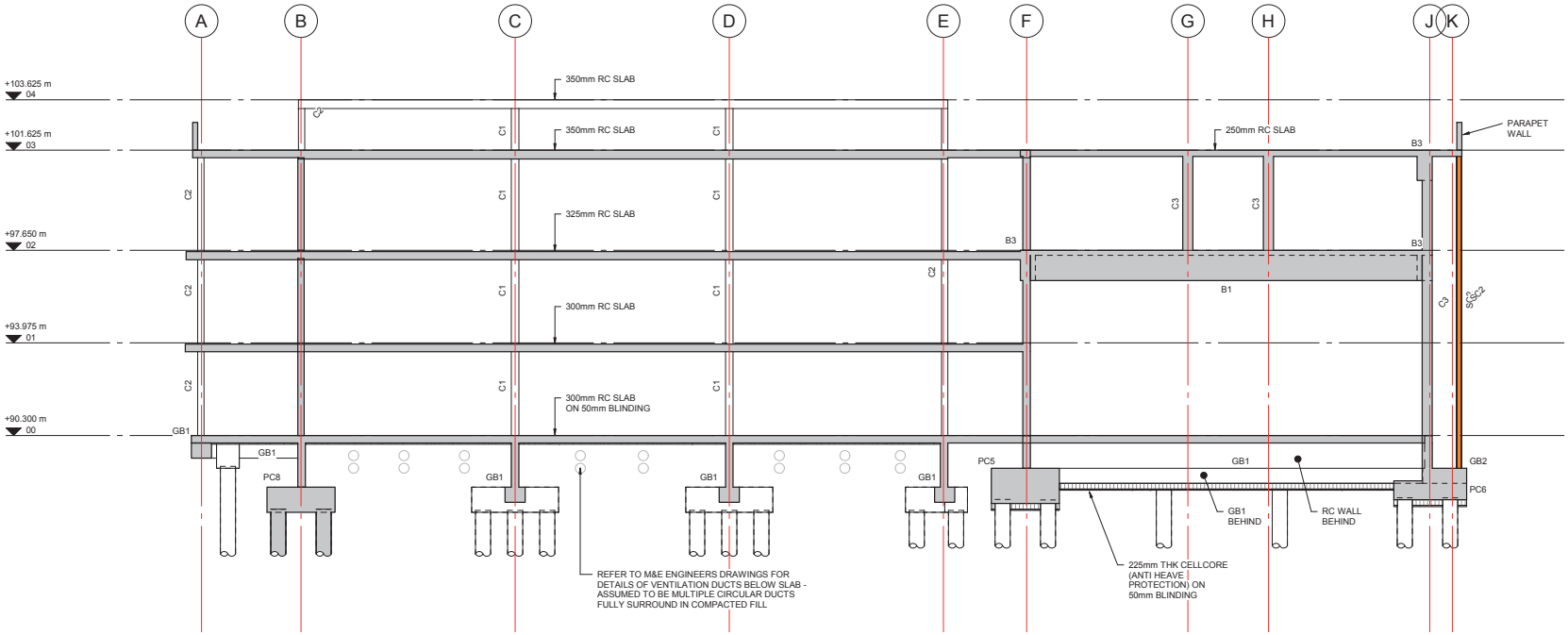


1 SECTION 1-1
1 : 100



2 SECTION 2-2
1 : 100

RC COLUMN SCHEDULE	
MARK	DESCRIPTION
C1	300x700 RC COLUMN
C2	250x500 RC COLUMN
C3	400x600 RC COLUMN
C4	250x600 RC COLUMN
C5	500x500 RC COLUMN

RC BEAM SCHEDULE	
MARK	DESCRIPTION
B1	700x1200 DEEP RC BEAM
B2	750x1000 DEEP RC BEAM
B3	600x1200 DEEP RC BEAM
B4	600x750 DEEP RC BEAM
B5	1400x1200 DEEP RC BEAM

NOT FOR CONSTRUCTION

Rev	Date	Description	Drawn	Check
P1	02.11.18	STAGE 3 ISSUE	JD	IP

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Drawing Status
STAGE 3

Project
RVC - HAWKSHEAD CAMPUS REDEVELOPMENT

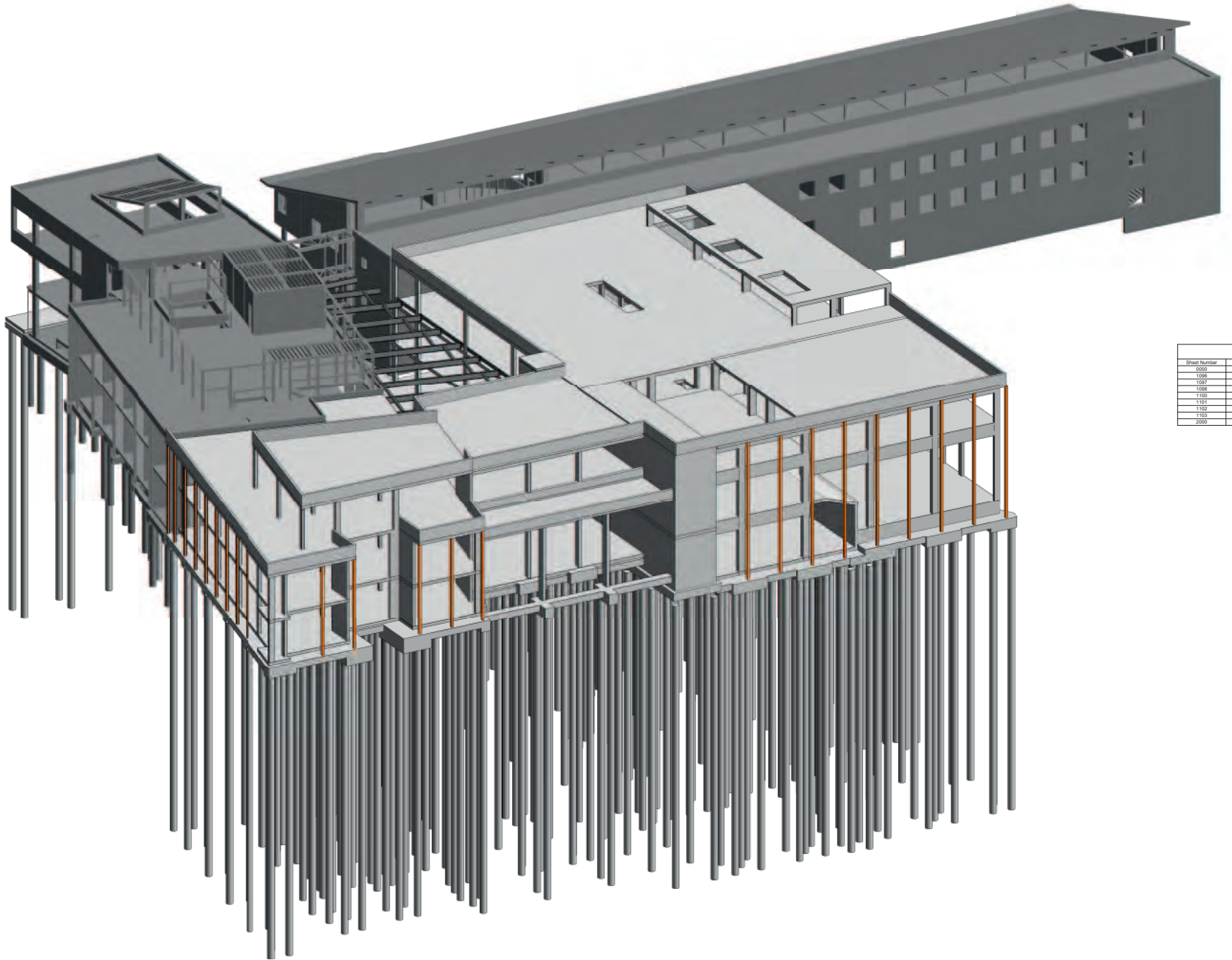
Title
BUILDING SECTIONS SHEET 1

Drawing No
170344-CON-X-XX-DR-S-2000

Date 10/31/18
Scale 1 : 100@A1
Drawn JD
Engineer IP
Project No 170344
Revision P1

RVC

HAWKSHEAD CAMPUS REDEVELOPMENT



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DRAWING SHEET LIST

Sheet Number	DRAWING NAME
0000	COVER SHEET
1096	PILING SCHEDULE
1097	PROPOSED PILING PLAN
1098	FOUNDATION PLAN
1100	GROUND FLOOR GENERAL ARRANGEMENT
1101	LEVEL 01 GENERAL ARRANGEMENT
1102	LEVEL 02 GENERAL ARRANGEMENT
1103	ROOF PLAN
2000	BUILDING SECTIONS SHEET 1

NOT FOR CONSTRUCTION

Rev	Date	Description	Drawn	Check
P2	02.11.18	STAGE 3 ISSUE	JD	IP
P1	24.07.18	STAGE 2 ISSUE	NL	IP

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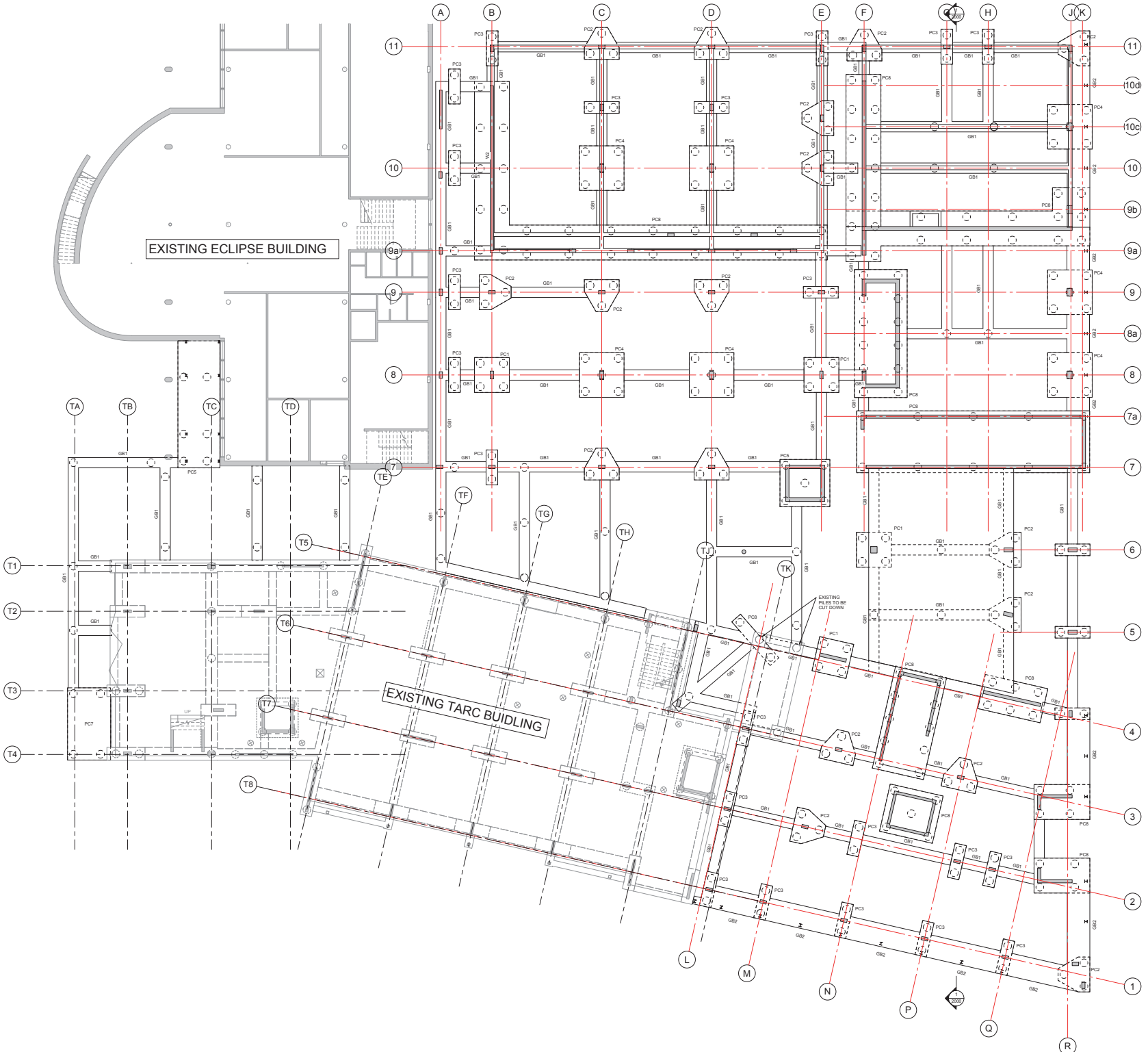
Drawing Status: STAGE 3

Project: RVC - HAWKSHEAD CAMPUS REDEVELOPMENT

Title: COVER SHEET

Drawing No: 170344-CON-X-XX-DR-S-0000

Date: 07/12/18
Scale: @A0
Drawn: NL
Engineer: IP
Project No: 170344
Revision: P2



RC GROUND BEAM SCHEDULE	
MARK	DESCRIPTION
GB1	600 DEEP RC GROUND BEAM

RC PILE CAP SCHEDULE	
MARK	DESCRIPTION
PC1	2700x2700x1000 DEEP RC PILE CAP
PC2	2700x2460x1000 DEEP RC PILE CAP
PC3	2100x750x1000 DEEP RC PILE CAP
PC4	3450x3450x1000 DEEP RC PILE CAP
PC5	1400 RC PILE CAP
PC7	450 RC PILE CAP
PC8	1000 RC PILE CAP

NOTE: ALLOW FOR 600mm DIA. x 10m DEEP CFA PILES. EXACT SIZE & DEPTH TO BE CONFIRMED UPON RECEIPT OF SITE INVESTIGATION REPORT & CONFIRMATION OF ANY RESTRICTIONS ON PILING ABOVE THE AQUIFER

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3. ALL WATERPROOFING AND FIRE PROJECTION TO RCHTECTS DETAILS AND SPECIFICATION.

REINFORCED CONCRETE NOTES

1. CONCRETE FOR ALL REINFORCED ELEMENTS IS TO BE GRADE RC32/40 TO BS 8500 PART 1.
2. MASS CONRETE FOR SUBSTRUCTURE ELEMENTS IS TO BE GRADE FND 4 TO BS 8500 PART 1.
3. REINFORCEMENT TO BE GRADE 500B HIGH YIELD TO BS 4449.
4. CONCRETE BELOW GROUND TO CONFORM TO ACEC CLASS AC-1 AND DESIGN SULPHATE CLASS DS-1.

PILING NOTES

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15. PILES TO BE DESIGNED TO RESIST POTENTIAL UPLIFT FORCES DUE TO HEAVE - SEE SITE INVESTIGATION REPORT FOR DETAILS OF GROUND CONDITIONS.
16. PILES TO HAVE 75mm EMBEDMENT INTO PILE CAPS & 50mm INTO GROUND BEAMS.

NOT FOR CONSTRUCTION

Rev	Date	Description	Drawn	Check
P3	05.11.18	STAGE 3 ISSUE	BP	BP
P2	02.11.18	STAGE 3 ISSUE	JO	IP
P1	24.07.18	STAGE 2 ISSUE	NL	IP

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Drawing Status: STAGE 3

Project: RVC - HAWKSHEAD CAMPUS REDEVELOPMENT

Date: JULY 2018

Scale: 1 : 100@A0

Drawn: NL

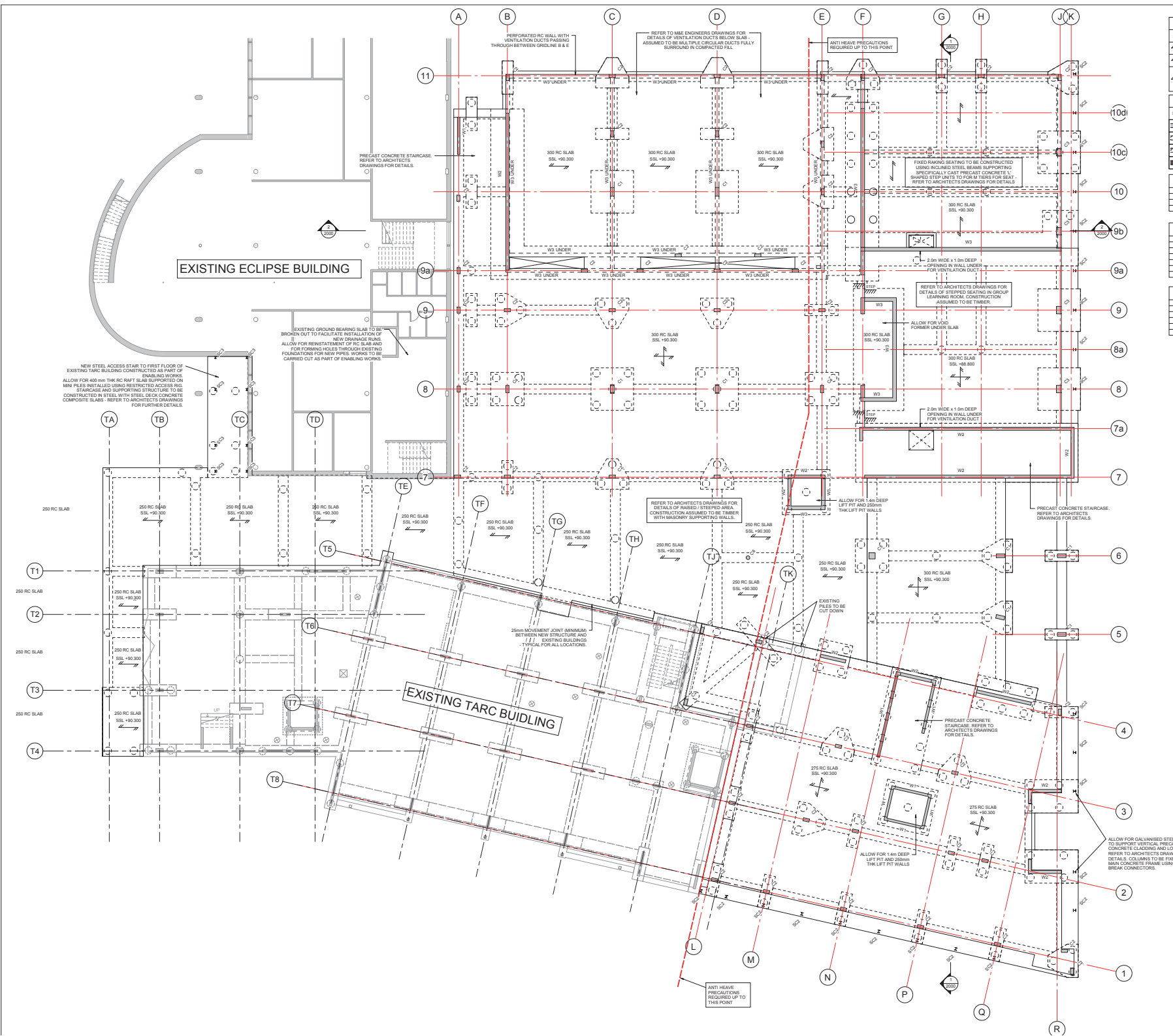
Engineer: IP

Title: FOUNDATION PLAN

Project No: 170344

Drawing No: 170344-CON-X-FN-DR-S-1098

Revision: P3



FLOOR CONSTRUCTION LEGEND	
SYMBOL	DESCRIPTION
	INDICATES ONE WAY SPAN OF RC SLAB. REFER TO PLANS FOR SLAB THICKNESS.
	INDICATES SPAN OF PC HOLLOWCORE FLOOR. REFER TO PLANS FOR SLAB THICKNESS.
	INDICATES TWO WAY SPAN OF RC SLAB. REFER TO PLANS FOR SLAB THICKNESS.

WALL LEGEND	
SYMBOL	DESCRIPTION
	INDICATES NEW RC WALL
	INDICATES NEW BLOCKWORK
	INDICATES NEW BRICKWORK
	INDICATES EXISTING STRUCTURE RETAINED

RC WALL SCHEDULE	
MARK	DESCRIPTION
W1	200 THICK RC WALL
W2	250 THICK RC WALL
W3	300 THICK RC WALL

RC COLUMN SCHEDULE	
MARK	DESCRIPTION
C1	300x700 RC COLUMN
C2	250x500 RC COLUMN
C3	400x600 RC COLUMN
C4	250x600 RC COLUMN
C5	500x500 RC COLUMN
C6	300 RC COLUMN

RC BEAM SCHEDULE	
MARK	DESCRIPTION
B1	700x1200 DEEP RC BEAM
B2	750x1000 DEEP RC BEAM
B3	600x1200 DEEP RC BEAM
B4	600x750 DEEP RC BEAM
B5	1400x1200 DEEP RC BEAM

GENERAL NOTES

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REINFORCED CONCRETE NOTES

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2. MASS CONCRETE FOR SUBSTRUCTURE ELEMENTS IS TO BE GRADE FND 4 TO BS 8500 PART 1.
3. REINFORCEMENT TO BE GRADE 500B HIGH YIELD TO BS 4449.
4. CONCRETE BELOW GROUND TO CONFORM TO ACEC CLASS AC-1 AND DESIGN SULPHATE CLASS DS-1.

STEELWORK NOTES

1. ALL STRUCTURAL STEEL TO BE GRADE S355 UNLESS NOTED OTHERWISE.
2. ALL MATERIALS AND WORKMANSHIP SHALL COMPLY WITH THE NATIONAL STRUCTURAL STEELWORK SPECIFICATION FOR BUILDING CONSTRUCTION.
3. THE STEELWORK FABRICATOR IS RESPONSIBLE FOR THE DETAILED DESIGN OF ALL STEEL CONNECTIONS INCLUDING BASE PLATE.
4. ALL EXTERNAL STEELWORK TO BE GALVANISED.

LIGHT GAUGE STEEL (LGS) NOTES:

1. ALL LIGHT GAUGE STEEL (LGS) IS TO BE DESIGNED AND DETAILED BY A SPECIALIST SUB-CONTRACTOR.
2. LGS IN EXTERNAL WALLS IS TO BE DESIGNED TO RESIST LATERAL LOADS FROM WIND ETC. AND BE DETAILED SO THAT LOADS ARE ADEQUATELY TRANSFERRED INTO THE MAIN STRUCTURAL FRAME.

MASONRY NOTES:

1. ALL MORTAR IS TO BE DESIGNATION (iii) EXCEPT AS FOLLOWS
   - BELOW DPC LEVEL - DESIGNATION (i)
   - PARAPETS - DESIGNATION (ii)
2. BRICKWORK IS TO HAVE A MINIMUM COMPRESSIVE STRENGTH OF 20N/mm²
3. ALL MASONRY BELOW GROUND IS TO BE FROST RESISTANT.
4. BLOCKWORK IS TO HAVE A MINIMUM COMPRESSIVE STRENGTH OF 5N/mm² AND A MAXIMUM DENSITY OF 1600kg/m³.

NOT FOR CONSTRUCTION

Rev	Date	Description	Drawn	Check
P3	05.11.18	STAGE 3 ISSUE	BP	BP
P2	02.11.18	STAGE 3 ISSUE	JD	IP
P1	24.07.18	STAGE 2 ISSUE	NL	IP

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Drawing Status: STAGE 3

Project: RVC - HAWKSHEAD CAMPUS REDEVELOPMENT

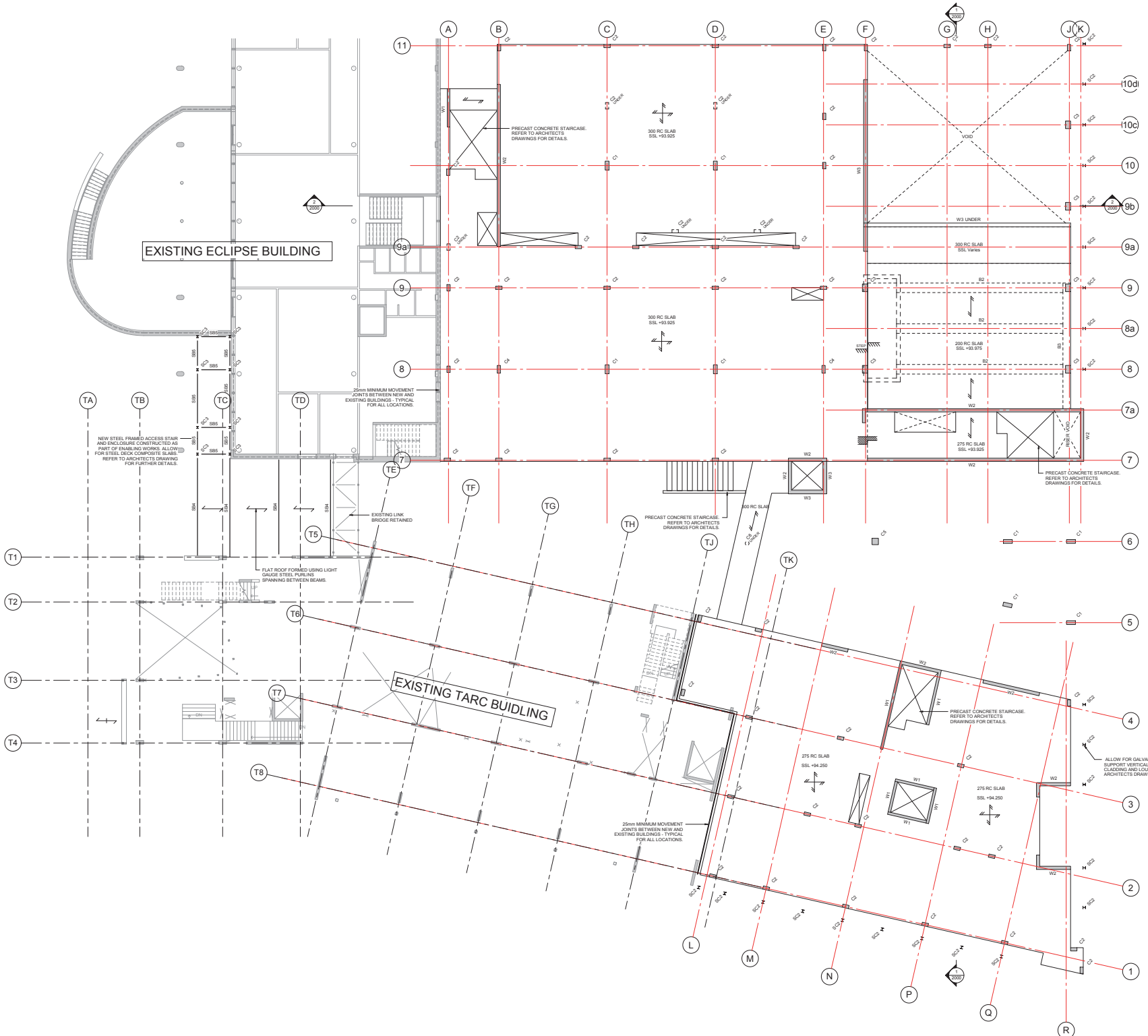
Date: JULY 2018
Scale: 1 : 100@A0
Drawn: NL
Engineer: IP

Title: GROUND FLOOR GENERAL ARRANGEMENT

Project No: 170344

Drawing No: 170344-CON-X-00-DR-S-1100

Revision: P3



FLOOR CONSTRUCTION LEGEND	
SYMBOL	DESCRIPTION
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	INDICATES SPAN OF PC HOLLOWCORE FLOOR. REFER TO PLANS FOR SLAB THICKNESS.
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WALL LEGEND	
SYMBOL	DESCRIPTION
	INDICATES NEW RC WALL
	INDICATES NEW BLOCKWORK
	INDICATES NEW BRICKWORK
	INDICATES EXISTING STRUCTURE RETAINED

RC WALL SCHEDULE	
MARK	DESCRIPTION
W1	200 THICK RC WALL
W2	250 THICK RC WALL
W3	300 THICK RC WALL

RC COLUMN SCHEDULE	
MARK	DESCRIPTION
C1	300x700 RC COLUMN
C2	250x500 RC COLUMN
C3	400x600 RC COLUMN
C4	250x600 RC COLUMN
C5	500x600 RC COLUMN
C6	300 RC COLUMN

RC BEAM SCHEDULE	
MARK	DESCRIPTION
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B2	750x1000 DEEP RC BEAM
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B5	1400x1200 DEEP RC BEAM

STEEL BEAM SCHEDULE	
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SB2	UC203x203x46
SB3	UB254x146x31
SB4	UC254x254x73
SB5	UC152x152x30

STEEL COLUMN SCHEDULE	
MARK	DESCRIPTION
SC1	RHS200x100x10
SC2	UC203x203x60
SC3	UC152x152x30

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NOT FOR CONSTRUCTION

Rev	Date	Description	Drawn	Check
P3	05.11.18	STAGE 3 ISSUE	BP	BP
P2	02.11.18	STAGE 3 ISSUE	JO	IP
P1	24.07.18	STAGE 2 ISSUE	NL	IP

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Drawing Status: STAGE 3

Project: RVC - HAWKSHEAD CAMPUS REDEVELOPMENT

Date: JULY 2018

Scale: 1 : 100@A0

Drawn: NL

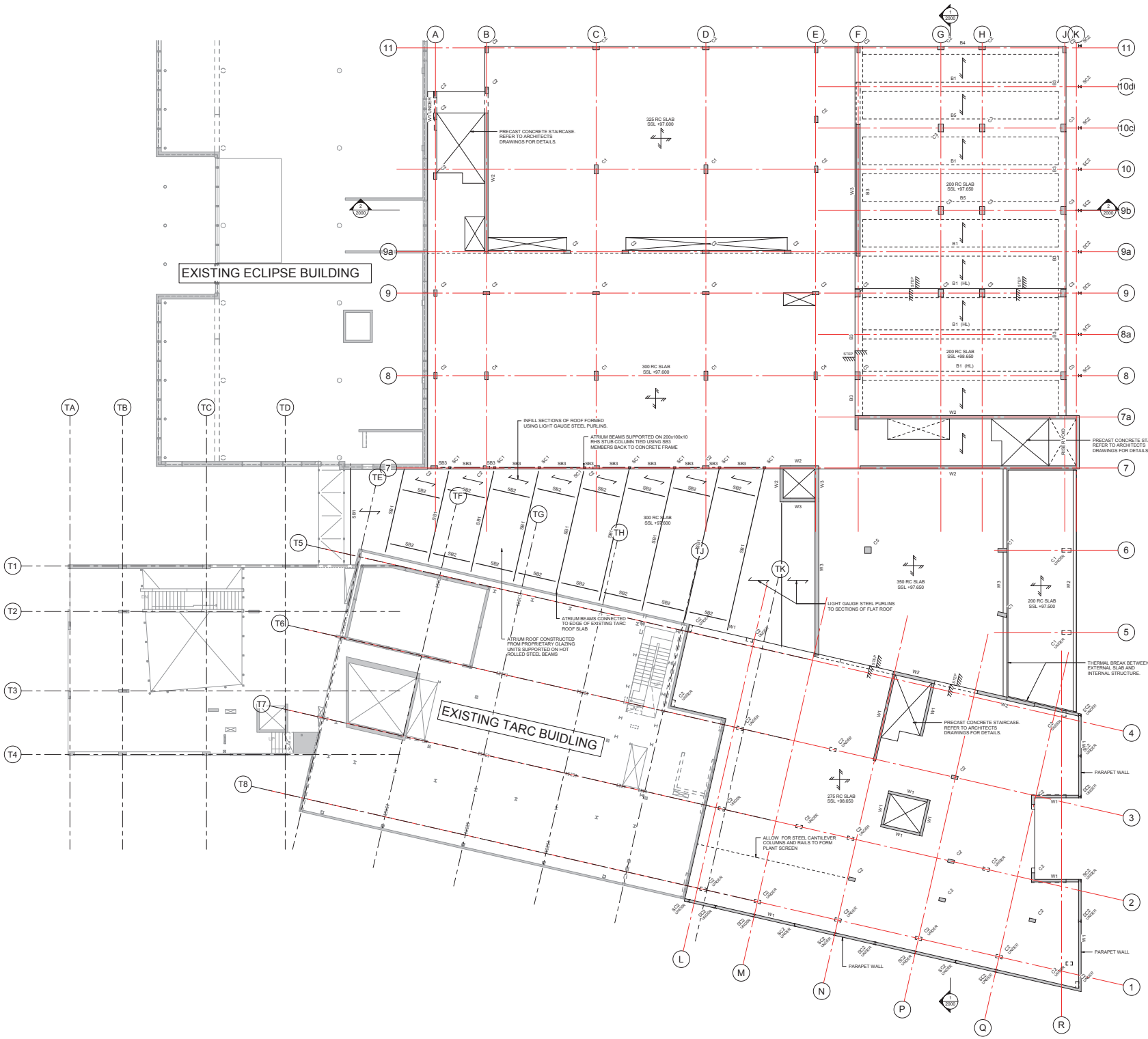
Title: LEVEL 01 GENERAL ARRANGEMENT

Engineer: IP

Project No: 170344

Drawing No: 170344-CON-X-01-DR-S-1101

Revision: P3



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P2	02.11.18	STAGE 3 ISSUE	JD	IP
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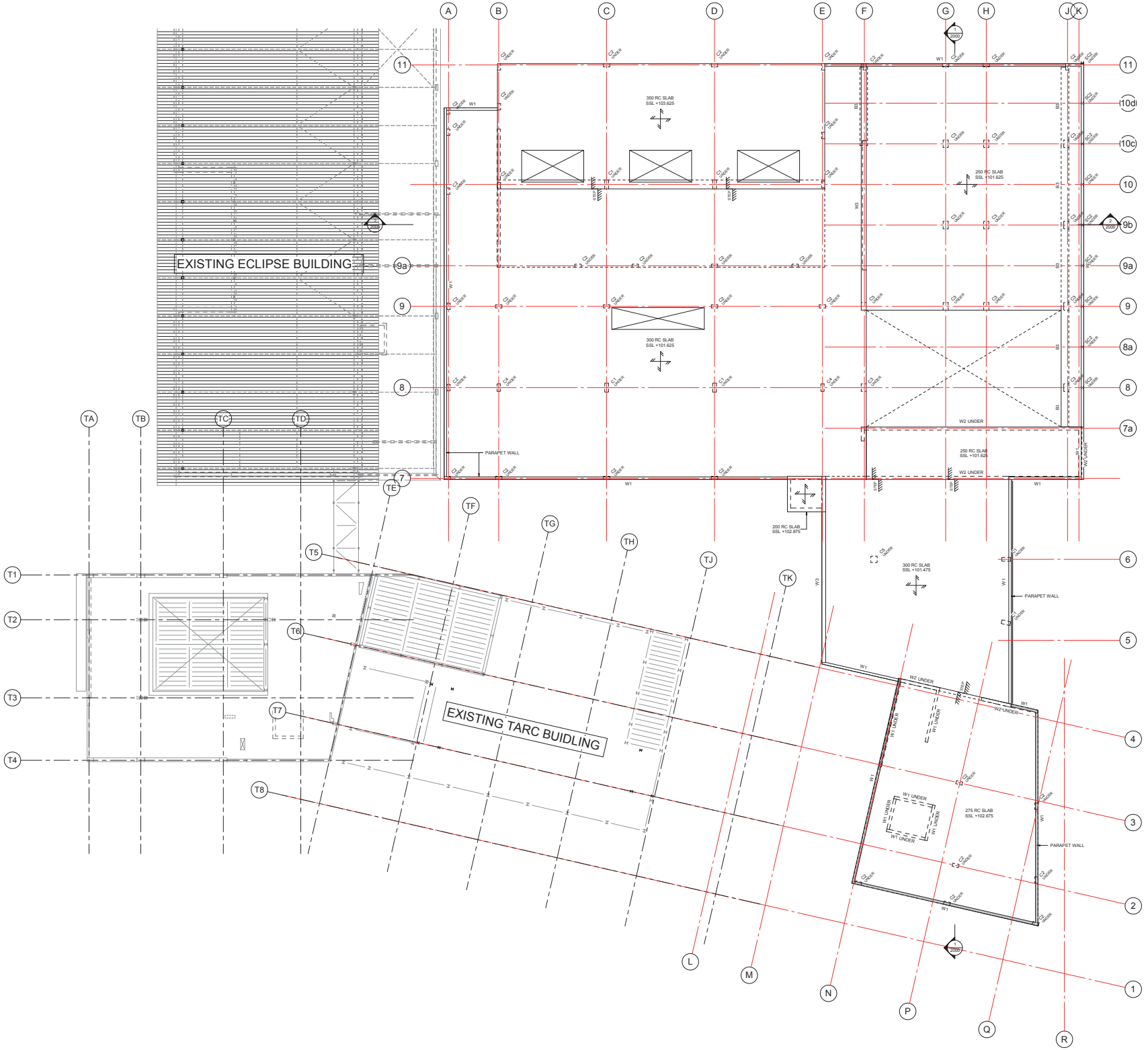
Drawing Status: STAGE 3

Project: RVC - HAWKSHEAD CAMPUS REDEVELOPMENT

Title: LEVEL 02 GENERAL ARRANGEMENT

Drawing No.: 170344-CON-X-02-DR-S-1102

Date: 07/12/18
Scale: 1 : 100@A0
Drawn: NL
Engineer: IP
Project No: 170344
Revision: P2



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Drawing Status: STAGE 3

Project: RVC - HAWKSHEAD CAMPUS REDEVELOPMENT

Title: ROOF PLAN

Drawing No: 170344-CON-X-RF-DR-S-1103

Revision: P2

Date: 07/12/18

Scale: 1 : 100@A0

Drawn: NL

Engineer: IP

Project No: 170344

APPENDIX 3
LWF

Royal Veterinary College

Hawkshead Campus Redevelopment

Stage 3 Fire Strategy

REPORT REFERENCE: 18028.2-FS-01-A

LAWRENCE WEBSTER FORREST

Fire Engineering & Fire Risk Management Consultants

Lawrence Webster Forrest

Royal Veterinary College

Hawkshead Campus Redevelopment

Stage 3 Fire Strategy

Prepared By:
Amy Reynolds
Fire Engineer

Approved By:
Holy Liang
Principal Fire Engineer

Report Status:

Issue	Description	Prepared by	Review by	Date
A	Issued to client	AR	HL	18/10/2018

Lawrence Webster Forrest
Fire Engineering & Fire Risk Management Consultants
Legion House, 75 Lower Road, Kenley, Surrey CR8 5NH
tel: +44 (0)20 8668 8663, fax +44 (0)20 8668 8583
e-mail:fire@lwf.co.uk, www.lwf.co.uk

Executive Summary

Lawrence Webster Forrest (LWF) has been commissioned by the Royal Veterinary College to produce a Stage 3 Fire Strategy for the proposed Hawkshead Campus Redevelopment located at Hawkshead Lane, Hatfield, Hertfordshire.

