19784

Carlow Library
Mechanical and Electrical Services
Stage 2A Developed Design Report

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EXECUTIVE SUMMARY

OBJECTIVE:

This report outlines the nature, scope and configuration of the various mechanical and electrical engineering services and systems for the proposed refurbishment and new build at the Library in Carlow town.

The purpose of this report is to provide an overview of the proposed developed design of the mechanical and electrical services to be installed in this building.

The mechanical and electrical design strategies proposed also incorporate additional system enhancements, which are provided to maximise the Building Energy Rating (BER) while providing the most robust, durable and maintainable systems as possible.

INTRODUCTION

This work comprises the refurbishment and remodelling of the Carlow Library along with the new extension.

The siteworks associated with the scheme includes for the provision of ESB Networks, EIR and Natural Gas. Routes of proposed natural gas, telecoms and ESB duct services will be reviewed in greater detail at detailed design stage however Utility record searches and initial provisional routes have been assessed, refer to Utilities section and associated drawing.

We note that the mechanical and electrical designs will be exempt from TGD Part L and nZEB due to building being “protected” however the designs will be targeting NZEB compliance for the new extension and improving the efficiency of the existing convent building where possible but will be subject to constraints with the building type and associated costs efficiency.

The Environmental Strategy for the scheme is to provide energy efficient systems and to employ a holistic approach to the integration of the building, its energy systems and its users.

The design team recognises the need for the building to be designed and operated in a manner that reduces the environmental impact of the building, while achieving it in an economical manner and maintaining an internal environment that is comfortable and enjoyable for the occupants and their visitors.

This takes account of the energy load for space heating, water heating, fixed lighting and ventilation. Low zero and renewable technologies were also reviewed and assessed if applicable for this scheme.

DESIGN APPROACH & METHODOLGY:

The project brief includes a study to establish the best strategy to redevelop the existing central library, library headquarters and county archives of the Presentation Building into a cultural hub and library for Carlow town.

BUILDING SYSTEMS: USER REQUIREMENTS

The design strategy for the building will be driven by a number of end user issues that require an integrated approach to the design of spaces and services. The provision of flexible and adaptable spaces that may be reconfigured over time is a key consideration. A user centred environment with a multitude of different types of spaces that can cater for dynamic interaction between staff and public demands an integrated servicing solution that is easily upgraded. Excellent WiFi and well located service hubs for printing, scanning and information retrieval is a given. The integration of book security systems and handling as well as audiovisual equipment will entail close communication with Carlow Co Council’s requirements and benchmarking of what is available in the marketplace as technology changes rapidly. As a service provider is in place, liaison will be required with the company to ensure that the technical requirements are in place.

SUSTAINABILITY

The issue of sustainability has a wide scope and requires the design team to address the environmental impact of the building in terms of building envelope and spatial planning, the internal environment and the building operation and maintenance. Our approach will be one of maximising passive design and the conditioning of the building using the building envelope, form and fabric. This means that the reliance on active M&E systems is reduced, along with the maintenance and running costs. Good access to both daylight and controlled sunlight – allowing shafts of sunlight into the building can provide delight and really lift spaces. Natural ventilation coupled with appropriate thermal mass will provide much of the conditioning with back-ground cooling when necessary to deal with peak summer-time temperatures. Maximising daylight and natural ventilation will tend to lead to larger open plan spaces. Absorption local to noise sources and to transmission routes will limit the spread of noise and reverberation. The arrangement of spaces and use can enable different acoustic environments throughout the building appropriate to each location.
Natural ventilation BMS controlled and heat recovery ventilation in all common areas of the new building, while the protected Convent building will include for some upgrading. The interface between old and new will be a particular challenge, especially for airtightness. The structure of the building in both the configuration and material has particular relevance to the sustainable building and initial design considerations for the services systems in the building which will have a major influence on the building's efficiency and overall performance. We look at optimising the façade to ensure adequate daylight, the use of natural ventilation and achieving comfortable conditions within the building. Dynamic Thermal Modelling allows for the performance of the building to be assessed in conjunction with the external environment, building usage, façade design and ventilation method to show the effect on the internal environment and building energy consumption. Consideration of design life is critical for sustainability, and will be addressed by way of appropriate selection of materials, detailed specifications to include criteria for design life and maintenance, integrated assessment of whole life costs and robust detailing.

Refer to Sustainability report for further details.

FABRIC INSULATION AND AIR TIGHTNESS

After discussions with the Architect the following U-Values for the will be targeted taking into account the existing building status.

<u>Existing Convent</u>

Element	U-Value (W/m²k)
	Existing (Figures noted in Energy Audit 2017)
Roof	0.25
Walls	2.3
Ground Floor	0.45
Doors, windows, rooflights	5.1

Element	U-Value (W/m²k)
	Proposed (Convent upgrade)
Roof	0.18
Walls	2.1
Ground Floor	0.45
Doors, windows, rooflights	5.1

New Extension

Element	U-Value (W/m²k)
	Proposed Extension
Pitched Roof	0.14
Flat Roof	0.18
Walls	0.19
Floor	0.19
Doors, windows, rooflights	1.45

Air tightness can greatly reduce the heating load of a building. This is determined by the quality of sealing to windows and doors, minimization of service penetrations and correct sealing around any remaining service penetrations.

With a reasonable standard of workmanship it would be expected to achieve an air permeability rate of <3 m3/(h.m2) for the new extension.

OVERHEATING

CIBSE TM52 was used to assess the risk of overheating. Building Regulations Part L 2017 Conservation of fuel and energy - buildings other than dwellings (TGD Part L: 2017) Section 1.3.6 recommends performing an overheating assessment in accordance with the 'adaptive method' described in CIBSE TM52.

The overheating analysis confirms the spaces passes the CIBSE TM52 overheating risk assessment criteria however the following should be noted.

It is important to note that there will be times when the rooms overheat. The single biggest issue that influences the viability of natural ventilation is summertime temperatures. The cooling potential of natural ventilation is limited by the prevailing climate and by occupant expectations of thermal comfort. Natural ventilation systems will not maintain ideal comfort conditions 100% of the time. Natural ventilation is driven by wind and buoyancy forces that are unpredictable in nature making control challenging, as a result natural ventilation systems may at times under-ventilate, resulting in overheating or reduced air quality conditions.

It is recommended that mechanical extract ventilation is installed to extract at the back of the Library space on the ground floor level. This will improve air movement within the space and remove the possibility of warm stale air build up. It is also recommended that the system is sized for the worst case / maximum occupancy.

Refer to Sustainability/Overheating Analysis report for further details.

UTILITIES & SITE SERVICES

ESB SUPPLY

The capacity has been assessed and meeting was had with the ESB and it was confirmed that the existing is a 4x120mm^2 aluminium cable, the current MIC is 29kVa. It is proposed to retain the incoming electrical supply as the existing capacity is adequate for this project.

There will be modifications to the existing arrangement within the existing Library entrance hall, Metering will be similar to current arrangement with single meter to the development and sub meter as required to Museum etc.

Note there shall be downtime on the electrical supply to the Museum during the Construction works.

Below ground services survey drawing has been received and reviewed.

EIR

There is existing EIR infrastructure local to the site. It is noted from the below ground services drawing that the existing EIR distribution serves the Library and the Museum. EIR supply shall be extended to the new Comms room in the new extension building.

The EIR infrastructure routed to the Museum will need diverting to accommodate the proposed new extension building. See drawing in Appendix A, however this will require further development during the detailed stage of the project.

Below ground ducting will be routed from the relevant services chambers to the Library Comms room.

Utility Ground Works

Separate underground service ducts shall be provided on the electrical installation to cater for each of the following:

- Incoming telecom supply
- Incoming broadband/IT provider

These shall consist of suitably sized pvc pipes incorporating long sweeping bends and where considered necessary suitable access chambers, draw pits and jointing chambers to facilitate the installation and replacement of cables.

Suitable pre-formed duct bends that meet the requirements of the cable manufacturer for bending radii will be used at ends of duct routes where cables rise out of the ground.

The ducts shall be located at a minimum of 600mm below finished ground level.

Where necessary a warning tape with a black legend will be provided for duct identification.

NATURAL GAS SUPPLY

There is an existing natural gas mains supply routed along Tullow Street, College Street in Carlow Town adjacent to this Library building (see Appendix A) and branches off to serve the gas meter at the front of the building.

The Gas Ireland Networks record drawing also indicates 63mm branch off College Street routed towards and along Presentation place within the rear car park of the Library, see Appendix A. The below ground services drawing indicates routing on site and branches to the houses this serves. This existing service will require diversion, see Appendix A diversions drawing. Gas Ireland Networks have been contacted and proposal is awaited.

The existing gas fired boilers located in the basement are served by gas supply off Tullow Street. It is not proposed to upgrade the gas mains to the Library building.

MAINS WATER SUPPLY

There is an existing water supply serving the Library building. There appears to be 1 No. water tank within the roof space which serves the building, it is assumed that the Museum building is served via separate mains water supply.

Civil Engineer shall provide water supplies to the development.

EXISTING & PROPOSED MECHANICAL SERVICES

PRIMARY HEATING SOURCE:

The existing Library is currently served via gas fired boiler located in the basement of the Convent building. The condition of the boiler plant appears to be in reasonable condition but is approx. 20 years old and is nearing end of life and will not be as efficient as new boilers. It is understood that the system is currently delivering hot water to the Convent building and extension via pipework and heating radiators. The Museum building is served by a separate boiler system.

Detailed consideration of energy efficient systems in relation to the primary energy supply source and renewable / Low carbon technologies / systems are assessed under the Sustainability Energy section.

Any renewable systems will be supplemented by high efficiency gas fired condensing modular boilers to make up any shortfall in the sustainable heat sources and to provide backup in the event of unavailability of either source due to maintenance or malfunction.

The primary heat source will be provided by a combination of air source heat pumps and gas fired boilers for the generation of low temperature hot water. It is envisaged that the new boiler heating plant shall be located in the convent basement boiler room (subject to fire strategy) with secondary plantroom and external air source heat pumps. The basement boiler room shall be complete with natural gas detection system.

The existing boiler flue system shall be replaced with new to suit new boilers.

The systems shall be complete with variable speed pumps, emitters, pipework, valves, thermal insulation and controls and serve variable temperature circuit for fabric heating.

Refer to Utilities and Site services section regarding natural gas supplies.

Refer to Stage 2A drawings for further details on services strategy and plant location.

FABRIC HEATING:

The design of the building fabric will be based on the 'U' values denoted in the U-Values table. These have been discussed with the Architect and Conservation team.

Fabric heating will be provided throughout the building by a combination of trench heating/radiators/warm air heating.

The primary heating medium will be Low Temperature Hot Water (LTHW) generated in the boiler at 80ºc flow and 60ºc return to serve the Convent building and LTHW generated at 40ºc flow and 30ºc return within the heat pump plantroom to serve the new extension.

The building will be zoned via dedicated circuits in relation to building orientation and hours of use etc. Overall control of the heating circuits will be provided via the Building Energy Management System (BEMS) to allow systems to be overridden should the need arise.

Heating pipework will be medium grade steel and shall be distributed in ceiling voids and vertical risers throughout the buildings, final routing in the Convent building will be further developed during the detailed design stage.

U-Values tables

Element	U-Value (W/m²k) Existing (Figures noted in Energy Audit 2017)
Roof	0.25
Walls	2.3
Ground Floor	0.45
Doors, windows, rooflights	5.1

Element	U-Value (W/m²k) Proposed (Convent upgrade)
Roof	0.18
Walls	2.1
Ground Floor	0.45
Doors, windows, rooflights	5.1

Element	U-Value (W/m²k) Proposed Extension
Pitched Roof	0.14
Flat Roof	0.18
Walls	0.19
Floor	0.19
Doors, windows, rooflights	1.45

Installation shall be in accordance with all Statutory Instruments, Regulations and Local Authority requirements as necessary.

All necessary fittings and equipment for automatic control shall be supplied with the new plant.

BOILER/AIR SOURCE HEAT PUMP SAFETY CONTROLS

The Boilers/Air source heat pumps shall be provided complete with control panel and alarms and shall incorporate the ability to connect to external fire alarm systems.

Pressure and temperature relief valves shall be provided.

HEATING ELEMENTS:

All heating elements shall be adequately designed, sized, and selected based on external design temperature of -5°C and shall provide maintainable room temperatures for room types and function.

TRENCH HEATING:

Trench heating shall be provided in the new extension building and zoned to suit main open areas/function/zoning. Manifold sets shall be provided.

RADIATORS:

The Convent building shall be provided with multicolumn radiators, other designated areas shall either be single or double panel high output pressed steel type radiators.

Radiators shall also be provided to the book store along with 2 port control valve to maintain a required temperature set point of 16°c (adjustable). The room condition should be a more stable environment than the existing due to less variables such as sunlight/ventilation through windows/leakage. There is no closed control system proposed.

All radiators shall be of the types, ratings and dimensions indicated and shall be manufactured and tested in accordance with IS EN 442.

The minimum clearance between the finished floor and the underside of a radiator shall be 100mm.

All radiators shall be pressure tested to 6Bar and shall come RAL coloured to Architects requirements.

HEATING CONTROLS:

The heating system shall be split into individually controlled zones.

Provision shall be made to control the space heat emission on the basis of a room temperature thermostat and thermostatic radiator valves on all radiators. The programmer shall have:

- Time scheduling by BMS.
- Boost facility
- Room thermostat with neon status light indicator
- 2 & 3 port valves

HEATING PIPEWORK & FITTINGS:

General:
Fittings shall be the same size as the tubes and pipes to which they are connected. The use of bushes is not acceptable.

Bends shall be long radius and all tees swept pattern, unless this precludes the natural venting of pipework.

Flanges shall comply with BS 1560-3.2:1989 or equivalent and shall be compatible with the materials, temperature and pressure of the system.

Bolts shall be capable of withstanding the service conditions and shall be the correct size for the flange as indicated in the appropriate flange tables.

Gaskets shall be to BS 3063: 1965 or IS EN 1514 as applicable, of a grade and thickness suitable for the temperature, pressure and operating conditions of the service.

