



Infrastructure Engineering and Construction Manual (IECM)

March 2018

At Sydney Olympic Park Authority, we are committed to ensuring that Sydney Olympic Park's public domain is consistently of the highest standard and that it promotes an engaged, healthy environment for our community and visitors.

The challenge of ensuring a high quality public domain will intensify in the years ahead as Sydney Olympic Park maintains its position as Australia's premier sports and events precinct, grows its business and education populations and welcomes a new residential community.

Sydney Olympic Park Authority has developed the Infrastructure Engineering Design Manual (IECM) to accompany the Urban Elements Design Manual (UEDM), which sets out clear quality and performance standards for the public domain. Together with other planning and control documents such as the Master Plan 2030, these documents will ensure that Sydney Olympic Park continues to be an exemplar of high quality, sustainable urban development.

Asset Management and Strategy Unit
Sydney Olympic Park Authority

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1 Document Control

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B	15/06/18	Amended	HN	HN	HN

2 Foreword

2.1 Vision

Sydney Olympic Park covers 640 hectares and is one of the world's largest urban parks. It includes 425 hectares of green spaces along with a diverse range of world-class sporting and leisure venues and a new town centre. This urban core of the park is evolving and includes commercial, residential, retail and educational development and accommodates a significant local population. The diversity of the park users and community demands a robust, flexible and of high quality urban domain.

While the Urban Elements Design Manual (UEDM) sets out the high quality standards for the public domain, the Infrastructure Engineering and Design Manual (IECM) is designed to achieve high quality durable and sustainable public infrastructure to support the community and developments on the site. IECM is aiming to achieve a seamless integration of engineering, architecture, technology and ecology by setting the processes and parameters for the design, construction and quality control in the precinct.

Sydney Olympic Park Authority's vision for the public domain is a world-class multi-functional sustainable precinct that continues to be the world-class regional park and premier for major sporting, entertainment and cultural events precinct and the showcase for smart cities and green star communities.

2.2 What is the IECM?

The Infrastructure Engineering and Construction Manual (IECM) is prepared and adapted by the Sydney Olympic Park Authority (the Authority) in 2017. The purpose of the IECM is to deliver an integrated and consistently high quality public realm for Sydney Olympic Park with a particular focus on the urban core of the Town Centre.

The IECM as a technical manual sets standards of performance and design quality which considers robustness, fitness for purpose, sustainability of material selection, operational efficiency and integration with the existing public domain as a legacy of the 2000 Summer Olympics. The IECM, in conjunction with other authority's guidelines, manuals and specifications, sets the standard for public safety, amenity and universal access.

The IECM aims to achieve high quality construction and sustainable public infrastructure and public domain by:

- Promoting value engineering;
- Emphasising the compliance with the regulation and current standards;
- Implementing better quality control processes;
- Defining the parameters and specification for design, construction and quality control of the works.

In the other words the IECM is the design, construction and handover specifications for all projects within the Sydney Olympic Park that provides the minimum engineering performance requirements for works to be undertaken in the public domain within the Sydney Olympic Park Precinct.

2.3 Who should use the IECM?

The IECM as a technical reference manual is applied to any proposed works within SOPA's land and any works that has an interface with SOPA lands or assets. This document should be used for the design of all elements of public infrastructures and utilities. This document is used by developers, consultants, contractor, utility companies, principle certifiers who are involved in any projects, utility installation and developments at Sydney Olympic Park.

2.4 How the IECM is used?

The IECM must be read in conjunction with various Authority's guild lines, design manuals and policies in addition to the development consent conditions and planning documents. Some of these documents are listed below:

- SOPA Urban Design Element Manual (UEDM);
- SOPA Parklands Element Design Manual (PEDM);
- SOPA Park Element Design Manual;
- SOPA Master Plan 2030;
- SOPA Guidelines: Access;
- SOPA Guidelines: Outdoor advertising and promotional signage;
- SOPA Guidelines: Protection of trees on construction sites;
- Major Events Impact Guidelines.

All the design documentation and quality control plans for any public infrastructure or publically accessible spaces must be in prepared in accordance with

- 4.1.8: Design Requirements (page 4.1.8)
- 9.6 : Quality Control (page 61)

The design consultants and developers must submit a complete construction quality control plan as part of their design documentation. The quality control plan must be written in conjunction with this document.

The construction specifications must be developed by the design consultants in accordance with this document and approved by the Authority prior to the commencement of the construction.

The certificates and checklist which are required by the authority must be prepared in accordance with various sections of this document including but not limited to:

- 9.8: Certification (page 62)
- 11: Checklists and Certificates (page 66)

2.5 How often IECM is updated?

As IECM has references to the current standards, any changes or update to the current standards must be considered by the users of the IECM.

The Authority aims to update this document annually. IECM may be updated and transferred onto the construction industry specification platforms such as NATSPEC and AUSPEC which be regularly update. Until adaption of such platforms, the document will be annually updated by the Authority when required.

3 Introduction

This technical manual has been prepared to detail the minimum engineering performance requirements for works to be undertaken in the public domain within the Sydney Olympic Park Precinct.

The manual covers the following areas:

- Design standards, including qualifications of the designers;
- Documentation standards;
- Typical details and standard specifications for works.

The manual is to be used for the following:

- New roadways and pathways under SOPA control;
- Modifications to existing SOPA public domain areas, such as works within the road reserve;
- Rectification of SOPA owned infrastructure following installation of services or other works in the public domain.

It is intended to be read in conjunctions with the Urban Elements Design Manual (UEDM).

3.1 Glossary

AEP	Annual Exceedance Probability
AS	Australian Standard
AS/NZS	Australian and New Zealand Standard
ASP	Accredited Service Provider
RMS	NSW Roads and Maritime Service
SOP	Sydney Olympic Park
SOPA	Sydney Olympic Park Authority
UEDM	SOPA Urban Elements Design Manual
WSAA	Water Services Association of Australia
WSC	Water Servicing Co-ordinator (Sydney Water)
WSUD	Water sensitive urban design
AG	SOPA Access Guideline

4 Design

4.1 General

4.1.1 Extent of works

Unless specified in the DA condition or previous correspondence with SOPA's planning team and infrastructure engineering team, the extent of the works for any development must include the adjacent public domain and full width of footpath. If any works are undertaken on the road the design must indicate these works. This includes all utility and essential services connection.

4.1.2 Qualifications of Designers

All works shall be designed by a professional engineer, registered on the National Engineering Register (NER).

The following additional requirements apply for specific services:

- Works on Ausgrid infrastructure shall be designed by a Level 3 ASP;
- Works on Sydney Water assets (sewer and water mains) shall be designed by a Sydney Water approved WSC.

4.1.3 Works boundary and Interface

The design for any works undertaken in SOPA's land must consider the followings:

- All interfaces must be free of any obstruction and all services and utilities in the public domain around the developments must be underground to maximise the accessibility and footpath width.
- No new above-ground utilities must be installed in the Sydney Olympic Park Areas. Any essential installation must be coordinated with the authority prior to commencement of works. These utilities includes but not limited electrical switchboards, electrical isolation pillars, light poles, utility pits.
- All footpath interfaces must be made good including the public areas surrounding the project extent of works and construction compounds.
- All surfaces must be designed and to have smooth transition and the designers must specify a minimum 600mm restoration zone where works has interface with SOPA's land, assets and infrastructure.
- All designs should be submitted to SOPA for approval including all utility connections, public domain plans and public infrastructures. The plans should include detailed survey of the areas within 20m of the work site.

4.1.4 Services

Service authorities include Sydney Water, Jemena, Ausgrid, Telstra, Optus, etc. Design of works on their mains and infrastructure shall be in accordance with their standards.

All the works including projects, developments and utility installations must be designed and submitted to SOPA for approval. Any works that have any impact on public domain including parks, roads, footpaths and other public infrastructure **must be submitted to SOPA for approval**. The work permits will not be granted to the works which does not have the approved design. Any changes to the design must be submitted to SOPA for approval.

All utility pit lids must be constructed in accordance with SOPA's specification provided in this document and their locations must be coordinated with SOPA prior to commencement of the works. **No obstruction or element** of the utilities must be installed **above ground**.

Service authorities shall be contacted at the start of the project, to determine their requirements and to confirm if the Authority has any works planned in the area that could affect the proposed public domain works. As soon as possible, details shall be provided to the Authority on requirements to raise or lower pit covers.

Location of services generally in road reserves shall be in accordance with *Guides to Codes and Practices for Street Opening*.

4.1.4.1 New Electrical Services:

Sydney Olympic Park was designed to ensure all utilities are well-integrated in the public domain elements with consideration of the precincts are used for major events.

The lighting for the areas where subjected to major event pedestrian activities must comply with the requirements of relevant standards for the crowded areas.

The SOPA Olympic light poles are designed to accommodate electrical network isolator with ring main isolators installed in them. Therefore these infrastructure must be used for any electrical network expansion and repairs and **no isolation pillars** are allowed in the SOPA precincts where Olympic light poles exists.

All new pits in the footpaths must have a class "D" loading rated lid as majority of the footpaths in the event precincts are subject to heavy traffics. The location of the pits must be coordinated with the authority to ensure compliance with the SOPA's public domain and operational guidelines. The lids also must be in-fill lid to match the surrounding paving materials.

Any departure from the SOPA's specification must be coordinated and approved by SOPA prior to commencement of the works.

4.1.4.2 Telecommunication infrastructure:

Sydney Olympic Park was designed to ensure all utilities are well-integrated in the public domain elements with consideration of the precincts are used for major events.

The telecommunication utility providers are encouraged to **share the infrastructure** to avoid clutter of the public domain as noted in the Telecommunication Act.

All new pits in the footpaths must have a **class "D"** loading rated lid as majority of the footpaths in the event precincts are subject to heavy traffics. The location of the pits must be coordinated with the authority to ensure compliance with the SOPA's public domain and operational guidelines. The lids also must be **in-fill lid** to match the surrounding paving materials.

Any departure from the SOPA's specification must be coordinated and approved by SOPA prior to commencement of the works.

Any **small cell or mobile tower** installation must be coordinated with the SOPA at the design stage. SOPA owns a network of underground conduits and fibre which may be shared with the utility providers. Also, SOPA may refer the utility providers to work with the **SOPA approved telecommunication contractor** for any mobile equipment installation in the precincts.

4.1.5 Work Site

The works site must be clearly shown on the drawings and proposed plans. If the works site is part of a super-lot, the intended subdivision must be clearly shown on the plans. Access and utility connections for each work site must be from public streets only and no access, easement or utility connection to the intended subdivision site must be through the super lot unless approved by SOPA's Asset Management Team.

All footpaths that has interface with the site require be renewing and resurfacing with SOPA approved materials.

4.1.6 Reference Standards

- The following standards shall apply to all design works:
- AS/NZS 1158 – Lighting for Roads and Public Spaces;
- AS 1428 – Design for Access and Mobility AS 1742 – Manual of Uniform Traffic Control Devices;
- Roads and Maritime Services (RMA) QA Specification R141 Pavement Marking

- AS/NZS 2890 – Parking Facilities;
- AS 3000 – Electrical Installations (known as the Australian/New Zealand Wiring Rules);
- AS 3008 – Electrical Installations;
- AS/NZS 3500.3 – Plumbing and Drainage – Stormwater Drainage;
- AS/NZS 3600 – Concrete Structures;
- AS 3700 – Masonry Structures;
- AS4100 – Steel Structures;
- AS5100 – Bridge Design;
- AS3996 – Access Covers and Grates;
- AS 3610 – Formwork for Concrete;
- AS3850 – Prefabricated Concrete Elements;
- AS3100 – Approval and Testing Specification - General requirements for Electrical Equipment;
- AS3017 – Electrical installations - Verification Guidelines;
- AS4282 – Control of the Obtrusive Effects of Outdoor Lighting;
- AS3439 – Low-voltage Switchgear and Control-gear Assemblies;
- SOPA Urban Elements Design Manual (UEDM);
- SOPA Parkland Elements Design Manual (PEDM);
- SOPA Technical Specifications for ICT Communications Installations and Routine Maintenance;
- SOPA Water Management and Irrigation Network Policy – Standard Technical Specification;
- SOPA Access Guidelines;
- Sydney Olympic Park Handover Procedures.

4.1.7 Documentation Standards

The following standards will apply:

- All drawings will be prepared using CAD. Format to be as detailed under Drawing Standards;
- Reports and specifications will be prepared using Microsoft Word;
- PDF versions of all documents are to be supplied.

Minimum information to be provided for SOPA review and approval:

- Plans showing the extent of work, including demolition;
- Existing services plan – all services must be located and mapped and the relevant levels and depths must be indicated on the drawings;

- Public Domain plans in accordance with the Urban Element Design Manual (UEDM) - Appendix A;
- Spot levels that clearly indicate the proposed and existing levels and falls associated with the works;
- Sections along roads at 15m intervals, and as required elsewhere to show specific changes in profile or discrete elements;
- Long section along all new roads;
- For footpath upgrades, long section along kerb lines;
- Pipe and pit locations, grate and invert levels, pipe sizes, pipe type and class of pipe;
- General finishes extent and type;
- Pavement types;
- Services locations and sizes;
- Furniture layout;
- Landscape plan (in accordance with UEDM);
- Road line marking;
- Signage location and type (in accordance with UEDM);
- Typical service trench layout;
- Construction and installation details for all street furniture and lightings;
- Construction specifications in accordance with this document, NAT SPEC and RMS;
- Complete quality control plan which includes hold points, witness points and responsibilities for all of the activities;
- Design safety and risk review certificate and schedule.