An assessment has been carried out of the information provided by the design team; items of non-compliance have been identified and solutions provided based on the minimum requirements for a satisfactory level of fire safety in accordance with the statutory guidance.

The assessment has not considered any additional requirements associated with property protection and any discussions associated with variations to the prescriptive approach are on the basis of life safety.

This report sets out the performance requirements for various design aspects. Detailed design, to achieve compliance with the standards specified, will be undertaken by others.

It is considered that the outline recommendations in this report will provide sufficient guidance to obtain approval from the relevant authorities and achieve a satisfactory level of safety, commensurate with the risks for the occupied premises.

Lawrence Webster Forrest
Fire Engineering & Fire Risk Management Consultants
Royal Veterinary College
Hawkshead Campus Redevelopment
Stage 3 Fire Strategy

Table of Contents

Lawrence Webster Forrest
Fire Engineering & Fire Risk Management Consultants
Royal Veterinary College
Hawkshead Campus Redevelopment
Stage 3 Fire Strategy

1 INTRODUCTION

1.1 General Description of the Development

The Royal Veterinary College (RVC) is the UK's largest, oldest and only independent veterinary school and a leading provider in veterinary education. The Hawkshead campus was originally created as a field station to complement the main campus in Camden, but has grown since the 1950s and is now where the trainee veterinary medical and nursing students and trainee specialists spend much of their time.

The campus houses clinical and research facilities as well as a significant portion of the College's administrative functions. Small animal and equine hospitals operate continuously and provide access to clinical caseload for students to gain the necessary experience to graduate with the clinical skills to enable them to practice independently as they enter the profession.

RVC has experienced a recent significant increase in teaching, clinical and research activities. This is now put increasing pressure on the College's buildings and facilities, particularly at the Hawkshead Campus.

There are currently approximately 1,050 students based at this campus together with 675 staff, however it is envisaged that the number of students will increase to 1,200 following the redevelopment.

The proposed development comprises the replacement of a single storey cellular 1960s brick building, which is outdated and no longer fit for purpose. It is envisaged that a 'Hub' of new spaces will be created, close to and connected to a number of the modern buildings at the heart of the campus.

The redevelopment involves demolishing the existing Main Clinical Block and constructing a new building which will provide replacement accommodation as well as additional academic space to accommodate the increase in student numbers. The new building will predominantly provide teaching and lecture rooms, research laboratories, 'write-up' space, academic staff offices and student break-out areas. This new building will also provide a connection, in the form of an atrium space, between two of the more modern existing academic buildings, Eclipse and Tarc.

The general layout of the proposed redevelopment can be seen below.

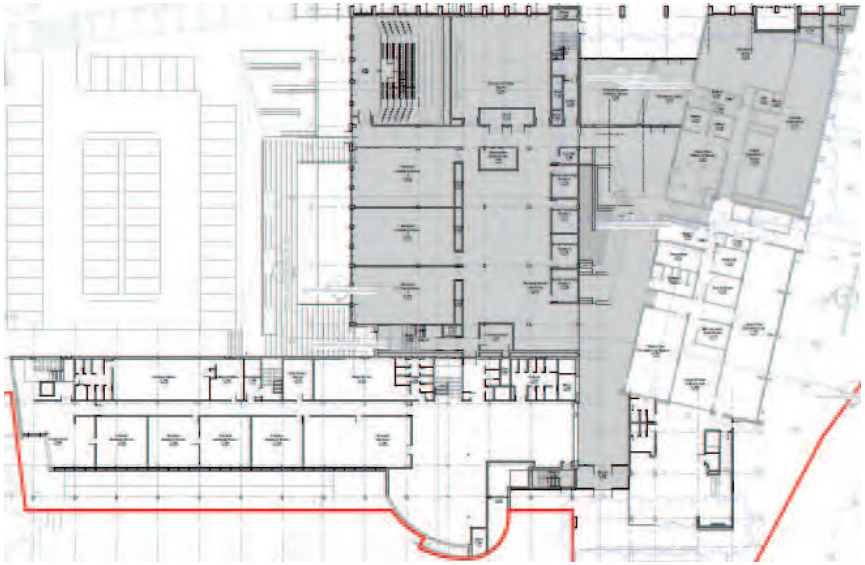

Figure 1.1.a Ground Floor Layout

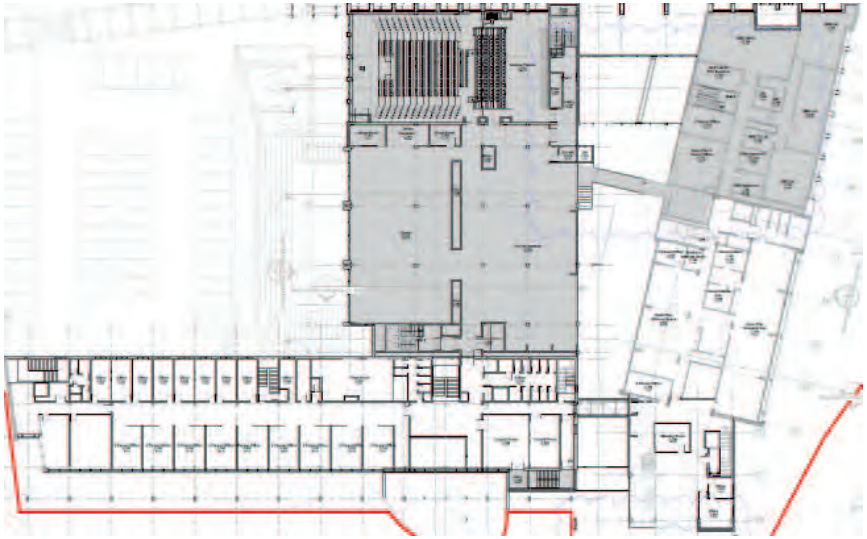

Figure 1.1.b First Floor Layout

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Stage 3 Fire Strategy

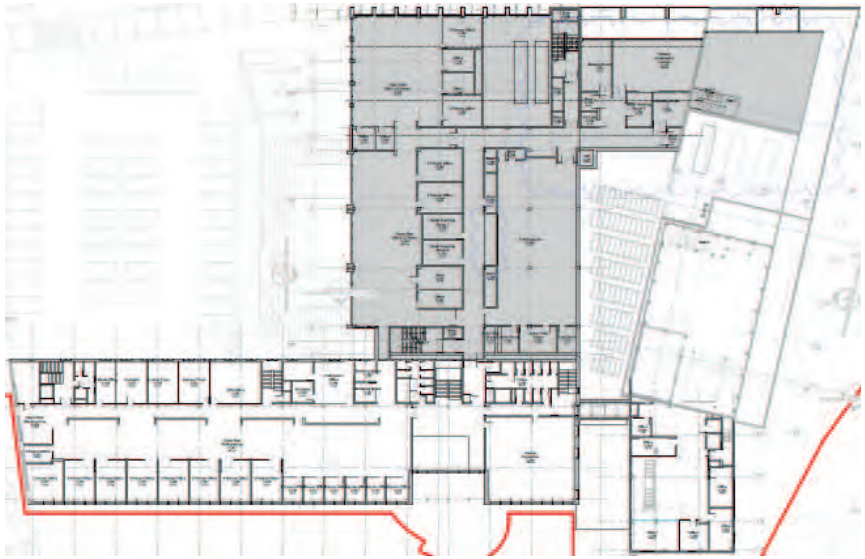

Figure 1.1.c Second Floor Layout

1.2 Purpose and Scope of the Report

The purpose of this report is to examine the proposed layouts in relation to fire safety precautions. On review of the layouts, any deficiencies highlighted have been raised and solutions proposed. If a compliant design cannot be achieved, a fire engineering approach can be adopted to meet the functional requirements of Building Regulations.

The purpose of this report is to present the findings to the approval authorities, with a view to achieve outline Building Control approval incorporating approvals following consultation with the Fire Authority.

Based on the recommendations provided within this report, it is believed that the premises will be provided with an adequate level of fire safety. As previously stated, for the purpose of this report and in line with the Building Regulations, the report makes recommendations for life safety only; property protection is not an objective of the Regulations and has not been specifically identified as one of the project design objectives by the Client.

1.3 Principle Guidance Documents

Considering the relative simplicity of this redevelopment it is proposed that the fire safety design for the premises will be provided in accordance with the published guidance document BS 9999: 2017 - Code of practice for fire safety in the design, management and use of buildings. This document allows a more flexible approach to meet the functional requirements of the building regulations.

By taking a more holistic view to fire safety, BS 9999 allows compensatory measures to offset other areas which may not meet the required standards e.g. travel distances and/ or total escape door width. Guidance provided in this document gives a more transparent and flexible approach to fire safety design through the use of a structured approach to risk-based design, where various physical and human factors of the building are taken into account.

Though the safety levels provided by BS 9999 should be functionally the same as other guidance documents, it will lead to a requirement for improved fire safety management and scrutiny of management, due to its reliance and recognition of the importance of management.

1.4 Risk Profile Overview

A design based on BS 9999 requires that an assessment of the fire risk profile be undertaken. This risk profile then has an impact on the design in terms of the expected minimum package of fire safety precautions for the building. The risk profile is derived by considering two main components, the occupancy characteristics and fire growth rate.

1.4.1 Occupancy Characteristics

The occupancy characteristic of the building is principally determined by considering whether occupants are familiar or unfamiliar with the building layout and whether they are likely to be awake or asleep. It is considered that there will be a single occupancy characteristic in the premises, and it is assumed that the occupants of the buildings will be awake and familiar with the building. This will give an occupancy category of A.

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Stage 3 Fire Strategy

1.4.2 Fire Growth Rate

The fire growth rate is intended to reflect the fire loading, the potential for fire growth and spread in the building, and is related to the types of materials and processes that are likely to be present.

The fire growth rate is potentially likely to vary throughout the building and although the exact fire load within each area is not known, it can be assumed that there will be low-mid level fire loading evenly distributed throughout the premises consisting of a mixture of combustible materials. For this reason a medium fire growth rate is considered reasonable in this situation. Should any specific higher risk areas become apparent, such as plant rooms, consideration will be given to providing additional/enhanced fire precaution measures.

1.4.3 Risk Profile

Considering the above, it is proposed that an A2 risk profile will be used for the purposes of specifying the required fire safety precautions within the majority of the building. For higher fire risk areas, such as plant rooms, an A3 risk profile is considered as appropriate.

1.4.4 Minimum Package of Fire Protection

BS 9999 outlines a minimum package of fire safety precautions required within a building, based upon the risk profile assigned to the particular building in question. Additional precautions that provide a benefit to fire safety above that required by the minimum package, can then be used to allow for variations in the design constraints such as increased travel distances and a reduction in escape width. The key items included within the minimum package of fire safety precautions are summarised in Table 1.4.a.

Precaution	Comment
Automatic Fire Detection and Alarm Systems	Minimum category M System in accordance with BS 5839 – 1:2017.
Emergency Lighting	To be provided in accordance with BS 5266-1 and BS EN 1838 in the following areas: • Underground or windowless areas • Internal corridors over 30m • Open plan areas of more than 60m^2

	• All sanitary accommodation with a floor area over 8m^2 • Windowless accommodation with a floor area less than 8m^2 • Electricity and generator rooms • Switch room/battery room for emergency lighting system
Exit Signage	To be in accordance with BS ISO 3864-1 and BS 5499-4.

Table 1.4.a Minimum Package of Fire Protection Measures

The minimum package of fire precautions also assumes compliance with the BS 9999 guidance for the provision of protected power circuits, doors on escape routes, fire protection of lift installations, mechanical ventilation systems and storage areas. It is intended that the building design will meet, or exceed, all of these minimum requirements.

1.4.5 Additional Fire Protection Measures

Although the requirements outlined in Table 1.4.a will meet the necessary fire safety standards, it is proposed to provide enhanced fire protection measures throughout the building in the form of an automatic fire detection and alarm system. This will provide a clear benefit to the occupants who will receive a much earlier warning of a fire within the building and will therefore be able to evacuate at a much earlier stage.

As the fire detection and alarm system is enhanced from the minimum standard, BS 9999 allows a 15% increase in travel distances and a 15% reduction in stair and door widths. This will be considered further in Section 2.

1.5 Reference Drawings

This report relates to the following plans provided by Norr.

Description	Drawing Number	Revision
Ground Floor Plan - Proposed	RVCH-NOR-01-00-DR-A-00-0002	P01
First Floor Plan - Proposed	RVCH-NOR-01-01-DR-A-00-0002	P01
Second Floor Plan - Proposed	RVCH-NOR-01-02-DR-A-00-0002	P01

Table 1.5.a Reference Drawings

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Hawkshead Campus Redevelopment
Stage 3 Fire Strategy

2 MEANS OF ESCAPE

2.1 Evacuation Strategy

The building will be designed for simultaneous evacuation. This means that the activation of an evacuation signal will give an instantaneous warning from all fire alarm sounders for an immediate evacuation of the whole building.

2.2 Horizontal Escape

2.2.1 Occupancy Figures

The minimum required width of any escape route is dependent on the maximum number of people likely to use the escape route in the event of a fire. It is recognised that in this type of environment there is no single occupancy factor which covers all areas at any one time; the occupancy figures will fluctuate at different times.

Whilst the areas of interest such as the office spaces, teaching facilities, library and social learning areas are calculated at full capacity, the ancillary accommodation within the building such as plant rooms, store rooms, WCs, etc. will only be occupied occasionally for short periods of time, therefore, for the purpose of this assessment, it is considered reasonable to disregard the occupants within the ancillary accommodation to reflect a more realistic occupancy distribution within the building.

The occupancy is estimated based on the assumed floor space factor and internal area as shown on the drawings referenced in Section 1.5. The estimated occupancies for each area are shown below. Where the design team has confirmed the occupancy numbers in particular rooms/areas, this has been identified in the final column, however floor space factor calculations have also been undertaken, to ensure the required occupancies are suitable for those designated areas.

Area/Room	Floor Area (m^2)	Floor Space Factor (m^2/person)	No. of Occupants*	Required Occupancy
Ground Floor				
C.105 Lecture Theatre	217.2	0.5	434	320
C.104 Group Learning	199.0	1.0	199	120
C.102 Directed Learning 3	123.6	2.0	62	60
C.101 Directed Learning 2	122.3	2.0	61	60
C.100 Directed Learning 1	122.5	2.0	61	60
C.114 Student Social Learning	296.7	2.0	148	-
C.109 Small Teaching Room 1	18.0	2.0	9	-
C.110 Small Teaching Room 2	18.0	2.0	9	-
C.111 Small Teaching Room 3	18.0	2.0	9	-
C.112 Small Teaching Room 4	18.0	2.0	9	-
Cafe	250.0	1.0	250	-
C.242 Café Kitchen	44.0	7.0	6	-
C.199 Student Services	114.7	6.0	19	-
C.198 Flexible Seminar Room	54.2	2.0	27	-
C.197 Flexible Seminar Room	54.2	2.0	27	-
C.196 Flexible Seminar Room	54.2	2.0	27	-
C.195 Flexible Seminar Room	54.2	2.0	27	-
C.189 E Media Office	26.1	6.0	4	-
C.181 Open Plan Write-up Space	81.3	4.0	20	15
C.180 Large Tissue Culture Lab	55.5	5.0	11	-
C.178 Microscope/Dark Room	15.7	5.0	3	-
C.175 Open Plan Research Lab	163.4	5.0	33	-
C.172 Pre PCR Lab	19.1	5.0	4	-
C.173 PCR Lab	17.6	5.0	4	-
C.177 Sequencer	20.6	5.0	4	-
C.121 Central Laboratory	155.3	5.0	31	-
C.117 Open Plan Office	68.0	4.0	17	12
C.115 Office	10.9	6.0	2	2
C.116 Office	10.8	6.0	2	1

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Hawkshead Campus Redevelopment
Stage 3 Fire Strategy

			Ground Floor Total**	**1311**
First Floor				
C.107 Upper Lecture Theatre	150.0	0.5	300	100
C.158 Study Room	15.3	2.0	8	-
C.159 Study Room	12.7	2.0	6	-
C.160 Library Reception	18.2	4.0	5	-
C.106 Library	375.2	5.0	75	-
C.108 Social Learning	375.5	2.0	188	-
C.248 Council Room	51.2	6.0	9	-
C.249 Council Room	33.1	6.0	6	-
C.231 4 Person Office	26.2	6.0	4	4
C.232 4 Person Office	26.1	6.0	4	4
C.233 4 Person Office	26.1	6.0	4	4
C.234 4 Person Office	26.2	6.0	4	4
C.235 4 Person Office	26.2	6.0	4	4
C.236 4 Person Office	26.0	6.0	4	4
C.237 4 Person Office	26.1	6.0	4	4
C.238 4 Person Office	26.2	6.0	4	4
C.239 4 Person Office	26.2	6.0	4	4
C.216 Office	17.0	6.0	3	2
C.217 Office	17.0	6.0	3	3
C.218 Office	17.0	6.0	3	3
C.219 Office	17.0	6.0	3	3
C.220 Office	17.0	6.0	3	3
C.221 Office	17.0	6.0	3	3
C.222 Office	17.0	6.0	3	2
C.223 Office	17.0	6.0	3	-
C.185 Office	19.7	6.0	3	2
C.292 Office	21.5	6.0	4	1
C.291 Office	10.3	6.0	2	1
C.290 Meeting Room	20.3	1.0	20	-
C.188 Open Plan Research Lab	165.9	5.0	33	-

C.186 Tissue Culture	12.7	5.0	3	-
C.187 Tissue Culture	13.6	5.0	3	-
C.183 2 Person Office	13.2	6.0	2	2
C.182 Open Plan Write-up Space	103	4.0	26	20
C.184 Breakout Meeting Space	7.1	1.0	7	-
C.132 Open Plan 6 Person Office	50.1	6.0	8	6
C.131 4 Person Office	27.5	6.0	5	4
C.123 VMD Approved TC Lab	13.2	5.0	3	-
C.127 VMD Approved TC Lab	13.1	5.0	3	-
C.124 SME TC Lab	11.1	5.0	2	-
C.130 GLP Lab for RVC Business	21.6	5.0	4	-
C.128 SME Lab	47.8	5.0	10	-
C.125 SME Lab	55.4	5.0	11	-
C.126 SME Lab	52.7	5.0	11	-
C.129 SME Office	97.7	4	24	20
			First Floor Total**	**621**
Second Floor				
C.147 Open Plan Office 38 Desks	200.5	4.0	50	38
C.141 Office	9.6	6.0	2	-
C.142 Office	8.7	6.0	1	1
C.146 4 Person Office	25.1	6.0	4	4
C.145 Office	13.7	6.0	2	-
C.144 Office	13.7	6.0	2	-
C.143 4 Person Office	25.2	6.0	4	4
C.138 Small Teaching Room 5	20.0	2.0	10	-
C.137 Small Teaching Room 6	20.0	2.0	10	-
C.133 Office	16.7	6.0	3	-
C.148 Open Plan Office 32 Desks	250.4	4.0	63	32
C.140 4 Person Office	29.3	6.0	5	4
C.139 4 Person Office	28.3	6.0	5	4
C.136 Small Teaching Room 7	18.2	2.0	9	-
C.166 Small Teaching Room 8	23.6	2.0	12	-

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Hawkshead Campus Redevelopment
Stage 3 Fire Strategy

C.151 Meeting Room	32.0	1.0	32	-
C.153 Visiting Academic's Lounge	86.9	1.0	87	-
C.149 Teaching Lab	271.5	5.0	54	-
C.201 1 Person Office	9.9	6.0	2	1
C.202 4 Person Office	28.1	6.0	5	4
C.203 4 Person Office	25.3	6.0	4	4
C.204 4 Person Office	25.3	6.0	4	4
C.205 4 Person Office	25.3	6.0	4	4
C.206 4 Person Office	25.3	6.0	4	4
C.207 4 Person Office	25.3	6.0	4	4
C.208 4 Person Office	25.3	6.0	4	4
C.209 4 Person Office	25.3	6.0	4	4
C.241 Open Plan Workstations	355.7	4.0	89	-
C.210 1 Person Office	9.5	6.0	2	1
C.211 1 Person Office	9.5	6.0	2	1
C.212 1 Person Office	9.5	6.0	2	1
C.213 1 Person Office	9.5	6.0	2	1
C.214 1 Person Office	9.5	6.0	2	1
C.215 1 Person Office	10.8	6.0	2	1
C.226 E Media Office	17.1	6.0	3	-
C.227 Available	26.6	6.0	4	-
C.228 Nursing Team	25.7	6.0	4	-
C.229 Nursing Team	26.2	6.0	4	-
C.253 CPD Office	43.9	6.0	7	-
C.254 CSS Admin Office	34.8	6.0	6	-
C.230 Available	9.4	6.0	2	-
C.306 Breakout Space	9.1	2.0	5	-
C.307 Breakout Space	8.7	2.0	4	-
C.240 Human Resources	156.3	6.0	26	-
C.304 Office	7.5	6.0	1	-
C.303 Office	16.7	6	3	-
C.305 Office	29.9	6.0	5	-
C.300 Office	17.6	6.0	3	-

C.301 Office	19.6	6.0	3	-
C.302 Office	18.6	6.0	3	-
			Second Floor Total**	**521**
			Grand Total	**2453**

*Occupancy has been rounded to the nearest whole number.

** The floor totals have been calculated using the required occupancy figures provided by the design team. For areas where the required occupancy has not been provided, the floor space factor occupancy has been used.

Table 2.2.a Estimated Occupancy

2.2.2 Number of Escape Routes and Exits

In accordance with BS 9999, the number of escape routes and exits from any room or storey in the building should be provided as shown below.

Maximum number of persons	Minimum number of escape routes/exits
60	1
600	2
More than 600	3

Table 2.2.b Number of escape routes and exits

Table 2.2.a shows that all storeys/areas/rooms, with an occupancy exceeding 60 persons, have a sufficient number of exits for the intended capacities, with the exception of the Visiting Academic's Lounge (C.153), which based on the floor space factor, has an occupancy of 87 but only a single exit. Due to the single exit, the occupancy within the room should be limited to 60 persons.

2.2.3 Direction of door openings

There are a number of doors that do not open in the direction of escape. BS 9999 requires all doors, which may be used by more than 60 people, to open in the direction of escape. Due to the intended capacities, the following doors highlighted in blue on the drawings below need to be reviewed to check the direction of opening is suitable. It should be noted that there is no drawing for the first floor below as it would appear that of all the doors either open in the direction of escape or will be used by less than 60 people.

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Stage 3 Fire Strategy

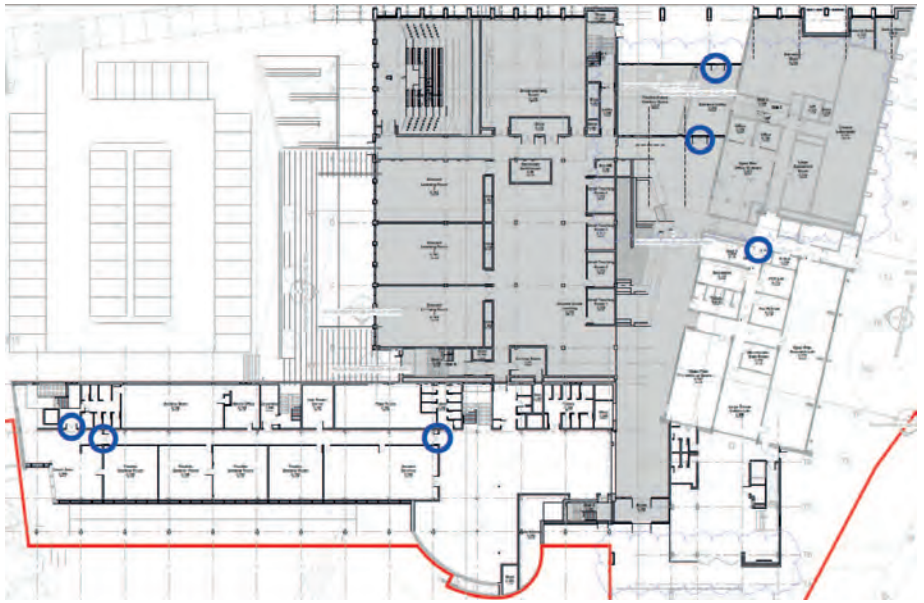

Figure 2.2.a Ground Floor Inward Opening Doors

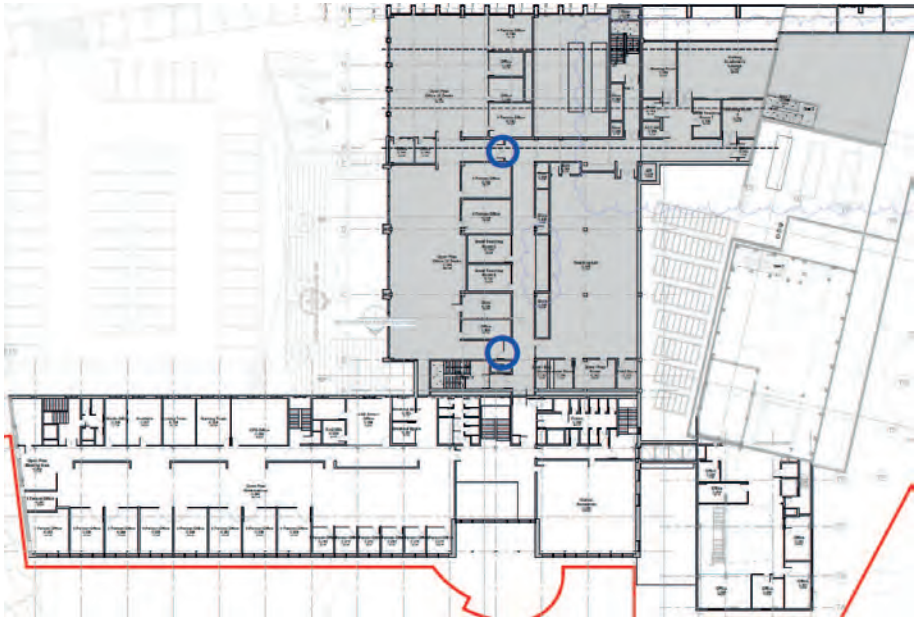

Figure 2.2.b Second Floor Inward Opening Doors

2.2.4 Exit Widths

The required clear escape width is based upon the maximum number of occupants that are expected to use the escape routes in the event of a fire. BS 9999 provides guidance on the minimum required clear escape width in terms of millimetre per person.

As additional fire protection measures are being provided to the building, the minimum exit widths can be reduced by 15%, however the minimum widths should not be less than the values outlined in Table 16 of BS 9999.

Risk Profile	Minimum exit width per person (with minimum fire protection package) (mm/person)	15% exit width reduction (mm/person)	Absolute minimum exit width per person (with additional fire protection measures) (mm/person)
A2	3.6	3.06	3.0

Table 2.2.c Minimum exit width per person

Table 2.2.c shows that a value of 3.06mm/person can be used when calculating the required exit widths.

Where a door has a width less than 1050mm, the following equation should be used to calculate the number of people who can safely be accommodated in the event of an evacuation.

$$n = \frac{500}{m}$$

where:
n= the number of persons safely accommodated by the door width
m= is the minimum door width, taken from Table 12 of BS999

When calculating the exit width, the exit affording egress to the most occupants should always be discounted. This is due to the fact that a fire may prevent one of the exits from being used, therefore discounting the exit affording egress to the most people creates the worst case scenario, where all

occupants will have to make their escape through the remaining exits. This ensures the exit widths are sufficient to allow all occupants to evacuate safely.

It should be noted that although some of the required exit widths may be considerably less than 800mm, all exits should have a minimum width of 800mm. Should there be a possibility that unassisted wheelchair access is required to any of these doors, the width should be increased to 850mm.

<u>Ground</u>

All exit widths, including the storey exit widths have been assessed and are considered suitable for the proposed occupancy numbers. This is based on the assumption that the exits highlighted in Section 2.2.3 are reviewed and the direction of opening is changed.

<u>First</u>

All exit widths, including the storey exit widths have been assessed and are considered suitable for the proposed occupancy numbers.

<u>Second</u>

The two doors providing access into the open plan office areas (C.147 and C.148) and the associated smaller closed plan offices are currently inward opening; as this area has an occupancy of 96 persons, the doors need to be rehung in the direction of escape. Assuming the doors are re-hung, in the event of a fire preventing the use of the largest door, the remaining single exit door has a width of approximately 920mm; this width can safely accommodate 138 people and is therefore considered satisfactory.

All other exit widths, including the storey exit widths have been assessed and are considered suitable for the proposed occupancy numbers.

2.2.5 Travel Distances

The maximum allowable travel distances depend upon the risk profile for the building. As stated previously, the building's risk profile is mainly A2, with the exception of plant rooms where an A3 risk profile is more appropriate. The allowable travel distances are given in Table 2.2.d below.

Risk Profile	Escape in two directions (m)	Escape in one direction (m)
A2	55	22
A3	45	18

Table 2.2.d Travel Distances (minimum fire protection package)

As an enhanced fire detection and alarm system will be fitted throughout the building and will provide a clear benefit to the occupants, travel distances can be increased by 15% as shown in Table 2.2.e.

Risk Profile	Escape in Two Directions (m)	Escape in One Direction (m)
A2	63	25
A3	52	21

Table 2.2.e Travel Distances (additional fire protection measures)

From the drawings provided, the following areas/rooms appear to have travel distances exceeding those outlined above and will require further review from the design team:

Ground

The Open Plan Write-up Space (C.181) appears to have a single direction of travel of approximately 31 metres.

First

The SME Lab (C.126) appears to have a single direction of travel of approximately 31 metres.

Second

The Visiting Academic's Lounge (C.153), Meeting Room (C.151) and Teaching Room 8 (C.166) all appear to have a single direction of travel to a storey exit exceeding the maximum limits in Table 2.2.e.

2.2.6 Inner Rooms

BS 9999 states that an inner room condition is acceptable when one of the following arrangements is in place:

- the enclosures (walls or partitions) of the inner room should be stopped at least 500mm below the ceiling; or

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- a suitably sited vision panel not less than 0.1m^2 should be located in the door or walls of the inner room, to enable occupants of the inner room to see if a fire has started in the outer room; or
- the access room should be fitted with a suitable automatic fire detection and alarm system to warn the occupants of the inner room of the outbreak of a fire in the access room.

As a fire detection and alarm system providing coverage to a L2 standard will be fitted throughout the premises, any access rooms will be provided with suitable automatic detection, which will alert occupants within the inner room of a fire.

2.2.7 Door Fastenings

Where a door on an escape route has to be secured against entry when the building or part of the building is occupied, it should only be fitted with a simple lock or fastening which is readily operated, without a key, from the side approached by people making their escape.

Likewise any doors operated by a code, combination, swipe or proximity card, biometric data or similar means, should be capable of being overridden from the side approached by people making their escape.

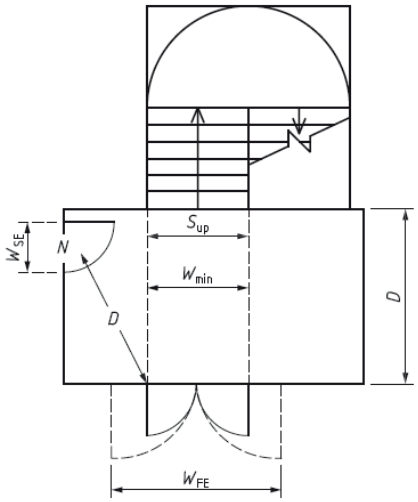
Electrically powered locks should return to the unlocked position under any of the following conditions:

- on operation of the fire alarm ;
- on loss of power or system error;
- on activation of a manual door release unit positioned at the door on the side approached by people making their escape. Where the door provides escape in either direction a unit should be installed on both sides of the door.

2.2.8 Merging Flows

Where ground floor storey exits share final exits with protected stairs, the width of the final exits should be sufficient to enable a maximum evacuation flow rate equal to or greater than that from the storey exit and stair combined.

The equation given for the calculation of the minimum final exit width to account for merging flows in the escape stairs at ground level is shown in the diagram below.



If $N > 60$ and $D < 2$ m

$W_{FE} = S_{up} + W_{SE}$

Otherwise

$W_{FE} = NX + 0.75S_{up}$

where:

N	is the number of people served by the final exit level storey exit;
D	is the lesser distance from the final exit level storey exit or the lowest riser from the upward portion of the stair, in metres (m);
W_{FE}	is the width of the final exit, in millimetres (mm);
S_{up}	is the stair width for the upward portion of the stair, in millimetres (mm);
W_{SE}	is the width of the final exit level storey exit, in millimetres (mm);
X	is the minimum door width per person (see **16.6** and Clause **18**), in millimetres (mm);
W_{min}	is the absolute minimum width of the final exit and should be not less than the width of the stair, in millimetres (mm).

Figure 2.2.c Merging Flows

As all of the protected stairs have doors leading from the ground floor to a shared final exit with the stair, merging flow calculations have been carried out for each of the stairs and the widths of the final exits can be seen in the table below.

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Stair	Required Final Exit Width (mm)	Comments
1	1686	The final exit should not be narrower than the stair so should be increased to 1750mm.
2	1274	Although the final exit width is sufficient for the proposed occupancy, the door separating the entrance lobby from the base of the atrium void space is considerably wider, therefore the final exit should be increased to the same size to prevent bottle-necking.
3	1283	Although the final exit is sufficiently wide, the cross corridor door separating the stair from the final exit is considerably narrower. The cross corridor door should be increased to at least the same size as the final exit door from the stair enclosure to prevent bottle-necking.
4	1686	The final exit should not be narrower than the stair so should be increased to 1750mm.
5	1292	Satisfactory
6	1365	Satisfactory
7	1301	Satisfactory

Figure 2.2.d Merging Flow Final Exit Width Requirements

2.2.9 Miscellaneous

Any dead-end corridors, exceeding 2 metres in length, should be constructed as protected corridors. If alternative escape routes are immediately available from a dead-end corridor, there is a risk that smoke from a fire could make both routes impassable before the occupants in the dead end have escaped. To avoid this, every dead-end corridor exceeding 4.5 metres in length should be separated by self-closing fire doors from any part of the corridor which:

- provides two directions of escape; or
- continues past one storey exit to another.

Additionally where a corridor provides access to alternative escape routes and is more than 12 metres long, the corridor should be sub-divided by self-closing fire doors, which are positioned approximately mid-way between the two storey exits.

2.3 Vertical Escape

There are a number of stairs serving the new redevelopment. Figure 2.3.a shows all of the staircases serving the new building and atrium void space as well as the stairs serving the TaRC and Eclipse buildings. All of the stairs are protected stairs, which lead directly to a place of ultimate safety, with the exception of Stairs 8, 9 and 10, which are classed as accommodation stairs and are therefore not included within the vertical escape calculations.

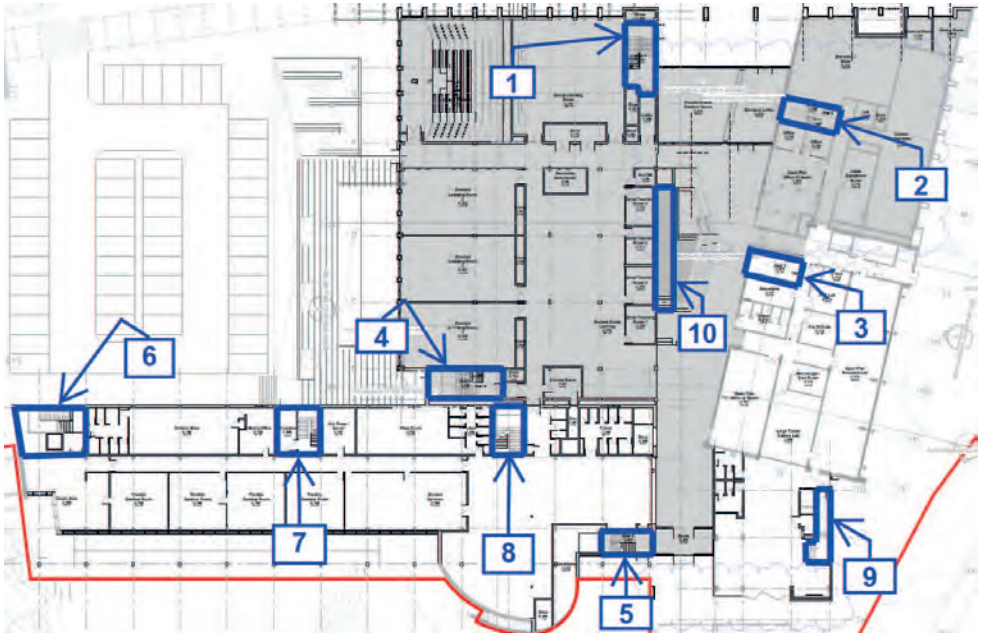

Figure 2.3.a Vertical Escape Provision

Using the estimated occupancies for the building, an assessment has been undertaken with recommendations given in Table 13 of BS 9999 to ascertain the minimum required clear widths for the stairs. Additionally as an enhanced level of fire detection and alarm will be provided within the

building the stair widths can be reduced by 15%. As not all of the stairs are lobby protected, each un-lobbied stair should be discounted in turn, when calculating the minimum required stair width. This will ensure in the event of a fire preventing access to one of the staircases, all occupants can safely evacuate using the remaining available exits.

