LA TROBE UNIVERSITY
BENDIGO FLORA HILL CAMPUS
MASTER PLAN REPORT

4.4 BUILT FORM AND SERVICES

PREPARED BY MGS ARCHITECTS
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LA TROBE UNIVERSITY

BUILT FORM STRATEGY

CONTEXT

The campus buildings were largely constructed in the 1960s and 1970s and have typical features of this era.

The Engineering, CLT, SCC, Graphic Design buildings were some of the first on campus. They are single storey and reaching the end of their life cycles. The Units were also built at this time and will also need to be replaced in the next ten to 15 years. The Applied Science buildings were constructed at a similar time, but are robust buildings of five stories and show potential for adaptive reuse.

The majority of buildings on campus were built following the 1975 Master Plan. The library building was built first, with its light brown brick material pallet, modular layout and distinctive corner service columns. Additional buildings were added over the next thirty years, each retaining a similar appearance. These buildings are robust and bring a particular coherence to the campus but have single glazing, little or no insulation, and perform poorly from a passive solar perspective.

In the last decade, several high-quality buildings have been added to the campus including the La Trobe Rural Health School and Hillside Apartments.

The built stock is generally well maintained and there have been periodical upgrades to the existing buildings, including the gradual addition of air-conditioning units.

The *La Trobe University Design Standards Version 13* (2015) sets minimum standards for both new and renovated buildings. Additional standards based on best practice urban design principles are outlined on the following pages

VISION

In the coming decades the built form of the campus will be renovated or replaced where required to improve the amenity and energy performance of the buildings. High quslity design and construction will be privilaged in the community orientated and academic core areas.

DIRECTIONS

Governance

— Analyse energy sub-metering data to establish high energy consumption buildings

— Determine functional and comfort issues regarding the existing buildings through discussions with facilities management and occupant surveys.

— Test Indoor Air Quality (IAQ) to identify poor performing buildings.

Demolition

Some buildings on campus are ageing, of low quality and will need to be replaced or significantly renovated within the next ten or 15 years. While demolition should only be considered if there is sufficient demand or requirement to replace the building in question, and the current function can be relocated, the removal of some buildings on campus could be an important step forward in upgrading the campus. Some buildings that could be replaced within the next 30 years include:

— The Engineering, CLT and SSC buildings. These buildings are only single level but are located in a very prominent position facing the sports field to the north of the campus.

— Graphic Design building.

— The Units.

Adaptive reuse and renovation

Adaptive reuse and renovation of the buildings on campus is preferred to demolition. Heavily utilised buildings should be targeted with measures to improve the amenity and performance of these buildings. Buildings that are a high priority for renovation include:

— The student union building is very heavily utilised but does not engage with its surroundings. It is in a prominent location and could benefit from increased solar access to the north.

— The Applied Science buildings would be very well suited to improvements such double facades.

Key interventions that relate to adaptive reuse and renovation include:

— Adding skylights to existing buildings in order to improve natural daylight penetration.

— Install window films to improve the performance of existing glazing.

— Improve insulation, air-tightness and glazing as part of rolling upgrades to reduce energy consumption and improve occupant comfort.

— Replacing fixed windows with operable windows.

— Creating living shading walls with deciduous plants. These will shade in summer but allow beneficial solar gains for heating in winter.

— Providing external shading structures to existing buildings. These could be double facades which in addition to shading provide improved visual appearance, new circulation routes and new serving reticulation.

— Creating atria in larger buildings to facilitate daylight penetration, cross ventilation and improve external views. These could also include open stairs to promote walking between floors rather than using lifts.

— Create pedestrian bridges between some buildings for improved access. For example, providing a bridge between AS1 and AS2 and a lift to both buildings could improve access for those with a disability.

During the consultation sessions conducted as part of the Master Plan process, there was concern expressed that the demolition and replacement of any buildings would incur a high capital cost. However outdated buildings incur high maintenance costs and will need to be replaced in the next ten to 15 years.

Any replacement of existing buildings is dependant on whether it supports the aims of the campus vision, whether there is an appropriate location to move the current function and whether appropriate funding channels exist (partnerships, grants, revenue from other projects).

EARLY WINS

— Install green walls on recessed fenestration facades such as AS1 and AS2.

ALIGNMENT WITH RFAS

BUILDING HEALTHY COMMUNITIES

— Increased comfort, amenity and usability for students and staff.

