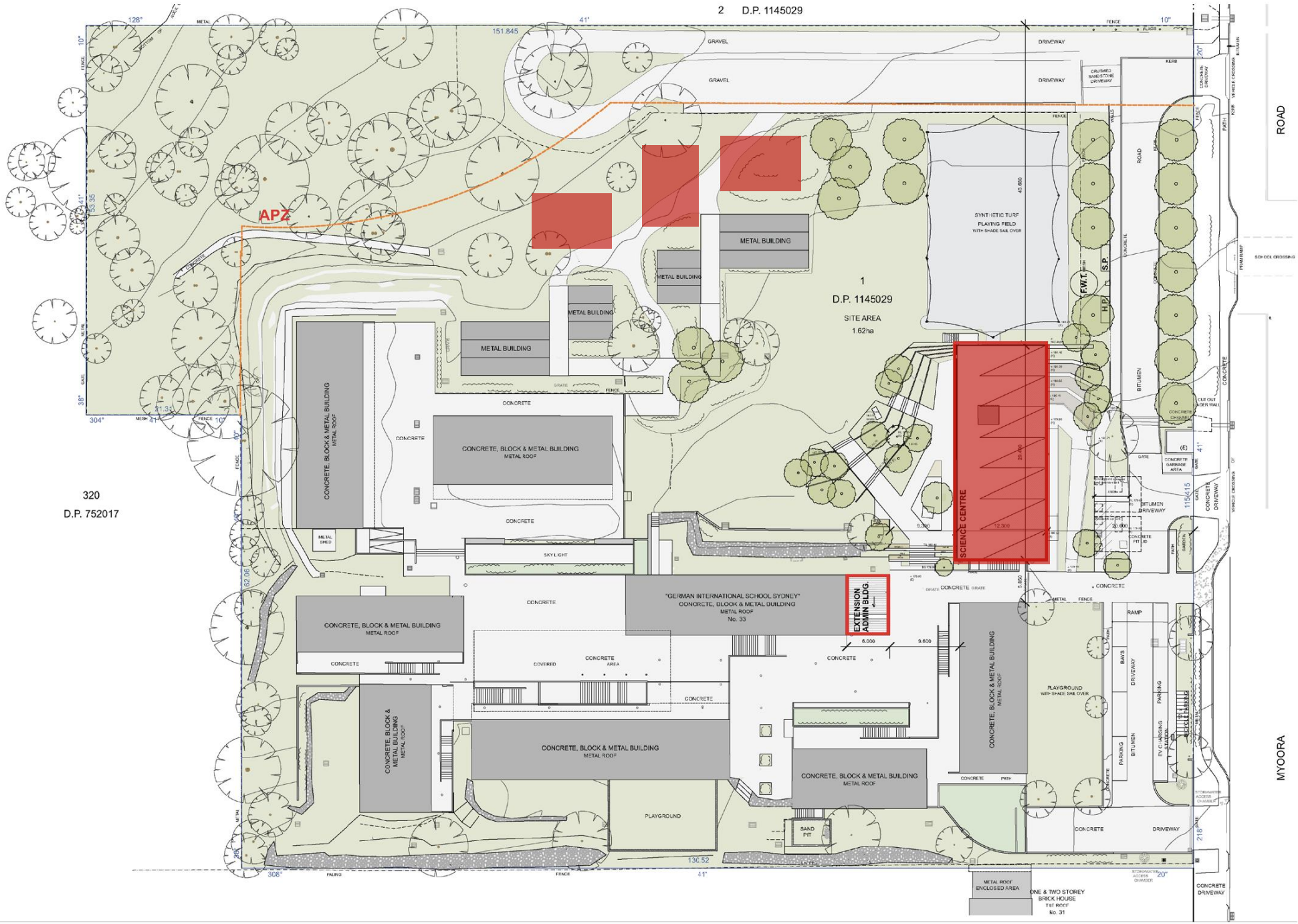
SEED - SUSTAINABLE ENVIRONMENTAL EDUCATION SPACES

CLT PASSIVEHOUSE CLASSROOMS

Australia’s first CLT Passivhaus demountable classrooms

GERMAN INTERNATIONAL
SCHOOL SYDNEY


2 D.P. 1145029
1
D.P. 1145029
SITE AREA
1.62ha
320
D.P. 752017
APZ
SCIENCE CENTRE
EXTENSION ADMIN BLDG.
"GERMAN INTERNATIONAL SCHOOL SYDNEY"
CONCRETE, BLOCK & METAL BUILDING
METAL ROOF
No. 33
CONCRETE, BLOCK & METAL BUILDING
METAL ROOF
METAL BUILDING
SYNTHETIC TURF
PLAYING FIELD
WITH SHADE SAIL OVER
PLAYGROUND
WITH SHADE SAIL OVER
SAND PIT
ONE & TWO STOREY
BRICK HOUSE
TILE ROOF
No. 31
METAL ROOF
ENCLOSED AREA
ROAD
MYOORA

MASTERPLAN

SCIENCE CENTRE

BRIEF

- 3 portable flexible learning spaces for 24 students to ease pressure on existing (small) classrooms

- As energy efficient as possible (accepting that demountables are generally not highly rated)

- cost efficient building

DEMOUNTABLES

DEMOUNTABLES

BRIEF

- 3 portable flexible learning spaces for 28 students to ease pressure on existing (small) classrooms

- As energy efficient as possible (accepting that demountables are generally not highly rated)

- cost efficient building

THERE NEEDS TO BE A BETTER WAY OF DOING THIS!

