



THE UNIVERSITY OF
**WESTERN
AUSTRALIA**

The University of Western Australia

Design and Construction Standards

SUSTAINABILITY

K

DOCUMENT CONTROL

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Director, Campus Management

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The Standards have been developed by Campus Management with the assistance of UWA staff, external consultants, contractors and colleagues from other education institutions.

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1 Introduction

1.1 PURPOSE

The UWA Design and Construction Standards (the *Standards*) outline UWA's expectations for its built forms in order to achieve consistency in the quality of the design and construction of those built forms. They are aligned with the UWA's *Campus Plan 2010* planning principles and UWA's requisites for aesthetic appeal, maintainability and environmental sustainability, while ensuring that there is sufficient scope for innovation and technological advancements to be explored within each project.

The Standards are intended for use by any parties who may be involved in the planning, design and construction of UWA facilities. This includes external consultants and contractors, UWA planners, designers and project managers as well as faculty and office staff who may be involved in the planning, design, maintenance or refurbishment of facilities. These Standards also provide facility managers, maintenance contractors and other service providers with an understanding of UWA services in order to assist in the maintenance and operation of facilities.

1.2 SERVICES

The UWA Design and Construction Standards for **Sustainability** (this document) are a part of UWA Design and Construction Standards set of documents (the Standards). The Standards are divided into the following service documents for ease of use, but must be considered in its entirety, regardless of specific discipline or responsibilities:

- A Building and Architecture
- B Mechanical Services
- C Electrical Services
- D Communication Services
- E Hydraulic Services
- F Security Services
- G Fire Services and Fire Safety Engineering
- H Structural Works
- I Civil Works
- J Irrigation Services
- K Sustainability (this document)**
- L Vertical Transport

1.3 RELATED DOCUMENTS

1.3.1 University Documents

The Standards are to be read in conjunction with the following relevant University documents:

- UWA General Preliminaries Document
- UWA Specification for As-Constructed Documentation
- Relevant UWA planning and policy documents such as the *UWA Campus Plan, Commercial Masterplan, Landscape Vision* and *Integrated Infrastructure Strategy, University Policy on Alterations to University Buildings*, etc.
- Relevant UWA operational and maintenance documents such as preferred vendors lists, room data sheets, operational and maintenance manuals, etc.
- Other documents as referenced within the *UWA Design and Construction Standards*.

1.3.2 Relevant Legislation

The planning, design and construction of each UWA facility must fully comply with current relevant legislation, including but not limited to:

- Relevant Australian or Australian / New Zealand Standards (AS/NZS),
- National Construction Code (NCC),
- Occupational Safety and Health (OSH) legislation,
- Disability Discrimination Act (DDA),
- Accessibility Aspiration Design Factors, and
- Local council and authority requirements.

1.3.3 Manufacturer Specifications and Data Sheets

All installation must be carried out in accordance with manufacturer specifications and data sheets to ensure product performance over its intended life and so as not to invalidate any warranties.

1.3.4 Project Specific Documentation

Requirements specific to a particular project, campus or other variable, will be covered by project specific documentation, such as client briefs, specifications and drawings. These Standards will supplement any such project specific documentation.

The Standards do not take precedence over any contract document, although they will typically be cross-referenced in such documentation.

Extracts from the Standards may be incorporated in specifications, however it must remain the consultant's

and contractor's responsibility to fully investigate the needs of the University and produce designs and documents that are entirely 'fit for purpose' and which meet the 'intent' of the project brief.

1.4 DISCREPANCIES

The Standards outline the University's generic requirements above and beyond the above mentioned legislation. Where the Standards outline a higher standard than within the relevant legislation, the Standards will take precedence.

If any discrepancies are found between any relevant legislation, the Standards and project specific documentation, these discrepancies should be highlighted in writing to the Associate Director Capital Works, Campus Management.

1.5 DEPARTURES

The intent of the Standards is to achieve consistency in the quality of the design and construction of the University's built forms. However, consultants and contractors are expected to propose 'best practice / state of the art' construction techniques, and introduce technological changes that support pragmatic, innovative design.

In recognition of this, any departures from relevant legislation, or the Standards, if allowed, must be confirmed in writing by the Associate Director Capital Works, Campus Management.