LA TROBE UNIVERSITY
BENDIGO FLORA HILL CAMPUS
BUILT FORM STRATEGY

0 50 100m

- New built from
- Best condition built form
- Medium condition built form
- Poor condition built form
- Development area that is community orientated
- Development area that is part of the academic core
- New skylights and atria investigation
- Additional solar shading or double facades

DEVELOPMENT CONTROLS

HEIGHT

— New development will range between three and five stories, aligning with the scale of the core campus.

— At sensitive interfaces, such as the interface with Bendigo South East College on Sharon Street, the height will be reduced to two stories.

— The height of new buildings must respond to the varying topography of the site and the height of the existing buildings, ensuring key views are maintained.

ALIGNMENT AND SETBACK

— Development must address Sharon Street to encourage active engagement.

— There must be strict alignment along the primary and secondary pedestrian networks to provide a strong built form edge.

VIEW CORRIDORS

— A view corridor between AS1 and AS2 buildings and extending east-west across the campus will be reinforced and maintained.

— A view corridor running north-south along the central pedestrian spine will be established and maintained.

ACTIVATED FRONTAGES

— Active facades are encouraged along the primary pedestrian network and with priority given to facades facing the Arrival Plaza.

— Ground floor / street level permeability will be encouraged in new development to ensure activation of all street and path frontages in the core campus.

— Active facades are also encouraged along Sharon Street.

ENTRANCES

— Primary entrances to buildings should address the primary pedestrian network and Sharon Street.

— Primary entries will be co-located and align with other adjacent building entries. Consider how the location of interior vertical circulation and collective study, lounge and recreation areas can be located to enrich the engagement of buildings with the adjoining pedestrian network and shared spaces.

— Secondary entries will be highly visible and located on main pedestrian routes through the campus.

— Ensure service entries to buildings are appropriately placed away and hidden from activated edges.

INTERFACES

— West: development will create a new public face for the University with high-quality facades and community-facing programmes.

— North-west: development will reinforce relationship with Bendigo South East College.

— North-east: development will have a relationship to the nearby activity centre of Strath Village and Strath Hill.

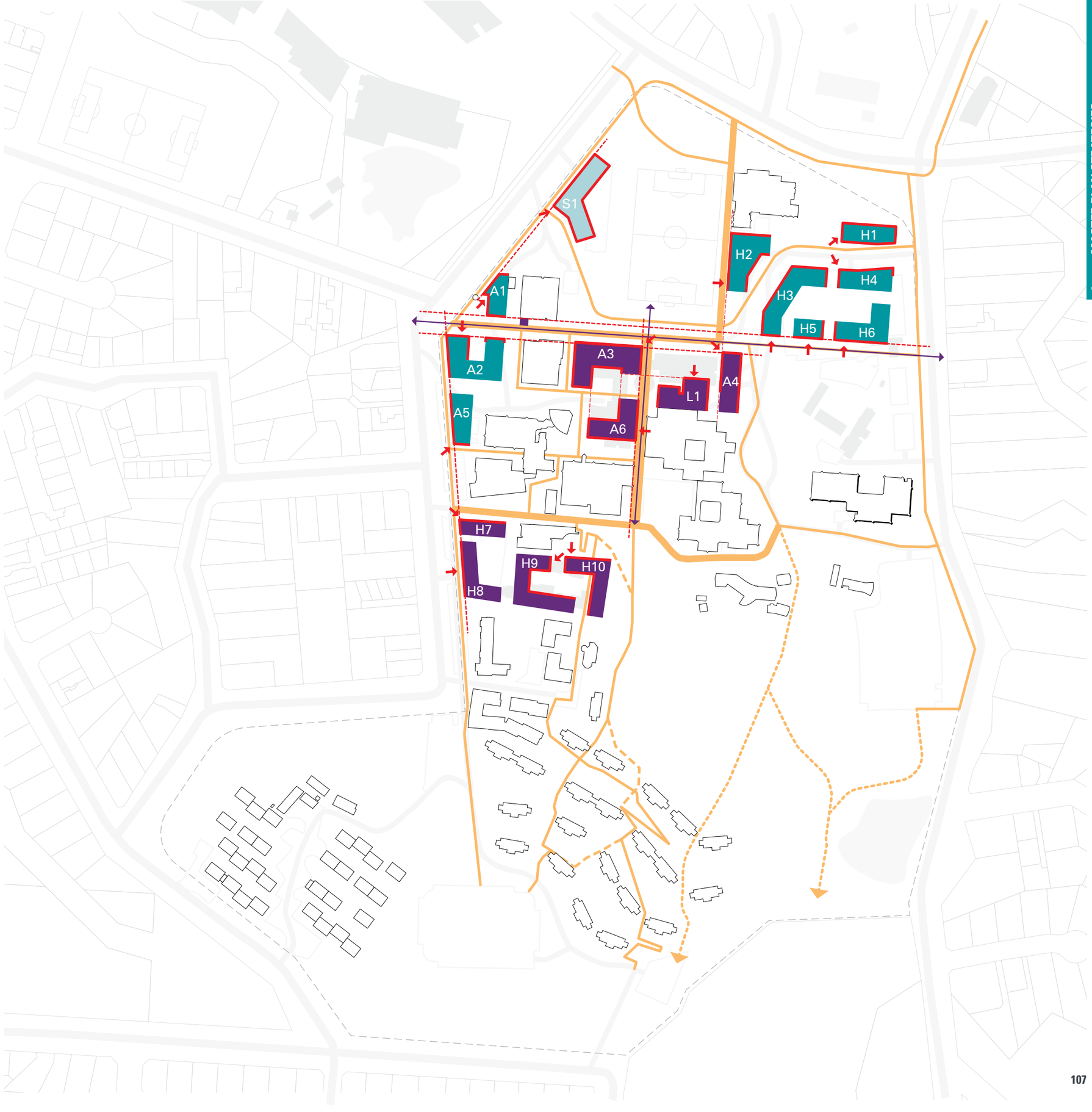
— East: development will respect the low density residential environment along Edwards Road.