KEY SUSTAINABILITY FEATURES

- Australia’s first Passivhaus demountable classroom
- Carbon-negative footprint of structure, storing 63 t CO2
- Almost no construction waste (e.g. 97.4% use of CLT mother panel)
- 90% reduction heating/cooling load
- Highly insulated airtight envelope with triple glazed, thermally broken windows
- Heat recovery ventilation for constant fresh filtered air supply
- Solar PV (7.5 kW) to cover building’s usage and supply extra over to Campus
- Built from renewable resources, using cross-laminated timber (CLT) for the structure and internal finishes, and timber for cladding

PASSIVHAUS STANDARD

Principles

PASSIVHAUS STANDARD

- Leading international low-energy design standard

- Developed in Germany in 1990 for small- and large-scale buildings of all types, i.e. Residential, work spaces, education, hospitals, …

- Scientifically proven, and cost-effective method to provide significantly improved comfort and indoor air quality, with minimal heating/cooling bills.

- Built with meticulous attention to detail and rigorous design and construction, according to principles developed by the International Passive House Institute (PHI), purely based on building physics

- 100,000+ Passivhaus buildings completed worldwide.

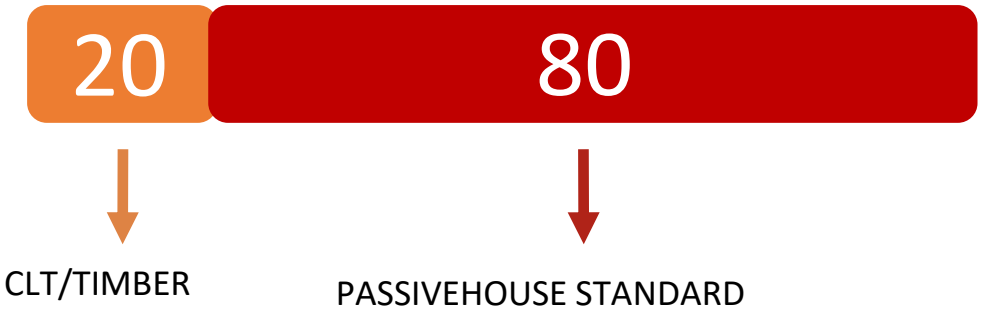
- Less than 60 completed in Australia, all from the last 6 years, about half from the last 3 years.

- Currently experiencing a large growth, as it offers exceptional independently verified quality (construction crisis in NSW) and critical response to a warming climate (recent bushfire season/pandemic)

- Canada went from 1 PH building in 2009 to more than 20% of all new construction in 10 years.