4.1.8 Quality Requirements for Design

4.1.8.1 Design

The consultants, designers and service providers must undertake the design activities in accordance with the NATSPEC part 0010- Quality control requirements.

4.1.8.2 Non-conforming Designs

The consultants/designers shall ensure that components of the design that do not conform to the SOPA's requirements are identified and controlled to prevent their unintended delivery.

The consultants as the Authority's contractor shall take appropriate action based on the nature of the nonconformity and its on the conformity of works, construction and services. This shall also apply to nonconforming products and services detected after delivery of products, during or after the provision of services.

When a non-conforming design or is identified The consultants shall:

- a) Correct the non-conforming components;
- b) Informing the Authority;
- c) Obtaining the Authority's approval for acceptance under concession.

Conformity to the requirements shall be verified when nonconforming designs are corrected.

The consultant shall retain documented information that:

- a) Describes the nonconformity;
- b) Describes the actions taken;
- c) Describes any concessions obtained.
- d) Identifies the authority deciding the action in respect of the non-conformity.

4.1.8.3 Certification and Checklists

Designers shall provide certification that the works comply with the relevant standards. The minimum level of certification to be provided shall be as per the certification detailed in Appendix B in addition of the checklists provided in NATSPEC part 0010. Certification shall be accompanied by the checklist that details the information required on the drawings. Refer to Appendix A for checklists.

4.1.8.4 Construction Test and Quality Control Plan

The consultant must prepare a complete test and quality control plan for all of the construction activities as part of the construction specification.

The responsibility for review and sign off of this executed plan must be assigned to an independent adequately qualified consultant, unless specified by the Authority. The specification must be written in the way that the developer/contractor is obligated to employ a specialist to oversee the construction and certify all of the activities.

The Authority must be notified of all of the hold points and timeframes 48 hours prior to the works and may conduct random inspections of the works.

4.1.8.5 Alteration of the Design

Any alteration to the approved design must be submitted to the Authority for approval 28 working days prior to the commencement of the construction. All statutory approval may require to be reviewed and submitted to the relevant authorities and approval for the changes must be obtained prior to the commencement of the construction. In the absence of the required approvals, the Authority will not agree to these changes.

For any changes to the approved development plans, the Authority's planning team must be consulted and appropriate pathway for the approval must be followed.

4.1.9 Co-ordination

Drawings are to be co-ordinated between all design disciplines. Items that require specific co-ordination include:

- Location of trees and lights, to ensure that trees do not reduce lighting levels;
- Levels and location of in-ground services, to prevent clashes between services, tree pits and footings, such as light pole footings.

Designs for all disciplines must be coordinated to ensure the public domain spaces are not cluttered by integrating services where possible. For instance lighting design must be coordinated with the traffic design to ensure that the street furniture can be installed on the light poles where possible.

4.1.10 Environmental and Remediated Lands Requirements

4.1.10.1 General

Sydney Olympic Park Authority is responsible for the protection of the Park's natural and cultural heritage, and compliance with applicable environmental and heritage legislations. SOPA's Biodiversity Management Plan is the key resource in ensuring SOPA meets its duties and obligations.

Advice shall be sought from SOPA's Senior Manager Environment and Ecology during the development/planning stage for works in Threatened Species Habitats (Map 2) and areas of heritage significance (Map 3).

Works in Threatened Species Habitat must meet the requirements of SOPA's *Standard Procedures for Biodiversity Management* – A supporting document to the SOPA Biodiversity Management Plan . All contractors and subcontractors must also comply with approved environmental management plans and work permit conditions.

Failure to comply will result in prosecution by relevant authorities, including the NSW Environment Protection Agency, National Parks and Wildlife Service, the NSW Heritage Council, and the Office of Environment and Heritage.

Sydney Olympic Park has responsibility for 105 hectares of remediated landfill and 430 hectares of parklands that include threatened species, nature conservation areas, heritage conservation areas and protected habitats. Works undertaken within or immediately adjacent to these areas may require alternative construction or design specifications to ensure works are consistent with the requirements of the legislation and do not impact on the management of these sensitive areas.

4.1.10.2 The Remediated Landfills

Sydney Olympic Park manages 10 engineered remediated landfills. These landfills are connected by a complex system of pumps and pipes which allow the extraction and transfer of contaminated groundwater (leachate) for treatment and disposal. The landfills and associated infrastructure are regulated by the NSW EPA under the Contaminated Lands Management Act Notice number 28040 issued to the Authority. The regulated area is shown in drawing *DRG 001-G-G-0112 REV B* attached. Waste contained within the landfills can potentially harm human health and the environment by causing acute and or chronic effects through exposure to leachate, landfill gases and solid wastes.

The NSW EPA therefore requires that the remediated landfills are managed in accordance with the Authority's Remediated Lands Management Plan (RLMP). To achieve compliance with regulatory requirements, construction specifications may need to be modified to provide for features such as shallow service trenching and mechanical protection; the use of light weigh machinery to avoid damage in and around leachate infrastructure; the separation of spoil for appropriate treatment and/or disposal, the management of stormwater separately from landfill leachate; consideration of the design in relation to potential for migration of landfill gas along conduits and into buildings or other structures and a wide range of other issues that can impact on design, materials and costs associated with construction and maintenance works on remediated landfills. The requirements for works on remediated landfills will need to be assessed by the Authority on a case by case basis.

Construction and maintenance works may also require an NSW EPA approval. Any approval would be sought by the Authority prior to commencement of work and may impact on delivery timeframes.

Contractors designing or undertaking any works on or immediately adjacent to remediated landfills or leachate transfer systems (as shown in drawing *DRG 001-G-G-0112 REV B*), **must seek specialist advice from the Authority's Remediated Lands Team early in the design stage for the project.**

The contractors must keep record of any waste disposal from the site to appropriate facilities and supply tip docket to the Authority regularly (Monthly or fortnightly). The slips must indicate the type of the waste (green, chemical, etc.).

4.1.10.3 The Parklands

Sydney Olympic Park contains high species diversity and abundance, including species of local, regional, national and international conservation significance, in areas subject

to regulatory provisions. Nearly half (304 hectares) of the Park is zoned under NSW planning legislation for environmental conservation and management due to its high ecological values.

All works taking place within or adjacent to areas zones as E1, E2 or E2 (see map 001-J-L-0016) or in a heritage precinct (see drawing 001-P-P-2245) must consider the ecological or historical opportunities and constraints during project planning and in the development of works specifications. These may include but are not restricted to; consistency with the Authority's environmental policies, assessment under the Parklands Plan of Management, State and Commonwealth legislation regarding threatened species and their habitats and the Conservation Management Plan for Newington Armoury and Nature Reserve.

To ensure works are designed, costed and constructed appropriately, contractors undertaking any works on or immediately adjacent to E1, E2 or E3 zones (see map 001-J-L-0016 REV C) or in a heritage precinct (see map 001-P-P-2245 REV F), contractors **must seek advice from the Authority's Environment and Ecology Team early in the design stage for the project.**

4.2 Stormwater

4.2.1.1 Design Requirements

Stormwater shall be designed in accordance with the following standards:

- AS/NZS 3500.3 – Plumbing and drainage – Stormwater drainage;
- Australian Rainfall and Runoff;
- SOPA's *Stormwater Management and Water Sensitive Urban Design Manual*.

Pipe networks shall be designed for a 20% AEP storm event (1 in 20 ARI)

Overland flow paths shall be designed for a 1% AEP storm event (1 in 100 ARI). In the event that an overland flow path is not available, the pipe system shall be designed for a 1% AEP storm event (1 in 100 ARI), with a pipe blockage factor of 50%. The designer shall ensure a freeboard of 500mm is provided between the top water level in the overland flow path and the floor level in adjacent buildings.

4.2.1.2 Water Quality

Water quality and treatment – WSUD measures and treatment devices shall be provided to meet the requirements of SOPA's *Stormwater Management and Water Sensitive Urban Design Manual*. Music modelling shall be undertaken to show that the

required treatment targets are achieved. The designer must explore all possible treatment options, to minimise the use of tertiary treatment devices.

When selecting treatment devices, the device should be consistent with existing devices within the precinct and maintenance and life cycle costs must be considered. Approval must be sought from SOPA Manager Building and Infrastructure during the concept development phase of the design for treatment devices that differ from existing devices within the precinct.

4.2.1.3 Details

Stormwater pits shall be provided at intervals not exceeding 30m. However, the locations are to be closer if required, to ensure that the maximum width of water flow in gutters does not exceed 1m. Pipe will be straight between pits, with no bends.

Minimum pit sizes shall be in accordance with AS/NZS 3500.3. Grate and cover classes shall be suitable for the area in which they are located. The minimum cover/grate shall be:

- Class B in pedestrian areas, not accessible by vehicles;
- Class D in public domain areas accessible by vehicles, such as major walkways or parks;
- Class D in roadways.

Grates in pedestrian areas shall be “heelguard” style, which meet access requirements and prevent stiletto heels from catching. Grates in cycle paths shall be cycle safe.

Kerb lintels shall be sized to cater for the incoming flow. Minimum size shall be 1.2m internal opening.

4.2.1.4 Erosion and Sediment Control

Erosion and sediment control measures shall be provided during construction. Works shall be designed in accordance with the latest edition of the “Blue Book” – *Managing Urban Stormwater – Soils and Construction*, published by Landcom.

4.2.1.5 Information on Drawings

The following details the minimum level of information to be provided on drawings

- Pit and pipe location
- Location and details of treatment devices
- Pipe Long-sections.

Refer to *Drawing Standards* for further information on details to be provided on drawings.

4.3 Roadways, Cycleways and Footpaths

4.3.1 Design Requirements

Roadways and footpaths shall be designed in accordance with the following standards:

- AS 1428 Series - Design for Access and Mobility;
- AS/NZS 2890.5 – Parking Facilities – On Street Parking;
- AS/NZS 2890.6 – Parking Facilities – Off Street Parking for People with Disabilities;
- Austroads Guide to Pavement Technology Part 2: Pavement Structural Design;
- SOPA Urban Element Design Manual (UEDM);
- Austroads Guide to Road Design Parts 1 to 8;
- Roads and Maritime Services (RMS) QA Specification R141 Pavement Marking;
- Roads and Maritime Services (RMS) QA Specification R143 Signposting
- Various Road and Maritime Authorities Specification for Traffic Control Device Design and Construction;
- All traffic Control works to be undertaken in accordance with AS 1742.3 and in accordance with the RMS TC Manual;
- *Austroads Guide to Traffic Management – Part 6 Intersections, Interchanges and Crossings; Part 8 Local area traffic management, Part 10 Traffic control and communications devices and Part 11 Parking.*

4.3.1.1 Material Design Parameters:

Design life for pavements shall be:

- Flexible pavements – 40 years;
- Rigid pavements – 40 years.

4.3.1.2 Design Traffic

Design traffic for roadways shall not be less than the following:

- Local access street 1.5x10⁵ ESA or 536,000 HVAG;
- Collector road 2x10⁶ ESA or 2,775,000 HVAG.

Designers are required to confirm that the traffic proposed for the streets does not exceed the values detailed above.

4.3.1.3 Geometric Design

All footpaths and pedestrian areas shall be compliant with AS1428.1, to provide access for disabled persons. The maximum cross-fall on pedestrian areas shall be 1 in 40 (2.5%).

The geometric road and cycleway design must be in accordance with Austroad and approved by SOPA. Road and Maritime and other transport authorities' Specification may also be used.

All road designs should be in accordance with Austroads Guides to Traffic Management. These include:

- Austroad Guide to Road Design Part 4A;
- Austroad Un-signalised and signalised intersections, Part 6A;
- Austroad Paths for Walking and Cycling Part /6B;
- Austroad Roadside Environment, Part 5;
- Austroad Road Management, Part 6;
- Austroad Intersection – Interchanges – Crossings. Part 15;
- Austroad Guide to Traffic Management- Road Environment Safety.

The parking design must be in accordance with the Australian Standards – AS2890.1, AS2890.2 and AS2890.6.

On roads intersecting with Australia Avenue, Olympic Boulevard, Edwin Flack Avenue, Sarah Durack Avenue and Bennelong Parkway, a low point shall be provided approximately 10m back from the intersection, to maximise capture of stormwater by the pipe system.

Bicycle lanes are to be provided in accordance with the SOPA Master Plan. For modification works in areas with existing bicycle lanes, the lane is to be retained.

4.3.1.4 Accessibility

All traffic and access infrastructure including footpath, carparks, roads, site-through links, parks and any public areas must be designed in accordance with the current Sydney Olympic Park Access Guidelines.

On-street disabled parking shall be provided at a rate of 1 space for every 50 spaces. Spaces shall be evenly distributed amongst the on-street parking. The spaces shall be provided in accordance with AS/NZS2890.6.