Heating:
Pipework shall be to BS EN 10216-1:2013 AND BS EN 10217-1:2019 and be of hot finished electric resistance welded construction from steel with minimum tensile strength of 360N/mm^2, unless indicated as seamless.

Fittings shall be to IS EN 10253 or equivalent, though in locations where LTHW pipework up to and including 50mm is exposed, BSP screwed connections may be permitted to BS 143 and 1256 : 2000 or equivalent with the approval of the Engineer.

Cold feeds and open vents shall be run in copper tube as specified for water services pipework. Suitable spherical seated unions shall be used on LTHW pipework up to and including 50mm for connection to valves and equipment and to permit easy dismantling of pipework.

Piping ends shall be within the recommended tolerances and shall be free from burrs and distortion.

Pipework Insulation:
All heating services pipework shall be insulated throughout all concealed runs as appropriate to the duty in accordance with current good practice for the purposes of energy conservation and prevention of heat transfer and condensation. Pipework installations shall be insulated with close cell insulation, standard BS: 3958 Part 4, Class O, or equivalent.

All piping are to be lagged with approved nitrile rubber pipe insulation having a minimum wall thickness of 25mm. Insulation should be neatly fitted with formed mitered joints at elbows and tees and should cover all valves and fittings. The manufacturer's approved adhesives should be used on all butt and seam joints.

COOLING:

Split DX system to be provided to serve the Communications Room to maintain optimum operating temperature for the equipment.

System shall consist of external condenser located on the roof, indoor unit, refrigerant copper pipework, insulation, condensate and controls.

It is not proposed to provide any active cooling within the Library development.

Refer to Stage 2A drawings for further details on services strategy and plant location.

DOMESTIC WATER SERVICES:

The works covered in this section shall include the following:

Hot, cold, and mains water installation including water storage tanks, water heater, etc.

Mains Water:
There is an existing water supply serving the Library building. There appears to be 1 No. water tank within the roof space which serves the building, it is assumed that the Museum building is served via separate mains water supply.

Mains water shall be provided to designated drinking points in the building.

Domestic Cold Water:
A new 2 compartment sectional cold water tank shall be provided within the roof void to supply the building.

The outflow from the roof void mounted cold storage tank will connect to a gravity fed system to serve both the cold water distribution system and the hot water distribution system. Cold and hot water will be distributed to all sanitary fittings.

Domestic Hot Water:
A new hot water storage cylinder is proposed to serve the new WC facilities within the extension, localised staff WC's and kitchenette within the Convent building. This hot water cylinder shall be served via the air source heat pump system.

Domestic hot water will be circulated at 60ºc and returned to the water heater at not less than 50ºc by means of circulating pump.

The hot water system will be pressurised throughout and all pipe work will be insulated in accordance with the relevant standards.

Taps on sinks / wash hand basins and shower mixer valves will be provided with integral anti scald valves to mix water to 43ºc at the outlet. No dead legs will exceed 0.3m.

All hot and cold water connections to rooms will be provided with local isolation to allow emergency isolation of services.

All domestic water service pipework shall comply fully with the requirements and conditions of Irish Water / County Council Water Division.

Domestic hot and cold water and above ground mains water pipework shall be fabricated from half hard copper tubing to IS EN 1057 : 2006 and shall be concealed throughout.

Copper fittings shall be lead-free solder ring capillary type to IS EN 1254 : 1998, though in locations where pipework up to and including 54mm is exposed, compression fittings to IS EN 1254 : 1998 may be permitted with the approval of the Engineer. Fittings shall be resistant to dezincification and shall be fully compatible with the copper tubing.

Suitable unions shall be used for connection to valves and equipment and for dismantling of pipework up to and including 54mm. Over 54mm, flanges shall be used to BS EN 1560-3.2: 1989.

Run-outs and dead legs to sanitary fittings shall be run generally in the form of a “float”, which shall be blanked at the end and capped. The Contractor shall include for making all final connections to sanitary fittings.

All pipe supports, hangers and brackets required to support and control the movement of pipework shall be supplied and erected by the Contractor and shall be fixed to the valves shall be resistant to dezincification and shall be fully compatible with the pipework system of which they form part.

Isolating valves up to and including 28mm shall be ball valves with brass body, chrome plated ball, PTFE seat and compression ends. Isolating valves over 28mm and up to 54mm shall be 3- piece bronze ball type with PTFE seat and solder ends.

Stopcocks up to 54mm shall be bronze to BS 1010 or equivalent with copper compression couplings. Stopcocks on underground mains pipework shall be fully compliant with Irish water Requirements.

Float operated valves for cold water tanks and Cisterns shall be of a size and type to suit the duty, and formed in plastic to prevent corrosion. Floats shall be to BS 1968 or BS 2456, as appropriate. Silent operation float valves to be used throughout.

Sanitary fittings (WC, WHB etc.) shall be capable of being isolated so that they can be maintained / replaced with ease. The Contractor shall supply and fit screwdriver operated ball valves in nickel plated forged brass at each individual item of sanitary ware for both Hot and Cold Water supplies.

In all places where pipes pass through walls or floors suitable sleeves shall be provided and fitted at such points. Sleeves shall be in one length and be fixed flush with surface or the finished floor or wall. Sleeves shall be of ample diameter to allow for the free movement of mains and branches due to expansion and contraction.

The pipes passing through these sleeves shall be fixed correctly to allow for this movement. This also applies to holes in floors and ceilings where it is not possible to fix sleeves. Gaps around pipes shall be sealed using a suitable mastic for low temperature pipes or silicone rubber for higher temperature pipes.

Control valves shall be resistant to dezincification and shall be fully compatible with the pipework system of which they form part.
Isolating valves up to and including 28mm shall be ball valves with brass body, chrome plated ball, PTFE seat and compression ends. Isolating valves over 28mm and up to 54mm shall be 3- piece bronze ball type with PTFE seat and solder ends.

Float operated valves for cold water tanks shall be to BS 1212 or equivalent of a size and type to suit the duty. Floats shall be to BS 1968 or BS 2456, or equivalent as appropriate. Where required, silencers shall be fitted on float valves.

The float valves shall be suited to the pressure available. Warning and/or overflow pipes shall be twice the bore of the float valve inlet pipe fitted.

The Contractor shall include for the supply and installation of a water meter on the mains pipe to the building and sub meter to the tank. All water meters shall comply in full with the requirements of Irish Water.

Pipework Insulation:
All water services pipework shall be insulated throughout all runs as appropriate to the duty in accordance with current good practice for the purposes of energy conservation and prevention of heat transfer and condensation. Pipework installations shall be insulated with close cell insulation, standard BS: 3958 Part 4, Class O, or equivalent.

All piping to be lagged with approved flexible polyethylene pipe insulation having a minimum wall thickness of 25mm. Pipes, all joints fully sealed with a suitable insulating tape. Insulation should be neatly fitted with formed mitered joints at elbows and tees and should cover all valves and fittings. The manufacturer’s approved adhesives should be used on all butt and seam joints.

Refer to Stage 2A drawings for further details on services strategy and plant location.

DOMESTIC SOILS AND WASTES:

The installation shall consist of a complete soils and wastes system, including traps, overflows, vents, access points, fire collars and acoustic insulation. This shall include all above ground pipework and all pipework within the lower areas to connect to existing below ground drainage system (by Civil Engineer)

Rainwater systems shall be designed by the Architect.

All soil pipework and fittings shall comply with BS 4514:2001 or equivalent, uPVC pipework. All waste pipework and fittings up to 55 mm dia. shall comply with BS EN 1329- 1:2000, or equivalent MuPVC pipework unless otherwise indicated. Unless otherwise indicated, soils and wastes pipework running through occupied spaces shall be insulated for condensation and acoustic purposes. All pipes and fittings shall be installed in strict accordance with Manufacturer’s instructions. All necessary pointing materials, fixings and accessories shall be as recommended by the Manufacturer.

The minimum internal diameters of traps to various appliances are as follows:-

- Wash Hand Basin - 32mm
- Sink - 40mm
- Dishwasher - 40mm
- WC - 110mm

Vent pipes shall be installed to ensure adequate ventilation of appliances to atmosphere and vent stacks shall extend 1,000mm above roof level to terminate.

The Soils and Waste System shall be installed in uPVC pipework to B.S. 4514 or equivalent and shall be tested to the Local Authorities Requirements.

Horizontal wastes shall be bracketed every 750mm with adequate number of expansion couplings, suitably bracketed. The minimum slope on horizontal pipework is 1:100.

Adequate access shall be provided throughout for cleaning.

All pipework 40mm and above passing through fire rated structures shall be fitted with intumescent fire collars.

All uPVC pipework and fittings shall have neoprene ‘O’ ring joints. MuPVC waste pipework and fittings shall have solvent welded joints except at expansion joints or boss connections to discharge stacks, which shall be jointed using ‘O’ rings.

Joints on socketless cast iron pipework shall be flexible mechanical type to BS EN 877 : 1999 or equivalent

Jointing to WC pans shall be made using proprietary flexible pan connectors. All jointing shall comply with the manufacturer’s instructions. Where applicable on a single stack system a collar boss may be used on the vertical stack to take bath discharge pipes.

VENTILATION:

Ventilation will be by natural ventilation means in so far as is possible. Where this is not feasible or for operational, environment, building constraints or acoustic reasons, mechanical ventilation will be provided.

Natural ventilation shall be provided via a combination of opening windows, demand control ventilation, louvres and roof lights/vent openings.

The Convent building shall be provided with natural ventilation via the existing opening windows. (It is understood that the existing windows shall be refurbished to maximise draught proofing).

Within the new extension, air shall be drawn in through openings at ground floor level i.e. window openings/louvres and discharge at high level through motorised louvres using the stack effect. Cross flow ventilation shall also be utilised where possible. Motorised louvres shall be provided to control ventilation/temperature within the spaces via BMS system.

Mechanical ventilation heat recovery systems shall be provided to the new first floor Library area to comply with TGD Part F.

Mechanical ventilation heat recovery system shall be provided to the basement book store for provide air change within the space. This room is expected to have relative humidity level ranging from 40 to 70. There is no closed control system proposed.

Mixed mode ventilation system via local mechanical ventilation systems shall be incorporated at the lower level to aid air movement within the deep plan area of the Main Library space.

Mechanical ventilation heat recovery system will be provided to the new WC block and local wc’s and tea point/kitchen areas shall be provided with local mechanical extract systems.

Smoke ventilation system shall be provided to the Atrium area (refer to Architect/Fire Consultant report).

Smoke Fire Dampers will be provided on all air ventilation ductwork where such ducts cross fire compartment lines, 30 and 60 minute compartments and individual high fire risk rooms. Fire smoke damper panel and associated wiring shall be provided.

Particular attention will be given to all ductwork systems to ensure that adequate provision is made throughout for access to facilitate periodic cleaning of the ductwork and for the maintenance and resetting of fire dampers, fire smoke dampers and volume control dampers.

Refer to Stage 2A drawings for further details on services strategy and plant location.

Ventilation shall comply with the TGD Part F, CIBSE guidelines and AM10.

Ventilation Ductwork:
Ducting must be competently installed to ensure minimum air resistance and leakage within systems. For guidance on air tightness please refer to HVCA DW/143 document ‘A Practical Guide to Ductwork Leakage Testing’. In order to minimise pressure loss, rigid duct should be used throughout.

Where flexible duct is used, lengths of flexible duct should only be used for final connections, negotiating obstacles or introducing irregular angles in the duct run. Duct installation should follow the plan as specified by the Engineer where possible. Where the direction of the duct run changes at a 90° angle, rigid components must be used. It is also appropriate to use rigid components for shallower bends (e.g. 45° bends).

Rigid ducting should be correctly supported using either purpose made clips or metal banding. Workable duct lengths should be connected together at floor level before being supported, particularly around obstructions. This ensures that the duct can be suitably sealed. Flexible ducts should be similarly supported, although extra care must be taken when using banding, as it can crush the duct and cause restrictions to airflow. Manufacturers proprietary clips are therefore recommended.

Lengths of rigid ducting should be connected using duct / straight pipe connectors or components, and sealed appropriately to ensure there is no leakage. Ducts should be sealed using tape, jubilee / speed clamps or sealant. Where sealant is used, a non-hardening variant should be mounted as there may be some slight movement in the system.

All ducts must be sealed against leakage, and special care taken for duct lengths which pass through inaccessible areas, such as ceiling voids and partition walls. It is also advisable that a silicone sealant is used rather than duct tape, as this ensures longevity.

Insulated duct (flexible or sleeves) should be used where required for the prevention of condensation on or within ductwork. This insulation must achieve a thermal conductivity of 0.04W/mK, which is characteristically equivalent to 25mm of fibre-glass insulation.

Insulated duct comes in two formats, standard and acoustic (where the internal bore is perforated). The acoustic variant should not be used outside the insulation barrier, as condensation can pass into the fibre-glass material, and reduce its effectiveness. Where insulated duct has been installed vertically, it may also be necessary to install condensation traps.

CONTROLS & BUILDING ENERGY MANAGEMENT SYSTEM:

The complete mechanical services installation will be controlled and monitored by a Building Energy Management System (BEMS). In addition, major electrical plant items shall be monitored by the BEMS, along with ESB meters, gas meter, water meter and electrical sub-meters.

The Building Management System will include the following:

- A local supervisory PC.
- A high speed modem.
- Control strategies and front-end graphics.

The electrical meters, gas meters and water meters could be connected to the BEMS for Energy monitoring.

The system will be complete with all outstations, relays, contactors and modem and include all sensors, actuators, meters and monitors to provide a fully integrated BEMS system. MCC panels will be Form 2b and will be complete with HOA switches for all plant items.

Water leaks will be monitored by means of the water meter reporting abnormal flow conditions.

All standalone items of equipment e.g., Heat pumps, DX condensers, pressurisation unit, natural gas detection panel, will have common alarm connections to the BEMS.

