WOOD & GRIEVE ENGINEERS

Campbelltown Sports and Health Centre of Excellence

ESD Concept Design Report & Geothermal HVAC Feasibility

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Revision

REVISION	DATE	COMMENT	APPROVED BY
1	14/03/2018	Concept Issue	NCJ
2	23/03/2018	Revised Concept Issue	NCJ

Contents

1. Executive Summary

This Ecological Sustainable Development (ESD) Concept Design Report has been prepared by Wood & Grieve Engineers (WGE) at the instruction of Peter Hunt Architects. The report has been prepared in response to preliminary discussion with the project design team & PCG with the intent to provide a response to original project brief & minimum DCP requirements for ESD as part of the project design response.

The intent of this ESD Concept Design Report is to:

- Identify two potential avenues of design response for the inclusion of ESD within the project
- Respond to Part 2.4 Sustainable Building Design of the Campbelltown Development Control Plan 2015
- Highlight additional ESD opportunities and strategies to be incorporated into the project design; and
- Provide a high-level overview of a potential geothermal HVAC solution.

To date, WGE have assumed formal NABERS & Green Star ratings are not included the project scope. This position has been formed on the basis of the following:

- The proposed building class is not eligible to receive formal NABERS Certification; and
- The proposed budget allocation of $250K for specific ESD response is unlikely to be sufficient to deliver a formal Green Star certification for the project.

The following chapters present further analysis and two alternative methodologies to respond to the project brief with the intent to outline both the challenges & opportunities to achieve a successful ESD outcome for the project. The two alternative options for compliance include:

- Inclusion of ESD initiatives under the Green Star framework – without formal GBCA certification; and
- An alternative approach to include a geothermal HVAC system which is design to deliver best value for money to the project with respect to both energy efficiency & operational savings.

The two methodologies nominated above have been formed on the basis that the main project drivers for a successful ESD outcome are as follows:

- Intermittent use facility with high peak load (4-9pm weekdays)
- Constant requirement for pool heating
- High water demand
- 250K budget provision for ESD
- A desire to reduce environmental impacts in a cost-effective way
- A desire for design resilience and future paybacks

We trust the detail included within this report presents evidence for further PCG analysis during project concept/schematic design. We additional feedback is required from the client, we have indicated throughout the report via ***bold italic text.***

2. Introduction

The Campbelltown Sports and Health Centre of Excellence (CoE) is a sports and recreation facility in the University of Western Sydney, Campbelltown, NSW. The proposed development includes a heated indoor pool, gym, offices, café, clinical rooms, an indoor court, and a carpark. The CoE will accommodate a range of elite training and sports science research activities, and include specialist equipment. The CoE aims to provide a facility for excellence in services provision and clinical training in the professional health and medical services.

The CoE is in a prime position to integrate sustainability into its core design and construction. The intent of this ESD Design Report is to:

- Identify two potential avenues of design response for the inclusion of ESD within the project
- Respond to Part 2.4 Sustainable Building Design of the Campbelltown Development Control Plan 2015
- Highlight additional ESD opportunities and strategies to be incorporated into the project design; and
- Provide a high-level overview of a potential geothermal HVAC solution.

The following sections outline the project ESD intent identified within both the project brief & the Council development control plan.

2.1 Campbelltown City Council – Project Brief

The project brief for the Campbelltown CoE identified the following key deliverables:

- Prepare an ESD design report outlining proposed design response in accordance with the project brief;
- Develop a computerised energy model in accordance with NABERS energy simulation validation protocol;
- Prepare NCC Section J Compliance Report; and
- Formal application to ESD bodies (NABERS, Green Building Council).

2.2 Campbelltown DCP – Part 2.4: Sustainable Design

Part 2 – Requirements applying to all types of development of the Campbelltown (Sustainable City) Development Control Plan 2015 includes the following key objectives with reference to sustainable building design:

Objectives

O.1 Encourage building design and siting to reduce energy consumption.

O.2 Encourage the use of solar power in building design.

O.3 Encourage the use of water recycling.

O.4 Ensure that residential buildings meet the requirements of BASIX (not applicable to this development).

Section 2.4 is further supplemented by the following guidelines:

- 2.4.1 – Rainwater Tanks – are to be provided for all new buildings (non-residential) containing a roof area of greater than 100m2.