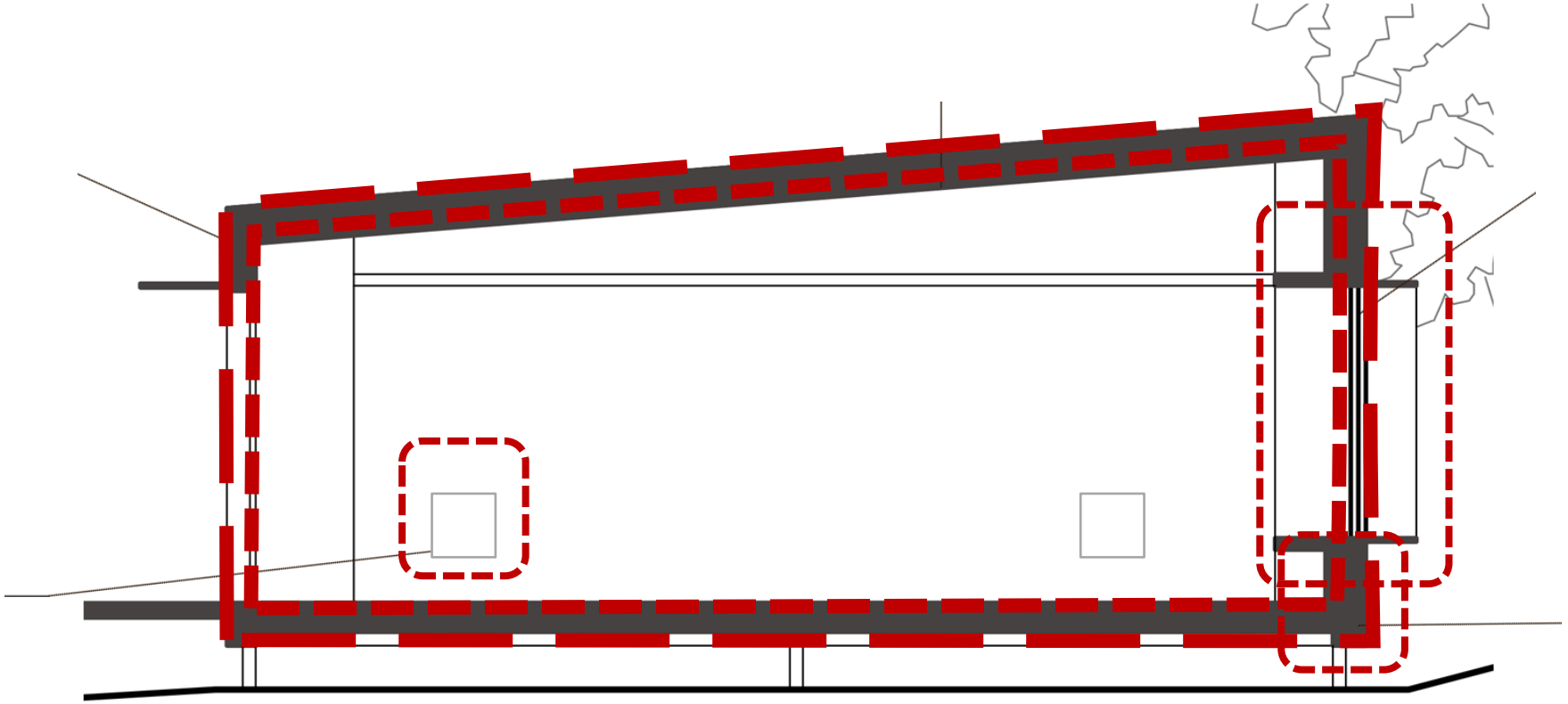
PASSIVHAUS STANDARD

- Importance of energy efficiency (for heating and cooling)
- Embodied energy vs operational energy in buildings



Benefits:

- 90% reduction heating/cooling costs
- No heating/ cooling only (SYDNEY) during prolonged heatwaves
- Increased thermal comfort during summer and winter - no draughts – temp. 20-25 C, regardless of outdoor temperature
- Healthy building – clean filtered air, no mould, no allergens, no smoke during bushfire season
- Very high built construction quality due to additional independent Passivhaus certifier