The BEMS will monitor each of the following:

- Mains Water Usage Consumption
- LPHW Boilers gas Consumption
- Electricity Consumption
- Distribution Board Electricity Consumption
- Main Switch Board MCCB's

PROTECTIVE SERVICES SYSTEMS:

First aid firefighting extinguishers will be provided in accordance with the requirements of Part B of the current Building Regulations Technical Guidance Documents. Electrical switch rooms will be provided with carbon dioxide and dry powder fire extinguishers. These shall be mounted within recessed boxes where possible & have appropriate signage.

Kitchens will be provided with a wall mounted 5KG dry powder extinguisher and a fire blanket.

Gas detection system will be provided in the Boiler room to isolate the gas supply in the event of a leak. This system will be interlinked with the Fire Alarm system where the gas supply will be isolated on activation of the fire alarm.

Smoke Fire dampers will close in the event of a fire alarm activation to prevent smoke traveling across fire boundaries. Fire smoke damper panel and associated wiring shall be provided.

STANDARDS AND CODES:

The following design codes, standards and guidance documents will be adhered to where applicable in the design, installation and commissioning of the Mechanical and Electrical Engineering Services including:-

- Current Building Regulations
- Safety, Health and Welfare at Work Construction Regulations
- Asbestos Regulations
- Local Authority Bye-Laws and Regulations
- Water Supply Authority Requirements
- ESB Requirement and Safety Guidelines
- ET101: ETCI National Rules for Electrical Installations
- Gas Networks Ireland Requirements and Safety Guidelines
- Fire Officers Requirements
- IS 820: Non-Domestic Gas Installations
- ETCI National Rules for Electrical Installations
- CIBSE Guidelines, Volumes A, B, C, D, E, F and K
- CIBSE Commissioning Codes Volumes A, C, R and W
- CIBSE Lighting Codes
- ASHRAE Design Guides
- Institute of Plumbing Engineering Services Design Guide
- HVCA DW/143 and DW/144
- Institute of Electrical Engineers Wiring Regulations
- IS 3217 and 3218, Emergency Lighting and Fire Alarm Standards
- BS 4371, IS EN 62305 and BS 6651, Earthing and Lightning Protection
- BS EN 14336, Heating Systems in Buildings
- HVAC Specifications for Ventilation Ductwork

PROPOSED ELECTRICAL SERVICES

ELECTRICAL SUPPLY & DISTRIBUTION:

A new ESB Meter/Client LV main distribution board will be located in the main entrance at ground floor. This client LV main distribution board shall in turn feed an internal switchroom that will be located within the existing Convent basement. When we establish the projected electrical loads, a formal application will be made to the ESB for an increase supply.

The installation shall be compliant with the 5th Edition National Rules for Electrical Installations IS-10101:2020 and the current ESB Networks requirements.

GENERATING PLANT:

There is no provision in the brief to provide a standby generator. Provision can be included if required in the new main switchboard to include a circuit breaker for the future connection of a standby generator.

CENTRAL EARTHING:

Earthing and equipotential bonding will be provided in accordance with the National Rules for Electrical Installations IS-10101:2020.

CENTRAL AND LOCAL SWITCHGEAR:

From Main Switchboard, LSF SWA PVC will serve the various LV Distribution Centres and Control Panels located throughout the building.

GENERAL & EMERGENCY LIGHTING SERVICES:

- General Lighting:
  A General & Emergency Lighting system for the entire building will be provided. The system will be designed with careful consideration for energy efficiency and day lighting. The installation will be compliant with the current CIBSE Lighting Guides, IS EN 12464, IS 3217:2013+A1:2017 and 5th Edition National Rules for Electrical Installations IS-10101:2020

- Standard Lighting:
  Standard lighting circuits and luminaires will be provided in accordance with the functionality of the various rooms and circulation spaces. In general, lighting design will be based on the recommendations of Lighting Guide LG2, as published by the CIBSE. In this context, due cognisance will be take of general recommendations, specific recommendations, and of light sources and equipment. In general LED lighting where appropriate will be employed with appropriate control systems to ensure efficient usage consistent with both occupancy and daylight availability. Good colour rendering will be provided in accordance with CIBSE standards.

- Emergency lighting:
  Standby and escape lighting circuits, emergency luminaires and exit signs will all be provided in accordance with the functionality of the various rooms and escape routes. Design standards will be in accordance with the recommendations of Irish Standard IS 3217-2013, +A1:2017 "Code of Practice for Emergency Lighting" as published by the NSAI. It is proposed to use an addressable emergency lighting control system.

- The Outdoor Environment Lighting:
  Lighting for the outdoor environment will be provided generally in accordance with the recommendations and guidelines of the CIBSE Lighting Guide LG6, "The Outdoor Environment". This will cover the illumination of, car parks, service yards, etc. Such lighting will be controlled by a combination of photocells and the BMS, as appropriate. Also included will be the provision of illuminated direction signs at appropriate locations, both internal and external to the building. Good colour rendering will be provided in accordance with CIBSE standards.

GENERAL SERVICES & SMALL POWER:

A complete General Services & Small Power installation for the entire building will be provided. All final circuits will be fed from the sub distribution boards throughout the building. This installation will be compliant with the 5th Edition National Rules for Electrical Installations IS-10101:2020

Final Distribution:

In general, final sub circuits at 230/400 Volts will comprise PVC/LSF insulated cables with stranded copper conductors enclosed in concealed metal trunking and metal conduits.

Where exposed cables are installed on cable tray / basket or are clipped directly to the slab or to walls, LSF type cabling will be used.

The routes of trunking and conduits to terminal outlets will be in ceiling voids over rooms and corridors with vertical drops concealed in plasterwork or within partitions or fitments.

COMMUNICATIONS SERVICES:

A complete Data & Telephone Services installation for the entire building will be provided. All data and communications cabling will extended from a centralised communications room to be located within the new extension basement and will be segregated from power cabling to eliminate interference. This installation will be compliant with the current ISO/IEC 11801, EN 50173-1, 5th Edition National Rules for Electrical Installations IS-10101:2020.

- Customers Premises Cabling:
  The ICT cabling installation will be designed and carried out in accordance with the requirements and recommendations of IS EN 50174, "Information Technology – Cabling Installation", Part 1 for specification and Part 2 for implementation. It is intended that a common wiring specification will be utilised for both voice and data outlets so that, by suitable patching, individual outlets may be utilised as either voice or data. In keeping with current developments and with those anticipated for the future, it is intended that a CAT 6A wiring system to EIA/TIS 568, IS 11801 and EN 50173 standards will be provided.
  It is proposed to maximise the use of the structured cabling system, to support not only Voice & LAN Services, but also to support other communications systems (e.g. public information displays), security systems, Wi-Fi and RFID technologies and a variety of Building Automation Systems.

- ICT Outlets:
  A common style of outlet (RJ45) will be deployed for all cable segments throughout the building, whether carrying Voice or Data services. These cable segments will be terminated in patch panels in ICT Cabinets in communications room and by means of patching will be available to distribute Telephone or LAN or other applications and services. The Communications Room will be located and laid-out in compliance with Standards and Good practice to achieve full coverage of the building.

  The cabinets will accommodate network switches and patch panels forming the interface between the backbone infrastructure, carrying the main ICT services, and the distribution cabling to individual outlets. The network switches shall be provided by the client separately as part of a fit-out contract.

UPS units will be provided to support the ICT equipment in the Main Communications Room. This room will have appropriate environmental conditions and can be secured by Access Control.

AUDIO AND VISUAL SYSTEMS:

Audio and visual systems (Public Information and Collaborative & Conferencing) will be provided throughout the building in accordance with the functional requirements. A complete free to air television services installation for the entire building will be provided. This system will be compatible with TV service providers such as UPC, Sky and Saorview requirements.
An induction loop system will be installed in locations as per the DAC.

FIRE DETECTION SYSTEM:

A complete fire alarm system for the entire building will be provided in the building. This installation will be compliant with the current, IS 3218:2013+A1:2019 and the 5th Edition National Rules for Electrical Installations IS-10101:2020
.

SECURITY SERVICES:

A complete Security Services system for the entire building will be provided as standalone. Access control will be required for some doors throughout the building. We will liaise with the client's technical department to fully develop the scope of work involved. This installation will be compliant with the current 5th Edition National Rules for Electrical Installations IS-10101:2020

CCTV camera locations will be agreed with the client's technical department during the detailed design.

ELECTRO-MECHANICAL INSTALLATIONS:

A complete wiring system to the Mechanical Services Installation for the building will be provided. This will cover all mechanical plant within the building and this installation will be compliant with the current Health Technical Memorandum 06-01 Part A and 5th Edition National Rules for Electrical Installations IS-10101:2020
Provision will be made to allow remote monitoring.

LIFT:

The lift must comply with the DDA regulations for disabled access and therefore must accommodate a wheelchair user with an additional person. The lift car can be no smaller than 1100mm x 1400mm with a clear 900mm entrance. The lift will be designed in accordance with EN-81 and Building Regulations.

The lifts will be machineroomless and incorporate 24 hour emergency monitoring facility.

TESTING AND CERTIFICATION:

The electrical contractor shall fully inspect, test and certify all electrical installation elements forming part of the works, as required by 5th Edition National Rules for Electrical Installations IS-10101:2020

Testing shall include both pre and post connection tests. A completion certificate and test record sheets shall be provided in respect of each completed installation in accordance with the 5th Edition National Rules for Electrical Installations IS-10101:2020

All electrical connections to ESB Networks equipment will be completed and that no connections that rely on the use of temporary connectors are left in situ.

Testing shall include the electrical commissioning of the smoke detectors and electrical supply and to the gas boilers.

All documentation relevant to the electrical installation shall be included in the Safety File to be handed over to Carlow County Council in accordance with the requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2013.

UNDERGROUND SERVICES:

Where electrical services cables are required to be laid underground they shall be accommodated in underground ducts with surface boxes provided at suitable points to facilitate future renewal and maintenance. The ducting installation shall be in accordance with the colour coding and other details specified in the Code of Practice for Avoiding Danger from Underground Services published by the Health and Safety Authority (H.S.A.). Suitable marking tape shall be laid for subsequent identification.
All underground cables shall be PVC/SWA/PVC to BS 6346 or cables with equivalent mechanical protection.

Each cable shall be identified along its route by means of suitable robust labels wrapped around its sheath. This identification shall be at all accessible points i.e. in switchrooms and at access chamber positions.

SOLAR PHOTOVOLTAICS

Photovoltaics will be installed for electricity generation. The design and sizing of a gridtied PV system is based around the following considerations:

1. Available roof space, orientation of roof and the angle of inclination
2. Possible sources of shading of the PV modules (which will reduce their electricity output)
3. Economics: Incentives, payments, initial cost of system, payback times.

STANDARDS AND CODES:

The following design codes, standards and guidance documents will be adhered to where applicable in the design, installation and commissioning of the Mechanical and Electrical Engineering Services including:-

- Current Building Regulations
- Safety, Health and Welfare at Work Construction Regulations
- Asbestos Regulations
- Local Authority Bye-Laws and Regulations
- Water Supply Authority Requirements
- ESB Requirement and Safety Guidelines
- 5th Edition National Rules for Electrical Installations IS-10101:2020
- Gas Networks Ireland Requirements and Safety Guidelines
- Fire Officers Requirements
- IS 820: Non-Domestic Gas Installations
- CIBSE Guidelines, Volumes A, B, C, D, E, F and K
- CIBSE Commissioning Codes Volumes A, C, R and W
- CIBSE Lighting Codes
- ASHRAE Design Guides
- Institute of Plumbing Engineering Services Design Guide
- HVCA DW/143 and DW/144
- Institute of Electrical Engineers Wiring Regulations
- IS 3217 and 3218, Emergency Lighting and Fire Alarm Standards
- BS 4371, IS EN 62305 and BS 6651, Earthing and Lightning Protection
- BS EN 14336, Heating Systems in Buildings
- HVCA Specifications for Ventilation Ductwork

PROJECT RISK ASSESSMENT

Project Title: Carlow Library	Project: No.: 19784	Designers: Varming Consulting Engineers	Date: Nov 2020 / Sheet No. 1
Design Stage: Stage 2A			

No.	Key hazards identified	Decisions / action / control
PROJECT RISK ASSESSMENT		
1.0	Existing below ground EIR/Gas services, diversion.	Applications to be submitted during the next design stage regarding routing and agreement of routes.
2.0	Boiler room, switch room and comms room are in the basement below ground level also book store.	Flood risk to be assessed.

APPENDIX A – GAS NETWORKS IRELAND RECORD UTILITY DRAWING

APPENDIX B – SUSTAINABILTY/OVERHEATING REPORT

Varming
Consulting Engineers Ltd.

STAGE 2A SUSTAINABILITY REPORT

PROPOSED EXTENSION
& REDEVELOPMENT
OF
CARLOW COUNTY LIBRARY

TULLOW STREET, CARLOW

Document Control

Rev	Purpose	Issued to	Issued by	Date	Notes
0	Review	Design Team	VCE	23/11/2020	Draft
1	Information	Design Team	VCE	11/12/2020	Revised building geometry

Table of Contents

PROPOSED EXTENSION & REDEVELOPMENT
CARLOW COUNTY LIBRARY

STAGE 2A SUSTAINABILITY REPORT

1. EXECUTIVE SUMMARY

1.1. This report verifies that the proposed new extension at Carlow County Library complies with Building Regulations Part L 2017 Conservation of fuel and energy - buildings other than dwellings through a holistic sustainable design philosophy approach to the construction and integration of the project, its systems and its users. This will be supported by the use of sustainable options and energy efficient systems.

1.2. The following compliance checks were carried out for the proposed new extension and confirm:-

- Overheating analysis verified in full compliance with Part L: 2017.
- Daylight analysis verified in line with BS 8206:2008.
- Indoor Air Quality analysis verified in line with CIBSE AM 10.
- Confirmation that an A3 Building Energy Rating and NZEB compliance has been achieved.

2. INTRODUCTION

2.1. The purpose of this report is to demonstrate the design for the proposed new extension at Carlow County Library complies with the Building Regulations in regards to Part L compliance and Building Energy Rating. The report also assesses Overheating and Indoor Air Quality through natural ventilation by means of openable windows.

