LANDSCAPE AND IRRIGATION DESIGN STANDARDS

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

DESIGN STANDARDS

Document Register

Issue	Date	Description	Initials
Revision 1	18/10/21	Project Use	SE

Contents

Landscape and Irrigation

1 Campus Sites

The University of Queensland has three main campus sites at St Lucia, Gatton and Herston.

Other sites include Toowoomba, Brisbane City (Queen Street and Customs House), Heron Island, Hidden Vale / Grandchester, Indooroopilly, Long Pocket, North Stradbroke Island, Woolloongabba, Pinjarra Hills, Mt Nebo, Monto and Dayboro. Medical clinical units and teaching hospitals are also situated in hospitals across Brisbane, Ipswich, the Sunshine Coast, Bundaberg, Hervey Bay, Rockhampton and Toowoomba.

Future landscape works should incorporate the preservation of important landscape areas and attributes as well as a recognition of landscape zones that may require a different design approach.

Design continuity and landscape character is intended to be reinforced through various landscape elements and street furniture for each Campus, to provide a consistent theme or character relevant to the site and context.

Generally, campus grounds are divided into landscape zones or precincts, which are defined and discussed in various site development plans, planning reports, precinct studies and campus master plans pertaining to each campus, or in some instances applicable to all campuses.

Designers and contractors are to liaise with the UQ Project Manager to identify and obtain the current, relevant documents that influence thedesign and construction of projects for the University.

Other UQ guiding documents that would influence projects, such as sustainability plans, cultural statements, and technical guides, should also be reviewed and considered at the commencement of design.

St Lucia Campus

The vision and principles outlined in the St Lucia Campus Master Plan and the UQ Placemaking and Landscape Strategy form the foundation from which landscape design projects at the St Lucia Campus should be based.

St Lucia Campus design will identify a formal landscape response closer to the campus core and Great Court, blending out to a more naturalistic, informal response at the campus periphery, particularly around the River edge and recreational sporting areas in the flood plain.

2 Site and Design Principles

With the exception of specific areas which the University may nominate as requiring a unique landscape treatment, the University requires the continuation of its overall landscape vision or concept and adherence to the standards outlined in the relevant university documents.

Consultants are required to initiate early discussion with the University's PM to ensure that a thorough understanding of the elements

underpinning the University's landscape design vision.

Design for external areas should provide a diversity of space types (ranging from reflective spaces to those which encourage interaction), that allow for spaces to function as living laboratories in support of teaching, learning and research.

Landscape design should also maximise use of vegetation and green space - garden, trees or turf - to maintain and extend the concept of a campus in a garden or park setting, where applicable.

UQ recognizes and promotes the importance of sustainable practices and biodiversity, especially around waterways within or adjacent campuses. Landscape consultants and designers are encouraged to pursue sustainable initiatives and increased biodiversity whenever opportunities present themselves.

Across all the campuses, the University maintains a collection of significant trees and vegetation that contribute to the landscape character of their larger cities and contexts. Designs which impact either physically or visually on significant trees are to be avoided.

3 Preliminaries

Landscape Documents

The drawing list noted on the cover page of the landscape drawing package outlines the works to be completed on the site. Ensure that landscape documentation is thoroughly examined and any discrepancies within documentation or reports are highlighted with the Principal's Representative and the design team to clarify these discrepancies.

The Site

The Site is the area within the extent of works as shown in the Landscape Documents. Additional areas for the use of the Contractor during construction, must be approved by the UQ PM.

Site boundaries must be clearly defined with appropriate site fencing, prior to any works commencing. Construction works and related activities, including storage of rubbish, stockpiles, equipment and materials, are to be restricted to within the fenced area. Pedestrian pathways, vehicular roads and access driveways, and building entries shall remain clear of obstruction, clean and in good condition.

Dilapidation Report and Rectification

A dilapidation report may be required and provided to the UQ PM prior to site occupation.

On completion, the site shall be cleared of all spoil and hard surfaces left clean. Any landscape fittings temporarily removed to allow the work to proceed will be reinstated by the Contractor.

The Contractor is to review the Contract Documents, to ensure construction activities can remain within the Extent of Works as indicated. Notify the UQ PM if additional areas or elements are likely to be damaged through construction activities, so that the designers and the UQ can review the Documents and make amendments if / as required.

Rectification of damage to any elements outside the site area shall be the responsibility of the Contractor, at no cost to the UQ, prior to site handover to the University. Where rectification works are inadequate, the Contractor will be liable for remediation.

4 Protection of Existing Elements

During the early design stages, the Consultant shall consult with the UQ PM and relevant university representatives with regards to the impact of the proposed construction works on existing elements within and in close proximity to the Site.

Damage to grounds, gardens, plant material, tree roots, paving, irrigation systems and outdoor furniture shall be avoided. Any damage shall be reported to the PM and an appropriate course of action identified prior to works proceeding.

The documentation for all projects is to include a requirement for the full reinstatement of the landscape to a standard at least equal to existing condition.

Objects of cultural importance such as sculptures, facades, mosaics, heritage items are to be protected during any works, as advised by the PM. Identified objects of cultural significance are to be identified in

contract documents and the protection measures described. There may be a requirement to salvage valuable items or materials as part of early works.

Existing Vegetation & Trees

A review of vegetation within the Site and in close proximity, should consider local, state government legislation or other similar pertaining to significant, protected or native vegetation. For example, under the Brisbane City Council's Natural Assets Local Law 2003 (NALL), a permit is required for the removal of any native vegetation on the St Lucia campus site as it is classified as Significant Native Vegetation (SNV). Mapped wetlands and waterways vegetation may be protected and heritage overlays may also include trees.

An arborists assessment of trees within and in proximity to the site may be required to inform the design and to determine trees to be retained and protected, trees to be removed, trees to be relocated and any tree maintenance works to be undertaken. Tree protection measures are to be in accordance with AS4970 Protection of Trees on Development Sites. A project Arborist may be engaged pre-construction, during construction and post-construction to ensure the health of all trees is appropriately managed

Wildlife

As part of maintenance, retrofit and new builds, ensure no native fauna and vegetation identified and protected under legislation or local bylaws is harmed or disrupted. Implement approved species and or vegetation management plans and have appropriate permits and licensed flora/fauna handlers to move protected fauna. Any issue pertaining to existing wildlife on the Campus is to be referred to the UQ Project Manager.

Red Imported Fire Ants (RIFA)

Materials and machinery is to be visually free from RIFA prior to brining on to an university campus site. Materials sourced from within a current RIFA Treatment Zone is to be certified free of RIFA by the supplier and all precautions, as set out in the legislation must be followed.

High risk items, such as soils and mulch, earthmoving equipment, potting mixes and plants and landscape materials, sourced from within an RIFA Treatment Zone are to be certified visually free of RIFA by the supplier.

If RIFA or nests are found, the Department of Primary Industries is to be notified within 24 hours as per legislation.

5 Earthworks and Softscape

Excavation of Topsoil and Stockpile of Spoil

Checks for underground services shall be made by the Contractor prior to any earthworks commencing, e.g. Dial Before You Dig (DBYD) and any services damaged to be repaired by the Contractor.

