Environmental Sustainability Guidelines

1. Environmental Sustainability Policy

The aim of the *Environmental Sustainability Policy* is to ensure that the future development of UniSA campuses is based on environmentally sustainable principles.

"Sustainability is the ability to maintain a high quality of life for all people, both now and in the future, while ensuring the maintenance of the ecological processes on which life depends and the continued availability of the natural resources needed." *The Institution of Engineers, Australia – Policy on Sustainability*.

All stages of building projects including master planning, urban design, external works, new buildings and refurbishment works, and furniture and equipment selections, shall be based on environmentally sustainable principles.

2. Environmental Sustainability Guidelines

The *Environmental Sustainability Guidelines* list environmental sustainability objectives for incorporation into the future development of UniSA campuses.

The guidelines are the performance objectives for the following:

- All new building work (internal and external), furniture, fittings, finishes and equipment.
- Assessing existing buildings and external areas, furniture, fittings, finishes and equipment.

Amendments

The guidelines shall be reviewed and amended to adopt new practices as they are developed and at the time amendments are made to statutory regulations.

3. Process

The following procedures shall be used to ensure environmental sustainability is addressed in each project type:

- *Environmental Sustainability Guidelines* as part of the *UniSA Design & Construction Guidelines* will be issued to all project teams by the Project Manager.
- The Principal Consultant, as part of the project team, is responsible for addressing sustainability issues in each project and determining the extent of the application of the *Environmental Sustainability Guidelines*.
- The Principal Consultant, as part of the project team, is responsible for monitoring the Contractor's compliance on site with Waste Management Plans and Environmental Management Plans.

4. Environmental Management

Consideration shall be given to the appropriateness of alternatives to development such as the 'no development' option and non structural alternatives. Where appropriate, evaluate site and local ecosystems using structured Environmental Impact Assessment Processes.

For projects over $1 million, the project team shall be responsible for preparing and adopting Environmental Management Plans through all phases of the project.

For projects over $0.5 million, the Contractor shall be responsible for preparing and adopting a Waste Management Plan for the construction process. Reference should also be made to the criteria of local councils which establish when Waste Management Plans are required.

5. Recycle Buildings, Use Existing Infrastructure

Assess thoroughly the opportunities to reuse existing facilities and the long-term viability of new facility proposals as a first option. Select and use appropriate assessment procedures such as economic appraisals, value management and master-planning.

Assess the heritage significance of proposed sites and implement preservation or risk education programs where appropriate. Ensure that there is no loss of significant heritage items. Restore and reuse such items wherever possible. Where demolition of buildings is required, individual items of heritage significance are to be saved and made available for public view.

6. Maximise Life Cycle and Future Adaptability of Building

Design for ease of future adaptability taking into account design and planning principles for durability, versatility, access, redundancy, simplicity, upgradeability, independence. Ensure retention of full as-built-documentation to assist effective decision making and prevention of costly probing exercises.

Maximise the potential life cycle length of facilities to reduce energy costs in demolition, and reconstruction. The durability of materials and so the maintenance required to extend its life can also significantly affect both the resources and energy use of a building.

7. Protect and Enhance the Site

Preserve and protect the physical viability of natural ecosystems by ensuring systems are retained intact, uninterrupted and unified. Seek to provide wildlife corridors between fragmented ecosystems in co-operation with neighbouring properties. Re-establish the widest possible range of indigenous plant and animal communities, in appropriate habitats, to restore the site to its potential diversity of species.

Conserve viable site populations of all native species and maintain their habitats. Protect natural habitats from the adverse effects of settlement such as stormwater runoff, erosion and invasion by exotic species. Support the maintenance of biodiversity with site remediation activities such as regeneration and revegetation.

Site the building for minimum impact on ecosystems by minimising cut and fill. Preserve appropriate existing landscape features where possible as a first option. Landscape design of built areas should reflect the inherent natural patterns of a site (the result of natural processes that have shaped it), as well as the human modifications of these patterns.

Minimise the use of chemicals (pesticides, herbicides and fertilizers) by designing for diversity, careful species selection and using thoroughly researched planting details and specifications. Protect the water quality of adjacent environments during construction by effective erosion and run-off controls.

8. Design and Build Energy Efficient Buildings

Minimise energy demand by adopting passive design solutions, eg. exploiting local climate and intrinsic properties of the design and materials, as a first priority, before resorting to active design solutions, eg. energy-consuming engineering services or systems. Apply this approach in conjunction with optimising user amenity and comfort. Good passive building performance results in the active systems, where required, using less energy and often being of a smaller capacity, thereby also saving capital costs.