4.3.1.5 Traffic Design

Prior to commencement of the project the following documents must be provided to the Authority:

- Traffic impact study including parking impact study and intersection modelling (where applicable);
- Parking plan including on-street and off-street car parking;
- Signage plan;
- Pavement marking plan;
- Signal design plans and relevant approvals;
- All new traffic device plans including but not limited to pedestrian crossings, pedestrian refuges, shared zones and median strips, and all relevant approvals.

The plans must be prepared in accordance with the RMS standards and Clause.

Some traffic devices require specific civil, drainage and lighting design to be associated with them. All of these drawing must be included in the submission and adequate references must be provided on all relevant drawings.

All traffic devices, changes in traffic conditions, traffic signals must be reviewed and approved by RMS and relevant approvals must be provided to the Authority as part of the submission and prior to commencement of the construction activities.

For development applications the approval may be submitted progressively during the construction. However, approval from RMS and the Authority for each traffic control device must be obtained prior to commencement of the device construction/ installation.

Construction traffic management plans and report are also required prior to the commencement of the works and must be submitted to the Authority in accordance with the work permit requirements.

4.3.1.6 Details

In concrete pavements, joints shall be provided to minimise cracking and allow movement of pavements. Panel dimensions shall be 1:1-1.5. Joints shall be detailed to prevent vertical displacement, and minimise the creation of potential trip hazards,

For asphaltic concrete pavements, the following requirements apply:

- Minimum asphalt thickness = 50mm;
- For pedestrian areas not accessible by vehicles, AC7 shall be used;
- For public domain areas accessible by vehicles and all roadways, AC10 shall be used.

Where the subgrade CBR is less than 3%, the subgrade shall be lime stabilised or a minimum of 300mm of crushed rock provided as subgrade. The adopted method and the thickness of material provided shall be in accordance with the recommendations of the geotechnical engineer.

4.3.1.7 Information on Drawings

The following details the minimum level of information to be provided on drawings:

- Kerb lines, footpaths, pavement types;
- Kerb line arc lengths and radii;
- Spot levels as required to confirm access requirements are met;
- Chainages, detailing cross-section locations;
- Cross sections showing proposed cross fall grades and widths;
- Road centreline long-section, showing chainages.

4.4 Water and Sewer

4.4.1 Design Requirements

Water and sewage systems shall be designed in accordance with the following standards:

- WSA – 03 Water Supply Code of Australia;
- WSA – 02 Gravity Sewage Code of Australia;
- Sydney Water Standards and Requirements;
- AS/NZS 3500 – Plumbing and Drainage – Water Services.

Evidence shall be provided that the design of the new works has been approved by Sydney Water.

4.4.2 Details

Potable water supply shall be provided such that a supply is available to all developments along new roadways and that fire hydrants are provided at intervals in accordance with Sydney Water standards.

A sewer connection point is required for each development site. Depending on the slope of the site, this may not form part of the roadworks, and is to be determined on a case by case basis.

4.4.3 Information on Drawings

The following details the minimum level of information to be provided on drawings:

- Location of pipes and valves;
- Location and details of control system.

Refer to *Drawing Standards* for further information on details to be provided on drawings.

4.5 Recycled Water

4.5.1 Design Requirements

Recycled water systems shall be designed in accordance with the following standards:

- WSA – 03Water Supply Code of Australia;
- AS/NZS 3500.1 – Plumbing and Drainage – Water Services.

4.5.2 Details

Where an existing recycled water system exists for the precinct, recycled water is to be provided along new roadways, with connections allowed for new development sites and for irrigation of landscaped areas.

4.5.3 Information on Drawings

The following details the minimum level of information to be provided on drawings

- Location of pipes and valves;
- Location of connection points to development sites.

Refer to *Drawing Standards* for further information on details to be provided on drawings.

4.6 Irrigation

4.6.1 Design Requirements

Irrigation systems shall be designed in accordance with the following standards:

- SOPA's Water Management and Irrigation Network Policy – Standard Technical Specification (See Appendix F);
- AS/NZS 3500.1 – Plumbing and drainage – water services;
- Irrigation Australia Urban Best Management Practice Guidelines.

4.6.2 Details

Irrigation systems shall be provided to new landscaped areas. Where a recycled water supply is provided, recycled water shall be used.

4.6.3 Information on Drawings

The following details the minimum level of information to be provided on drawings

- Location of pipes and irrigation points;
- Location and details of control system.

Refer to *Drawing Standards* and the *Technical Specification* for further information on details to be provided on drawings.

4.7 Gas

4.7.1 Design Requirements

Fuel gas systems shall be designed in accordance with:

- Jemena standards;
- AS 4645 – Gas distribution networks.

Evidence shall be provided that the design of the new works has been approved by Jemena.

4.7.2 Details

Gas mains are to be provided such that a connection point is provided to all new developments.

4.7.3 Information on Drawings

The following details the minimum level of information to be provided on drawings

- Location of new pipes and valves;
- Location of connection points to development sites.

Refer to *Drawing Standards* for further information on details to be provided on drawings.

4.8 Electrical, Lighting, CCTV and Public Address

4.8.1 Special Relationship between Ausgrid and SOPA Distribution and Metering

The delineation between the Ausgrid and SOPA electrical infrastructure is unique to the Sydney Olympic Park site. There are two styles of poles specified in the Urban Elements Design Manual (UEDM). Where the type 2 to 7 and type 9 poles are used there is generally a special Ausgrid ring main unit in the base of each pole and Ausgrid distribution feeders run between the poles. Each pole has a distribution board which has circuits for the streetlight, power outlets and any other power requirements for the area. The mains are generally metered at the substation.

Lighting placement and operation in Threatened Species Habitat shall be developed in consultation with Senior Manager E&E to balance public safety and biodiversity protection. Certain areas of Threatened Species Habitat are also restricted access areas to the public (Newington Armory, Blaxland Riverside Park, Newington Nature Reserve and the Brickpit), either wholly or between specific hours, due to their sensitive nature and very high ecological value. Lighting is not allowed in these precincts as it interferes with behaviours critical to species survival.

Where Type 8 poles are used they are either powered by a SOPA private circuit or by an Ausgrid street lighting circuit.

Each pole has a C-Bus relay which controls the streetlight.

There are instances where Ausgrid mains were not required and the poles have been connected by a SOPA private circuit that either originates from a Type 2 to 7 pole or a switchboard.

Changes to the location of poles that have Ausgrid mains requires an Accredited Services Provider 3 (ASP3) to document the design for Ausgrid approval and the work must be carried out by an Accredited Service Provider 1 (ASP1). Connections to the distribution boards in the Type 2 to 7 poles can be carried out by a standard electrical contractor.

Type 2 to 7 poles that are directly fed from an Ausgrid main shall be treated as a main switchboard and shall have an earth stake and MEN link.

The entire installation shall comply with the requirements of AS3000 and AS3008.

4.8.2 Electrical

4.8.2.1 Design Requirements

Sydney Olympic Park was designed to ensure all utilities are well-integrated in the public domain elements with consideration of the precincts are used for major events.

The SOPA Olympic light poles are designed to accommodate electrical network isolator with ring main isolators installed in them. Therefore these infrastructure must be used for any electrical network expansion and repairs and **no isolation pillars** are allowed in the SOPA precincts where Olympic light poles exists.

All new pits in the footpaths must have a class “D” loading rated lid as majority of the footpaths in the event precincts are subject to heavy traffics. The location of the pits must be coordinated with the authority to ensure compliance with the SOPA’s public domain and operational guidelines. The lids also must be in-fill lid to match the surrounding paving materials.

Any departure from the SOPA’s specification must be coordinated and approved by SOPA prior to commencement of the works.

The electrical system shall be designed in accordance with AS3000 and AS3008. The designer shall submit documentation for all submains and sub-circuits showing the fault level, voltage drop and fault loop impedance.

All submains and final sub-circuits shall be designed with 50% capacity, unless they are servicing a specific load.

All underground cables shall be run in conduit.

No joints shall be made in pits unless there is specific written approval from the SOPA Manager Building and Infrastructure.

4.8.2.2 Existing System

The designer shall check the capacity of existing systems, including distribution boards and cables, and confirm that the existing system has capacity to cater for the new works. A short design report shall be submitted to SOPA Senior Manager Infrastructure Engineering proving that the system has capacity. The report shall be submitted at the concept design stage and resubmitted during detailed design if proposed loads increase.

4.8.3 Lighting

4.8.3.1 Design Illumination Levels

The lighting for public spaces shall generally be designed to comply with the relevant categories from AS/NZS1158. Road lighting is to comply with AS/NZS1158.1.1 (V Category Lighting) and pedestrian areas are to comply with AS/NZS1158.3.1.

Many roads in Olympic Park have different functions in normal and event mode. In these cases the lighting should comply with both the V and P category. The UEDM specifies the V and P category for the majority of road and public spaces in the Park. Where the design area is not specified similar roads should be used as a guide and the level agreed in conjunction with SOPA.

The lighting for the areas where subjected to major event pedestrian activities must comply with the requirements of relevant standards for the crowded areas.

The UEDM specifies the luminaires and poles types for each street and area. All new or upgraded installations shall be designed with the specified LED luminaires. Alternatives must be approved in writing by the Manager-Building and Infrastructure.

Existing installations that are being altered will retain the same luminaires.

Luminaires that are not nominated in the UEDM shall only be used for specific applications that are not covered by the UEDM and with specific approval of SOPA.

Additional poles shall be allocated an asset number. This will be issued by SOPA.

4.8.3.2 Lighting Control

There is a site wide C-Bus system for the control of all external lighting. The system generally has individual control over each luminaire. In some of the central streets there are two lighting levels so that 50% of the lighting is switched off in the early hours of the morning. With some SOPA private circuits the entire circuit is controlled by a single C-Bus relay.

SOPA Drawing 001-J-G-0036 Rev P *C-BUS Connections and Lighting Details* indicates the location and cabling for all c-bus cables, relays and network bridges (nodes)

Note that C-bus cables are to be run serially. Where the addition to the network will increase the length of the run to greater than 900 meters then a network bridge should be added as part of the design.

Following completion of the works the C-bus system will need to be reprogrammed to include the new luminaires and the C-Bus distribution drawing updated. Reprogramming shall include the head computer and Pascal Automotive Controllers (PAC) Units.

4.8.4 Public Address

A public address system is to be provided for the central areas of the park, as highlighted on the Plan in Figure 1. The speakers will be mounted on lighting poles within the zone. The designer is to contact SOPA Manager Information Technology for details of the specific requirements for the area.

A 50mm conduit shall be provided from the lighting pole to the source of the signal. The cable and supply and installation of the equipment shall be by SOPA approved public address contractor.

Where a new area may be extended in the future the conduit should continue to the boundary of the works.

Conduit and installation requirements shall be in accordance with SOPA's Technical Specification for ICT Communications Installations and Routine Maintenance Work. See Appendix H.

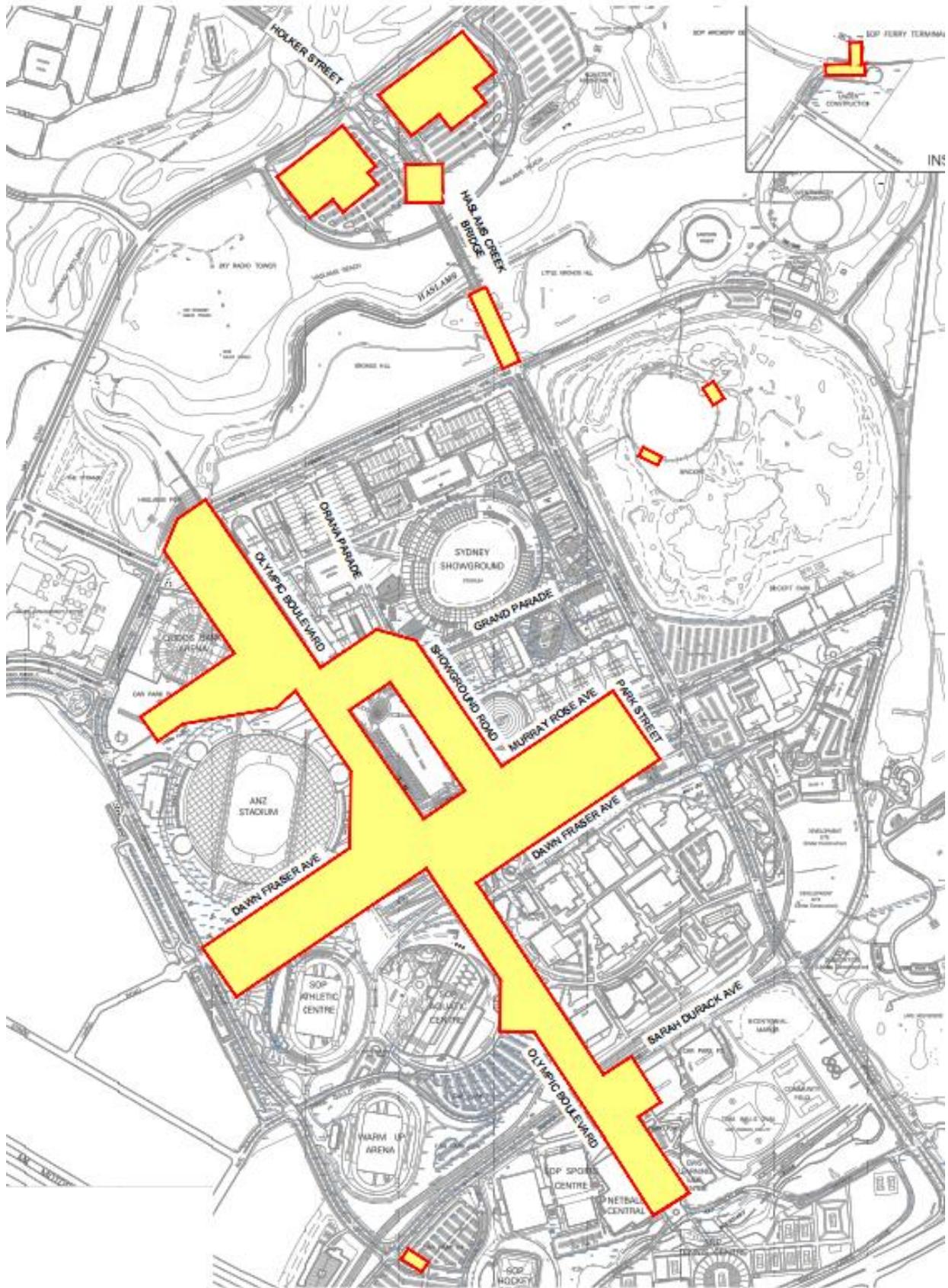


Figure 1 – Zone where public address system to be provided.