Table 1 "Table 2.4.1" Rain Water Tank Capacity

Roof Area	Capacity of Rain Water Tank
101 m² to 200 m²	3,000L
201 m² to 1,000 m²	5,000L
1,001 m² to 5,000 m²	10,000L
5,001 m² to 10,000 m²	20,000L
10,001 m² to 20,000 m²	50,000L
above 20,000 m²	100,000L

- All new buildings are encouraged to include a solar hot water system. Where the site is connected to gas mains, the system is encouraged to be gas boosted (over electric).
- The design of new buildings shall be encouraged to maximise opportunities for cross flow ventilation, where practical, thus minimising the need for air conditioning.
- Outdoor lighting shall be designed to minimise pollution form the unnecessary dispersion of light into the night sky and neighbouring properties.

Sections 3, 4 & 5 of this report respond in further detail to both the project brief requirements & applicable DCP provisions.

3. Project Design Brief – Challenges

As a prelude to the information provided within Sections 4 & 5, the following provides a summary of the challenges in complying with the ESD outcomes of the project brief.

NABERS

Currently formal NABERS energy certification only applies to commercial office, data centers, retail centers and hotels. The proposed development scheme includes what is predominantly classified as a mixed-use, assembly building. In this instance, the project brief requirement of formal application to the Office of Environment & Heritage NSW to achieve NABERS Certification cannot be complied with. NABERS Methodology for energy assessment could be applied to the project; however formal certification is not achievable at this point in time.

Further to the above, energy modelling performance for the project can be verified via JV3 energy modelling as required by NCC Section J – energy efficiency.

greenstar

Green Star assesses the sustainable design, construction and operation of buildings, fit outs and communities. Our built environment is currently the world's single largest contributor to greenhouse gas emissions, and also consumes around a third of our water, and generates 40 per cent of our waste. Launched by the Green Building Council of Australia in 2003, Green Star is Australia's only national and voluntary rating system for buildings and communities.

Green Star will assess the environmental performance of a project in the following categories:

- Building Management
- Indoor Environment Quality
- Energy (Greenhouse Gas Emissions)
- Transport
- Water
- Materials
- Land Use & Ecology
- Emissions; and
- Innovation

The latest version of Green Star – Design & As-built 1.2 includes both project design & construction under the same certification process. While this ensures the environmental performance in project design is realised at the point of project practical completion, it also adds (at times) significant cost to the administration and execution of project delivery.

The current estimated budget for minimum 4 Star Green Star Design & As-built certification is between $500,000 and $600,000, with the final real cost subject to site-specific variability, project location and consultant/contractor pricing. The projected estimate to achieve Green Star certification significantly exceeds the current ESD budget allocation of $250,000.

With the currently ESD budget allocation is in mind, the current approach is apply the Green Star framework to the project without inheriting the additional administrative costs associated with the Certification process in order to optimise the project spend on ESD initiatives.

4. Proposed Design Methodology 1: Green Star Framework

Sections 4 & 5 detail two alternative approaches to the project's response to allocating the available $250K ESD capital budget.

4.1 Green Star Framework

Methodology 1 includes the utilisation of the Green Star framework without the formal project certification element. The Green Building Council of Australia encourages project's to utilise the Green Star framework as an industry best practice design tool.

An example of the Green Star framework is provided below:

Green Star - Design & As Built Scorecard

Project:	Campbelltown Centre of Excellence
Targeted Rating:	4 Star - Best Practice