Stair	No. of floors served	Minimum Required Stair Width (mm/person)	15% Reduction in Stair Width (mm/person)	Maximum occupants served by the stair	Minimum Required Stair Width (mm)	Available Stair Width (mm)
Stair 1	3	3.25	2.76	511	1411	1750
Stair 2	2	3.80	3.23	314	1015	1200
Stair 3	3	3.25	2.76	194	536	1200
Stair 4	3	3.25	2.76	486	1342	1750
Stair 5	3	3.25	2.76	257	710	1200
Stair 6	3	3.25	2.76	267	737	1550
Stair 7	3	3.25	2.76	443	1223	1200

Table 2.3.a Stair Widths for Risk Profile A2

Although the ground floor is not served directly by the stairs, some of the final exits at ground floor level are shared with the stair cores, therefore the ground floor has been included within the number of floors served by each of the stairs as outlined within BS 9999. Currently Stair 7 is not wide enough for the proposed figures, however due to the large numbers being served at ground floor level, the minimum stair width required increases dramatically; in reality occupants of the ground floor will not be using the stairs and will only be using the shared final exits, therefore for this reason all of the staircase widths are considered satisfactory.

Where protected stairs do not lead directly to a place of ultimate safety, protected corridors should be provided from the foot of the stair enclosure to a final exit; this will ensure occupants remain in a protected means of escape throughout the evacuation.

2.4 Seating and Gangways

Seatways should be of a sufficient width to enable easy movement towards a gangway for all persons along a row. The width of the seatway should not be less than 300mm and should be constant throughout the length of the row.

The slope of a tier of seating should not be more than 35° above the horizontal plane. The maximum number of seats in a row is determined by the seatway width and the number of gangways. This is shown in the table below.

Seatway Width (mm)	Maximum number of seats in a row	
	Gangway on one side	Gangway on two sides
300 – 324	7	14
325 – 349	8	16
350 – 374	9	18
375 – 399	10	20
400 – 424	11	22
425 – 449	12	24
450 – 474	12	26
475 – 499	12	28
500+	12	Limited by travel distance

Table 2.4.a Number of seats in a row

The travel distances within areas with fixed seating in rows should not exceed 15 metres in a single direction and 32 metres, where escape is available in more than one direction.

Where gangways are provided, they should be at least 1100mm wide and should be aligned with the ends of all the rows of seats to ensure a uniform width is maintained along the gangway.

Further information regarding seating and gangways can be found in Annex D of BS 9999.

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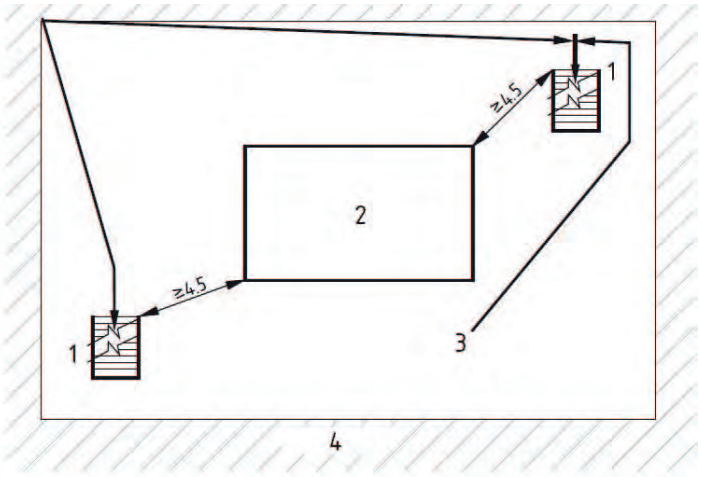
2.5 Open Spatial Planning

As there are no compartment floors within the proposed building, the atrium area connecting all of the floors does not meet the definition of an atrium, as outlined in BS 9999, therefore this atrium space can be classed as a 'void' instead.

BS 9999 allows open spatial planning providing the following conditions are met:

- Storey exits should be sited away from any open connection so that escape routes do not approach the opening;
- The maximum travel distance from the opening to the nearest storey exit should not exceed the travel distances outlined in Section 2.2.5;
- Escape should be away from the opening and the subsequent escape route should not pass within 4.5 metres of the opening.

From the drawings provided, it would appear that the open connections within the atrium space comply with the requirements outlined above.



Key
1 Exit
2 Atrium void open or not enclosed by smoke retarding construction
3 Escape away from atrium
4 Outer wall

Figure 2.5.a Open Connections

2.6 Disabled Evacuation

Refuge points will be provided at all upper levels in the vicinity of a protected escape stair and will be suitably signed in accordance with BS 5499-5: 2002. The refuge point will have minimum dimensions of 1400 x 900mm and will not reduce the width of the escape route or obstruct the flow of occupants evacuating the building.

An emergency voice communication (EVC) system, complying with BS 5839-9: 2003 will be provided, allowing communication between the refuge point and the main receiver station; the location of the main receiver station is yet to be confirmed.

As the project is currently at the design stage, the evacuation strategy for disabled persons has not yet been finalised, however in line with the rest of the RVC's buildings, the strategy will incorporate the use of evac chairs to evacuate disabled persons to a place of ultimate safety.

Due to the physical nature of the training courses provided at RVC, the number of disabled students is likely to be minimal, however any staff members and regular visitors, who require assistance in the event of an evacuation, should be provided with Personal Emergency Evacuation Plans (PEEPs).

Under the Regulatory Reform (Fire Safety) Order 2005, it is expected that means should be provided to effect the full evacuation of the building without any reliance on the fire and rescue service to aid in the evacuation of any occupants including disabled individuals. With the proposed measures in place, it is anticipated that there will be no reliance upon fire and rescue service personnel.

2.7 Emergency Lighting

Emergency lighting will be installed in accordance with BS 5266:2016 and BS EN 1838:2013 throughout the premises. Emergency luminaries should be sited on escape routes to final exits, and external emergency lighting should be installed on those discharge points unless the area is satisfactorily lit by independent external lighting.

The emergency lighting system will be provided with testing facilities such as key operated test-switch for each circuit, to enable the un-switched supply to each luminaire/circuit to be isolated for test.

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Hawkshead Campus Redevelopment
Stage 3 Fire Strategy

2.8 Signage

Escape signage will be provided to escape routes throughout the premises. Exits, other than those in normal use for egress, should be clearly marked with appropriate signage.

Escape signage will need to fully comply with the recommendations of BS 5499 and BS ISO 3864-1:2011.

3 AUTOMATIC FIRE DETECTION AND MEANS OF WARNING

A Category L2 system, as described in BS 5839-1: 2017, will be fitted throughout the premises and will comprise of a mixture of detectors and audio and visual alarms. The type of detection to be provided within the atrium void space has not yet been confirmed, however it is likely that it will consist of either beam detection or an aspirating system. The fire detection and alarm system will be monitored remotely.

The type of fire alarm system normally required for either an A2 risk profile is a manual system, therefore a fire alarm system providing L2 coverage is considered a significant enhancement from the benchmark standard.

The alarm is a two-stage alarm, with an investigation period prior to the system going into full alert and prompting evacuation. A second actuation (detector or call point) will place the system immediately into full alarm. Additionally an initial actuation of either a manual call point or heat detector will place the system immediately into full alarm.

The fire alarm must be audible throughout the premises with the provision of supplementary visual beacons in locations where the background noise level necessitates the use of ear defenders (e.g. plant rooms). Consideration should also be given to alerting people with hearing and/or visual impairments. Personal Emergency Evacuation Plans (PEEPs) should be put in place for members of staff, students and regular visitors with disabilities including those with sensory impairments.

It is recommended that the main fire alarm control panel be situated within the main entrance to the building, where it will be easily accessible to the attending Fire Service.

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4 SMOKE CONTROL

RVC and the design team have confirmed that Automatic Opening Vents (AOVs) will be provided within the atrium void space. The total geometric free area of the AOVs has not yet been confirmed, however for smoke clearance for fire-fighting, the free area of the vents should not be less than 10% of the maximum plan area of the void on the top floor level.

5 INTERNAL FIRE SPREAD

5.1 Linings

In accordance with BS 9999, the internal linings for the proposed development are recommended to be as detailed below in Table 5.1.a.

Location	National Class	European Class
Small rooms of area not more than 30m^2	3	D-s3, d2
Other rooms	1	C-s3,d2
Other circulation spaces	0	B-s3, d2

Table 5.1.a Classification of linings

5.2 Structural Fire Protection

In accordance with the guidance given in BS 9999, all load bearing elements of structure will be provided with fire protection to achieve a minimum of 60 minutes fire resistance as outlined in BS 476. This requirement also applies to any element of structure that supports or provides stability to another.

The following elements can be excluded from the above fire resistance requirements:

- Any structure that only supports a roof, except where the roof performs the function of a floor or where the roof structure is essential for the stability of an external wall that requires fire resistance;
- The lowest floor of the building;

In accordance with Table 23 of BS 9999, fire rating of elements of structure for the proposed development should be as follows, based on a risk profile of A2.

Approximate Building Height (metres)	Fire Resistance Period (minutes)
Greater than 5 but not more than 18	60

Table 4.2.a Recommended Fire Resistance Period of Elements of Structure

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Hawkshead Campus Redevelopment
Stage 3 Fire Strategy

5.3 Compartmentation

The main objective of compartmentation is to prevent rapid fire spread, which may prevent occupants of the building from escaping safely. Compartmentation reduces the chance of a fire becoming large thereby protecting the means of escape and also reducing the likelihood of fire spread to neighbouring buildings.

Due to the risk profile and building height, there is no limit on compartment size therefore compartmentation is not required between floors or on each floor to separate the floor area into smaller compartments, however fire resisting construction will still be needed in certain areas to protect escape routes, and prevent rapid fire spread from special fire hazard rooms. These key areas are outlined below.

Room/Area	Minimum Period of Fire Resistance (minutes)
Compartment Floors	Not required
Compartment Walls	Not required
Protected Corridors	30 (loadbearing capacity, integrity and insulation)
Protected Stairs	30 (loadbearing capacity, integrity and insulation)
Electrical Riser Cupboards	30 (loadbearing capacity, integrity and insulation)
Ancillary Accommodation	As per Table 29 of BS 9999
Cavity Barriers	30 (integrity), 15 (insulation)
Ductwork (see 33.3v of BS 9999)	30 (integrity)

Table 5.3.a Key Areas of Compartmentation/Fire Resisting Construction

Any lift wells should either be contained within the enclosures of a protected stairway, or be enclosed throughout their height with fire-resisting construction.

5.4 Concealed Spaces

Concealed spaces and cavities in the building can allow the rapid unseen spread of fire and smoke to areas remote from the seat of an incident.

If concealed spaces or cavities are created, cavity barriers will be required. The cavity barriers must provide a minimum of 30/15 minutes' fire resistance period in term of integrity and insulation

respectively. Cavity barriers must be securely supported so as to guarantee integrity and insulations properties irrespective of the failure of un-rated components.

In accordance with Clause 33 of BS 9999, cavity barriers should be provided in accordance with Figure 5.4.a below and includes, but is not limited to, the following:

- All junctions between an external cavity wall and every compartment floor and compartment wall;
- All junctions between an internal cavity wall and every compartment floor, compartment wall, or other wall or door assembly which forms a fire-resisting barrier;
- For a protected escape route, i.e. protected corridor, a cavity that exists above or below any fire resisting construction should either be fitted with cavity barriers on the line of the enclosures to the protected escape route or for the cavities above the fire resisting construction, enclosed on the lower side by a fire resisting ceiling which extends throughout the building, compartment or separated part;
- Where the dimension of uninterrupted ceiling void is greater than 20m. The maximum dimensions of cavities should be less than 20m in any direction.

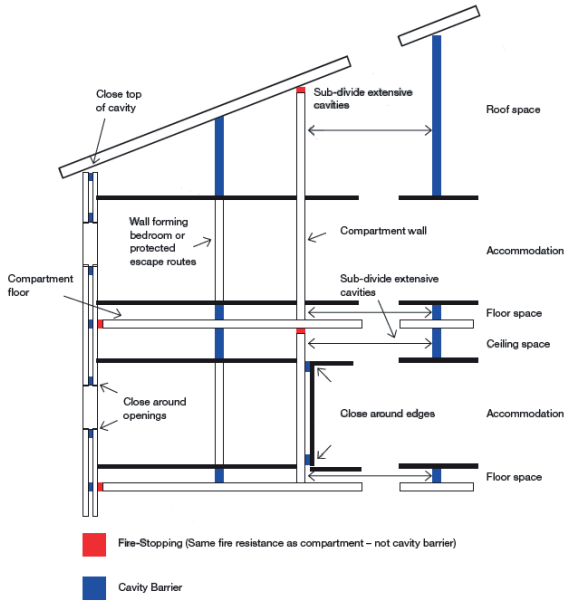

Figure 5.4.a Provisions for Cavity Barriers

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Stage 3 Fire Strategy

Any openings in a cavity barrier should be limited to those for:

- doors which have at least 30 minutes fire resistance and are fitted in accordance with the provisions outlined in BS 9999;
- the passage of pipes which meet the provisions in Clause 32.6 of BS 9999;
- the passage of cables or conduits containing one or more cables;
- openings fitted with a suitably mounted automatic fire dampers; and
- ducts which are fitted with a suitably mounted automatic fire damper where they pass through the cavity barrier. This does not apply to fire-resisting ductwork.

5.5 Fire Stopping

All penetrations through fire separating elements should be adequately fire stopped or sealed to ensure that the integrity and performance of the element is not impaired. Areas that will require fire stopping will be around pipe and cable services, ventilation ducts and flues and junctions between fire separating elements.

All elements and services that penetrate a compartment wall, floor or other element of fire resisting construction are to be fire stopped using a method appropriate to the element penetrated and the surrounding construction.

Typical fire stopping materials include:

- Cement mortar
- Gypsum-based plaster
- Cement-based or gypsum-based vermiculite/perlite mixes
- Glass fibre, crushed rock, blast furnace slag or ceramic-based products (with or without resin binders) and
- Intumescent mastics.

Systems used must be designed, installed, tested and maintained in full accordance with the relevant BS 476 standard and the ASFP Approved Code of Practice.

Any ventilation ductwork will also need to be fire protected where it penetrates a fire separating element. As ventilation ducts provide a potential route for fire spread through the duct consideration of how this will be fire stopped must also be made. Three basic methods should be considered:

- Protection using fire dampers;
- Protection using fire resisting enclosures;
- Protection using fire resisting ductwork.

Where a ventilation duct serves more than one part of a compartmented or fire separated protected escape route, smoke detector operated fire dampers should be provided where ductwork enters each fire separated or smoke separated section of the escape route.

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6 EXTERNAL FIRE SPREAD

6.1 External Wall Surfaces

As the relevant boundaries are all in excess of 1000mm and the building in less than 18 metres in height, there are no specific requirements in relation to the external surfaces.

6.2 Unprotected Areas

To prevent external fire spread from and to adjacent buildings BS 9999 requires limiting the extent of unprotected areas to the sides of a building which would not give adequate protection against the external spread of fire from one building to another. The amount of unprotected area allowed is dependent on the distance to site boundaries / notional boundaries.

Since both the Eclipse and TaRC buildings are existing, with the façades for both buildings remaining unchanged, it is assumed that the addition of the new atrium void space linking the two buildings together will not worsen the external fire spread and will therefore comply with the functional requirements of the Building Regulations.

Additionally as the development will form part of the Hawkshead Campus, where all buildings are operated/managed by RVC, the separation distances can be ignored, as confirmed in BS 9999.

7 FIRE SERVICE ACCESS AND FIRE FIGHTING FACILITIES

7.1 Mains and Hydrants

Due to the height of the building, fire mains are not required within the building, however the building should still be provided with a suitable supply of fire-fighting water, which should be capable of delivering a sufficient flow of water to enable effective fire-fighting to be undertaken. Early consultation (prior to the construction of the building) should be undertaken with the water authority, fire and rescue service and building control body on the nature of the water supply and the quantities or capacity to be provided.

The water supply should comprise one or a combination of the following:

1. hydrants provided by the water supply company on the street mains;
2. private hydrants designed and installed in accordance with BS 9990, ideally forming part of a ring main system;
3. a static or natural water supply.

Hydrants should be located in positions that are near to building entry points and fire appliance parking positions. For buildings not provided with fire mains, hydrants should be provided within 90 metres of an entry point to the building and not more than 90 metres apart. All hydrants should have signage in accordance with BS 3251.

7.2 Vehicle Access

As the building height is less than 11 metres, fire service vehicle access should be provided to the perimeter of the building. The percentage of perimeter access depends on the total floor area of the building.

Total floor area of the building (m^2)	Percentage of the building perimeter (%)
2000 – 8000	15
8000 – 16000	50
16000 – 24000	75
>24000	100

Table 7.2.a Perimeter Access

The proposed building will have a total floor area between 8000 and 16000m^2, therefore perimeter access is required to 50% of the building. From the drawings provided, it would appear that access is available to almost 100% of the perimeter, therefore the redevelopment is deemed to comply.

Every elevation to which vehicle access is provided should have a suitable door not less than 750mm wide giving access to the interior of the building. Doors should be provided such that there is no more than 60 metres between each door and/or the end of that elevation. It is believed that the current proposals achieve this requirement.

Any roads providing fire vehicle access should comply with the widths and hard-standing requirements outlined in BS 9999 and as shown below.

Appliance Type	Min. width of road between kerbs (m)	Min. width of gateways (m)	Min. turning circle between kerbs (m)	Min. turning circle between walls (m)	Min. clearance height (m)	Min. carrying capacity (t)
Pump	3.7	3.1	16.8	19.2	3.7	12.5
High-reach	3.7	3.1	26.0	29.0	4.0	17.0

Table 7.2.b Vehicle Access Route Requirements

In addition, where the access route includes a dead end exceeding 20 metres in length, suitable turning facilities should be provided.

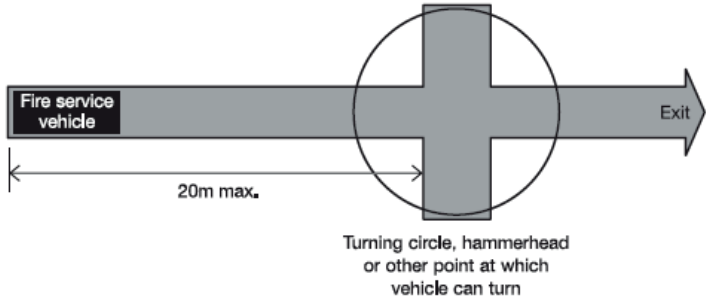

Figure 7.2.a Turning Facilities

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Stage 3 Fire Strategy

8 PORTABLE FIRE FIGHTING EQUIPMENT

A detailed analysis of the risks within the building should be undertaken with portable fire-fighting equipment (PFFE) provided accordingly.

Portable fire extinguishers should be selected and installed in accordance with BS 5306-8:2012 and BS 5306-3:2017.

Normally, extinguishers should be located in conspicuous positions where they will be readily seen by persons following an escape route, i.e. room exits, corridors, stairways, lobbies and landing. Extinguishers should be sited in such a way that it is not necessary to travel more than 30m from the site of the fire to reach an extinguisher.

9 FIRE SAFETY MANAGEMENT

On occupation of the building a fire risk assessment will need to be carried out to comply with the Regulatory Reform Order (Fire Safety) 2005. That fire risk assessment will need to consider the level of management on site. There should be sufficient numbers of staff on duty at all times to manage the requirements of this fire strategy.

The management fire safety procedures should recognise that to compliment the passive and active fire safety measures, there must be a safe and effective procedure in the form of a fire evacuation plan.

When this plan is in place, it will be rehearsed in the form of staff training and fire/evacuation drills.

The emergency plan together with the notices and procedures detailed in this report will form the basis of the management commitment to effective fire safety procedures.

Records of all staff training should be maintained in a Fire Safety Logbook.

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Stage 3 Fire Strategy

10 CONCLUSION

The proposals outlined in this document demonstrate a level of fire safety equal to or greater than the general standard implied by compliance with the recommendations in BS 9999. This level of safety, therefore, satisfies the functional requirements of the Building Regulations relating to fire safety.

11 LIMITATIONS

The information limitations and assumptions used in the preparation of this report are described below.

Building Regulations

This report considers Building Regulations which deal with life safety only. Property protection, business continuity and insurance issues are not addressed in this report.

Other Limitations

Complying with the recommendations of this report will not guarantee that a fire will not occur. This report has been prepared for sole benefit, use and information of the Royal Veterinary College and other members of the design team and the liability of LWF, its directors and employees, in respect of the information contained in this report, will not extend to any third party.

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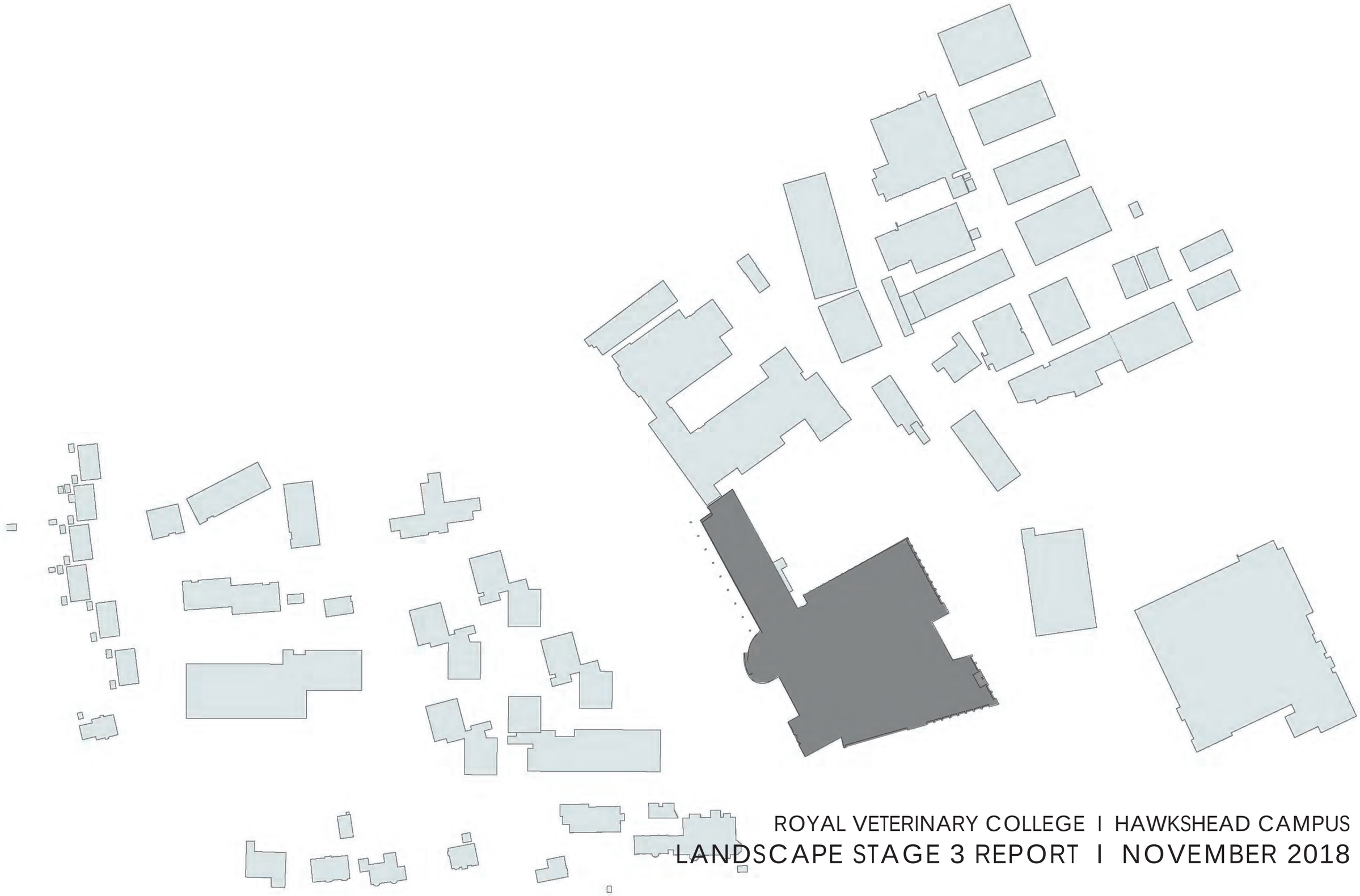
Hawkshead Campus Redevelopment
Stage 3 Fire Strategy

REFERENCES

1. BS 9999:2017 Fire safety in the design, management and use of buildings – Code of practice.
2. BS 5839-1: 2017, Fire detection and fire alarm systems for buildings. Code of practice for system design, installation and maintenance
3. BS 5266-1:2016, Code of practice for the emergency lighting of premises
4. BS EN 1838:2013, Lighting applications. Emergency Lighting
5. BS 5499, Fire safety signs, notices and graphic symbols Part 1: 1990 Specification for fire safety signs
6. BS ISO 3864-1:2011, Graphical symbols. Safety colours and safety signs. Design principles for safety signs and safety markings
7. BS 476, Fire test on building materials and structures
8. External Fire Spread – Building Separation and Boundary Distances, Fire Research Station, BRE 187
9. BS 5306-3:2017, Fire extinguishing installations and equipment on premises. Commissioning and maintenance of portable fire extinguishers. Code of practice
10. BS 5306-8:2012, Fire extinguishing installations and equipment on premises. Selection and positioning of portable fire extinguishers. Code of practice

APPENDIX 4
TURKINGTON MARTIN



ROYAL VETERINARY COLLEGE I HAWKSHEAD CAMPUS

LANDSCAPE STAGE 3 REPORT I NOVEMBER 2018

REVISION	DESCRIPTION	DATE
0	Draft Issue	02-11-2018

TM368-R06 Landscape Stage 3 Report

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Contents

1.0 Introduction

1.0 Introduction

The Landscape Stage 3 Report has been prepared by Turkington Martin Landscape Architects and based on the supporting landscape design information prepared for the planning application which will be submitted on behalf of The Royal Veterinary College. The design has been developed and co-ordinated with the wider design team and reference should be made to their sections of the report. It has also been presented and discussed at a meeting with Welwyn Hatfield Borough Council in September 2018 and were generally supported. The proposals have also been presented to the Hertfordshire Design Review Panel.

As the design progressed, the scope extended to include a wider area of the campus. This was in response from comments made by the Hertfordshire Design Review Panel, to help connect the new facilities back into the wider campus, to help develop an overall sense of place at Hawkshead and increase the usable amenity space for the students, in line with the wider masterplan.

The Landscape Strategy prepared for the detail planning application explained the external environment of the existing Hawkshead Campus; identified the opportunities and illustrated an overall strategy, which was supported by a number of strategies, sections and other visual material.

A principle aim of the design is to connect the new facilities back into the wider campus and help develop an overall sense of place at Hawkshead and increase the usable amenity space for the students, in line with the wider masterplan.

The east west student connection across the campus and through the building is reinforced to improve access and legibility and increase the usable amount of outdoor social space as part of a series of connected routes and spaces. As part of this strategy it is proposed to enhance the entrance space at the campus to improve the sense of arrival and welcome at RVC Hawkshead

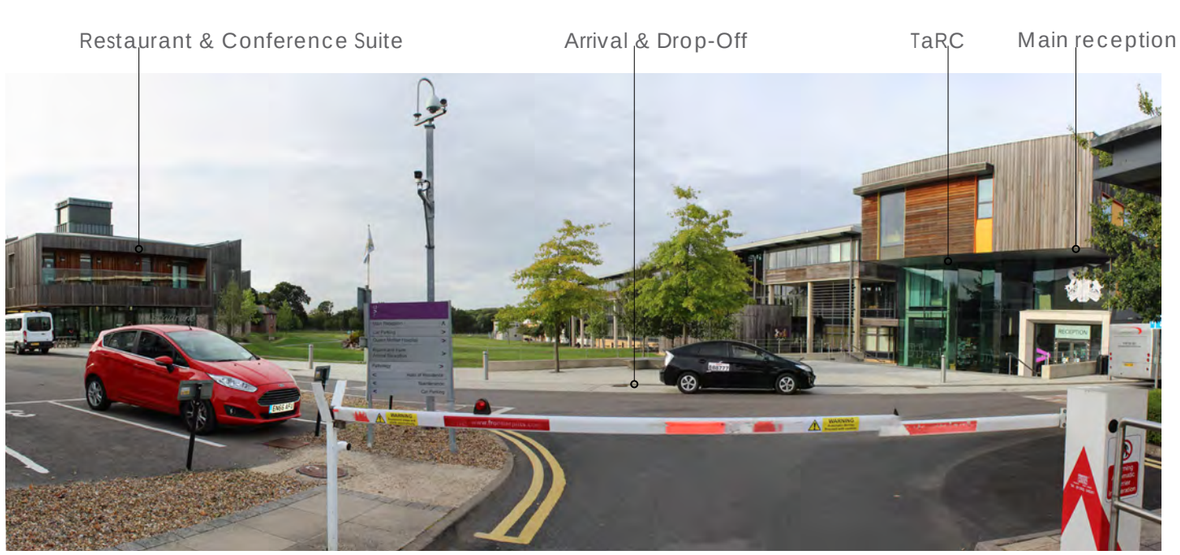
The existing mature tree belt to the east and associated swale is a key characteristic of the campus and it has been important to retain and protect the trees and enhance their setting by removing the various outbuildings and hardstanding to improve the amenity and nature conservation value. Elsewhere the proposals introduce wild flower meadows, native tree planting and alternative mowing regimes in conjunction to improve the bio-diversity across the campus.

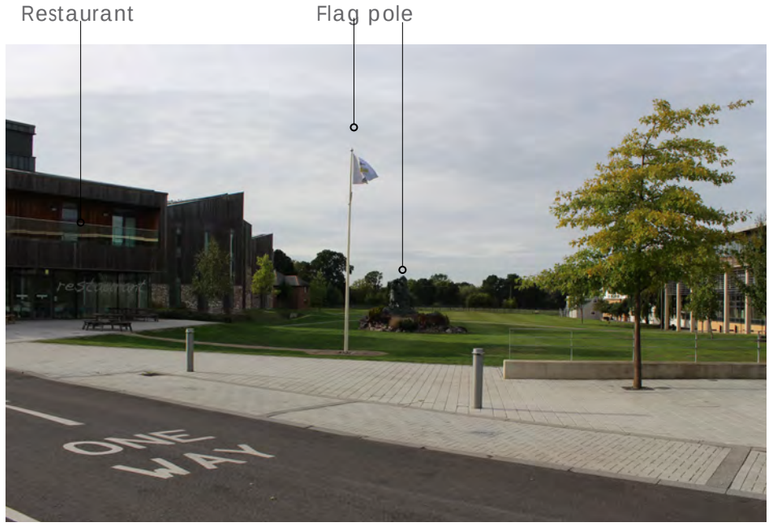
One of the principle design concepts is to develop the short-term parking area as a flexible courtyard that can be used by students when not in use. Around the courtyard, careful consideration has been given to connecting the existing building thresholds to ensure accessible routes and access for all. A restrained palette of materials, furniture and planting has been developed, building on the existing recent external works, to ensure continuity across the campus and create a vibrant, welcoming and social environment for students and College staff.

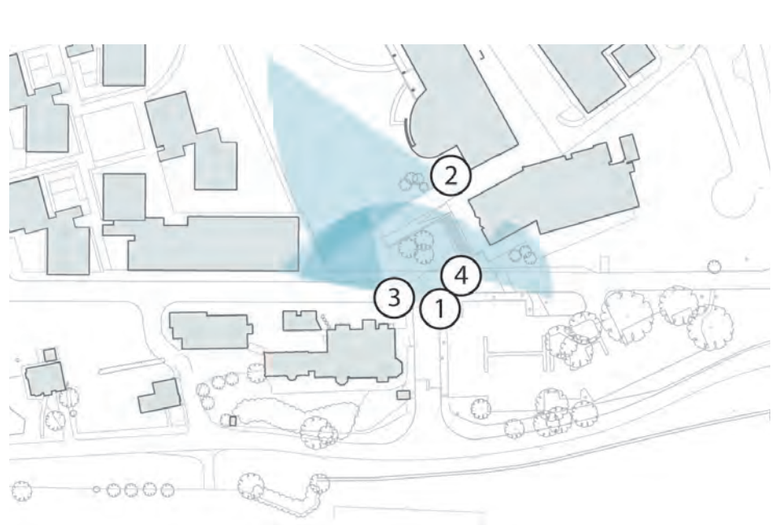
The Landscape Strategy now forms the basis of this Stage 3 Report.

2.0 Site Context

2.1 Site Context I Views - Arrival







2.1 Site Context I Views

Existing tree belt & swale

Existing outbuildings & hard standing within tree belt

Existing tree belt & swale

Existing pedestrian access across swale

2.1 Site Context I Views

Existing access from Eclipse

Access from rear of lecture theatre

CEEED building & existing parking

Access from rear of lecture theatre

CEEED building

2.2 Site Context I Existing Trees

The existing trees in proximity of the new development have been surveyed categorised in terms of their age, amenity value and root protection areas. Reference should be made to the Arboricultural Report undertaken by Broad Oak, which is included as part of the planning submission documents.

The landscape strategy is to retain the integrity of the existing mature tree belt and enhance where possible with new native tree planting. There are no category A trees in this area.

T00 Canopy spread of Category B tree, in accordance with Arboricultural survey

T00 Canopy spread of Category C tree, in accordance with Arboricultural survey

T00 Canopy spread of Category C tree, in accordance with Arboricultural Survey

Root protection area (RPA) in accordance with Arboricultural

Trees not included in Arboricultural Survey

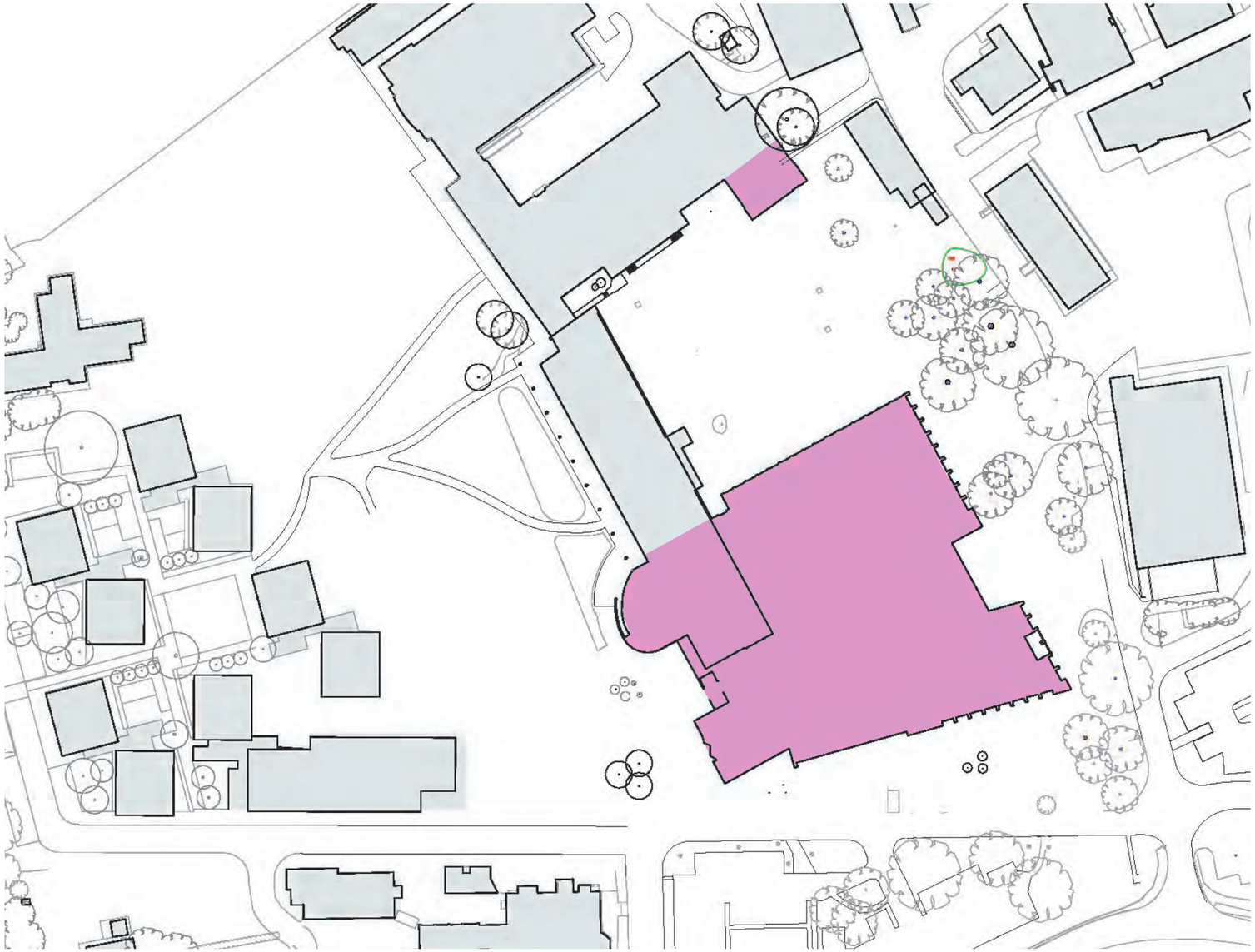
The adjacent detailed diagram illustrates the existing levels around the proposed development site and demonstrates the overall level change from south to north. Careful consideration is required to maintain accessible routes, particularly from east to west whilst co-ordinating threshold levels and maintaining where possible existing trees and root protection areas.