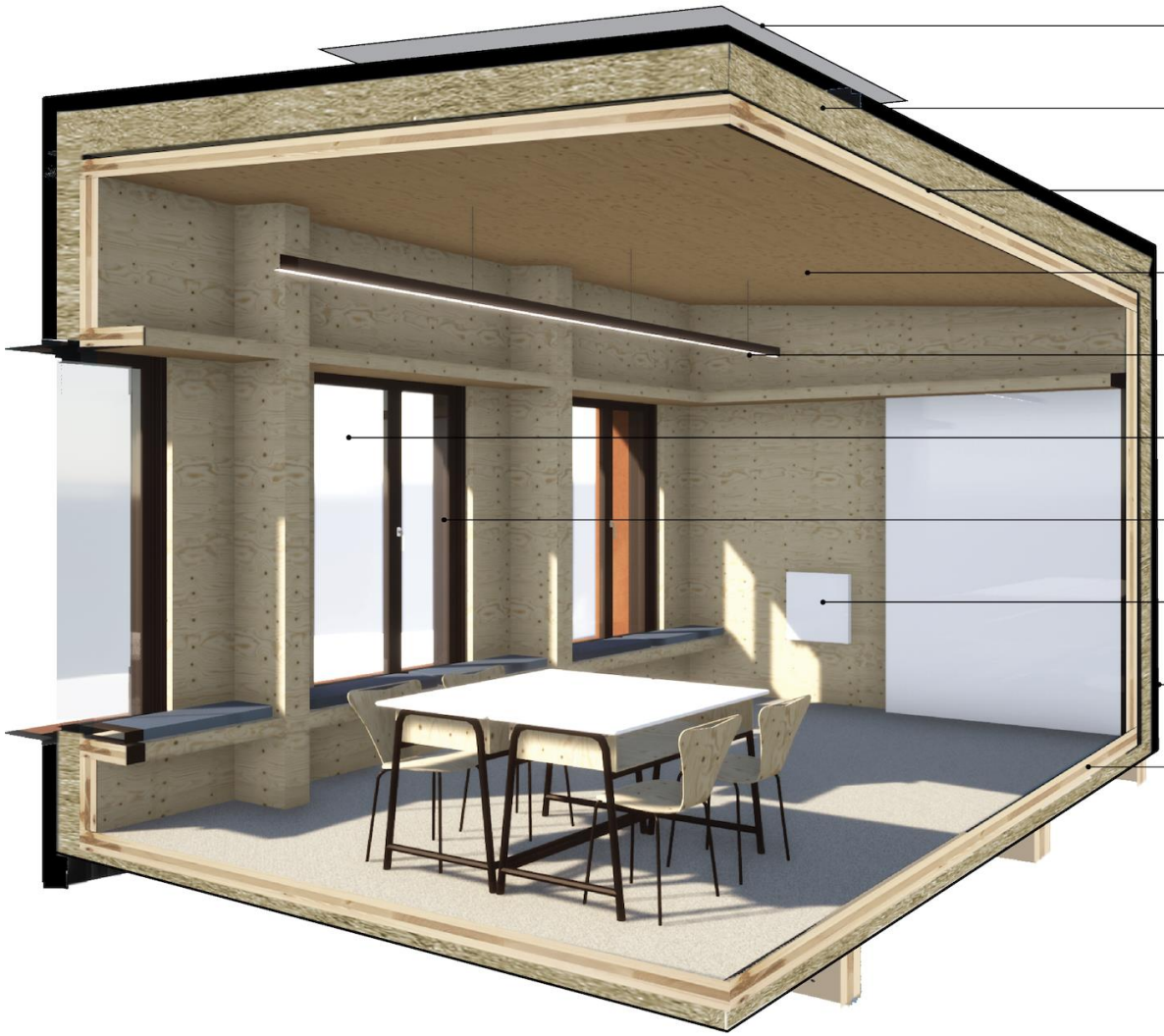


Insulation:
Rockwool
Rigid fibre insulation λ=0.038

U-Value Wall: 0.253 W/(m²K) (~R 4)
U-Value Roof: 0.182 W/(m²K) (~R 6)
U-Value Slab: 0.351 W/(m²K) (~R 2)

Windows:
Raico thermally broken aluminium
U-Value Frame: 1.1 W/(m²K)
Glazing
Triple glazed St.Gobain 4/12/4/10/4
U-Value glass: 0.72 W/(m²K)
g –value: 55 %

HRV
Decentralised system:
4 x Lunos Nexxt



SOLAR PV PANELS

PASSIVHAUS STANDARD (PH) ROOF INSULATION

AIRTIGHTNESS LAYER / SERVICES ZONE

CROSS LAMINATED TIMBER STRUCTURE (CLT)

ENERGY EFFICIENT LED LIGHTING

TRIPLE GLAZING

THERMALLY BROKEN WINDOW SYSTEM

HEAT RECOVERY VENTILATION

PH WALL INSULATION

PH FLOOR INSULATION

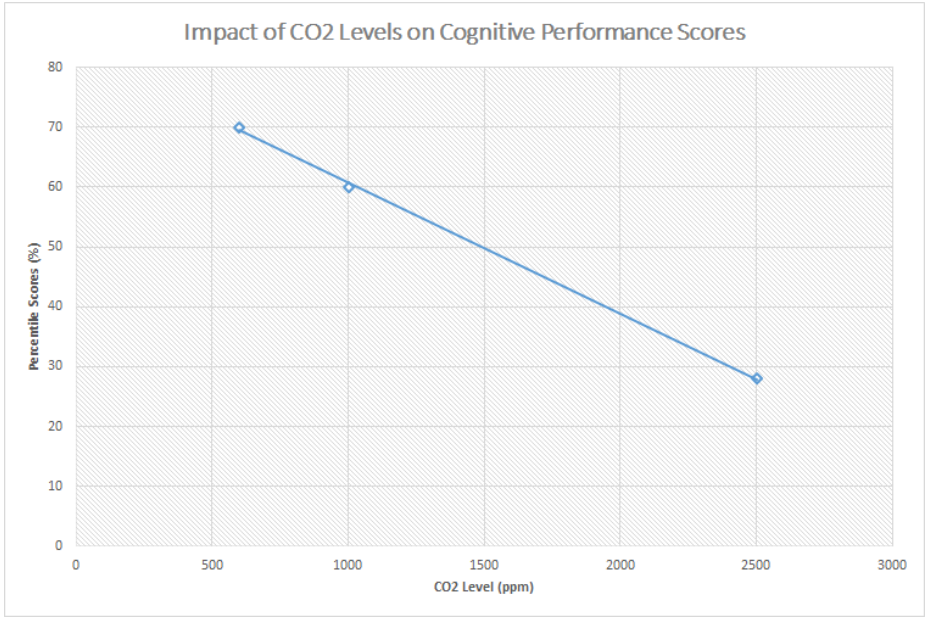
PASSIVHAUS STANDARD MODULAR CLT LEARNING SPACE

SECTIONAL VIEW

VENTILATION CONCEPT

CO2 LEVEL - IMPACT ON HUMANS

250-400ppm	Normal background concentration in outdoor ambient air
400-1,000ppm	Concentrations typical of occupied indoor spaces with good air exchange
1,000-2,000ppm	Complaints of drowsiness and poor air.
2,000-5,000 ppm	Headaches, sleepiness and stagnant, stale, stuffy air. Poor concentration, loss of attention, increased heart rate and slight nausea may also be present.
5,000	Workplace exposure limit (as 8-hour TWA) in most jurisdictions.
>40,000 ppm	Exposure may lead to serious oxygen deprivation resulting in permanent brain damage, coma, even death.