2.2. Simulations were carried out using the IES VE-Pro 2019 suite of simulation software. This software is in accordance with CIBSE Applications Manual 11 'Building Energy & Environmental Modelling' (CIBSE AM11).

2.3. All spaces with external windows were dynamically simulated in order to identify the viability of naturally ventilation.

2.4. Each occupied space with external glazing was simulated for daylight levels and the results examined in line with the recommendations in BS 8206:2008 Lighting for buildings - Code of practice for daylighting (BS 8206:2008).

2.5. This report also assesses the BER achieved. The software used to calculate the BER was IES VE Compliance using the SBEMie v5.5.h.1 methodology.

2.6. The extension falls under the remit of the requirements set out in L4 of Part L 2017, with guidance provided in Section 2 of TGD L 2017. Part L4 applies to all works to existing buildings other than dwellings that are covered by the requirements of the Building Regulations, including extensions, material alterations, material changes of use and major renovations to a cost optimal level.

3. FINDINGS

3.1. Overheating was simulated and analysed against the criteria referenced in CIBSE Guide A and Thermal Comfort Metric CIBSE Technical Memorandum 52 (CIBSE TM52). The Library space simulated complies with the criteria.

3.2. The output from the simulations shown in Appendix 1, Table 13 demonstrates that the naturally ventilated Library space achieves flow rates above 10 litres / second / person which was confirmed utilising methods specified in CIBSE Applications Manual 10 'Natural Ventilation in Non-domestic Buildings' (CIBSE AM10). CIBSE AM10 also recommends using CO_2 concentration as an indicator of indoor air quality (IAQ), refer to Appendix 4.

3.3. The average daylight factor for all perimeter rooms meet the recommended levels stated in BS 8206:2008.

3.4. The BER shown in Appendix 3, Figure 4 demonstrates that the building achieves an A3 rating and the BRIRL document shown in Appendix 4 Figure 5 demonstrates NZEB compliance.

4. OVERHEATING

4.1. CIBSE TM52 was used to assess the risk of overheating. Building Regulations Part L 2017 Conservation of fuel and energy - buildings other than dwellings (TGD Part L: 2017) Section 1.3.6 recommends performing an overheating assessment in accordance with the 'adaptive method' described in CIBSE TM52. Described below are the design criteria detailed within the document.

4.2. The following is the overheating requirement from CIBSE TM52. The three criteria below, taken together, provide a robust yet balanced assessment of the risk of overheating of buildings in the UK and Europe.

4.3. A room or building that fails any two of the three criteria is classed as overheating.

Criterion 1: Hours of Exceedance

The first criterion sets a limit for the number of hours that the operative temperature can exceed the threshold comfort temperature (upper limit of the range of comfort temperature) by 1 K or more during the occupied hours of a typical non-heating season (1 May to 30 September).

Criterion 2: Daily weighted Exceedance

The second criterion deals with the severity of overheating within any one day, which can be as important as its frequency, the level of which is a function of both temperature rise and its duration. This criterion sets a daily limit for acceptable temperature for a room, beyond which the level of overheating is unacceptable.

Criterion 3: Upper limit temperature

The third criterion sets an absolute maximum daily temperature for a room, beyond which the level of overheating is unacceptable. To set an absolute maximum value for the indoor operative temperature the value of ΔT shall not exceed 4K.

5. INDOOR AIR QUALITY

5.1. In addition to simulating overheating in the selected spaces, the Indoor Air Quality (IAQ) was also analysed.

5.2. CIBSE AM10 recommends using CO_2 concentration as an indicator of IAQ to show that the required ventilation rate is being achieved. This is done by showing that the IAQ achieved by the natural ventilation strategy is equivalent to that provided using a constant ventilation rate of 10 litres per second per person during occupied hours.

5.3. From the dynamic simulations performed it was found that the Library space achieves a lower CO_2 level by the use of natural ventilation compared to the CO_2 level provided by a constant fresh air supply of 10 litres per second per person in compliance with CIBSE AM10.

6. OVERHEATING AND IAQ MODEL INPUT DATA

SOFTWARE & CLIMATE DATA

6.1. Overheating simulations were carried out using the ModelIT, SunCast, MacroFlo, Apache, and VistaPro modules of IES VE-Pro 2019 suite of simulation software. This software is in accordance with the guidance and recommendations of CIBSE Applications Manual AM 11: Building Energy & Environmental Modelling (CIBSE AM11).

6.2. It is noted that the CIBSE TM52 methodology recommends using an appropriate “design summer year” (DSY) that has been developed by CIBSE and the University of Exeter to account for changes in temperature and weather patterns due to climate change. The weather files available are limited to 14 locations in the UK. The Manchester weather file was used as the average Manchester temperature profile is the closest to temperatures currently experienced in Carlow.

BUILDING ENVELOPE

6.3. The following construction fabric data was used in all simulations.

Element	U-Value (W/m².K)
External Wall	0.19
Ground Floor	0.19
Pitched Roof	0.14
Flat Roof	0.18
Doors	1.45

Table 1 -Thermal Properties of Building Fabric

Glazing Description	U-Value (W/m².K)	g-value	LT-value
Glazing (Including Frame)	1.45	0.40	0.70
Rooflight	1.45	0.40	0.70

Table 2 - Glazing Properties

6.4. For the purposes of the dynamic simulations air permeability through the building fabric was assigned based on a design rate of 3.00 m³/h/m² @50Pa and assumed to be continuous.

OPENING SECTION DETAILS

6.5. All openings were modelled to open when indoor operative temperature exceeds 23ºC.

6.6. Openings were assigned to be shut 18.00 - 09:00 and assigned not to open when external temperatures are below 0ºC in order to account for the likelihood that occupants will wish to avoid cold drafts.

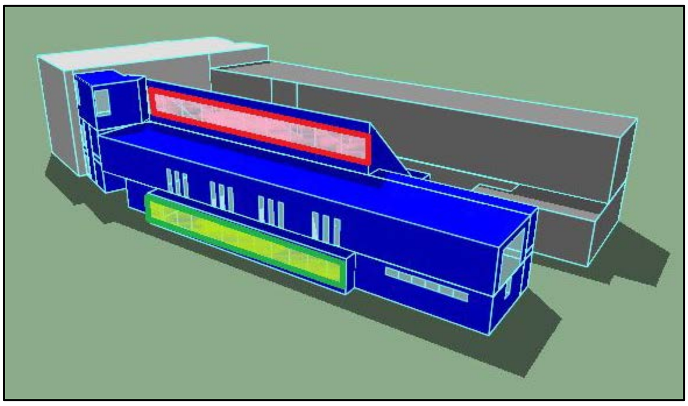


Figure 01 – Free Openable Area Applied to Glazed Section

6.7. The following opening areas were applied to the model:

- Ground Floor (Figure 01 & 02: highlighted green) - 7.90 m²
- Clerestorey (Figure 01 & 02: highlighted red) – 31.05 m²

All openings were assigned to open during occupied hours (09:00-18:00) when;
The internal air temperature within the space is >23ºC, with windows fully open when the internal temperature is >24ºC
AND
The external air temperature is >0ºC
OR
The internal CO_2 concentration exceeds 700ppm, with windows fully open when the internal CO_2 concentration exceeds 1,000ppm

Table 3 - Opening Characteristics

6.8. Consideration was given to an enhanced window regime that allows for openings to be closed where external temperature exceeds the internal temperature (for instance, during a heat wave).

HEAT GAINS

6.9. The following internal gains were applied to the simulation model.

	Occupancy				
Room Name	**Number of People**	**Sensible Load (W/person)**	**Latent Load (W/person)**	**Lighting (W/m²)**	**Equipment (W/m²)**
Library Space	160	75	55	12	20
Staff Office	5	75	55	12	10

Table 4 – Internal Gains

6.10. The occupancy in the Library Space increases to 250 people between the times of 10:00 – 12:00 and 14:00 – 16:00.

6.11. Note that all results are directly affected by the inputs and any deviation will affect the results.

7. DAYLIGHT MODEL INPUTS AND METRIC

7.1. The introduction of natural daylight provides interaction with the external environment while minimising the use of artificial lighting and hence reducing the energy consumption and CO_2 emissions of the building.

7.2. The daylight factor is a numerical measure for the subjective daylight quality in a space. It describes the ratio of outside illuminance over inside illuminance, expressed in per cent. The higher the DF, the more natural light is available in the room. It is expressed as such:

DF = 100 * e / E

Where:

e inside illuminance at a fixed point

E outside horizontal illuminance under an overcast (CIE sky) or uniform sky.

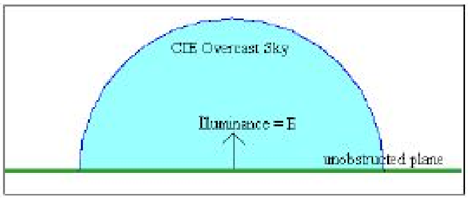
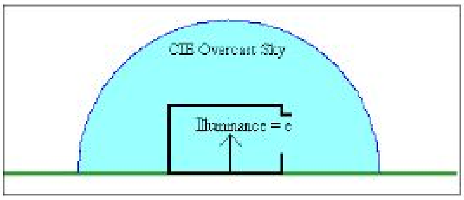
Daylight Factor Methodology	
	
E = illuminance on unobstructed plane	e = illuminance at point in interior

Figure 2: Daylight Factor

7.3. The calculation takes into account the direct and reflected, internal and external, component of daylight to determine the daylight factors within the calculated space.

7.4. The Daylight level was simulated for a task area 800mm above floor level within each room. The task area and surface properties considered were as per Tables 5 and 6.

Task Area	
Working plane height (m)	0.80
Margin (m)	0.50

Table 5 – Task Area

7.5. Quality settings - Reflections and shading from inner and outer surfaces of this room and shading from surfaces of other visible rooms. Using the full progressive radiosity inter reflection method.

Surface	Reflectance
Wall	60
Ceiling	70
Floor	20
Glazing transmittance	70%

Table 6 – Surface Properties

7.6. The daylight factor levels for the model were determined using a standard CIE overcast sky model which represents the worst case in design terms.

7.7. The following table details some practical examples of daylight factor's and what they mean:

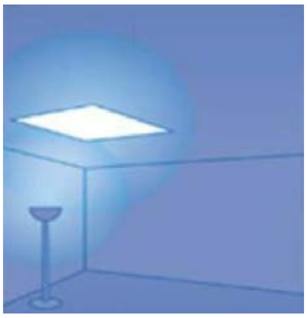
Practical Examples of Daylight Factor (DF)		
		
DF less than 2%	**DF between than 2 - 5%**	**DF greater than 5%**
Room Looks Gloomy	The optimum range of daylighting for efficient energy use	Room appears to be strongly lit by daylight
Often needs full artificial lighting during the day	Room appears to be predominantly lit by daylight	Artificial lighting rarely required during the day
Décor is dominated by the appearance of artificial lights	Artificial lighting is required away from the glazed area and on dull days	Potential solar gain is a consideration and therefore careful specification is required

Table 7 – Practical Examples of Daylight Factor

7.8. BS 8206-2:2008 Lighting for Buildings - Code of practice for daylighting; states in paragraph 5.5 "It is considered good practice to ensure that rooms in dwellings and in most other buildings have a predominantly daylit appearance. In order to achieve this the average daylight factor should be at least 2.0%."

7.9. CIBSE Guide A Section 1.9.4 Criteria for design using natural daylight states, "If the average daylight factor exceeds 5% on the horizontal plane, an interior will look cheerfully daylit, even in the absence of sunlight. If the average daylight factor is less than 2% the interior will not be perceived as well daylight and electric lighting may need to be in constant use".

8. SUSTAINABLE DESIGN APPROCH

8.1. The design team recognises the need for the project to be designed and operated in a manner that reduces the environmental impact of the building in an economic manner while maintaining an internal environment that is thermally and visually comfortable and enjoyable for occupants.

8.2. Designs prepared by the design team shall exceed statutory requirements in all aspects of sustainability and achieve the highest levels of environmental effectiveness possible within project constraints and result in the most advantageous Life Cycle Cost outcomes.

8.3. Sustainability concerns a wide range of issues including management of resources such as fuel and water, the global human impact on biodiversity, the link between economic growth and environmental degradation, security, quality of life and sustainable communities.

8.4. In the built environment the major challenge is to design buildings which meet the need of the occupants and users and provide a comfortable thermal and visual environment in an energy efficient and economically feasible manner. This approach enables us to consider all sustainable design options that are available for this project while achieving a level of sustainability beyond regulatory requirements.

8.5. The most applicable aspects are those of designing to reduce energy usage as well as minimising environmental impacts through the usage of materials and equipment which are obtained from sustainable sources or have the lowest possible in-use environmental impact.

9. BUILDING REGULATIONS REQUIREMENT & RECOMMENDATIONS

9.1. In regards to this building the Building Regulations Part L 2017 Conservation of fuel and energy - buildings other than dwellings (TGD Part L: 2017) Section 0.6.1 states:

Part L does not apply to works to an existing building (including extensions) which is a “protected structure” or a ‘proposed protected structure” within the meaning of the Planning and Development Act 2000 (No 30 of 2000).

9.2. The following is the recommended overall energy efficiency objective for this project:

- Improve the existing converted convent building fabric to a cost optimal level where technically and functionally feasible. As this is a protected structure, the type of works should be carefully assessed for their material and visual impact on the structure in order to preserve the architectural integrity of the particular building.
- Deliver a new extension which complies with NZEB requirements detailed in TGD Part L: 2017 in turn achieving a minimum A3 Building Energy Rating (BER).

10. ENERGY EFFICIENT DESIGN

10.1. The approach to Energy Efficient Design is to use the principles of integrated design to prioritise a well-designed envelope which responds to both climate and occupants needs. The extent and complexity of services required can be rationalised, thus reducing the associated energy and carbon implications along with capital and operating costs.

10.2. The methodology to deliver this project is summarised in the three step strategy below:

10.3. **First Step – Minimise Demand through Passive Measures**

Optimise the passive features of the project first to reduce the demand for active energy systems.