Core Points Available	Total Score Targeted
100	45.0

NA	CATEGORY / CREDIT	AIM OF THE CREDIT / SELECTION	CODE	CREDIT CRITERIA	POINTS AVAILABLE	POINTS TARGETED
	Management				14	
	Green Star Accredited Professional	To recognise the appointment and active involvement of a Green Star Accredited Professional in order to ensure that the rating tool is applied effectively and as intended.	1.0	Accredited Professional	1	1
	Commissioning and Tuning	To encourage and recognise commissioning, handover and tuning initiatives that ensure all building services operate to their full potential.	2.0	Environmental Performance Targets	-	Complies
			2.1	Services and Maintainability Review	1	1
			2.2	Building Commissioning	1	1
			2.3	Building Systems Tuning	1	1
			2.4	Independent Commissioning Agent	1	
	Adaptation and Resilience	To encourage and recognise projects that are resilient to the impacts of a changing climate and natural disasters.	3.1	Implementation of a Climate Adaptation Plan	2	2
	Building Information	To recognise the development and provision of building information that facilitates understanding of a building's systems, operation and maintenance requirements, and environmental targets to enable the optimised performance.	4.1	Building Operations and Maintenance Information	1	1
			4.2	Building User Information	1	1
	Commitment to Performance	To recognise practices that encourage building owners, building occupants and facilities management teams to set targets and monitor environmental performance in a collaborative way.	5.1	Environmental Building Performance	1	1
			5.2	End of Life Waste Performance	1	
	Metering and Monitoring	To recognise the implementation of effective energy and water metering and monitoring systems.	6.0	Metering	-	Complies
			6.1	Monitoring Systems	1	1
	Construction Environmental Management	To reward projects that use best practice formal environmental management procedures during construction.	7.0	Environmental Management Plan	-	Complies
			7.1	Formalised Environmental Management System	1	1
	Operational Waste	Prescriptive Pathway	8A	Performance Pathway - Specialist Plan	-	
			8B	Prescriptive Pathway - Facilities	1	1
	Total				14	12

By utilising the Green Star framework the development can look to implement a number of industry best practice ESD initiatives and maximise the benefit of the $250K budget allocation. Examples of ESD initiatives that can be included within the develop by utilising the Green Star framework include:

- Comprehensive commissioning & tuning (HVAC, lighting, water, BMS) post practical completion – ensuring building operation achieves the design efficiency.
- Energy / water sub-metering for operational efficiency monitoring and management.
- Construction environmental management plan – ISO14001 – ensuring the construction of the project does not result in significant or irreversible environmental damage.
- Effective operational waste facilities which reduce waste to landfill rates by including appropriate provisions for recycling including paper, glass, cardboard, plastic & green wastes.
- Improved Acoustic comfort – resulting in higher performing and more comfortable interior environment.
- Lighting efficiency – LED lighting as standard.
- Lighting controls – daylight / motion sensor and/or BMS control.
- Improved thermal comfort – high performance building fabric improving energy efficiency and reduced condensation risks.
- High WELS rated FFE to achieve potable water demand reduction.
- 90% diversion from landfill construction & demolition waste target for the mains works contractor.
- PVC (pipes, cables, etc.) to be sourced from best practice manufacturers.
- Steel to be sourced from members of Australian Steel Institute Sustainability Charter.
- Inclusion of opportunities for sustainable transport – secure bicycle storage, lockers, end of trip facilities to encourage the adoption of sustainable transport methods.
- Maintained ecological value of the site – ensuring the proposed development does not cause significant impacts to the local ecology of the site.
- Drought tolerant landscaping – reducing potable water demand
- Stormwater management – including ensuring post development levels do not exceed post development levels.

The above list of initiatives can be achieved within the project with very little additional cost premium to the project with the removal of the project administration requirements required for a Green Star project certification.

Further information on Green Star design framework is provided within Appendix A of this report.

4.2 Campbelltown DCP – Response

Relevant clauses in the Campbelltown DCP the adoption of the Green Star framework can address the following relevant Sections of the Campbelltown City Council DCP 2015.

2.4.1 b) A rain water tank shall be provided for all new buildings containing a roof area greater than 100sqm for all development not specified by BASIX. The rain water tank shall have a minimum capacity in accordance with Table 2.4.1.

Response: The roof area is between 1,001 m^2 and 5,000 m^2, therefore the capacity of the rain water tank to be installed on the site shall be min.10,000L. Under the Green Star methodology, this capacity could increase to as much as 65,000L. A detailed potable water supply calculation can be undertaken to identify the final RWT size for inclusion within the project.

Client to confirm if additional storage capacity is required for sporting field irrigation.

2.4.1 d) The rain water tank incorporated in new commercial and industrial development exceeding 5,000sqm shall be connected to the plumbing in the building to provide water for toilets.

Response: The proposed development does not specifically fall within the category of commercial or industrial development, however the final commitment on rainwater reuse will be determined via the scope inclusion of rainwater tank size & end use demand.

Client to confirm if toilet flushing connection to rainwater tank is required – subject to inclusion of sport field irrigation demand.

2.4.2 a) All new buildings are encouraged to provide a solar hot water system.

Response: A solar hot water system will be considered as an alternative option for the project if the use of geothermal energy exchange is not pursued. Refer section 5.0 for additional information of the proposed geothermal HVAC solution. In the event the project does not proceed with this option, solar hot water can be consider as an alternative.