Any departures made without such written confirmation shall be rectified at no cost to UWA.

1.6 PROFESSIONAL SERVICES

For all works, it is expected that suitably qualified and experienced professionals are engaged to interpret and apply these Standards to UWA projects. Works cannot be carried out by unqualified and unlicensed consultants or contractors.

1.7 STRUCTURE OF DOCUMENT

This document is structured into 4 parts:

- Part 1** Introduction (this Section)
- Part 2** General Requirements – outlines the general requirements or design philosophies adopted at UWA
- Part 3** Checklist for project team – checklist of items for consideration at various stages of a project
- Part 4** Specifications (if applicable) – materials specifications and/or preferred lists for materials, processes or equipment used by UWA.

1.8 DEFINITIONS

For the purpose of this document, the following definitions apply:

- Can:** Implies a capability of possibility and refers to the ability of the user of the document, or to a possibility that is available or might occur.
- May:** Indicates the existence of an option.
- Shall:** Indicates that a statement is mandatory.
- Should:** Indicates a recommendation.

2 General Requirements

2.1 SUSTAINABILITY PROFESSIONAL

For new buildings or major refurbishment projects, appoint a Sustainability Professional to provide the following services:

- *BCA Section J 1 - 4* compliance
- Energy and Thermal Comfort modelling
- Complete and certify compliance with this document or with other documents and guidelines (such as *Green Building Council Australia's Green Star Ratings System*) if these are used.
- Provide advice, support and information related to Sustainability principles, structure, timing and processes
- Provide guidance and support in all stages of the project.

2.2 DESIGN CONSIDERATIONS

2.2.1 Space Planning

Assessment of space requirements and consideration of space planning principles should be undertaken prior to the construction of any new development. Space should be allocated in accordance with *TEFMA Space Planning Guidelines*.

2.2.2 Re-Use of Structure

Wherever possible, existing structures or facades should be re-used or recycled.

2.2.3 Design Intent Report

All Services Consultants shall produce a design intent report which includes:

- Description of the basic functions, operations, and maintenance of the nominated building systems including a description of its intended operation and maintenance requirements; and a list of what the main components are (including controls), their operation and the importance of their efficient use.
- The targets for the project energy and water consumption and energy and water budgets for all nominated building systems.
- Description of how energy, water, and aspects of indoor environment quality are metered and monitored. This includes a meter diagram that illustrates how energy and water budgets are confirmed in operation.

2.2.4 Services and Maintainability Review

Ensure that UWA reviews all design documentation for:

- Commissionability
- Controllability
- Maintainability
- Operability
- Safety.

All services shall incorporate review comments into their documentation as required.

2.2.5 Environmental Building Performance

Set targets for the expected energy and water performance of the building as a monthly or seasonal estimate. These targets should be suitable for comparison with the operational energy and water measurements for the building and so they should be targeted to the metering to be installed in the building. At a minimum, they should include whole building energy and water estimates but may include sub-meter benchmarks if appropriate.

2.2.6 Metering

Metering schematics and schedules including loads for each meter is to be provided. Meter validation will need to be undertaken prior to handover and included within 'as constructed' documentation.

All water and energy meters must be connected to the Building Management and Control System (BMCS), capable of capturing and processing the data produced by the installed energy and water meters, and accurately and clearly presenting data consumption trends. Consult UWA regarding BMCS points schedule for all metering and monitoring.

2.2.6.1 Energy Metering

Energy sub meters (electricity and natural gas) shall be used to independently measure no more than 100kW. Sub-metering shall also comply with *BCA Section J8* where applicable. Where a single item of equipment exceeds these limits, it should be separately metered from all other items. All energy meters and the monitoring system must be validated in accordance with *Section 8.5 (Non-utility metering system validation)* of the *NABERS Energy & Water for Offices: Rules for Collecting and Using Data*.

2.2.6.2 Water Metering

Water sub meters shall be used to independently measure no more than 20% of the total building water use. Where a single end use exceeds this limit and cannot be practically divided into smaller usage loads, it should be separately metered from all other items. All water meters and the monitoring system must be validated in accordance with *Section 8.5 (Non-utility metering system validation)* of the *NABERS Energy & Water for Offices: Rules for Collecting and Using Data*.