- Careful consideration of glazing ratios.
- Use of solar shading to minimise summertime overheating.
- Utilise useful solar gains in winter.
- Maximise the use of natural light to reduce electrical consumption.
- Optimise the building envelope through high levels of insulation and airtightness.
- Eliminate thermal bridging through careful detailing.

10.4. **Second Step – Reduce Consumption**

After optimising the passive design elements, it is important that all active mechanical and electrical systems meet the remaining energy demand. The systems must be robust and efficient to minimise maintenance costs as far as is practical while still delivering the require services to the building.

- Efficient heating, ventilation and hot water systems.
- Efficient lighting and controls.
- Efficient distribution of services.
- Use energy management system.
- Comprehensive commissioning of all systems.

10.5. **Third Step – Use low-carbon fuel sources.**

In order to meet NZEB requirements and achieve a minimum A3 rating on the new extension it is proposed to develop a design incorporating a renewable technology appropriate to the building type. Section 4 of this report details the possible renewable options.

PROJECT DESIGN OVERVIEW:

- High quality fabric envelope with enhanced insulation standards, achieving low U-values
- High specification glazing with solar shading where required and very good light transfer qualities
- Excellent air tightness.
- LED lighting throughout with 'Dali' lighting control systems allowing full automatic control.
- High efficiency renewable technology system.
- Low flow water appliances for conservation of water usage.
- Power metering of areas and systems.
- Variable speed motor drives.
- Low energy fan motors.

11. RENEWABLE TECHNOLOGIES

11.1. As part of the enhanced sustainability of this building, and the requirement to achieve NZEB compliance in the proposed new library extension the following renewable, low and zero carbon technologies were considered:

- Biomass
- Ground Source Heat Pumps
- Solar Thermal
- Wind Turbines
- High Efficiency Combined Heat and Power (HE CHP)
- Air Source Heat Pumps
- Photovoltaic Cells (PV)

11.2. Technologies were reviewed with respect to capital cost, performance, maintainability, reliability and running costs within the project constraints.

11.3. **Biomass**

4.3.1 Biomass could be used to provide heating and hot water to the building. The system requires boiler plant and fuel storage. Regular deliveries are required.

4.3.2 Advantages:

- Classed as a carbon neutral energy source, thus technically reducing carbon emissions significantly.
- No increase in noise over and above a traditional boiler.
- Eligible for operational aid under the "Support Scheme for Renewable Heat".

4.3.3 Disadvantages:

- Requires a large foot print in terms of storage and plant provision.
- The building will rely on regular delivery of fuel meaning reliance on reliable service, increasing on site traffic, noise and added on-going expenditure plus handling equipment to convey fuel from the main delivery point to the Boiler.
- On site emissions.

4.3.4 Financially Viable: > 20 years

4.3.5 Decision - not recommended due to running costs, increased handling, site traffic and space provision.

11.4. **Ground Source Heat Pumps**

4.4.1 Ground Source heat pumps could be used to provide heating and hot water to the building. The installation could either utilise bore holes or “slinky’s” buried in trenches.

4.4.2 Advantages:

- Offer significantly higher COP’s than standard heat pumps.
- No fuel storage requirements.
- No combustion involved and no emission of potentially dangerous gases, No flues are required.
- No noise constraints.
- Eligible for grant under the “Support Scheme for Renewable Heat”.

4.4.3 Disadvantages:

- Expensive to install therefore requiring long pay back periods especially as its primary use will be heating only, and therefore will not benefit from savings in the summer periods.
- Ground investigation required in order to get a thorough understanding of the local geology.

4.4.4 Financially Viable: 20 years

4.4.5 Decision - not recommended due to site restrictions and high capital cost of install.

11.5. **Solar Thermal**

4.5.1 Solar thermal could be installed to provide hot water to the building. The installation would require a centrally located hot water plant, primarily heated utilising a boiler plant.

4.5.2 Advantages:

- Can provide significant CO_2 savings in buildings with high hot water usage.
- No combustion involved and no emission of potentially dangerous gases.
- No noise constraints.

4.5.3 Disadvantages:

- Solar thermal energy cannot be generated with the consistency of most fossil fuels. The system does not function effectively on cloudy, rainy, or foggy days
- Requires plant space for hot water storage.
- Generally requires more maintenance than PV systems.
- Compared to photovoltaic panels, solar thermal panels only heat water.
- Planning required.

4.5.4 Financially Viable: 15 - 20 years

4.5.5 Decision - not recommended due to the low hot water consumption for this building type.

11.6. **Wind Turbines**

4.6.1 A noticeable number of wind turbines would be required to have a significant impact on the Buildings carbon emissions.

4.6.2 Advantages:

- Requires minimal floor space within the building.
- No combustion involved and no emission of potentially dangerous gases.

4.6.3 Disadvantages:

- Noise issues and visual impact / light flicker in a residential area.
- Relative small carbon benefit.
- Planning required.

4.6.4 Financially Viable: 15 - 20 years

4.6.5 Decision - not recommended due to the cost of the system, Noise and light flicker impact to the local environment and having a poor output compared to the other renewable electrical generating systems such as PV (€/kW output)

11.7. **High Efficiency Combined Heat and Power (HE CHP)**

4.7.1 HE CHP could be used to provide heating, hot water and produce electrical energy to the building. The system requires boiler plant space.

4.7.2 Advantages:

- HE CHP is an integrated system that harnesses wasted energy in traditional power generation.
- Reduced energy costs.
- CHP requires less fuel to produce a given energy output and avoids transmission and distribution losses that occur when electricity travels over power lines.
- Eligible for operational aid under the "Support Scheme for Renewable Heat".

4.7.3 Disadvantages:

- Requires a large foot print in terms plant provision.
- A CHP is not seen as a "true" sustainable energy source (being predominately fuelled by natural gas) unless it can be used with renewable fuels such as Biogas.
- Noise pollution a risk.
- Heat generated in summer may go to waste.
- On site emissions.

4.7.4 Financially Viable: 15 - 20 years

4.7.5 Decision - not recommended due to plant requirements and noise levels.

11.8. **Air Source Heat Pumps**

4.8.1 Air Source heat pumps could be used to provide heating and hot water to the building. The installation could requires space for indoor and external units, as the heat pump absorbs heat from outside air and uses this heat within the building.

4.8.2 Advantages:

- Heat pumps require less maintenance than the combustion heating systems.
- No fuel storage requirements.

- No combustion involved and no emission of potentially dangerous gases, No flues are required
- Cheaper to run than oil and gas boilers.
- Eligible for grant under the “Support Scheme for Renewable Heat”.

4.8.3 Disadvantages:

- Heat pump systems have a high start-up cost.
- Less efficient in winter due to low Coefficient of Performance (COP) levels.

4.8.4 Financially Viable: < 15 years

4.8.5 Decision – recommended as this option is a good fit for the project, as all of the buildings heating and hot water demand can be served by the system while generating enough renewable contribution to achieve an A3 BER.

11.9. **Photovoltaic Cells (PV)**

4.9.1 PV could be considered to be installed on the roof and provide a certain percentage of the buildings electricity demand.

4.9.2 Advantages:

- PV panels provide clean energy.
- Relatively simple to install on new and existing buildings.
- Requires minimal floor space within the building, and does not have an impact on the actual usable internal floor space.
- Relatively cheap compared to other renewable sources.
- No noise constraints.
- Easy to add to the system at any time during the construction phase.
- The system size can be increased at any time in the future subject to site constraints.

4.9.3 Disadvantages:

- Can require large area externally (Roof).
- Access to PV panels may prove difficult.
- Though PV panels have no considerable maintenance or operating costs, they are fragile and can be damaged relatively easily.

- Planning required.

4.9.4 Financially Viable: < 10 years

4.9.5 Decision - recommended as the system can be installed at any time during the construction phase and the payback period is relatively good compared to other renewable technologies.

12. PRELIMINERY SBEM ANALYSIS

12.1. The purpose of this analysis is to evaluate the existing Carlow County Library building in terms of a BER assessment and also demonstrate the proposed design for the extension, complies with TGD Part L: 2017 and achieves NZEB compliance.

1.1. The following assessment were carried out:

- Existing Building (base) – This rating gives a baseline and shows the building energy rating of the existing build as it stands – **C1** rating.
- Proposed New Extension – This demonstrates the proposed design achieves an **A3** rating and full NZEB compliance.

12.2. The software used to calculate the BER was IES VE Compliance using the SBEMie V5.5.h.1 methodology.

12.3. SBEMie is the official Irish methodology for calculating the energy performance and associated carbon dioxide emissions for the provision of space heating, ventilation, water heating and lighting in buildings other than dwellings. The SBEMie software tool is a key component of the Irish Building Energy Rating (BER) scheme.

Passive Overview:

12.4. In order to minimise the heating load of the new extension and provide improved comfort for the occupants the following construction fabric data is proposed:

Element	U-Value (W/m².K)
Walls	0.19
Floor	0.19
Pitched Roof	0.14
Flat Roof	0.18
Door	1.45

Table 8 -Thermal Properties of Building Fabric (Proposed New Extension)

Glazing Description	U-Value (W/m².K)	g-value	LT-value
External Glazing (Including Frame)	1.45	0.40	0.70
Rooflights	1.45	0.40	0.70

Table 9 - Glazing Properties

12.5. An air tight building envelope has two main advantages; it reduces infiltration of external cold air which increases the heating demand and related energy consumption. It also prevents the exfiltration of warm humid air into the building fabric which can lead to moisture build-up. Careful planning and coordination is required to ensure an airtight envelope is achieved. It is critical therefore to ensure the following;

- The continuous airtight envelope is clearly indicated on drawings.
- All mechanical and electrical services are carefully coordinated to minimise service penetrations though the envelope.
- All services and equipment are to be neatly installed and clearly marked.
- Clearly communicate this to the services contractors through drawings and 3D models.
- Ensure that any unavoidable penetrations are correctly sealed using approved tapes and gaskets.

12.6. It is proposed to achieve building air permeability of 3.00m3/h/m2 at 50Pa or better. This also exceeds the requirement of TGD L 2017.

12.7. Thermal bridging Psi values were taken from Table 6, Section 3.4.3 of the SBEMie Technical Manual v5.5.h.

Active Systems Overview

12.8. Heating and hot water circuits served by air source heat pump systems. The heat pump systems meet the eco-design Regulation 813/2013 implementing Directive 2009/125/EC with regards to eco-design requirements for space heaters and combination heaters. System controls as per Section 1.4.2 of TGD Part L: 2017.

12.9. The building will be predominantly naturally ventilated by means of openable windows. This will ensure a thermally comfortable environment with good indoor air quality. It is proposed that the first floor library area will be ventilated by a mechanical ventilation heat recovery unit.

12.10. General extract ventilation provided from toilet areas. The relevant Specific Fan Power (SFP) values listed in Section 1.4.3.7 of TGD Part L 2017 improved by 20%.

Mechanical Ventilation Heat Recovery Unit	
SFP (W/(l/s))	1.90
Heat Recovery	Plate heat exchanger
Heat Recovery Seasonal Efficiency	0.75

Table 10 – First Floor Library Space Mechanical Ventilation Details

12.11. Photovoltaic array details:

Proposed PV Array Details	
Number of Panels	8
Watts per Panel	370
Orientation	East
Inclination (°)	15
Peak Power (kW)	3.00

Table 11 – PV Array Details

12.12. LED lighting is proposed throughout the building, this provides energy efficiency, reduced electrical costs, and also a long life so that replacement and maintenance costs are minimised.

12.13. Occupancy Detectors (e.g. Passive Infrared (PIR)) – Activates lighting when presence is detected to prevent lights being left on wasting energy. Normally utilised in low traffic areas such as toilets and Stores, in addition areas such as corridors, plant spaces, circulation areas and public toilets. The system will incorporate a time delay to prevent premature switching whilst the rooms are still occupied.

12.14. Daylight Optimisation – Daylight optimisation utilised in perimeter areas to reduce the lighting load by dimming or switching off luminaires when not required due to adequate daylight illumination levels. Day light optimisation is achieved through the separate switching of lights adjacent to daylight sources.

APPENDIX 1: OVERHEATING AND IAQ RESULTS

OVERHEATING RESULTS:

Room Name	Criteria 1	Criteria 2	Criteria 3	Criteria Failing	Comment
	%Hrs Top-Tmax>=1K	Max. Daily Deg.Hrs	Max. DeltaT		
Library Space	2	11	2	2	Pass
Staff Office	1	7	2	2	Pass

Table 12 – Adaptive Comfort Results

While the overheating analysis passes the required criteria a maximum temperature of 31.25ºC is experienced at the back of the space. This is expected as this is a deep plan space. There will be times when the back of the space experiences low levels of air movement when compared to the front of the space where the openings are located.

INDOOR AIR QUALITY RESULTS:

	Carbon Concentration (ppm)		
Room Name	Constant 10 l/s/p	Openable Windows	Comment
Library Space	898	711	Pass
Staff Office	877	868	Pass

Table 13 – Indoor Air Quality Results

1.1. Similar to the overheating simulation the results from the IAQ analysis show the CO_2 levels are below the recommended level when simulated in line with CIBSE AM 10. Simulations indicate good CO_2 concentration levels and mean air age, although the levels increase to the back of the library space.

RECOMMENDATIONS:

It is recommended that mechanical extract ventilation is installed to extract at the back of the Library space on the ground floor level. This will improve air movement within the space and remove the possibility of warm stale air build up. It is also recommended that the system is sized for the worst case/maximum occupancy.

APPENDIX 2: DAYLIGHT RESULTS

The daylight factor results in the following tables confirm all simulated spaces meet the recommendations set out in BS 8206: Part 2: 2008 Code of Practice for daylight as referenced in Technical Guidance Document L (2017) of the Building Regulations "Conservation of Fuel and Energy – Other Than Dwellings".