NCC requirement:
"For natural ventilation classroom window area for ventilation must be 12.5% of the classroom floor area."

But there is no requirement on how much and how often these windows should be open.

CO2 LEVEL - SCHOOL PERFORMANCE

Australian schools are underperforming in terms of energy efficiency and indoor environment quality.

"In our analysis, the CO_2 concentrations in Victorian classrooms ranged from 912 to 2,235 ppm. During certain times of occupied hours, levels reached up to 5,000 ppm. These concentration levels indicate very poor ventilation and slow air exchange between indoor and outdoor air.

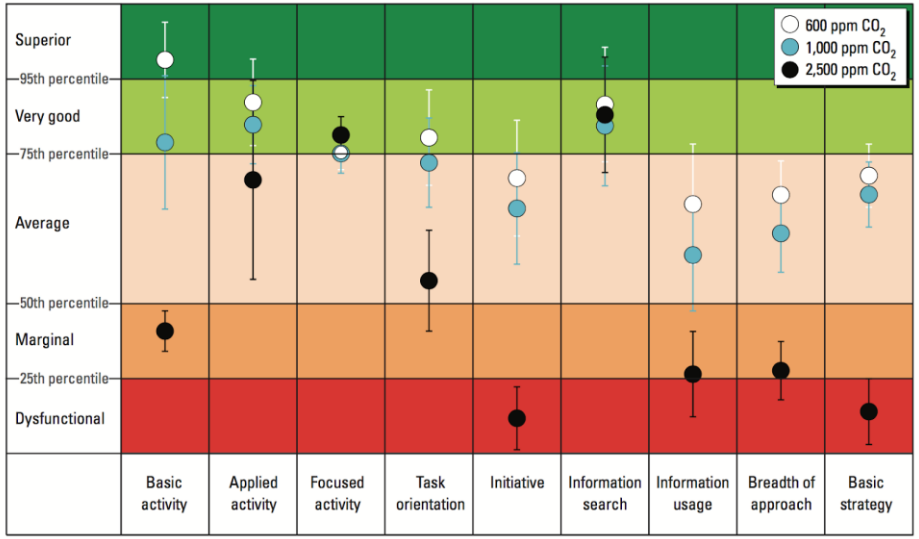
Good ventilation inside classrooms also protects students against airborne transmission of diseases such as COVID-19. Improving ventilation inside classrooms will help schools respond to potential outbreaks."

During a pandemic, the number of air changes per hour should be higher than usual. The World Health Organisation recommends six air changes per hour.

https://theconversation.com/australian-children-are-learning-in-classrooms-with-very-poor-air-quality-154950

CO2 LEVEL - IMPACT ON CHILDRENS PERFORMANCE

According to a study from Harvard, increasing indoor CO2 levels by 400 ppm would result in a decrease in cognitive functioning by 21%. Classrooms that are not properly ventilated could have CO2 levels reaching beyond 3000 ppm, compared to the healthy level of 1000 ppm. With CO2 levels that high, students could experience up to an 80% decrease in cognitive functions. This makes it almost impossible to make schools an optimal learning environment without continuous ventilation.



Effects of exposure to carbon dioxide and bioeffluents on perceived air quality, self-assessed acute health symptoms, and cognitive performance