2.2.7 Independent Commissioning Agent

A commissioning agent, independent of the project design team, shall be employed to lead the commissioning and tuning process. Consult UWA with regards to nominating a commissioning agent.

2.2.8 Building Commissioning

All services to be commissioned in accordance with *ASHRAE Commissioning Guidelines* and *AIRAH DA27 Building Commissioning manuals* or an equivalent alternative standard.

2.2.9 Building Tuning

All service consultants to include a detailed building tuning plan with their tender documentation which includes:

- The requirement for 4 off. quarterly tuning reviews in the 12 month tuning period after practical completion
- Specific tuning issues to be addressed by the contractor at these reviews
- Performance benchmarks for each system that should be used to ensure systems operate efficiently and in accordance with the design.

2.3 CONSTRUCTION MANAGEMENT

2.3.1 Environmental Management Plan

The Contractor must ensure a comprehensive, project-specific Environmental Management Plan (EMP) is in place for construction. The environmental management plan must include the requirements outlined in the *NSW Environmental Management Systems Guidelines* unless an equivalent alternative standard can be identified.

The contractor should have their environmental management system formally certified against *AS 14001* or an equivalent standard.

2.3.2 Construction Pollutants

All ductwork and absorptive materials such as carpets and furniture must be kept covered throughout construction or stored off site to prevent contamination with construction dust and chemicals. This includes the requirement to cap off all ductwork with plastic at the end of each day.

2.3.3 Reduction of Construction and Demolition Waste

A minimum of 90% of the waste generated during construction and demolition must be diverted from landfill through reuse or recycling. Either a single bin system with off-site sorting or a multiple bin solution can be used.

A summary report outlining the total quantity of construction and demolition waste from site and the proportion of the total that was recycled shall be provided to UWA.

2.3.4 Building Operations and Maintenance Information

Comprehensive Operations and Maintenance information shall be made available to the manager of the facility.

2.4 INDOOR ENVIRONMENT QUALITY

2.4.1 Entry of Outdoor Pollutants

The outdoor air intakes shall be design to comply with *ASHRAE Standard 62.1* to ensure minimum separation distances from pollution sources are maintained. Minimum separation distances shall be reflected in the mechanical services drawings.

2.4.2 Elimination of Pollutants

Sources of pollution such as plant rooms, kitchens and vehicle exhaust shall be exhausted directly to outside with no recycling of exhaust air to other spaces.

Where none of these facilities are included in the design, this requirement is not applicable.

Exhaust systems shall be shown in mechanical services documentation.

2.4.3 Indoor Pollutants - Paints, Adhesives, Sealants and Carpets

All internally applied paints, adhesives, sealants and carpets must not exceed the stipulated 'Benchmark VOC Limits' shown in *Appendix A* of this document.

2.4.4 Indoor Pollutants - Engineered Wood Products

All engineered wood products that are installed internally must be classed as E0, representing formaldehyde emissions less than 0.5mg/L or 0.041ppm.

2.4.5 Views

At least 60% of spaces where occupants are expected to work for extended periods of time must have a clear line of site to a high quality view such as an external view.

2.4.6 Existing Ductwork

All existing ductwork shall be cleaned in accordance with the *AIRAH HVAC Hygiene Best Practice Guidelines* or the *ACR 2006 Assessment, Cleaning and Restoration of HVAC Systems* or an equivalent standard.

2.4.7 Optimal Provision of Outdoor Air

Variable volume outside air systems shall be provided to all regularly occupied spaces where practical. CO₂ sensors shall be included in all regularly occupied spaces with variable volume outside air systems to:

- Reduce the outside air rate to a minimum level when the space is unoccupied
- Increase the outside air rate for all regularly occupied spaces to either 100% above the *AS 1668* minimum requirement or to a level that modelling demonstrates will never exceed 700ppm.

Mechanical documentation shall include CO₂ sensors and describe controls methodology.

2.4.8 Internal Noise Levels

Design all regularly occupied spaces to have an internal ambient noise level no more than 5dBA above the 'satisfactory' sound levels provided in the Table 1 of *AS 2107*. The assessment of the space noise levels must include all typical internal and external noise sources in the building with all services operational but with no occupant noise.

