

QODA

North Herts Leisure centre - Royston

Energy Statement

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QODA

Revision Summary

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1 Executive Summary

This Energy Statement has been prepared by QODA Consulting as part of the planning application for the refurbishment and extension of Royston Leisure Centre, Royston, Hertfordshire, SG8 7XT, to be referred to as “The Proposed Development”. The Proposed Development will provide leisure facilities and amenities to the local community with a total gross internal floor area (GIA) of 4,071 m².

The energy strategy has been developed in line with the national planning policy framework, the North Herts District Council: local plan 2011-2031, the North Herts Council: Sustainability Supplementary Planning Guidance (SPG), and Approved Document L: Volume 2: Buildings other than dwellings (ADL2). Additionally best practice standards for energy efficient, low carbon design has been followed throughout the design process to ensure that the design complies and exceeds carbon emissions targets, which includes decarbonisation works that are supported by a Salix application.

Energy modelling has been carried out on the development to determine the impact of all significant refurbishment improvements, as well as having delivered an early-stage BRUKL assessment for the extension, in line with ADL2.

The energy performance of the Proposed Development is mainly driven by the following key factors:

- High-performance fabric insulation.
- Energy efficient building services and controls.
- The inclusion of low or zero carbon technology (LZCT) in the form of an Air Source Heat Pump (ASHP) and Photovoltaic (PV) panels.

Results show that 74% site wide carbon reduction is achieved compared to the baseline case and represents a high-performance, low-carbon development. The results show that the planning application achieves low carbon energy at the silver standard, as per the North Herts District Council Sustainability SPG. Please refer to section 3, section 7, and appendix A for further information.

Refurbishment Carbon Emissions	Tonnes of Co2 Per annum	Improvement
Baseline building (kg CO ₂ /yr)	336	-
Proposed building (kg CO ₂ /yr)	95	-
Total Carbon saving over baseline	241	71.2%

Table 1-1: Refurbishment carbon reduction from proposed measures

Extension Carbon Emissions	Tonnes of Co2 Per annum	Improvement
Notional building (kg CO ₂ /yr)	3.9	-
Actual building (kg CO ₂ /yr)	0.1	-
Total Carbon saving over baseline	3.8	97.4%

Table 2-2: Extension carbon reduction from proposed measures

2 Introduction

2.1 Existing Site

The development is located next to the King James Academy in Royston, which itself lies within the municipality of North Herts District Council. The site is near to a residential area, though there are no large buildings in the close vicinity to the site.

The existing building gross internal area (GIA) is approximately 2,804 m² with a large car park and a high proportion of green open space around the site. Please see Figure 2-1 for a bird eye view of the existing site.



Figure 2-1: Existing Site

2.2 Proposed Development

The proposed development is for the refurbishment and extension of the two-storey leisure centre within the grounds of the site. The proposals aim is to accommodate exemplary leisure facilities and supplementary spaces that engage with the users to make an environment that provides a high quality of comfort and wellbeing.

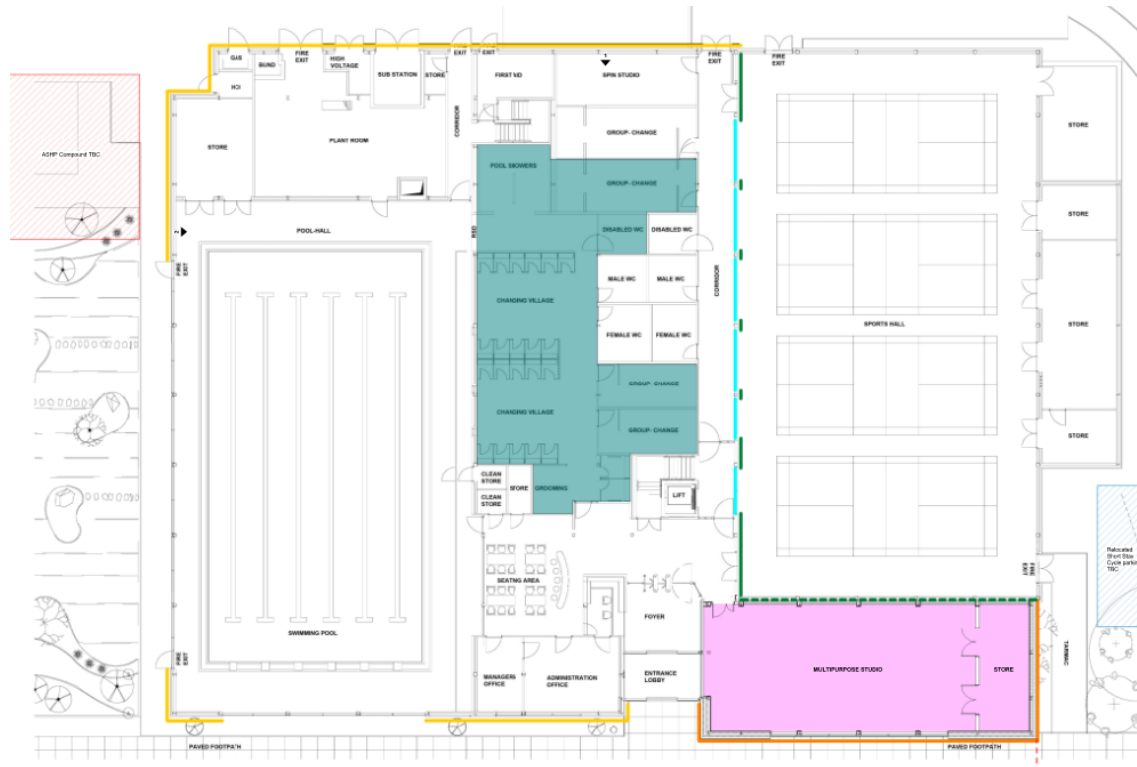


Figure 2-2: Proposed Ground Floor Plan

While the size and context of the site limits the amount of intervention available, the intention is for the proposed development to remove all fossil fuel consumption related to space heating and domestic hot water, as well as significantly improving specific elements of the building fabric.

3 Planning Requirements

The Proposed Development will be designed in line with current national, regional and local policy. The policies that have been considered for this energy and sustainability assessment include: the National Planning Policy Framework 2024; North Herts District Council: Local Plan 2011 - 2031; Salix – Public Sector Decarbonisation Scheme (PSDS); and approved Document L: Volume 2 (2021 edition incorporating 2023 amendments) Buildings other than dwellings.

3.1 National Planning Policy Framework (2024)

The National Planning Policy Framework sets out the Government’s planning policies for England and how these should be applied. It provides a framework within which locally prepared plans for housing and other development can be produced. At the heart of the NPPF is a presumption in favour of sustainable development. Achieving sustainable development means that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives).

- 1) **An economic objective** – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right type is available in the right places and at the right time to support growth, innovation and improved productivity; by identifying and coordinating the provision of infrastructure.
- 2) **A social objective** – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations: To foster a well-designed and safe built environment, with accessible services and open spaces that reflect current and future needs and support communities’ health, social and cultural well-being.
- 3) **An environmental objective** – to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution and mitigating and adapting to climate change, including moving to a low carbon economy.

3.2 North Herts District Council: Local Plan 2011 - 2031

Policy NE12: Renewable and low carbon energy development

Proposals for solar farms involving the best and most versatile agricultural land and proposals for wind turbines will be determined in accordance with national policy. Proposals for other renewable and low carbon energy development which would contribute towards reducing greenhouse gas emissions will be permitted subject to an assessment of the impacts upon:

- i. Landscape quality, landscape character and visual amenity, including consideration of cumulative impacts of development;
- ii. Environmental assets;
- iii. The historic environment, including the impact on the setting of historic assets;
- iv. The transport network;
- v. Air quality;
- vi. Aviation interests; and
- vii. The amenity of residents.

In assessing renewable and low carbon energy proposals against the above criteria the Council will give significant weight to their local and wider benefits, particularly the potential to reduce greenhouse gas and other harmful emissions, and the social benefits of community owned schemes where this is relevant.

Proposals for decentralised energy schemes associated with development of the strategic sites allocated in the Plan will be encouraged subject to an assessment of the impacts.

In all cases, end of life/redundant plant, buildings, apparatus, and infrastructure must be removed and the site restored to its former state or a condition agreed with the Council.

3.3 North Herts Council: Sustainability Supplementary Planning Guidance 2024

North Herts council: Sustainability Supplementary Planning Guidance (SPD) 2024, takes into account three pillars of sustainability:

- Environmental - protecting the natural environment and resources;
- Social - ensuring that everyone has access to basic needs such as housing, food, and healthcare; and
- Economic - creating a strong economy that can provide jobs and opportunities for everyone.