+ (00.00) Existing key level

+ (00.00) THL Existing threshold level

3.0 Landscape Framework

3.1 Landscape Framework I Proposed Development

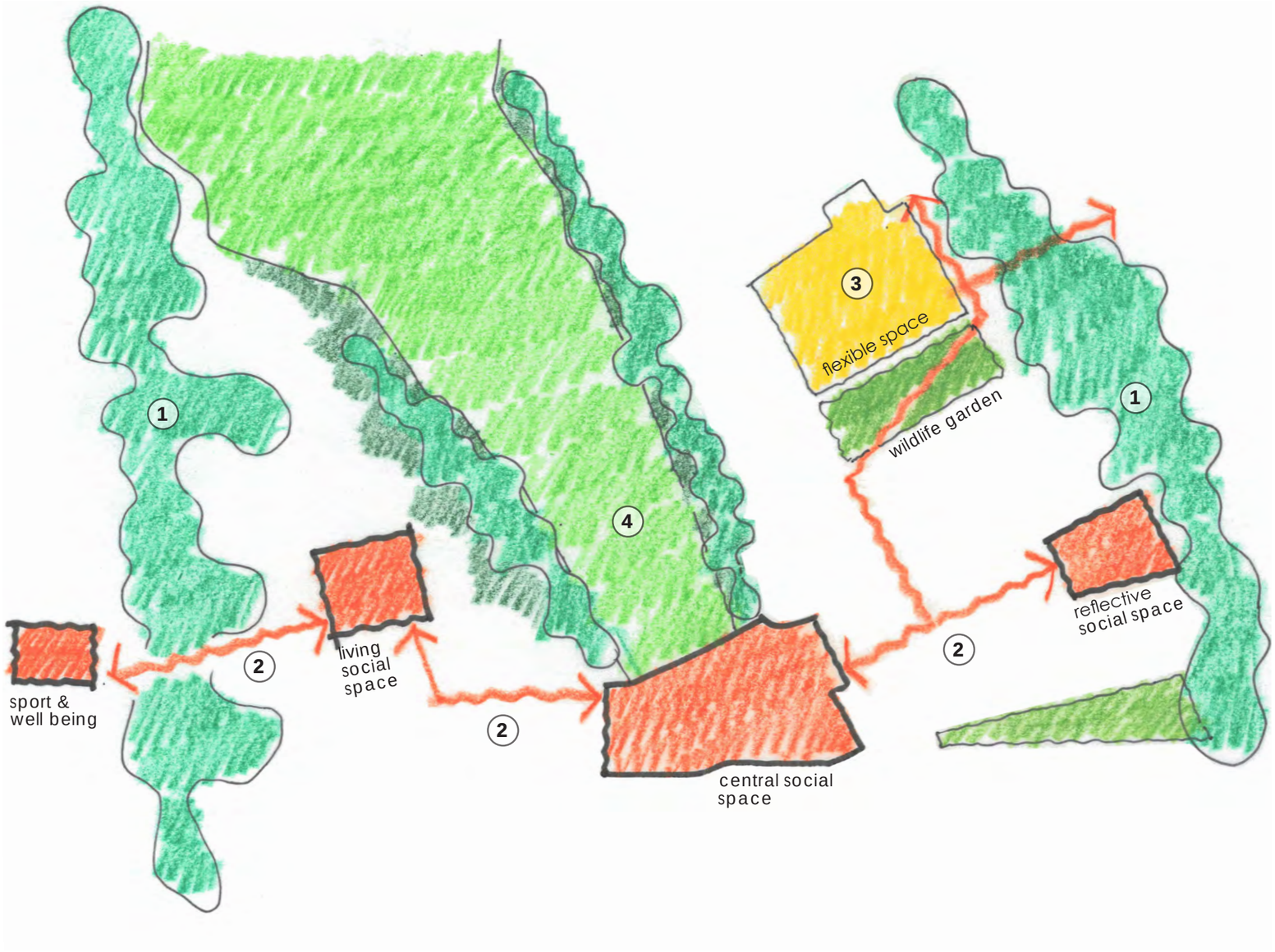


The new development comprises a new academic building that extends and connects TaRC with the Eclipse Building. The built form then creates a courtyard space framed by ts northern edge and the existing Eclipse and CEEED elevations. The building has been carefully placed to retain as many existing trees as possible which form part of the mature tree belts through the campus.

The building arrangement reconfigures the existing entrance into TaRC to between the two buildings to reinforce the east west axial connection through to the eastern part of the campus. The new entrance provides the opportunity to examine the arrival space into the campus and the pedestrian connection across the green to the Restaurant and Conference Suite.

The courtyard space will require some parking in the short term. The landscape strategy aims to limit its impact and develop a solution that can revert to a more social pedestrian space in the future.

3.2 Landscape Framework I Wider Objectives



A key objective is to reinforce the east west pedestrian connection between the Sports & Well-Being Centre across the main central heart of the campus through to the academic and clinical facilities. Part of realising this aspiration is to reconfigure the area between the Restaurant and Conference Suite and the new development to provide a generosity of space to improve the sense of arrival and encourage increased social interaction.

There is also the opportunity to look at the relationship between the Central Green and existing buildings to develop a more natural transition between the two by introducing intermittent tree planting with longer grass and wild flowers below. This will help frame the views across the lawn, create an interesting and varied edge, increase the nature conservation value and set the buildings back amongst trees, reinforcing the green rural character.

As the masterplan develops there is the opportunity to rationalise the path system and access across the Central Green.

1. Retain, protect & reinforce green fingers to enhance nature conservation value
2. Develop hierarchy of pedestrian routes linking main social spaces
3. Develop a flexible paved space for short term parking & other managed uses
4. Enhance central green space and frame with wild flower and native tree planting

3.3 Landscape Framework I Site Objectives

The following landscape objectives were established at the start of the design process and have acted as a touchstone as the design has progressed. It is considered important that there is positive relationship between the common inside and outdoor spaces to not only reinforce the east west connection but also to generate a sequence of social spaces, that differ in character, size and aspect across the campus.

It is also important that the new building respects and relates to the existing tree belt to the east. The landscape strategy aims to improve the quality of this area and increase the bio-diversity through clearing much of the back of house equipment in the area and plant with wild flowers and bulbs.

1. Retain & protect green finger
2. Create flexible paved space for parking & other managed uses
3. Develop garden walk as part of accessible pedestrian route
4. Upper terrace as break out & social space
5. East terrace break out & social space overlooking green finger
6. Building elevations engage with existing landscape
7. Limited routes across green finger

1 College Green
2 Hawkshead Square
3 Restaurant Terrace
4 Main Entrance
5 Arrival & Bus Drop Off
6 Internal Social Space
7 East Square & Terrace
8 The Garden
9 Break Out Space
10 Flexible Parking Court
11 Green Finger
12 Discreet Servicing

3.4 Landscape Framework I Initial Concept

The adjacent concept diagram illustrates the key landscape principles for the routes and spaces, in particular the east west connectivity, the arrival space and new parking courtyard. As part of developing the character of these spaces, names have been applied to aid description and begin to suggest their character.

A brief description of the spaces, their anticipated use and relationships with the existing and proposed built form is set out below. Whilst some of the detail has been refined and set out later in the document, the principles have remained consistent.

1 College Green

This is a much loved and well used space. It offers views out to the wider countryside as you arrive at the main entrance off Hawkshead Lane. It is intended adjust the southern end to integrate with the enlarged Hawkshead Square. As part of the strategy to increase bio-diversity a wild flowers with occasional trees ill be integrated along each edge, this will also frame the views and help assimilate the existing and new buildings into the landscape. The existing statue will remain.

2 Hawkshead Square

The existing space is increased to provide space for more social activity, reinforce the connections from east to west in a more legible fashion, make more use of the open south facing aspect and create more of a sense of arrival. New tree planting and seating will be integrated into the design. The new configuration will retain and integrate the existing steps and ramp down to TaRC.

3 Restaurant Terrace

The existing terrace will be retained and integrated with the broader square.

4 Main Entrance

The entrance is relocated to align with the key pedestrian connections. The existing entrance paving to TaRC will continue across the new threshold. Additional break out and meeting space is provided. It is intended that inside and outside space appears seamless at this point.

5 Arrival & Bus Drop Off

Along this frontage the paving is set back to allow for taxi drop off. To the east the paving is extended back to the building to allow a comfortable waiting area for the shuttle bus with seating.

6 Internal Social Space

Conceived as the heart of the new building, this active flexible space encourages social interaction between students. It forms part of the key east west link to maximise its use with a seamless connection between outside and inside.

7 East Square & Terrace

The link opens out into a new space with terrace steps down to accommodate the change in level down to the existing swale and more natural areas within the retained tree belt. An accessible ramp is integrated along the southern edge of the space. A screen wall separates the route from the service area.

8 The Garden

A lush planted garden provides a new amenity asset in this area, a degree of protection to the break out area from the lecture theatre and takes up the change in level in the courtyard space.

9 Break Out Space

A modest break out and social space is integrated at the upper level adjacent to the seminar rooms and lecture theatre.

10 Flexible Parking Court

The court is designed to subtly accommodate cars whilst acting as a successful amenity space for students and events without vehicles. Through careful paving design, avoiding a fully set out car park, the space can double up to be a useful additional space.

11 Green Finger

A key characteristic of the campus, the existing tree belt is retained and enhanced to provide a significant contribution to improving the bio-diversity as well as valuable visual amenity. The ground will be cleared and wild flower planting added. New routes across will be carefully integrated with the root protection areas. Where possible the existing swale will also be cleared and enhanced.

12 Discreet Servicing

A limited quantum of servicing is required in this location. The area and turning requirements will be kept to a minimum and contained with and screen wing walls.

3.5 Landscape Framework I Character Areas

The landscape areas can be divided into four broad areas, namely, the eastern tree belt, courtyard, arrival & main link and central green, as below. As the design has developed these areas have been refined relative to their uses and adjacencies to buildings and the existing landscape. The images opposite give an indication of the character and activities envisaged.

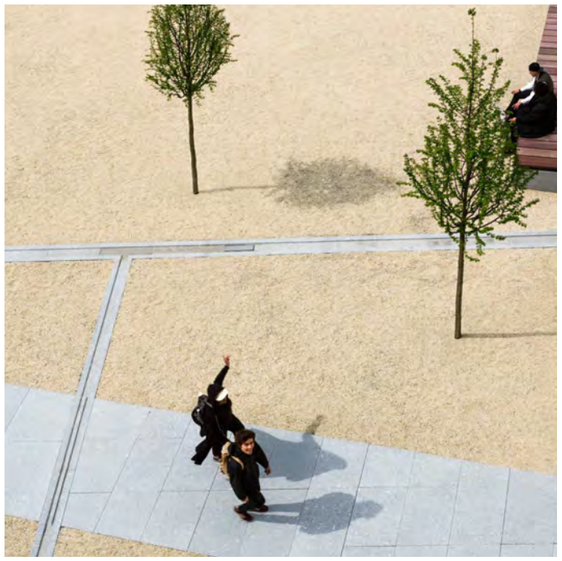
Courtyard

Eastern tree belt

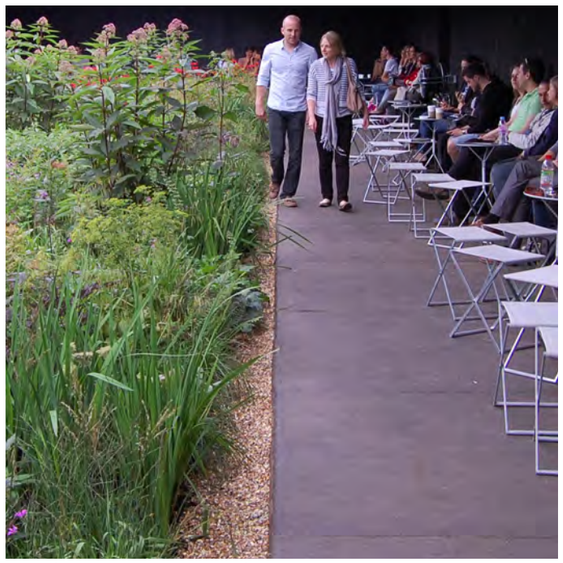
Arrival & main link

Central Green

COURTYARD



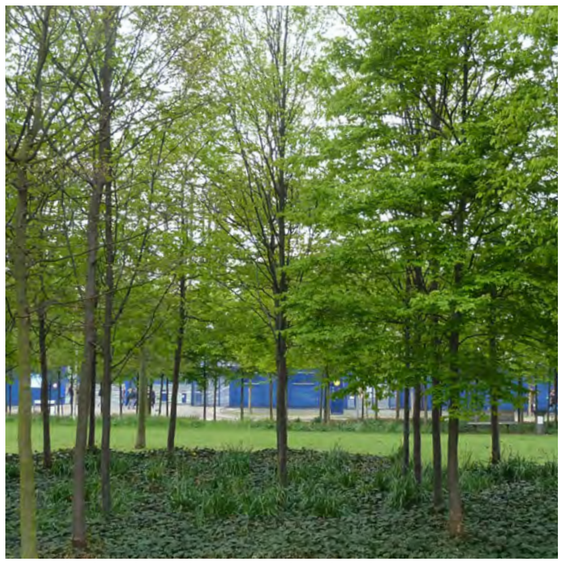
Subtle use of paving in parking court



Breakout space & garden

EASTERN TREE BELT

East square & terrace



Trees belt & bio-diverse underplanting

ARRIVAL SQUARE

Paved social space & link

Sitting, meeting, eating

CENTRAL GREEN

Flexible use central mown lawn area

Bio-diverse edges to Central Green

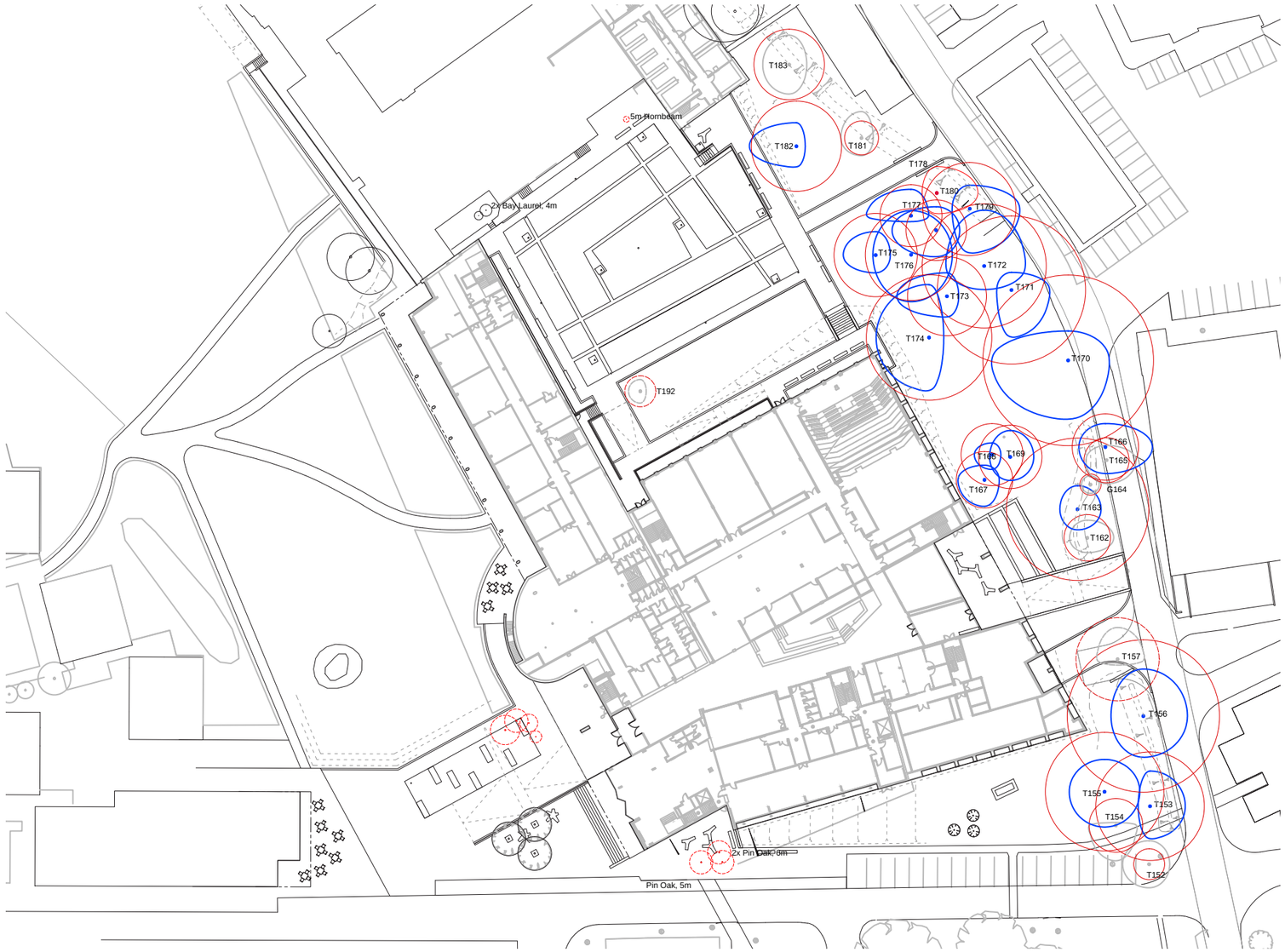
3.6 Landscape Framework I Overall Landscape Plan

Section Aa

Section Bb

4.0 Landscape Strategies

4.1 Landscape Strategies I Trees Retained & Removed



The building footprint, servicing requirements and access are arranged to minimise the impact on the existing tree and their RPAs. A limited number of Category C trees are to be removed. Further detail and description of these trees can be found in the Arboricultural Survey by Broad Oak Ltd.

T00 Canopy spread of retained Category B tree, in accordance with Arboricultural survey

T00 Canopy spread of retained Category C tree, in accordance with Arboricultural survey

T00 Canopy spread of retained Category C tree, in accordance with Arboricultural survey

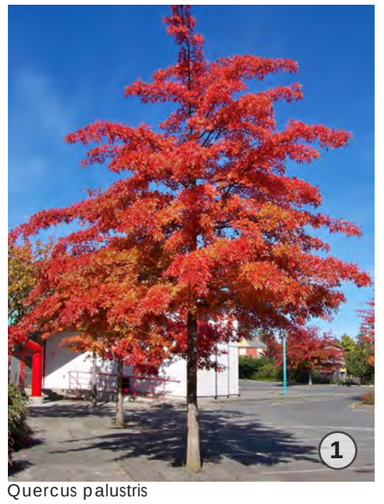
T00 Canopy spread of Category C tree to be removed, in accordance with Arboricultural survey

Root protection area (RPA) of tree to be retained, in accordance with Arboricultural

Root protection area (RPA) zof tree to be removed, in accordance with Arboricultural survey

Tree to be retained, not included in Arboricultural survey

Tree to be removed, not included in Arboricultural survey



Quercus palustris

Gleditsia triacanthos 'Sunburst'

Betula pendula

Acer campestre

Existing trees

1 Proposed tree Hawkshead Square

2 Proposed tree Parking Court

3 Proposed tree, bio-diverse garden

4 Proposed tree, Central green & Tree belt

Prunus spp


Calamagrostis brachytrichia


Tricyrtis formosana Autumn Glow


Dryopteris wallichiana


Hemerocallis spp


Tiarella cordifolia


Anemanthele lessoniana


Imperata cylindrica


Iris sibirica

Quercus robur


Ajuga reptans


Echinacea purpurea ‘Firebird’


Rodgersia pinnata ‘Superba’


Hydrangea ‘Annabelle’


Luzula sylvatica


Hosta spp


Geranium ‘Rozanne’


Cornus ‘Mid-Winter Fire’

4.3 Landscape Strategies I Bio-diversity

A preliminary Ecological Appraisal has been prepared by Applied Ecology Ltd, which is included in the submitted suite of planning documents.

The principle areas for increasing bio-diversity include the existing tree belt and swale, the edges of the Central Green, the garden and potentially other grass areas that could be less intensively mown. As the detail landscape design is progressed, further co-ordination with the ecologist will ensure the maximum benefit for wildlife and habitat creation is realised through the choice of planting and landscape management.

1. Enhanced green finger - existing outbuildings and hard standing removed where possible, access across the area limited, new wild flower planting, swale managed to improve nature conservation value.
2. New areas of wild flowers and native trees - reduce intensity of mowing at edges, introduce wild flower planting and occasional tree groups
3. New wildlife garden - plant with species to encourage pollination and with a mix of flowers, fruits and seeds.
4. Identify areas where less intensive mowing regime can be implemented.

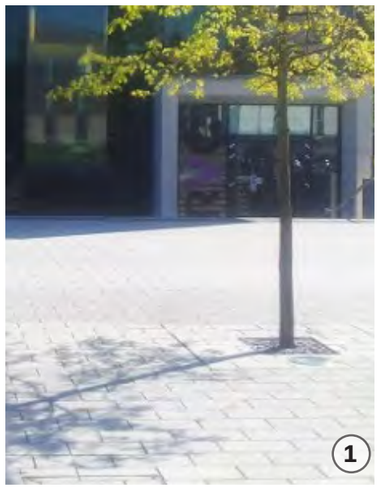
4.4 Landscape Strategies I Overall Levels

+ (00.00)	Existing level
+ 00.000	Proposed level
+ 00.000 THL	Proposed threshold level

4.5 Landscape Strategies I Paving & Furniture

A simple robust palette of paving is proposed that builds on the existing materials previously established around TaRC, student village and restaurant. This will help tie the new development into the surrounding context and create an integrated and connected route through the building. New seats are installed at the main social areas to encourage student interaction.

1. Silver grey textured paving slabs for pedestrian use to match existing
2. Timber seats to promote social interaction in new increased social space overlooking the meadow
3. Sculptural concrete feature seating
4. Steps, silver grey textured concrete
5. Banding of smooth silver-grey concrete slabs, pencil edged with resin bound gravel central space
6. Sitting steps overlooking the tree belt and wild flowers
7. Dark grey stone paving to match existing as threshold
8. Slate scalping edge to building
9. Fair faced concrete retaining & screen walls with metal balustrade to match existing
10. Naturally bound gravel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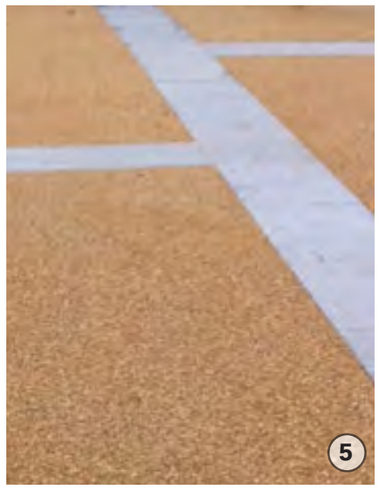
2


3


4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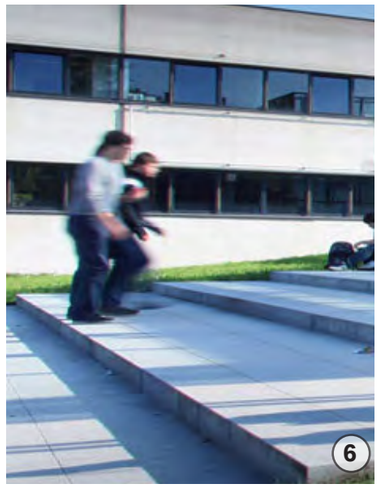
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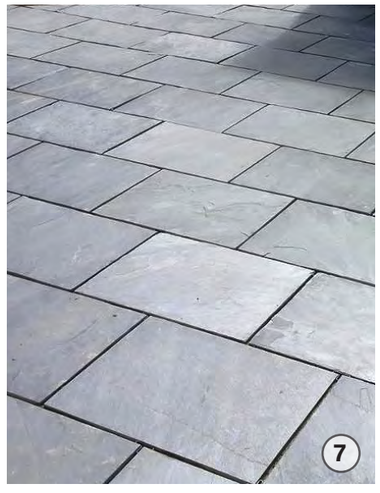
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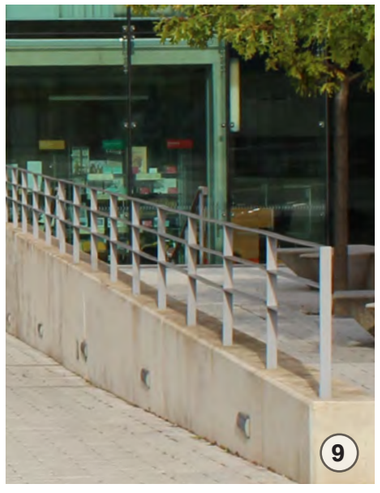
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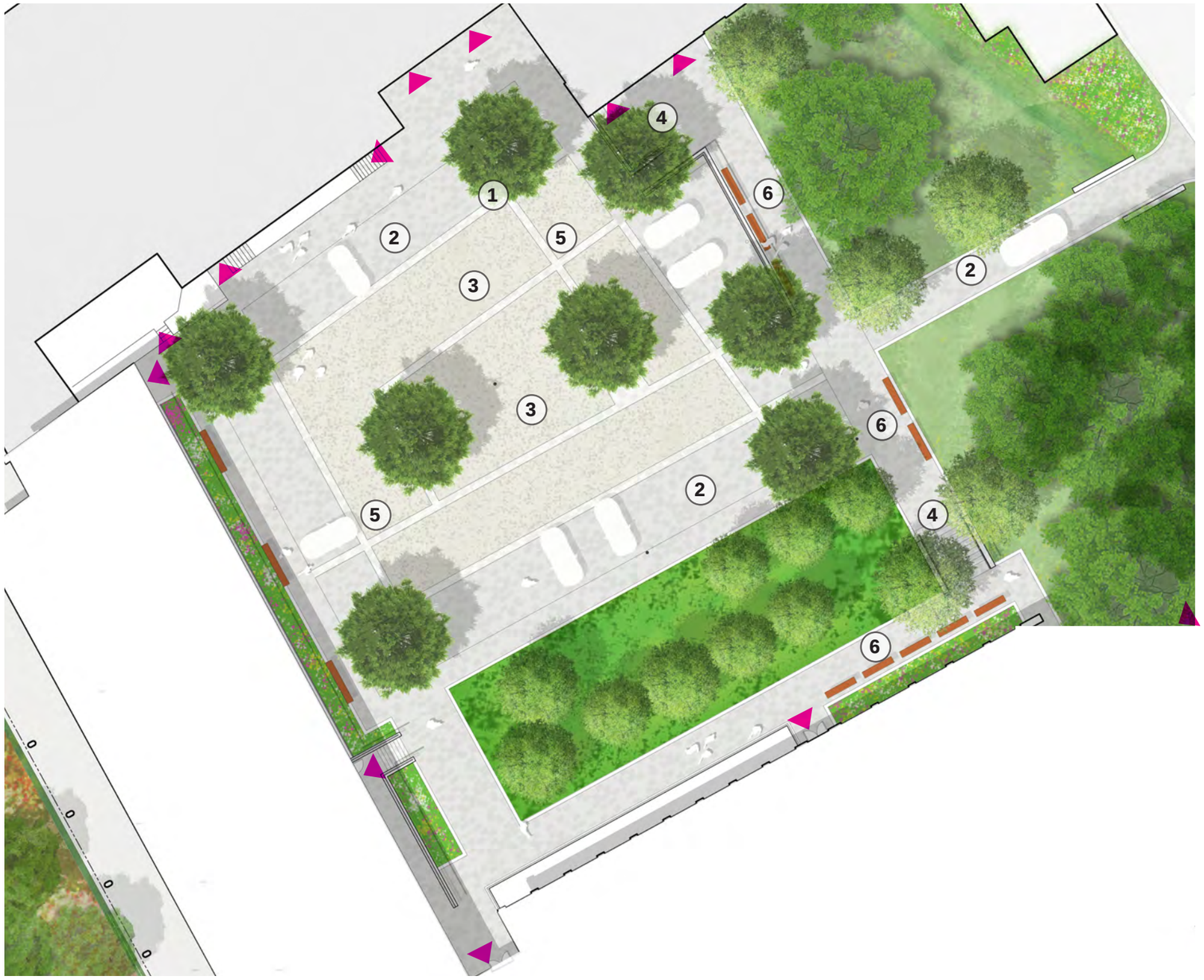
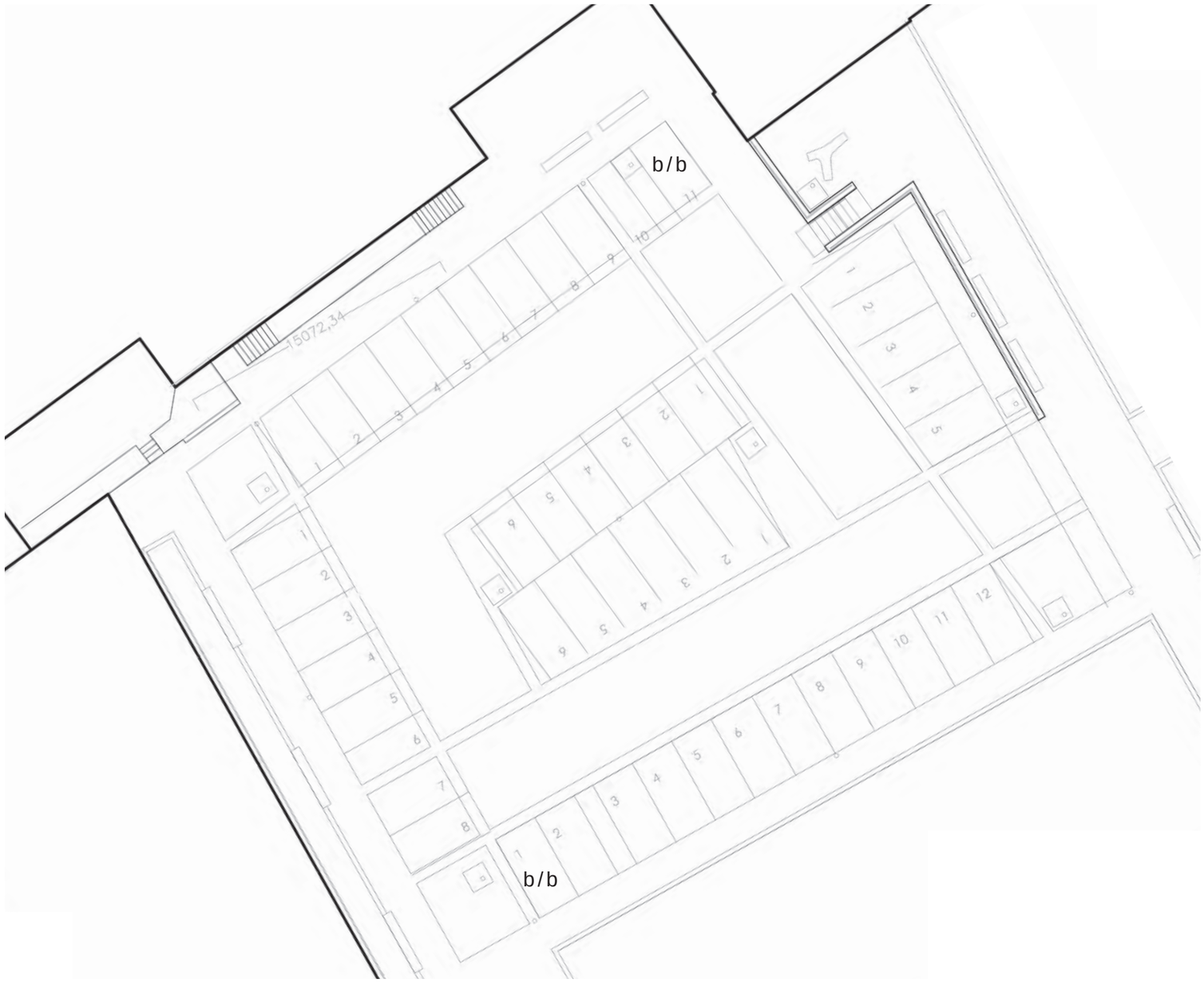
4.6 Landscape Strategies I Parking Court



The Flexible parking area is conceived as a courtyard space, set out and paved in finishes that can read as an amenity square for flexible use by students. To this end it is not envisaged to mark out individual bays, but install paving zones, of parking depth, marked by bands of contrasting paving.

1. Silver grey textured paving slabs for pedestrian use
2. Silver grey textured concrete setts for vehicular use
3. Silver grey permeable resin bound gravel within Parking Square
4. Steps, silver grey textured concrete
5. Banding of smooth silver-grey concrete slabs, pencil edged
6. Sculptural concrete feature seating
7. Free standing timber seat with armrest and back rest, timber batons on metal supports

4.6 Landscape Strategies I Parking Court



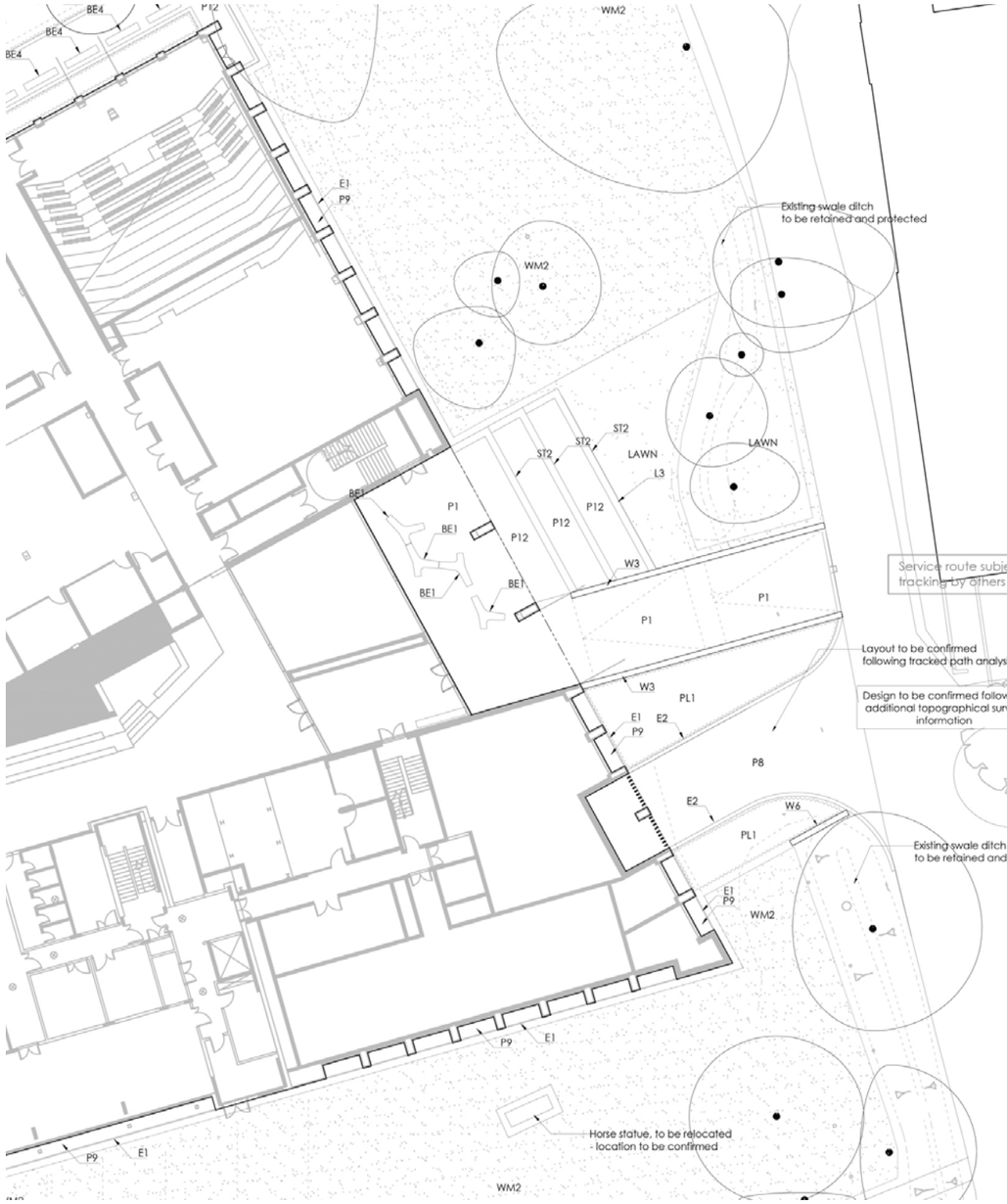
The parking area is designed to appear as a courtyard that can also be used by students for events at times when cars aren'r parked there. The adjacent diagram illustrates the number of cars that are able to park there at capacity. Two spaces are identified as blue badge bays, however there are a number of spaces that will provide the additional accessible space should they be required.