2.4.9 Reverberation

Reverberation time in the general learning areas must be below the maximum stated in the 'Recommended Reverberation Time' provided in *Table 1 of AS 2107*.

An acoustic report confirming compliance of the architectural design shall be provided during design phase. Confirmation that acoustic systems were installed as per design or an acoustic testing report shall be provided prior to practical completion.

2.4.10 Acoustic Separation

The sound insulation in general learning areas shall comply with:

- For partition walls: $D_w + L_{Aeq,T} > 75$ and
- For corridor walls: $D_w + L_{Aeq,T} > 70$.

For sole occupancy units, acoustic separation shall meet or exceed the requirements in the *BCA*.

An acoustic report confirming compliance of the architectural design shall be provided during design phase. Confirmation that acoustic systems were installed as per design or an acoustic testing report shall be provided prior to practical completion.

2.4.11 Lighting Colour Rendering Index

All lights in regularly occupied spaces must have a minimum colour rendering index of 80 unless the space has particular requirements where this is not justified.

2.4.12 Lighting Illuminance Levels

Lighting systems must be designed to have maintained illuminance levels that meet the levels recommended in *AS 1680* for the relevant space type.

2.4.13 Localised Lighting Control

All regularly occupied spaces must be provided with lighting controls that allow the occupants to have the ability to adjust the lighting levels to suit the task. This includes the ability turn lights on and off and to adjust the lighting levels. Task lighting should be considered for staff workstations where appropriate.

2.4.14 Daylighting

Daylight modelling shall be performed to demonstrate that the majority of regularly occupied spaces have suitable levels of daylight for their proposed use.

A daylight factor of 2% or a daylight illuminance of at least 160Lux for 80% of the typical occupied daytime hours is to be achieved, where practical.

2.4.15 Daylight Glare Reduction

All windows in regularly occupied spaces must include occupant controllable internal blinds or be adequately shaded to prevent daylight glare issues.

2.5 ENERGY

2.5.1 Greenhouse Gas Emissions Reduction

Detailed energy modelling of the building and an options analysis report to outline cost effective greenhouse gas reduction strategies when compared to a 'reference' building shall be produced. The energy modelling must be completed in accordance with the *Green Star Design and As Built* guidelines. The options analysis must include a whole-of-life cost estimate at a minimum of:

- Multiple glazing / shading / envelope options
- Multiple HVAC system options
- HVAC control options - e.g., CO₂ control, economy mode, etc.
- Mixed mode operation
- On site renewable energy options including solar PV, including battery storage
- Options for any other major energy consuming equipment where appropriate.

All buildings must implement any greenhouse gas savings initiatives with a simple payback period of 5 years or less with an aim to achieve a minimum of 40% reduction when compared to the 'reference' project with an aspirational target of more than 60% reduction.

2.5.2 Advanced Lighting Controls

Advanced lighting controls such as motion sensors and daylight controls shall be utilised to minimise lighting energy, in accordance with *BCA Section J*.

All external lighting must be connected to be BMCS to ensure external lighting is not left on during daylight hours.

Refer *UWA Design and Construction Standards – Electrical Services* for further information.

2.5.3 Renewable Energy Sources

For major projects and where practical, renewal energy sources should be considered. Where appropriate, life cycle analysis shall be undertaken and evaluated for the projects.

Where renewable energy sources (for example, solar PV systems) are to be incorporated, all regulatory protocols required shall be incorporated into the project, including all necessary consultation with and obtaining the approval of UWA.

2.6 POTABLE WATER

2.6.1 Potable Water Reduction

All water consuming fixtures and fittings must meet the requirements as per the *UWA Design and Construction Standards – Hydraulic Services*. If there are any variations to the fixtures and fittings, at a

minimum, the following water efficiency levels shall be adopted:

- Washroom and kitchen taps less than or equal to 6L/min
- Urinals less than or equal to 1L/flush. Waterless urinals are not to be used for maintenance reasons.
- Toilets dual flush with average less than or equal to 6L/flush
- Showers less than or equal to 9L/min.