This SPD covers the following four main types of development, major residential developments, minor residential developments, major non-residential development and minor non-residential development. Whilst North Herts Council strongly support the need to retrofit existing building stock to make it more energy and water efficient, the Council has very limited influence over existing building stock and consequently this document does not address this specific issue. Section 9 provides additional guidance on the retrofitting of historic buildings.

Sections related to this energy statement have been summarised below utilising the councils, bronze, silver and gold ranking in table 3.1 & 3.2. Whilst these standards refer to new-build projects, and therefore do not apply, the design team has sought to integrate whenever feasible, and as a minimum shall comply with the bronze standard.

Bronze	Silver	Gold
Submit an Energy Statement and a Sustainability Statement showing compliance with national and local Policy and Building Regulations	Submit a Sustainability Statement from a certified assessor showing: • maximisation of solar gain through site layout, orientation, and design (for the purpose of energy efficiency) • measures to prevent overheating	Submit an Energy Statement from a certified assessor showing: • on-site reductions of 50% (minimum) in CO2 emissions over and above Building Regs Part L unless it is justifiably difficult to achieve, in which case a saving of >35% will be required
	Submit an Energy Statement from a certified assessor showing: • lower carbon alternatives to gas boilers • on-site reductions of 35% (including 10% through fabric first measures) in CO2 emissions over and above Building Regulations Part L unless it is justifiably difficult to achieve	commitment to achieve Passivhaus certification and site assessment at planning stage using Passive House Planning Package (PHPP) to confirm compliance against

Table 3.1 – Optimising passive design & fabric performance requirement table

Bronze	Silver	Gold
Ensure development is Policy & Building Regulations compliant	Show that at least 20% renewable energy is provided from onsite renewable technology such as PV. If this cannot be achieved, it should be shown that PV provision has been maximised.	Show that at least 40% renewable energy is provided from onsite renewable technology such as PV. If this cannot be achieved, it should be shown that PV provision is above 20% and has been maximised.
Submit a Feasibility Study from an Energy Specialist showing the most appropriate Low/Zero Carbon technology to be implemented on site.	Submit a Feasibility Study from an Energy Specialist showing the most appropriate Low/Zero Carbon technology to be implemented on site will be supported	Submit a Feasibility Study from an Energy Specialist showing the most appropriate Low/Zero Carbon technology to be implemented on site will be supported

Table 3.2 – Achieving low carbon energy requirement table

It should be understood that the proposed development is not required to meet the policy requirements above, as the proposed development is a refurbishment with the addition of a minor newbuild extension, and as such is significantly constrained in the level of intervention achievable as compared to a new build development. Regardless of this the design team has strived to implement strategies that are in the spirit of the SPG, and meet key targets wherever practical and feasible.

3.4 Salix – Public Sector Decarbonisation Scheme (PSDS)

The Public Sector Decarbonisation Scheme provides grants for public sector bodies to fund heat decarbonisation and energy efficiency measures.

Phase 3 of the Public Sector Decarbonisation Scheme was announced in 2022, and the first phase of PSDS Phase 3 is Phase 3b which closed to new applications in November 2022. These projects are currently being delivered.

These Guidance Notes cover PSDS Phase 3c and refer to the new PSDS Phase 3c application window. As we begin this new phase of the Public Sector Decarbonisation Scheme, the emphasis remains on providing grant funding for projects that focus on the decarbonisation of heat.

The Department for Business, Energy and Industrial Strategy (BEIS) initiated the PSDS funding to help meet the UK Government's ambitious carbon emissions targets. In 2019, the UK Government set out targets to achieve Net Zero greenhouse gas emissions across the whole UK by 2050.

The majority of buildings in the public sector still rely on burning fossil fuels for heating, hot water and catering. The PSDS therefore places a focus on the decarbonisation of heat within the public sector whilst taking a 'whole building' approach. Phase 3b PSDS builds on Phase 3a, with refinements implemented to respond to stakeholder feedback regarding the proportion of funding made available for financing projects that deliver over more than one financial year. Other changes sharpen the scheme's focus on cost effective decarbonisation of heat and the overall achievement of carbon emission savings.

The scheme, delivered by Salix Finance, gives Applicants the opportunity to submit separate applications for separate projects or combine several projects in a single application for a single year fund allocation or a multiyear fund allocation. The new features of Phase 3c are set out in Section 2 of this guidance document.

Multi-year applications

Phase 3b increases the funding pot for multi-year applications spending in both 2023/24 and 2024/25 and makes up to £233m in FY 2024/25 available.

Planning year

Applicants can also apply for funding at the Phase 3c application window for projects with spend in 2024/25 only, using 2023/24 as a planning year. This is with the aim to allow applicants to have longer to plan their projects with the certainty of committed funding.

Applicant contribution

Applicants are expected to contribute funding equivalent to the like-for-like costs of replacing their fossil fuel heating system. For Phase 3c, this cost is set at a minimum of 12% of total project costs. Applicants are still required to evidence these costs in all cases, including where the like-for-like costs would come in at less than 12%, in which case, Applicants are still expected to contribute the 12% minimum. Applicants with like-for-like fossil fuel replacement equipment costs over 12% are expected to contribute their full like-for-like replacement costs. For example, if the like-for-like replacement cost comes out at 15% of an Applicant's total project costs, then Applicants must contribute the 15%.

‘Whole building’ approach

The ‘whole building’ approach criteria will be applied only to the buildings where the proposed low carbon heating measures are heating that part of a building, meaning that PSDS grant funding cannot be used to fund energy efficiency measures in buildings not served by the proposed low-carbon heating installation. For example, a hospital building will not be eligible to apply for insulation in Block ‘A’ where the low carbon heating measure is only heating Block ‘B’.

Energy efficiency cap

To sharpen the scheme’s focus on heat decarbonisation, there is a maximum proportion of the grant value that can be claimed for energy efficiency. This maximum proportion will be set at 58% of total grant costs within each application.

Hybrid heating systems

Phase 3c PSDS will not support hybrid heating systems where new fossil fuel boilers are being installed as part of the project. In addition, new boilers funded by the contribution from the Applicant will specifically exclude a project from being eligible. The project is expected to meet the heat demand provided by the end-of-life system being replaced. For example, if the fossil fuel heating system being replaced previously met the heat demand for the whole of Building A, then the new low carbon heating system, alongside the efficiency measures installed, should also meet the heat demand for the whole of Building A. In buildings with multiple fossil fuel heating sources, applicants are not required to replace all units.

Grant start date

In order to provide grant recipients with as much time as possible to complete their projects once the grant has been agreed, grant recipients will be able to start work on their project as soon as they have signed and returned their grant offer letter. This includes works in FY 22/23. No grant funding can be claimed for work undertaken before the grant offer letter is accepted by the grant recipient. Salix and BEIS are able to do this because we are forecasting that some phase 3b projects will have abandoned or descope which will create underspend in financial year 2022/23. Salix can then make this available for Phase 3b grant recipients to make an early start. However, if there is insufficient underspend from Phase 3a to cover the costs incurred from this early start for Phase 3b, grant recipients need to be prepared to meet all or part of any costs incurred from their planned contribution to funding the project. The costs covered by the grant in financial year 2022/23 will have to comply with the terms and conditions of the Phase 3c grant and will need to have been claimed by the end of April 2023. Applicants that have the flexibility in their projects to start earlier than 1 April 2023 should make this clear as part of their application.

Assessment process

Applications will be assessed by Salix’s Energy and Carbon team as well as external technical assessor, who provide added independent assurance that the project is deliverable, and any savings are reasonably achievable.

Applications assessed will have technical and due diligence checks in line with the size and scope of their project. Applications will be initially reviewed to meet the Phase 3b criteria. Applications will go on to have a full review including but not limited to:

- Technical case which will cover areas including the technical feasibility, future resilience, energy/carbon savings calculations and energy monitoring plan.

- Financial case which will cover areas including breakdown of project costs, operating and maintenance costs and evidence of firm pricing.
- Project governance which will cover areas including project risks and mitigations, project implementation/schedule, previous experience, procurement and deliverability within the grant funding time window.

If there are any questions or further information required, the Applicant will be contacted to request this. It will not be possible to progress the application further until the requested information is provided and agreed by Salix.

Applicants are expected to return information and evidence to Salix to meet the queries within two working days. Where this is not met, applications will be unsuccessful.

If applications are considered poor in terms of quality or supporting evidence, then Salix exercises the right to reject the application without completing full due diligence.