Excavations and earthworks should be limited to avoid disturbance to adjacent landscape. Topsoil shall be set aside separately from other spoil and kept clean of contaminants and protected from degradation.

All reinstatement shall be adequately compacted to avoid slumping and finished grade changes over time. Heavy compaction of areas to be planted must be avoided.

Care shall be taken when using excavators or other digging or earthmoving equipment in proximity to overhanging trees or other vegetation to avoid damage to branches or the canopy. Where works are being undertaken within sensitive landscape areas (eg. Within a TPZ), hand excavation may be required and advice should be sought from the PM.

Approval for the stockpiling of materials or storage on garden beds or grassed areas shall be determined through liaison with the University Project Manager. Where stockpiling is permitted, the Contractor is responsible for landscape reinstatement and establishment.

Soils and Mulches

All soils and mulches must be suitable for the proposed application and comply with AS4454 and AS4419. Samples must be provided for approval prior to installation.

Stockpiled topsoil for re-use is to be installed to a minimum depth of 100mm.

Fresh soils, sands and aggregates brought to site must be clean and evidence the physical and chemical properties to comply with the standard as specified in the contract documents; NATA accredited laboratory soil tests for physical properties and nutrient levels may be required. Imported soils must be free of Nutgrass.

Before placing soil, the subsoil shall be properly prepared by cultivating (minimum 300mm depth) after applying gypsum and/or lime to address clay permeability and acidity / alkalinity, as required.

Soils for planting areas on grade are to be a minimum 300mm depth; soils for turf areas on grade are to be a minimum 100mm depth.

Soil depth for podium planters shall be commensurate with the planting proposed and should generally be 600mm internal soil depth for groundcovers, 800mm internal soil depth for shrubs and 1000mm internal soil depth for trees. Depths are to be confirmed with the UQ Project Manager .

Garden mulch

All mulches must be free of weed material and seed, debris and other foreign matter or contaminants. Samples must be submitted to the PM for approval prior to application.

Organic mulches must be thoroughly aged, with a coarse texture comprising 80% of particles in the 20-35mm size range and 5-10mm in thickness, with no particles exceeding 50mm. Mulches should comply with Australian Standard AS4454 Composts, Soil Conditioners and Mulches. Any nitrogen drawdown resulting from the application of mulches must be counteracted by use of appropriate fertilisers.

Inorganic mulches (gravels, recycled brick etc) may be suitable for some applications, with preference given to alternative materials with less environmental impact.

Mulches shall be evenly spread at 100mm minimum depth to planting areas.

Planting Design

University of Queensland campuses generally combine Australian native plants with complementary exotic species. This sympathetic blending of species should be continued.

Where appropriate, distinct planting themes or character may be developed for specific geographic region, to highlight plant form and properties, according to botanic classification, for indigenous or culinary themes etc. Designs are to be approved by the PM.

Plant selection should consider trees, shrubs, grasses and strappy-leaved plants and groundcovers and avoid annuals or ephemeral plants. Plants should be selected for site suitability, taking into consideration aspect, sunlight levels, soil conditions including

drainage, wind, natural rainfall patterns and the established planting character of adjacent areas.

Preference should be given to plant selections that are hardy, drought-tolerant, non-weedy or invasive, long-lived, low maintenance, resistant to pests and disease, and as free as possible of potential hazards.

Tree selection should aim for canopy cover across the campus, longevity and root or growth habits. Tree species known to cause allergies or regularly shed limbs must be avoided and large trees should not be planted close to buildings or to major underground service corridors.

Climbing plant support structures and the design of climbing plants or “green walls” should only be used where there is sufficient access for appropriate equipment for on-going maintenance

Landscape and planting design must consider maintenance requirements into the future, aesthetic presentation and visual impact throughout all stages of growth to maturity, and any amenity issues or possible adverse implications for campus infrastructure.

Planting

Planting plans should identify the species to be used, the pot / stock size and quantity of each species, and the set out and density proposed. Substitutions are to be approved by the PM.

Planting density must consider the mature size of the plants and accommodate growth and establishment, whilst ensuring the planting area has adequate plant coverage over time avoiding empty areas.

Quality nursery stock that meets the nominated specifications are to be used, and

plants treated and handled carefully to avoid damage to roots, stems and growing shoots.

New plants should have an application of fertiliser to help establishment. Pelletised, low odour, slow release organic fertilisers with a balanced NPK ratio are preferred for planting areas and low phosphorus fertilisers preferred for native plantings; used as per the manufacturer's prescribed rate.

Plants to be set at the correct planting depth so the top of the rootball is even with the finished soil level and thoroughly watered in on completion of planting.

Advanced tree stock may require staking to ensure appropriate support for establishment and growth.

Turf

Turf shall be of an approved, A Grade turf species that is free from weeds, sourced from a reputable commercial turf supplier. Preferred species include the below, or approved equivalent:

- Legend and Green Couch for general areas.
- Palmetto and Sir Walter for shade areas.
- Playing Fields - Premium Grade Green Lees Park Couch.

Turfed areas shall be lightly consolidated after preparation to avoid settlement and be graded evenly prior to installation. Turf should be laid with staggered joints and top dressed with sandy loam or sand to fill any depressions.

Regular watering should occur to ensure healthy establishment.

6 Hard Landscaping

Mowing / Garden Edges

Mowing or garden edges are to clearly define the extent of the garden bed, retain the mulch, and inhibit the encroachment of grasses and/or weeds from adjacent lawn areas.

Mowing or garden edges are typically constructed of plain in situ concrete, minimum 150mm wide x 150mm depth. Concrete mowing edges are to have construction joints and maximum 1500mm centres. Alternative, durable materials and detailing for mowing / garden edges (eg, brick) to be designed in collaboration with the UQ. Timber is not to be used for mowing / garden edges.

Pedestrian Pathways, Stairs and Ramps

Footpaths should provide a continuous accessible path of travel to all facilities and should not incorporate barriers such as steps or stairways. All footpaths are to comply with AS 1428.2 and subsequent amendments.

Wherever possible, gradients shall be no steeper than 1 in 40 for concrete or paved pedestrian surfaces. Walkways shall be no steeper than 1 in 20 and ramps provided at no greater than 1 in 14 to suit disabled access. All access gradings are to be in accordance with AS 1428.2 and the Disability Discrimination Act, 1992.

Stairs and ramps are to be designed and constructed in accordance with the National Construction Code, Australian Standards AS1428 and subsequent amendments. Approved non-skid tread, colour contrast nosings and tactiles are to be provided in line with Standards and Codes.

Tactile Ground Surface Indicators (TGSIs) should be incorporated as specified in AS1428.4 and subsequent amendments.

All pedestrian pavements shall achieve a slip resistant finish and be free of trip hazards along paths of travel. The slip resistance of all horizontal concrete surfaces is to be 'Class V' in accordance with AS4586.

Slip resistance of pavements is to comply with AS/NZS 4586 – 2013 for the classifications as documented.