One 50mm CCTV (if required)

One 50mm PA (if required)

4.8.8 Lighting, CCTV, Public Address and Electrical Pits

Provide pits in conduit runs at change of direction and runs in excess of 30metres.

Pits shall be in-situ concrete pits and shall be supplied with a frame and pit lid. Lids shall be sealed to prevent ingress of stormwater

Pits in paving shall be stainless steel pit lids and frame with a knife edge and infill paving.

Pits and pit lids shall have the following classifications:

- Class B in pedestrian areas, not accessible by vehicles;
- Class D in public domain areas accessible by vehicles, such as major walkways or parks;
- Class E in roadways.

The minimum pit shall be 600 x 600 with the depth to suit the installation and statutory requirements.

The pit frame shall be permanently anchored to the top of the pit and any paving bricks within 200mm of the edge of the pit shall be cemented in place.

The finished level of the pit cover shall be:

- Flush with paved surfaces;
- 25mm above the ground surface in grassed areas;
- 50mm above the ground surface in landscaped areas.

All pits shall be drained to stormwater or a local rubble drain. If gravity drainage is not possible, then a sump pump shall be provided.

All pits shall be labelled with the appropriate service.

The consultant shall identify the environmental implication of the works and consult with SOPA's environmental management team regarding the:

- Placement of pits in remediated lands;
- Works footprint and time frame in habitat areas to arrange for appropriate practices e.g. induction, frog clearance prior to works.

If a proposed site suits installation requirements but not statutory or SOPA requirements then alternative sites need be selected in consultation with EI and/or E&E depending on the works area.

4.8.9 Integration of RMS Traffic Signals

SOPA has developed additional poles in the Type 2 to 7 suite to accommodate RMS traffic signal equipment. These are the Type 9 and Type 9a poles. These have been installed in Australia Avenue. Before designing an intersection with traffic signals confirm that the Type 9 and Type 9a poles are acceptable to the RMS in the proposed location.

All intersections requiring RMS signal equipment are to be designed by an RMS accredited signal designer. Evidence shall be provided that the signal design has been approved by the RMS.

4.8.10 Information on Drawings

The following details the minimum level of information to be provided on drawings:

- Location of cables, pits, light poles;
- Location and size of spare conduits;
- Distribution board details.

Refer to *Drawing Standards* for further information on details to be provided on drawings.

4.9 Communications

4.9.1 Design Requirements

Communications systems shall be designed in accordance with:

- SOPA's Technical Specification for ICT Communications Installations and Routine Maintenance Work. See Appendix H.

Where communications services are owned by third parties liaise with the owner with respect to the removal and reinstatement of the cabling.

4.9.2 Relocation of Equipment

Where equipment is relocated such that the existing cable has insufficient length, the cable shall be replaced for its entire length. Joints and splices will only be accepted with the specific approval of SOPA Manager Information Technology.

4.9.3 Conduits Associated with Communications

Conduits shall be provided between each lighting pole to accommodate the following:

- Flush with paved surfaces;
- 25mm above the ground surface in grassed areas;
- 50mm above the ground surface in landscaped areas.

All pits shall be drained to stormwater or a local rubble drain. If gravity drainage is not possible, then a sump pump shall be provided.

All pits shall be labelled with the appropriate service.

4.9.5 Telecommunication infrastructure:

Sydney Olympic Park was designed to ensure all utilities are well-integrated in the public domain elements with consideration of the precincts are used for major events.

The telecommunication utility providers are encouraged to **share the infrastructure** to avoid clutter of the public domain as noted in the Telecommunication Act.

All new pits in the footpaths must have a **class “D”** loading rated lid as majority of the footpaths in the event precincts are subject to heavy traffics. The location of the pits must be coordinated with the authority to ensure compliance with the SOPA’s public domain and operational guidelines. The lids also must be **in-fill lid** to match the surrounding paving materials.

Any departure from the SOPA’s specification must be coordinated and approved by SOPA prior to commencement of the works.

Any **small cell or mobile tower** installation must be coordinated with the SOPA at the design stage. SOPA owns a network of underground conduits and fibre which may be shared with the utility providers. Also, SOPA may refer the utility providers to work with the **SOPA approved telecommunication contractor** for any mobile equipment installation in the precincts.

5 Protection and Rectification

5.1 Protection

Existing SOPA infrastructure, assets and the environment shall be protected during any works. Measures shall include, but not be limited to:

- Tree protection measures as per relevant Australian Standards and current best practice and SOPA Guidelines for the Protection of Trees on Construction Sites;
- Temporary fencing or barriers to prevent access to areas to be protected;
- Geotextile, builder's plastic or other suitable material to protect existing pavements from damage such as oils spills, wheel indent, chipped pavers etc.
- SOPA's permanent frog fence to be protected. Obtain frog fence specification from SOPA E&E should temporary wetland protection or a permanent replacement to damaged frog fence be required. Just expanding on point 2, as it sounds like only temporary structures are protected;
- Landscaping/habitat in all areas shall be protected from vehicular traffic and unnecessary foot traffic through clear delineation of work site;
- Contractors and their subcontractors shall report assets damaged during works to SOPA contract manager.

Damage shall be rectified in accordance with SOPA's rectification standards. Repairs to asphaltic concrete pavements shall be in accordance with the RMS Specification M250.

5.2 Tree Protection

The Authority is aiming to increase the tree canopy cover in the precinct. Therefore no trees must be removed from the site without obtaining approval from the relevant asset manager and strategic planning team.

The significant trees can only be relocated and must not be removed under any circumstances.

All trees impact by the construction activities in must be protected. A tree protection plan must be submitted the Authority as part of the construction management plan. Tree protection measures as per relevant Australian Standards and current best practice and SOPA Guidelines for the Protection of Trees on Construction Sites.

The contractor must consider the wildlife and nests prior to the commencement of the works. The trees must be investigated for any fauna/nests prior to commencement of any construction activities on site. The construction management plan must address protection of all fauna/nests are located prior to or during works. Contractor must

contact the Authority’s Environment and Ecology team for advice regarding retention or removal of any wildlife on the site. During the construction, the contractor must contact the Authority’s Ecology team and Park Rangers for assistance, if any wildlife is found on site.

5.3 Dilapidation Reports

Prior to commencing works, a Dilapidation Report shall be provided to SOPA to detail the existing condition of SOPA infrastructure. The reports will be required to cover the following areas:

- Existing damage to kerbs, including cracks, chips etc.;
- Existing damage to footpaths, including cracks;
- Existing damage to road pavements, including cracks, depressions, potholes etc.;
- Existing fuel / oil spills;
- Current condition of landscaping / trees / turfed areas near proposed works;
- Any drainage in the vicinity of the site (within 35m from the site boundary) must be photographed and CCTV footage must be included in the dilapidation report;
- Existing damage to pits, bollards, poles etc.

Dilapidation reports shall be used to assess if the Developer / Contractor has damaged infrastructure during construction of works.

5.4 Assessment of Damage and Determination of Rectification

On completion of works or lease, the dilapidation report shall be updated to include any new damage. The updated report is to clearly indicate new damage. The need for rectification or payment of restitution will be assess by SOPA based on the revised report.

The following details criteria for replacement or repair:

Item	Criteria for Replacement	Criteria for Repair/Restitution	Repair Method or Restitution Amount
Cracked footpaths/ pavements	Cracks > 0.5mm	Cracks<0.5mm	Epoxy repair cracks. \$100/m ² restitution
Damaged kerb / Kerb and gutter	Damage greater than that accepted for restitution	Isolated damage, with chips less than 50mm x 50mm in area or single cracks	Epoxy repair chips. \$150/m restitution with min \$150

Item	Criteria for Replacement	Criteria for Repair/Restitution	Repair Method or Restitution Amount
Depressions in pavement	Depressed area over 100mm x 100mm by 3mm deep	Depressed area smaller than 100mm x 100mm	\$ 250/m ² restitution, with minimum \$250
Oil / fuel spill	Area over 1m ² , or more than 4 smaller areas within a 5m ² area.	Any spill smaller than that requiring replacement	\$ 250/m ² restitution, with minimum \$250
Damage to turf	Area over 1m ² , or more than 4 smaller areas within a 5m ² area.	Any area smaller than that requiring replacement	Reseed area and water to generate new growth. \$50/m ² restitution, with minimum \$100
Sedimentation and erosion	Any sedimentation in public realm including road, footpath, green spaces and underground drainage networks must be cleaned. The methodology must be submitted to the Authority prior to the commencement of the work. The damages and works will be monitored, supervised and approved by the Authority's environmental compliance officer constantly during the construction and at the time of handover.		
Damage to line marking	Damage to lines greater than 2m in length	Any length shorter / smaller than that requiring replacement	Repaint lines. \$5/m restitution with minimum \$100

Note: Restitution rates in the table are the minimum rate. Final value to be agreed with SOPA.

Damages to the other infrastructure, landscaping, natural habitat, water bodies, heritage listed items and historically significant places including Olympic legacy areas and artworks must be reported to the Authority. The rectification methodology must be approved by the authority and all relevant stakeholders. The contractor must be aware that heavy fines may apply to any damages to some of the items. The fines and penalties will be issued by relevant authorities and units in the Authority.

6 Modification of Existing

6.1 Interface with public domain

The designer must consider integration of the new works to the existing public domain space. All footpaths and roads that have interface with the work site must be reinstated to assure integration of the new works with the existing public domain. The integration includes but not limited to:

- Resurfacing the full width of the footpath around the site. Where the footpath is concrete pavers, the pavers must be removed and re-laid around the site to assure a high quality workmanship and integration.
- Where site has a set back, the setback area must be full integrated with the existing footpath as mentioned above.
- All existing signs, lightpoles, electrical switchboards, isolation pillars, telecommunication cabinets and other above ground utilities must be removed or relocated from the footpath to an approved location to avoid the clutter in public domain. Refer to the section 4.8 for more information.
- All integration works must be fully-documented in the design stage and submitted to SOPA for approval.

6.2 Change in levels and terrains

All changed in terrain and levels in public domain and its interface with development must be fully assessed during the design stage to ensure:

- The area is fully DDA compliant.
- All works are compliant with accessibility and safety guidelines.

The works shall be reviewed by accredited qualified consultants to ensure safety, accessibility and compliance and the reports must be submitted to SOPA for review.

6.3 Conversion to LED Lights

Where streetlights are being changed to LED lights, the LED light shall be a model listed in the addendum to the UEDM. The road lighting shall be recalculated with the proposed luminaire to confirm compliance with the V and P category requirements listed in the UEDM for the specific road. Calculations, certified by a Full Member of the Illuminating Engineering Society, shall be submitted to the SOPA representative prior to installation.

6.4 Modifications to Lighting Control

Where additional poles are installed there are two options for the lighting control:

- Road lights that are part of a run of existing lights with C-Bus relays in them shall have a discrete C-Bus relay with a new address. The lighting control program shall then be reprogrammed to include the new fitting;
- Where a new spur of lights is to be added, particularly if they are type 8 poles, then a contactor can be installed in the pole providing the power and the new spur can be switched together. The C-Bus address for the new spur shall be

unique from the existing light on the source pole and the lighting control system shall be reprogrammed to include the new relay.

6.5 Restoration of Electrical Services and/or Street Lighting

With the exception of Ausgrid cable, where equipment is relocated such that the existing cable has insufficient length the cable, the cable shall be replaced for its entire length. Joints and splices will only be accepted with the specific approval of SOPA Manager Building and Infrastructure.

6.6 Reinstallation of Street Light Poles

Prior to reinstallation of street lighting or pedestrian poles the poles shall be thoroughly cleaned inside and out and then any chips and scratches in the paintwork shall be patched.

Where a pole is removed and reinstalled in another location, the C-Bus system shall be reprogrammed to reflect the new location of the pole.

Any poles not required for new works which are in good condition are to be returned to the SOPA depot for storage and future reuse. Undertake any cleaning / preparation to make the poles ready for storage.

For a relocated pole, the footing and installation details are to match the existing. A structural engineer shall confirm that the details are suitable for the new location.