Space Name	Daylight Factor (%)
Staff Office	2.40
Ground Floor Library Space	7.10
First Floor Library Space	3.50

Table 14 – Option 02 Daylight Factor Results

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APPENDIX 3: PRELIMINARY BER CERTIFICATES

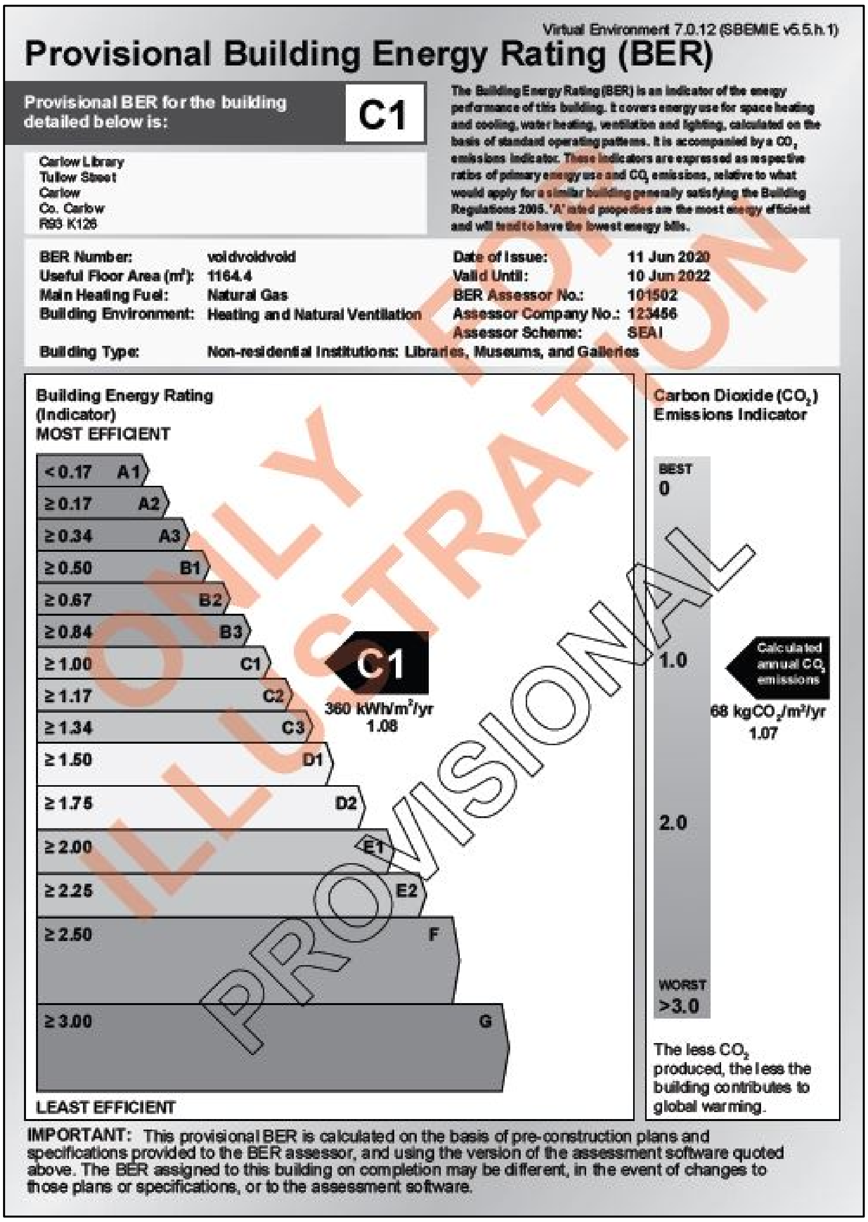
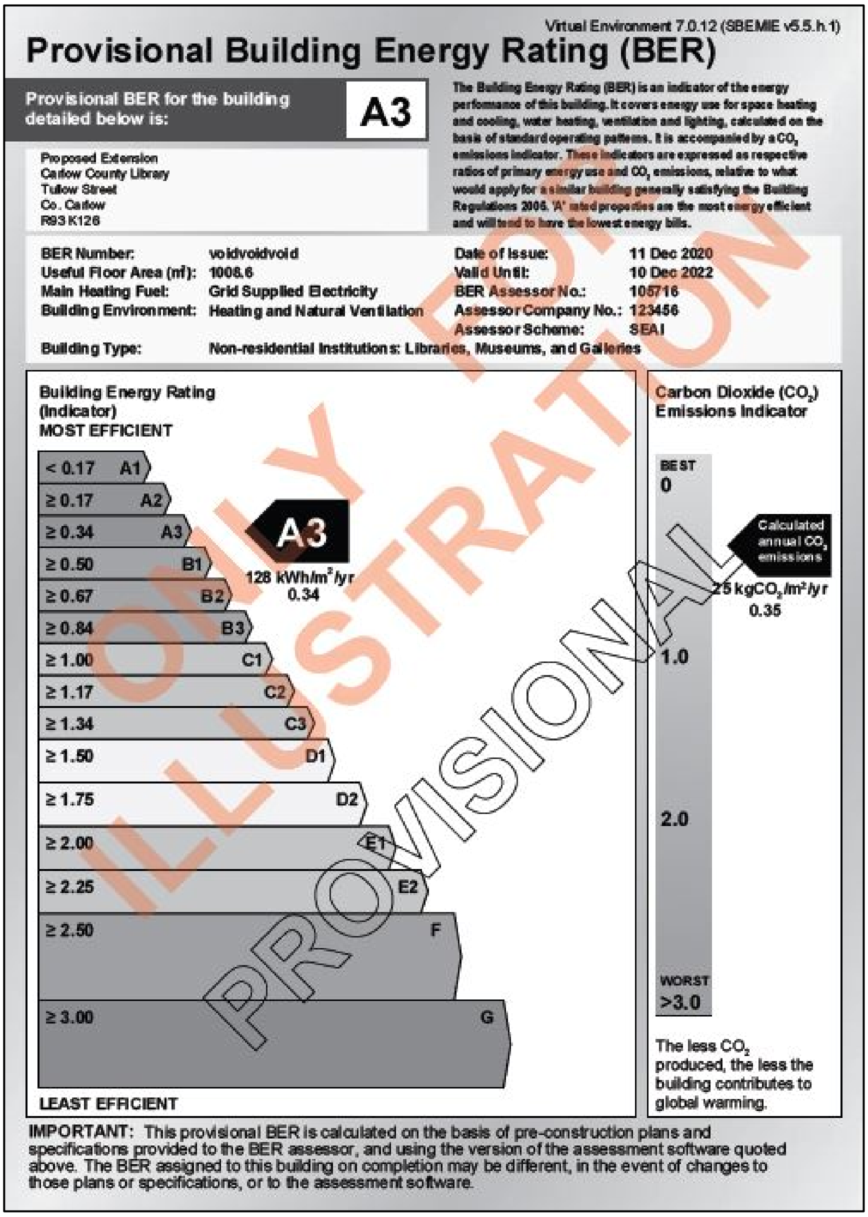


Figure 3 – Base BER Certificate


Virtual Environment 7.0.12 (SBEMIE v5.5.h.1)

Provisional Building Energy Rating (BER)

Provisional BER for the building detailed below is: **A3**

The Building Energy Rating (BER) is an indicator of the energy performance of this building. It covers energy use for space heating and cooling, water heating, ventilation and lighting, calculated on the basis of standard operating patterns. It is accompanied by a CO_2 emissions indicator. These indicators are expressed as respective ratios of primary energy use and CO_2 emissions, relative to what would apply for a similar building generally satisfying the Building Regulations 2005. 'A' rated properties are the most energy efficient and will tend to have the lowest energy bills.

Proposed Extension
Carlow County Library
Tullow Street
Co. Carlow
R93 K126

BER Number:	voidvoidvoid	Date of Issue:	11 Dec 2020
Useful Floor Area (m²):	1008.6	Valid Until:	10 Dec 2022
Main Heating Fuel:	Grid Supplied Electricity	BER Assessor No.:	105716
Building Environment:	Heating and Natural Ventilation	Assessor Company No.:	123456
		Assessor Scheme:	SEAI
Building Type:	Non-residential Institutions: Libraries, Museums, and Galleries		

IMPORTANT: This provisional BER is calculated on the basis of pre-construction plans and specifications provided to the BER assessor, and using the version of the assessment software quoted above. The BER assigned to this building on completion may be different, in the event of changes to those plans or specifications, or to the assessment software.

Figure 4 – Stage 2a Preliminary BER Certificate

APPENDIX 4: PRELIMINARY BRIRL RESULTS

Varming Consulting Engineers Ltd.

BRIRL Output Document

Compliance Assessment with the Building Regulations (Ireland) TGD-Part L 2017

This report demonstrates compliance with specific aspects of Part L of the Building Regulations. Compliance with all aspects of Part L is a legal requirement. Demonstration of how compliance with every aspect is achieved may be sought from the Building Control Authority.

Library Extension

Date: Mon Nov 23 14:29:53 2020

Administrative information

Building Details

Address: Proposed Extension, Carlow County Library, Tullow Street, Carlow, Co. Carlow, R93 K126

NEAP

Calculation engine: SBEMIE

Calculation engine version: v5.5.h.1

Interface to calculation engine: Virtual Environment

Interface to calculation engine version: 7.0.12

BRIRL compliance check version: v5.5.h.0

Client Details

Name: Name

Telephone number: Phone

Address: Street Address, Co. Carlow, Eircode

Energy Assessor Details

Name: Name

Telephone number: Phone

Email: you@yourISP

Address: Street Address, Co. Carlow, Eircode

Primary Energy Consumption, CO2 Emissions, and Renewable Energy Ratio

The compliance criteria in the TGD-L have been met.

Calculated CO2 emission rate from Reference building	24.7 kgCO2/m2.annum
Calculated CO2 emission rate from Actual building	25.6 kgCO2/m2.annum
Carbon Performance Coefficient (CPC)	**1.04**
Maximum Permitted Carbon Performance Coefficient (MPCPC)	**1.15**
Calculated primary energy consumption rate from Reference building	130.2 kWh/m2.annum
Calculated primary energy consumption rate from Actual building	130.3 kWh/m2.annum
Energy Performance Coefficient (EPC)	**1**
Maximum Permitted Energy Performance Coefficient (MPEPC)	**1**
Renewable Energy Ratio (RER)	**0.23**
Minimum Renewable Energy Ratio	**0.2**

Heat Transmission through Building Fabric

Element	$U_{a-Limit}$	U_{a-Calc}	$U_{i-Limit}$	U_{i-Calc}	Surface with maximum U-value*
Walls**	0.21	0.17	0.6	0.6	0000000_W6_A1
Floors (ground and exposed)	0.21	0.15	0.6	0.15	00000019_F
Pitched roofs	0.16	0.15	0.3	0.15	0000001D_C
Flat roofs	0.2	0.15	0.3	0.15	0000001D_C
Windows, roof windows, and rooflights	1.6	1.22	3	1.4	0000001D_W1_O0
Personnel doors	1.6	-	3	-	"No ext. personnel doors"
Vehicle access & similar large doors	1.5	-	3	-	"No ext. vehicle access doors"
High usage entrance doors	3	-	3	-	"No ext. high usage entrance doors"

$U_{a-Limit}$ = Limiting area-weighted average U-values [W/(m2K)]
U_{a-Calc} = Calculated area-weighted average U-values [W/(m2K)]
$U_{i-Limit}$ = Limiting individual element U-values [W/(m2K)]
U_{i-Calc} = Calculated individual element U-values [W/(m2K)]

* There might be more than one surface with the maximum U-value. ** Automatic U-value check by the tool does not apply to curtain walls whose area-weighted average and individual limiting standards are 1.8 and 3 W/m2K, respectively.

Air Permeability	Upper Limit	This Building's Value
m3/(h.m2) at 50 Pa	5	3

Figure 5 – Stage 2a BRIRL Document

APPENDIX C – STAGE 2A MECHANICAL & ELECTRICAL SERVICES DRAWINGS

Varming Consulting Engineers
No. 3 Eastgate Road, Eastgate Business Park
Little Island, Co. Cork
021 237 5080 info@varming.ie
www.varming.ie

Project Number	Project Title	Discipline	Document Register
19784	Carlow Library	Mechanical & Electrical	Drawings are to be read in conjunction with services specifications and Architectural, Civil / Structural, Engineering and other relevant drawings.