2.4.2 b) Where the site is connected to the gas main, the solar hot water system is encouraged to be gas boosted.

Response: hot water system is expected to be gas fired, solar integration TBC.

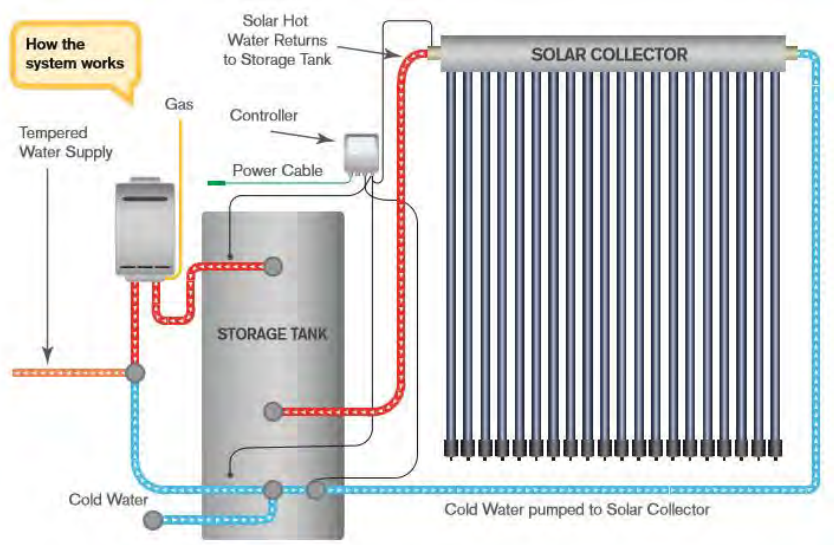

Figure 1: Gas Solar-boosted hot water system. Source: Solar Hot Water Queensland

2.4.3 a) The design of new buildings shall be encouraged to maximise opportunities for cross fow ventilation, where practical, thus minimising the need for air conditioning.

Response: It is recommended the Indoor sports halls be naturally ventilated. Natural ventilation and mixed mode operation of the change rooms and pool will also be investigated. Humidity control will also need to be further assessed in accordance with the pool design.

2.4.4 a) Outdoor lighting shall be designed to minimise pollution from the unnecessary dispersion of light into the night sky and neighboring properties.

Response: Outdoor lighting will be designed in accordance with the Green Star Design and As Built v1.2 credit requirements – *AS4282: 1997 Control of the Obtrusive Effects of Outdoor Lighting*. This design standard limits light pollution & impacts on ecology beyond the site boundary & the night sky.

5. Proposed Design Methodology 2: Geothermal HVAC System

Proposed design methodology 2 would be to focus the majority of the allocated $250K ESD budget allowance into an ESD initiative designed to provide the single biggest bang for investment. Based on the project characteristics, WGE believe this is to be achieved by implementing more energy efficiency HVAC system which will address both swimming pool heating & intermittent HVAC demand for the facility during peak daily periods.

Based on this approach, we believe the project should consider further feasibility on the value of including a dedicated geothermal HVAC system.

5.1 System Overview

The heating and cooling requirements of the proposed development operating in parallel (swimming pool / remaining sports complex), coupled with the new carpark and oval work, make the CoE an ideal candidate site for geothermal exchange system.

A geothermal system works with the constant temperatures of the ground to maintain indoor temperatures and pool temperature with ground heat exchangers. Water is then pumped to a ground source heat pump to provide pool heating and air conditioning.

This type of system can be highly efficient and address the parallel HVAC requirements of constant pool heating and intermittent cooling of the remaining sports complex.

Benefits of a geothermal system:

- Lower greenhouse gas emissions
- Low energy costs (up to 70% savings in heating mode)
- Lower maintenance costs
- Quiet – less acoustic treatment requirements
- Increased floor space – reductions in space required for plant could increase GFA by up to 3%.
- Improved look of the building – no roof mounted plant is required.
- Simple sustainability marketing tool.
- Future proofing – constant heat source/sink.

The temperature of the ground in Campbelltown is 16-18°C. Water is pumped through bores in the ground, rejecting or extracting heat from the ground. A similar system to the one proposed has been retrofitted to St Peter's College in Adelaide. Refer Appendix A for a dedicated swimming pool facility case study.