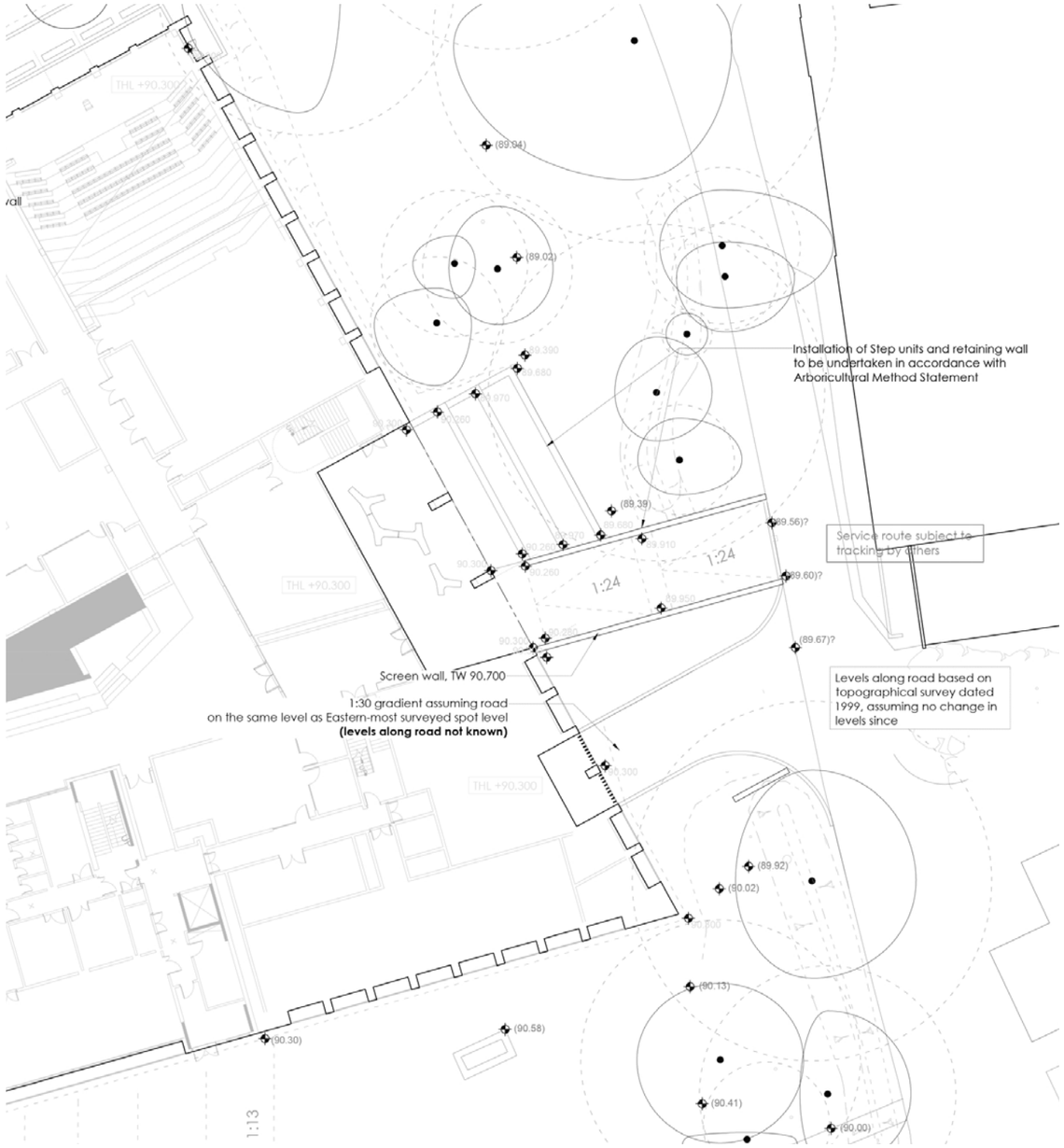
The sketch plans below illustrate the parking with cars and how it will appear and be used without vehicles in the space. It is envisaged when there are events and functions, cars may be restricted and the space revert to amenity use.

As a parking court

As new social space with cars relocated for student amenity use

4.7 Landscape Strategies I East Square & Terrace



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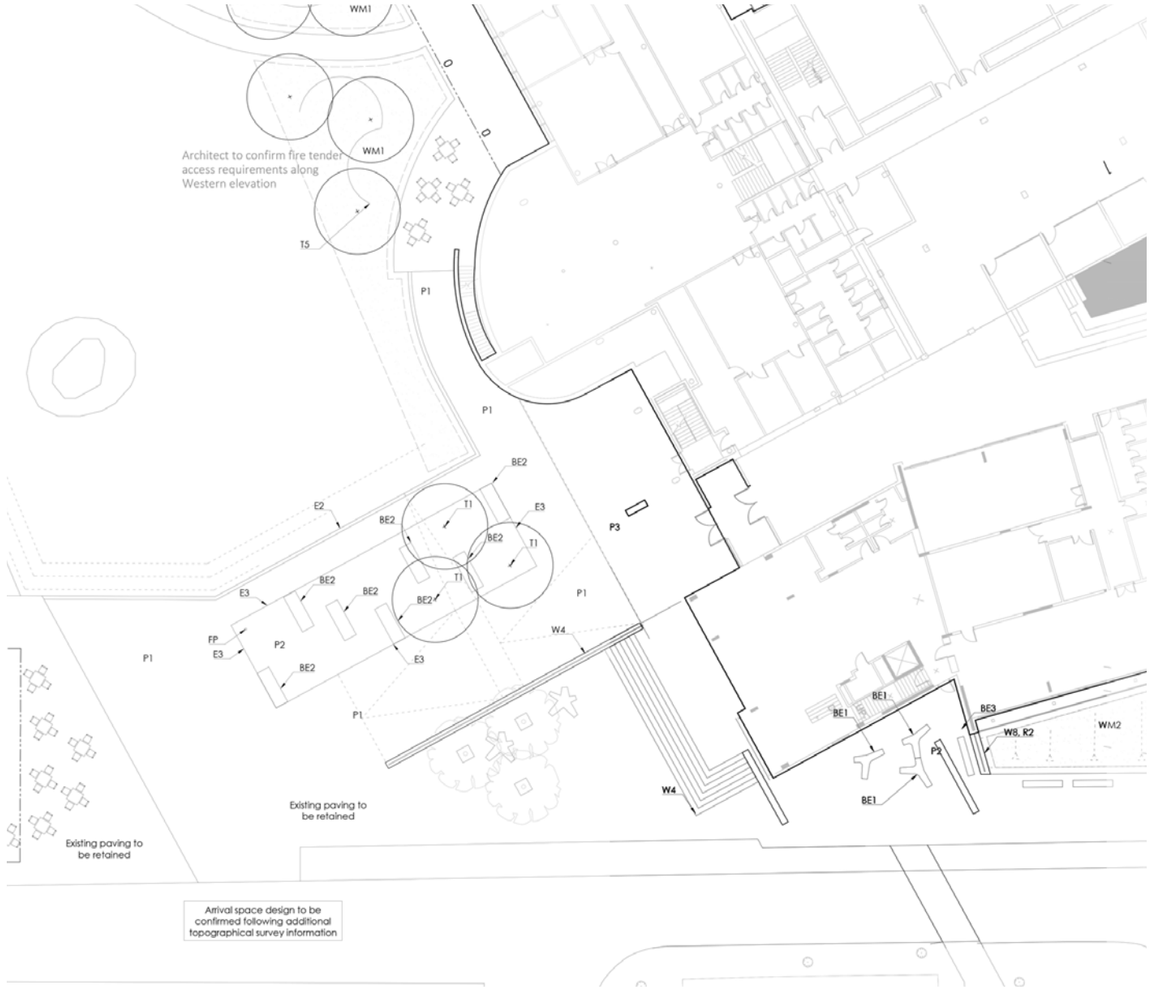
(90.17)
(90.26)
(90.18)
(90.22)
(90.25)
(90.47)
(90.71)?
(90.85)?
(90.26)
(90.65)?
(91.29)
(91.12)?
(91.29)
(91.33)
(91.16)
(91.04)
(90.93)
Existing retaining wall retained
W3; Retaining wall, top of wall +91.700
50mm upstand kerb
50mm upstand kerb


WM1
WM1
Architect to confirm fire tender access requirements along Western elevation
T5
P1
P1
P3
BE2
E2
T1
E3
BE2
BE2
T1
E3
BE2
BE2
T1
P1
FP
E3
P2
E3
BE2
P1
W4
P1
BE1
BE3
W8, R2
WM2
P2
BE1
W4
Existing paving to be retained
Existing paving to be retained
Arrival space design to be confirmed following additional topographical survey information

5.0 Views


restaurant

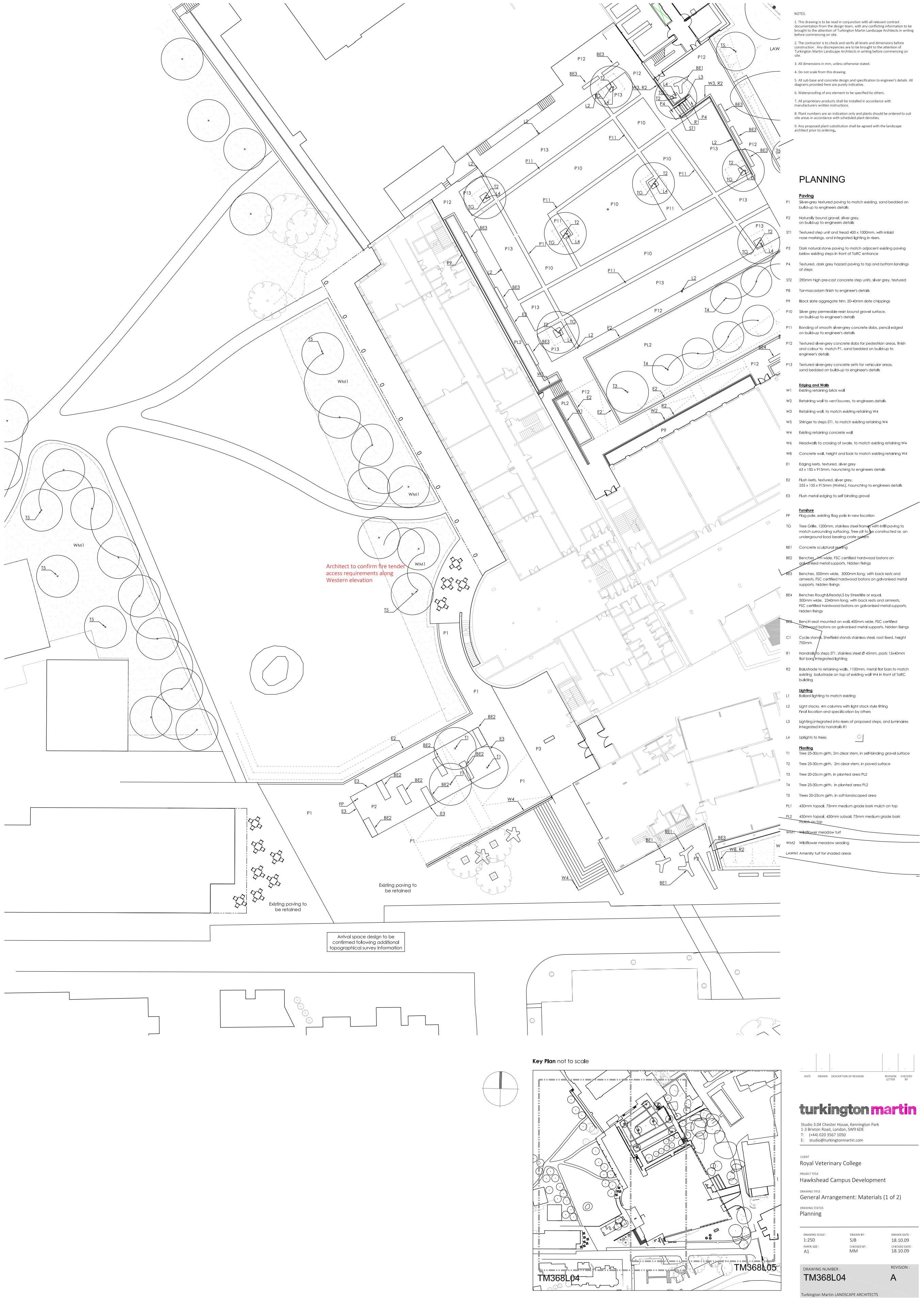
6.0 Conclusion

Whilst the landscape has been co-ordinated with the architecture and engineering to ensure an integrated solution as much as possible for the planning submission, there remains a number of areas where further co-ordination is required between disciplines.

- Final design of levels to link space between TaRc and restaurant following receipt of further survey information.
- Integration of fire path to west of Eclipse Building.
- Integration of steps, wall and new façade to west elevation of TaRC.
- Final co-ordination of service access to the east, including swept paths, screen walls, access of drainage swale, edge protection and existing trees.
- Final co-ordination and confirmation with arboricultural consultant works in close proximity to the RPAs.
- Final co-ordination of levels, access requirements and retained thresholds to the east elevation of TaRC.
- Confirmation of the removal of outbuildings and other features to improve setting and amenity value of eastern tree belt.

7.0 Appendix

The following drawings form part of the stage 3 information and are available at full size.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Architect to confirm fire tender access requirements along Western elevation
Existing paving to be retained
Arrival space design to be confirmed following additional topographical survey information
Key Plan not to scale
TM368L04
TM368L05
DATE
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Studio 3.04 Chester House, Kennington Park
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CLIENT
Royal Veterinary College
PROJECT TITLE
Hawkshead Campus Development
DRAWING TITLE
General Arrangement: Materials (1 of 2)
DRAWING STATUS
Planning
DRAWING SCALE : 1:250
DRAWN BY : SJB
DRAWN DATE : 18.10.09
PAPER SIZE : A1
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CHECKED DATE : 18.10.09
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REVISION : A
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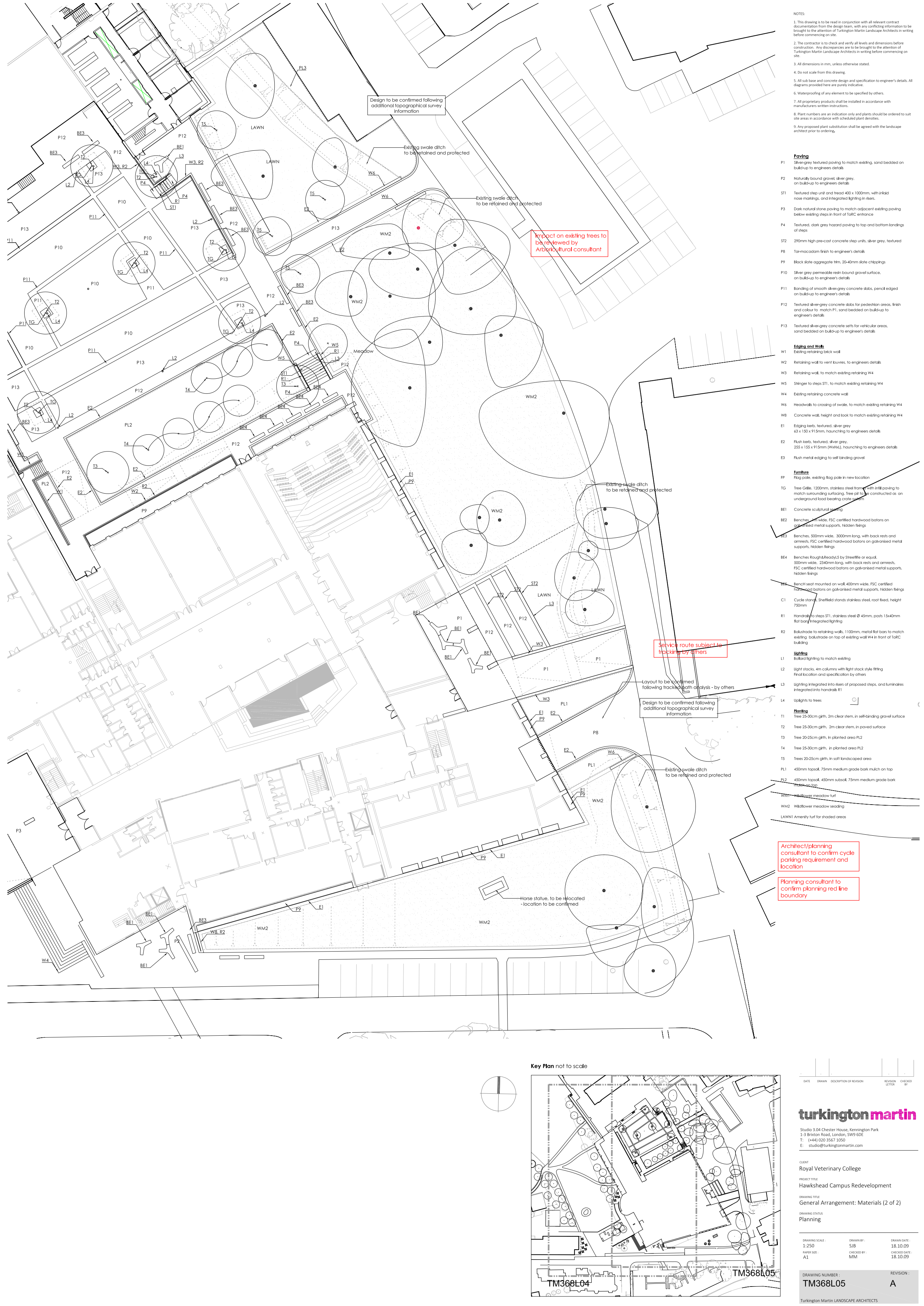
Design to be confirmed following additional topographical survey information
Existing swale ditch to be retained and protected
Impact on existing trees to be reviewed by Arboricultural consultant
Service route subject to tracking by others
Layout to be confirmed following tracking/path analysis - by others
Horse statue, to be relocated - location to be confirmed
Architect/planning consultant to confirm cycle parking requirement and location
Planning consultant to confirm planning red line boundary
Key Plan not to scale
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Planning
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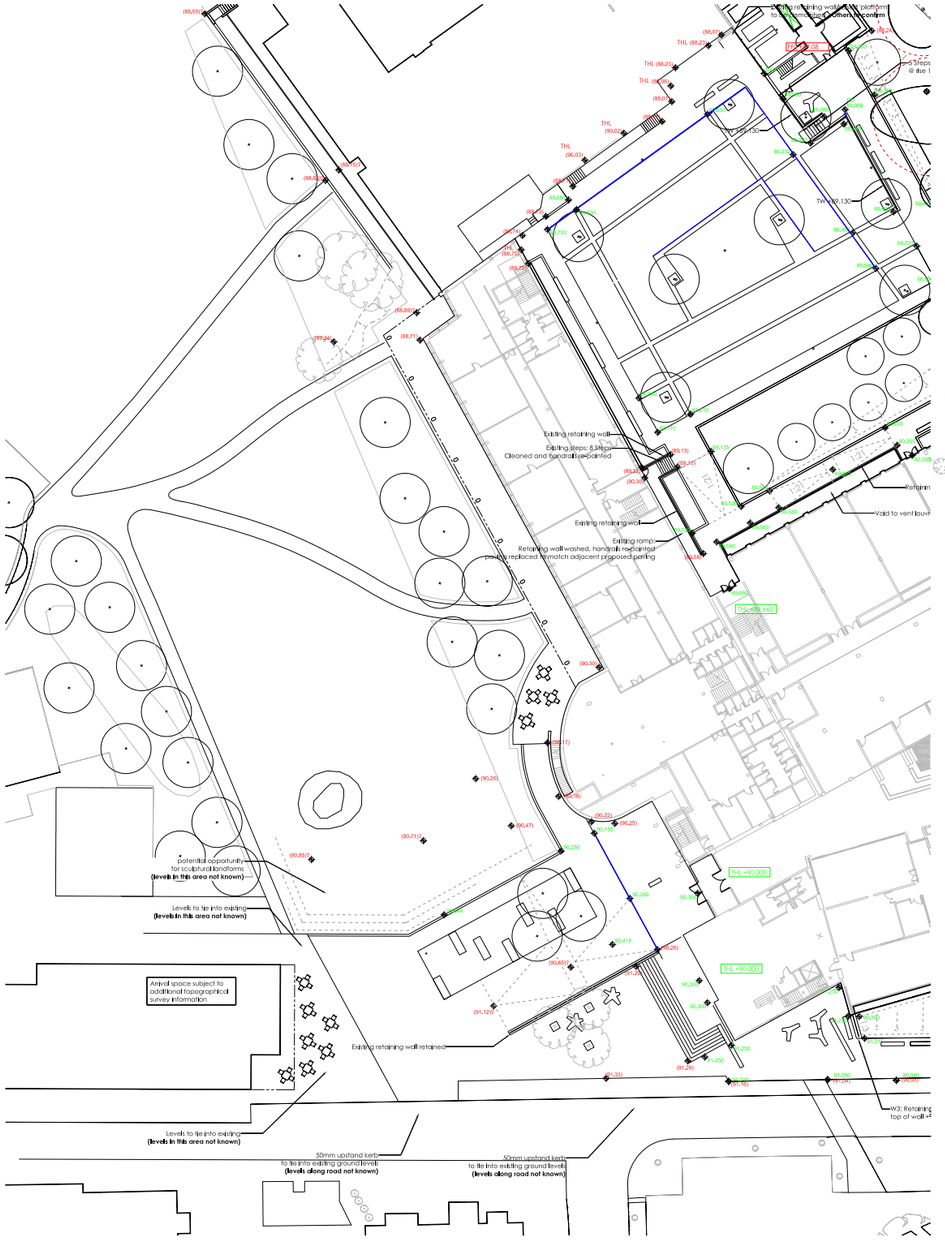

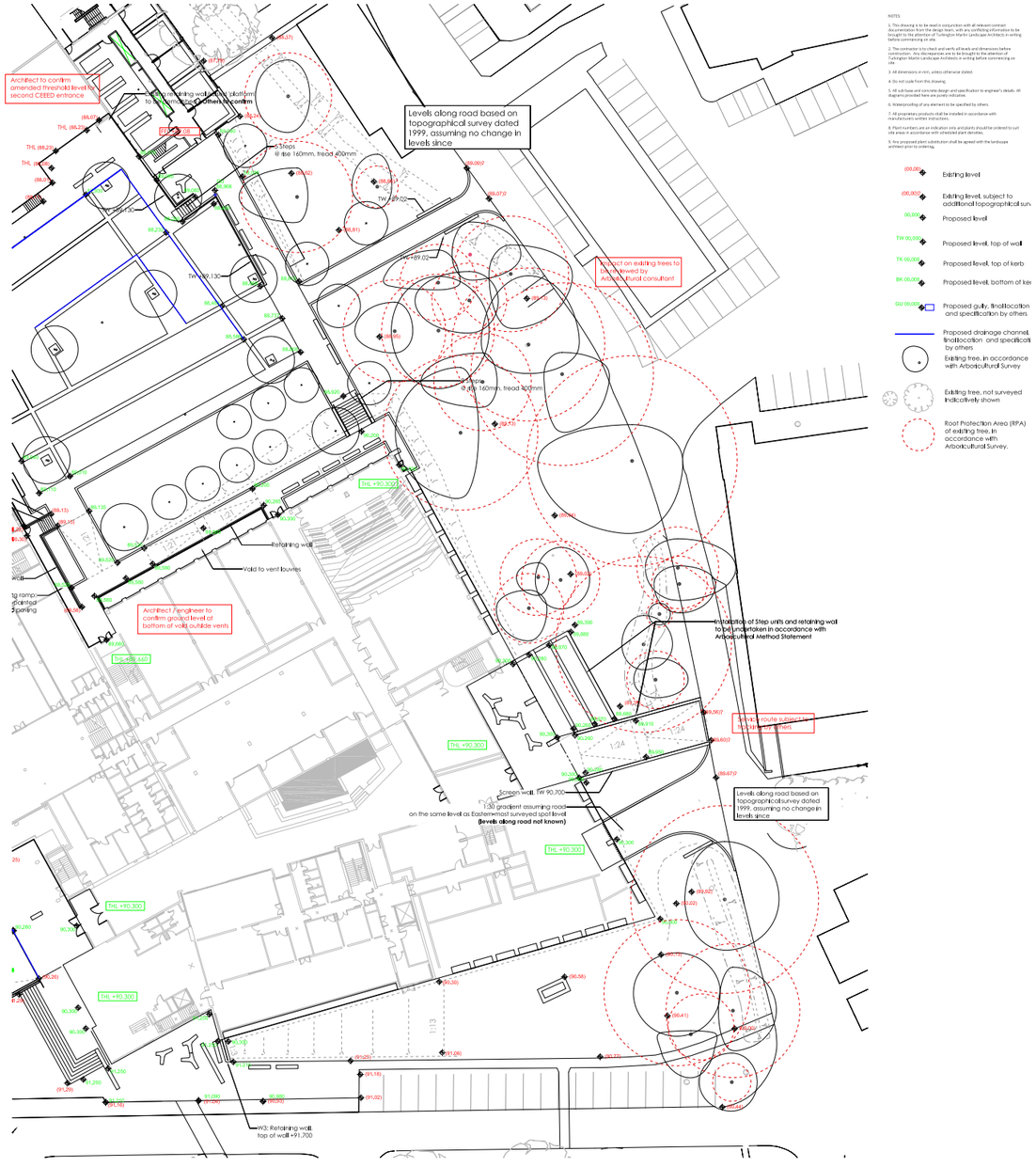

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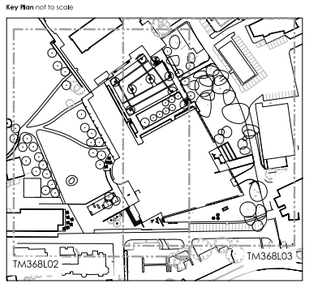

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DRAWING TITLE: General Arrangement: Levels (1 of 2)
DRAWING STATUS: Planning

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PAPER SIZE	CHECKED BY	CHECKED DATE
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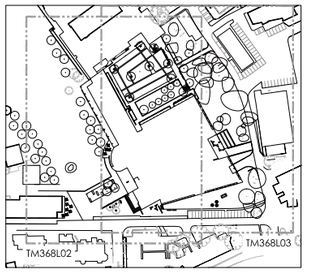

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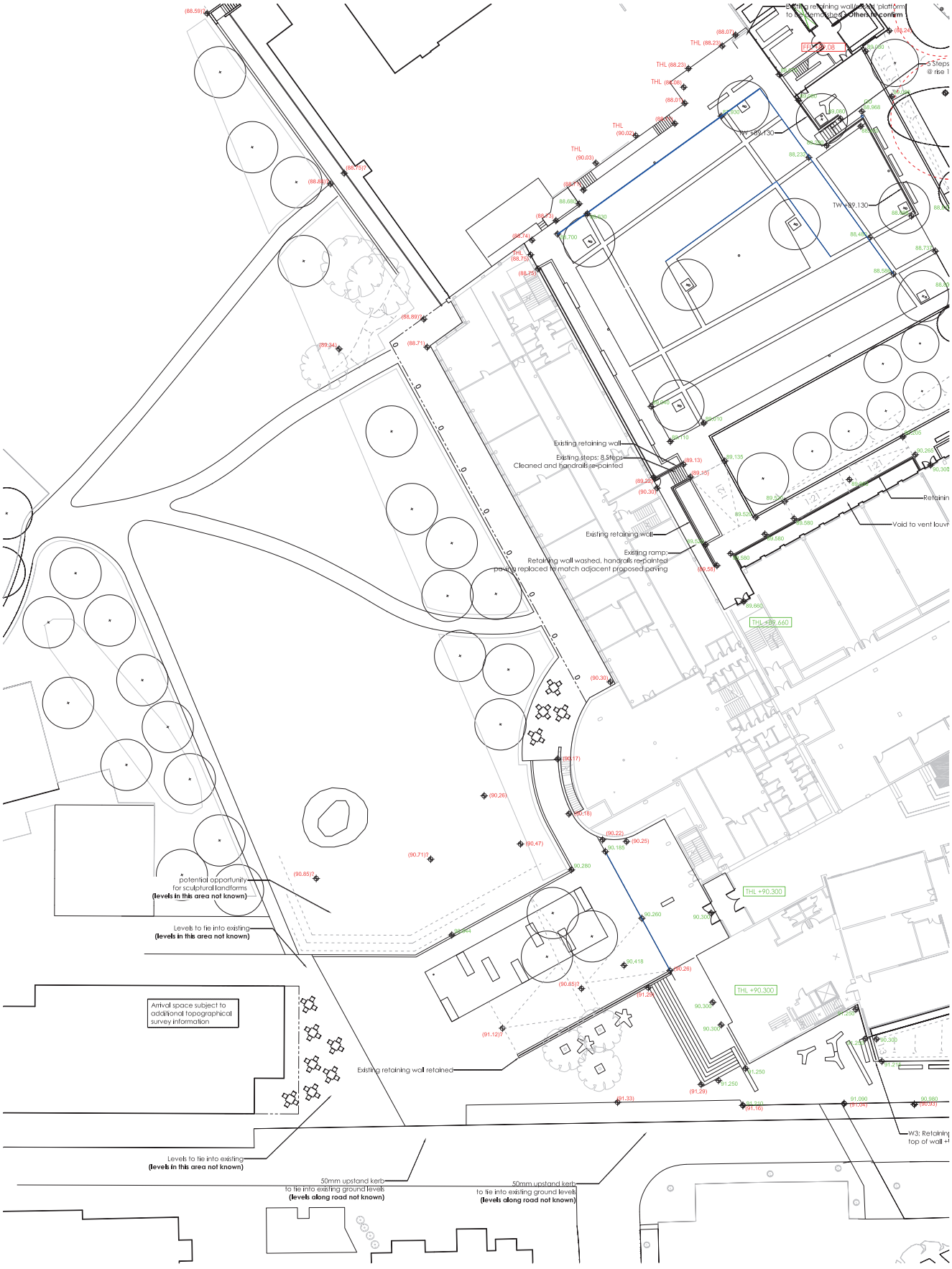

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7. All proprietary products shall be installed in accordance with manufacturers written instructions.
8. Plant numbers are an indication only and plants should be ordered to suit site areas in accordance with scheduled plant densities.
9. Any proposed plant substitution shall be agreed with the landscape architect prior to ordering.

(00.00) Existing level

(00.00)? Existing level, subject to additional topographical survey

00.000 Proposed level

TW 00.000 Proposed level, top of wall

TK 00.000 Proposed level, top of kerb

BK 00.000 Proposed level, bottom of kerb

GU 00.000 Proposed gully, final location and specification by others

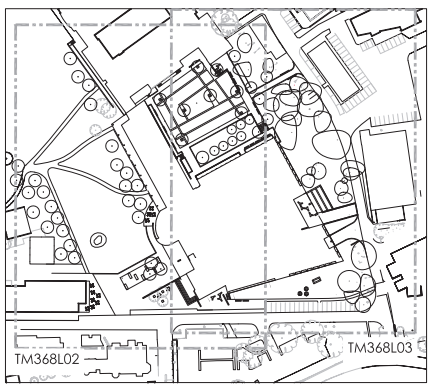
Proposed drainage channel, final location and specification by others

Existing tree, in accordance with Arboricultural Survey

Existing tree, not surveyed indicatively shown

Root Protection Area (RPA) of existing tree, in accordance with Arboricultural Survey. Hatched area indicates anticipated conflict between RPA and construction (to be confirmed by Arboricultural Consultant)

Key Plan not to scale



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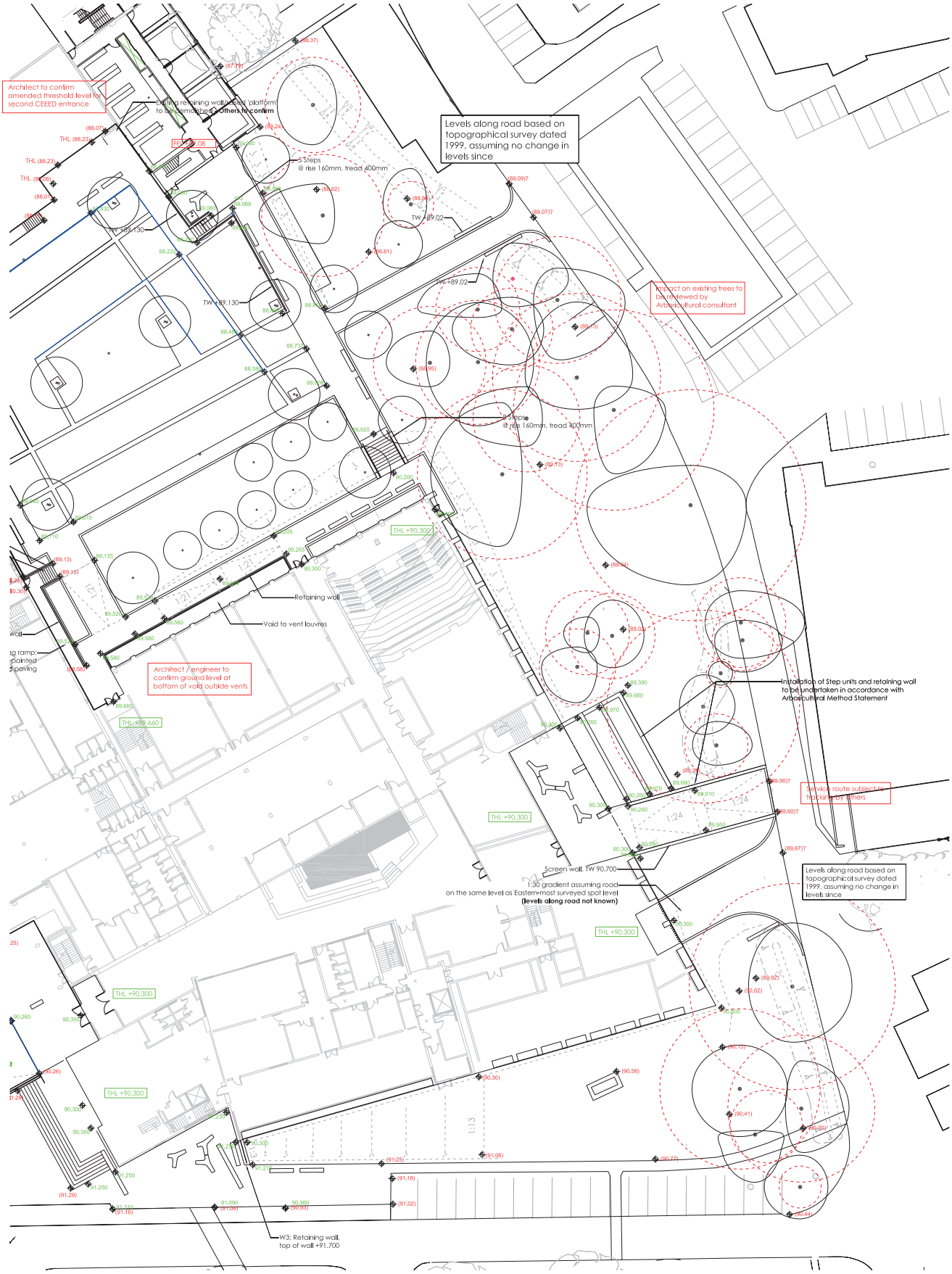

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(00.00)? Existing level, subject to additional topographical survey

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TK 00.000 Proposed level, top of kerb

BK 00.000 Proposed level, bottom of kerb

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Proposed drainage channel, final location and specification by others

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Root Protection Area (RPA) of existing tree, in accordance with Arboricultural Survey.

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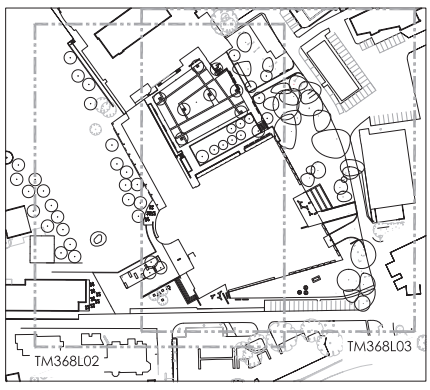

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PLANNING

Paving

P1 Silver-grey textured paving to match existing, sand bedded on build-up to engineers details

P2 Naturally bound gravel, silver grey, on build-up to engineers details

ST1 Textured step unit and tread 400 x 1000mm, with inlaid nose markings, and integrated lighting in risers.

P3 Dark natural stone paving to match adjacent existing paving below existing plaspin front at ToRC entrance

P4 Textured, dark grey hazard paving to top and bottom landings of steps

ST2 290mm high pre-cast concrete step units, silver grey, textured

P8 Tar-macadam finish to engineer's details

P9 Black slate aggregate trim, 20–40mm slate chippings

P10 Silver grey permeable resin bound gravel surface, on build-up to engineer's details

P11 Bonding of smooth silver-grey concrete slabs, pencil edged on build-up to engineer's details

P12 Textured silver-grey concrete slabs for pedestrian areas, finish and colour to match P1, sand bedded on build-up to engineer's details

P13 Textured silver-grey concrete setts for vehicular areas, sand bedded on build-up to engineer's details

Edging and Walls

W1 Existing retaining brick wall

W2 Retaining wall to vent louvres, to engineers details

W3 Retaining wall, to match existing retaining W4

W5 Stringer to steps ST1, to match existing retaining W4

W4 Existing retaining concrete wall

W6 Headwalls to crossing of swale, to match existing retaining W4

W8 Concrete wall, height and look to match existing retaining W4

E1 Edging kerb, textured, silver grey 63 x 150 x 915mm, haunching to engineers details

E2 Flush kerb, textured, silver grey, 255 x 155 x 915mm (Wxhxl), haunching to engineers details

E3 Flush metal edging to self binding gravel

Furniture

FP Flag pole, existing flag pole in new location

TG Tree Grille, 1200mm, stainless steel frame with infill paving to match surrounding surfacing. Tree pit to be constructed as an underground load bearing crate system.