ISSUE DATE: 29-JULY-2020 | 30-NOV-2020 | 07-DEC-2020

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Distribution To:	Organisation:	29-JULY-2020	30-NOV-2020	07-DEC-2020									
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Structural Engineer:	Punch Consulting	E		E									
Quantity Surveyor:	DWP	E		E									
Client:	Carlow County Council												
Main Contractor:	To be appointed												
Mechanical Sub-Contractor:	To be appointed												
Electrical Sub-Contractor:	To be appointed												

Status and Revision (e.g. S0 : P0.01)

Document:	Drawing Title:	Scale:	Size:	29-JULY-2020	30-NOV-2020	07-DEC-2020									
PLAN DRAWINGS:															
19784-VCE-ZZ-ZZ-DR-ME-001	Mechanical & Electrical site services	1:100	A0	S2 : P01		S2 : P02									
19784-VCE-ZZ-00-DR-ME-1000	Mechanical & Electrical services strategy Basement	1:100	A1		S1 : P01	S1 : P02									
19784-VCE-ZZ-00-DR-ME-1001	Mechanical & Electrical services strategy Ground Floor	1:100	A1		S1 : P01	S1 : P02									
19784-VCE-ZZ-00-DR-ME-1002	Mechanical & Electrical services strategy First Floor	1:100	A1		S1 : P01	S1 : P02									
19784-VCE-ZZ-00-DR-ME-1003	Mechanical & Electrical services strategy Second Floor	1:100	A1		S1 : P01	S1 : P02									
19784-VCE-ZZ-00-DR-ME-1004	Mechanical & Electrical services strategy Roof Void	1:100	A1		S1 : P01	S1 : P02									
DOCUMENTS:															
Stage 1 M&E report				P01											
Stage 2 M&E report						P01									

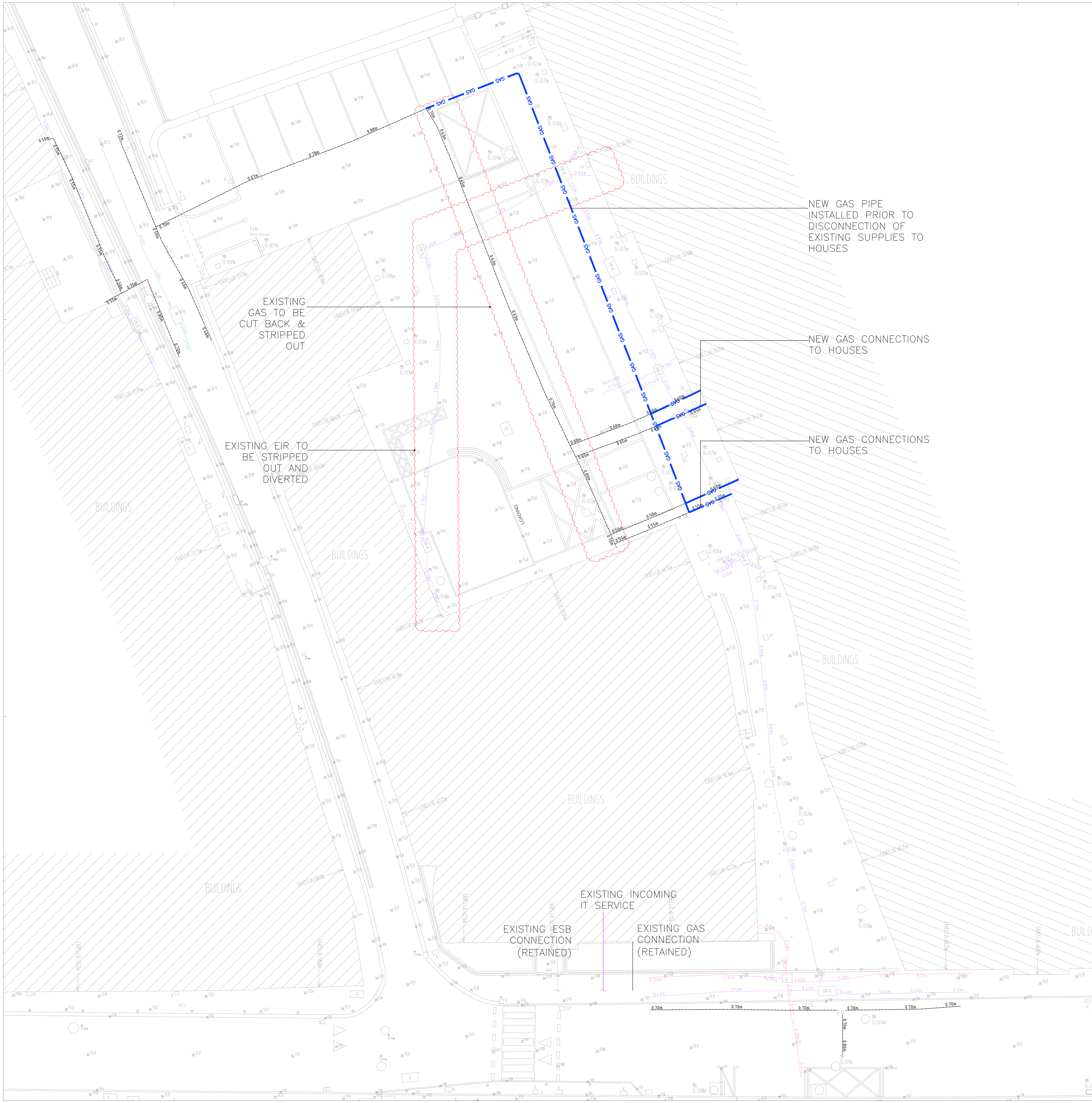
Status Codes

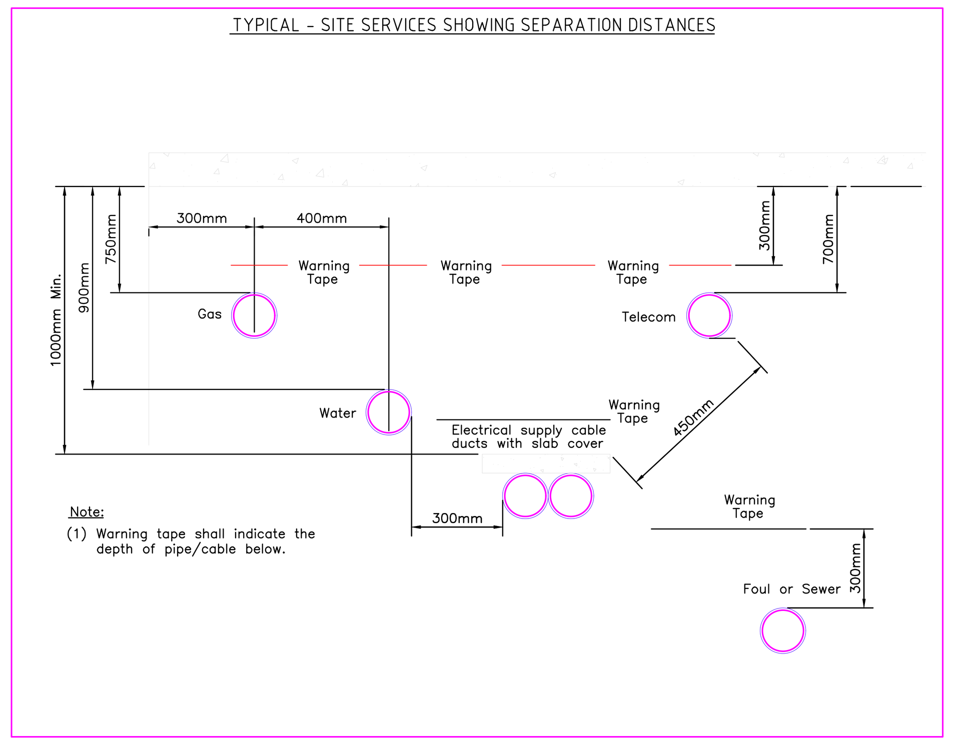
Work in Progress: **S0**-WIP

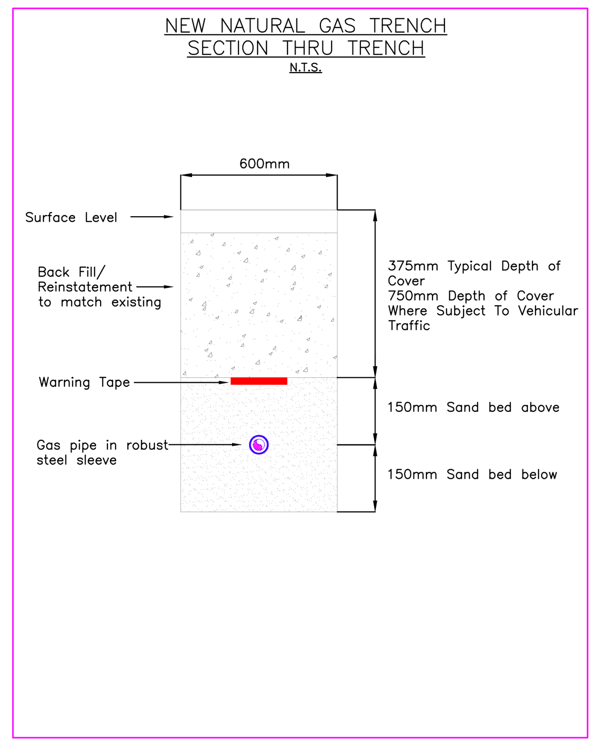
Shared: **S1**-Suitable for Coordination; **S2**-Suitable for Information; **S3**-Suitable for Review & Comment; **S4**-Suitable Stage Approval; **S6**-Suitable for PIM Authorisation; **S7**-Suitable for AIM Authorisation

WIP to Published: **D1**-Suitable for Costing; **D2**-Suitable for Tender; **D3**-Suitable for Contractor Design; **D4**-Suitable for Manufacture / Procurement

Published Documentation: **A1, A2, A3, An** etc. - Approved and accepted as stage complete; **B1, B2, B3, Bn** etc. - Practically signed off with minor comments; **CR**-As Constructed Record Documentation







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LEGEND:

EXISTING SERVICES

- Eir — EIRCOM
- CATV — CABLE TELEVISION
- CCTV — CLOSE CIRCUIT TELEVISION
- CO — COMMUNICATION
- CA — COMPRESSED AIR
- FO — FIBRE OPTICS
- Gas — GAS
- HV — HV ELECTRICITY CABLE
- LV — LV ELECTRICITY CABLE
- 275kV — 275KV
- 132kV — 132KV
- 66kV — 66KV
- 33kV — 33KV
- 11kV — 11KV

NEW SERVICES

- GAS — NEW GAS PIPE LINE
- ESB — NEW RED ESB UNDERGROUND PVC DUCTING
- EIR — NEW EIRCOM UNDERGROUND PVC DUCTING
- NEW EIR JB4 MANHOLE
- NEW GAS METER

Rev	Status	Date	Description	D.E.
P02	S2	DEC'20	STAGE 2A ISSUE	J.R.
P01	S2	JUL'20	STAGE 1	J.R.

Revision: P01

Project Drawing Reference: 19784-VCE-ZZ-ZZ-DR-ME-001

Status: S2

Varming Project Number: 19784

Date	Checked By	Drawn By	Scale
JULY 2020	J.R.	M.D.	1:100@A0

Client: CARLOW COUNTY COUNCIL

Project Title: CARLOW COUNTY LIBRARY

Drawing Title: MECHANICAL & ELECTRICAL SITE SERVICES

Varming Consulting Engineers Ltd.

Dublin 01 4872300
Cork 021 2375080
Roscommon 090 6602380
Website www.varming.ie

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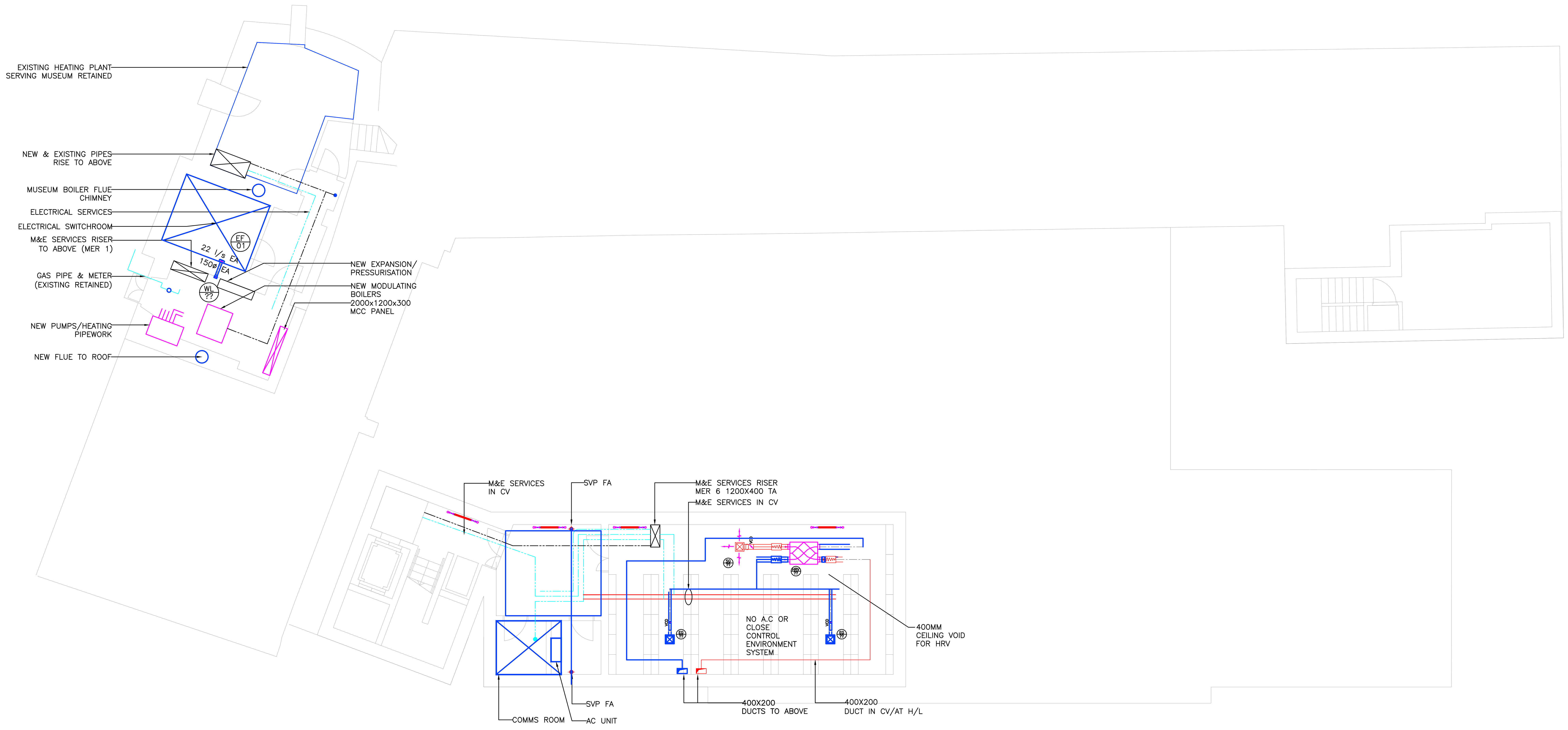
Titleblock Revision: 2020_2



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MAIN PIPEWORK ROUTING

ELECTRICAL WIRING ROUTING

M&E RISER (MER)

RADIATOR

Rev	Status	Date	Description	D.E.
P02	S1	DEC'20	STAGE 2A ISSUE	J.R.
P01	S1	NOV'20	STAGE 2A DRAFT	J.R.

Revision	Project Drawing Reference
P01	19784-VCE-ZZ-ZZ-DR-ME-1000
Status	**Varming Project Number**
S1	19784

Date	Checked By	Drawn By	Scale
NOV'20	J.R.	N.B.	1:100

Client
CARLOW COUNTY COUNCIL

Project Title
CARLOW LIBRARY

Drawing Title
MECHANICAL & ELECTRICAL SERVICES STRATEGY BASEMENT

Varming Consulting Engineers Ltd.