The assessed Phase 3c PSDS Application Form will be shared with the Applicant. This includes feedback for useful learning points.

3.5 Approved Document L: Volume 2 (2021 edition incorporating 2023 amendments) Buildings other than dwellings

Building Regulations are statutory instruments that seek to ensure that the policies set out within any relevant UK legislation are carried out. Building Regulations approval is required for the majority of building work carried out in the UK.

ADL covers the requirements with respect to the conservation of fuel and power in all buildings. It sets performance parameters relating to insulation levels, air permeability, heating efficiency, ventilation and air conditioning systems together with hot water storage and lighting efficiency.

It also sets out the requirements for calculating the carbon dioxide emissions and the Carbon Emission Targets for each building type. The proposed development is seeking to comply entirely with ADL where consequential improvements have been made.

4 Energy & Carbon Strategy

This section calculates the total energy and associated carbon emissions of the base case buildings using the notional building generated in line with NCM Modelling Guidance 2022. The energy hierarchy has been followed to ensure passive measures are at the centre of design, with efficient services and low-zero technologies supporting further reduction.

4.1 General Approach

Passive Design

A ‘fabric first’ approach has been taken, with the aim of reducing the building’s energy demands through a high performing building envelope, in line with the SPD targets on “optimizing passive & fabric performance”. The key point is that such measures are more difficult to implement later.

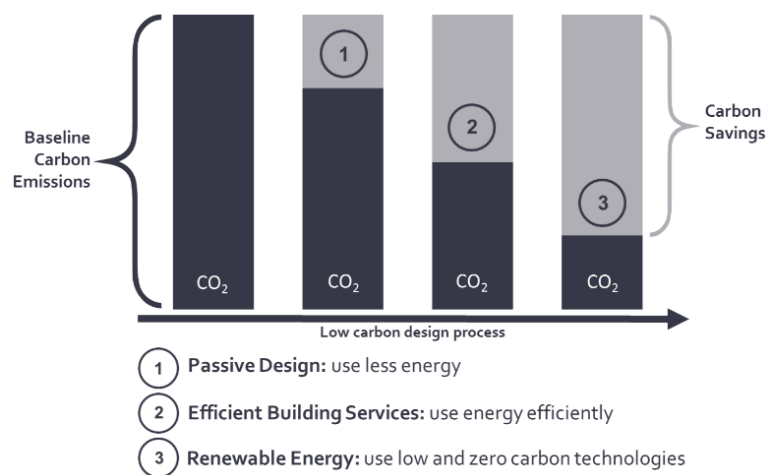


Figure 4-1: Energy Hierarchy

Efficient Building Services

Heat, ventilation, and light will be provided efficiently through appropriate selection of products, good design practices and controls. Minimising distribution and storage losses from space heat and hot water systems is a significant element of this, and due to the building type, optimising hot water demand is paramount. Technologies such as LED lighting, and high-performance ventilation systems with heat recovery will also be adopted as part of the design.

Renewable Energy

The final stage of carbon reduction is to utilise renewable energy (or low carbon) technology which supplies heat or power from a low (or zero) carbon source. It is far easier to retrofit such technologies compared to building envelope measures. In the context of Royston Leisure Centre, this takes the form of Air Source Heat Pumps and onsite photovoltaic (PV).

5 Calculation Methodology

Dynamic simulation modelling assessments have been conducted to calculate the development's performance in terms of energy demand and carbon emissions. The DSM software from IES has been used for this assessment, following bespoke decarbonisation assessment methods and the NCM Modelling Guide (2021) assessment procedure together with the proposed building specifications.

5.1.1 Carbon Factors

SAP 10.2 was published by BRE in December 2021. The SAP 10.2 carbon factors were produced by the government to be a closer representation of the carbon intensity of the grid today. The SAP10.2 Carbon Factors have been used to generate carbon emissions throughout.

	SAP 10.2 (kgCO ₂ /kWh)
Natural Gas	0.210
Grid Electricity	0.136

Table 3- SAP 10.2 carbon factors

5.1.2 Scope

The project is aiming to access public funding via Salix in order to electrify and decarbonise the Proposed Development. The scope of works has been split into two elements:

- Refurbishment of the existing development
- Construction of a 360m² extension

All upgrades to the existing site and the entire extension will be compliant with Building Regulations. Furthermore, detailed feasibility studies and energy calculations have been produced to evidence that the existing site will decarbonise in line with Salix agreements.

5.2 Refurbishment

The PSDS 3c Salix application has been submitted on the basis that all existing services onsite which rely on fossil fuels and are at the end of their useful life will be removed and replaced with low-zero carbon technologies.

Energy audits have been conducted at the earliest stages to ascertain the current energy performance of the development, with efforts made to break this down into the different end uses including:

- Gas
 - Space heating
 - Pool water heating
 - Domestic hot water heating
- Electricity
 - Space heating
 - Pool water heating
 - Domestic hot water heating
 - Cooling
 - Auxiliary
 - Lighting
 - Small power

A baseline model has been calibrated, using dynamic simulation modelling (DSM), on the basis of the information above, and carbon calculations have been produced to show the impact of the proposed interventions.

5.3 Extension

A DSM model has been developed to produce a BRUKL report for the extension which shows the improvements against the notional requirements of ADL.

6 Baseline

6.1 Refurbishment Baseline Specification

To establish the baseline CO₂ emissions for the refurbishment, regulated CO₂ emissions have been calculated for a baseline model for each component of the refurbishment.

The baseline specification is indicated in Table 6.1.

Building	Royston Leisure Centre (Baseline - Refurbishment)
	Fabric Specification
External wall U-value	0.45 W/m ² K
Roof U-value	0.25 W/m ² K
Ground Floor U-value	0.45 W/m ² K
Curtain Wall Glazing	U-Value = 2.1 W/m ² K (Double glazing)
	g-value 0.60
Door U-value	Same as curtain wall
Internal Blinds	No
Thermal Mass Parameter	High Thermal Mass Construction
	Building Air Permeability
Air-tightness standard	8 m ³ /h.m ² @50Pa
	Space Heating
System	Gas Boiler or split-multi split system
Emitters	Air distribution, air conditioning unit
SCoP	91%
	Space Cooling
System	Split-multi split system
Emitters	DX unit
SCoP	275%

	Hot Water System
System	Gas boiler
	Cylinder in heated space
SCoP	91%
	Ventilation
System Type	Central air handling units
Ductwork Insulated?	Yes
Ducting Type	Semi-rigid
Specific Fan Power	2.9 W/l/s
Heat Exchanger Efficiency	65%
	Lighting
Lighting	LED

Table 6-1: Existing Baseline Specification

6.2 Extension Baseline Specification

To establish the baseline CO₂ emissions for the extension, regulated CO₂ emissions have been calculated for a baseline model for each component of the extension.

The baseline specification is indicated in table 6-2.

Building	Royston Leisure Centre (Baseline - Extension)
	Fabric Specification
External wall U-value	0.25 W/m ² K
Roof U-value	0.18 W/m ² K
Ground Floor U-value	0.18 W/m ² K
Curtain Wall Glazing	U-Value = 1.4 W/m ² K (Double glazing)
	g-value 0.48
Door U-value	Same as curtain wall
	Building Air Permeability
Air-tightness standard	3 m ³ /h.m ² @50Pa
	Space Heating
System	Air Source Heat Pump
Emitters	Air distribution, air conditioning unit
SCoP	264%
	Space Cooling
System	Split-multi split system
Emitters	DX unit
SCoP	440%
	Hot Water System
System	Air Source Heat Pump
	Air distribution, air conditioning unit
SCoP	286%

	Ventilation
System Type	Central air handling units
Ductwork Insulated?	Yes
Ducting Type	Semi-rigid
Specific Fan Power	1.8 W/l/s
Heat Exchanger Efficiency	65%
	Lighting
Lighting	95 lm/cW

Table 6-2: Extension Baseline Specification (Minimum standard)

7 Proposed Building

7.1 Passive Design Measure

Passive design is the implementation of strategies that minimise energy consumption and intern emissions by reducing the demand for energy in the first instance, through minimising losses and harnessing energy where available. Passive design methods include but are not limited to:

- Optimising building form, orientation, and site layout.
- Use of natural ventilation.
- Maximising daylighting.
- Use of high-performance glazing.
- Optimising glazing ratio and use of solar shading.
- Use of enhanced thermal insulation and improvements to U-Values.
- Improvements to fabric and air permeability.
- Minimising thermal bridging.