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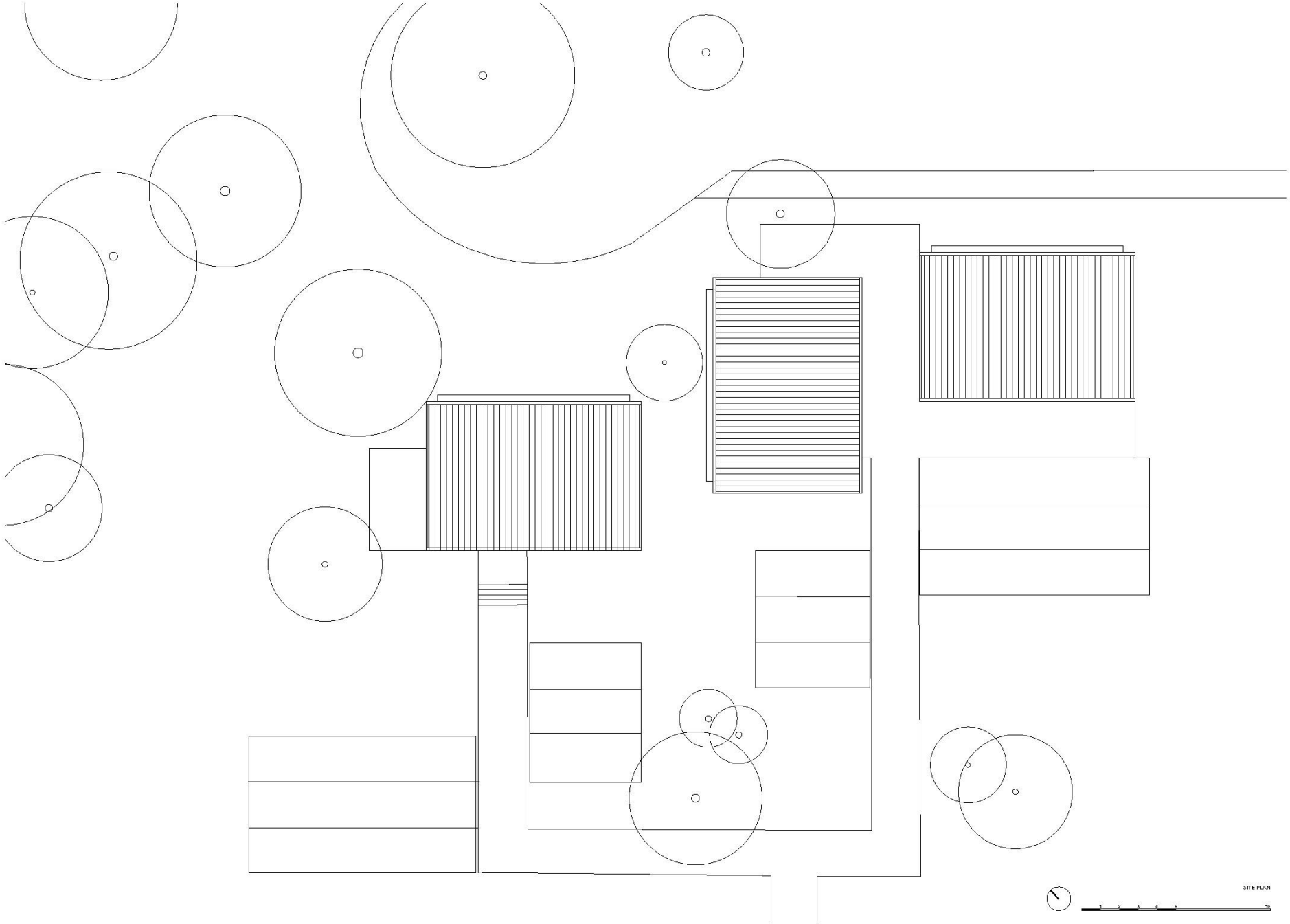
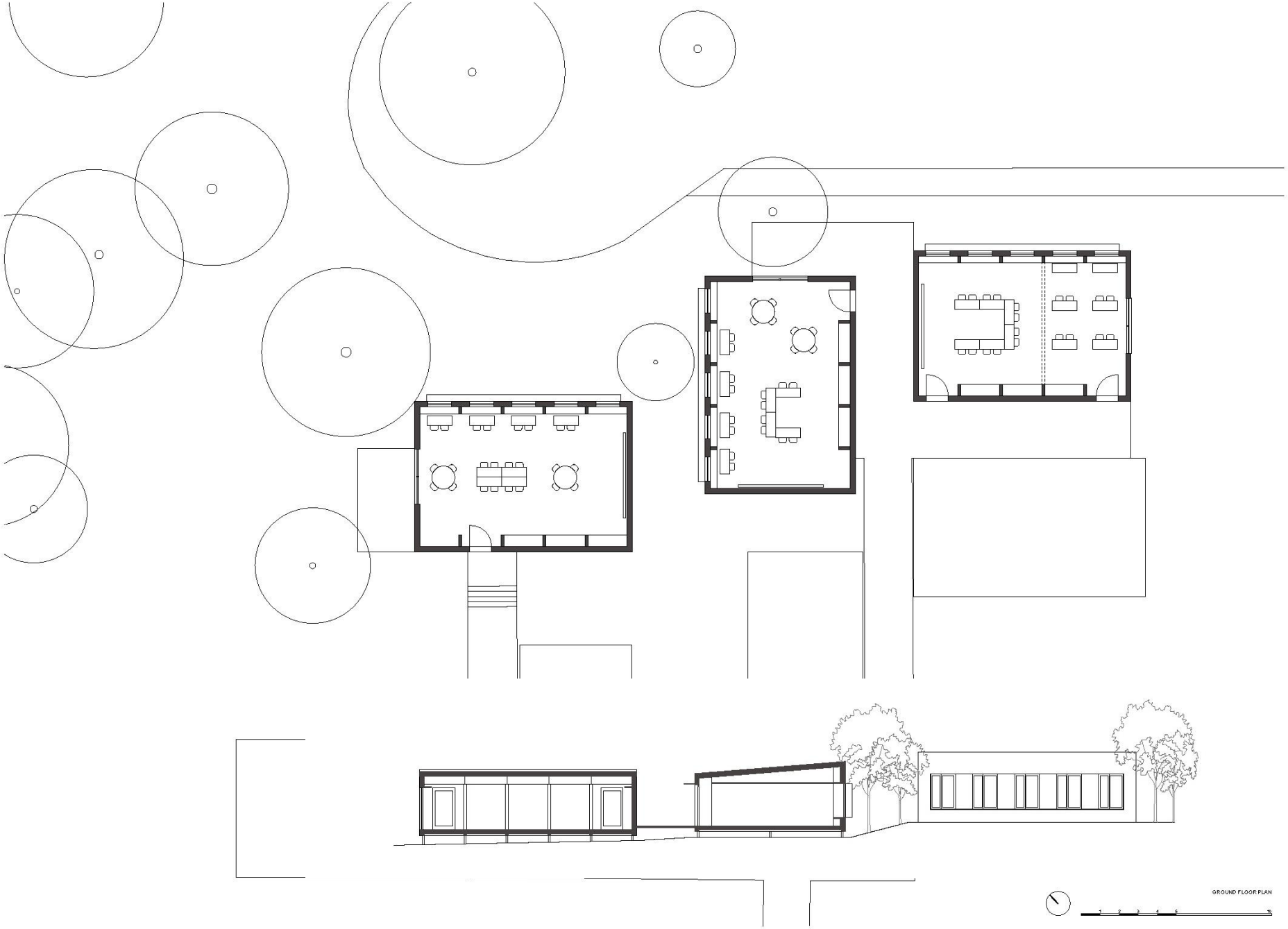
Design