6.7 Material selection

All materials must be selected from sources that have ISO 14001 accreditation.

The design must include a full life cycle analysis and the design documentation submission shall include EPD (Environmental Product Declaration). The life cycle shall include the material, transport, life cycle maintenance and disposal of the materials at the end of its useful life.

The designer shall provide alternative designs with calculated life cycle analysis to approve that the selected materials satisfy the requirements of the material selection for Green Star Communities.

6.8 Reuse of Materials

Where modification works are occurring, existing materials shall be reused where possible. This shall include existing pavers, street furniture, light poles, equipment inside poles or switchboards etc. Undertake any cleaning or repairs required to bring the items up to good condition, with an extended design life of 20 years. Certification

shall be provided by a professional engineer that the design life is achieved. The certification is to be submitted to the SOPA Manager Building and Infrastructure. On completion of cleaning/repairs, SOPA Manager Infrastructure and Building shall inspect the items and provide approval prior to installation. If during cleaning/repairs the items are found not to be suitable, new materials are to be provided.

If materials are in good condition but in excess of requirements for the project, the materials are to be delivered to the SOPA depot, packaged in a manner to allow storage.

7 Service Trenching and Reinstatement

7.1 Service Trenching

Service trenching shall be undertaken in accordance with the following:

- Street Opening Conference Guides to Codes and Practices for Street Opening;
- Relevant authority requirements;
- SOPA Technical Specification Section “Service Trenching and Road Opening” in Appendix C.

Any service trenching must be designed and executed after comprehensive consideration of the environment. Refer to Sections 15 of this document.

7.2 Reinstatement of Pavement

Existing pavements shall be repaired following the installation of services or modification of adjacent works, such as installation of new kerbs.

The backfilling of the pits must be carried out by an accredited contractor and the backfill material must be adequately compacted in layers (250mm maximum thickness).

The pavement area around new or relocated poles shall be reinstated. As a temporary measure, cold mix asphalt may be used to fill the area immediately around the pole and prevent trip hazards in areas open to the public. Permanent repairs to the surrounding pavement shall be undertaken within 4 weeks. Refer to the “Service Trenching and Road Opening” section of the SOPA Technical Specification in Appendix C for further details.

The pavement area over service trenches may be filled with cold mix asphalt to prevent trip hazards as a temporary measure. Permanent rectification works shall be undertaken within 4 weeks. In rectifying pavements, the following conditions are to be met:

- For concrete pavements, the full panel width, between existing joints, shall be replaced. Sawcut joints in the middle of a panel are not acceptable. New joints shall be provided to match the existing joints in the pavement. Refer to Drawing SV007 in Appendix D;
- For pavers, sufficient pavers shall be removed to allow even replacement of pavers;

- For narrow asphalt footpaths, up to 1.5m, the top asphalt layer shall be replaced for the full width of the footpath. For wider footpaths, the asphalt shall be replaced for half the path width. Refer to Drawing SV005 in Appendix D.
- For asphalt roads, the asphalt shall be replaced between construction joints or between the edge and the existing construction joint. Refer Drawing SV005 in Appendix D.

8 Drawing Standards

This section details SOPA's requirements for the preparation of drawings.

Unless otherwise agreed with SOPA, all drawings are to be on A1 size sheets.

8.1 CAD Drafting Standards

Drawing shall be prepared in accordance with SOPA's CADD Procedures Manual, Refer to Appendix E for a copy of the manual.

8.2 Drawings in Set

The set of drawings are to generally be presented in the following format:

- Title Sheet, Notes and Index of Drawings;
- Demolition plans;
- Erosion and sediment control plans;
- Civil works plans, showing pavements, kerbs etc.;
- Road long sections;
- Road cross sections;
- Kerb return details;
- Signage and line marking plans;
- Stormwater drainage plans (may be combined with civil works plan subject to clarity of the drawings);
- Stormwater drainage long sections;
- Civil works details, including stormwater;
- Services plans including detailed survey of located services and their depths;
- Landscape planting plans and details;
- Irrigation plans;
- Lighting and electrical plans;
- Substation layout;
- Set-out plans.

8.3 Civil Detail Plans

Detail plans shall include the following:

- North point;
- Boundary locations;
- Existing contours and spot levels;
- Existing features, such as pavements, roads, paths, pits, trees, buildings, kerbs etc.;

- Existing services plan;
- Road centre line, showing changes, extent of proposed works, including:
 - Kerb location and type;
 - Footpath / pedestrian pavement location and type;
 - Roadway extent;
 - Kerb ramps;
 - Vehicle laybacks;
 - Banks;
 - Retaining walls;
 - Location of new pits.

8.4 Road Long and Cross Sections

Long sections are to include the following:

- Existing and design levels at least every 10m and at vertical curves;
- Grade between vertical curves;
- Length of each vertical curve;
- Change of each intersection point (IP);
- Level of each IP;
- Tangent changes;
- Centreline intersection changes;
- Change and level of each crest and sag;
- Location and level of existing services that cross the roadway.

Cross sections are to be provided at 10m intervals and are to include the following:

- Existing and design levels at the property boundary, building line, top and bottom of kerb, lip of gutter, centreline of road, edge of footpaths and as required elsewhere to detail the proposed levels.
- Location and level of existing and proposed services.
- Off-set dimensions for kerbs, paths etc. from the centreline of the road
- Cross-falls where they differ from typical sections/
- Location of the property boundary.

Typical road cross-sections are to be provided for the works. They are to provide the following typical information:

- Road reserve width;
- Road width between face of kerbs;
- Location and width of footpaths;
- Kerb and gutter type;

- Location and width of bioswale (if required);
- Pavement cross-fall;
- Footpath cross-fall.

8.5 Kerb Return Plans

The longitudinal section for each kerb return shall include the following:

- Design levels for lip of gutter and top of kerb at maximum of 5m internals;
- Location, level and change of pram ramp and wings;
- Kerb change;
- Road change;
- Location of any high and low point;
- Tangent point changes and levels.

8.6 Stormwater Drainage Plans and Long Sections

Stormwater drainage plans are to include the following:

- Location of pits and pipes;
- Each pit to have a specific number/name;
- Pipe sizes;
- Invert and grate level at each pit, and on incoming pipes.

Stormwater drainage plans may be combined with the civil works plans, providing the drawings are clear and the information able to be easily read.

Stormwater drainage long sections are to include the following:

- Pit number/name;
- Pipe size, grade, type and class;
- Pipe change;
- Existing and finished ground levels;
- Design inert levels;
- Peak flow;
- Hydraulic grade line;
- Location and level of other services, where they cross stormwater pipes.

8.7 Civil Works Details

Detail sheets are to contain all relevant details for the proposed works. Reference may be made to SOPA standard drawings, which are contained in Appendix D.

8.8 Services Plans (including Lighting and Electrical)

- Services plans shall include the following:
- Location of all services;
- Size of proposed service and type and class of material;
- Location and of light poles and trees, to confirm co-ordination.

8.9 Irrigation Plans

Irrigation plans are to be prepared in accordance with SOPA's Water Management and Irrigation Network Policy – Standard Technical Specification and to include the following:

- Location of pipes;
- Location and type of sprinkler head / dripper etc.;
- Connection point to the water supply;
- Control system.

8.10 Electrical and Lighting Plans

Electrical and lighting plans are to include the following:

- Pole locations including the pole type, outreach arm, setback and mounting height;
- Luminaire type and wattage. If the light is a directional light the aiming angles should be nominated;
- Conduit sizes and use;
- Cable sizes;
- Pit locations, sized and pit cover class;
- Power source and switchboard modifications / switchboard design;
- Electrical design loads.

8.11 Set-out Plans

Set out plans are to contain the location and details of set out points for the works.

Points to be provided include:

- Face of kerb;
- Both ends and mid-points of curves;
- Centrelines of roadways;
- Light poles, trees and furniture.

8.12 Scales and Dimensions

The following scales are to be used in preparing plans, unless otherwise agreed with SOPA prior to submission:

- Detail plans, including civil, stormwater and services: 1:200;
- Road long section – 1:100 vertical, 1:500 horizontal;
- Road cross-section – 1:100 vertical and horizontal;
- Kerb return plan- 1:200;
- Kerb return long sections – 1:100 vertical, 1:200 horizontal;
- Stormwater long-sections – 1:100 vertical and 1: 200 horizontal;

Linear dimensions are to be in metres, with the exception of details, which may be in millimetres.

Chainage is to be to the nearest 0.01m. Levels are to be AHD and expressed to the nearest 0.005m. Set-out is to be to MGA co-ordinates.

9 Construction

9.1 Construction Management Plan

Prior to the issue of a relevant Construction Certificate, a Construction Environmental Management Plan (CEMP) shall be submitted to the Authority. The CEMP must address, but not be limited to, the following matters, where relevant:

- Hours of work;
- 24 hour contact details of site manager;
- Traffic management, in consultation with SOPA and RMS and TfNSW;
- Construction noise and vibration through the preparation of a Construction Noise and Vibration Management Plan (CNVMP), prepared by a suitably qualified person, which addresses the relevant provisions of AS 2436- Guide to Noise Control on Construction, Maintenance and Demolition Sites, and the Interim Construction Noise Guideline (Department of Environment and Climate Change, 2009);
- Management of dust to protect the amenity of the neighbourhood;
- Erosion and sediment control including plans, materials, inspection and monitoring schedules, response time, reporting schedule (in accordance with clauses 9.4 and 9.5)
- Procedures for encountering groundwater during construction works including contact with NSW Department of Primary Industries- Water;
- Measures to ensure that sediment and other materials are not tracked onto the roadway by vehicles leaving the Subject Site;
- Segregation and management of contaminated materials and spoil stockpiles; and
- External lighting in compliance with AS 4282 Control of the Obtrusive Effects of Outdoor Lighting (noting also that lighting is to be designed and controlled to minimise artificial sky glow and adverse disturbance to fauna within Bicentennial Park and Badu Mangroves).

The CEMP must not include works that have not been explicitly approved in the development consent. In the event of any inconsistency between the consent and the CEMP, the consent shall prevail.

Any changes to the arrangement of the construction site and site entry must be submitted to the Authority for approval. These changes include but not limited to changes and alteration of:

- Site fence;

- Sedimentation control;
- Traffic management.

The Applicant must submit a copy of the CEMP to SOPA prior to commencement of work.

9.2 Road Opening Permit and Works Permit

A Road Opening Permit is required for all works involving excavation of roads, footpaths, kerb & gutter or nature strip.

SOPA Works Permit is to be obtained prior to undertaking any work on SOPA controlled land. This is to include activities such as surveying, geo-technical investigations, services location etc.

9.3 Environmental Consideration

Sydney Olympic Park Authority is responsible for the protection of the Park's natural and cultural heritage, and compliance with applicable environmental and heritage legislations. SOPA's Biodiversity Management Plan is the key resource in ensuring SOPA meets its duties and obligations.

Advice shall be sought from SOPA's Senior Manager Environment and Ecology during the development/planning stage for works in Threatened Species Habitats (Map 2) and areas of heritage significance (Map 3).

Works in Threatened Species Habitat must meet the requirements of SOPA's Standard Procedures for Biodiversity Management – A supporting document to the SOPA Biodiversity Management Plan . All contractors and subcontractors must also comply with approved environmental management plans and work permit conditions.

Failure to comply will result in prosecution by relevant authorities, including the NSW Environment Protection Agency, National Parks and Wildlife Service, the NSW Heritage Council, and the Office of Environment and Heritage.

9.4 Erosion and Sediment Control

Erosion and sediment control measures shall be provided during construction. Measures shall be in accordance with the latest edition of the "Blue Book" – *Managing Urban Stormwater – Soils and Construction*, published by Landcom.

The contractor is responsible for maintenance and daily inspection of the erosion and sediment control. The contractor shall prepare and maintain a photographic record of the daily inspection and provide the records to SOPA as part of the monthly project progress report.

The Authority **constantly monitors** the construction activities and may issue notices if the contract is in breach of any Act or regulations.

The contractors must **clean and rectify** the damages in accordance with the methodology provided in the environmental and construction management plan under supervision of the Authority's environmental compliance officer.

9.5 Approved Contractors

Works undertaken on communications systems shall be undertaken by a contractor approved by SOPA Manager Information Technology.

Works undertaken on public address and CCTV systems shall be undertaken by a contractor approved by SOPA Manager Security.

Works undertaken on C-BUS systems shall be undertaken by a contractor approved by SOPA Manager Building and Infrastructure.

Works on Sydney Water assets shall be undertaken by a Sydney Water approved contractor. Construction shall be overseen and certified by a Sydney Water WSC.

Works on Ausgrid services shall be undertaken by an Ausgrid approved contractor.

9.6 Quality Control

The contractor/ developer is responsible to employ adequately qualified firms to oversee, supervise and certify all of the activities in accordance with the designer's recommendations, unless advised by the Authority. The QMS must be prepared in accordance with the Aus-Spec Part 0161.

In the absence of the test and quality control plan in the design documents, the contractor must prepare appropriate test and quality control plan prior to commencement of the works and submit the plan to the Authority for approval.

The Authority must be notified of all of the hold points and timeframes 48 hours prior to the works and may conduct random inspections of the works.