Handrails, landings, widths and grades for ramps, walkways and pathways are in accordance with the Australian Standard AS 1428 and subsequent amendments.

Handrails

Handrails to be provided to ramps and stairs in accordance with the National Construction Code, Australian Standards AS1428.0 & 1428.4.1 and shall meet structural requirements.

Handrails in the campus core or higher order outdoor spaces to be durable, high quality materials e.g. stainless steel, as approved by the UQ. Handrails in the lesser order areas, or

areas more remote from the campus core may be galvanized or powder coated finishes, as approved by the UQ.

“Open hook ends” to all handrails must be closed off.

Tactile Ground Surface Indicators (TGSIs)

Provide warning type TGSIs in accordance with the National Construction Code, Australian Standards AS1428.0 & 1428.4.1. Directional type TGSIs shall be used where determined in consultation with the UQ PM or appropriate personnel, and / or by an Access Consultant.

Pavements

Finished pavement levels shall be set so as to promote overland flow or stormwater movement away from building entries, therefore 100mm minimum lower than internal floor levels. Building entries to conform with 1428.1.

Pavements may direct overland flow to stormwater pits, channels and similar, or to turfed areas or planting areas where appropriate.

Services under Pavements - paths that are cut for installation of new service crossings shall be taken back to the nearest joint and rebuilt as a whole new slab to match original joint pattern. PVC conduits are to be installed under pavements for service crossings and may require brass plaques or similar to identify the service at surface level.

Concrete Pavements

Pavements may be either exposed aggregate concrete or broom finished – either plain grey or with colour additive as agreed during the design. Concrete colours and finishes should generally match adjoining pavements or complement the character of the space. Concrete pavements are to be designed and constructed with expansion and control joints.

Unit Pavers

Unit pavers may including stone, clay, precast concrete or similar. Unit paving in pedestrian areas to be minimum 20mm depth or 30mm minimum for areas of regular vehicular traffic/use. Unit paving shall be installed on a reinforced concrete base slab, minimum 100mm depth for pedestrian traffic, minimum 150mm depth for vehicular traffic areas.

Set pavers on a nominal 10mm thickness of mortar bedding, fill joints with matching sand and cement/colour agent and install 10mm thick flexible expansion joints and where new paving adjoins existing pathways, walls or structures. Grout should be suited to the application, with colour selection to match the paving.

The design is to consider the pavement pattern, layout, set-out point and control joints to ensure the aesthetic quality is maintained in the design. Setout pavers to maintain a uniform joint width, typically between 6 – 12mm.

Variations in pavers are to be distributed in hue, colour, or pattern uniformly, by mixing pavers or paving batches before laying.

A sample setout of the unit pavers is to be inspected and approved prior to installation.

Control joints are to be inspected and approved before sealing and grouting.

Submissions of paver samples, grout and sealant samples or sample panels of finishes are to be provided for approval by the UQ PM, prior to ordering and installation.

Podium Planting Areas

The planning and design of podium planting areas should be undertaken in collaboration with landscape designers, engineers, project architects and the relevant departments of UQ.

Consideration is to be given to the following, when designing podium landscape areas:

- Waterproof membranes, specific for podium planting areas, should be used.
- Membranes which incorporate a certified root barrier treatment are preferred. If a separate root barrier is selected, the separate membrane materials should be compatible.
- Membranes should be tested by flooding and inspection.
- Plant selection should consider the rooftop environment (exposure to sun and wind) and root invasiveness.
- Growing medium should comprise a minimum of 75 per cent inorganic materials.

- Consider the use of waterproofing additives during the construction of concrete podium structures and slabs.
- Drainage and overland flow design should ensure that water drains freely.
- Exposed components are to be UV stable.

7 External Walls and Retaining Walls

Refer to Architectural, Civil and Structural Engineering Design Standards

Generally

External walls in the landscape or open space areas may be freestanding walls, seating walls or retaining walls.

Design and selection of materials and finishes shall be determined in consultation with the relevant UQ facilities staff and the PM, should be compatible with the character of the space and built form and meet the functional requirements.

All walls are to have waterproofing to the footings and all other surfaces in contact with soil and exposed to the elements. Geotextile fabric and drainage is to be installed behind all retaining walls. Waterproofing is to be installed behind all concrete, concrete masonry and block or brick retaining walls.

Podium planter walls are to be constructed in concrete or reinforced concrete masonry, fully tanked and waterproofed and properly drained and tested to ensure waterproofing and drainage is fully functional, prior to placing soil

Skate deterrents to be installed to tops of walls where damage is possible or likely, with deterrents integrated into the wall detailing.

In-situ Finishes

Concrete wall surface finishes are to be minimum Class 2 'off-form' finish to comply with AS 3160 – 2010. The Contract Document are to clearly specify the minimum standard for surface finishes and to nominate test panels for inspection and approval by the UQ PM. In situ concrete walls may be coloured concrete or plain grey, depending on the context, character and application.

Masonry

Concrete masonry wall and block selection, design and finishes are to be approved by the UQ PM, with the selected finish considerate of the context and visual appearance.

Applied Finishes

Applied finishes are to be roller or brush applications; avoid spray finishes on site. A minimum of three coats of applied finishes to be provided to external walls, where an applied finish is specified. The three coats will comprise a primer and two finishing coats. Membrane coatings on concrete masonry block walls shall be applied over a 6mm minimum thick cement render coat. Compatible applied finishes, rendering systems and membrane coatings are to be selected.

Facing

Stone Facing, tiles or similar / other wall facings may be used, as approved by the UQ, which may be either installed using mortar or an adhesive, depending on the wall type, facing and the application.

Concrete masonry walls shall be rendered with a minimum 12mm thick cementitious mortar, finished so as to achieve maximum adhesion. Facings (stone, tiles etc), are not to be adhesive fixed to concrete masonry walls.

Where an adhesive tile application is recommended for use on an external wall, a flexible, rubberized adhesive is to be used, in accordance with the manufacturer's technical specification and recommended applications. Expansion joints are to be integrated into the design.

Retaining Walls

Retaining walls are to be built from durable, dependable material with structural integrity and longevity in mind. Masonry, concrete and stone or boulder walls are typical of the type of materials to be used. Timber is not to be used in the construction of retaining walls.

Retaining walls above 1m must be certified by a structural engineer. Boulder walls are to be maximum 900mm high, typically constructed of sandstone or other rock as approved by the UQ project manager.

Consider fall heights and pedestrian access / proximity to the top of the retaining walls and install appropriate fall barriers or fencing as

required.

Seating Walls

Seat walls are encouraged as a way to create informal meeting and gathering places at locations that naturally attract people, such as at building entrances. Seat walls should be generously sized to allow for comfortable informal use, minimum 450mm wide and of a height between 400 and 600mm to allow for comfortable seating. The finish for seating walls shall be a smooth finish.

8 Landscape Furniture

A suite of high quality furniture will provide continuity between spaces and help to reinforce the precinct's landscape character and university brand.