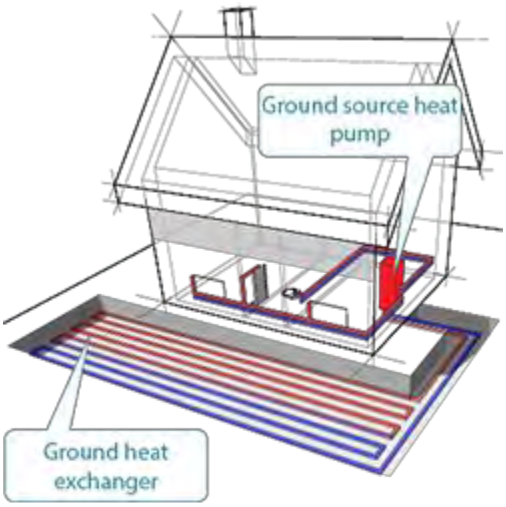

Figure 2: Ground Source heat exchange system. Source: Geoexchange Australia

5.2 System Equipment

There are many ways to optimise a geothermal solution. The option presented below is a 100% geothermal heating and cooling system with no additional air conditioning systems. As further energy modelling and site analysis is undertaken the optimal solution will be better resolved. This may include a partial geothermal system with some traditional air conditioning plant.

The following is a high-level summary of the HVAC equipment required:

- A conservative estimate of 65 (100m deep) ground heat exchanger bore holes at $9,500 each. This is likely to be revised down with energy modelling.
- Ground source heat pumps for air conditioning – transfer energy from water to air.
- Ground source heat pump for pool – transfer energy from water to water.

Traditional system equipment removed as a result of the geothermal system:

- Cooling towers & condensers on the roof for air conditioning.
- Boilers to heat the pool.

5.3 Cost Feasibility

The additional ground heat exchanger bore holes are expected to add up to an additional $600,000 to the cost of a traditional HVAC system for the site. This is a conservative estimate and may be less in reality.

System payback is estimated at between 10-12 years (further refinement may identify additional efficiency). The pay back will be faster if:

- Ground conditions are favorable so less bores are required;
- Energy modelling demonstrates a requirement for fewer bores and
- Energy prices increase (as they are expected to do so in future).

After the payback period is complete, the CoE will be saving around $50,000/year in electricity costs.

5.4 Additional Funding Methods

In the event the proposed geothermal system does not fit within the project budget, there are a range of low cost capital available for renewable energy projects in Australia which can be considered by the client.

Clean Energy Finance Corporation is a specialist clean energy financier, investing with commercial rigor to increase the flow of finance into renewable energy, energy efficiency and low emissions technologies. CEFC invest in projects with the strongest potential for decarbonisation, including low carbon electricity, such as solar, wind, battery storage and bioenergy; ambitious energy efficiency, such as property, infrastructure, manufacturing and agribusiness; and electrification and fuel switching, such as vehicles and biofuels.

In addition to CEFC additional financing mechanisms are available if additional capital works funding is required to include the geothermal system within the project budget.

APPENDIX A : Green Star Framework

Green Star - Design & As Built Scorecard

Project:	Campbelltown Centre of Excellence
Targeted Rating:	4 Star - Best Practice