— South: development will be limited on this interface as it engages with One Tree Hill Regional Park.

LA TROBE UNIVERSITY
BENDIGO FLORA HILL CAMPUS
DEVELOPMENT CONTROLS

0 50 100m

- 2 Level development
- 3 Level development
- 4-5 Level development
- Activated frontages
- Building entries
- Building alignments
- View corridors
- Primary pedestrian network
- Walking trail to National Park



PROGRAMME AND YIELD

PROGRAMME

— Academic functions are concentrated in the core of the campus.

— Housing is focused on the fringe of the campus, in proximity to the campus core.

— Sports related functions are located in the north of the campus so that they have a relationship to the sports facilities in Bendigo South East College and Brennan Park.

YIELD

— The adjacent table shows the Gross Floor Area (GFA) that can be expected from the development contained within the Master Plan.

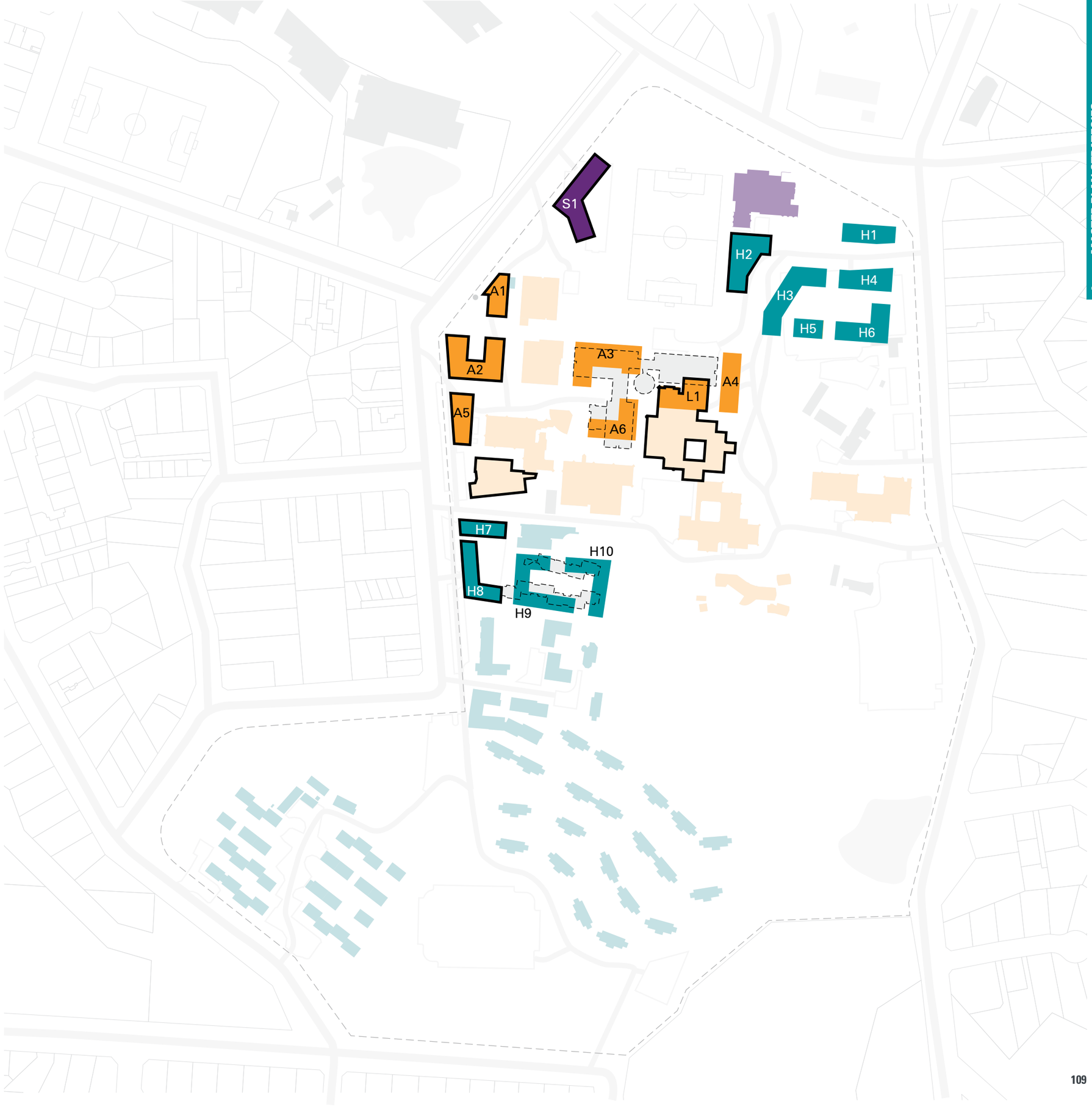
MASTER PLAN YIELD

Building Code	Programme	Levels	GFA (sqm)
H1	Residential	3	1,880
H2	Residential	3	3,120
H3	Residential	3	3,460
H4	Residential	3	2,150
H5	Residential	3	1,050
H6	Residential	3	2,660
H7	Residential	4	1,760
H8	Residential	4	3,020
H9	Residential	4	4,530
H10	Residential	4	3,380
S1	Sports	2	2,360
L1	Library	4	2,140
A1	Academic	3	1,460
A2	Academic	3	3,980
A3	Learning Hub	4	5,280
A4	Student Union	4	2,870
A5	Academic	3	1,970
A6	Academic	4	3,280
		Total	50,360

LA TROBE UNIVERSITY
BENDIGO FLORA HILL CAMPUS
PROGRAMME AND YIELD

0 50 100m

- New Core-to-University built form
- Existing Core-to-University built form
- New sport focused built form
- Existing sport focused form
- New residential built form
- Existing Residential built form
- Community focused and iconic built form
- Demolished built form



SUSTAINABILITY AND INFRASTRUCTURE STRATEGY