Different precincts will have distinct requirements for furniture selection and use; e.g. on the St Lucia Campus, The Great Court precinct would be the highest order quality and quantity of furniture, whereas the more natural areas next to the River, would have less furniture and the furniture selection would be more informal.

Landscape furniture can be a combination of proprietary items and bespoke designs, appropriate to the site and intended use.

Landscape furniture includes, but is not limited to:

- Seats and benches
- Tables
- Tree grates and tree guards
- Bollards
- Waste and Bin enclosures
- Drinking fountains and water refill stations
- Bicycle Facilities.

Furniture Selection Generally

Furniture on the St Lucia Campus shall be in accordance with the UQ Landscape and Placemaking Guidelines or as directed by the UQ PM.

Property and Facilities Division shall be consulted on the type, materials, colours and character of furniture items to be incorporated into the Landscape design.

Street furniture selection and design should consider the following:

- Availability and lead times
- Locally manufactured products
- Durable, high quality materials
- Aesthetics and visual appearance
- Character and compatibility with the site, built form and landscape character
- Maintenance requirements and access for maintenance
- Furniture that minimizes or deters vandalism
- Replacement or repairs (parts or replacement of products being available)
- Ergonomic design to ensure comfort and ease of use
- Integration of infrastructure into furniture to supports events and outdoor learning areas (GPOs, recharging points, WiFi hotpots)
- Variety to support a wide range of users with different physical requirements
- All abilities use and access

Seats and Benches

Seating variety should be considered within spaces across the university campus to cater for a wide range of users and applications.

Bench seats will serve as seating for higher turnover areas, for informal spaces, or when part of a table and seating combination. Seats with backrests offer greater comfort and would be used for longer durations. Seats in combination with tables can serve multifunctional purposes, for example for study and for eating.

Options that support comfortable laptop use should be placed in outdoor learning hub areas or breakout spaces near key learning and research centres such as libraries. Typically, the seat would include a small table (integrated to provided separately) and a backrest.

Seating types and locations best suited to an outdoor space would be determined after exploring the following:

- the site, seating function and number of users – busier areas require a greater concentration of seating and seating options conducive to group gatherings

- the orientation of the seat and the user seating position, eg. Is the seat facing a view, or are a group of seats facing each other to encourage group interaction
- the aesthetic or visual appearance and character of the seat as a street furniture item
- the comfort and tactile qualities of the seating material – e.g. the feel of timber is preferred to the feel of concrete
- durable seats that are low maintenance and minimize the risk of vandalism
- options to use freestanding seats or seats integrated within, or mounted on walls or plinths
- the requirement for all abilities access and use.

Bespoke or custom seating designs should follow the appropriate ergonomic design guidelines and allow the user's body to be comfortable and not restricted. The seat design elements critical for this:

- Seat height should allow feet to comfortably rest on the ground
- The seat depth should allow clearance at the back of your knees
- Backrest angle and shape should support the natural curves of your spine, particularly the lower back
- Users should be able to change seating positions to ensure different muscle groups can be used for support

Throughout the university campus, freestanding seating should be installed on a concrete or paved surface to protect the area surrounding, and particularly to the front of the seat, from erosion.

Tables

General Purpose Outlets (GPOs) for powering digital equipment, recharging points for mobile phones and other infrastructure that supports users and university functions and events, could be integrated into tables and seating.

Tree Grates and Tree Guards

New tree plantings may require protection tree guards, tree cages or approved similar protective surrounds, depending on the location and siting of the new planting. Consideration should be given to the size of the new tree against the susceptibility to damage via impact, vandalism or damage from animals (eating, digging up).

Tree guards may be integrated with tree grates for trees installed in paved spaces, typically this would be in the Campus core areas.

In planting areas where smaller trees are installed, for example in revegetation areas, simple stakes and coreflute tree guards or similar may serve as a temporary measure to protect trees during their early growing seasons.

Adequate tree clearances are to be considered to provide space for the growth of the tree trunk and canopy.

Bollards

Bollards create a physical boundary around or adjacent to an external space; providing a visual cue signifying a pedestrian priority area. Intended to prevent vehicular incursion or to protect buildings, the siting and type of bollard should be both functional and decorative.

Safety bollards may be heavy duty or more lightweight, depending on the impact resistance required and application. The type of bollard proposed for the application to be coordinated between consultant designers and the University.

Bollards are generally placed in busy vehicular zones, for example pick-up areas, campus entries and transport hubs, where there is a greater chance of vehicular and pedestrian conflict. Tighter spacing between bollards increases protection for pedestrians, whilst the increased number of bollards create more surface area to absorb vehicular impact.

Accessibility is an important consideration during the design of bollard spacing, so that there is adequate space for pedestrians, bicycles, wheel chairs and mobility scooters to path through bollards. Bollard spacing should be minimum 900mm between two adjacent bollards to enable wheelchair thoroughfare, whilst a maximum spacing of 1500mm effectively prevents vehicular access. If vehicles are parked alongside a kerb where bollards are to be placed, the setback for bollards should be minimum 500mm from back of the kerb.

Removable bollards will provide a means of controlling access into an external space for vehicles to facilitate maintenance, servicing or emergency access.

Waste and Bin Enclosures

Refer to the University's Environmental Management System (EMS) for procedures and facilities for waste stream types, waste collection, storage and disposal including general waste, recyclables, construction waste and green waste.

Bins and bin enclosures are to be provided to external spaces throughout the university campus. In determining location of bins and appropriate disposal infrastructure, consideration should be given to:

- the EMS procedures for the waste stream relevant to external spaces (typically general waste, recycling, bottles and / or green waste)
- providing bins in areas where activity is concentrated and/or within popular congregation spaces
- distribution and quantity of bins to ensure capacity meets demand / quantity of rubbish generated in the area
- the aesthetic or visual appearance and character of the bin enclosure as a street furniture item
- bin colours and signage to clearly identify the waste type to be disposed of in that receptable (typically red colour is used for general waste, yellow colours are used for recyclable materials)
- bin enclosures or bin types that prevent animal incursion and minimize the risk of vandalism
- bin collection access and procedures and ongoing maintenance.

The number of bins in each enclosure, and their location, shall be determined in consultation with the UQ PM and the relevant waste management personnel.

Bin enclosures should be provided with a concrete slab below. Enclosures are to accommodate the preferred wheeled bin sizes used by the university campus (typically this is 240L wheeled bins).

Enclosures are to be stainless steel or similar approved, durable material suitable for regular cleaning and maintenance. Consider the location or proximity of bins to hosecocks to access water for maintenance.

Refer to the EMS and UQ PM for campus specific procedures relating to construction and building waste.

Drinking Fountains and Water Refill Stations

Water refill stations can be identified on UQ Maps.

Drinking fountains and water refill stations shall be considered for external areas throughout the university campus and these should be suitable for all abilities use and access.

Drinking fountains and water refill stations in external landscaped areas shall be of durable materials, with a concrete footing or installed on a concrete slab, to manufacturer's specifications. Water source is to be potable drinking water, with wastewater captured and disposed of in accordance with university and regulatory plumbing, water and wastewater guidelines.