Core Points Available	Total Score Targeted
100	52.0

Total Points Awarded	Total Points TBC
0.0	0.0

NA	CATEGORY / CREDIT	AIM OF THE CREDIT / SELECTION	CODE	CREDIT CRITERIA	POINTS AVAILABLE	POINTS TARGETED	POINTS AWARDED	POINTS TBC	OUTCOME	ASSESSMENT COMMENTS
	Management				14					
	Green Star Accredited Professional	To recognise the appointment and active involvement of a Green Star Accredited Professional in order to ensure that the rating tool is applied effectively and as intended.	1.0	Accredited Professional	1	1				WGE Accredited GSAP as part of the project design team.
	Commissioning and Tuning	To encourage and recognise commissioning, handover and tuning initiatives that ensure all building services operate to their full potential.	2.0	Environmental Performance Targets	-	Complies				
			2.1	Services and Maintainability Review	1	1				To be undertaken prior to design finalisation.
			2.2	Building Commissioning	1	1				To be contractually required by the main works contractor.
			2.3	Building Systems Tuning	1	1				To be contractually required by the main works contractor.
			2.4	Independent Commissioning Agent	1					
	Adaptation and Resilience	To encourage and recognise projects that are resilient to the impacts of a changing climate and natural disasters.	3.1	Implementation of a Climate Adaptation Plan	2	2				To be developed during detailed design phase.
	Building Information	To recognise the development and provision of building information that facilitates understanding of a building's systems, operation and maintenance requirements, and environmental targets to enable the optimised performance.	4.1	Building Operations and Maintenance Information	1	1				To be developed & provided to buidlng users.
			4.2	Building User Information	1	1				To be developed & provided to buidlng users.
	Commitment to Performance	To recognise practices that encourage building owners, building occupants and facilities management teams to set targets and monitor environmental performance in a collaborative way.	5.1	Environmental Building Performance	1	1				To be developed during detailed design phase.
			5.2	End of Life Waste Performance	1					
	Metering and Monitoring	To recognise the implementation of effective energy and water metering and monitoring systems.	6.0	Metering	-	Complies				
			6.1	Monitoring Systems	1	1				BMS link to metering for effective management & monitoring.
	Construction Environmental Management	To reward projects that use best practice formal environmental management procedures during construction.	7.0	Environmental Management Plan	-	Complies				
			7.1	Formalised Environmental Management System	1	1				To be contractually required by the main works contractor.
	Operational Waste	Prescriptive Pathway	8A	Performance Pathway - Specialist Plan	-					
			8B	Prescriptive Pathway - Facilities	1	1				Waste provisions to comply with Green Star standard.
	Total				14	12	0	0		

NA	CATEGORY / CREDIT	AIM OF THE CREDIT / SELECTION	CODE	CREDIT CRITERIA	POINTS AVAILABLE	POINTS TARGETED	POINTS AWARDED	POINTS TBC	OUTCOME	ASSESSMENT COMMENTS
	Indoor Environment Quality				17					
□	Indoor Air Quality	To recognise projects that provide high air quality to occupants.	9.1	Ventilation System Attributes	1	1				To be developed during detailed design phase.
□			9.2	Provision of Outdoor Air	2					
□			9.3	Exhaust or Elimination of Pollutants	1	1				To be developed during detailed design phase.
□	Acoustic Comfort	To reward projects that provide appropriate and comfortable acoustic conditions for occupants.	10.1	Internal Noise Levels	1	1				Acoustic design to manage internal noise levels.
□			10.2	Reverberation	1					
□			10.3	Acoustic Separation	1					
	Lighting Comfort	To encourage and recognise well-lit spaces that provide a high degree of comfort to users.	11.0	Minimum Lighting Comfort	-	Complies				
□			11.1	General Illuminance and Glare Reduction	1	1				Electrical lighting design to achieve Green Star criteria.
□			11.2	Surface Illuminance	1					
□			11.3	Localised Lighting Control	1					
	Visual Comfort	To recognise the delivery of well-lit spaces that provide high levels of visual comfort to building occupants.	12.0	Glare Reduction	-	Complies				
□			12.1	Daylight	2	2				Design to include high levels of natural daylight.
□			12.2	Views	1	1				Design to include access to external views for building occupants.
□	Indoor Pollutants	To recognise projects that safeguard occupant health through the reduction in internal air pollutant levels.	13.1	Paints, Adhesives, Sealants and Carpets	1	1				Architectural specification to include
□			13.2	Engineered Wood Products	1	1				Architectural specification to include
□	Thermal Comfort	To encourage and recognise projects that achieve high levels of thermal comfort.	14.1	Thermal Comfort	1					
□			14.2	Advanced Thermal Comfort	1					
	Total				17	9	0	0		

NA	CATEGORY / CREDIT	AIM OF THE CREDIT / SELECTION	CODE	CREDIT CRITERIA	POINTS AVAILABLE	POINTS TARGETED	POINTS AWARDED	POINTS TBC	OUTCOME	ASSESSMENT COMMENTS
	Energy				22					
	Greenhouse Gas Emissions	E. Modelled Performance Pathway	15A.0	Conditional Requirement: Prescriptive Pathway	-					
			15A.1	Building Envelope	-					
			15A.2	Glazing	-					
			15A.3	Lighting	-					
			15A.4	Ventilation and Air-conditioning	-					
			15A.5	Domestic Hot Water Systems	-					
			15A.6	Building Sealing	-					
			15A.7	Accredited GreenPower	-					
			15B.0	Conditional Requirement: NatHERS Pathway	-					
			15B.1	NatHERS Pathway	-					
			15C.0	Conditional Requirement: BASIX Pathway	-					
			15C.1	BASIX Pathway	-					