All the test results, inspection reports and certification must be submitted the Authority monthly and as part of the project progression report.

9.7 Important Note

The contractor shall inspect the sediment control and site safety measures daily and prepare photographic report. The reports must be sent to the Authority's project manager or planning team weekly for review.

The Authority will conduct random checks of the construction site to review the safety, environmental and construction quality.

9.8 Certification

On completion of construction, certification shall be provided that the works comply with the design documentation. The certification shall be provided by the engineer responsible for overseeing the works during construction. The minimum level of certification shall be as per the format provided in Appendix B.

9.9 Hand Over

On completion of construction, handover of the works shall be in accordance with Sydney Olympic Park Hand Over Procedures. See Appendix G for details.

9.10 General Requirements

In addition to the documents required in Appendix G, the contractor must provide:

- As-built plan for each asset type with the assets clearly marked and tagged.
- An asset registers corresponding to the asset type and as-built plans. The asset register must include the information below:
 - a. Asset type;
 - b. Location;
 - c. Tag – corresponding to as-built plans;
 - d. Length;
 - e. Height;
 - f. Fittings;
 - g. Material;
 - h. Expected useful life;
 - i. Warranties;
 - j. All geometric characteristics for instance for a drainage pipe length, size, slope, invert at upstream and downstream, connecting pits, offset from kerb and nominated capacity must be provided in the asset register;
 - k. Colour;
 - l. Other data.

The asset register must be designed to suit the Authority's requirements and the asset type.

- All operation manuals.
- Relevant certificates.

10 Engineering Plan Checklists

The designer must refer to NATSPEC Part 0010 and provide all relevant NATSPEC checklists as part of the design documentation.

The Authority may require other checklist and calculations to be provided as part of the design documentations. The consultant must seek advise at the commencement of the project to ensure that provision of the relevant checklist has been agreed upon and will be provided to the Authority.

10.1 Engineering Plan Checklist

Site: _____ Date: _____

Developer: _____

Consultant: _____

Design Engineer: _____

Qualifications: _____

This checklist shall be completed and signed by the Design Engineer.

Drawings	
Bar scales and north point provided on all drawings	
Bench marks and datum shown	
Significant trees shown on drawings.	
Property boundaries shown	
Location of existing services shown	
Levels shown for new works, which demonstrate compliance with access requirements.	
Set-out for works provided	
Erosion and sediment control measures detailed	
Stormwater pipe layout shown on drawings	
Long-section provided for new stormwater pipes, including levels, flow, pipe size, class, material	
Roadway / pavement plans show extent of works	
Long section provided for new roadway	
Cross-sections provided at 10m intervals	
Location of services shown on cross-sections and long sections	
Bicycle lanes provided in new roadways	

Drawings

Details provided for all new works	
Long-section provided for driveway access, demonstrating vertical clearance.	
Location of light poles shown on drawings and co-ordinated with trees.	
Certified lighting calculations to demonstrate compliance to AS/NZS1158	
Irrigation plans	
Telecommunication plan	
Traffic design plan	
Asset list / register	
Construction Specifications	
Quality management plan including hold points and witness points	
DDA compliance certificate	

11 Checklists and Certificates

11.1 Minimum format for Structural Design Certificate

Letterhead

Date

The Principal Certifying Authority

C/-

Address line 1

Address line 2

SUBURB STATE POSTCODE

Dear _____,

PROJECT DESCRIPTION STRUCTURAL CERTIFICATE

We certify that the design as shown on drawings listed in the attached schedule A complies with:

1. The relevant Clauses of section B of the Building Code of Australia;
2. The architectural plans detailed in the attached schedule B;
3. Australian standards AS1170, AS1720 and AS3600;
4. SOPA Infrastructure Technical Design and Construction Manual;
5. Accepted engineering practice and principles.

No other standards or practices have been relied upon for this certification.

This certification shall not be construed as relieving any other party of their responsibilities, liabilities or contractual obligations.

Yours faithfully,

Company Name

Signatures Name

Qualifications

NER Structural– Membership No. #####

Schedule A

List of Structural Engineering Drawings

Number	Title	Amendment
1	Insert title	Insert amendment

Schedule B

Certified Architectural Drawing Numbers Revision List

Number	Title	Amendment
1	Insert title	Insert amendment

11.2 Minimum Format for Civil Design Certificate

Letterhead

Date

The Principal Certifying Authority

C/-

Address line 1

Address line 2

SUBURB STATE POSTCODE

Dear ,

PROJECT DESCRIPTION CIVIL CERTIFICATE

We certify that the design as shown on drawings listed in the attached schedule A complies with:

1. Australian standards AS/NZS 3500.3;
2. SOPA Infrastructure Technical Design and Construction Manual;
3. List other standards;
4. Accepted engineering practice and principles.

No other standards or practices have been relied upon for this certification.

This certification shall not be construed as relieving any other party of their responsibilities, liabilities or contractual obligations.

Yours faithfully,

Company Name

Signatures Name

Qualifications

NER Civil– Membership No. #####

Schedule A

List of Civil Engineering Drawings

Number	Title	Amendment
1	Insert title	Insert amendment

11.3 Minimum format for Electrical Design Certificate

Letterhead

Date

The Principal Certifying Authority

C/-

Address line 1

Address line 2

SUBURB STATE NSW

Dear ,

PROJECT DESCRIPTION ELECTRICAL CERTIFICATE

We certify that the design as shown on drawings listed in the attached schedule A complies with:

1. Australian standards AS3000 and AS3008;
2. SOPA Infrastructure Technical Design and Construction Manual;
3. List other standards;
4. Accepted engineering practice and principles.

No other standards or practices have been relied upon for this certification.

This certification shall not be construed as relieving any other party of their responsibilities, liabilities or contractual obligations.

Yours faithfully,

Company Name

Signatures Name

Qualifications

Schedule A

List of Electrical Engineering Drawings

Number	Title	Amendment
1	Insert title	Insert amendment

11.4 Minimum format for Lighting Design Certificate

Letterhead

Date

The Principal Certifying Authority

C/-

Address line 1

Address line 2

SUBURB STATE POSTCODE

Dear ,

PROJECT DESCRIPTION LIGHTING CERTIFICATE

We certify that the design as shown on drawings listed in the attached schedule A complies with:

1. Australian standards AS/NZS1158;
2. SOPA Infrastructure Technical Design and Construction Manual;
3. SOPA Urban Element Design Manual;
4. List other standards;
5. Accepted engineering practice and principles.

No other standards or practices have been relied upon for this certification.

This certification shall not be construed as relieving any other party of their responsibilities, liabilities or contractual obligations.

Yours faithfully,

Company Name

Signatures Name

Qualifications

Lighting Design Professions or Membership of Illumination Engineering Society

Level and Membership No #####

Schedule A

List of Lighting Drawings

Number	Title	Amendment
1	Insert title	Insert amendment

11.5 Minimum Format for Structural Construction Certificate

Letterhead

Date

The Principal Certifying Authority

C/-

Address line 1

Address line 2

SUBURB STATE POSTCODE

Dear _____,

PROJECT DESCRIPTION STRUCTURAL CERTIFICATE

We certify that the design as shown on drawings listed in the attached schedule A complies with:

1. The relevant clauses of section B of the Building Code of Australia;
2. The architectural plans detailed in the attached schedule B;
3. Relevant Australian standards listed below:
 - a. AS1170
 - b. AS1720
 - c. AS3600
 - d. list other standards
4. SOPA Infrastructure Technical Design and Construction Manual;
5. Accepted engineering practice and principles.

We also certify that we have carried out inspections of the details documented on the drawings listed in Schedule A (attached), in accordance with accepted engineering practice and principles during construction of the project. At the times of the inspections the work approved conformed with the intent of our Structural Engineering design, refer attached copy of our Engineering Reports.

This certification shall not be construed as relieving any other party of their responsibilities, liabilities or contractual obligations.

Yours faithfully,

Company Name

Signatures Name

Qualifications

NER Structural – Membership No. #####

Schedule A

List of Structural Engineering Drawings

Number	Title	Amendment
1	Insert title	Insert amendment

Schedule B

Certified Architectural Drawing Numbers Revision List

Number	Title	Amendment
1	Insert title	Insert amendment

11.6 Minimum Format for Civil Construction Certificate

Letterhead

Date

The Principal Certifying Authority

C/-

Address line 1

Address line 2

SUBURB STATE POSTCODE

Dear _____,

RE: PROJECT DESCRIPTION CIVIL CERTIFICATE

We certify that the design as shown on drawings listed in the attached schedule A complies with:

1. Australian standards AS/NZS 3500.3;
2. SOPA Infrastructure Technical Design and Construction Manual;
3. List other standards;
4. Accepted engineering practice and principles.

No other standards or practices have been relied upon for this certification.

We also certify that we have carried out inspections of the details documented on the drawings listed in Schedule A (attached), in accordance with accepted engineering practice and principles during construction of the project. At the times of the inspections the work approved conformed with the intent of our Civil Engineering design, refer attached copy of our Engineering Reports.

This certification shall not be construed as relieving any other party of their responsibilities, liabilities or contractual obligations.

Yours faithfully,

Company Name

Signatures Name

Qualifications

NER Civil – Membership No. #####

Schedule A

List of Civil Engineering Drawings

Number	Title	Amendment
1	Insert title	Insert amendment

11.7 Minimum Format for Electrical Construction Certificate

Letterhead

Date

The Principal Certifying Authority

C/-

Address line 1

Address line 2

SUBURB STATE POSTOCDE

Dear _____,

PROJECT DESCRIPTION ELECTRICAL CERTIFICATE

We certify that the design as shown on drawings listed in the attached schedule A complies with:

1. Australian standards AS/NZS 3000 and AS3008;
2. SOPA Infrastructure Technical Design and Construction Manual;
3. List other standards;
4. Accepted engineering practice and principles.

No other standards or practices have been relied upon for this certification.

We also certify that we have carried out inspections of the details documented on the drawings listed in Schedule A (attached), in accordance with accepted engineering practice and principles during construction of the project. At the times of the inspections the work approved conformed with the intent of our Electrical Engineering design, refer attached copy of our Engineering Reports.

This certification shall not be construed as relieving any other party of their responsibilities, liabilities or contractual obligations.

Yours faithfully,

Company Name

Signatures Name

Qualifications

Schedule A

List of Electrical Engineering Drawings

Number	Title	Amendment
1	Insert title	Insert amendment

11.8 Road Opening Permit Application Form

Application for temporary road and/or footpath occupancy:

Section 1 Applicant Details

Name	
Address	
Phone	
email	
Contact Person	(Name and Mobile)

Section 2 Location of Work

Area of Work:

- Road only
- Road and footpath with no pedestrian access
- Road and footpath with pedestrian access
- Footpath only with no or limited pedestrian access
- Footpath only with pedestrian access

Street address	
----------------	--

Section 3 Dates and time of proposed occupancy

Date of proposed works	
Time of proposed works	

Section 4 Activity Details

Purpose of the works:	
Length of the affected area (from state to end of road tapering)	
Width of the affected area	
Number of kerbside lanes affected	
Number of travel lanes affected	

Does this work require mobile crane set-up?

- Yes (Gross weight of the crane: _____tonne)
- No

Is the work within 100m of traffic signals?

- Yes (Attach RMS Road Occupancy Licence)
- No

Does the work area affect Bus Lanes or Bus Services?

- Yes (Attach written consent from relevant bus companies)
- No

Does the work area affect a Taxi Zone?

- Yes (Attach written consent from the Taxi Council)
- No

Does the work area affect access to properties?

- Yes (Attach a copy of the notice to be distributed to residents / businesses advising them of the work)
- No

Section 5 Site Contact Details

Name of worksite supervisor	
Mobile #	

Section 6 Documents to be Submitted

- Traffic and pedestrian management plan (To be submitted for all works affecting traffic or pedestrian areas)
- Drawings and specifications for the proposed works
- Consent details from relevant authorities
- Insurance certificates

Section 7 Insurance Details

Public liability policy #	
Name of insurance company	
Period of insurance	
Limit of liability	(minimum \$10million)
Workers compensation policy #	
Name of insurance company	
Period of insurance	

Section 8 Applicant Declaration

I declare on behalf of the business nominated on this application form that the information I have provided is true and correct in every detail. I understand that Sydney Olympic Park Authority may withdraw and cancel the permit if information I have supplied is not true and correct. I declare that the public liability and workers compensation insurances shall not be cancelled or lapse with the agreement of Sydney Olympic Park Authority before or during the works. I understand that I, as a permit holder, am to reimburse Sydney Olympic Park Authority for the cost of repair of any damage caused to the public domain as a result of the works.

Applicant's name

Applicant's signature

Date

12 Environmental Management

12.1 General

12.1.1 Responsibilities

General requirement: Provide environmental management, as documented.

12.1.2 Interpretation

12.1.2.1 Abbreviations

General: For the purposes of this work section the following abbreviations apply:

- EIA: Environmental impact assessment;
- EMP: Environmental management plan.