Please See Table 7-1 which demonstrates the regulation requirement and the targeted fabric performance for the proposed development

Fabric Specification		
	Refurbishment	Extension
External wall U-value	0.17 W/m ² K*	0.18 W/m ² K
	0.26 W/m ² K*	
	0.50 W/m ² K*	
	0.56 W/m ² K*	
Flat Roof U-value	0.18 W/m ² K	0.12 W/m ² K
Ground Floor U-value	0.45 W/m ² K	0.15 W/m ² K
Exposed Floor U-value	0.45 W/m ² K	0.15 W/m ² K
Roof Light	U-Value = 2.1 W/m ² K	U-Value = 1.2 W/m ² K
	g-value = 0.6	g-value = 0.6
Fully glazed doors	U-Value = 2.1 W/m ² K	U-Value = 1.2 W/m ² K
	g-value = 0.6	g-value = 0.6
Windows	U-Value = 2.1 W/m ² K	U-Value = 1.2 W/m ² K
	g-value = 0.6	g-value = 0.6
Curtain wall System	U-Value = 2.1 W/m ² K	U-Value = 1.2 W/m ² K
	g-value = 0.6	g-value = 0.6
Building Air Permeability		
Air-tightness standard	8 m ³ /h.m ² @50Pa	3 m ³ /h.m ² @50Pa

*Please see Appendix B

Table 7-1: Fabric Specification

When designing the new build extension the team has aimed to optimise form factor over the solar gains given the large internal gains of a leisure centre and the risk this presents to overheating in addition to restriction posed on site by the existing structure. Given the limitation of the building's existing geometry the design team has prioritised implement passive design strategies through the improvement of fabric performance as demonstrated by the design's exceedance of the building regulations fabric performance requirements. This has resulted in measurable energy saving in line the goals of North Herts SPD reducing energy consumption in the first instance through the use of optimising passive design & fabric performance.

7.2 Active Design Measures

Active design measure reduces a buildings energy consumption through the implementation of systems and technology which actively monitor, manage and control a buildings energy consumption, often by using a small amount of energy in the first instance they actively recover and prevent unnecessary energy use intern reducing consumption and carbon emissions. Active design methods include but are not limited to:

- Use of mechanical ventilation with heat recovery (MVHR) system with summer bypass.
- Installation of low energy LED lighting with photocell/timer clock/presence detection controlling where possible.
- Use of smart meters for heat and electricity networks.
- Use of programmable heating controls with individual zone control for heating and hot water
- Use of wastewater heat recovery.

The proposed development's primary heating and ventilation strategy utilises air distribution supplying heating through the central air handling unit system, with fresh air being supplied via fans which vary in size and capacity. This allows the scheme to take advantage of existing infrastructure whilst taking advantage of central plant which is a low-zero carbon technology, providing effective thermal comfort and allowing the entire building to become fossil-free. All Domestic Hot water (DHW) is to be provided by the same high temperature heat pumps.

Studios and gym areas, including the extension, will be supplied by decentralised variable refrigerant flow (VRF) units which have significantly improved ScoPs and SEERs.

Please see Table 7-2 which outlines the specification of applied active measure for the proposed development and for further information refer to the mechanical specification produced by QODA Consulting.

Building	Royston Leisure Centre (Proposed)
	Space Heating
System	HT ASHP or split-multi split system
Emitters	Air distribution, air conditioning unit with VSD
SCoP	336%
	Space Cooling
System	Split-multi split system
Emitters	DX unit
SCoP	630%
	Hot Water System
System	HT ASHP
	Cylinder in heated space - VSD
SCoP	336%
	Ventilation
System Type	Central air handling units
Ductwork Insulated?	Yes
Ducting Type	Semi-rigid
Specific Fan Power	1.8 W/l/s
Heat Exchanger Efficiency	80%
	Lighting
Lighting	110 lm/cW

Table 7-2: Active Measures

7.3 Low Zero Carbon Technologies

Low Zero Carbon Technologies (LZCT) are methods of harvesting or generating energy on site, in the aim of reducing the dependency on the national grid in the effort to decarbonise the grid, increase country wide energy production, create more energy resilient building and preserve energy in its higher forms i.e electric being of higher value than heat. LZCT are essential for reaching net zero carbon emission but are considered as the last option for decarbonising a building as they work to supply a building with cleaner, cheaper energy rather than tackling the primary concern of reducing energy demand.

As part of this assessment a site-specific analysis was carried out to investigate which Low zero Carbon Technologies are best suited to the developments in line with North Herts SPD guidance and its aims of “Achieving Low Carbon Technologies”. The investigation results of numerous LZCT and the ones implemented are discussed and can be seen in table 7-4.

Please see Table 7-3 below summarising how photovoltaic supply and carbon reduction impact has been pro-rated.

Low Zero Carbon Technologies - PV	
	PV: Refurbishment
Model	Trina Vertex 5+ 450W
No.	315
Area	703.4 m2
Orientation	South
Inclination	30 degrees
Peak Power	141.38 KwP
	PV: Extension
Model	Trina Vertex 5+ 450W
No.	39
Area	86.9 m2
Orientation	South
Inclination	30 degrees
Peak Power	17.47 kWp

Table 7-3: Low zero Carbon Technologies summary (LZCT)

The design team working specialist PV contractors has maximised PV generation on-site were technically and practically feasible working within the constraints of existing building's orientations, limited roof space for PV and plant equipment as well as structural limitation of the building itself. As a result, 12.6% of the building energy demand shall be met by onsite PV generation, while this falls short of the North Herts local council target of 20% due to the high energy demand of spa/leisure facility and the limitation of working with an existing building this still presents a measurable reduction in carbon emissions.

For further information please see the PV calculation in appendix A and figure 7-1 for a 3d visualization of the PV panel allocation.

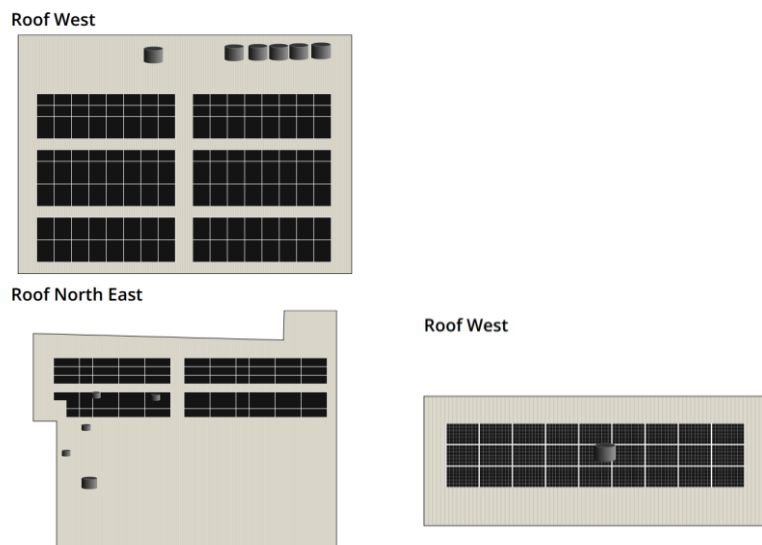


Figure 7-1: 2d visualization of PV allocation

Site specific analysis carried out to investigate which technologies are best suited to the developments is show in Table 7-4.

Technology	How It Works	Key Considerations	Viability for Royston Leisure Centre
Air-source Heat Pump (air to water ASHP) 	Heat pumps and exchangers extract heat from outside air to provide space heating and/or hot water.	- Requires a suitable location for the external unit to the building - planning permission may be required. - The noise generated by the external unit must be considered. - ASHP Like GSHPs, air to water heat pumps are most effective when providing space heating via under-floor heating systems designed to operate at temperatures of around 30°C-40°C. - ASHPs are the most cost effective and easiest to install when compared to GSHPs and WSHPs however GHSPs are more efficient. - The increasingly decarbonizing electrical grid combined with high efficiency heat pumps results in a low carbon source of heat.	