FLOOR PLANS



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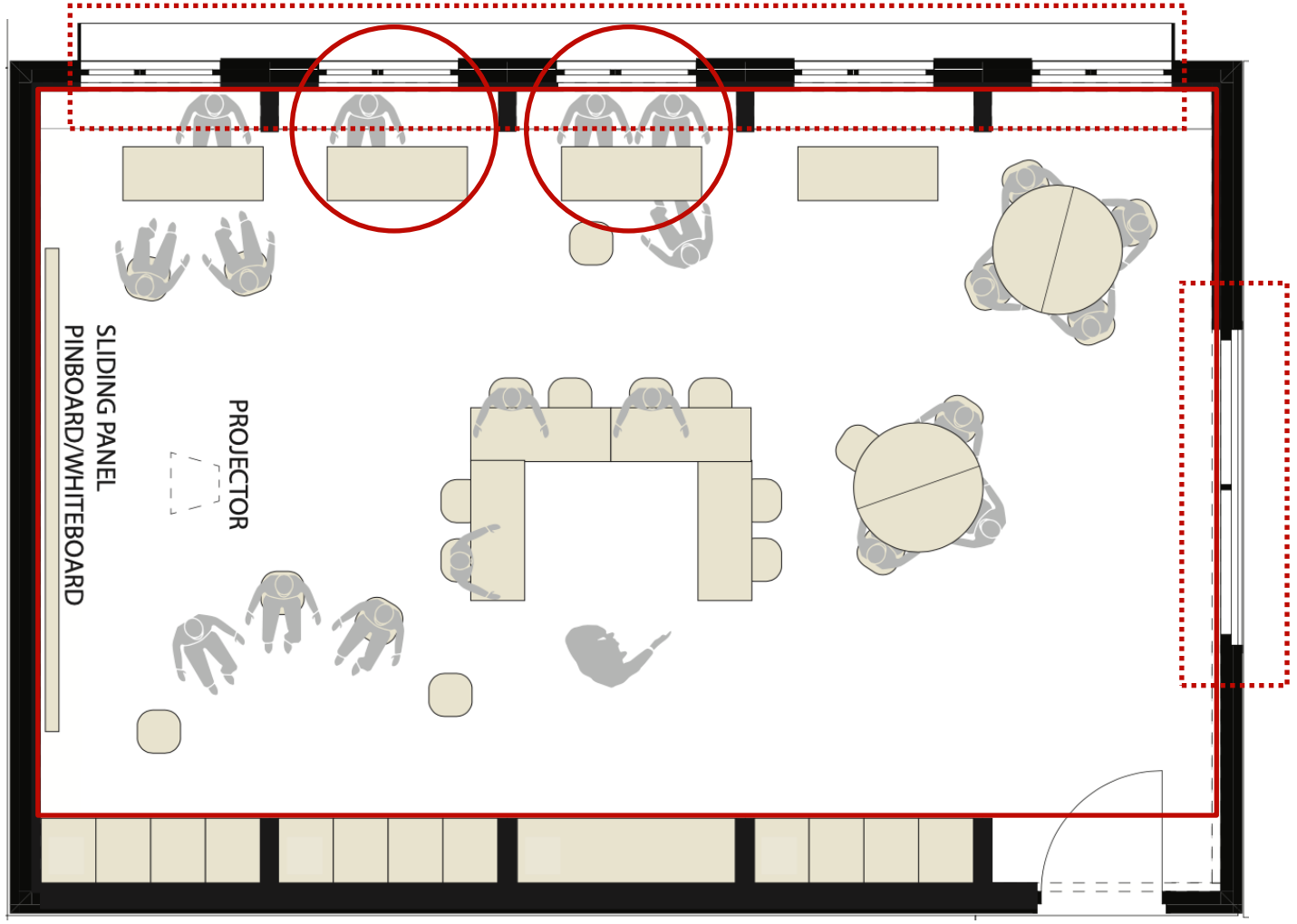
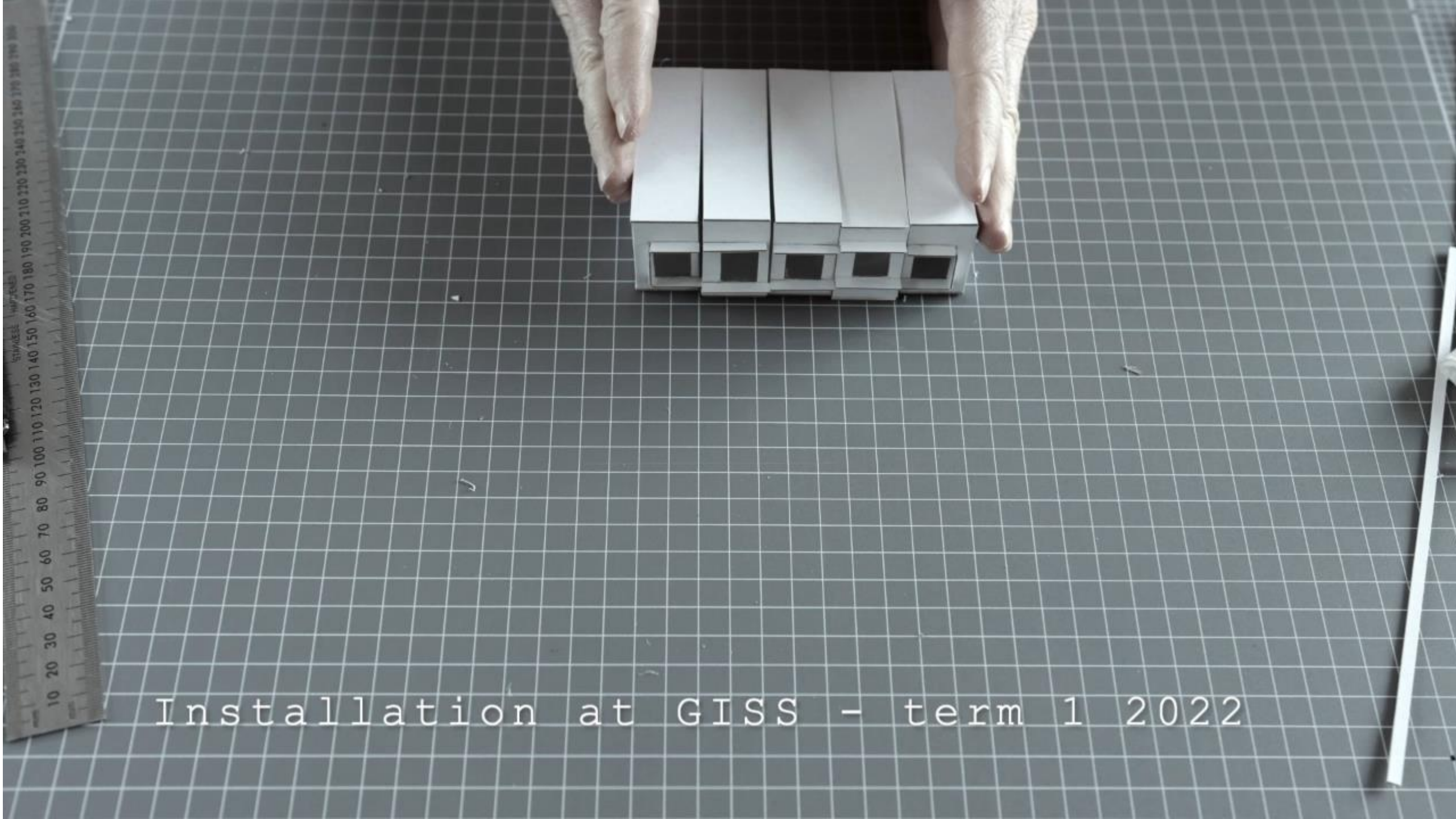


- Flexible classrooms: >3.25 m2/student: Offering ample space to re-create the learning environment

- lots of natural light with big windows and connection through large sliding doors to integrate outdoor learning
- Retreat/individual (or small group) learning in window seats


Installation at GISS - term 1 2022

SEED - SUSTAINABLE ENVIRONMENTAL EDUCATION SPACES

Construction


DEMAG


LAROS
TECHNOLOGIES
XA 23AA

SEED - SUSTAINABLE ENVIRONMENTAL EDUCATION SPACES

Photos

PHOTOS

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CLT assembly in Canberra

S.E.E.D. CLASSROOMS - CARBON FOOTPRINT

-60

metric tonnes of carbon dioxide stored in the project's mass timber

+22

metric tonnes of CO2 emissions avoided

18

equivalent number of cars taken off australian roads for one year

17 sec

time to regrow the amount of timber from austrian forests

THANK YOU.

For more information visit our website www.bettiundknut.com.au

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