Dublin 01 4872300
Cork 021 2375080
Roscommon 090 6602380
Website www.varming.ie

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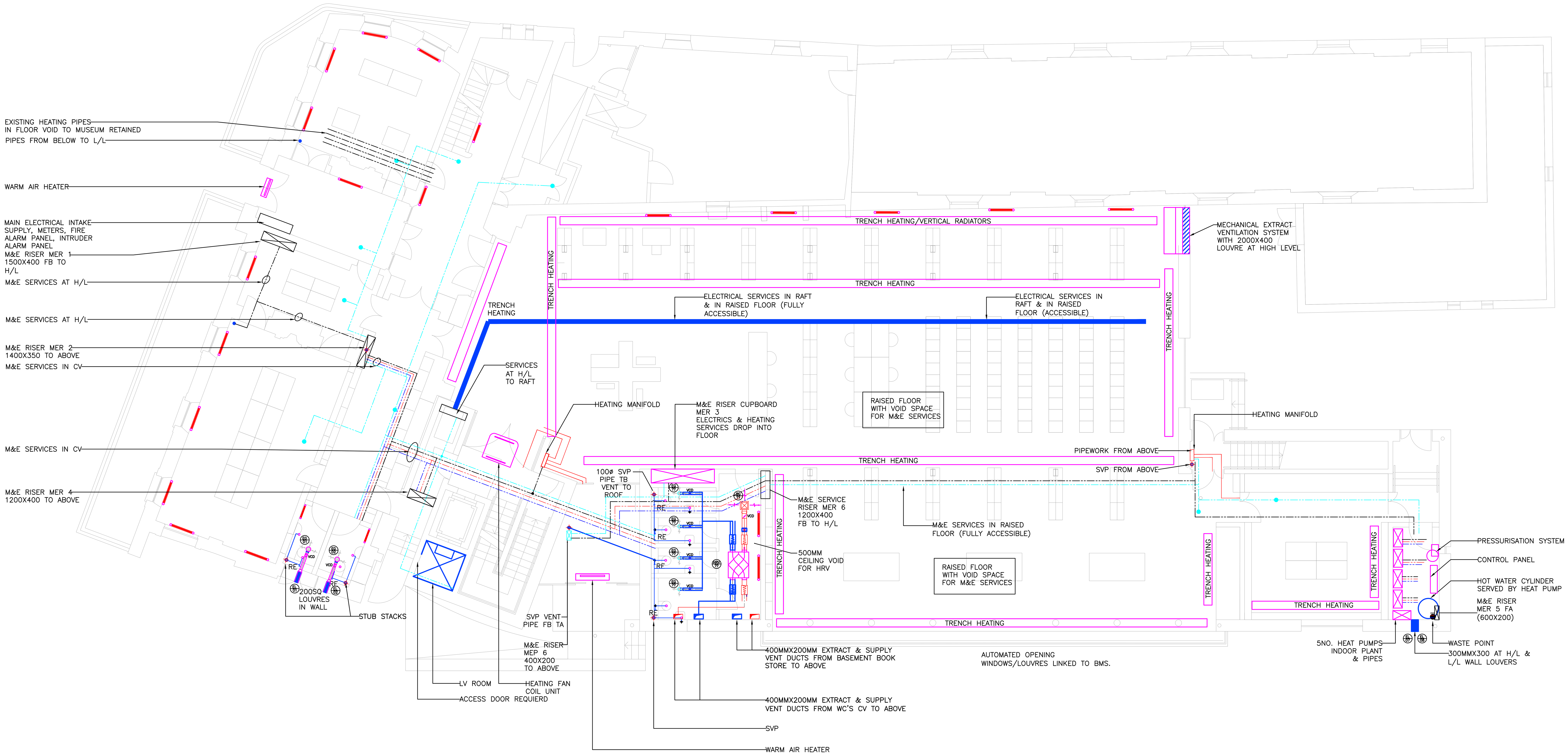

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MAIN PIPEWORK ROUTING
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M&E RISER (MER)
RADIATOR
FAN COIL UNIT
EXTRACT GRILL
WARM AIR HEATER

Rev	Status	Date	Description	D.E.
P02	S1	DEC'20	STAGE 2A ISSUE	J.R.
P01	S1	NOV'20	STAGE 2A DRAFT	J.R.

Revision: P01
Project Drawing Reference: 19784-VCE-ZZ-ZZ-DR-ME-1001
Status: S1
Varming Project Number: 19784

Date	Checked By	Drawn By	Scale
NOV'20	J.R.	N.B.	1:100

Client: CARLOW COUNTY COUNCIL

Project Title: CARLOW LIBRARY

Drawing Title: MECHANICAL & ELECTRICAL SERVICES STRATEGY GROUND FLOOR

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MAIN PIPEWORK ROUTING

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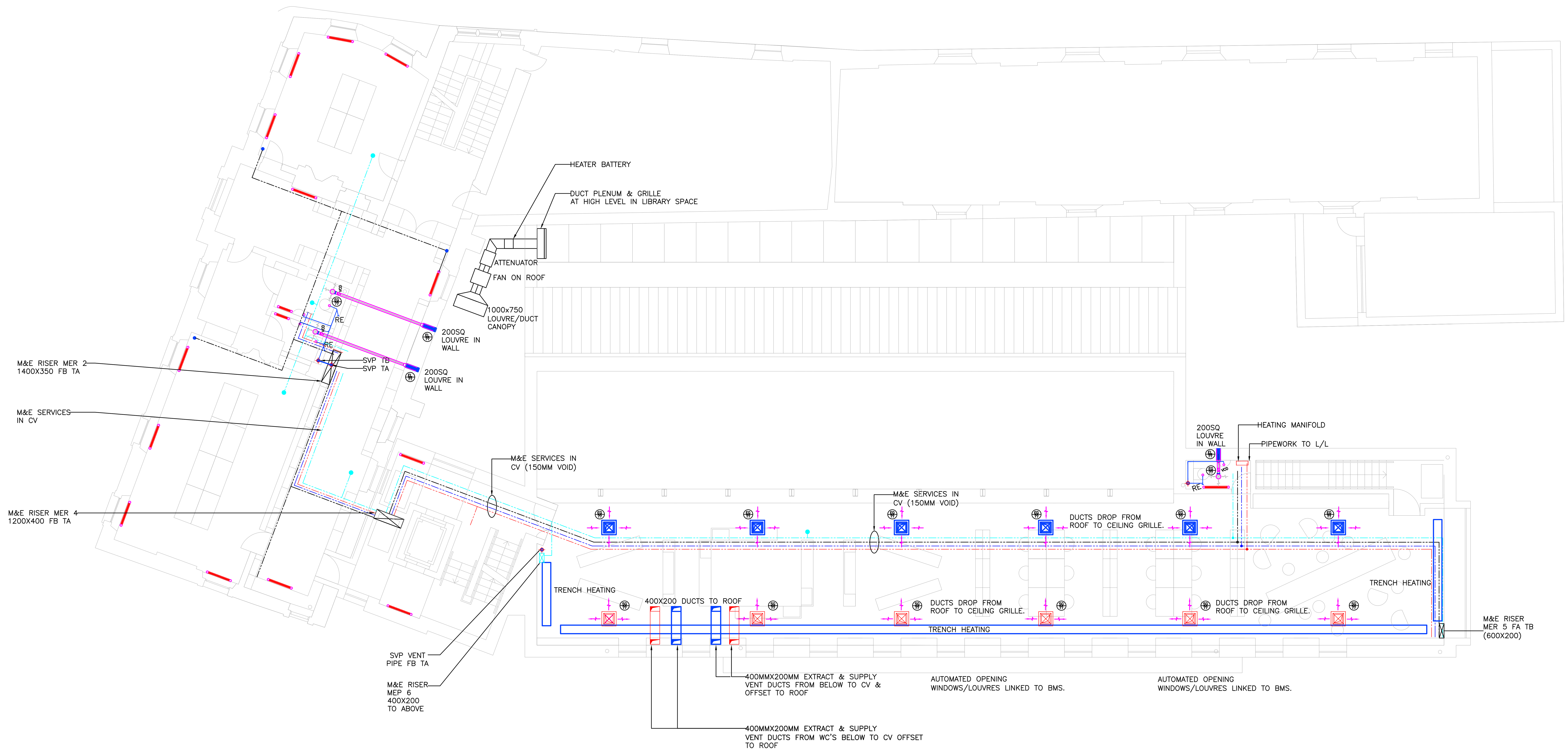

Rev	Status	Date	Description	D.E.
P02	S1	DEC'20	STAGE 2A ISSUE	J.R.
P01	S1	NOV'20	STAGE 2A DRAFT	J.R.

Revision: P01

Project Drawing Reference: 19784-VCE-ZZ-ZZ-DR-ME-1002

Status: S1

Varming Project Number: 19784

Date	Checked By	Drawn By	Scale
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Client: CARLOW COUNTY COUNCIL

Project Title: CARLOW LIBRARY

Drawing Title:

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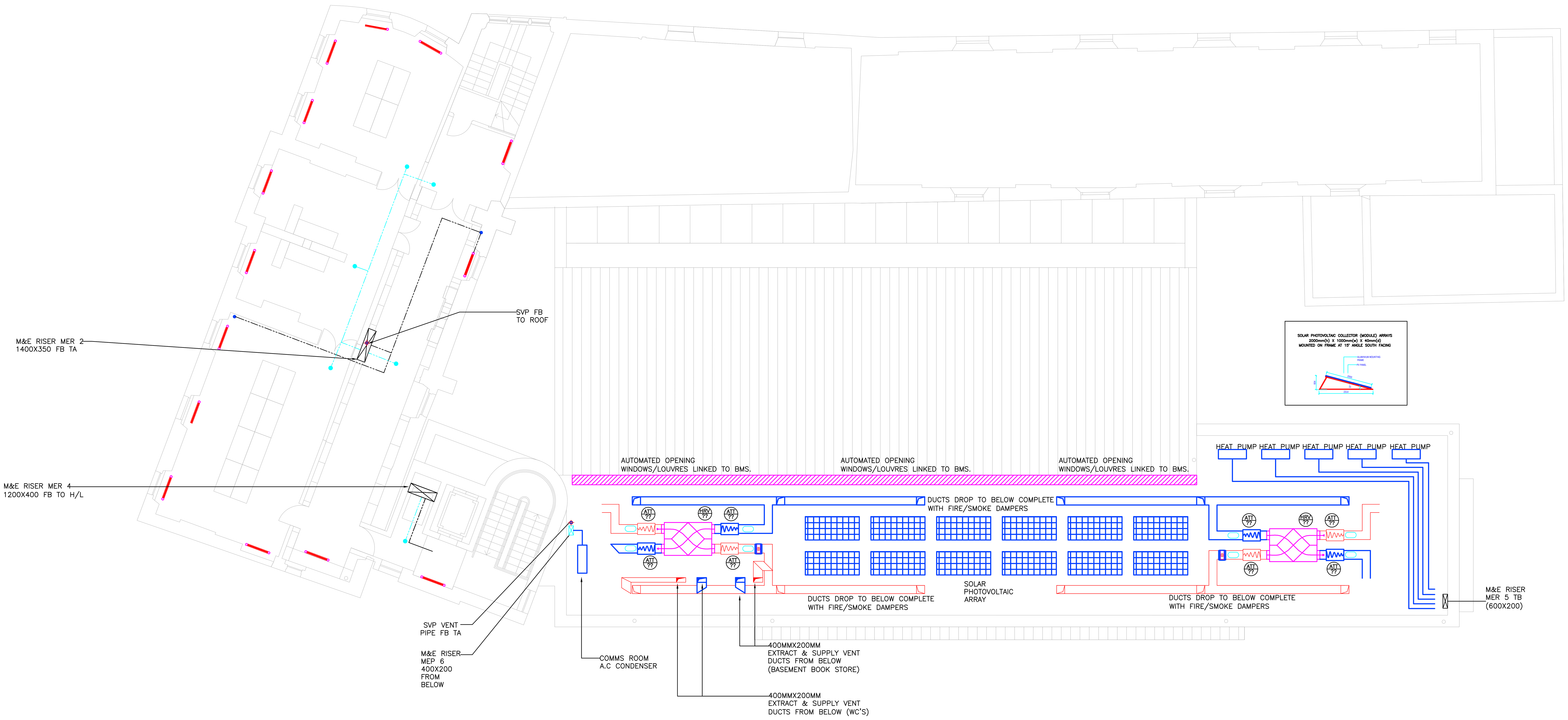

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P02	S1	DEC'20	STAGE 2A ISSUE	J.R.
P01	S1	NOV'20	STAGE 2A DRAFT	J.R.

Revision: P01

Project Drawing Reference: 19784-VCE-ZZ-ZZ-DR-ME-1003

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Project Title: CARLOW LIBRARY

Drawing Title:
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General Notes
A. DO NOT SCALE FROM THIS DRAWING- WORK ONLY FROM FIGURED DIMENSIONS.
B. ALL ERRORS & OMISSIONS TO BE REPORTED TO THE CONSULTING ENGINEER
C. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ARCHITECTS AND STRUCTURAL ENGINEER'S DRAWINGS.
D. REFER TO DOCUMENT REGISTER FOR DESCRIPTION OF STATUS CODES.

MAIN PIPEWORK ROUTING
ELECTRICAL WIRING ROUTING
M&E RISER (MER)

Rev	Status	Date	Description	D.E.
P02	S1	DEC'20	STAGE 2A ISSUE	J.R.
P01	S1	NOV'20	STAGE 2A DRAFT	J.R.

Revision: P01
Project Drawing Reference: 19784-VCE-ZZ-ZZ-DR-ME-1004
Status: S1
Varming Project Number: 19784

Date	Checked By	Drawn By	Scale
NOV'20	J.R.	N.B.	1:100

Client
CARLOW COUNTY COUNCIL

Project Title
CARLOW LIBRARY

Drawing Title
MECHANICAL & ELECTRICAL SERVICES STRATEGY ROOF VOID LEVEL

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Engineering for the Future

Titleblock Revision: 2020_2