CONTEXT

La Trobe University aims to become one of Australia's leading sustainable universities, demonstrating leadership on a national scale.

The campus was largely constructed in the 1960s and 1970s. Although the campus is well maintained there are a number of opportunities to consolidate campus infrastructure to better meet the needs of the University.

Sustainability issues such as transport and ecology are covered elsewhere in this report.

VISION

The campus will continue to improve its existing infrastructure in order to improve the amenity of the campus and reduce energy and water usage and emissions.

DIRECTIONS

Governance

— Establish holistic sustainability performance framework for the campus.

— Implement the adaptive reuse and environmental upgrade of existing buildings in order to do the following; mitigate energy and water consumption associated with new construction, decrease operational energy consumption, decrease water consumption, improve thermal comfort, improve indoor air quality, increase natural light and create flexible spaces for improved utilisation.

— Create an infrastructure upgrade and development plan that considers the current and future needs of the campus.

Infrastructure

— Reroute the authority stormwater drain at the north of the campus to allow future development in this area.

— Relocate the Student Union sub-station to the north to serve future developments in the north-east of the campus.

— Provide new west substation to serve academic buildings.

— Provide cooling (air-conditioning) to the Health Sciences and Arts Buildings.

— Provide flood lighting to the sports field.

— Trial electric car charging station.

Energy and $C0_2$ Emissions

— Consolidate campus energy accounts.