The design team shall provide a whole-of-life cost assessment of a recycled or rainwater system to reduce total potable water consumption. This analysis shall be presented to UWA for review and incorporation where appropriate.

2.7 EMISSIONS

2.7.1 Stormwater

All stormwater should be infiltrated or reused on site to prevent any stormwater leaving site in a typical year. Where not possible, light liquid and solid arrestors shall be provided to prevent pollution discharge into natural water bodies. Refer *UWA Design and Construction Standards – Hydraulic Services* for further details.

2.7.2 Light Pollution

The external lighting must comply with AS 4282.

All external lighting must have a maximum upward light ratio of 5%.

Up lighting of trees or buildings must be avoided. Where specialty up lighting is required, these lights must be connected to the BMCS to ensure lighting is not left on when not required.

2.8 MATERIALS

2.8.1 Fitout Performance

All interior fitout and finishes must be designed with an expected life of at least 10 years. The following shall be provided to ensure compliance:

- Interior fitout and finishes schedules (base building supplied)
- Interior architect statement summarising fitout and finishes expected life.

2.8.2 Portland Cement Reduction

Concrete mixes which reduce Portland cement content as much as possible should be used where practical.

A minimum 40% reduction in Portland cement should be demonstrated as an average across all concrete used in the project.

Generally, this is easy to achieve for some items such as foundations and columns but may be difficult for some pre-cast or post-tension slabs, etc. Refer *UWA Design and Construction Standards – Structural Works* for further details.

2.8.3 PVC

All PVC cables, pipes, flooring and blinds must meet the *Green Building Council Australia's Best Practice Guidelines for PVC*.

2.8.4 Preferred Source of Timber

All suppliers of timber will be requested to provide recycled or PEFC / FSC certified timber where this does not add a significant cost burden to the project. Full chain-of-custody certification for any new timber used within the building, demonstrating formal PEFC / FSC certification, should be maintained where practical. This includes all formwork, engineered timber and solid timber products used.

A confirmation letter listing the quantity and certification status for all timber products used on site shall be provided.

2.8.5 Responsible Steel Fabricator

All steel should be sourced from a responsible steel fabricator who:

- Has a valid *ISO14001 Environmental Management System* in place
- Is a member of the World Steel Association's Climate Action Programme.

The majority of structural steel should be supplied by a steel fabricator who is accredited to the Environmental Sustainability Charter of the Australian Steel Institute.

The majority of steel reinforcing bar and mesh should be produced using energy-reducing processes in its manufacture. Energy reduction must equate to at least 40MJ/tonne.

2.8.6 Environmental Product Selection

Provide at least 3% by cost of products that have high environmental sustainability. High environmental sustainability is achieved by products that are:

- Reused
- Recycled
- Have an environmental product declaration

- Have third party certification such as Ecospecifier Green Tag or GECA
- The supplier offers a Stewardship Program in which supplier is contractually obligated to collect the item for recycling / reuse at the end of life.

All carpet must comply with one of the following sustainability certification schemes shown in *Appendix B* of this document.

2.9 TRANSPORT

Refer *UWA Campus Plan* for *UWA Integrated Transport Strategy* for transport planning principles and strategies.

Refer *UWA Design and Construction Standards – Building and Architecture* for end-of-trip facilities provisions.

2.10 ECOLOGICAL VALUE

Landscaping should aim to improve the ecological value of the site by increasing the quantity and/or value of the landscaping as a part of the development. If building area increases as a part of the development, this may still be achieved by including higher value landscaping such as native or indigenous planting in place of grass.