Bicycle Routes on Campus

Refer to current Campus Cycling Maps to determine existing bicycle routes and supporting facilities and infrastructure.

The UQ bicycle network comprises on road routes and on pathway routes, as well as pedestrian priority pathways where cyclists must dismount and walk bicycles or where bicycles are not permitted.

New works / projects are to consider whether any pathways within the site connect to and from, or form part of, the existing bicycle and pedestrian network. Consider whether external areas should include supporting infrastructure and facilities such as bicycle racks, bicycle repair stations or water refill stations.

Bicycle Facilities

Bicycle racks are provided on every UQ campus; the locations can be identified using UQ Maps.

Bicycle racks are to be situated in visible, well lit areas, protected from weather where possible. Facilities should be provided in

accordance with AS 2890.3:2015 Parking facilities Part 3: Bicycle Parking.

Bicycle repair stations are located on every UQ campus and at PACE and Long Pocket sites and can be identified using UQ Maps.

Consider the location of external spaces in the context of the bicycle route network on campus and, existing bicycle repair stations to determine whether a bicycle repair station might be located within a site.

Repair stations have tools for basic repair and maintenance tasks, such as changing a flat tyre, or adjusting brakes and derailleurs. Tools typically include screwdrivers, allen wrenches, tyre levers and air pumps.

9 Water Supply & Drainage

Refer to the Hydraulic Engineering Design Standard for water supply to external areas.

Water Supply is to be provided to hosecocks, drinking fountains, irrigation systems and water features.

Landscape areas, courtyards and outdoor spaces near buildings are to be serviced by hose cocks in close proximity.

Drainage

Refer to the Civil Engineering, Stormwater Design Standard for in ground drainage, overland flow and surface drainage.

Refer to the Architectural and Hydraulic Engineering Design Standards for drainage associated with buildings and roofed structures in external areas.

Drainage to Softscape areas (Planting and Turf)

The design of the drainage system is to consider –

- potential or existing connections to the university stormwater system
- the capacity to capture, channel and discharge high volumes of water during a significant storm event
- the soil type and permeability
- the irrigation schedule and watering rates for the softscape areas
- the natural drainage patterns of the site and overland flow potentially directed towards and throughout planting and turf areas, and
- maintenance and serviceability, for example flushing and inspection points.

Drainage is to be provided to -

- Planting and turf areas on grade or on natural ground,
- Planting and turf areas on podium
- Behind retaining walls
- In association with underground footings where water may collect behind or around the footing and potentially compromise the foundations or structural integrity of the footing (eg. Post footings of outdoor structures or fencing).

Drainage to on grade softscape areas is to comprise slotted agricultural drainage pipes; drainage to podium areas, behind retaining walls or in association with footings may be slotted agricultural drainage or drainage cell, depending on the suitability and application.

All drainage is to be installed with geofabric to ensure functional longevity, minimizing siltation and pipe blockages. Drainage systems on grade are to be installed in gravel trenches.

Slotted drainage pipes are to be 100mm minimum diameter.

Where drainage is installed under pavements and hardscape areas, rigid PVC shall be used.

All drainage systems in softscape areas, behind retaining walls or in association with footings are to connect to and discharge into the stormwater system, unless otherwise approved by the UQ PM.

Trafficable grates for stormwater pits are to be stainless steel, compatible with wheelchair traffic and non-slip, “heel guard” type or approved equivalent suitable for pedestrian areas.

10 Lighting

Refer to the Electrical Engineering and Lighting Design Standards

11 External Signage

Refer to the Signage Design Standards and the UQ External Signage Manual.

12 Post Construction

Maintenance Period

The Landscape Maintenance period shall commence from the date of Practical Completion of the Works and shall extend for the period nominated in the Landscape Documents.

Maintenance of landscape works will include all works and actions as outlined in the Landscape Documents. Typical maintenance procedures for softscape works include watering, pruning, weeding, pest and disease control, the application of fertilizer and soil conditioners, mowing of turf, replenishment of mulch, rectification of soil subsidence, replacement of dead or missing plants. Replacement plants shall be of a size and maturity which matches those in the landscape at the time of replacement.

Typical maintenance procedures for hardscape elements include supplementary coats of painted finishes or stains, cleaning of elements and graffiti removal, tightening of bolts or swages, rubbish collection.

Regular inspections shall be undertaken by the UQ PM and by the Design Consultant during the maintenance period to ensure maintenance activities are being carried out in accordance with the Landscape Documents.

Defects Liability Period

During the defects liability period the Contractor will be responsible for the full establishment and maintenance of all aspects of the new works, including plants and planting areas, turf, pavements, walls, furniture, fittings and features, and the operation and proper functioning of associated irrigation.

On completion of the defects liability period:

- Any planting failures, equipment breakdowns or other repairs associated with installations delivered as part of the project works is to be made good by the Contractor.
- Trees and garden plantings shall be healthy and well presented.
- The density and composition of the planting shall comply with the Landscape Documents.
- Planting areas shall be free of weeds and have an appropriate covering and depth of mulch or other specified surface dressing.
- All landscape surfaces, fixtures, fittings, furniture and equipment shall be in proper order.
- An inspection carried out by the UQ PM or his/her nominee and approval given.

General cleaning of external areas within the project precinct during the Defects Liability Period will be the responsibility of the University.

As Built Drawings, Warranties, Manuals

The Contractor is to provide all information regarding the assets installed and built to ensure ongoing operations, maintenance and repairs can be carried out. This may include the provision of –

- Warranties
- Guarantees
- Maintenance and Operational Manuals
- As Constructed Drawings.

In addition, the Contractor is required to undertake a post construction site survey and provide the relevant digital and hard copy files, as directed by the UQ PM.

13 Irrigation

Referenced Documents

Current documentation and guidelines utilised by UQ for project procurement include the following:

- The Water Efficiency Management Plans (WEMP)
    - pbs_WEMPCustomsHouse.pdf
    - pbs_WEMPExptlMine.pdf
    - pbs_WEMPGatton.pdf
    - pbs_WEMPPinjarra.pdf
    - pbs_WEMPStLucia.pdf

- The Sustainability Action Plan
    - UQ-SAP.pdf
- Lakes Management Operating Procedure
    - pro_LakesMgt.pdf
- Irrigation Operating Procedure
    - pro_Irrgtn.pdf
- Water Management Program
    - WtrPrgrm.pdf

Referenced Standards

The design standards adopted are listed below, and are to be adopted as part of the design documentation where relevant, noting that the governing body/Local Authority will take precedence:

- ASA185 - Solvent welding cement for use with rigid uPVC pipe and fittings.
- AS1159 - Polyethylene Pipes for Pressure applications.
- AS1167 - Welding & Brazing filler materials.
- AS1319-1994 - Safety Signs for the Occupational Environment
- AS1345-1995 - Identification of the contents of piping, conduits and ducts.
- AS 1432 : 1996 - Copper tubes for plumbing, gas fitting and drainage applications.
- AS1477 - Unplasticised PVC (uPVC) pipes and fittings for pressure application (metric).
- AS1585 - Capillary alloy threaded pipe fittings for use with pipe threads of Whitworth form.
- AS1628 - Copper alloy gate valves and non-return valves for use in water supply and hot water services.
- AS2032 - Code of practice for installation of uPVC pipe systems
- AS 2033 : 1980 - Installation of polyethylene pipe systems.
- AS2053 - Non-metallic conduits and fittings
- AS2129 - Flanges for pipe, valves and fittings
- AS2698.1 - Plastic Pipes and Fittings for Irrigation and Rural Application.
- AS 2698.2 :2000 - Plastic pipes and fittings for irrigation and rural applications ¬Polyethylene rural pipe.
- AS 2698.3 :1990 - Plastic pipes and fittings for irrigation and rural applications ¬Mechanical joint fittings for use with polyethylene micro irrigation pipes.
- AS2845 - Water supply mechanical back flow prevention devices.
- AS 2845.1 :1998 - Water supply ¬ Backflow prevention devices ¬ Materials, design and performance requirements.
- AS 2845.2 :1996 - Water supply ¬ Backflow prevention devices ¬ Air gaps and break tanks.
- AS 2845.3 :1993 - Water supply ¬ Backflow prevention devices Field testing and maintenance.
- AS3500 - National Plumbing and drainage code.
- AS3500 - Section 9 - Non-drinking water
- AS 3500.0:1995 - National Plumbing and Drainage Code ¬ Glossary of Terms.
- AS 3500.1.1:1998 - National Plumbing and Drainage Water Supply Performance requirements.
- AS/NZS 3500:2003 - National Plumbing and Drainage Water Supply ¬ Acceptable Solutions.
- AS 3500.2.1:1996 - National Plumbing and Drainage Sanitary plumbing and drainage - Performance requirements.
- AS 3500.2.2:1996 / Amdt 1:1999 - National Plumbing and Drainage Sanitary plumbing and drainage - Acceptable Solutions.
- AS 4129 : 2000 - Fittings for polyethylene (PE) pipes for pressure applications.
- AS 4130 : 2001 - Polyethylene pipes for pressure applications.AS 1742.

14 Water Supply

Water Source & Usage Constraints

Water supply for irrigation systems at University of Queensland campus' vary between potable, harvested rainwater, and recycled water. Guidelines for the use of non

potable water can be obtained from DEWS web site

It is important to understand the following terms when interpreting the requirements detailed in the table that follows.

Minimum on-site controls

- Certain controls must be employed for every use of recycled water. These controls are required because recycled water, other than purified recycled water (which has been very highly treated and can be used to replenish drinking water supplies), cannot be considered suitable for human consumption.

Minimum on-site controls must include:

- Compliance with all applicable plumbing requirements, to prevent cross-connections with drinking water pipes
- Prominent warning signs at public access points to where recycled water is used indicating that the recycled water is not suitable for drinking or for human exposure. Signage to be compliant with Australian Standard 1319-1994 Safety Signs for the Occupational Environment
- Precautions to ensure the recycled water does not contaminate any source of water used as a supply of drinking water (e.g. dam or bore). This may require the use of setback distances (the distance from where the recycled water is applied to the location of the water source used as a supply of drinking water).
- When there is any doubt as to whether the use of recycled water in a particular area will have negative impacts on a supply of drinking water, recycled water providers are strongly encouraged to make contact with the potentially impacted entity and to discuss the proposed use of recycled water in that area.
- No runoff or ponding of recycled water, and
- No overspray.
- Prominent warning signs must be displayed, at points of public access and on taps and fittings, that indicate the water is not suitable for drinking or human contact, for example: − Recycled water: do not drink, avoid contact

Spray drift control

Spray drift control is an on-site control mechanism that minimises spray from drifting beyond the irrigation area. This can be achieved by the use of low-angle throw sprinklers nozzles, vegetation pressure reduction valves, physical screening (e.g. windbreaks), anemometer switching (to monitor and respond to wind conditions) and other related methods.

Restricted access

Restricted access can be defined as:

- Preventing members of the public from accessing the area where recycled water is being used, and for four hours after use or until dry. This may be achieved through the use of physical barriers, appropriate to the location, that deter access (e.g. uninterrupted fencing with locked gates), or
- Irrigating at times when there is a very low likelihood of members of the public being present in the area where recycled water is being used.

Buffer zone

A buffer zone is an area, between where recycled water is used (for example the edge of the wetted area from a sprinkler) and where members of the public could be present, that minimises or eliminates potential for exposure to recycled water.

Table 1 Water Quality Classifications and allowable uses

Water Quality Class	Usage	Health Control Measures	Requirements of Health Control Measures	Comments
Class A+ (POT)	All irrigation	No on-site control required	No control methods required	Water efficient irrigation delivery methods conforming with current Australian and Industry best practice standards. For potable water, use the following colour pipe: HDME / MDPE = Black poly pipe with blue line stripe. uPVC = Blue or white pipe.
Class A (NP)	All irrigation	Minimum level of on-site controls	There must be no recycled water overspray of the property boundary, pedestrian paths or walkways	Water efficient irrigation delivery methods conforming with current Australian and Industry best practice standards. Irrigation sprinkler outlets should utilise nozzles that provide large droplets to minimise wind drift. Lilac colour pipe, valve boxes sprinkler caps must be used . Recycled water use signage required.
Class B (NP)	Aerial spray irrigation & sub surface irrigation	Medium level of on-site controls	Use drip or subsurface irrigation; OR Restrict public access during and after irrigation for four (4) hours or until dry; AND One (1) of the following: Implement spray drift controls to prevent drift beyond the irrigation area. Implement a minimum buffer distance of 30 metres from the irrigation area to the nearest point of public access.	Water efficient irrigation delivery methods conforming with current Australian and Industry best practice standards. Irrigation sprinkler outlets should utilise nozzles that provide large droplets to minimise wind drift within buffer zones Any aerial spray irrigation zones should be limited to areas within security fenced areas to restrict public access. Sub surface drip irrigation recommended for all landscape gardens Lilac colour pipe, valve boxes sprinkler caps must be used. Recycled water use signage required.
Class C (NP)	Aerial spray irrigation & sub surface irrigation	High level of on-site controls	Use drip or subsurface irrigation; OR Restrict public access during and after irrigation for four (4) hours or until dry; AND Both of the following: Implement spray drift controls to prevent drift beyond the irrigation area. Implement a minimum buffer distance of 50 metres from the irrigation area to the nearest point of public access.	Water efficient irrigation delivery methods conforming with current Australian and Industry best practice standards. Irrigation sprinkler outlets should utilise nozzles that provide large droplets to minimise wind drift within buffer zones. Any aerial spray irrigation zones MUST be limited to areas within security fenced areas to restrict public access. Sub surface drip irrigation recommended for all landscape gardens Lilac colour pipe, valve boxes sprinkler caps must be used. Recycled water use signage required.
Class D (NP)	Primarily sub surface irrigation only	Maximum level of on-site controls	If members of the public may be in the vicinity of the irrigation area: No public access and drip irrigation, or No public access permitted, a spray drift control, and a buffer zone of at least 50 metres	Water efficient irrigation delivery methods conforming with current Australian and Industry best practice standards. Irrigation sprinkler outlets should utilise nozzles that provide large droplets to minimise wind drift within buffer zones. Any aerial spray irrigation zones **MUST** be limited to areas within security fenced areas to prevent public access. Sub surface drip irrigation recommended for all landscape gardens Lilac colour pipe, valve boxes sprinkler caps must be used. Recycled water use signage required.