— Prioritise demand reduction (energy efficiency) before supply-side initiatives such as, building fabric and passive design upgrades, building system and controls tuning, continue lighting upgrades. (Library and Education buildings recently completed) and high efficiency HVAC systems.

— Implement Demand Management Technology.

— Implement Solar PV on suitable existing and new buildings.

— Implement solar thermal on new residential building roofs to provide a local hot water supply.

Water

— Prioritise demand reduction (water efficiency) before water recycling initiatives including: Low flow fittings throughout campus, Xeriscaping / low irrigation demand landscaping and increased sub-surface irrigation coverage (including the sports field).

— Large scale stormwater harvesting for irrigation of sports field.

— Implement Water Sensitive Urban Design (WSUD) initiatives such as Green roofs, Raingardens, porous pavements and Grass swales.

Engagement

— Install sustainability signage around the campus (targets, achievements, how students can contribute etc.).

— Introduce an on-campus sustainability centre.

— Hold staff / student sustainability competitions.

— Host sustainability events.

— Increase student vegetable gardens.

BARRIERS TO CHANGE

Implementation of the campus vision may be subject to barriers such as:

— Cost of implementation.

— Resourcing of operational and maintenance staff.

— Changes to La Trobe University policy and management.

EARLY WINS

— Introduce sustainability signage around the campus that displays targets, achievements and how students can contribute to the sustainability of the campus.

— Create an infrastructure development plan that considers the current and future needs of the campus.

— Install flood lighting at the sports field.

ALIGNMENT WITH RFAS

SECURING FOOD, WATER AND THE ENVIRONMENT

— Reduced $C0_2$ emissions.

— Improved energy and water efficiency.

— Improved energy security.