Technology	How It Works	Key Considerations	Viability for Royston Leisure Centre
Ground-source Heat Pump (GSHP) 	- GSHPs transfer heat from the ground into a building to provide space heating and/or hot water. - The ground tends to be at a constant temperature of around 12°C throughout the year and, through the use of a refrigerant cycle this constant low-grade heat can be harnessed to provide a useful level of heat for a building.	- Feasibility depends on space for the piping circuit and whether the geology is suitable for either boreholes or trenches. - Heat pumps are most suitable for low temperature heating systems such as underfloor heating. - The capital cost of GSHPs are significantly higher than fossil-fuel boiler. - Greatest carbon savings when combined with renewable electricity-generating technologies. - The increasingly decarbonizing electrical grid combined with high efficiency heat pumps results in a low carbon source of heat.	X
Biomass 	- Energy by burning solid organic matter in the form of wood chips or sawdust pellets. - Biomass boilers can provide energy for heating and hot water systems. - A carbon neutral energy source.	- Best suited for relatively continuous operation. - Require store facilities to accommodate the fuel. - Ideally, biomass fuel should be sourced locally to reduce transport costs and associated carbon emissions. - Use may be limited in Smoke Control Zones.	X

Technology	How It Works	Key Considerations	Viability for Royston Leisure Centre
Cobined Heat and Power (CHP) 	- CHP is the simultaneous generation of both usable heat and electrical power from the same source. - Fuel (usually mains gas or oil) is combusted in an engine where the mechanical power produced is used to generate electricity while the heat emitted provides space heating or hot water.	- CHP requires predictable and fairly constant electricity and heating loads for best performance. - CHP units are best suited for hotels, leisure homes, student accommodations, hospitals and schools. - The unit should be sized on heat demands, rather than electrical requirements - units are usually sized on the building's hot water load as this is continuous throughout the year.	X
Solar Thermal 	- Solar thermal panels generate hot water from the sun's energy through the use of solar collectors. - A mixture of water and anti-freeze is circulated through the solar collectors and a heat exchanger within the water storage cylinder to heat the water in the tank.	- Most effective in a south-facing position on an incline of 30-40 degrees. - Panel locations should be clear of obstructions and over shading. - Requires space for a hot water cylinder close to the collectors. - Most economically viable in buildings with a high hot water demand or where a building is not on the national gas grid.	X

Technology	How It Works	Key Considerations	Viability for Royston Leisure Centre
Photovoltaics (PV) 	- PV arrays are made up of semi-conductor solar cells which convert sunlight into electricity. - Energy from sunlight causes an electrical current to flow between difference atomic energy levels within the solar cells. - PV panels are made of solar cells, and several panels create a PV array.	- The position of the PV array will affect the energy generation and, consequently the carbon and financial savings. - PV panels may require regular cleaning to avoid a reduction in efficiency - PV panels should be free from shading from adjacent buildings/trees. - Permission is required from the DNO (Distribution Network Operator) to connect the array to the grid (the cost of this grid connection is dependent on the size of the array and its location on the grid).	✓
Wind 	- Wind turbines produce energy by using wind power to drive a generator. - Turbines can either be free-standing or roof-mounted. Roof-mounted wind turbines require an average wind speed of 3 m/s to be viable whereas larger, stand-alone turbines require greater speeds of approximately 6 m/s to be viable.	- Rural areas are better suited than urban areas as the wind speeds are higher and less turbulent. - Pay-back periods are strongly dependent on wind conditions plus the length of cabling required to connect the turbine to the building. - Planning permission is required and is often a contentious issue.	✗

Technology	How It Works	Key Considerations	Viability for Royston Leisure Centre
Battery Storage 	• Generally used in conjunction with solar PV to maximize on-site energy generation, battery storage stores excess energy for later use. • Commercial battery storage systems are often packaged in server rack type systems and can be provided as a standalone container-based system to allow for easy integration on site.	• Battery storage systems are still quite costly and can be hard to justify from a commercial perspective. • Battery storage systems for commercial developments are often very large, which will need to be considered as part of the project space planning.	x

Table 7-4: Low zero Carbon Technologies analysis (LZCT)

8 Summary

The following results show the predicted performance of the Proposed Development, broken down into refurbishment impact and extension impact, based on methodology in section 5. These results show that if the planning application was to be measured against the North Herts Council: Sustainability Supplementary Planning Guidance 2024 targets, as if it was a new build development, it would achieve the following applicable rankings.

Optimizing passive design & fabric performance – Silver – Being an existing building with minor extension there is limited opportunity for the optimisation of orientation and layout. In addition, leisure centres have a high energy consumption compared to many other building types, due the hot water demand, making EUI targets unrealistic to achieve. All other silver criteria has been surpassed, including an on-site carbon reduction of 71.2% against the existing building being achieved, which far exceeds the 35% identified in the SPD. In addition, provision of numerous low carbon alternative technologies have been specified.

Achieving low carbon energy – Silver – As shown in section 7.3, several low carbon technologies have been considered with the most appropriate systems being implemented, to maximise the carbon/energy saving in respect to and feasibility of implementation. Furthermore, the building has maximised its PV provision were feasible, generating electricity equivalent to 12.56% of the building operation energy through PV generation onsite. This is expected to be further optimised during commissioning and in-use to maximise the use of generated electricity on site, by the heat pumps.

8.1 Results

The below tables detail the annual carbon emissions calculated for the existing and proposed building. Not only does the proposed extension show an improvement of 97% over the building regulations minimum standards but the whole site demonstrates a carbon emissions reduction of over 70%, twice that as required for new-built projects under the Supplementary Planning Guidance.

Refurbishment Carbon Emissions	Tonnes of Co2 Per annum	Improvement
Baseline building (kg CO ₂ /yr)	336	-
Proposed building (kg CO ₂ /yr)	95	-
Total Carbon saving over baseline	241	71.2%

Table 8-1: Refurbishment carbon reduction from proposed measures

Extension Carbon Emissions	Tonnes of Co2 Per annum	Improvement
Notional building (kg CO ₂ /yr)	3.9	-
Actual building (kg CO ₂ /yr)	0.1	-
Total Carbon saving over baseline	3.8	97.4%

Table 8-2: Extension carbon reduction from proposed measures

Appendix A – PV calculations

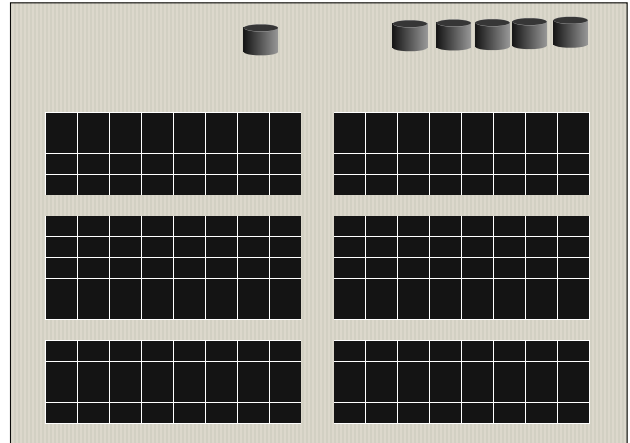
System Overview

Your system comprises 353 Trina Vertex S+ 450W N-Type Black White Mono solar panels to collect sunlight and turn it into DC electricity.

The panels will be connected to 1 Huawei SUN2000 115KTL-M2 3ph inverter, which converts the DC electricity into mains (AC) electricity.

We include all the isolators, wiring and meters needed to connect the system safely to your electrical system. Your system will be installed and certified by our trained installation team.

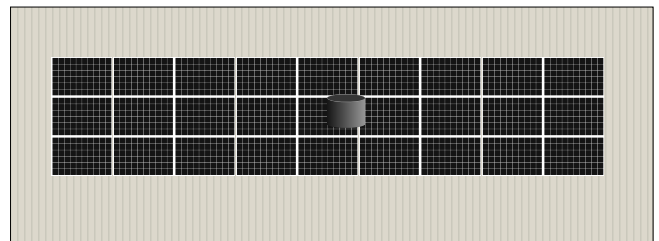
Roof West



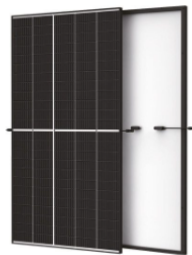
Roof North East



Roof West



System Components



Solar Panels: Trina Vertex S+ 450W N-Type Black White Mono x 353

The dual glass design of the Trina Vertex S+ offers high reliability in harsh conditions, better trapping light for high power output.

Model	TSM-450-NEG9R.28
Power	450 watts
Dimensions	1134 x 1762mm



Inverter: Huawei SUN2000 115KTL-M2 3ph

The SUN2000 3ph string inverter by Huawei combines consistent high efficiency, AI powered safety control and reliable performance for a highly dependa...

AC Power	115000 watts
Trackers	10



Mounting: K2 metal roof mounting system

Since 2004, K2 Systems has developed pioneering and highly functional mounting system solutions for photovoltaic assemblies around the world.

Designed for	Trapezoidal Sheet Metal roofs
Colour	Not specified

System Performance

We have made an estimate of the annual energy generation of your system. This takes into account the following factors that affect the output of a solar array.