Water Supply Hydraulic Parameters

The irrigation designer must always comply with the hydraulic performance limitations in conformance with Australian Standards and National Plumbing Code regardless of the quality of the water source.

The following hydraulic parameter limitations are specified to ensure the irrigation system optimum performance whilst guaranteeing safe operation in accordance with relevant Australian Standards.

Table 2 Hydraulic Design Limitation - Velocities

Component	Maximum Velocity
Water meter & backflow assembly	1.0 m/sec
Mainline pipework & valves	1.0 m/sec
Lateral pipework	1.5 m/sec

Table 3 Water Supply Hydraulic Design Limitation – Flow rates

Water meter & backflow assembly size	Recommended Duty
25mm	1.0 L/sec @ 450kPA
32mm	1.5 L/sec @ 450kPA
40mm	2.0 L/sec @ 450kPA
50mm	4.0 L/sec @ 450kPA
80mm	5.0 L/sec @ 450kPA

Irrigation / Plumbing scope of works delineation

It is generally considered that all projects will have a defined scope of works between plumbing and irrigation contractors as follows:

Plumbing

- Connection to water source
- Local water authority approved Primary water meter
- Backflow prevention assembly with secure enclosure
- Isolation valve after backflow prevention assembly for irrigation system connection

Irrigation

- All components downstream of irrigation system connection
- point isolation valve

Level of Backflow Prevention

It is recommended for all irrigation systems with UQ properties to use a Reduced Pressure Zone Valve assembly for full protection of water mains from backflow and back pressure.

Water Supply Arrangements & Components

Irrigation systems can be supplied from various type of pressurised water sources.

The following hydraulic components described for each pressurised water source are considered minimum requirements for all irrigation systems to comply with Australian Standards, National Plumbing Code, and Industry best practices.

Pressurised Potable Town Mains

Direct connection to local water authority potable town mains supply.

Typically 400-500 kpa pressure range

- Local water authority approved primary water meter
- Backflow Prevention Device
- Y strainer
- Main water source Isolation
- Water supply pressure regulation (site specific requirement only)
- Master control solenoid valve with flow sensor for connection to irrigation controls system
- Irrigation mainline isolation point/s
- Irrigation mainline air valve/s
- Irrigation zones solenoid valves with on valve pressure regulation

Storage tank & pressure pump system with potable supply top up to tank

Pressure pump system connected to storage tank with potable fill to tank as backup supply

Typically 500-600 kpa pressure range

- Local water authority approved primary water meter
- Backflow Prevention Device on backup supply to tank
- Y strainer
- Main water source Isolation for both tank fill and main pump system
- In tank float valve for auto topup of tank from potable source
- Irrigation pressure pump system
- Filtration system to suit condition of water supply with backwash plumbed to drainage system
- Master control solenoid valve with flow sensor for connection to irrigation controls system
- Irrigation mainline isolation point/s
- Irrigation mainline air valve/s
- Irrigation zones solenoid valves with on valve pressure regulation

Open water body & pressure pump system

Pressure pump system with suction line from open body water source (lake)

Typically 500-600 kpa pressure range

- Suction line with either submerged intake screen on plinth or suction screen with footvalve slung under floating pontoon
- Water body level monitoring system to prevent exceeding draw down limit
- Suction line isolation point
- Irrigation pressure pump system
- Filtration system to suit condition of water supply with backwash plumbed to drainage system
- Master control solenoid valve with flow sensor for connection to irrigation controls system
- Irrigation mainline isolation point/s
- Irrigation mainline air valve/s
- Irrigation zones solenoid valves with on valve pressure regulation

Water Management Plans

Local water authority conditions of use for the specific water supply available for use with irrigation must be obtained prior to commencement of the irrigation design to determine the water usage management plans require to be submitted for use of the available water source.

15 Pipework and Valves

Pipework Systems

The irrigation designer must always comply with the hydraulic performance limitations in conformance with Australian Standards and National.

Pipe depth and trench details
The following pipe coverage and trenching widths are recommended.

All mainline pipework is to have 100mm of sand bedding under pipework and marker tape colour coded to suit the water supply laid 200mm above pipework.

Marker tape must have metallic tracer wire included

Table 4 Pipe cover and trenching

Pipework	Cover over pipe	Trench width
Mainline	450mm	300mm
Lateral	300mm	200mm

Pipe material and flow parameters
The following pipe materials are recommended for mainline and lateral pipework

All mainline pipe work is to be either uPVC CL12, Rubber Ring Joint, Class 12 to AS 1477 or M.D.P.E. PE 100, PN 12.5 to AS / NZS. 4131

All Lateral pipe work will be uPVC CL12 SWJ or M.D.P.E. PE 80, PN 12.5, to AS / NZS. 4131
All pipework is to be colour coded to suit water supply as per Table 1

Mainline & Lateral Pipe Hydraulics

Maximum Main Line Velocity: 1.0m/s.

Maximum pressure loss in mainline pipes to 30 m head / 1,000m, for mains less than 500m; 15m head / 1,000m for mains over 500metres.

Preferred Mainline Configuration: Ring mains wherever possible.

Maximum Lateral Line Velocity: 1.5m/s.

Maximum pressure loss in lateral pipes between the first and last outlets on a station of no more than 10% of the designed operating pressure of the selected irrigation outlets

Table 5 Pipe size and flow parameters

MDPE PN12.5	Mainline Pipework Flow @ 1.0m/sec		Lateral Pipework Flow @ 1.5m/sec			uPVC Cl 12	Mainline Pipework Flow @ 1.0m/sec		Lateral Pipework Flow @ 1.5m/sec	
125mm	8.90 L/sec	534.00 L/min	-	-		-	-	-	-	-
110mm	6.88 L/sec	412.80 L/min	-	-		100mm	8.12 L/sec	487.20 L/sec	12.2 L/sec	732.00 L/min
90mm	4.60 L/sec	276.00 L/min	6.84 L/sec	410.40 L/min		80mm	4.90 L/sec	294.00 L/sec	7.35 L/sec	441.00 L/min
75mm	3.19 L/sec	191.40 L/min	4.74 L/sec	284.40 L/min		65mm	3.52 L/sec	211.20 L/sec	5.29 L/sec	317.40 L/min
63mm	2.25 L/sec	135.00 L/min	3.35 L/sec	201.00 L/min		50mm	2.23 L/sec	133.80 L/sec	3.35 L/sec	201.00 L/min
50mm	1.42 L/sec	85.20 L/min	2.11 L/sec	126.60 L/min		40mm	1.44 L/sec	86.40 L/sec	2.16 L/sec	129.60 L/min
40mm	0.90 L/sec	54.00 L/min	1.35 L/sec	81.00 L/min		32mm	1.09 L/sec	65.40 L/sec	1.64 L/sec	98.40 L/min
32mm	0.58 L/sec	34.80 L/min	0.86 L/sec	51.60 L/min		25mm	0.68 L/sec	40.88 L/sec	1.03 L/sec	61.80 L/min
25mm	0.35 L/sec	20.94 L/min	0.52 L/sec	31.20 L/min		20mm	0.41 L/sec	24.60 L/sec	0.62 L/sec	37.20 L/min

Irrigation Valves

The following list of valves are commonly found in irrigation systems.