BE1 Concrete sculptural seating

BE2 Benches, 2m wide. FSC certified hardwood batons on galvanised metal supports, hidden fixings

BE3 Benches, 900mm wide, 3000mm long, with back rests and armrests, FSC certified hardwood batons on galvanised metal supports, hidden fixings

BE4 Benches RoughAReady65 by Streetlife or equal, 500mm wide, 2340mm long, with back rests and armrests, FSC certified hardwood batons on galvanised metal supports, hidden fixings

BE5 Bench seat mounted on wall, 400mm wide, FSC certified hardwood batons on galvanised metal supports, hidden fixings

C1 Cycle stands, Sheffield stands stainless steel, roof fixed, height 750mm

R1 Handrail to steps ST1, stainless steel Ø 45mm, posts 15x40mm flat bars, integrated lighting

R2 Balustrade to retaining walls, 1100mm, metal flat bars to match existing balustrade on top of existing wall W4 in front of ToRC building

Lighting

L1 Bollard lighting to match existing

L2 Light stacks, 4m columns with light stack style lamp. Final location and specification by others

L3 Lighting integrated into risers of proposed steps, and luminaires integrated into handrail R1

L4 Uplights to trees

Planting

T1 Tree 25-30cm girth, 2m clear stem, in self-binding gravel surface

T2 Tree 25-30cm girth, 2m clear stem, in paved surface

T3 Tree 20-25cm girth, in planted area PL2

T4 Tree 25-30cm girth, in planted area PL2

T5 Trees 20-25cm girth, in soft landscaped area

PL1 450mm topsoil, 75mm medium grade bark mulch on top

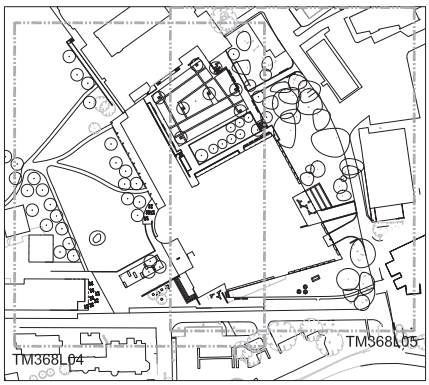
PL2 450mm topsoil, 450mm subsoil, 75mm medium grade bark mulch on top

WM1 Wildflower meadow turf

WM2 Wildflower meadow seeding

LAWN1 Amenity turf for shaded areas

Key Plan not to scale



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DRAWING TITLE
General Arrangement: Materials (1 of 2)

DRAWING STATUS
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7. All proprietary products shall be installed in accordance with manufacturers written instructions.

8. Plant numbers are an indication only and plants should be ordered to suit site areas in accordance with scheduled plant densities.

9. Any proposed plant substitution shall be agreed with the landscape architect prior to ordering.

Paving

P1 Silver-grey textured paving to match existing, sand bedded on built-up to engineers details

P2 Naturally bound gravel, silver grey, on built-up to engineers details

ST1 Textured step unit and tread 400 x 1000mm, with inlaid nose markings, and integrated lighting in risers.

P3 Dark natural stone paving to match adjacent existing paving below existing steps in front of ToRC entrance

P4 Textured, dark grey hazard paving to top and bottom landings of steps

ST2 290mm high pre-cast concrete step units, silver grey, textured

P8 Tar-macadam finish to engineer's details

P9 Black slate aggregate trim, 20-40mm slate chippings

P10 Silver grey permeable resin bound gravel surface, on built-up to engineer's details

P11 Banding of smooth silver-grey concrete slabs, pencil edged on built-up to engineer's details

P12 Textured silver-grey concrete slabs for pedestrian areas, finish and colour to match P1, sand bedded on built-up to engineer's details

P13 Textured silver-grey concrete setts for vehicular areas, sand bedded on built-up to engineer's details

Edging and Walls

W1 Existing retaining brick wall

W2 Retaining wall to vent louvres, to engineers details

W3 Retaining wall, to match existing retaining W4

W5 Stringer to steps ST1, to match existing retaining W4

W4 Existing retaining concrete wall

W6 Headwall to crossing of swale, to match existing retaining W4

W8 Concrete wall, height and look to match existing retaining W4

E1 Edging kerb, textured, silver grey 63 x 150 x 915mm, haunching to engineers details

E2 Flush kerb, textured, silver grey, 255 x 155 x 915mm (WxHx), haunching to engineers details

E3 Flush metal edging to self binding gravel

Furniture

FP Flag pole, existing flag pole in new location

TG Tree Grills, 1200mm, stainless steel frame with infill paving to match surrounding surfacing. Tree pit to be constructed as an underground load bearing cavity system

BE1 Concrete sculptural seating

BE2 Benches, 1m wide, FSC certified hardwood batons on self-finished metal supports, hidden fixings

BE3 Benches, 500mm wide, 3000mm long, with back rests and armrests, FSC certified hardwood batons on galvanised metal supports, hidden fixings

BE4 Benches Rough&ReadyLS by Streetlife or equal, 500mm wide, 2340mm long, with back rests and armrests, FSC certified hardwood batons on galvanised metal supports, hidden fixings

BE5 Bench seat mounted on wall, 400mm wide, FSC certified hardwood batons on galvanised metal supports, hidden fixings

C1 Cycle stands, Sheffield stands stainless steel, inset fixed, height 730mm

R1 Handrail to steps ST1, stainless steel Ø 45mm, posts 15x40mm flat bars, integrated lighting

R2 Balustrade to retaining walls, 1100mm, metal flat bars to match existing. Balustrade on top of existing wall W4 in front of ToRC building

Lighting

L1 Bollard lighting to match existing

L2 Light stacks, 4m columns with light stack style fitting. Final location and specification by others

L3 Lighting integrated into risers of proposed steps, and luminaires integrated into handrail R1

L4 Uplights to trees

Planting

T1 Tree 25-30cm girth, 2m clear stem, in self-binding gravel surface

T2 Tree 25-30cm girth, 2m clear stem, in paved surface

T3 Tree 20-25cm girth, in planted area PL2

T4 Tree 25-30cm girth, in planted area PL2

T5 Trees 20-25cm girth, in soft landscaped area

PL1 450mm topsoil, 75mm medium grade bark mulch on top

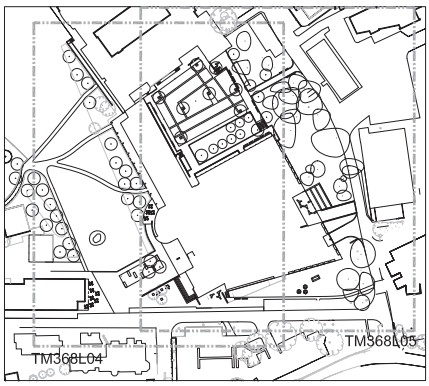
PL2 400mm topsoil, 450mm subsoil, 75mm medium grade bark mulch on top

WM1 Wildflower meadow turf

WM2 Wildflower meadow seeding

LAWN1 Amenity turf for shaded areas

Key Plan not to scale



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turkington martin
Studio 3.04 Chester House, Kennington Park
1-3 Brixton Road, London, SW9 6DE
T: (+44) 020 3567 1050
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CLIENT
Royal Veterinary College

PROJECT TITLE
Hawkshead Campus Redevelopment

DRAWING TITLE
General Arrangement: Materials (2 of 2)

DRAWING STATUS
Planning

DRAWING SCALE:	DRAWN BY:	DRAWN DATE:
1:250	SJB	18.10.09
PAPER SIZE:	CHECKED BY:	CHECKED DATE:
A1	MM	18.10.09

DRAWING NUMBER: TM368L05
REVISION: A

Turkington Martin LANDSCAPE ARCHITECTS

APPENDIX 5
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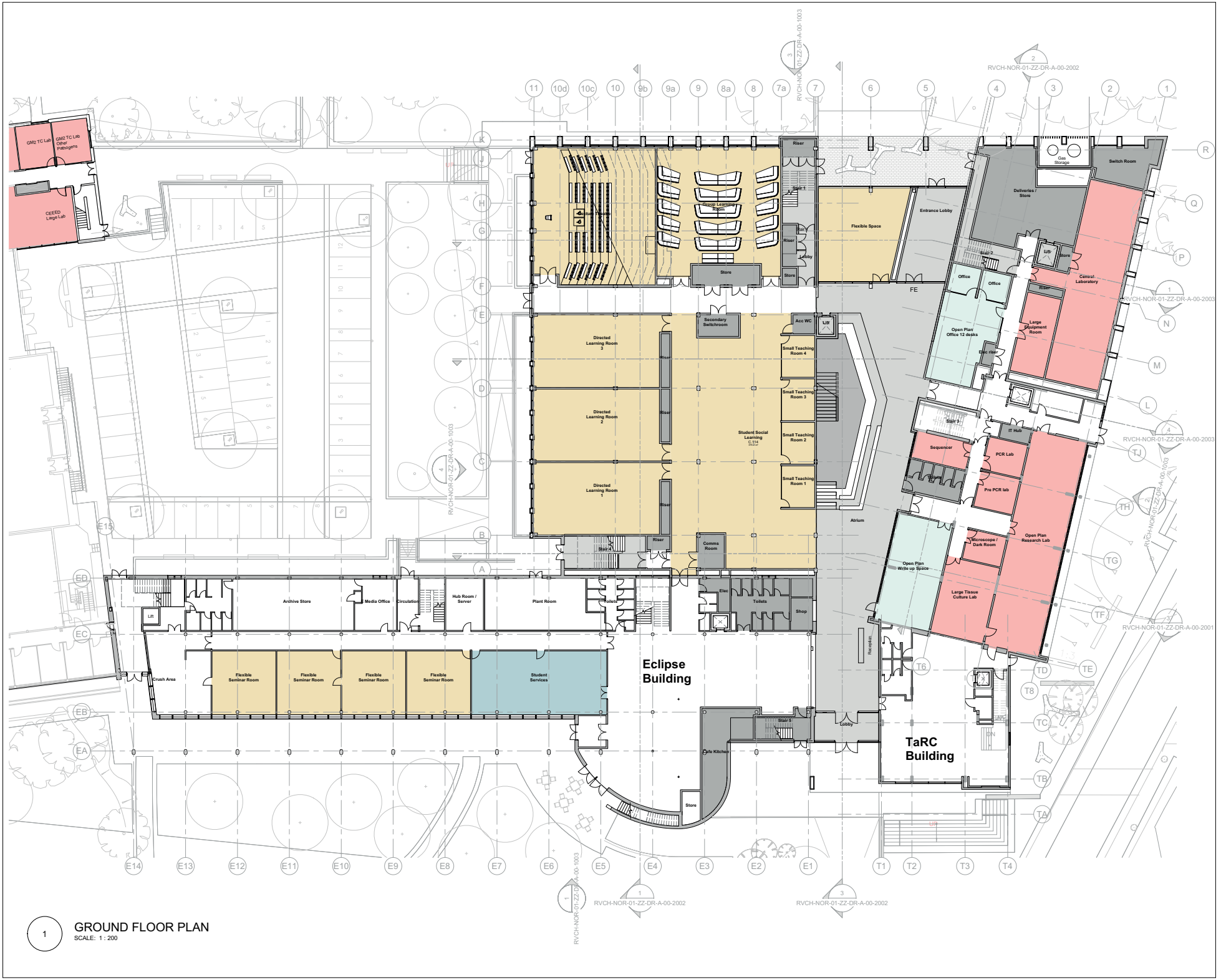

1 GROUND FLOOR PLAN
SCALE: 1 : 200

DATE	REVISION	REV	DRW	CHK
02/11/18	Stage 3 Submission	P01	CC	LD

DEPARTMENT

- Circulation
- Existing
- Infrastructure
- Lab Write Up Space
- Laboratory
- Office/Admin
- Teaching

Keyplan

North Arrow: True North

Detail Symbol: Detail No. / Sheet No.

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Client ROYAL VETERINARY COLLEGE	
Project HAWKSHEAD CAMPUS REDEVELOPMENT	
Drawing Title GROUND FLOOR PLAN	
Sheet Status S2 - FOR INFORMATION	
Project No. IAGG17-0049	
Drawing No. RVCH-NOR-01-00-DR-A-00-0003	Rev. P01

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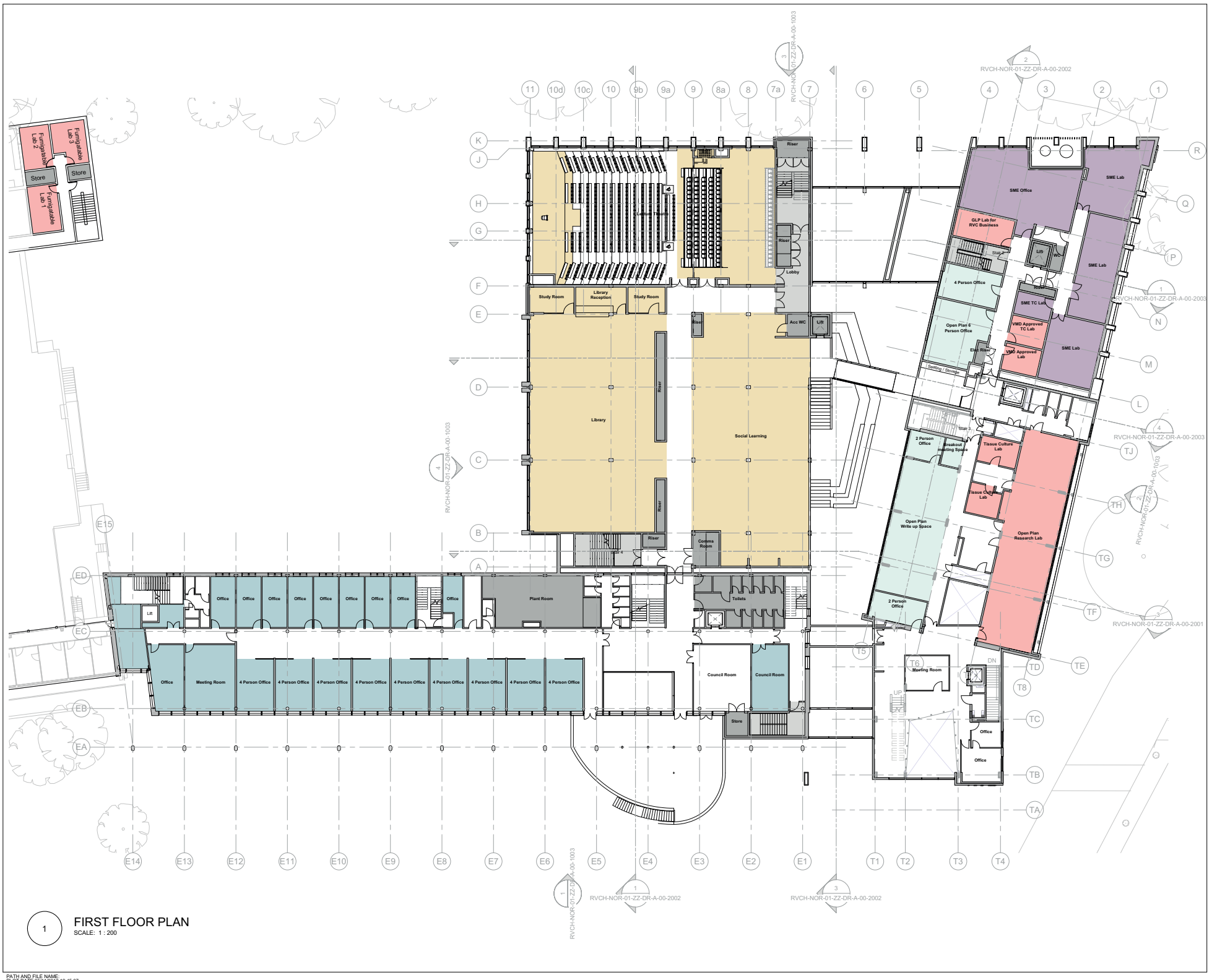

1 FIRST FLOOR PLAN
SCALE: 1 : 200

DATE	REVISION	REV	DRW	CHK
02/11/18	Stage 3 Submission	P01	CC	LD

DEPARTMENT

- Circulation
- Existing
- Infrastructure
- Lab Write Up Space
- Laboratory
- Office/Admin
- SME Hub

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Drawing Title
FIRST FLOOR PLAN

Sheet Status
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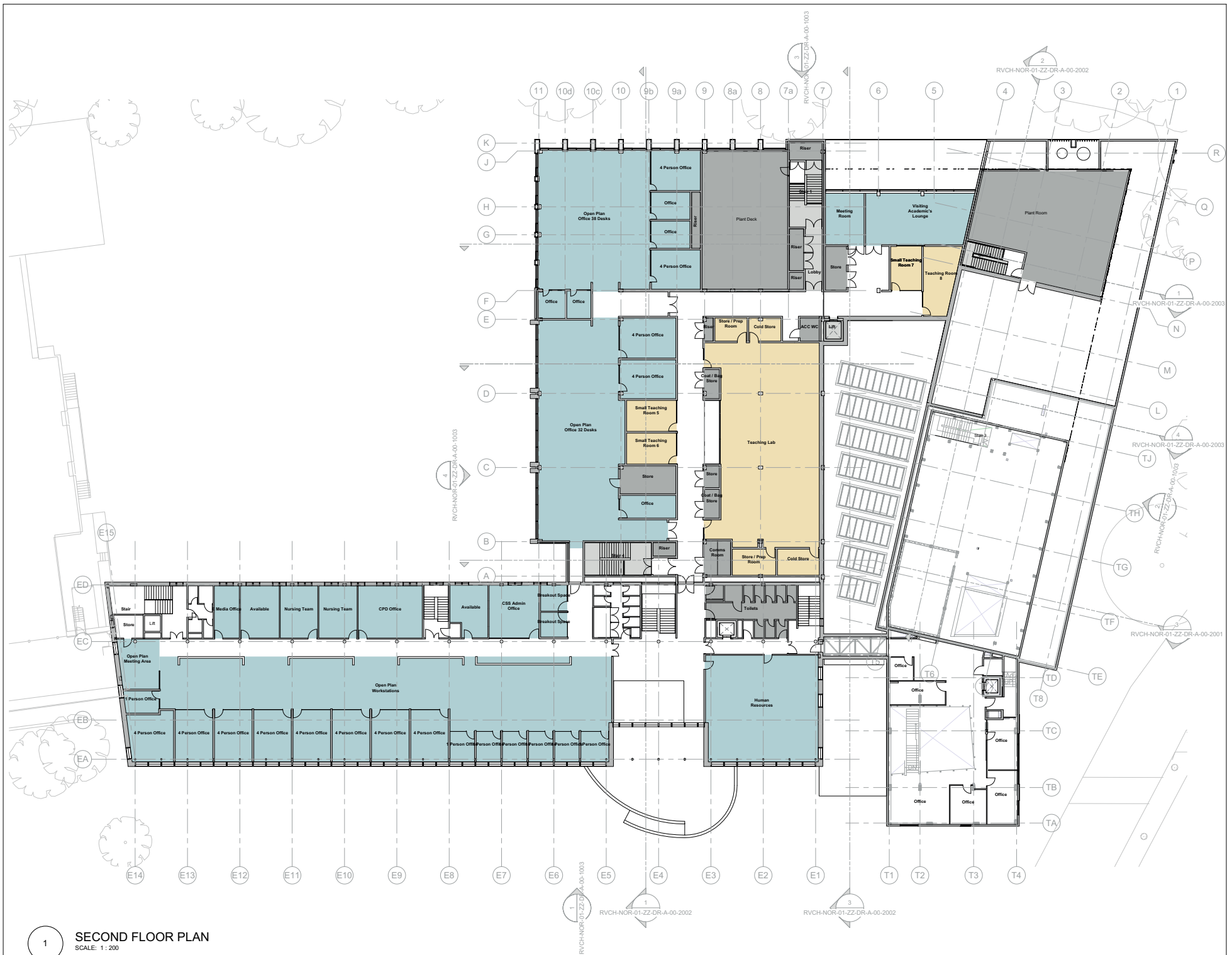

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DATE	REVISION	REV	DRW	CHK
02/11/18	Stage 3 Submission	P01	CC	LD

DEPARTMENT

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- Teaching

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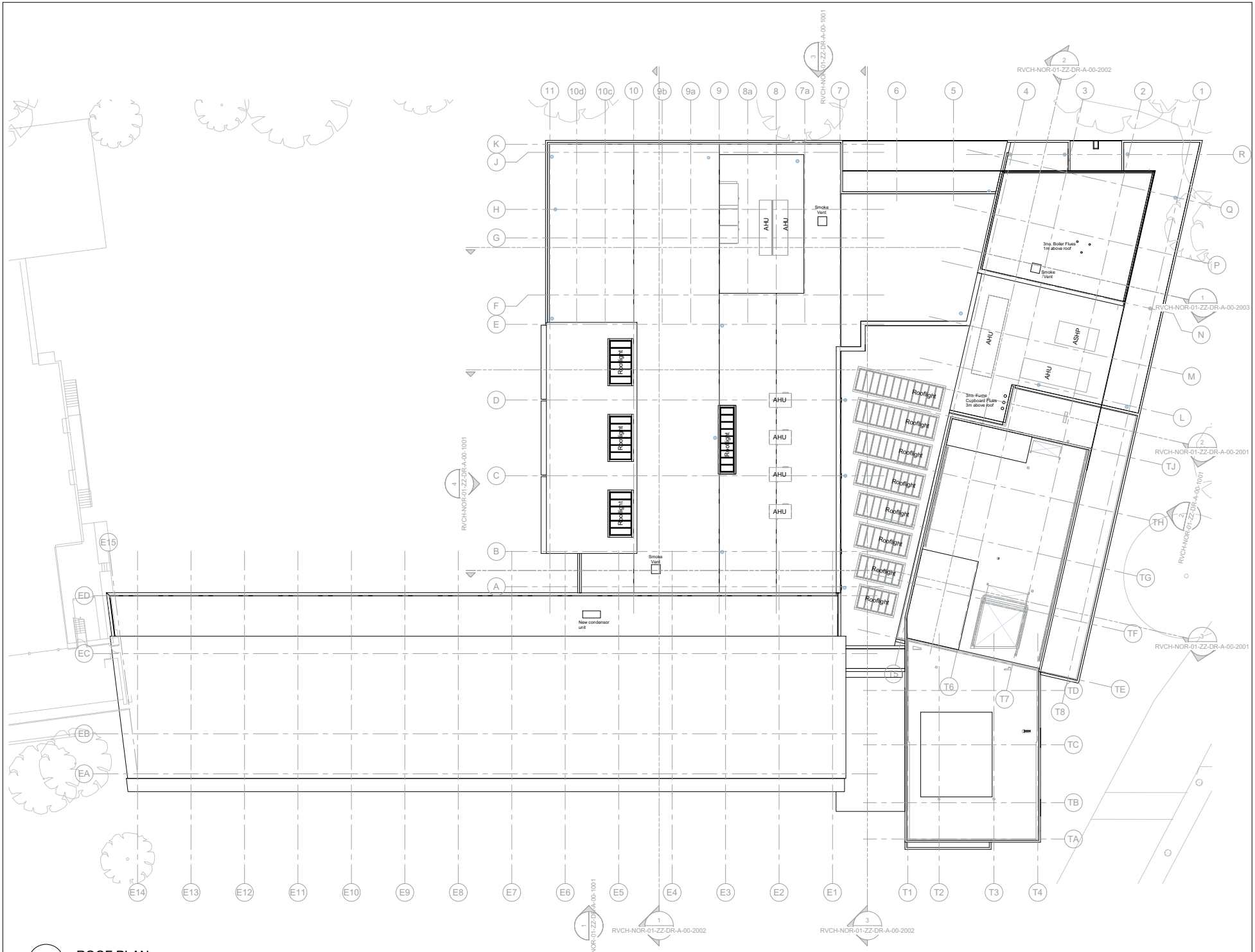

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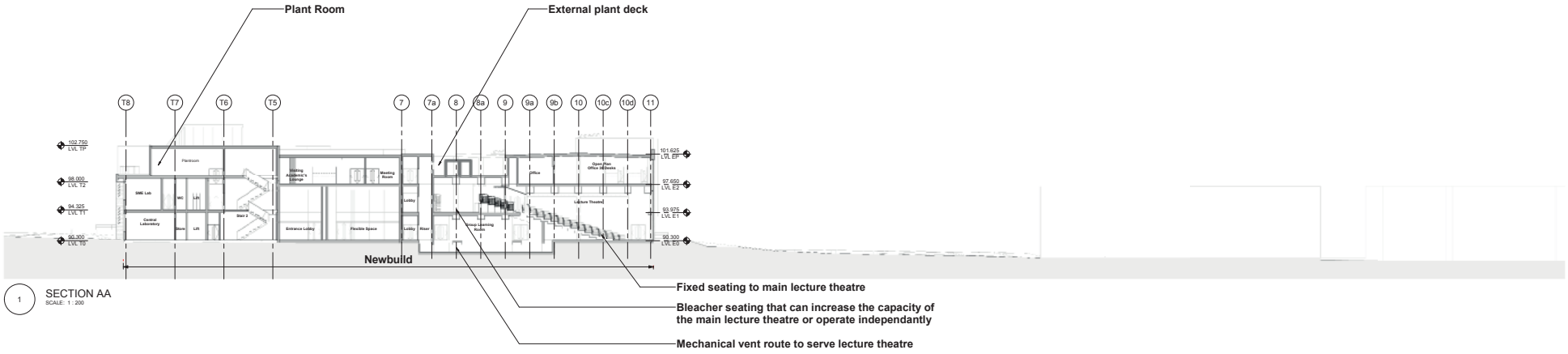

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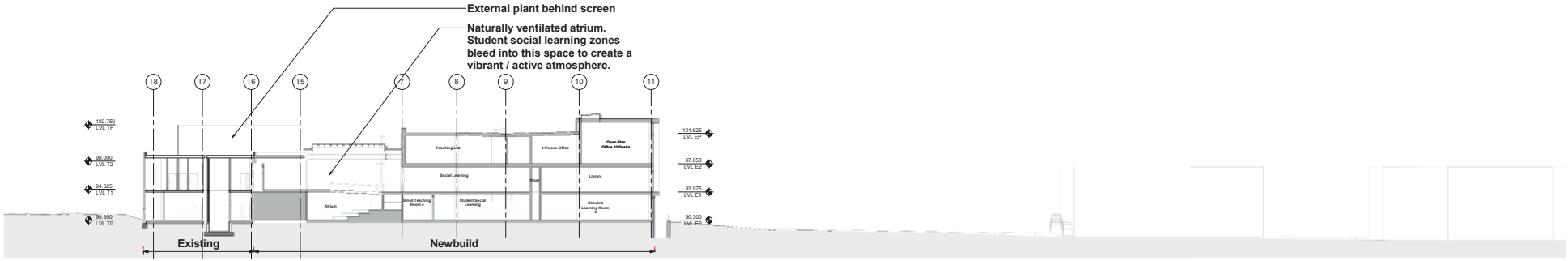

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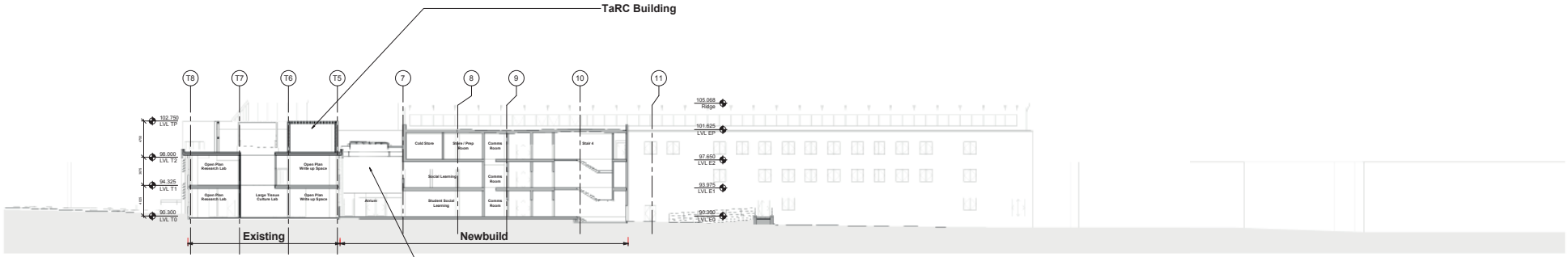

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Drawing Title
GA SECTIONS - SHEET 1

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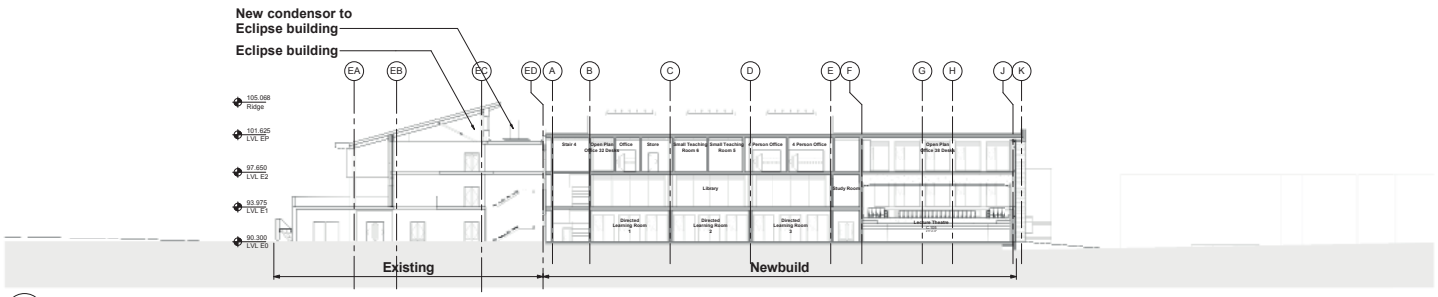

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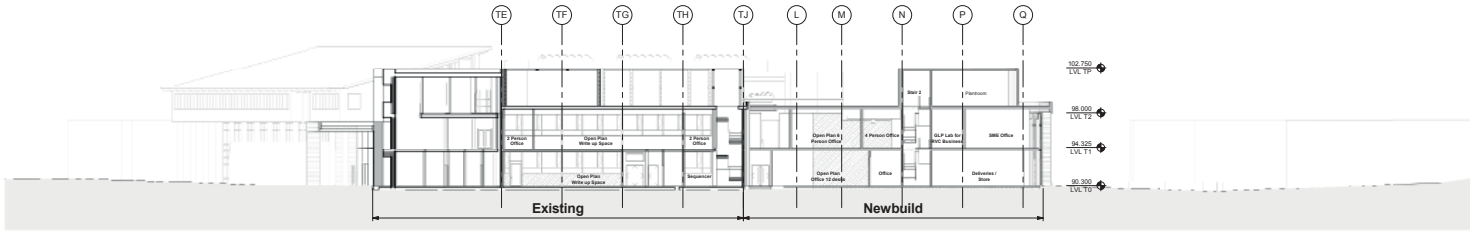

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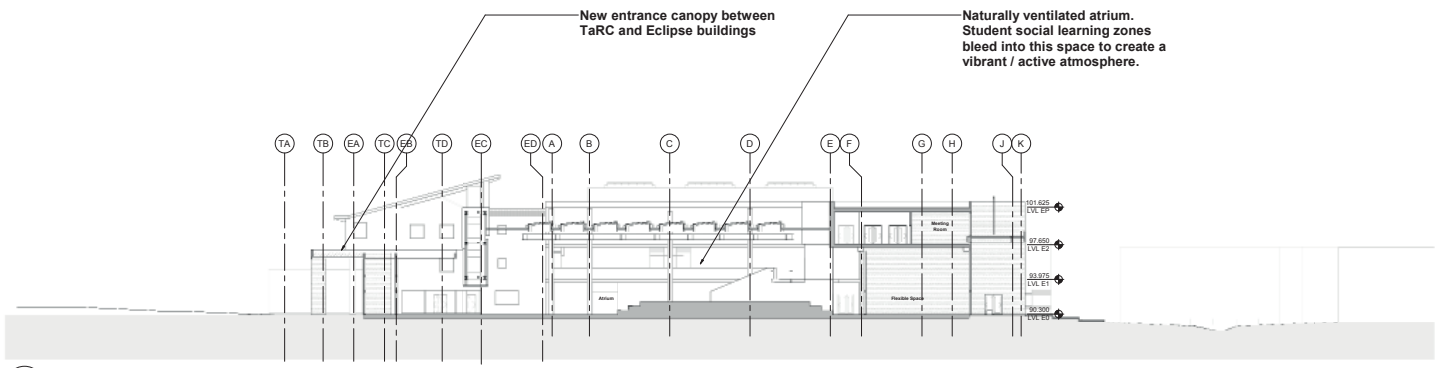

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GA SECTIONS - SHEET 2

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2 SECTION AA2 Copy 2
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4 SECTION BB Copy 1
SCALE: 1 : 100

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SCALE: 1 : 100

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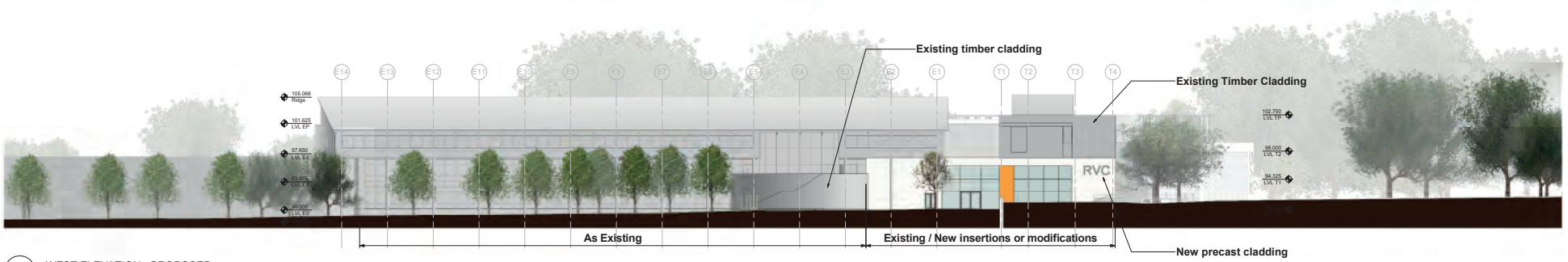

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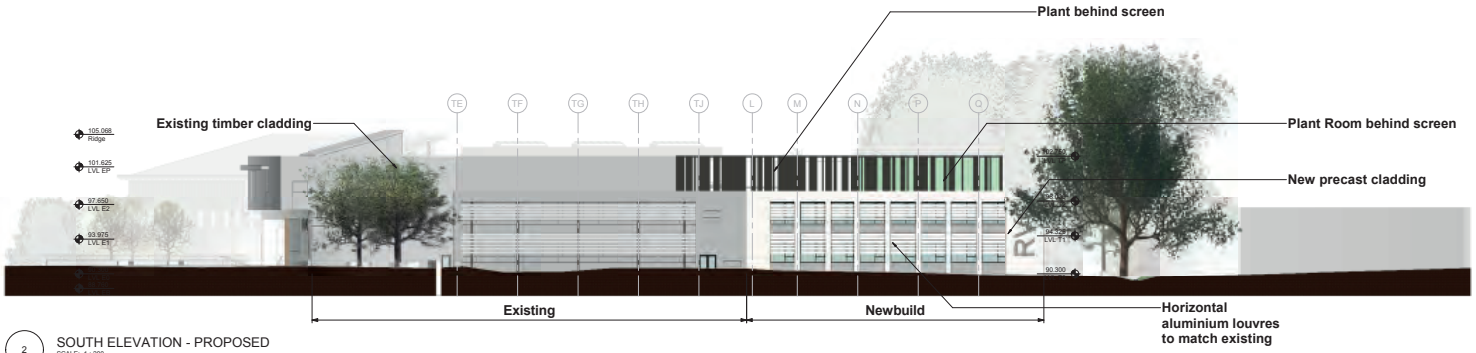

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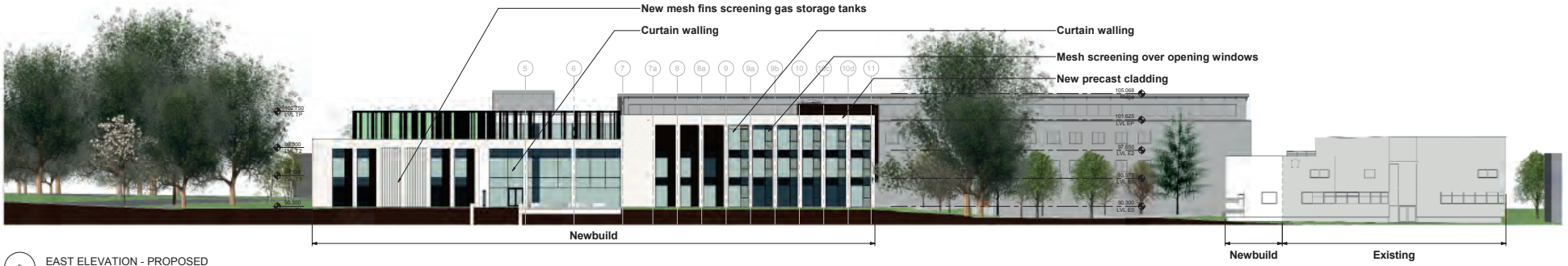