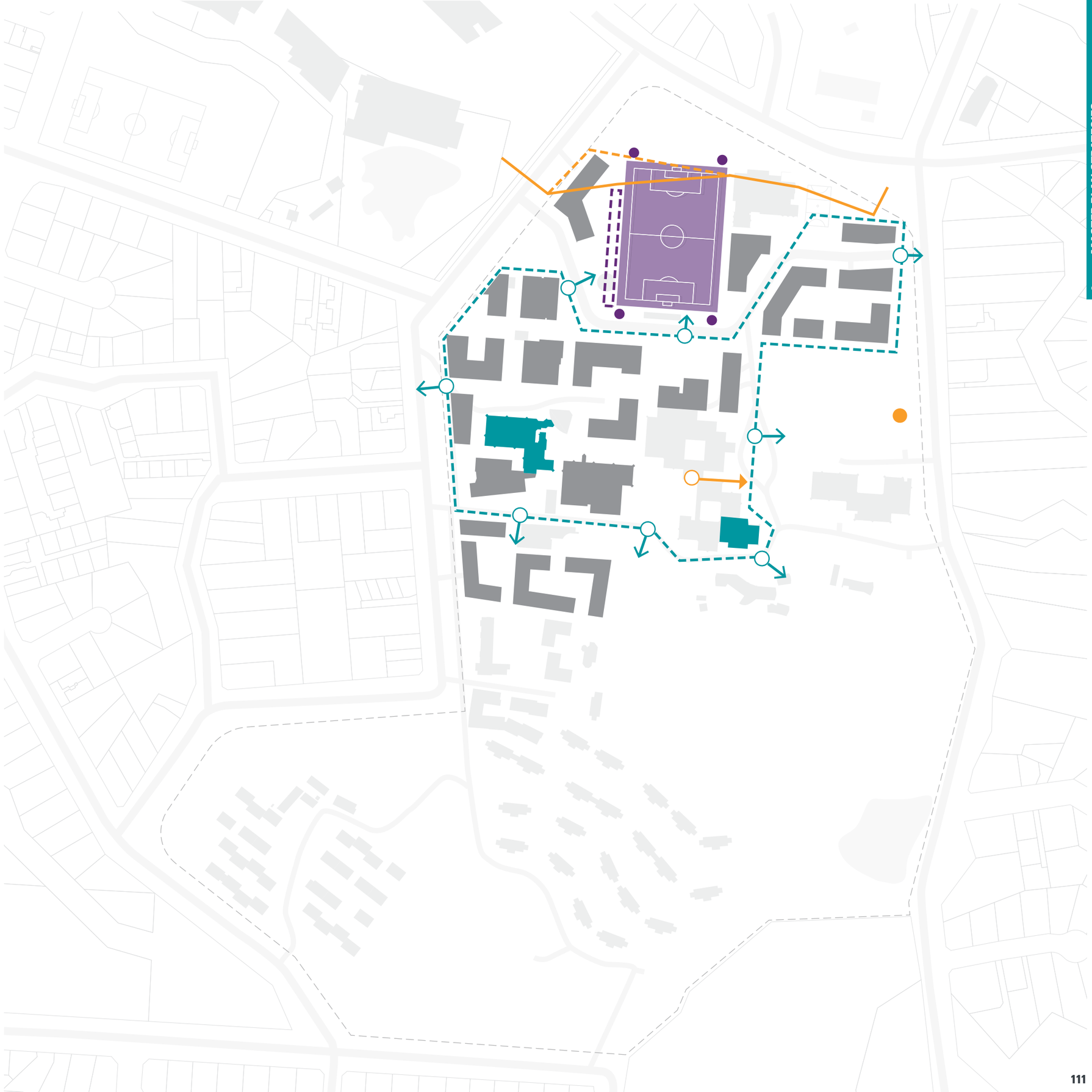
SPORT, EXERCISE AND REHABILITATION

— Increased usage hours of the sports field.

LA TROBE UNIVERSITY
BENDIGO FLORA HILL CAMPUS
SUSTAINABILITY AND INFRASTRUCTURE STRATEGY

0 50 100m

- Electric car charging station
- Relocate Student Union sub-station
- Flood lighting
- Smart grid technology (arrows radiating outwards to show increased coverage over time)
- Existing stormwater drain
- Proposed relocation of stormwater drain
- Storm water harvesting tanks
- Sports field
- Roof mounted solar PV arrays
- Provide air conditioning



ENERGY STRATEGY

CONTEXT

La Trobe University has implemented a target to reduce $C0_2$ emissions and energy use from the University's facilities and buildings by at least 30% by 2022 when compared to 2010 emissions.

ANALYSIS

The analysis presented displays the achievable reduction in $C0_2$ emissions if the campus 'Energy and $C0_2$ Emissions' vision is implemented. Modelled assumptions are as follows:

Demand Increase

— 20 kWh/m²/annum electricity for air conditioning of the Health Sciences and Arts Buildings.

— 30% $C0_2$ emissions increase as a fraction of EFTSL increase, based on 200 by 2022.

Energy Efficiency

— Through ongoing improvements to building fabric performance, 0.5% electricity and 0.25% gas reduction per year.

— Through ongoing building tuning and Demand Management Technology to improve system performance, 1% electricity and 0.5% gas reduction per year.

— Lighting upgrades based on the 'Siemens Detailed Facility Study Submission – Energy Performance Contract, 2013'.

— HVAC upgrades based on the 'Siemens Detailed Facility Study Submission – Energy Performance Contract, 2013'.

— Solar PV based on La Trobe University's solar opportunity analysis for a 750 kW system installed incrementally across the campus.

Modelling Results

— Allowing for demand increases, implementation of demand reduction (energy efficiency) initiatives may result in $C0_2$ emissions reductions of 20% by 2022 compared to current emissions.

— Implementation of Solar PV may reduce $C0_2$ emissions by a further 15%.

SUMMARY

— Solar PV is scalable, install around the campus over time as funding becomes available and in coordination with other building projects. This is of particular benefit because the cost of Solar PV systems is predicted to fall in the future.

— Solar PV systems require very little active maintenance. In comparison, a large central energy system (e.g. co-generation / tri-generation) system requires regular maintenance.

Historically the cost of renewable energy technologies has been higher than the price of fossil fuel-based grid energy.

Over the life of the Master Plan onsite solar photovoltaics are likely to become more attractive due to the convergence of decreasing capital cost and increasing grid energy costs.

Solar photovoltaics are scalable, meaning arrays may be added to existing and new buildings over time as funds become available.

Within this Master Plan, large-scale central energy systems such as co-generation, tri-generation and large-scale solar thermal have not been proposed. This is due to the relatively small scale of the campus. A large central energy system would require significant capital cost, require ongoing Maintenance and would require high annual utilisation rates to provide reasonable payback.