The location of the system

Sunlight is weaker near the poles than near the equator. We use data from a meteorological model of the intensity of sunlight over the course of the year in different locations all over the world.

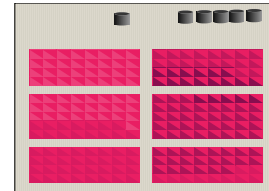
The orientation of the system

Solar panels that face south receive a little more sunlight than panels that face east or west. However, in diffuse light the orientation of the panels makes little difference, so the effect is less marked than many people imagine.

The degree of shading

If you have trees, neighbouring buildings or nearby high ground that will shade your PV array, the output of the system will be reduced. We have used a 'sunpath diagram' that estimates how often sunlight will be blocked from reaching the panels.

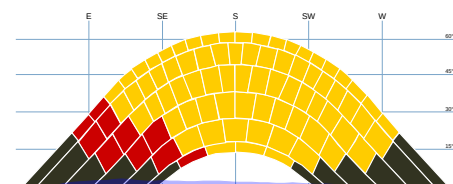
Roof diagrams



Stringing diagrams indicate which solar panels are connected to which inverter inputs.

Full sunpath and stringing diagrams for this system are given on the following page.

Sunpath diagrams



Sunpath diagrams indicate where the sky as seen from the solar array is blocked by neighbouring buildings, chimneys, trees, or other obstructions.

**We expect your system to generate
124,623 kWh per year**

Installation data

Installation capacity of PV system – kWp (stc)	159 kWp
Orientation of the PV system – degrees from South	See roof diagrams
Inclination of system (pitch) – degrees from horizontal	See roof diagrams
Postcode region	Zone 1

Performance Calculations

kWh/kWp (Kk)	See sunpath diagrams
Shade Factor (SF)	See sunpath diagrams
Estimated output (kWp x Kk x SF)	124623 kWh

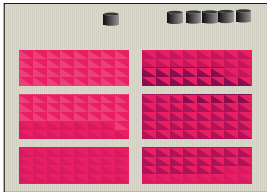
Estimated PV self-consumption

Assumed annual electricity consumption	594790kWh
Expected solar generation consumed in property	98810kWh

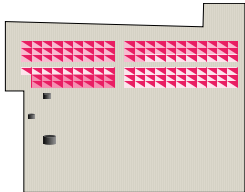
Important note: The performance of solar PV systems is impossible to predict with certainty due to the variability in the amount of sunlight from location to location and from year to year. This estimate is based upon a model that takes account of meteorological data at your location and makes an allowance for losses due to shading of the panels. This is a complex calculation however, and no model can be 100% accurate. It should not be considered a guarantee of performance.

If shading is present on your system that will reduce its output to the factor stated. This factor was calculated using industry standard shading methodology and we believe that this will yield results within 10% of the actual energy estimate stated for most systems.

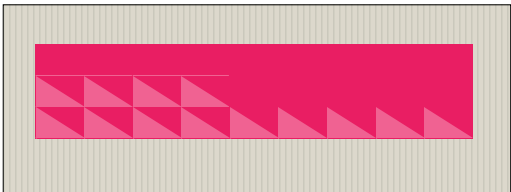
Roof diagrams



Roof West Orientation: 69° Pitch: 7°

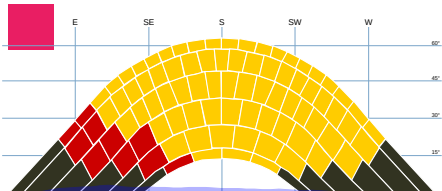


Roof North East Orientation: -113° Pitch: 5°

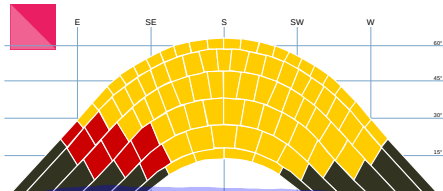


Roof West Orientation: 69° Pitch: 17°

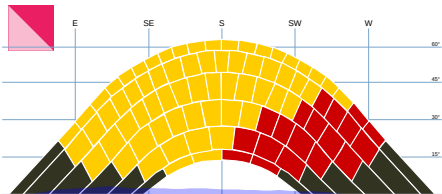
Sunpath diagrams



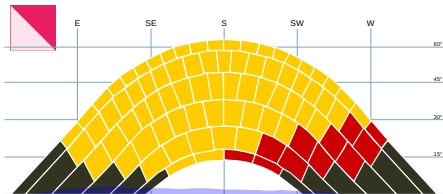
Shade factor: 0.90 Kk: 857



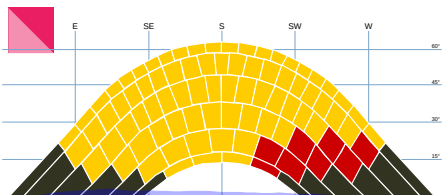
Shade factor: 0.92 Kk: 857



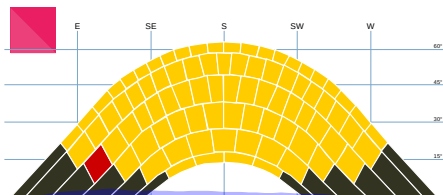
Shade factor: 0.81 Kk: 810



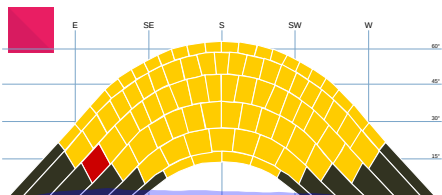
Shade factor: 0.89 Kk: 810



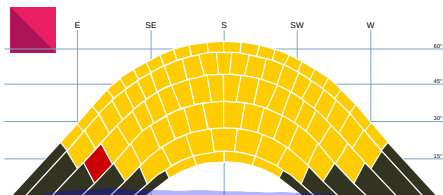
Shade factor: 0.92 Kk: 810



Shade factor: 0.99 Kk: 843



Shade factor: 0.99 Kk: 843



Shade factor: 0.99 Kk: 843

Appendix B – Wall Insulation Markup



North Elevation - Proposed
1 : 100



West Elevation - Proposed
1 : 100

RENDER ON MASONRY = $0.17 \text{ W/m}^2\text{k}$
 INSULATED SANDWICH PANEL = $0.18 \text{ W/m}^2\text{k}$
 WINDOWS/CURTAIN WALL = $1.2 \text{ W/m}^2\text{k}$
 NEW ROOF = $0.12 \text{ W/m}^2\text{k}$
 INSULATED INTERNAL LINING = $0.30 \text{ W/m}^2\text{k}$
 NEW FLAT ROOF = $0.12 \text{ W/m}^2\text{k}$

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MAINTENANCE/CLEANING	
DECOMMISSION/DEMOLITION	

Note - drawings based on existing building survey provided by Pinnacle Infotech

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NHDC DECARBONISATION	
ESB Project Code	Drawn CSM Date 08/11/24
2090	Checked KP
Client: Willmott Dixon	
Job: Royston Leisure Centre	
Drawing: Proposed Elevation - North Elevation	
Scale: 1:100	
Revision: 1	
project originator zone invt type role number	