		15D.0	Conditional Requirement: NABERS Pathway	-				
		15D.1	NABERS Energy Commitment Agreement Pathway	-				
		15E.0	Conditional Requirement: Reference Building Pathway	-	Complies			
		15E.1	Comparison to a Reference Building Pathway	20	5			To be developed during detailed design phase.
Peak Electricity Demand Reduction	Performance Pathway	16A	Prescriptive Pathway - On-site Energy Generation	-				
		16B	Performance Pathway - Reference Building	2				
Total				22	5	0	0	

Transport				10				
Sustainable Transport	Performance Pathway	17A.1	Performance Pathway	10	7			To be developed during detailed design phase.
		17B.1	Access by Public Transport	0				
		17B.2	Reduced Car Parking Provision	0				
		17B.3	Low Emission Vehicle Infrastructure	0				
		17B.4	Active Transport Facilities	0				
		17B.5	Walkable Neighbourhoods	0				
Total				10	7	0	0	

Water				12				
Potable Water	Prescriptive Pathway	18A.1	Potable Water - Performance Pathway	0				
		18B.1	Sanitary Fixture Efficiency	1	1			Architectural specification to include.
		18B.2	Rainwater Reuse	1	1			Rainwater reuse tank to be sized during detailed design.
		18B.3	Heat Rejection	2	2			No water based heat rejection system - proposed geothermal system is a closed loop design deemed to be compliant.
		18B.4	Landscape Irrigation	1	1			Landscape irrigation to include sub-soil delivery.
		18B.5	Fire System Test Water	1				
Total				6	5	0	0	

Materials				14				
Life Cycle Impacts	Performance Pathway - Life Cycle Assessment	19A.1	Comparative Life Cycle Assessment	6	3			To be developed during detailed design phase.
		19A.2	Additional Life Cycle Impact Reporting	1	1			To be developed during detailed design phase.
		19B.1	Concrete	0				
		19B.2	Steel	0				
		19B.3	Building Reuse	0				
Responsible Building Materials	To reward projects that include materials that are responsibly sourced or have a sustainable supply chain.	20.1	Structural and Reinforcing Steel	1	1			Architectural specification to include.
		20.2	Timber Products	1				
		20.3	Permanent Formwork, Pipes, Flooring, Blinds and Cables	1	1			Architectural specification to include.
Sustainable Products	To encourage sustainability and transparency in product specification.	21.1	Product Transparency and Sustainability	3				
Construction and Demolition Waste	Percentage Benchmark	22A	Fixed Benchmark	-				
		22B	Percentage Benchmark	1	1			
Total				14	7	0	0	

Land Use & Ecology				6				
Ecological Value	To reward projects that improve the ecological value of their site.	23.0	Endangered, Threatened or Vulnerable Species	-	Complies			
		23.1	Ecological Value	3				
Sustainable Sites	To reward projects that choose to develop sites that have limited ecological value, re-use previously developed land and remediate contaminate land.	24.0	Conditional Requirement	-	Complies			
		24.1	Reuse of Land	1				
		24.2	Contamination and Hazardous Materials	1				
Heat Island Effect	To encourage and recognise projects that reduce the contribution of the project site to the heat island effect.	25.0	Heat Island Effect Reduction	1				
Total				6	0	0	0	

Emissions				5				
Stormwater	To reward projects that minimise peak stormwater flows and reduce pollutants entering public sewer infrastructure.	26.1	Reduced Peak Discharge	1	1			Stormwater design to include provisions to comply with Green Star.
		26.2	Reduced Pollution Targets	1	1			Stormwater design to include provisions to comply with Green Star.
Light Pollution	To reward projects that minimise light pollution.	27.0	Light Pollution to Neighbouring Bodies	-	Complies			
		27.1	Light Pollution to Night Sky	1	1			Electrical design to comply with Green Star standards.
Microbial Control	To recognise projects that implement systems to minimise the impacts associated with harmful microbes in building systems.	28.0	Legionella Impacts from Cooling Systems	1	1			No water based heat rejection system - proposed geothermal system is a closed loop design deemed to be compliant.
Refrigerant Impacts	To encourage operational practices that minimise the environmental impacts of refrigeration equipment.	29.0	Refrigerants Impacts	1				
Total				5	4	0	0	