12.1.2.2 Definitions

General: For the purposes of this work section the following definitions apply:

- Authorities: Any authority or agency covering statutory requirements relating to the project, including clearances for work in that particular area;
- Clearances: A formal certificate, approval or condition issued by an authority to allow work to be carried out in a particular area;
- Contamination of land: The presence of a substance in, on or under the land which is a designated hazardous material and/or is at a concentration above that which is normally found in that locality, such that there presents a risk of harm to human health or to the environment;
- Environment: The physical factors of the surroundings of human beings including the land, waters, atmosphere, climate, sound, odours, tastes, the biological factors of animals and plants and the social factor of aesthetics;
- Environmental audits: A review of environment management practices, in particular the evaluation of a site for environmental liability;
- Environmental impact assessment: A method for predicting environmental impacts of a proposed development including minimising identified impacts;
- Environmental management plan: A project or site specific plan describing the management of the environmental issues and considerations for the activity being undertaken. This applies to the design, construction and operation of the buildings, external works and infrastructure;
- Organic waste: Includes all food wastes, vegetative wastes from land clearing and pruning operations, biosolids produced from the treatment of liquid wastes, garden wastes and forestry waste (bark and saw dust) and paper and cardboard products;

- Pollution incident: An incident or set of circumstances during or as a consequence of which there is, or is likely to be a leak, spill or other escape of a substance as a result of which pollution has occurred, is occurring or is likely to occur;
- Weed: An invasive plant that degrades natural areas, reduces the sustainability or affects the health of people and animals.

12.1.3 Submissions

12.1.3.1 Control Plans

Requirement: Submit the following:

- Environmental management plan;
- Soil erosion and sediment control plan;
- Weed management plan.

12.1.4 Inspection

12.1.4.1 Notice

Inspection: Give notice so that inspection may be made of the following:

- Discovery of non-conforming items, e.g. contamination;
- Completed removal or rectification of non-conforming items;
- Discovery of unexpected finds.

12.2 Execution

12.2.1 Environmental Management Plan

12.2.1.1 Control Plan

EMP: Submit a plan with the following details:

- Project description, including site location, construction activities, and project schedule;
- EMP context, describing how the EMP fits into the overall project planning process;
- EMP objective and environmental policy;
- Assignment of responsibility for environmental controls, including hierarchy of management;
- Conditions of approvals, licences and permits to meet statutory requirements;
- Reporting requirements;

- Environmental training plan and procedures. Include in the plan, a program to familiarise staff with the EMP and/or management controls, environmentally sensitive areas and responsibilities;
- Environmental auditing program and corrective action procedures;
- Emergency response procedures including response time;
- Risk assessment;
- Details of potential environmental impacts and operational control measures for implementation including:
 - Heritage;
 - Preservation of visual values;
 - Protection of endangered species, including the green and golden bell frog.
 - Preservation of habitat;
 - works in and near waterbodies;
 - excavation works on remediated lands;
- Details of environmental protection for each activity;
- Locations of environmental controls and environmentally sensitive areas.
- Communication procedures;
- Other items necessary to protect the surrounding environment.

Activities Staging: Address the phases of activity, as appropriate:

- Before construction and site establishment;
- During construction;
- After construction, including rehabilitation activities and site and landscaping maintenance such as erosion and sedimentation controls.

Completed EMP: Submit and gain approval before work commences on site.

12.2.2 Procedural and Personnel

12.2.2.1 Community Liaison

General: Notify residents of construction activities which will affect access to, or disrupt the use of, their properties.

Notice: Minimum 5 working days, unless the work is of an urgent nature with safety implications.

Notification content:

- The nature of the work;
- The reason for it being undertaken;
- The expected duration;
- Changes to traffic arrangements and property access;

- The 24-hour contact number of the representative responsible.

12.2.2.2 Internal Monitoring

Approval authority: The Contract Administrator.

Documentation: Provide descriptions of the following:

- Environmental monitoring: Procedures for implementation and recording;
- For all control measures to be implemented: Non-conformance control and corrective action procedures.

Records: Maintain records of results of environmental monitoring, including the effectiveness of any remedial action taken.

Internal monitoring personnel: Provide staff names and contact details.

Machinery and equipment: Provide details of proposed plant.

Review timing: Undertake reviews of the EMP or control measures at the following stages:

- When there is a change in the project, e.g. scope;
- Following significant environmental accidents;
- When improved performance is required to reduce specific environmental impact;
- At completion of environmental audits;
- At the end of the project.

12.2.2.3 Emergency Response

Emergency response personnel: Provide staff names and contact details.

Response time: within 24 hours of discovery. Life threatening events to be addressed immediately.

12.2.2.4 Complaints

Reporting: Within 1 working day of receiving a complaint about any environmental issue, including pollution, submit a written report detailing the complaint and remedial action taken.

Register: Keep a register of all environmental complaints and action taken.

12.2.2.5 Reporting

Requirement: Compile the environmental management reports to record the progress of the following:

- Performance against statutory requirements;
- Performance against the EMP, environmental objective and policy, ecologically sustainable development outcomes and targets;
- Summary of monitoring, inspection and audits;
- Summary of reports required to meet the statutory requirements;
- Summary of environmental emergencies, incidents, non-conformance and complaints;
- Summary of corrective actions where required.

Reporting frequency: At the end of each month.

12.2.2.6 Unexpected Finds

Requirement: If encountered, give notice and close off affected site area with barrier tapes and warning signs to prevent access. Unexpected finds include asbestos and other hazardous or volatile contaminants, archaeological finds and items of heritage value.

Further action: Provide proposed action plan for addressing the issue to the contract administrator and await advice.

12.2.3 Soil Erosion and Sediment Control

12.2.3.1 Control Plan

Plan: Submit a soil erosion and sediment control plan with the following details:

- Staging of operations and sequence of works;
- Diversion of upstream water around the site;
- Provision of temporary drains and catch drains;
- Application of diversion, dispersal and/or retention measures to concentrate flows to control and dissipate stormwater through the site without damage;
- Spreader banks or other structures to disperse concentrated runoff;
- Temporary grassing or other treatments to disturbed areas and long-term stockpiles;
- Restoration of disturbed areas in progress with the works;
- Use of mulch materials to protect disturbed or exposed areas where suitable.

Areas: Include all site areas and access and haulage tracks, stockpile and storage areas and compound areas.

12.2.4 Weed Management

12.2.4.1 Control Plan

Plan: Submit a weed management plan with the following details:

- Identify weeds and infestation zones within the work site and the investigation period;
- Method and date of cleaning vehicles and machinery;
- Cleaning bay location and treatment date;
- Contaminated fill stockpile, treatment type and treatment date.

12.2.4.2 Weed Management Personnel

Requirement: Submit details of the following:

- Subcontractors who will treat weed infestations;
- Chemical handlers, qualifications, date, and spray type.

12.2.4.3 The Contractor Must Also

- Keep record of greenwaste and chemical waste disposal to appropriate facilities – supply tip docket on request
- Supply MSDS for all herbicide to be used on site for approval
- Comply with SOPA pesticides notification policy

12.2.5 Site Control and Protection Measures

12.2.5.1 Air Quality Control

Requirement: Protect adjoining owners, residents and the public against dust, dirt, water nuisance and injury. Use dust screens and watering to reduce dust nuisance.

12.2.5.2 Dewatering

Requirement: Keep earthworks free of water. Provide and maintain slopes, crowns and drains for excavations and embankments, to make sure there is free drainage. Construct, including placing of fill, masonry, concrete and services, on ground where free water has been removed. Prevent water flow over freshly laid work.

Water disposal: Dispose off-site.

12.2.5.3 Dust Control

Dust control measures: Required.

12.2.5.4 Lighting of Fires

Prohibition: Do not light fires.

12.2.5.5 Noise Control and Vibration

Standard: To the recommendations of AS2436.

Noise levels: Avoid excessive noise and long periods of elevated noise that is reasonably anticipated to annoy or adversely affect the adjacent community.

Noise suppression: Minimise noise nuisance with measures including the following:

- Enclose noisy equipment;
- Provide noise attenuation screens;
- Maintain plant in good working order;
- Fit effective residential class silencers to all engine exhausts;
- Fit engine covers to all plant.

Limits on ground vibration: Make sure ground vibration levels transmitted from operating items of plant in the vicinity of buildings do not exceed levels that are close to the lower level of human perception inside the premises or cause structural damage to the buildings and other structures.

Monitoring: Provide the following:

- Baseline condition measurements before commencement of the works.
- Progressive monitoring during the works to confirm conformance with approval conditions.

12.2.5.6 Vegetation and Fauna

Wildlife to be protected: All native species.

Trees to be removed: Inspect to establish if nesting native fauna are present. If present, give notice.

Pruning: To AS4373.

12.2.5.7 Water Quality

Wash out: Prevent wash out from entering waterways or stormwater drains.

Cross connection: Make sure there are no cross connections between stormwater and the public sewerage system.

12.2.5.8 Vehicular and equipment contamination precautions

Covers: Use tarpaulins to prevent the dropping of materials on public roads.

Washing: Wash the underside of all vehicles leaving the site as follows:

- Mud: Do not carry onto other areas, including adjacent paved streets;
- Noxious plants: If those designated by the local authority are present on the site, make sure seeds are not carried onto other areas, including adjacent paved streets.

12.2.5.9 Wheel Wash/Shaker Bay

Facilities: Provide the following:

- Shaker area size: 3.5m x 12m min;
- Surface: Crushed concrete or rock of between 100 mm and 200 mm approximate diameter;
- Services: High pressure hose water supply;
- Location: Locate the shaker bay and provide berms to drain to grassed areas of the site and allow infiltration to the subsurface.

12.2.6 Other Environmental Controls

12.2.6.1 Cultural Heritage

Training: Make sure all personnel working on the site have received training on their responsibilities regarding cultural heritage and are made aware of any sites/areas, which must be avoided. Mark-up such sites/areas on a site map and make available to all relevant personnel during the works.

Notice: Give notice if any item encountered is suspected to be an artefact of heritage value, relic or material which is Aboriginal or belonging to early settlement.

Action: Stop construction work that might affect the item and protect the item from damage or disturbance.

13 Site Preparation

13.1 General

13.1.1 Responsibilities

Requirement: Provide site preparation.

13.1.1.1 Incidental Works

Generally: Undertake the following:

- Reinstatement: Reinstatement undeveloped ground surfaces to the condition existing at the commencement of the contract.
- Minor trimming: As required to complete the works, as documented.

13.1.2 Interpretation

13.1.2.1 Definitions

General: For the purposes of this work section the following definitions apply:

- Authorities: Any authority or agency covering statutory requirements relating to the project, including clearances for work in that particular area;
- Clearances: A formal certificate, approval or condition issued by an authority to allow work to be carried out in a particular area;
- Network utility operator: The entity undertaking the piped distribution of drinking water or natural gas for supply or is the operator of a sewerage system or a stormwater system.

13.1.3 Submissions

13.1.3.1 Execution Details

Requirement: Submit details of methods and equipment proposed for the following:

- Clearing and grubbing;
- Tree removal and transplanting.

13.1.4 Inspection

13.1.4.1 Notice

Inspection: Give notice so that inspection may be made of the following:

- Trees to be removed.

13.2 Execution

13.2.1 Community Liaison

13.2.1.1 Notification

General: Notify residents about construction activities which will affect access to, or disrupt the use of, their properties.

Notice: Minimum 5 working days, unless the work is of an urgent nature with safety implications.

Notification content:

- The nature of the work;
- The reason for it being undertaken;
- The expected duration;
- Changes to traffic arrangements and property access;
- The 24-hour contact number of the representative responsible.

13.2.2 Existing Services

13.2.2.1 General

Requirement: Before commencing earthworks, locate and mark existing underground services in the areas which will be affected by the earthworks operations including clearing, excavating and trenching.

Utility services: Contact DIAL BEFORE YOU DIG to identify location of underground utility services pipes and cables.

Excavation: Do not machine excavate within 1 m of existing underground services.

Existing service lines: If required, divert services detected during excavation to new routes, clear of the building, and reconnect to the network utility operator's requirements.

13.2.3 Site Clearing

13.2.3.1 Extent

Requirement: Clear only the following site areas:

- Areas to be occupied by works such as structures, paving, excavation, regrading and landscaping.
- Other areas designated to be cleared.

13.2.3.2 Clearing and Grubbing

Clearing: Remove everything on or above the site surface, including rubbish, scrap, grass, vegetable matter and organic debris, scrub, trees, timber, stumps, boulders and rubble.

Grubbing: Grub out stumps and roots over 75mm diameter to a minimum depth of 500mm below subgrade under buildings, embankments or paving, or 300mm below finished surface in unpaved areas. Backfill holes remaining after grubbing with sand material to prevent ponding of water. Compact the material to the relative density of the existing adjacent ground material.

Redundant/decommissioned works: Remove works, including slabs, foundations, pavings, drains and access chambers covers found on the surface.

13.2.3.3 Batters

Temporary protection: Where change in level between crest and toe is more than 1.5m, protect from erosion with geofabric, a hessian and tar or heavy duty black polythene sheet waterproof cover. Seal joints and securely fix down at crest and toe.

13.2.3.4 Surplus Material

Topsoil and excavated material: Continually remove unwanted stripped soil and other material from the site as the work proceeds, including any material dropped on footpaths or roadways.

13.2.4 Stormwater and Sediment Control

13.2.4.1 General

Erosion and sediment control measures: To the *0172 Environmental management* work section.

13.2.4.2 Waterways and Drains

Waterways: Temporarily divert, as necessary, ditches, field drains and other waterways affected by excavation and reinstate on completion.