2090-RLC-THERMAL MARKUP
 KP-2024-12-03
 10F5

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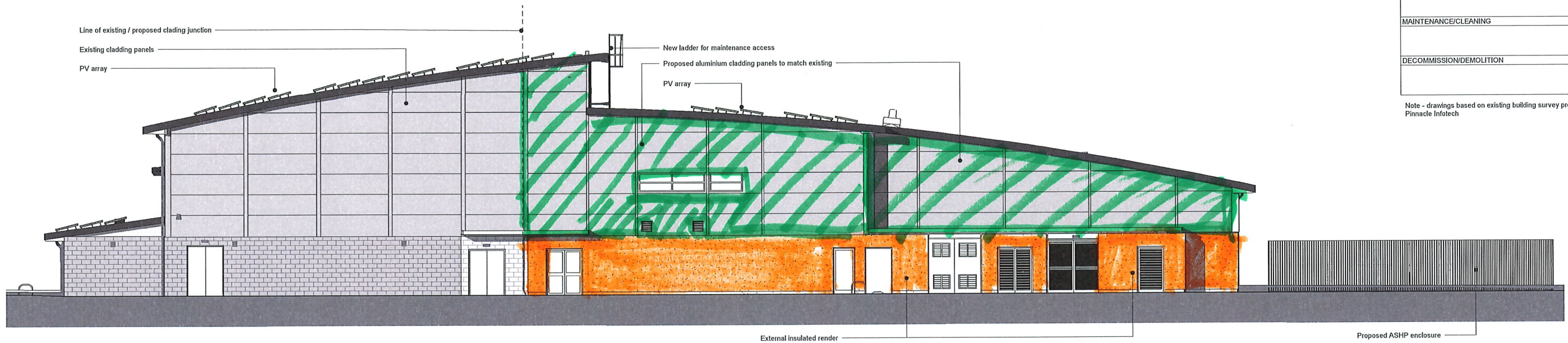
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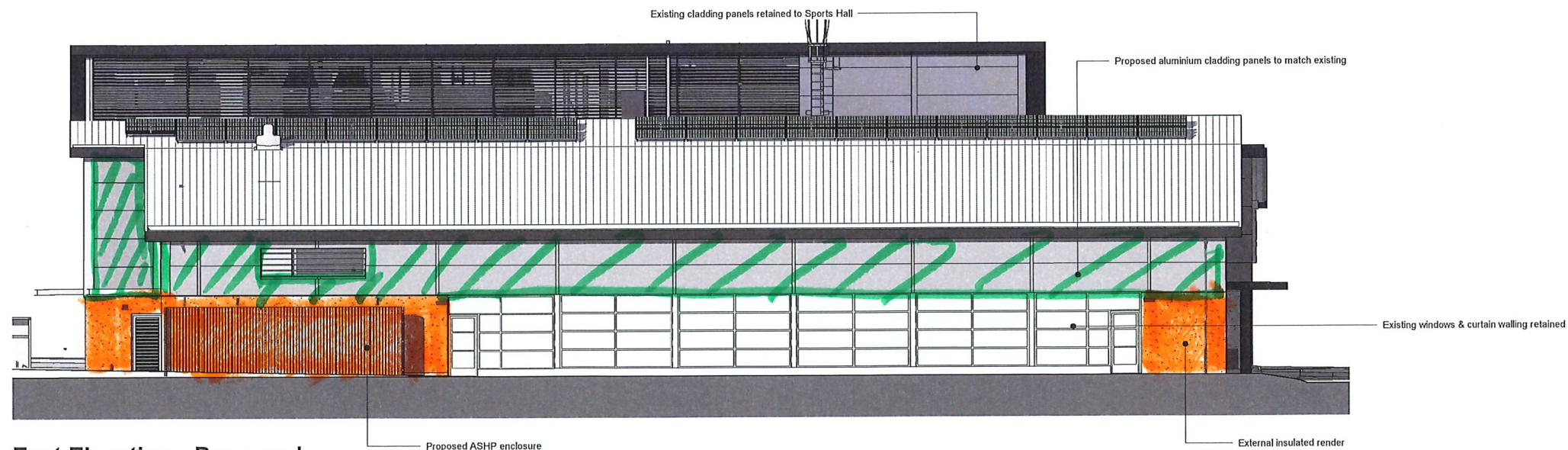
MAINTENANCE/CLEANING

DECOMMISSION/DEMOLITION

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South Elevation - Proposed
1 : 100



East Elevation - Proposed
1 : 100

Scale 1:100
0 1 2 3 5m

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P01	Revision	11.11.24	KP	CSM
No.	Revision	Date	Chk	Auth