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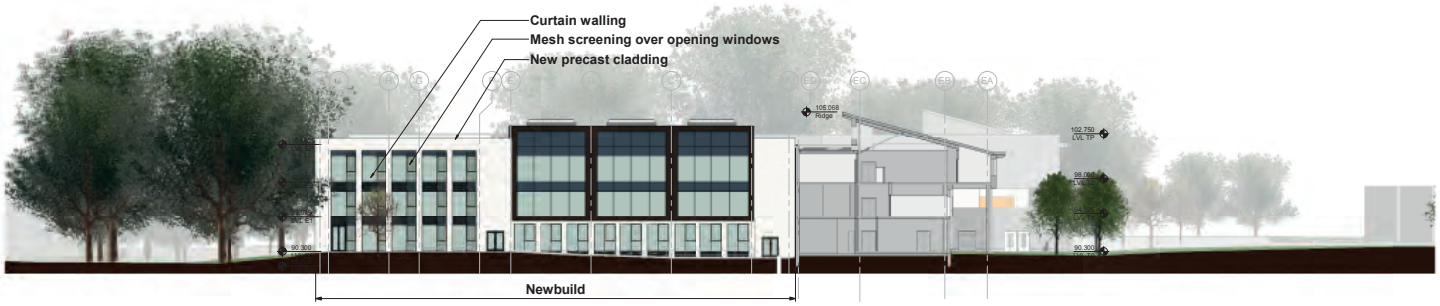

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DATE	REVISION	REV	DRW	CHK
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HAWKSHEAD CAMPUS REDEVELOPMENT

Drawing Title
ELEVATIONS - PROPOSED

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Drawing No.
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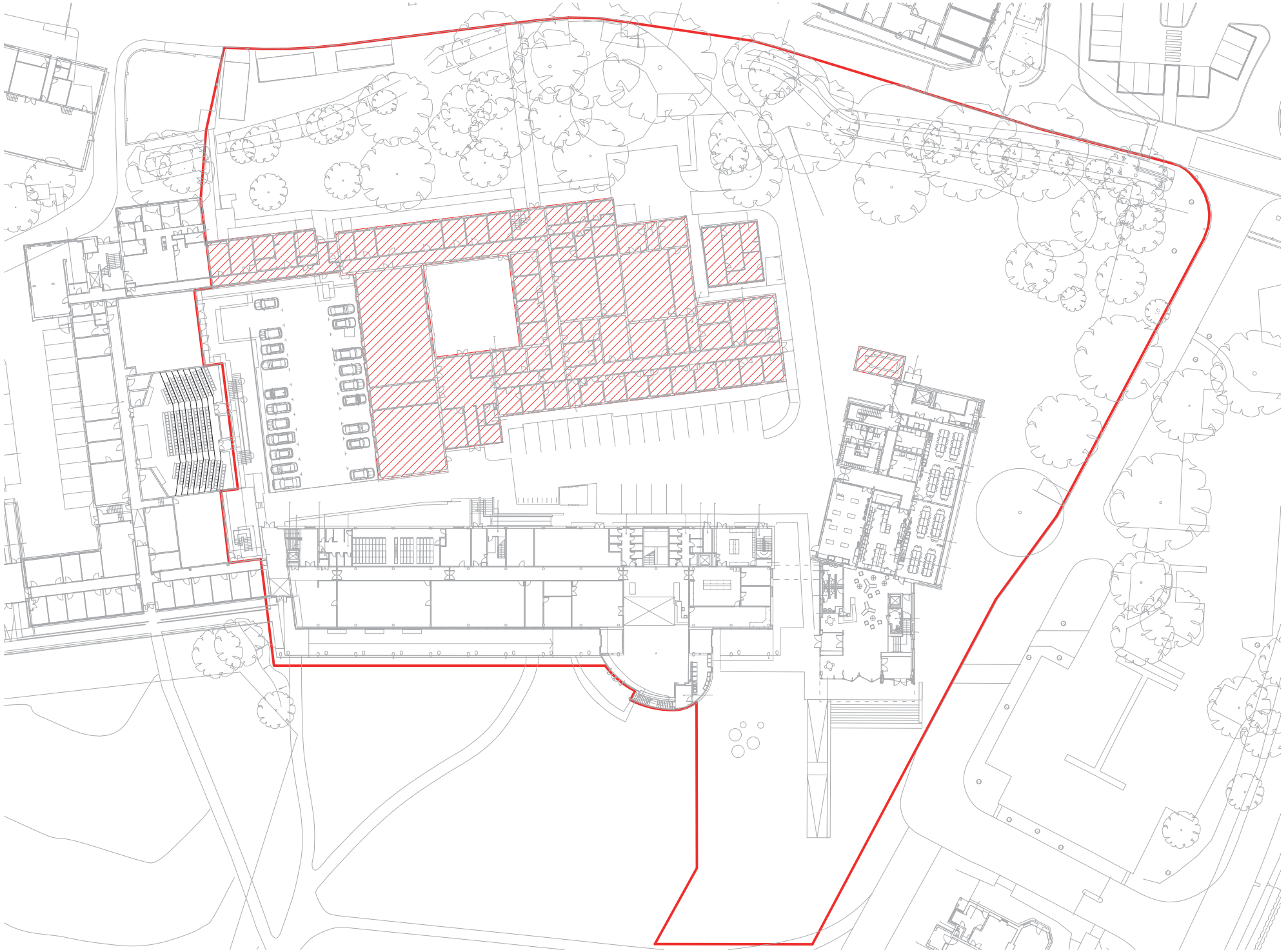
P01



1 DEMOLITION PLAN
SCALE: 1 : 200

DATE	REVISION	REV	DRW	CHK
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REDEVELOPMENT

Drawing Title
DEMOLITION PLAN

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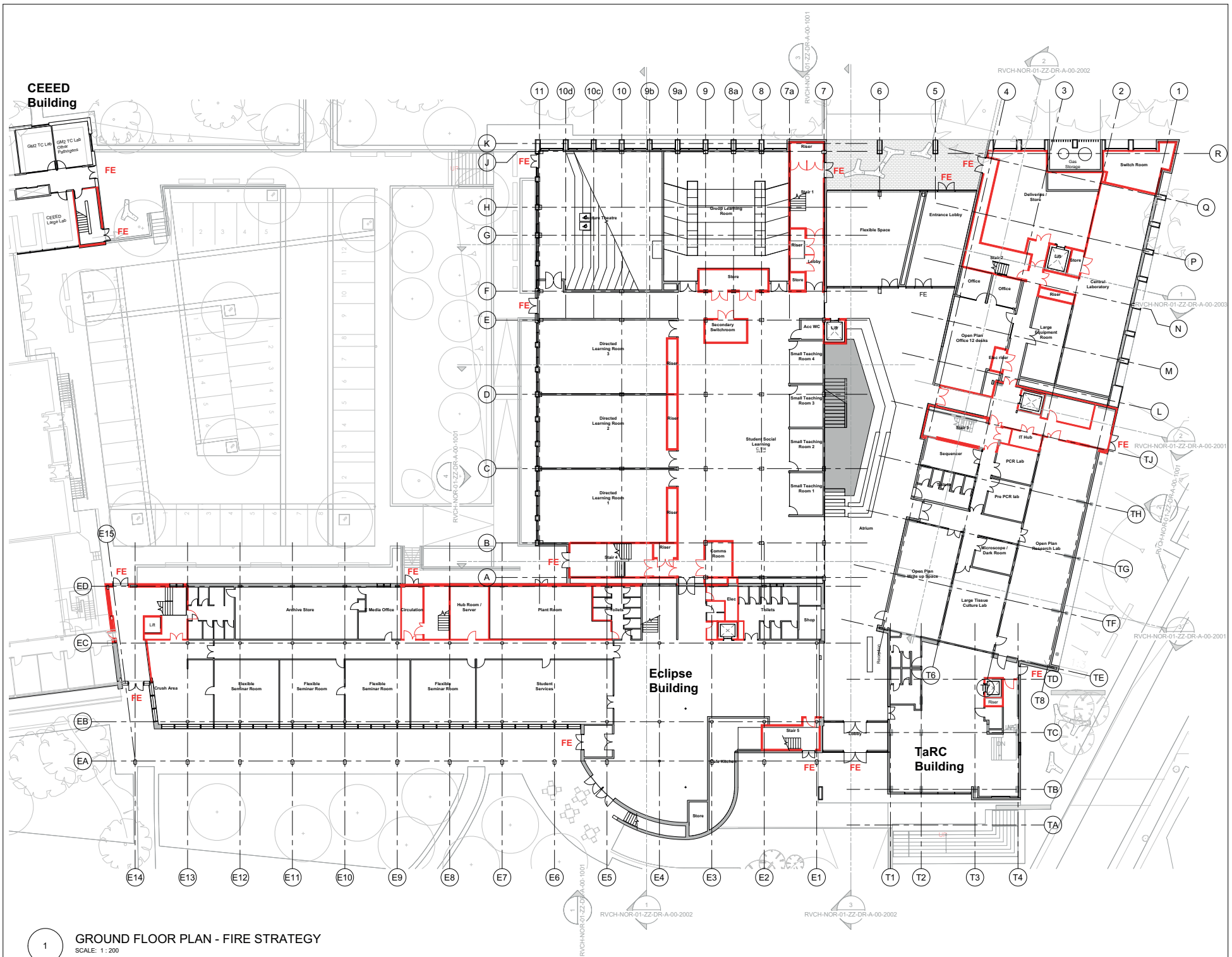

1 GROUND FLOOR PLAN - FIRE STRATEGY
SCALE: 1 : 200

DATE	REVISION	REV	DRW	CHK
02/11/18	Stage 3 Submission	P01	CC	LD

FE FIRE EXIT

30 MIN FIRE RATED CONSTRUCTION

Keyplan

North Arrow: True North

Detail Symbol: Detail No. / Sheet No.

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Client: ROYAL VETERINARY COLLEGE

Project: HAWKSHEAD CAMPUS REDEVELOPMENT

Drawing Title: GROUND FLOOR PLAN - FIRE STRATEGY

Sheet Status: S2 - FOR INFORMATION

Project No.: IAGG17-0049

Drawing No.: RVCH-NOR-01-00-DR-A-68-0001 Rev. P01

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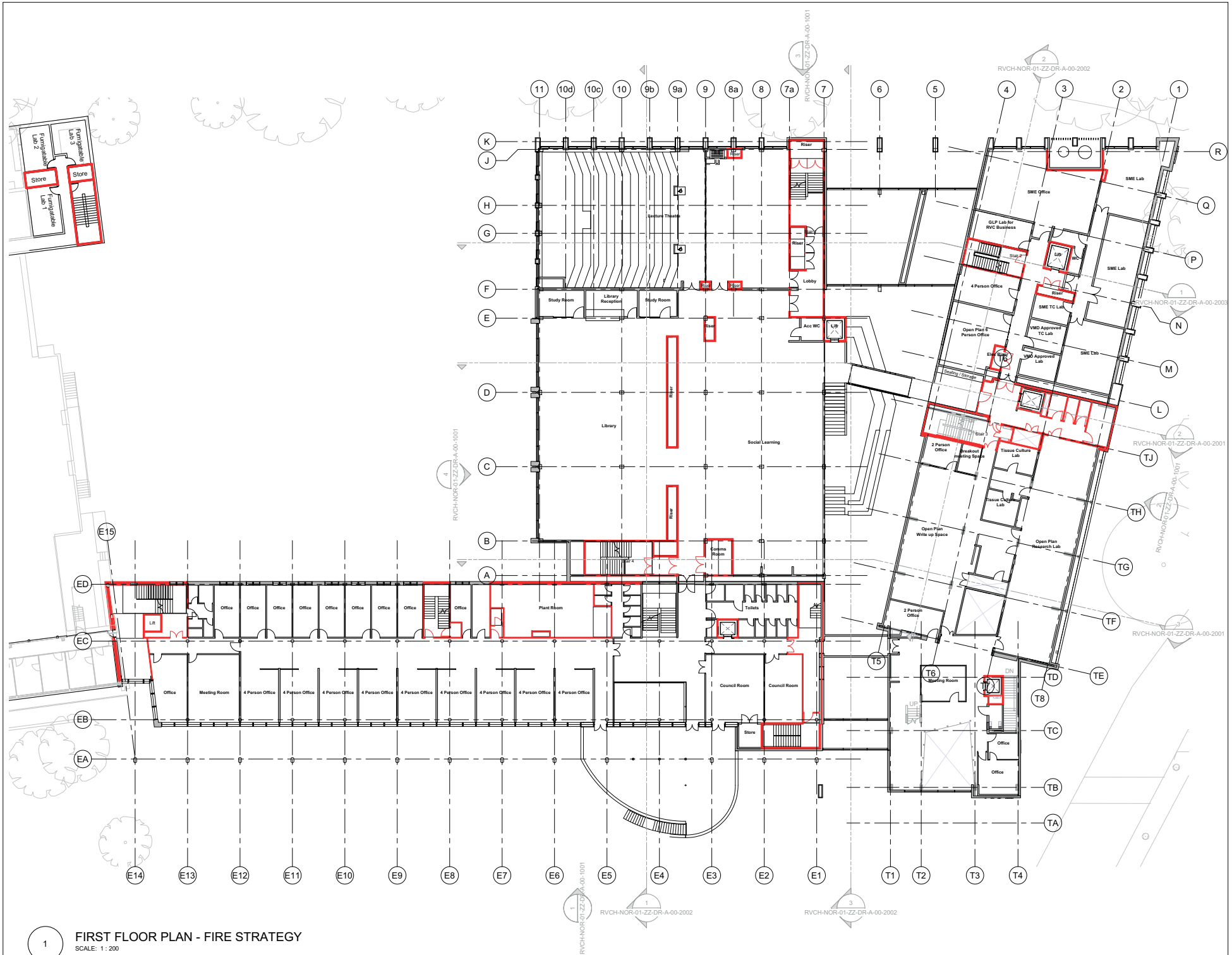

1 FIRST FLOOR PLAN - FIRE STRATEGY
SCALE: 1 : 200

DATE	REVISION	REV	DRW	CHK
02/11/18	Stage 3 Submission	P01	CC	LD

FE FIRE EXIT

30 MIN FIRE RATED CONSTRUCTION

Keyplan

North Arrow

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Project
HAWKSHEAD CAMPUS REDEVELOPMENT

Drawing Title
FIRST FLOOR PLAN - FIRE STRATEGY

Sheet Status
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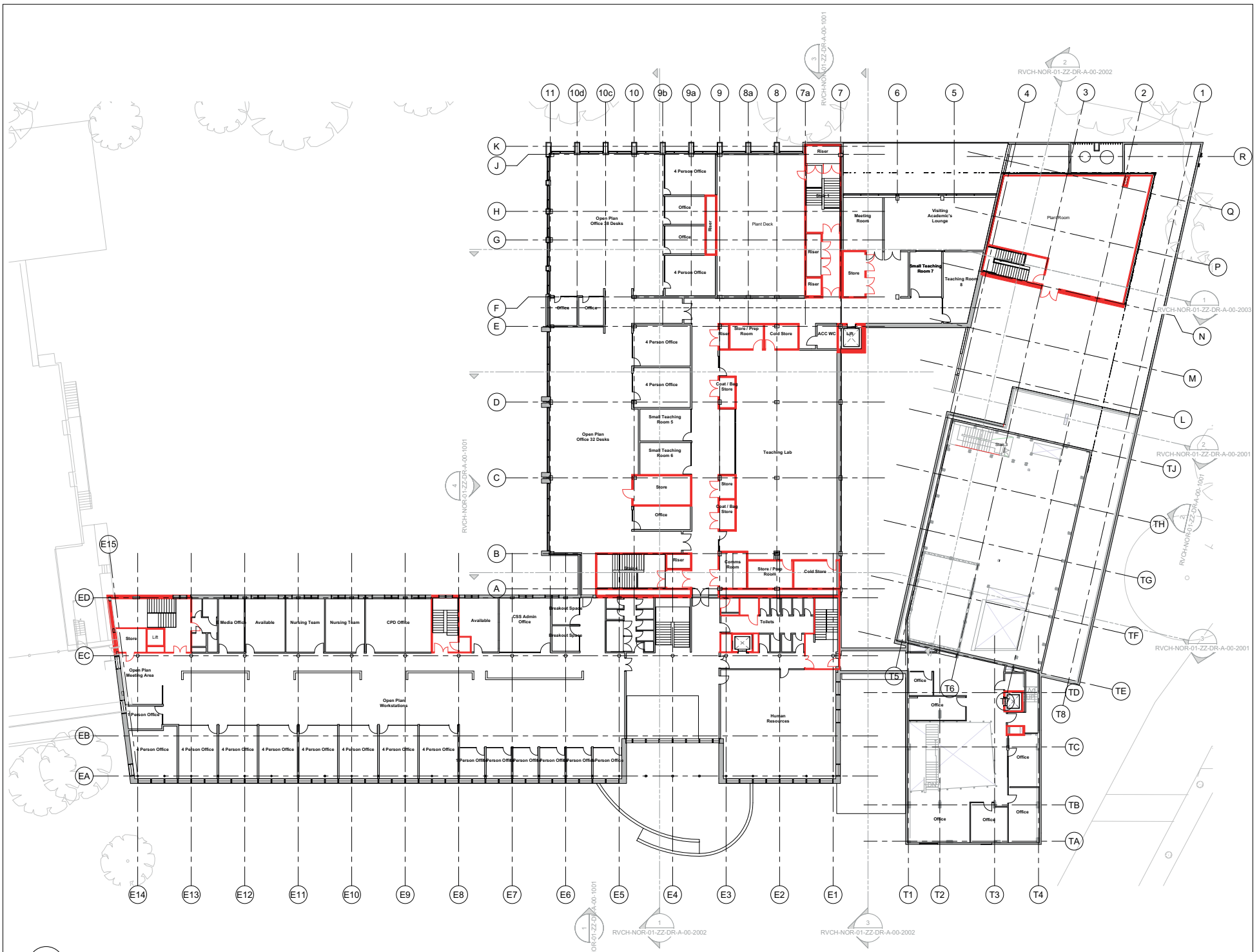

1 SECOND FLOOR - FIRE STRATEGY
SCALE: 1 : 200

DATE	REVISION	REV	DRW	CHK
02/11/18	Stage 3 Submission	P01	CC	LD

FE FIRE E IT

30 MIN FIRE RATED CONSTRUCTION

Keyplan

North Arrow: True North

Detail Symbol: Detail No. / Sheet No.

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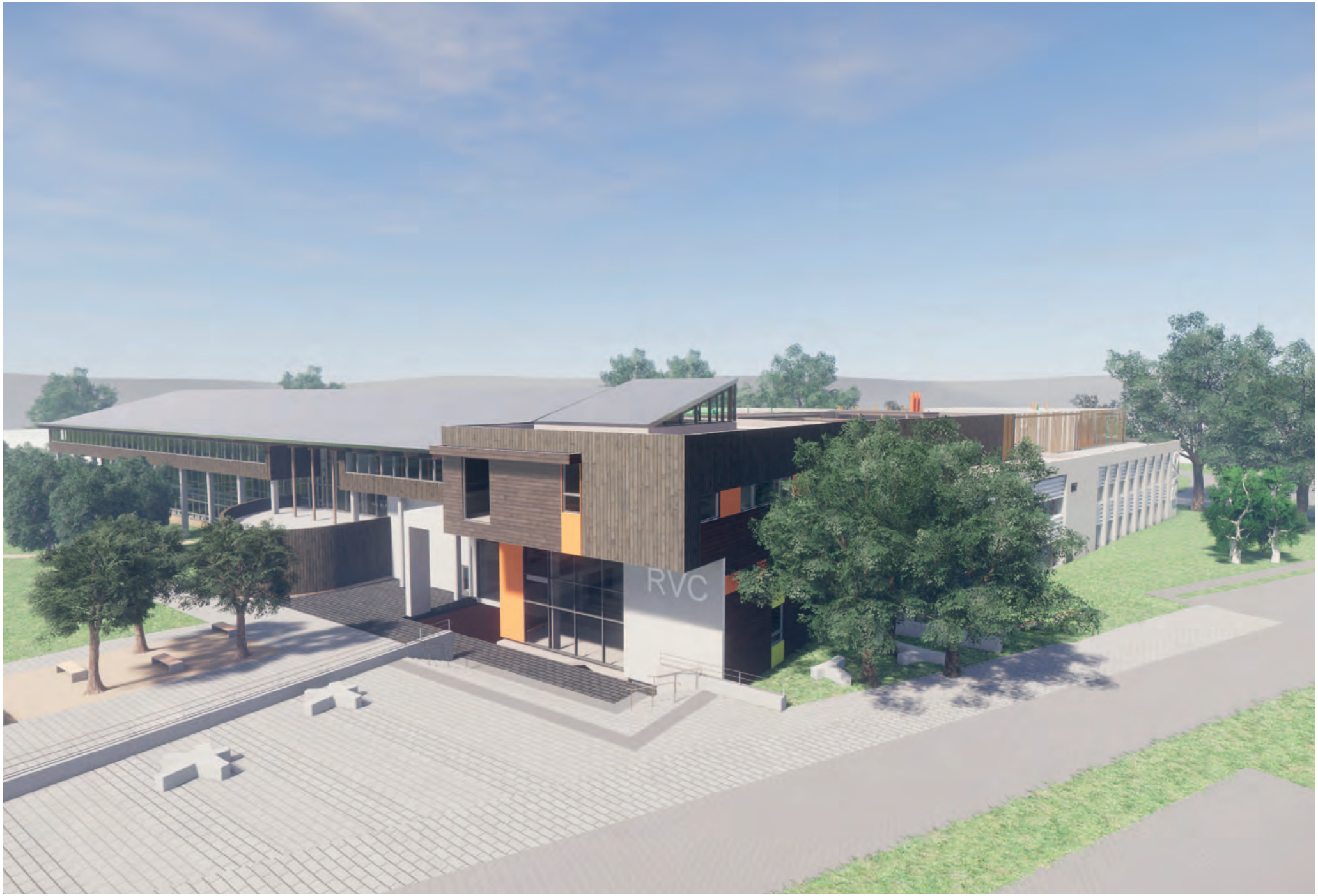
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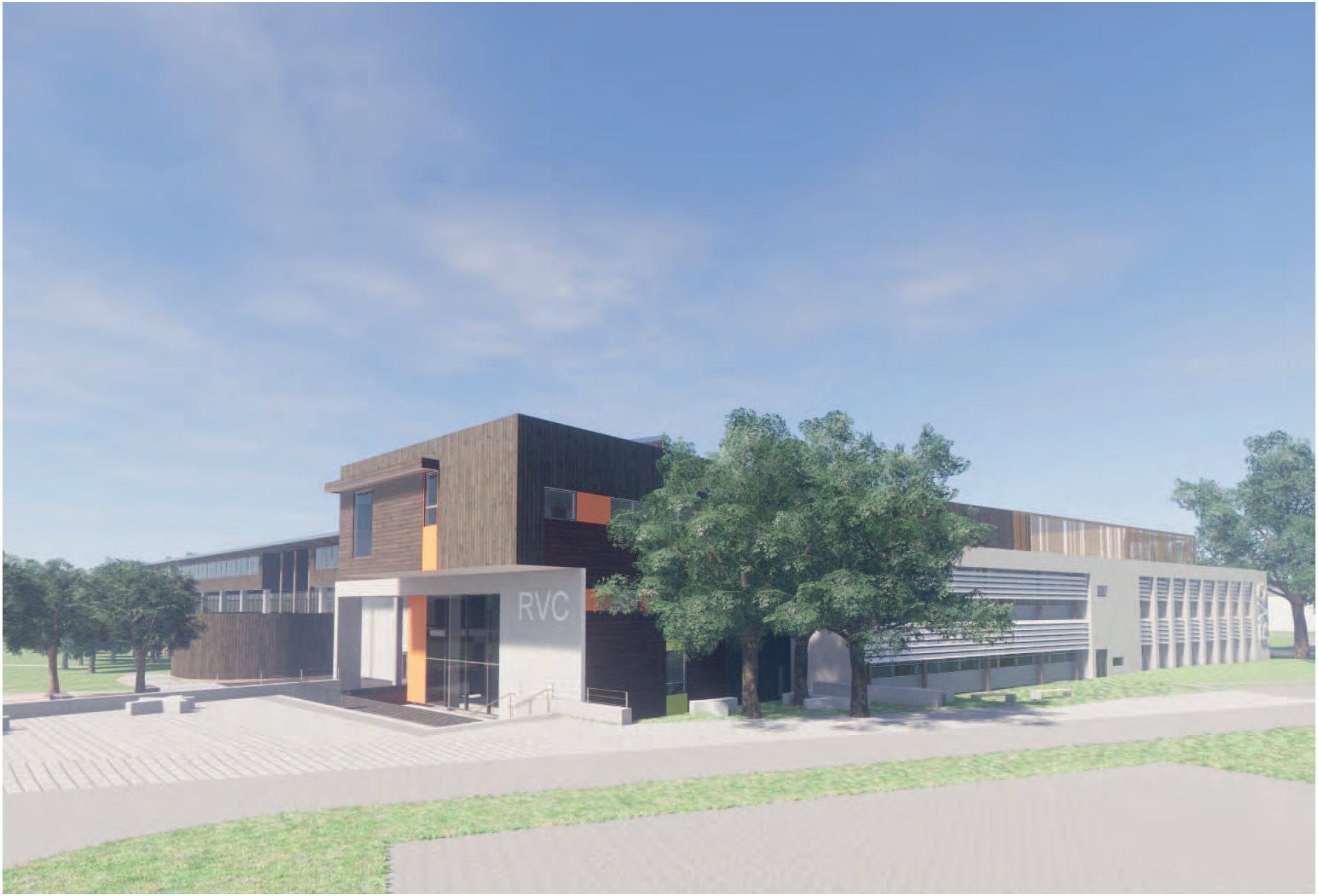
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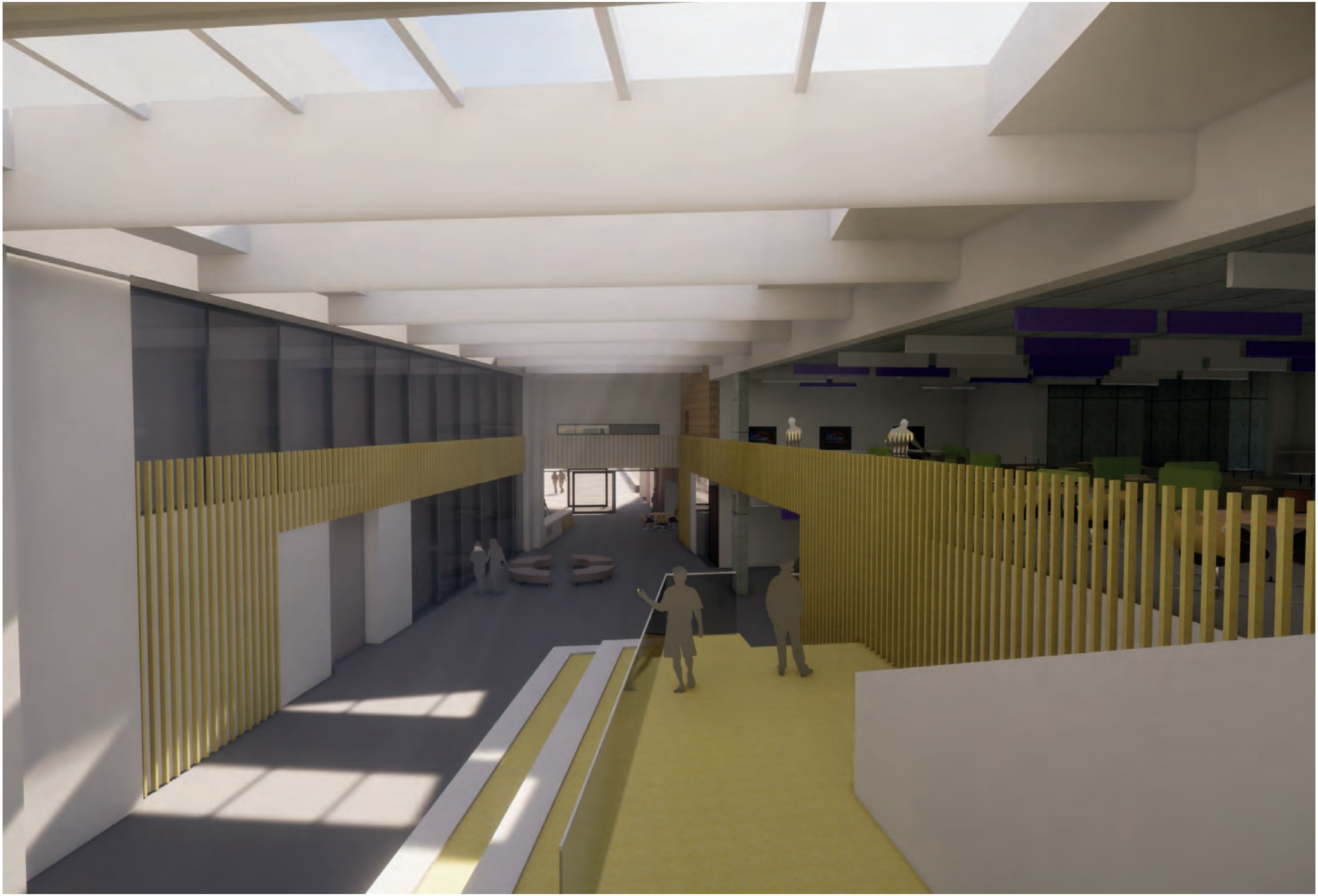
RVC



APPENDIX 6
AECOM
LIFE CYCLE ASSESSMENT REPORT

Project:	**Royal Veterinary College – Hawkshead Redevelopment**		
Subject:	**Life Cycle Assessment of Embodied Carbon**		
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Executive summary

An early stage analysis of the embodied carbon impacts of the proposed design of the new building for the Royal Veterinary College. This shows that the embodied impact of the initial design is broadly in line with buildings of a similar height, the key determining factor in these calculations. The analysis at this stage is based only on the main structural components, as these have the largest impact on embodied impacts. The design is at a relatively early stage, and so there are a number of options available to decrease the embodied impacts and therefore deliver an outcome below the benchmark levels. The recommended next steps to address these opportunities are to:

- Include as high a proportion of cement replacement (GGBS) in the concrete whilst maintaining the required performance,
- Optimise the design of steel reinforcing in stage 3,
- Consider the use of a timber solution for the roof structure, and
- Adopt the use of timber instead of steel studs for the internal partitions.

These options should be investigated in Stage 3, when other more detailed design options should also be included in the analysis.

Introduction

This Life Cycle Assessment (LCA) report describes the work undertaken on Embodied Carbon in support of the Stage 2 design of the Royal Veterinary College, Hawkshead Campus. It covers the following:

1. The scope of works.
2. An outline of the process, methodology and assumptions made.
3. The results from key elements of design.
4. Comparison of the results against an appropriate benchmark; and
5. The recommendations for embodied carbon savings.

This study has been carried out in-line with BRE Guidance Note 08 and the principles of life cycle assessment as set out in ISO 14040.

The calculation was undertaken using data extracted from a combination of sources:

Consibee *(Structural Engineers)*

- *Stage 2 Report – Civil & Structural*
- *RVC – Hawkshead Campus, Redevelopment - Structural Drawings*

Norr *(Architects)*

- *Outline Architectural Specification*
- *Base elevation drawings*
- *Floor plan drawings*

These documents provide information on the most significant building elements across the stage 2 design. A comprehensive list of estimated quantities of building elements has not been provided therefore a number of measurements and calculations were made from the above sources. This is further explained in the assumptions section of this report.

The requirements of this work are to provide the embodied carbon impact in the form of Global Warming Potential (GWP) of the developments building elements, whilst also providing recommendations for embodied carbon savings as the design progresses. To do this, the GWP is shown as TCO_2e/m^2 Gross Internal Floor Area (GIA) which allows easier comparison between projects.

The information extracted from the various sources outlined within the introduction, were all manipulated with a bespoke spreadsheet. This allows us to present the data in a way that eases the input of building elements into Etool. Etool is a commercial piece of software that is BRE IMPACT compliant. This enables the project to achieve all LCA relevant credits within the 2014 BREEAM assessment, should this be required.

The specifications and 2D drawings for the project, give details of the building materials used. During data manipulation elemental build-ups which had a similar construction were merged and matched with comparable Etool templates. Where there was no comparable Etool template, custom templates were created or current templates were manipulated to change the quantities of materials which make up a building component (i.e. steel and concrete in reinforced concrete).

Etool was then used to output the GWP data for all relevant life cycle stages in a unit of kg CO_2e/m^2 GIA. The GIA of the whole design was estimated from the floor slab areas for the ground, 1st and 2nd floors as 6,930m².

Recommendations for less carbon intensive materials were then tested using the baseline model. By replacing baseline templates with templates which contain more carbon efficient material build ups, Etool is able to present a percentage saving against the total $kgCO_2e/m^2$ value.

Where building elements had a quantity deemed too low to have a noticeable contribution to the embodied carbon total (less than 1%), they have been excluded from the assessment.

Assumptions

Certain assumptions were made when aligning templates / materials in an attempt to provide a model which serves as an appropriate representation of the building elements. The assumptions made for this are detailed below:

- The level of concrete reinforcement has not been specified within design and therefore for each concrete structural element, the level of reinforcement was estimated from typical reinforcement quantities found in structural elements (Price and Myers, 2001), other than the levels for the slabs and walls which were taken from guidance given by the Structural Engineers on the project. These were taken as:
  - Piles: 0.5% - 39 kg/m³
  - Pile caps / raft slabs: 1.5% - 115 kg/m³
  - Ground beams: 2.9% - 230 kg/m³
  - Columns: 1.9% - 150 kg/m³
  - Beams: 2.8% - 220 kg/m³
  - Slabs: 1.9% - 150 kg/m³
  - Walls: 1.4% - 110 kg/m³
- Concrete piles were assumed to be 10m deep and 600mm diameter, as noted on the Conisbee foundation plan. The number of concrete piles was counted from the Foundation Plan drawing provided by Conisbee.
- The size of all concrete beams (ground and upper floors) was taken from measured lengths, and the dimensions provided in the RC beam schedules on the structural drawings.
- The size of all concrete columns was taken from the dimensions provided in RC column schedules on the structural drawings, and assuming a height of 3.68m per a floor as shown on the architect's elevation drawing.

- The size of all RC walls was taken from the thickness provided in the RC wall schedules on the structural drawings, measured lengths from the structural drawings and assuming a height of 3.68m per floor as shown on the architect's elevation drawings.
- The size of all slabs (solid and hollow-core) was taken from measured plan areas on the structural drawings and the labelled slab thicknesses.
- The size of all roofs was taken from measured plan areas from the structural drawings
- The size of all steel beams was taken from measured lengths of beams from the structural drawings and weights per metre length, provided in the Steel beam schedules on the structural drawings.
- The size of all steel columns was taken from the weights per metre length provided in the Steel column schedules on the structural drawings and assuming a steel roof structure height of 2.5m as estimated from the architect's elevation drawings.
- External glazing and wall elements (cladding, brise soleil etc.) were measured from the architectural elevation drawings.
- There are no cement substitutes (GGBS or PFA) within the concrete structures as described and the steel is not assumed to have any recycled content for the purpose of the baseline model, and only virgin materials have been used for the baseline model.
- Due to a lack of information provided at this early stage the only internal finishes included were internal walls / partitions, doors (including frames), and finishes to walls (i.e. paint); and no external works have been included in the model and analysis.
- Sizes of internal walls (solid and glazed) were measured from the architect's floor plan drawings at the time of this report.
- Materials for all non-structural building elements were taken the architectural specification, and where full thicknesses or details of materials have not been provided, these have been assumed based on standardised Etool templates.

Benchmarks for comparison

The baseline model has been compared to benchmarks ($kgCO_2e/m^2$) for office buildings as this is deemed the building type with an available benchmark, that has the closest resemblance to this college building. Four different benchmarks have been used for comparative purposes; using their total respective figures for the substructure, superstructure and internal finishes:

- 877 $kgCO_2e/m^2$ – from the Etool 'International Office Benchmark 2010' (10 stories)
- 481 $kgCO_2e/m^2$ - from the Etool – Small Commercial Office' benchmark, 2016. (2 stories)
- 789 $kgCO_2e/m^2$ - from an average calculated using 30 office studies that AECOM have previously undertaken. (1 – 36 stories)
- 444 $kgCO_2e/m^2$ – from a 3 storey building (Chichester House) previously modelled by Aecom.

These values clearly vary significantly, which is in part due to the larger buildings requiring significantly more foundations per m^2.