Innovation				10					
Innovative Technology or Process	The project meets the aims of an existing credit using a technology or process that is considered innovative in Australia or the world.	30A	Innovative Technology or Process	10					
Market Transformation	The project has undertaken a sustainability initiative that substantially contributes to the broader market transformation towards sustainable development in	30B	Market Transformation						
Improving on Green Star Benchmarks	The project has achieved full points in a Green Star credit and demonstrates a substantial improvement on the benchmark required to achieve full points.	30C	Improving on Green Star Benchmarks						
Innovation Challenge	Where the project addresses an sustainability issue not included within any of the Credits in the existing Green Star rating tools.	30D	Innovation Challenge		3				To be developed during detailed design phase.
Global Sustainability	Project teams may adopt an approved credit from a Global Green Building Rating tool that addresses a sustainability issue that is currently outside the scope of this Green Star	30E	Global Sustainability						
Total				10	3	0	0		

TOTALS	AVAILABLE	TARGETED	AWARDED	TBC
CORE POINTS	100	49.0	0.0	0.0
CATEGORY PERCENTAGE SCORE		49.0		
INNOVATION POINTS	10	3.0		
TOTAL SCORE TARGETED		52.0		

APPENDIX B Geothermal Case Study – St Peters College, SA.

Note: Digital clips below can be further viewed at http://www.geoexchange.com.au

St Peter's College Pool, Adelaide, SA

Year installed: 2016

System capacity: 170 kW Cooling, 180 kW Heating

Delivery method: Water to Air Ground Source Heat Pumps (GSHPs) for ducted heating and cooling and Water to Water Reversible Chiller GSHP's for swimming pool water heating

Ground Source Heat Pump: WaterFurnace Envision Series XL Ducted water-to-air, WaterFurnace Envision2 Chiller NKW water-to-water.

Ground Heat Exchanger: Vertical boreholes

ENERGY SAVING: Up to 60 % savings compared to conventional reverse-cycle air-conditioning

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In 2016, St Peter's College in Adelaide became the first school in South Australia to use geoexchange to heat their indoor pool and provide space conditioning to the pool enclosure.

We designed and installed the geoexchange system.

Watch this video to discover how we helped the college save money on it's heating and cooling bills while also taking steps to a sustainable future:

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Birds Eye View of a Geoexchange Ground Heat Exchanger

Partnering with the Energy Efficiency Council

Drilling Program

This timelapse video shows the complete drilling program at St.Peter's:

Ground temperatures of 17C are accessed through the installation of a Ground Heat Exchanger (GHX) beneath the adjacent sports oval. This consists of 45 boreholes drilled to a depth of 70 metres each.

The water circulated through the polyethylene pipe within this GHX extract heat from the ground and deliver it to a series of Ground Source Heat Pumps (GSHPs) that are located in the main plant room.

Two of the GSHPs transfer this heat from the GHX into the pool water while six GSHPs supply the pool hall with space heating and/or cooling.

360° Video of the Plantroom

This 360-degree video shows the plantroom at St Peter's. This video technology enables the user to pan around while viewing, thus seeing the plantroom from various angles and giving an insight into the geoexchange system setup.

Jason Haseldine, St Peter’s College Director of Finance and Administration, said the installation of a geothermal energy solution aligns with the School’s vision for sustainability outlined in its Strategic Plan, Our Preferred Future 2015-2018.

> *“Environmental sustainability is one of the world’s greatest challenges and we must all do what we can to address this global issue – we must focus on minimising our carbon emissions and environmental footprint through energy, water consumption and waste recycling,” he said.*
>
> *“I am excited to see our School lead the way in South Australia and take the first step towards our sustainable future, with the start of these important geothermal works.*
>
> *“As a School, these works are also significant for our students – they will help us, as educators, continue to lead by example for our boys and educate them about living sustainably so they develop into environmentally-responsible adults.”*

Yale Carden, the Managing Director of GeoExchange Australia said St Peter’s College is to be commended for identifying the importance of energy efficiency to their overall sustainability strategy.

> *“Schools have a leading role to play in the necessary transition to a clean energy future and St Peter’s College has embraced this responsibility,” he said.*
>
> *“Their leading role is an important element in assisting the South Australian Government achieve their stated target of Adelaide being a carbon neutral city by 2050.”*

Featured in:

- **HVAC&R Nation**
- EcoLibrium, March 2016

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