3 Checklist for Project Team

ACTIVITY	RESPONSIBILITY	STAKEHOLDER(S)	TIMEFRAME
Appoint Sustainability Consultant for projects with a contract value greater than \$2M or where one is deemed necessary	Project Manager	CM (Engineering Services) / CM (Capital Works)	Gate 2 Feasibility
Ensure space planning considerations have been taken into account	Project Manager	CM (Engineering Services) / CM (Capital Works)	Gate 2 Feasibility
Engage other consultants as required (acoustic consultant, operational waste consultant, lighting consultant, emissions consultant, etc.)	Project Manager	CM (Capital Works)	Gate 3 Planning
Complete Design Intent Report	Sustainability / Services Consultants	CM (Engineering Services) / CM (Capital Works)	Gate 3 Planning
Complete Services and Maintainability Review	Services Consultants	CM (Engineering Services) / CM (Building Operations)	Gate 3 Planning
Complete energy and water performance benchmarks	Sustainability Consultant	CM (Engineering Services) / CM (Building Operations)	Gate 3 Planning
Complete metering schedules and BMCS points lists	Services Consultants	CM (Engineering Services) / CM (Building Operations)	Gate 3 Planning
Complete Indoor Pollutants Spreadsheet (Paints, adhesives, sealants, carpets and engineered wood products)	Architect / Services Consultants	CM (Engineering Services)	Gate 3 Planning
Complete greenhouse gas modelling report	Sustainability Consultant	CM (Engineering Services)	Gate 3 Planning
Whole of life analysis for rainwater / recycled water systems	Hydraulic Consultant	CM (Engineering Services)	Gate 3 Planning
Engage Independent Commissioning Agent	Project Manager	CM (Building Operations) / CM (Capital Works)	Gate 3 Planning
Submit Environmental Management Plan	Contractor	CM (Capital Works) / CM (Facilities Operations)	Gate 5 Construction
Submit Waste Management Report	Contractor	CM (Capital Works) / CM (Facilities Operations)	Gate 5 Construction
Building Tuning and Commissioning	Contractor	CM (Building Operations)	Gate 6 Review

Abbreviations

AIRAH	Australian Institute of Refrigeration Air-Conditioning and Heating
ASHRAE	American Society of Heating, Refrigeration and Air-Conditioning Engineers
BCA	Building Code of Australia
CM	Campus Management
CO ₂	Carbon Dioxide
EMP	Environmental Management Plan
FSC	Forest Stewardship Council
GECA	Good Environmental Choice Australia
HVAC	Heating, Ventilation and Air-Conditioning
LED	Light Emitting Diode
NABERS	National Australian Built Environment Rating System
NSW	New South Wales
PEFC	Programme for the Endorsement of Forest Certification
PV	Photovoltaic
PVC	Poly Vinyl Chloride
TEFMA	Tertiary Education Facilities Management Association
UWA	The University of Western Australia
VOC	Volatile Organic Compound

References

- Assessment, Cleaning and Restoration of HVAC Systems (ARC 2006), National Air Duct Cleaners Association.
- DA27 Building Commissioning design application manuals, AIRAH
- HVAC Hygiene Best Practice Guidelines, AIRAH
- AS 1668 The use of air-conditioning and ventilation in buildings
- AS/NZS 1680 Interior Lighting
- AS/NZS 2107 Acoustics – Recommended design sound levels and reverberation times for building interiors
- AS 4282 Control of the obtrusive effects of outdoor lighting
- AS 14001 Environmental management systems certification
- Commissioning Guidelines, ASHRAE
- Building Code of Australia
- Green Star Rating System, Green Building Council Australia
- Energy & Water for Offices: Rules for Collecting and Using Data, NABERS
- Environmental Management Systems Guidelines, NSW Environment Protection Authority
- Space Planning Guidelines, Tertiary Education Facilities Management Association
- Campus Plan, University of Western Australia
- Integrated Transport Strategy, University of Western Australia

Appendix A: Summary of Paint and Adhesives VOC Limits

Type	Benchmark VOC (g/L)
General purpose adhesives	50
Interior wall and ceiling paint, all sheen levels	16
Trim, varnishes and wood stains	75
Primers, sealers and prep coats	65
One and two pack performance coatings for floors	140
Acoustic sealants, architectural sealant, waterproofing membranes and sealant, fire retardant sealants and adhesives	250
Structural glazing adhesive, wood flooring and laminate adhesives and sealants	100

Appendix B: Sustainability Certification Schemes

Scheme	Reference
GECA	See http://www.geca.org.au/ for a database of compliant products
ECS	See http://www.carpetinstitute.com.au/environmental/ for more details
Green Tag	See http://www.globalgreentag.com/ for more details
SMaRT 4.0 Sustainable	See http://mts.sustainableproducts.com/ for more details
VOC less than 0.5mg/m ² /hr	Check MSDS or supplier datasheet for confirmation of VOC levels.



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