The baseline model however does have its limitations, such as the lack of a database of material quantities and inaccuracies whilst taking measurements from the drawings. Furthermore, as the benchmark is not of a standardised similarly sized commercial building, it prevents the ability of the benchmark comparison to highlight the embodied carbon impacts of building elements which are unique to this design

Results

Table 1: The stage 2 baseline model gave the following results (all figures are given to 2 significant figures):

	RVC Total GWP (kgCO2e)	RVC GWP ($kgCO_2e/m^2$ GIA)
Substructure	1,400,000	210
Superstructure	2,400,000	350
Internal Finishes	120,000	17
People & Equipment (construction process)	96,000	-
Total	**4,000,000**	**540**

Figure 1 below shows how the total GWP (kg⁺ Oůeƺ ²kG A)kforkthekRV⁺ kbaselinek odelkco pareskto kthek differentkbench arkkfig resk entionedkpre!io sl"#k

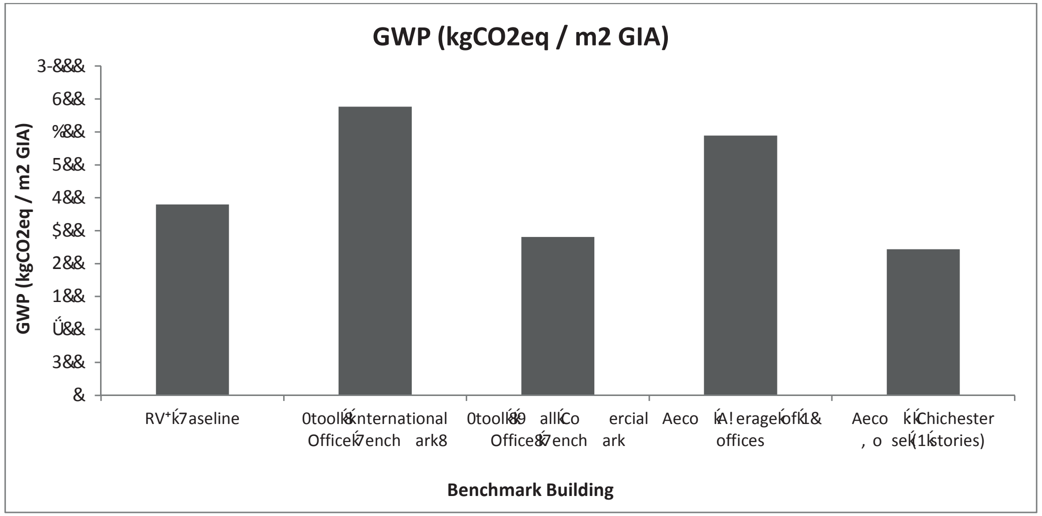

Figure 1: Comparison of RVC baseline model to varying benchmarks

From this it can be seen that, compared to the benchmarks, the RVC baseline model currently has a better GWP ($%&k kg⁺ Oůeƺ ²kG A)kthankthekIargekofficekb ildingkbench ark#k' hekRV⁺ k odelkalsokco paresk(ellkagainstk Aeco)ska!eragek al ekfro kpre!io skst dies#k hiskiskIargel"kd ektokthesekbench arkskco ingkfro ktallerk b ildingkthatk t"picall"kha!ek chkhigherkstr ct ralkde andskthankthekRV⁺ katkthreekstore"s#k

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The chart below, **figure 2,** displays the split of embodied carbon between the assumed building Elements as a percentage of the overall.

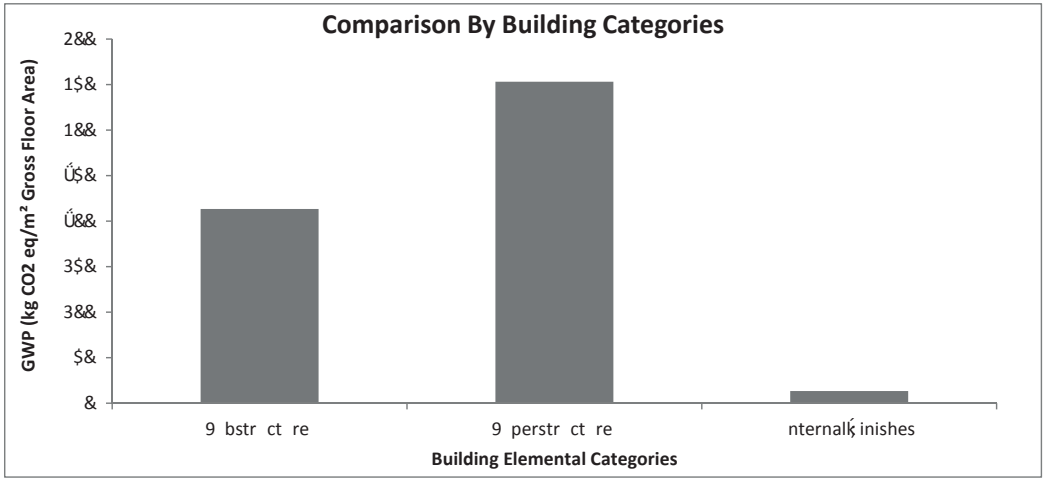

Figure 2: Comparison of GWP across building element categories for assumed Baseline Design.

As expected, the main focus of embodied carbon is concentrated within the superstructure, with a significant proportion also within the substructure. This is a result of the presence of large quantities of concrete and steel in each of these. Other significant contributors come from the external walls which are made up of a large amount of glass and external walls clad with concrete.

Figure 3 portrays this break down by the main components, with the dominating influence of steel and concrete seen within the frame and foundations. This also provides a focus for the design team to identify building elements where optimisation of material selection is most likely to reduce the carbon impact of the building.

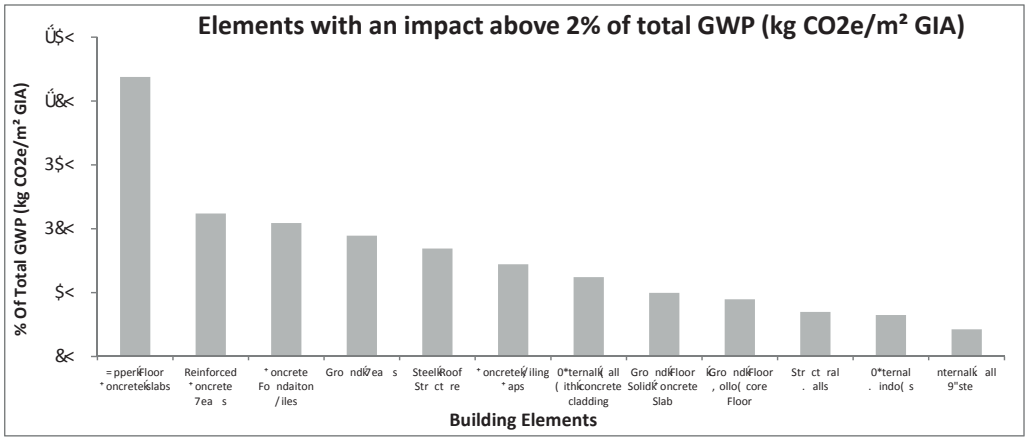

Figure 3: Demonstrates the split of embodied carbon between the baseline RVC model building elements.

Understanding where the majority of the carbon is sourced from can also help us understand where recommendations for reductions in embodied carbon can be focused. **Figure 4** displays the split between the three main stages of the construction process assessed within Etool. This shows that 93.4% of carbon is produced by the products themselves,

with 4.3% of carbon resulting from expected approaches to transport and 2.3% expected to be in the on-site construction works.

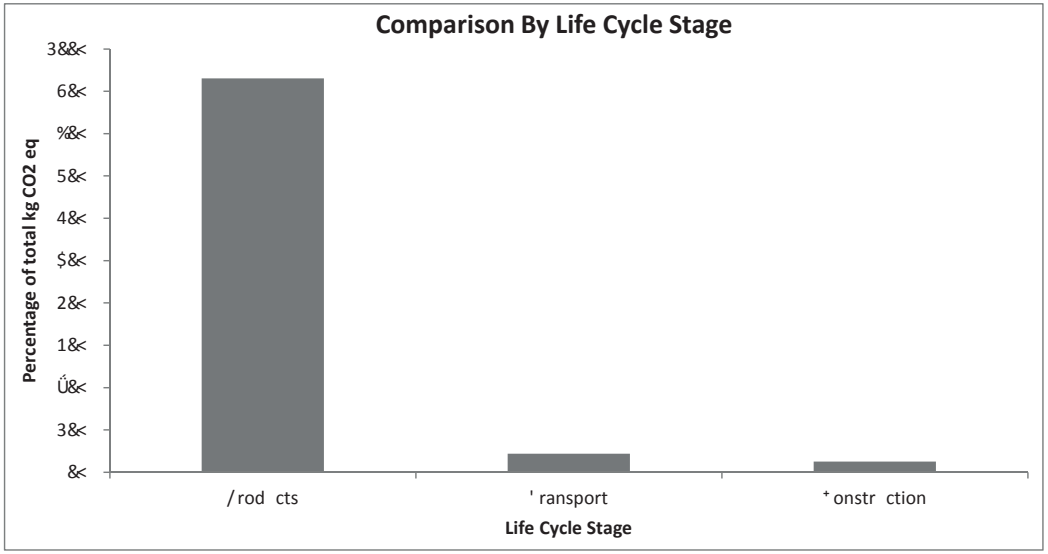

Figure 4: Comparison of embodied carbon produced across the main sources of carbon.

When calculating the impacts for transport and construction, Etool makes industry standard assumptions based on where the site is located.

The product stage (A1 – A3) of the building life cycle consists of raw material extraction, processing and transportation – all the work done 'to the factory gate'. With 93% of the total embodied carbon being produced during this stage, the materials and manufacturers selected to supply building elements and materials for this design should be the main issue taken into consideration.

Options analysis / recommendations

The recommendations provided within this technical note respond to the results of the baseline model, and therefore focus on the two main materials which contribute the most to the total embodied carbon of the design – concrete and steel. Further improvements could be made through changing the concrete cladding for a timber alternative or the aluminium components to the windows/glazed wall curtains; however these have not been included due to their effect on the architectural design. The recommendations provided include:

1) 50% replacement of cement with GGBS (ground granulated blast-furnace slag).
2) Reduction in reinforcement steel within the structural concrete elements.
3) CLT replacement for the roof structural element currently deigned to be constructed of steel.
4) Replace the steel stud frame component of the internal wall partitions, with timber stud framing.

1) As mentioned in our assumptions, the concrete elements of the baseline model are not assumed to contain any cement replacement materials. The standard Portland cement found in concrete can be partly replaced with either Pulverised Fuel Ash (PFA) or Ground Granulated Blast-Furnace Slag (GGBS). The comparative embodied carbon for Portland Cement, PFA and GGBS, according to 'Fact Sheet 18, Embodied CO_2 of UK cement, additions and cementitious material' as referenced in *'BSRIA's Inventory of Carbon and Energy',* are as follows:

- Portland Cement: **0.913** $kgCO_2e/kg$
- PFA: **0.004** $kgCO_2e/kg$
- GGBS: **0.067** $kgCO_2e/kg$

However as PFA is becoming less readily available as coal fired power stations close, GGBS has been chosen to replace 50% of the cement for this analysis, as this a standard percentage replacement. For the different reinforcement levels, the make-up of concrete elements including the GGBS was calculated using a standard 2:3:3 mix (Cement/GGBS:Sand:Aggregate). It should be noted that there is a concern regarding possible effects to the finished colour of the concrete from large quantities of GGBS, especially with there being many areas of exposed concrete on the proposed RVC development. **Figure 5** shows the carbon savings per m^2 floor area for different concrete elements within the building design, with a combined total saving of 235,000 $kgCO_2e$ (34 $kgCO_2e/m^2$). The biggest savings come from the slabs and piling due to their larger volumes.

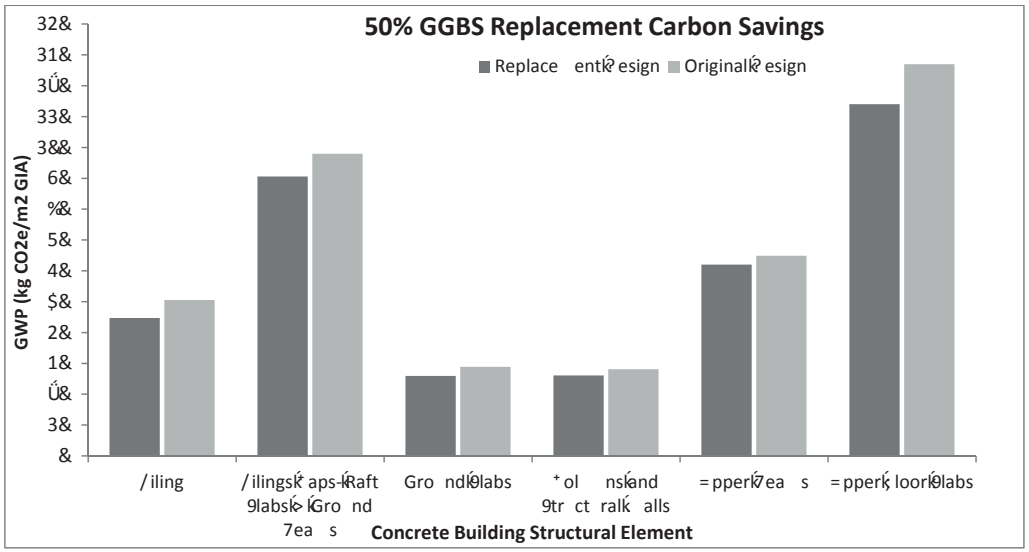

Figure 5: Savings made by 50% GGBS replacement for structural concrete elements

2) As shown in Recommendation '1)', the level of steel reinforcement within the concrete structural elements is important in terms of embodied carbon. By reducing the amount of steel for reinforcing concrete, significant carbon savings can be made. As reinforcement levels were not provided by the structural engineers at the time of this technical note, safe levels (taken from literature) were taken for the original baseline model. The levels have been reduced to demonstrate the potential for carbon savings, partly based on standard Etool standard template. However it is unknown if such reduced reinforcement levels are achievable for this design without the necessary input from the structural engineers. Therefore the results of this analysis are simply for demonstration purposes, and to encourage the structural design to be considered in this light. Note the piling reinforcement has been unchanged as 0.5% steel has been capped as the minimum reinforcement level for structural elements within this analysis.

The reduction in steel reinforcement levels for demonstration purposes are:

Concrete Building Element	Steel Reinforcement- Original Design	Reduced Steel Reinforcement
Piles	0.5% - 39 kg/m^3	0.5% - 39 kg/m^3
Slabs (ground and upper)	1.9% - 150 kg/m^3	1.5% - 115 kg/m^3
Pile Caps / raft slabs	1.5% - 115 kg/m^3	1% - 79 kg/m^3
Ground Beams	2.9% - 230 kg/m^3	2% - 160 kg/m^3
Columns	1.9% - 150 kg/m^3	1% - 79 kg/m^3
Upper Floor Beams	2.8% - 220 kg/m^3	2% - 160 kg/m^3
Structural Walls	1.4% - 110 kg/m^3	1% - 79 kg/m^3

The above replacement figures gave a total carbon saving of 330,000 $kgCO_2e$ (48 $kgCO_2e/m^2$). **Figure 6** shows how, as expected, the concrete elements with the largest reduction in reinforcement levels produce the greatest carbon savings. These included the upper floor slabs, the upper floor beams and the piling caps/raft slabs and ground beams.

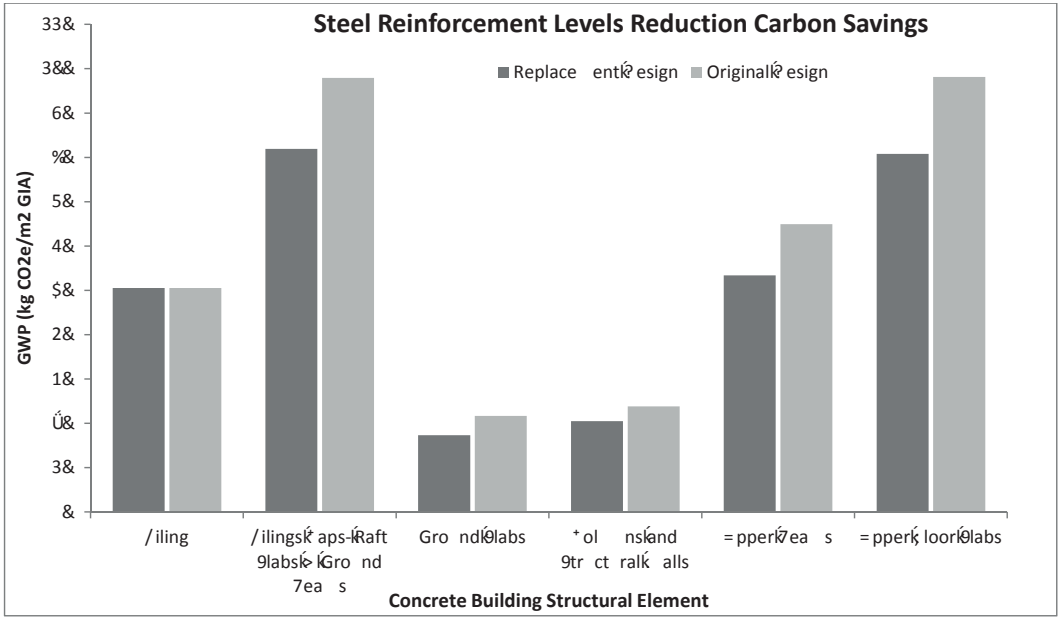

Figure 6: Savings made by reducing the quantity of steel for concrete reinforcement compared to the baseline model.

3) Cross Laminated Timber (CLT) is a timber based material which can be used as a structural alternative to steel. CLT has a negative embodied carbon impact within the Etool and LCA assessment due to the sequestration of carbon within timber. This means that replacing the steel roof structure with CLT would reduce the embodied carbon of this structural element by a figure greater than the steel structure current GWP of 340,000 kgCO_2e (49 kgCO_2e/m^2).

   The true benefit of this recommendation is not yet known however, as a proper CLT structural design would be needed to provide the quantity of the material needed. Addressing this is a recommendation going forward.

4) The internal steel stud walls were one of the twelve elements with a GWP of 2% or more of the total, with a GWP of 84,230 kgCO_2e (12.2 kgCO_2e/m^2). Within this building element the steel stud metal framing accounted for 25,000 kgCO_2e (3.6 kgCO_2e/m^2). Whilst the architectural specification detailed the use of a metal stud wall system, a timber alternative is an option.

Figure 7 shows the impact of replacing all internal steel stud framing with timber. Similar to CLT, timber stud framing has a negative embodied carbon impact and the overall improvement is a reduction of 62,000 kgCO_2e (9 kgCO_2e/m^2).

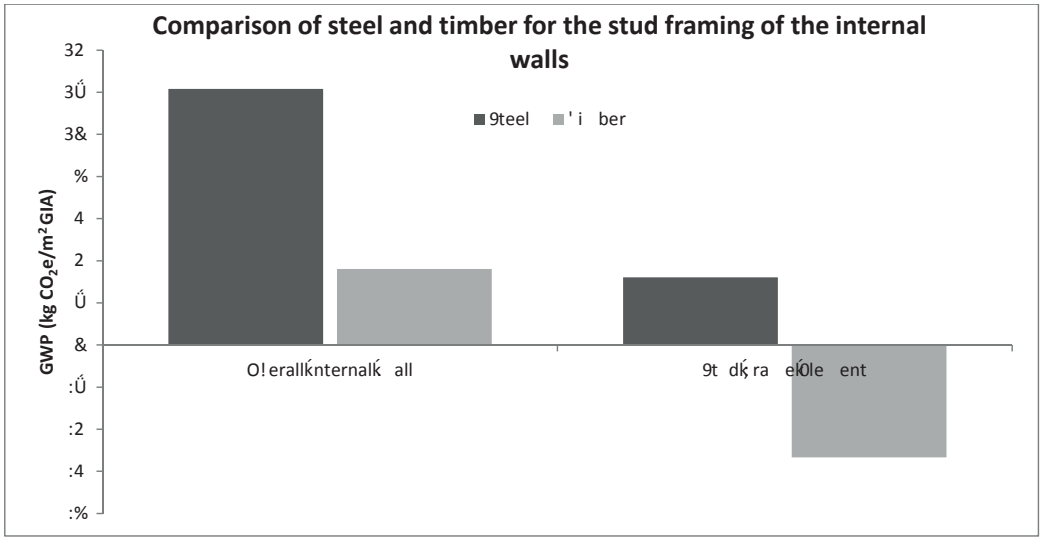

Figure 7: Savings made by replacing the steel stud framing component of the internal wall partitions, with a timber stud alternative.

Conclusion

This cradle to construction LCA, has identified 4 opportunities where carbon savings could be made. Due to limitations in details of concrete make-up and steel reinforcement levels provided at the time of this report, the improvements demonstrated in the results section may not be a true reflection of potential improvements. However, they do demonstrate the need to consider such improvements during the design, to limit the GWP of the buildings structures. This is particularly true given that it currently has a higher GWP kgCO_2e/m^2 than its most comparable benchmark.

Significant improvements can be made to the carbon impact through the use of GGBS to replace in part cement in concrete. Whilst there is a longer curing time associated with the use of cement replacements, their use should be seriously considered to counteract the embodied carbon associated with cement.

Furthermore limiting the quantity of steel found within these concrete structures is also recommended, and structural engineers should be encouraged to not ‘over-reinforce’ concrete structures, whilst maintaining an appropriate level of safety. The biggest improvement will clearly come if this is applied in conjunction with the GGBS cement replacement due to the majority of the RVC structure being formed of reinforced concrete.

Smaller, but still significant reductions in the embodied energy within the internal finishes can be made through the use of timber over steel for the fixtures including the stud framing of the internal wall partitions. However, when combined with the use of GGBS and reduced reinforcement steel, there could be a reduction of 91 kgCO_2e/m², showing that the RVC design could achieve a GWP that is close to that of the proposed benchmark.

Finally, there is the possibility for the steel roof structure to be replaced with a CLT design, which based on CLT having a negative carbon factor, will have a significant improvement. However this will require a new design by the structural engineers to realise the full impact such an improvement could have.

The implementation of these recommendations within the design is reliant upon their feasibility to be implemented and the impact, if any, they have on the integrity of the design. The recommendations therefore act as a demonstration as to what can be achieved if the embodied carbon impacts of building elements are considered at appropriate stages in design and action is taken to implement the reductions.

APPENDIX 7
ACCOMMODATION SCHEDULE

ACCOMMODATION SCHEDULE

LEVEL	ROOM No	NAME	DEPARTMENT	AREA
Circulation				
LVL E0	C.257	Stair 1	Circulation	30.3 m²
LVL T0	C.258	Stair 2	Circulation	33.1 m²
LVL E0	C.260	Stair 4	Circulation	35.2 m²
LVL E1	C.262	Stair 1	Circulation	30.0 m²
LVL E1	C.263	Stair 4	Circulation	28.7 m²
LVL E1	C.264	Stair 5	Circulation	19.0 m²
LVL E2	C.265	Stair 1	Circulation	28.1 m²
LVL E2	C.266	Stair 4	Circulation	28.7 m²
LVL T1	C.267	Stair 2	Circulation	19.6 m²
LVL T2	C.269	Stair 2	Circulation	19.6 m²
LVL E0	C.272	Entrance Lobby	Circulation	62.3 m²
LVL E0	C.273	Lift	Circulation	5.5 m²
LVL E2	C.276	Lift	Circulation	6.5 m²
LVL E0	C.277	Lift	Circulation	7.1 m²
LVL E0	C.280	Lobby	Circulation	11.3 m²
LVL E0	C.284	Lobby	Circulation	25.3 m²
LVL E1	C.287	Lobby	Circulation	26.7 m²
LVL E0	C.313	Atrium	Circulation	489.4 m²
LVL E2	C.322	Lobby	Circulation	13.2 m²
Circulation				**919.6 m²**
Existing				
LVL E0	C.189	E Media Office	Existing	26.1 m²
LVL E0	C.190	Circulation	Existing	14.3 m²
LVL E0	C.191	Hub Room / Server	Existing	26.1 m²
LVL E0	C.192	Plant Room	Existing	74.8 m²
LVL E0	C.193	Crush Area	Existing	50.2 m²
LVL E0	C.194	Archive Store	Existing	84.0 m²
LVL E0	C.243	Store	Existing	7.7 m²
LVL E0	C.246	Toilets	Existing	28.0 m²
LVL E1	C.248	Council Room	Existing	51.2 m²
LVL T0	C.259	Stair 3	Existing	24.1 m²
LVL T1	C.268	Stair 3	Existing	23.6 m²
LVL T1	C.290	Meeting Room	Existing	20.3 m²
LVL T1	C.291	Office	Existing	10.3 m²
LVL T1	C.292	Office	Existing	18.9 m²
LVL T2	C.300	Office	Existing	17.6 m²
LVL T2	C.301	Office	Existing	19.6 m²
LVL T2	C.302	Office	Existing	18.6 m²
LVL T2	C.303	Office	Existing	16.7 m²
LVL T2	C.304	Office	Existing	7.5 m²
LVL T2	C.305	Office	Existing	29.9 m²
LVL E2	C.308	Stair	Existing	36.0 m²
LVL E2	C.317	Store	Existing	8.4 m²
Existing				**613.6 m²**
Infrastructure				
LVL E0	C.97	Comms Room	Infrastructure	11.8 m²
LVL E0	C.98	Secondary Switchroom	Infrastructure	11.7 m²
LVL E0	C.99	Acc WC	Infrastructure	5.5 m²
LVL E0	C.103	Riser	Infrastructure	4.0 m²
LVL T0	C.119	Switch Room	Infrastructure	29.7 m²
LVL T0	C.122	Deliveries / Store	Infrastructure	100.9 m²
LVL E2	C.134	Store	Infrastructure	20.3 m²
LVL E2	C.135	Coat / Bag Store	Infrastructure	5.6 m²
LVL E2	C.150	Store	Infrastructure	12.0 m²
LVL E2	C.154	Comms Room	Infrastructure	11.8 m²
LVL E2	C.155	Store	Infrastructure	4.2 m²
LVL E1	C.156	Comms Room	Infrastructure	11.8 m²
LVL E2	C.161	Coat / Bag Store	Infrastructure	5.6 m²
LVL E2	C.164	Riser	Infrastructure	2.6 m²
LVL E0	C.167	Riser	Infrastructure	6.2 m²
LVL E0	C.169	Riser	Infrastructure	6.1 m²
LVL E0	C.170	Store	Infrastructure	17.8 m²
LVL T0	C.174	IT Hub	Infrastructure	5.9 m²
LVL T0	C.176	Toilets	Infrastructure	23.6 m²
LVL E1	C.225	Plant Room	Infrastructure	70.8 m²
LVL E0	C.242	Cafe Kitchen	Infrastructure	43.7 m²
LVL E0	C.244	Toilets	Infrastructure	39.1 m²
LVL E0	C.245	Shop	Infrastructure	15.1 m²
LVL E0	C.247	Elec	Infrastructure	9.0 m²
LVL E1	C.250	Store	Infrastructure	6.7 m²
LVL E1	C.251	Toilets	Infrastructure	50.3 m²
LVL E1	C.252	Elec	Infrastructure	3.5 m²
LVL E2	C.255	Toilets	Infrastructure	48.2 m²
LVL E2	C.256	ACC WC	Infrastructure	5.8 m²
LVL E0	C.261	Stair 5	Infrastructure	18.7 m²
LVL E0	C.270	Riser	Infrastructure	6.1 m²
LVL E1	C.274	Acc WC	Infrastructure	6.4 m²
LVL E1	C.275	Lift	Infrastructure	5.5 m²
LVL E0	C.278	Riser	Infrastructure	3.4 m²
LVL E0	C.279	Store	Infrastructure	3.8 m²
LVL E0	C.281	Riser	Infrastructure	7.9 m²
LVL E0	C.282	Store	Infrastructure	3.2 m²
LVL E0	C.283	Riser	Infrastructure	7.4 m²
LVL E1	C.285	Riser	Infrastructure	7.4 m²
LVL E1	C.286	Riser	Infrastructure	7.9 m²
LVL T1	C.288	Lift	Infrastructure	7.1 m²
LVL T1	C.289	WC	Infrastructure	3.8 m²
LVL E1	C.293	Riser	Infrastructure	2.5 m²
LVL E1	C.294	Riser	Infrastructure	12.5 m²
LVL E1	C.295	Riser	Infrastructure	6.1 m²
LVL E2	C.296	Riser	Infrastructure	7.4 m²
LVL E2	C.297	Riser	Infrastructure	7.9 m²
LVL E2	C.298	Riser	Infrastructure	3.2 m²

LVL E2	C.299	Riser	Infrastructure	4.0 m²
LVL E0	C.310	Elec riser	Infrastructure	3.1 m²
LVL T1	C.311	Elec Riser	Infrastructure	2.5 m²
LVL T1	C.312	Riser	Infrastructure	3.6 m²
LVL E2	C.318	Riser	Infrastructure	6.4 m²
LVL E2 PLANT	C.319	Plant	Infrastructure	154.7 m²
LVL E1	C.321	Riser	Infrastructure	4.0 m²
Infrastructure				**895.5 m²**
Lab Write Up Space				
LVL T0	C.115	Office	Lab Write Up Space	10.9 m²
LVL T0	C.116	Office	Lab Write Up Space	10.8 m²
LVL T0	C.117	Open Plan Office 12 desks	Lab Write Up Space	64.2 m²
LVL T1	C.131	4 Person Office	Lab Write Up Space	27.5 m²
LVL T1	C.132	Open Plan 6 Person Office	Lab Write Up Space	46.8 m²
LVL T0	C.181	Open Plan Write up Space	Lab Write Up Space	81.3 m²
LVL T1	C.182	Open Plan Write up Space	Lab Write Up Space	103.0 m²
LVL T1	C.183	2 Person Office	Lab Write Up Space	13.2 m²
LVL T1	C.184	Breakout meeting Space	Lab Write Up Space	7.1 m²
LVL T1	C.185	2 Person Office	Lab Write Up Space	19.7 m²
Lab Write Up Space				**384.5 m²**
Laboratory				
LVL T0	C.118	Large Equipment Room	Laboratory	36.9 m²
LVL T0	C.121	Central Laboratory	Laboratory	155.3 m²
LVL T1	C.123	VMD Approved TC Lab	Laboratory	13.2 m²
LVL T1	C.127	VMD Approved Lab	Laboratory	13.1 m²
LVL T1	C.130	GLP Lab for RVC Business	Laboratory	21.6 m²
LVL T0	C.172	Pre PCR lab	Laboratory	19.1 m²
LVL T0	C.173	PCR Lab	Laboratory	17.6 m²
LVL T0	C.175	Open Plan Research Lab	Laboratory	163.4 m²
LVL T0	C.177	Sequencer	Laboratory	20.6 m²
LVL T0	C.178	Microscope / Dark Room	Laboratory	15.7 m²
LVL T0	C.180	Large Tissue Culture Lab	Laboratory	55.5 m²
LVL T1	C.186	Tissue Culture Lab	Laboratory	12.7 m²
LVL T1	C.187	Tissue Culture Lab	Laboratory	13.6 m²
LVL T1	C.188	Open Plan Research Lab	Laboratory	165.9 m²
Laboratory				**724.1 m²**
Office/Admin				
LVL E2	C.133	Office	Office/Admin	16.7 m²
LVL E2	C.139	4 Person Office	Office/Admin	28.3 m²
LVL E2	C.140	4 Person Office	Office/Admin	29.3 m²
LVL E2	C.141	Office	Office/Admin	9.6 m²
LVL E2	C.142	Office	Office/Admin	8.7 m²
LVL E2	C.143	4 Person Office	Office/Admin	25.2 m²
LVL E2	C.144	Office	Office/Admin	13.7 m²
LVL E2	C.145	Office	Office/Admin	13.7 m²
LVL E2	C.146	4 Person Office	Office/Admin	25.1 m²
LVL E2	C.147	Open Plan Office 38 Desks	Office/Admin	200.5 m²
LVL E2	C.148	Open Plan Office 32 Desks	Office/Admin	250.3 m²
LVL E2	C.151	Meeting Room	Office/Admin	26.0 m²
LVL E2	C.153	Visiting Academic's Lounge	Office/Admin	69.6 m²
LVL E0	C.199	Student Services	Office/Admin	114.7 m²
LVL E2	C.200	Open Plan Meeting Area	Office/Admin	25.4 m²
LVL E2	C.201	1 Person Office	Office/Admin	9.9 m²
LVL E2	C.202	4 Person Office	Office/Admin	28.1 m²
LVL E2	C.203	4 Person Office	Office/Admin	25.3 m²
LVL E2	C.204	4 Person Office	Office/Admin	25.3 m²
LVL E2	C.205	4 Person Office	Office/Admin	25.3 m²
LVL E2	C.206	4 Person Office	Office/Admin	25.3 m²
LVL E2	C.207	4 Person Office	Office/Admin	25.3 m²
LVL E2	C.208	4 Person Office	Office/Admin	25.3 m²
LVL E2	C.209	4 Person Office	Office/Admin	25.3 m²
LVL E2	C.210	1 Person Office	Office/Admin	9.5 m²
LVL E2	C.211	1 Person Office	Office/Admin	9.5 m²
LVL E2	C.212	1 Person Office	Office/Admin	9.5 m²
LVL E2	C.213	1 Person Office	Office/Admin	9.5 m²
LVL E2	C.214	1 Person Office	Office/Admin	9.5 m²
LVL E2	C.215	1 Person Office	Office/Admin	10.8 m²
LVL E1	C.216	Office	Office/Admin	17.0 m²
LVL E1	C.217	Office	Office/Admin	17.0 m²
LVL E1	C.218	Office	Office/Admin	17.0 m²
LVL E1	C.219	Office	Office/Admin	17.0 m²
LVL E1	C.220	Office	Office/Admin	17.0 m²
LVL E1	C.221	Office	Office/Admin	17.0 m²
LVL E1	C.222	Office	Office/Admin	17.0 m²
LVL E1	C.223	Office	Office/Admin	16.9 m²
LVL E1	C.224	Office	Office/Admin	11.7 m²
LVL E2	C.226	E Media Office	Office/Admin	17.1 m²
LVL E2	C.227	Available	Office/Admin	26.6 m²
LVL E2	C.228	Nursing Team	Office/Admin	25.7 m²
LVL E2	C.229	Nursing Team	Office/Admin	26.2 m²
LVL E2	C.230	Available	Office/Admin	23.8 m²
LVL E1	C.231	4 Person Office	Office/Admin	26.2 m²
LVL E1	C.232	4 Person Office	Office/Admin	26.1 m²
LVL E1	C.233	4 Person Office	Office/Admin	26.1 m²
LVL E1	C.234	4 Person Office	Office/Admin	26.2 m²
LVL E1	C.235	4 Person Office	Office/Admin	26.2 m²
LVL E1	C.236	4 Person Office	Office/Admin	26.0 m²
LVL E1	C.237	4 Person Office	Office/Admin	26.1 m²
LVL E1	C.238	4 Person Office	Office/Admin	26.2 m²
LVL E1	C.239	4 Person Office	Office/Admin	26.2 m²
LVL E2	C.240	Human Resources	Office/Admin	156.3 m²
LVL E2	C.241	Open Plan Workstations	Office/Admin	355.7 m²
LVL E1	C.249	Council Room	Office/Admin	33.1 m²
LVL E2	C.253	CPD Office	Office/Admin	43.9 m²
LVL E2	C.254	CSS Admin Office	Office/Admin	34.8 m²
LVL E2	C.306	Breakout Space	Office/Admin	9.1 m²
LVL E2	C.307	Breakout Space	Office/Admin	8.7 m²
LVL E1	C.315	Meeting Room	Office/Admin	45.1 m²

LVL E1	C.316	Office	Office/Admin	91.2 m^2
Office/Admin				**2410.8 m^2**
SME Hub				
LVL T1	C.124	SME TC Lab	SME Hub	11.1 m^2
LVL T1	C.125	SME Lab	SME Hub	55.4 m^2
LVL T1	C.126	SME Lab	SME Hub	52.1 m^2
LVL T1	C.128	SME Lab	SME Hub	47.8 m^2
LVL T1	C.129	SME Office	SME Hub	97.7 m^2
SME Hub				**264.0 m^2**
Teaching				
LVL E0	C.100	Directed Learning Room 1	Teaching	122.5 m^2
LVL E0	C.101	Directed Learning Room 2	Teaching	122.3 m^2
LVL E0	C.102	Directed Learning Room 3	Teaching	123.6 m^2
LVL E0	C.104	Group Learning Room	Teaching	199.0 m^2
LVL E0	C.105	Lecture Theatre	Teaching	217.2 m^2
LVL E1	C.106	Library	Teaching	375.2 m^2
LVL E1	C.107	Lecture Theatre	Teaching	438.1 m^2
LVL E1	C.108	Social Learning	Teaching	376.3 m^2
LVL E0	C.109	Small Teaching Room 1	Teaching	18.0 m^2
LVL E0	C.110	Small Teaching Room 2	Teaching	18.0 m^2
LVL E0	C.111	Small Teaching Room 3	Teaching	18.0 m^2
LVL E0	C.112	Small Teaching Room 4	Teaching	18.0 m^2
LVL E0	C.114	Student Social Learning	Teaching	376.2 m^2
LVL E2	C.136	Small Teaching Room 7	Teaching	18.0 m^2
LVL E2	C.137	Small Teaching Room 6	Teaching	20.0 m^2
LVL E2	C.138	Small Teaching Room 5	Teaching	20.0 m^2
LVL E2	C.149	Teaching Lab	Teaching	271.7 m^2
LVL E1	C.158	Study Room	Teaching	15.3 m^2
LVL E1	C.159	Study Room	Teaching	12.7 m^2
LVL E1	C.160	Library Reception	Teaching	18.2 m^2
LVL E2	C.162	Store / Prep Room	Teaching	14.8 m^2
LVL E2	C.163	Cold Store	Teaching	14.4 m^2
LVL E2	C.165	Store / Prep Room	Teaching	9.8 m^2
LVL E2	C.166	Teaching Room 8	Teaching	28.7 m^2
LVL E0	C.195	Flexible Seminar Room	Teaching	54.2 m^2
LVL E0	C.196	Flexible Seminar Room	Teaching	54.2 m^2
LVL E0	C.197	Flexible Seminar Room	Teaching	54.2 m^2
LVL E0	C.198	Flexible Seminar Room	Teaching	54.2 m^2
LVL E0	C.271	Flexible Space	Teaching	104.5 m^2
LVL E2	C.309	Cold Store	Teaching	9.6 m^2
Teaching				**3196.7 m^2**