Optimise energy outcomes by considering and selecting design options on the basis of lowest life cycle cost. Where life cycle costs are within 10% of each other, select the option with the lowest greenhouse gas emissions.

Minimise energy demand by taking maximum advantage of site selection and planning, by:

- Giving preference, if possible, to a site with suitable shape, orientation and topography that allows building design and placement to optimise passive attributes.
- Locating the building with due consideration to orientation, solar gains, daylight access, overshadowing within and outside the site, while also meeting functional needs.

- Minimising energy requirements by optimising building design, while also meeting functional needs, by means such as:
  - Selecting building form (shape, shallow or deep plan, single or multi-storey) that best provides for daylight access and control of heat gain and loss. Avoid causing undesirable overshadowing within and outside the site.
  - Orientating building to optimise solar control. Generally, preferred orientation is an east-west long axis for ease of controlling solar gains through north and south facing windows, to maximise daylight opportunities, and to minimise solar loads on east and west elevations.
  - Planning layout of internal spaces to maximise opportunities for and to fully exploit passive design measures such as daylighting strategies and passive heating from controlled solar access. Minimise effects of undesirable heat gains by arranging 'buffer zones' between the source and the occupied zone: for example, locating service cores, stores, plant rooms or toilets on western side of building.
  - Optimising thermal resistance of building envelope to optimise heat gain or loss, and to minimise consequential thermal discomfort and cooling / heating energy use. Use insulation.
  - Controlling solar access and optimising use of daylight to minimise need for energy consuming mechanical cooling / heating and artificial lighting. Optimise solar control to minimise summer heat gains, and if appropriate, benefit from passive heating of winter sun (note – winter solar gains may be undesirable in some cases), use external sun shades.
  - Maximising use of local resources, where possible, to reduce transportation energy.

9. Optimise Engineering Services Design

Minimise energy consumption by optimising the engineering services design. As a priority, integrate engineering services to gain maximum benefit from the passive attributes of the building, eg. artificial lighting and daylight.

Engineering services design should include:

- Dividing building into zones according to function and operational needs, cooling and heating load profiles, occupancy patterns and densities, out-of-hours use, and local emissions. Identify zones for special uses that require special or more stringent environmental conditions, and treat them separately rather than raise servicing and energy consumption levels of building as a whole.
- Selecting system types, eg. central plant or distributed discrete plant, combination ambient-task lighting or general lighting, most appropriate for zones and building as a whole, to ensure optimum operating efficiency and minimum energy wastage from unnecessary operation.
- Selecting control systems most appropriate for zones, engineering services or systems, and building as a whole, ranging from simple local controls, eg. local switches, time switches, occupancy sensors, to fully integrated building management and control systems (BMCS), to ensure optimum operating efficiency and minimum wastage from unnecessary operation.
- Providing metering and monitoring systems to a level commensurate with complexity of building, as energy management tools to ensure efficient building operation. Such systems can be set up to track systems or sub-systems for heating, cooling, ventilation, lighting, general power and water heating.
- Designing lighting systems to ensure optimum efficiency under all conditions of building's expected usage. Maximise efficiency and minimise unnecessary energy use by means such as:
  - Choosing most efficient lighting system design and minimum lighting level appropriate for required application.
  - Using most efficient luminaries appropriate for required application. High efficiency luminaries reduce energy use and heat generated, which also means lower air conditioning loads or lower impact on comfort in naturally ventilated buildings.
  - Adopting effective lighting controls to ensure optimum operating efficiency and minimum wastage from unnecessary operation, eg. localised switches to encourage occupants' use, occupancy sensors, timers, central programmable time switches or control systems.
  - Maximising contribution of daylight to reduce use of artificial lighting, eg. switch lighting rows parallel to daylight sources to enable luminaries to be separately switched off or dimmed.
  - Minimise unnecessary operation of external lighting by using photoelectric switches.
- Designing heating, ventilation and air conditioning (HVAC) systems to ensure optimum efficiency under all expected building operating conditions, from part load to full load conditions. Maximise efficiency and minimise unnecessary energy use by means such as:

  - Providing zones with different cooling / heating demands, operating hours or more stringent temperature / humidity requirements with separate HVAC systems.
  - Minimising conflicting cooling and heating demands, and avoid reheat systems, which waste energy in simultaneous cooling and heating.
  - Limiting outside air quantities to meet code and dilution needs, to minimise unnecessary heating and cooling of unconditioned air.
  - Comfort air conditioning should not have humidity control.
  - Including automatic start / stop controls, eg. time switches, after-hours switches for limited out-of-hours use, to limit unnecessary HVAC operation.
  - Using building's thermal mass to delay and reduce peak loads, thereby achieving reduced plant size and energy consumption.
  - Adopting energy-saving devices and systems such as variable speed drives for fans and pumps, waste heat recovery to pre-heat incoming air or water.
- Considering the use of energy cogeneration principles
- Selecting most appropriate hot water units for the building, eg. electric, gas, solar with electric / gas boost, heat pump. Minimise heat and energy loss by locating units close to areas of greatest demand. Centralised systems with recirculating closed loop reticulation are generally less efficient than decentralised discrete units at points of use with minimum dead legs of pipework. Recirculating pumps should be thermostatically controlled to limit unnecessary operation.
- Energy-efficient lifts should include intelligent controls to optimise operational efficiency against occupant movement patterns, and to minimise unnecessary travel.
- Selecting energy efficient equipment and appliances based on their rated performance or recognised star rating scheme.
- On completion of installation, ensure engineering services and energy efficiency measures are properly commissioned and are operating as design intended.
- During building's operating life, carry out programmed preventative maintenance on all systems to ensure they continue to operate efficiently.
- As part of managing building operation, monitor its energy use to ensure it is within acceptable limits (such as the forecast energy consumption from Energy Efficiency Statement, a benchmark for this type of building or a pre-determined target). Account for any overruns and take corrective actions. Implement further opportunities to improve operational efficiency as building usage changes over time.

10. Make the Building Healthy

Consider holistically, the common denominators of Sick Building Syndrome, including temperature and air velocity, fresh air ventilation rates, relative humidity, lighting, noise, micro-organisms, respirable particulates, volatile organic compounds, gaseous pollutants, tedious work schedules, control by occupants and negative ions.

Avoid the use of polluting substances by selecting low impact construction materials and providing high indoor air quality. Provide appropriate lighting for different uses and maximise use of daylight. Minimise unacceptable noise.

11. Select Low Impact Construction Materials

Consideration is to be given to the 'cradle to grave' implications of material choices, the implications of the materials' extraction, manufacture, use and disposal.

Subject building material selections to systematic consideration of whole of life environmental impacts. Avoid the use of hazardous or suspected materials or only use them with adequate safety devices and precautions.

Impacts that should be considered are:

- Impact on natural ecosystems from which the material was extracted / grown.
- Amount of energy required in production / transportation.
- Environmental impacts generated by construction activities.
- Amount of toxin waste generated in production.
- Potential of material to be recycled.
- Amount of recycled material used in production.
- Life space and durability of product.

- Effectiveness of product.
- Any threat to human health from deterioration of the product.
- Nature of waste generated by disposal of the product.

Adopt life cycle costing principles for materials and systems selection that includes capital, recurrent and disposal costs. Co-ordinate criteria used for calculations with methodology used for LCA.

Use recycled and recyclable building materials, where fit-for-purpose, in walls, roofs and floors and demolition materials in fill and hardcore. This may include the re-use of materials or components from existing site facilities that are to be demolished. Investigate local facilities for receiving recyclable materials and establish a policy for the construction phase to be written into specifications. There will be a cost and potential environmental penalty if the specification makes unrealistic demands through additional transport for recycling. Also, landscape design should include provision for the recycling of green and organic waste during establishment and facility operation.

Avoid use of rainforest timber and timber from Australian high conservation forests. Balance consideration of environmental impacts of use of treated plantation timbers against use of untreated timbers from natural growth forests.

Design for use of timber substitutes or engineered wood products in preference to solid wood. Consider appropriate design detailing for engineered products to avoid any off-gassing potential.

12. Provide High Air Quality

Internal Air

All new and refurbished buildings shall comply with AS 1668.2 *Mechanical Ventilation & Air Conditioning*.

- Maximise effectiveness of ventilation through careful consideration of integrity of fresh air intake, provide filtration of fresh air, and due regard to internal building divisions and configuration.
- Use local exhaust ventilation for specific indoor sources such as wet areas, photocopier and printer locations, etc.
- Consider adoption of a building flush-out immediately prior to occupancy. Sustaining a period of full ventilation using 100% outdoor air for at least one week will reduce levels of residual volatiles. This can be a useful strategy to improve indoor air quality in high-risk situations.
- Control humidity in mechanically ventilated buildings to 40 – 70% RH by steam (not water spray) humidification.
- Protect against release of microbial hazards such as legionella bacteria into ambient air by proper design and maintenance of air conditioning and ventilation systems.
- Specify fitout and management procedures to minimise toxic fume emission from adhesives, sealants, paints, coatings, carpets, and pest control practices etc. Emissions from materials can be quite high at fitout time but then decline rapidly. Use of vapour barriers and lack of ventilation tends to permit build-up of chemical vapour in a space. Materials of high sink capacity (carpets, fabrics, upholstery, etc.) absorb and then slowly emit chemical concentrations. Avoid these installations while major emissions are still occurring.
- Avoid use of air polluting materials.
- Ensure reduction of construction contaminants in buildings prior to occupancy such as dust, particulates, water infiltration related contaminants, volatile organic compounds, etc. Specify appropriate protocols.
- Make good un-flued gas heaters.