Long-term options for the campus include:

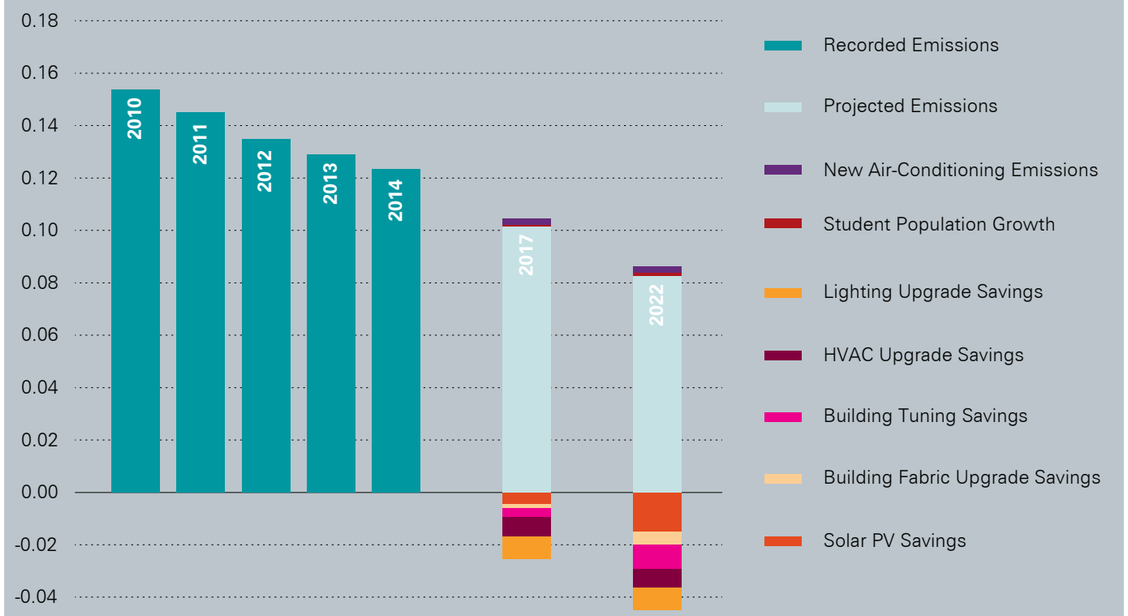
— Further installation of solar photovoltaics on a precinct scale.

— Building Integrated Photovoltaics.

— Waste to energy technologies including gasification and anaerobic digestion, which may supplement the site natural gas supply.

Market forces change continually. Newly available technologies will need to be implemented based on rigorous feasibility studies undertaken at the time of project inception.

FACILITY GREENHOUSE GAS EMISSIONS (TCO_2-E/M²)



WATER AND SEWER STRATEGY

CONTEXT

Water use at the campus increased significantly in 2012 and 2013. This is primarily due to new residential buildings coming on line and reinstatement of the grass sports field. La Trobe University has committed to a target to reduce mains water use per person by at least 10% compared to 2010 water use.

ANALYSIS

The analysis presented displays the achievable reduction in mains water use if the campus 'Water' vision is implemented. Modelled assumptions are as follows:

Water Efficiency

— Through ongoing reduction in demand by upgrade of fixtures and fittings and low water demand landscaping, 2% mains water reduction per year.

Water Recycling

— Install a large stormwater harvesting system (500 ML) adjacent to the grass sports field which connects into the existing authority stormwater drain running across the north of the campus.

— It is assumed that the sports field requires 25mm per week of irrigation during summer months.

Modelling Results

— Implementation of demand reduction (water efficiency) initiatives may result in main water use reduction of 5% by 2022 compared to 2014 usage.

— Implementation of a large scale stormwater harvesting system may reduce mains water use by 6%.

SUMMARY

— The sports field provides the campus with amenity and potential community engagement opportunities. Some of the additional water usage may be offset by large stormwater harvesting and water efficiency initiatives.

— During periods of drought, stormwater capture will be limited and a sports field irrigation strategy will need to be agreed with local authorities.

Use of stormwater for other end uses may be investigated for future stages of the Master Plan:

— Firefighting.

— Laundry.

— Dust suppression during construction.

Within this Master Plan, the following initiatives have been not discussed but are proposed:

— Recycled water ring main.