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2090	Checked	KP		

Client
Willmott Dixon

Job
Royston Leisure Centre

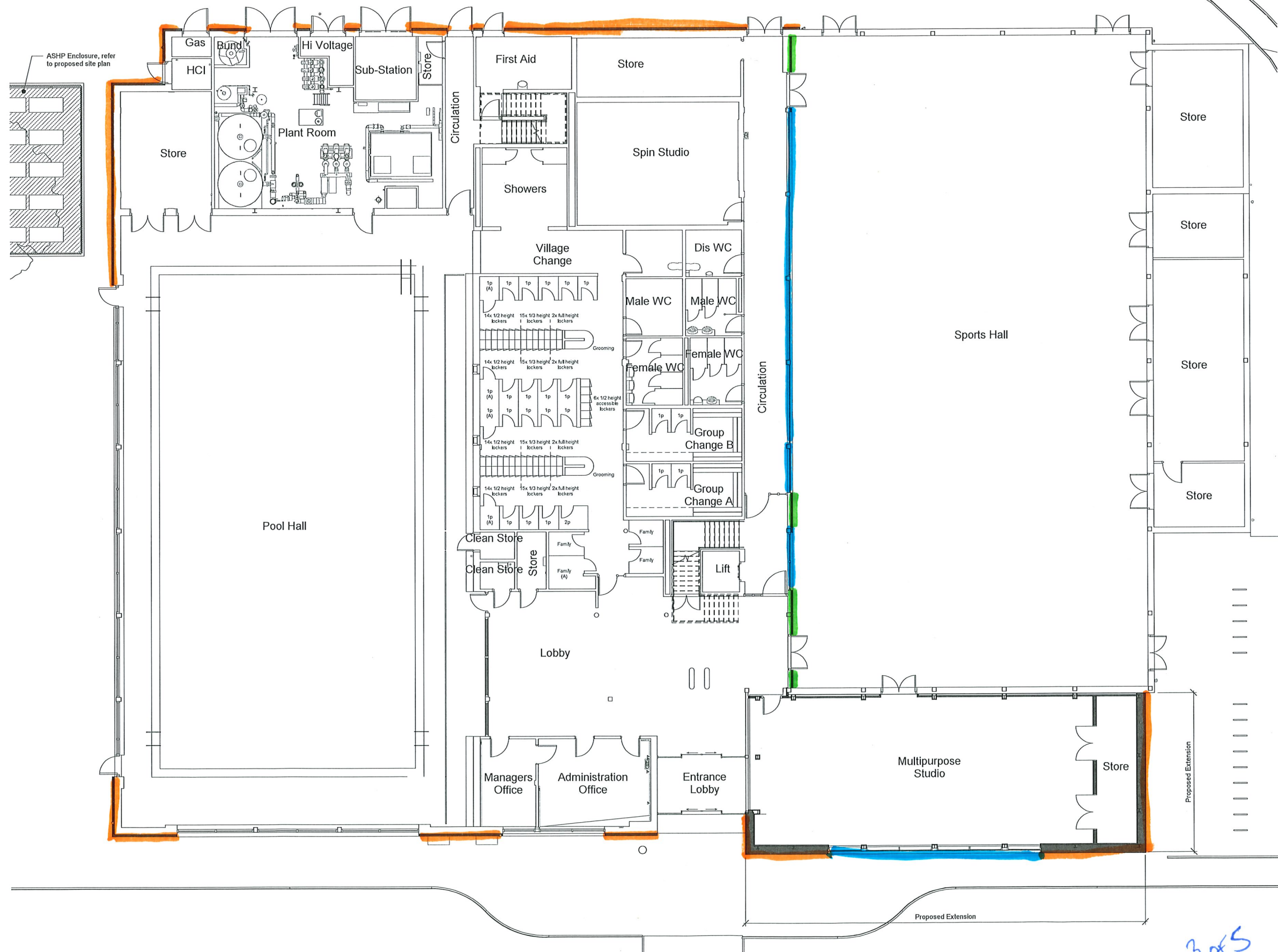
Drawing
Proposed

Scale

Revision

project

2 of 5

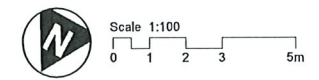


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2090	Checked	KP		

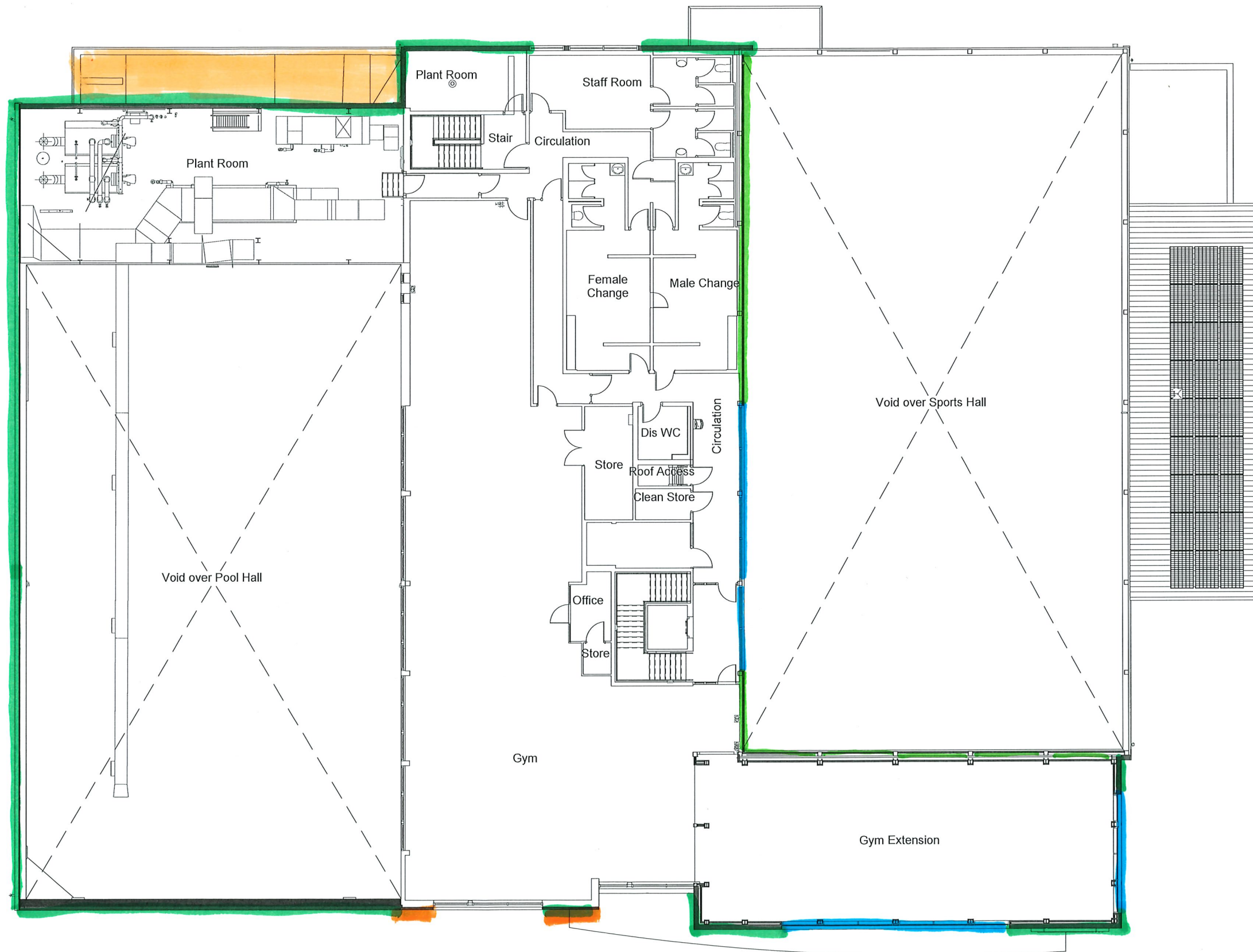
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Willmott Dixon

Job
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Scale

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P01 Planning Issue 27.11.24 KP CSM
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NHDC DECARBONISATION
SBA Project Code 2090
Client Willmott Dixon
Job Royston Leisure Centre
Drawing

Drawn CSM Date 08/11/24
Checked KP

Scale

Revision

project originator zone level type role number

project originator zone level type role number

project originator zone level type role number

project originator zone level type role number

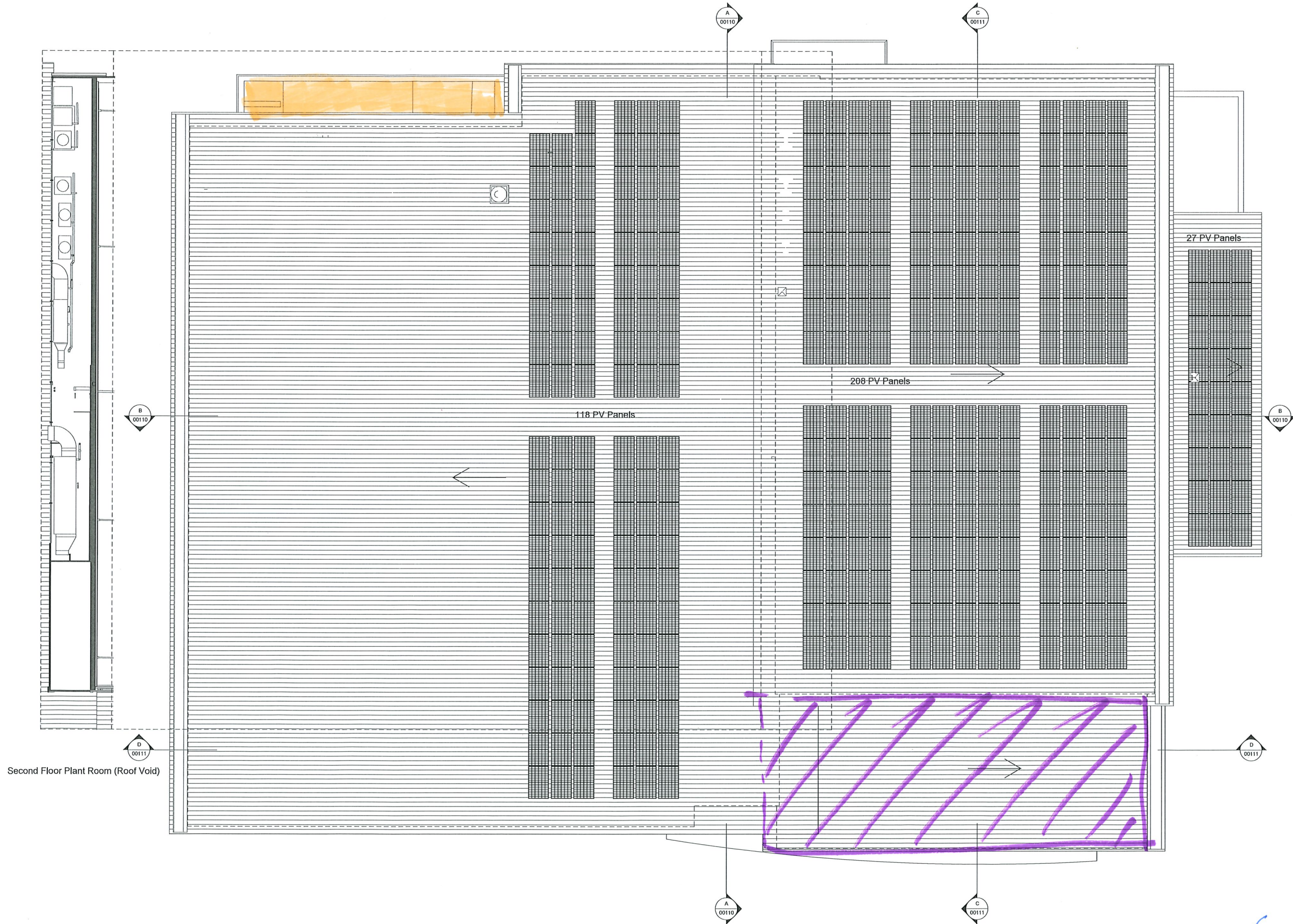
project originator zone level type role number

project originator zone level type role number

project originator zone level type role number

4 of 5

FF



- No. Note
- 1 All dimensions to be verified on site by GENERAL CONTRACTOR prior to any work, setting out or shop drawings being prepared.
 - 2 Drawings not to be scaled. Work to figured dimensions only.
 - 3 Copyright SAUNDERS BOSTON LIMITED. All rights reserved. This drawing remains the property of SAUNDERS BOSTON LIMITED at all times and may not be reproduced or copied in whole or in part without their prior written consent.
 - 4 This drawing and related specifications are for use only in the stated location.
 - 5 This drawing is to be read in conjunction with all other Consultants drawings and specifications.
 - 6 Drainage has not been surveyed and any fall pipe locations and below ground drainage runs are indicative.
 - 7 It is assumed that all works will be carried out by a competent contractor who will be working where appropriate, to an approved method statement.

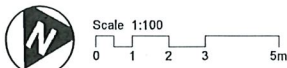
HEALTH, SAFETY & ENVIRONMENTAL INFORMATION
In addition to the hazards/risks normally associated with the types of work detailed on this drawing, also note the following:

CONSTRUCTION

MAINTENANCE/CLEANING

DECOMMISSION/DEMOLITION

Note - drawings based on existing building survey provided by Pinnacle Infotech



P01	Planning Issue	27.11.24	KP	CSM
No.	Revision	Date	CHK	Auth



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NHDC DECARBONISATION

SBA Project Code	Drawn	CSM	Date	30/08/24
2090	Checked	MNL		

Client
Willmott Dixon

Job
Royston Leisure Centre

Drawing
~~Proposed Roof Plant Space and Roof Plan~~

Scale
1:100 CSM

Revision
20

project	originator	zone	level	type	code	number
REL	SBA	XX	RI	DR	XX	10012

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