External Air

Minimise air pollution and emissions from buildings. Specify refrigerants and processes that minimise ozone depleting potential and greenhouse warming potential. Abandon use of chlorination of water on sites and use ozone or UV instead.

13. Reduce Impact of Materials on Indoor Air Quality

Maintain a high level of indoor air quality by designing to avoid in new buildings or monitor for presence in refurbished buildings potential air quality hazards such as:

- Formaldehyde from building boards and UF insulation.

- Contamination from some soils or fill.
- Carbon monoxide from motor fuel.
- Volatile organic compounds from some building products.

Specify fitout and management procedures to minimise toxic fume emission from adhesives, sealants, paints, coatings, carpets, pest control practices, etc. Emissions from materials can be quite high at fitout time but then decline rapidly. The use of vapour barriers and lack of ventilation tends to permit the build-up of chemical vapour in a space. Materials of high sink capacity (carpets, fabrics, upholstery, etc.) absorb and then slowly emit chemical concentrations. Avoid these installations while major emissions are still occurring.

Use building materials such as insulations and carpet backings free of CFC and HCFC. Avoid use of hazardous materials such as asbestos and lead-containing products. For all glass and mineral fibres a policy of care needs to be adopted. Masks should always be used, and batts should be isolated in bags. Select building materials to avoid pollutant release during fires.

The following table gives some alternative products that may be chosen when building or renovating to provide a healthier environment. Refer to the Project Manager for approval for the use of the "safer product".

POTENTIALLY HAZARDOUS PRODUCT	SAFER PRODUCT
Chemical termite treatment	Barrier methods made from granite or stainless steel
Carpets	Hardwood timber
Synthetic carpet underlay	Jute or wool/jute mix underlay
Petrochemical paints and varnishes	Plant chemistry-based paints and varnishes
Pressed wood cupboards and furniture	Hoop pine plywood
Pressed wood sub-flooring	Solid timber
Glues and adhesives	Use physical methods eg. nailing, cementing of floor tiles. Use rubber latex, casein or PVA glues sparingly
Un-flued gas heating and cooking	Electric heating and cooker. Flued gas heating and install range hood above stove vented to outside.

(Source: Klymenko, P., 1996, Indoor Air Quality: Selecting products for cleaner air, Green Games Watch)

14. Reduce Noise

Protect sites from noise pollution from local features such as traffic, industry and entertainment venues. Provide screening or appropriate earth mounding to control noise. Design site layout to separate noise generating activities from quiet activities. Minimise noise transmission from space to space within multiple-occupancy buildings. Minimise noise emitted from external equipment such as fans, air-conditioners, compressors, and from other noise generating sources.

15. Optimise Light

Design and site buildings to avoid hazardous or undesirable glare to pedestrians, motorists, people using open spaces and those in other buildings. Avoid overshadowing and visual intrusion of adjoining sites. Design to minimise the impact of night lighting on adjacent areas.

16. Save Water

Use water efficient equipment, eg. toilets, taps, showers, appliances.

Design landscape to minimise water use, eg. select plants that require minimal watering, maximise rainwater infiltration, and slow peak stormwater velocities which may cause erosion. Measures may include minimising paved areas and increasing permeability to increase absorption, conveying stormwater via grassed swales rather than gutters or drains.

Control stormwater runoff from parking areas to prevent oil and grease runoff entering nearby waterways. Prevent any discharge of stormwater into the sewerage system. Consider measures to reduce pollutant loads entering the sewer system.

17. Minimise Waste

Design for minimum wastage in construction and demolition by:

- Formally applying dimensional co-ordination where it will practically assist efficiency of material use, particularly for modular components and materials supplied in set sizes or dimensions or where high levels of wastage may occur.
- Giving design consideration to future ability and ease of recycling construction materials and components at time of refurbishment or completion of facility's life.
- Preparing and implementing waste management project plans during project in construction phase for construction and demolition wastes. Plans should identify alternatives to landfill and describe procedures and management practices.
- Making provision in project programming for recovery, storage and transfer of re-useable materials from demolition works, including their transport from site to recycling and re-use stations; specify accordingly and supervise during construction. Consider use of separable or early works packages where this is of advantage to project.
- Adopt special procedures for disposal or recycling of hazardous materials in refurbishing existing buildings.

Input to Document

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