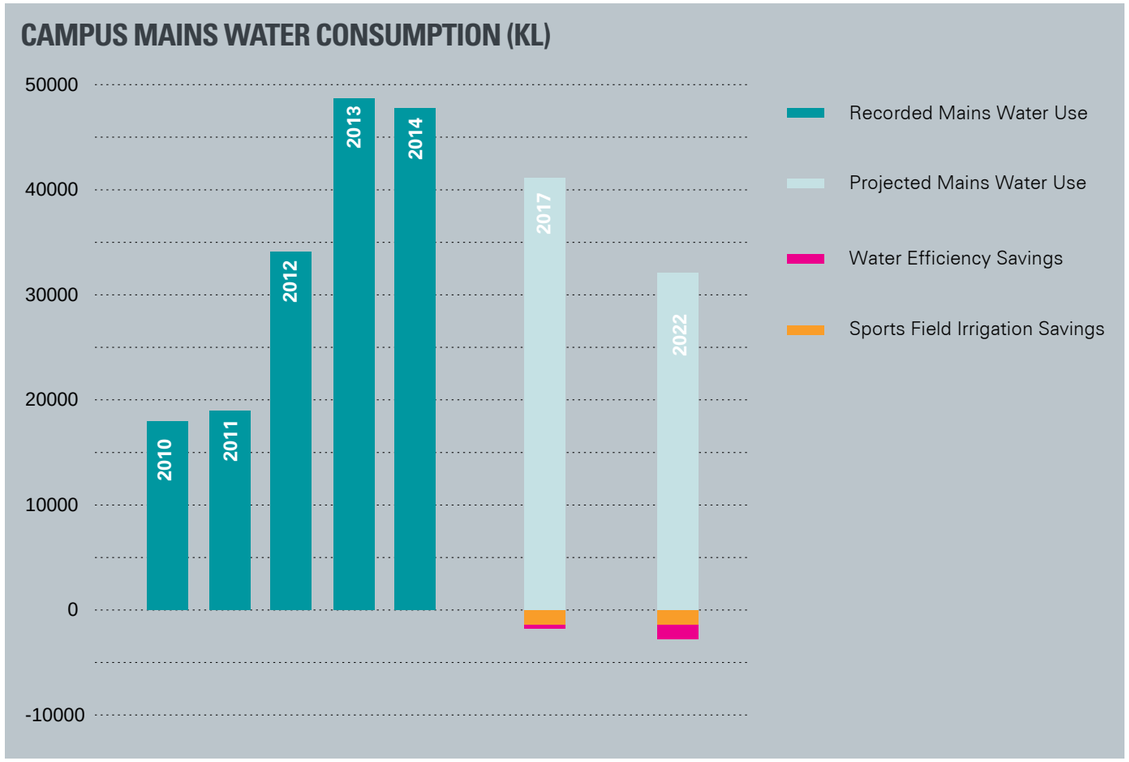
— Grey water harvesting.

— Black water harvesting.

— Bore water.

This is due to the relatively small scale of the campus. These systems would require significant capital cost, require ongoing maintenance and would require high annual utilisation rates to provide reasonable payback.

Market forces change continually. Newly available technologies will need to be implemented based on rigorous feasibility studies undertaken at the time of project inception.



WASTE STRATEGY

CONTEXT

The campus currently collects, separates and disposes of the following separate waste and recycling streams:

— General waste, to landfill.

— Comingled recycling, to local recycling centres.

— Clean paper and cardboard, to local paper collection centres.

— e-Waste, fluorescent tubes, batteries and printer cartridges, to local specialist recycling facilities.

— Green waste, to council collection. The green waste skip is often contaminated by local residents dumping household waste and furniture.

Most of this waste collection and storage occurs at the campus waste management compound located adjacent to car park 9.

The University cafeteria also provides reduced price coffee for patrons who bring in their own reusable coffee cup, in an effort to reduce the quantity of disposable cups used on campus. This scheme is currently limited by a lack of cup rinsing / washing facilities.

VISION

The campus waste strategy aims to reduce the University's environmental impact due to waste materials going into landfill, toxic materials polluting the local ecosystem and total resource consumption.

DIRECTIONS

— Improve and expand campus central waste management facilities.

— Increase staff and student education and knowledge of existing recycling facilities and schemes.

— Introduce organic waste collection and composting.

— Retain green waste on campus for use in landscaping.

— Engage a specialist waste management consultant to complete a holistic assessment and recommendations for the campus waste management systems and processes.

EARLY WINS

— Increase recycling education and signage, and increase co-mingled recycling facilities around the campus for staff and students.

ALIGNMENT WITH RFAS

SECURING FOOD, WATER AND THE ENVIRONMENT

— Reduced resource consumption.

— Reduced waste to landfill.

The campus waste strategy aims to reduce the University's environmental impact due to waste materials going into landfill, toxic materials polluting the local ecosystem and total resource consumption.