Isolation Valves
For the purpose of shutting off or isolating sections of mainline

Scour Valves
For the purpose of flushing sections of mainline pipework and are located at low points along the pipework or between valve sections.

The scour valve should be sized to allow a minimum scour velocity of 0.6 m/s to be achieved in the main pipe.

Air Valves
For the purpose of releasing trapped air within mainline pipework to reduce flow restrictions and the effects of pressure surge.

Air valves should be placed along the pipeline at all high points or significant changes in grade.

Check Valves
For the purpose of controlling direction of water flow in one direction only by preventing reverse flow of water.

Ball Valves
For the purpose of isolating sections of lateral pipework downstream of solenoid valve. Ball valves are not to be used for mainline isolation purposes.

Pressure Reducing Valves
For the purpose of controlling higher or fluctuating pressure in upstream pipework to a reduced constant pressure to protect components and equipment on the outlet side of the valve.

Pressure Sustaining Valves
For the purpose of maintaining a minimum set pressure upstream of the valve, catering for fluctuations in pressure on either side of the value. This is achieved by the valve gradually opening or closing to maintain a set pressure

Solenoid Valves
Low voltage 24, electromechanically-operated valve for the purpose of controlling water flow to designated areas

On-Valve Pressure Regulator
For the purpose of variably reducing pressure locally at the solenoid valve by fitting a variable pressure reducing device between the solenoid coil and the valve body.

In-Line Pressure Regulator
For the purpose of reducing pressure to a constant pre-set level locally at the solenoid valve by fitting an inline pre-set pressure device upstream of the solenoid valve.

Quick Coupling Valve
For the purpose of accessing irrigation mainline for manual watering via a secure valve and key with a hose fitted to the valve insertion key.

16 Control System

Control system compatibility is the primary consideration for any project where an existing controls system may exist on site.

Following the selection of the appropriate brand and level of control, the consultant or contractor should consult directly with the end user of the irrigation system to define all required control components

Controls Systems

A method of automatically controlling irrigation zones over a period of time (water window) from a central point via low voltage 24v cabling.

Typical Watering Window: 8.0 hours / night x 7 nights / week.

Irrigation controller to be of commercial grade control and have the minimum features:

- Multiple start stop programs
- Multiple start times per program
- 365 day calendar
- Minimum run time per zone oof 1 minute
- Multiple sensor input to suit project requirements
- WIFI communication ability to remote smart device
- Non-volitile momory / battery backup
- Digital display for irrigation zone programming

Central Control
An irrigation controls system utilising a centrally based pc with interface device/s to remotely control and monitor irrigation controllers located in the field.

Stand Alone Field Controller

An irrigation controller installed for the purpose of controlling localised irrigation zones only.

Control Cabling

Two method of cabling connections between the controller and solenoid valves can be used, either multi core cable or decoder cable.

Multi core cable system

Irrigation solenoid valves connected to the irrigation controller with low voltage multicore cable.

Cable wire qty sized to suit controller capacity and number of solenoids to be connected.

Decoder controls system

Irrigation solenoid valves connected to the irrigation controller with low voltage twisted pair cable.

Decoder modules connected to the decoder cable are then wired to the solenoid valves with specific addresses for the irrigation controller to communicate with.

Wire Joins

Wire join clips filled with either epoxy or gel solution to provide a waterproof membrane to protect exposed wire from moisture corrosion.

Grounding & Surge Protection

For decoder cable control systems the following electrical grounding requirements must be used.

Grounding Plate

Copper plate installed underground and wired to controller for grounding purposes.

Grounding Rod

Copper grounding rod installed at end of decoder cable runs and also ever 150m along cable path.

Line Surge Protection

In line fuse device installed on decoder cable before direct connection to controller

Control Sensors

Irrigation operation can either be over ridden or adjusted by using situation sensing devices.

Rain Sensor

Sensor for over riding irrigation in the event of rainfall

Wing Sensor

Sensor for over riding irrigation in the event of high wind

Flow Sensor

Sensor for over riding irrigation in the event of flow rate occurring outside of predefine limits

Pressure Sensor

Sensor for over riding irrigation in the event of pressure changes outside of predefine limits

Moisture Sensor

Sensor for either over riding irrigation or monitoring soil moisture levels

ET Sensor

Sensor for monitoring and adjusting irrigation water budget rates in response to evapotrasnspiration

Water Level Sensor

Sensor for monitoring water levels either tanks or wet wells to activate or deactivate irrigation or refill water source

17 Irrigation Outlets

Irrigation application methodology and appropriate outlet choice is primarily governed by water source quality.

Various types of irrigation outlets can be used to water landscape and turf areas, however it is vital to select the correct method and product that is suitable and also conforming with the specific water supply quality.

Aerial Spray Irrigation

A method of watering landscape and turf areas from over head watering from pressureised outlets.

All sprinkler / nozzle combinations must have the following minimum features:

- Commercial grade construction
- Pressure compensation
- Matched precipitation
- Integral check valve to prevent low head drainage
- Wiper seal
- Self flush on retraction

Fixed spray sprinkler

A sprinkler outlet with fixed “fan” style water distribution available in 50mm, 100mm, 150mm, 300mm popup sprinkler bodies and fixed rigid shrub riser with variable arc fan style nozzle fitted.

Rotary spray sprinkler

A sprinkler outlet with “finger” rotary style water distribution available in 50mm, 100mm, 150mm, 300mm popup sprinkler bodies and fixed rigid shrub riser with rotary style nozzle fitted.

Gear drive rotor sprinkler

A sprinkler outlet with water single stream style water distribution available in 100mm, 300mm popup sprinkler bodies and fixed rigid shrub body.

Sub Surface Irrigation

A method of watering small area or internal building landscapes via direct root watering below ground in areas where aerial spray irrigation is either not permitted or not appropriate.

Inline drip tube

An outlet device consisting of internal emitters within a low density pipe.

All drip emitters must have the following minimum features

- Anti drain / Anti Syphon
- Root intrusion protection (non treflan)
- Pressure compensated to 1.5m

Root watering Devices

An outlet device for applying water and aeration to advanced tree rootball via an adjustable bubbler housed in a perforated tube. Top of tube sits flush at ground level with slotted grate to allow air movement to base of rootball zone.