Stormwater drains: Divert drains detected during excavation to new routes, clear of structures, and reconnect to the network utility operator's requirements.

13.2.5 Existing works to be retained

13.2.5.1 Marking

Requirement: Mark out works with 1m high 50 x 50mm timber stakes with yellow plastic tapes attached to prevent accidental damage.

13.2.6 Trees to be Removed

13.2.6.1 Designation

Extent: Trees to be removed are to be approved by SOPA Manger Site Presentation prior to removal.

Marking: Mark trees and shrubs to be removed as follows:

- Tags: Surveyor's ribbon or road marking paint;
- Location: 1000mm above ground level.

13.2.7 Tree Protection

13.2.7.1 General

Protection measures: Provide before commencement of earthworks.

13.2.7.2 Trees to be Retained

Extent: All trees NOT marked for removal.

13.2.7.3 Tree protection

Tree protection zone (TPZ): To AS4970 Section 3.

Tree protective measures: To AS4970 Section 4.

Monitoring and certification: To AS4970 Section 5.

13.2.7.4 Work Near Trees

Harmful materials: Conform to the following:

- Keep the area within the dripline free of sheds and paths, construction material and debris;
- Do not place bulk materials and harmful materials under or near trees;
- Do not place spoil from excavations against tree trunks;
- Prevent wind-blown materials such as cement from harming trees and plants.

Damage: Prevent damage to tree bark. Do not attach stays, guys and the like to trees.

Work under trees: Do not remove topsoil from, or add topsoil to, the area within the dripline of the trees.

Excavation: If excavation is required near trees to be retained, give notice. Minimise period of excavation under tree canopies.

Hand methods: Use hand methods to locate, expose and cleanly remove the roots on the line of excavation. If it is necessary to excavate within the drip line, use hand methods so that root systems are intact and undamaged.

Roots: Do not cut tree roots exceeding 50mm diameter. Where it is necessary to cut tree roots, use cutting methods that do not excessively disturb the remaining root

system. Immediately after cutting, water the tree and apply a liquid rooting hormone to stimulate the growth of new roots.

Backfilling: Backfill excavations around tree roots. Place the backfill in layers of 300mm maximum depth and compacted to a dry density similar to that of the original or surrounding soil. Do not backfill around tree trunks to a height greater than 200mm above the original ground surface. Immediately after backfilling, thoroughly water the root zone surrounding the tree.

Backfill material:

- Mix proportions (topsoil:well-rotted composts) by volume: 3:1;
- Neutral pH value;
- Free from weed growth and harmful materials.

Compacted ground: Do not compact the ground or use skid-steel vehicles under the tree dripline. If compaction occurs, give notice.

Compaction protection: Protect areas adjacent the tree dripline. Submit proposals for an elevated platform to suit the proposed earthworks machinery.

Watering: Water trees as necessary, including where roots are exposed at ambient temperature more than 35°C.

Mulching: Spread 100 mm thick organic mulch to the whole of the area covered by the drip line of all protected trees.

13.2.8 Transplanting

Consider calling for a tree transplanting specification prepared by a qualified arborist.

13.2.8.1 General

Scope of any tree transplanting must be submitted to and approved by SOPA, minimum eight (8) months prior to commencement of the works.

Experience: All transplanting shall be undertaken by a firm experienced in transplanting trees of a similar size to those to be transplanted. Transplanting shall be supervised by a qualified arborist.

Notice: Give notice before:

Root cutting: 48hours before commencement of work

Conditions: Select a time for transplanting appropriate to the season, time of actual operation, rootball diameter and depth, lifting methods and weather conditions.

13.2.8.2 Preparation

Watering: Establish a temporary trickle irrigation system, or manually water the intended trees for a period of two weeks before ball excavation work.

Fertilising: Apply one application of liquid fertiliser mix to the foliage and root as appropriate to the species. Apply sufficient liquid fertiliser mix to allow the spray to drip from foliage and soak into the rootball. Do not spray the fertiliser mix on excessively hot, dry or windy days.

13.2.8.3 Rootball

General: Minimise the cutting of roots. Use only sharp tools, water blasting or water cutting.

Initial cut: Conform to the following:

- Manually or using chain trenching machine. Replace trees where rootballs have been excavated by backhoe or an excavator.
- Cut 250mm beyond the required finished rootball dimensions of each side to allow damaged roots to be trimmed back to final dimensions and sealed.

Hand trimming: To 100mm less than the required finished rootball dimension. Cut back all roots greater than 25mm diameter.

Rootball cutting: Conform to the following:

- Symmetrical about the trunk and in proportion to the overall size of the tree except where the limitations of individual tree planter openings require specific tailoring of the rootball dimension;
- Cut the rootball to a size which maximise the rootball for each specimen.

Trench: Backfill and lightly compact with clean sand, free of any foreign matter, pathogens or any substances which may be deleterious to future root growth. Apply root inducing formulation to the manufacturer's recommended concentration, to effectively saturate the backfill in the trench.

Consider the following site supervision procedures: Do not proceed with any rootball excavation before the tree has been inspected by the contract administrator to determine the final orientation of the tree in relation to the design effect. Do not commence any rootball excavation work without written approval from the contract administrator .

Upon approval to proceed, nominate tree branches to be removed before root pruning.

Following approval by the contract administrator, trim approved branches in conformance with accepted standards of tree surgery practice and as instructed by the contract administrator.

13.2.8.4 Maintenance of On-site Plant Material

Watering: Maintain a trickle irrigation system around each tree, located within the trenched rootball perimeter. Program the system to supply water at an optimum rate to encourage healthy growth and avoid desiccation through excessive transpiration following the pruning of the roots. Monitor the system continuously until the tree is lifted and removed to its final destination.

Fertilising: Submit a program for regular fertiliser application continued over this period.

Responsibility: Take all necessary precautions to safeguard the health and well-being of all on site plant material before the lifting and transplanting into their finished location.

13.2.8.5 Above Ground

Pruning: If pruning of branches is required to balance root loss, obtain prior approval.

Lifting: Thoroughly irrigate to the full depth of the rootball two days before transplanting of each specimen. Do not fracture the ball of soil around the root system. Maintain ball in firm condition during transplanting by wrapping in hessian or other appropriate open weave material, securely tied.

Storage: Transport transplanted trees to a designated nursery site. Store and maintain until ready for planting.

Planting: Avoid disturbing the rootball during moving and planting. After placement, remove the rootball wrapping and ties by cutting.

Watering: At completion of transplanting, water the rootball thoroughly and continue to water until established.

13.2.9 Tree Maintenance

13.2.9.1 General

Notice: Give notice before commencing tree maintenance.

Pruning: To AS4373 using a fully qualified and experienced arborist. Carry out all required works in a safe manner.

13.2.9.2 Execution

Repair: Undertake tree surgery and rectify any damage to existing trees to be retained.

Operations: Remove dead and decayed wood or limbs that have been broken. Make all cuts at branch collars. If trees show signs of deterioration after the work is completed, carry out a program of soil amelioration such as soil aeration, irrigation or incorporation of organic material. Continue this program until the end of the plant establishment period.

Root pruning: Do not excessively disturb the remaining root system. Cut off damaged roots cleanly inside the exposed or damaged area. Cover exposed root area with soil immediately after pruning, do not leave roots exposed.

Wetting and new root stimulation: Form a water collecting basin and apply a rooting hormone and wetting agent to the rootball.

Precautions: Avoid damage to trees being treated and to nearby trees and surroundings. Do not use trees as anchors for winching operations or bracing. Provide bracing as necessary before cutting to prevent uncontrolled breakages and damage to surroundings.

Failure: If repair work is impracticable, or is attempted and is rejected, remove the tree and root system and make good.

Restitution by replacement tree: Replace with tree of the same species and similar size.

13.2.10 Completion

13.2.10.1 Clean Up

Progressive cleaning: Keep the work included in the contract clean and tidy as it proceeds and regularly remove from the site waste and surplus material arising from execution of the work, including any work performed during the defects liability period or the plant establishment period.

Removal of plant: Within 10 working days of the date of practical completion, remove temporary works, construction plant, buildings, workshops and equipment which does not form part of the works, except what is required for work during the defects liability period or the plant establishment period. Remove these on completion.

Waste disposal: To the *0172 Environmental management* work section.

14 Earthwork

14.1 General

14.1.1 Standards

Earthworks: Conform to the recommendations of those parts of AS 3798 which are referenced in this worksection.

14.1.2 Interpretation

14.1.2.1 Abbreviations

General: For the purposes of this worksection the following abbreviations apply:

- GITA: Geotechnical inspection and testing authority;
- GTA: Geotechnical testing authority.

14.1.2.2 Definitions

General: For the purposes of this worksection the definitions given in AS1348, AS3798 and the following apply:

- Description and classification of soils: To AS1726;
- Site classification: To BCA3.2.4;
- Bad ground: Ground unsuitable for the purposes of the works, including fill liable to subsidence, ground containing cavities, faults or fissures, ground contaminated by harmful substances and ground which is or becomes soft, wet or unstable;
- Base: Layer(s) of material forming the uppermost structural element of a pavement and on which the surfacing may be placed;
- Discrepancy: A difference between contract information about the site and conditions encountered on the site, including but not limited to discrepancies concerning the following:
 - The nature or quantity of the material to be excavated or placed;
 - Existing site levels;
 - Services or other obstructions beneath the site surface.
- Rock: Monolithic material with volume greater than 0.5m³ which cannot be removed until broken up by rippers or percussion tools.
- Site topsoil: Soil excavated from the site which contains organic matter, supports plant life, conforms generally to the fine to medium texture classification to AS4419 (loam, silt, clay loam) and is free from:
 - Stones more than 25mm diameter;
 - Clay lumps more than 75mm diameter;
 - Weeds and tree roots;
 - Sticks and rubbish;
 - Material toxic to plants.

- Subbase: The material laid on the subgrade below the base either for the purpose of making up additional pavement thickness required, to prevent intrusion of the subgrade into the base, or to provide a working platform;
- Subgrade: The trimmed or prepared portion of the formation on which the pavement or slab is constructed. Generally taken to relate to the upper line of the formation;
- Zone of influence: A foundation zone bounded by planes extending downward and outward from the bottom edge of a footing, slab or pavement and defining the extent of foundation material having influence on the stability or support of the footings, slab or pavement.

14.1.3 Tolerances

14.1.3.1 General

Finish: Finish the surface to the required level, grade and shape within the following tolerances:

- Under building slabs and load bearing elements: +0, -25mm;
- Pavement subgrades: +0, -4mm;
- Batters: No steeper than the slope shown on the drawings. Make sure flatter slopes do not impact on boundaries or required clearances to buildings, pavements or landscaping;
- Other ground surfaces: ± 50 mm, provided the area remains free draining and matches adjacent construction where required. Provide smoothness as normally produced by a scraper blade.

14.1.4 Submissions

14.1.4.1 Design

Calculations: Submit calculations by a professional engineer to show that proposed excavations and temporary supports, including where applicable supports for adjacent structures, will be stable and safe.

14.1.4.2 Execution Details

Report: Submit a time based schedule noting the methods and equipment proposed for the earthworks, including the following:

- Dewatering and groundwater control and disposal of surface water;
- Excavation methods, stages, clearances, batters and temporary supports;
- Stockpiles and borrow pits;
- Placing and compaction methods and stages.

Geotechnical site investigations: Provide a geotechnical report supporting the procedures proposed for excavation.

Disposal location: Submit the locations and evidence of compliance with the relevant authorities for the disposal of material required to be removed from site.

Temporary shoring: Submit a proposal for any temporary shoring or underpinning required including the progressive removal.

Proof rolling: Submit method and equipment for proof rolling, supported by the geotechnical engineer.

Certified records of measurement: Submit a certified copy of the agreed records of measurement.

Construction records: Submit the following to AS 3798 Clause 3.4 and Appendix B:

- Geotechnical site visit record; and
- Earthworks summary report.

14.1.4.3 Materials

Imported fill: Submit certification or test results by a GTA registered laboratory which establish the compliance of imported fill with the contract including the source.

14.1.4.4 Tests

Compaction: Submit certification and/or test results in conformance with the specified level of responsibility to AS 3798.

14.2 Products

14.2.1 Fill Materials

14.2.1.1 General

Suitable material: To AS3798 Clause 4.4 including inorganic, non-perishable material suitably graded and capable of compaction to the documented density.

Unsuitable materials: Do not use unsuitable material for fill in conformance with AS3798 Clause 4.3.

Sulfur content: Do not provide filling with sulfur content exceeding 0.5% within 500mm of cement bound elements (for example concrete structures or masonry) unless such elements are protected by impermeable membranes or equivalent means.

Re-use of excavated material: Only re-use suitable material in conformance with AS3798 Clause 4.4.

Stockpiles: Segregate the earth and rock material and stockpile, for re-use in backfilling operations.

Locations: Do not stockpile excavated material against tree trunks, buildings, fences or obstruct the free flow of water along gutters where stockpiling is permitted along the line of the trench excavation.

Disposal: If stockpiling is not permitted under the contract, dispose of excavated material off-site to AS3798 Clause 6.1.8.

14.2.2 Imported Fill

14.2.2.1 General

Borrow or imported material: Only when no suitable excavated material is available.

Suitable material: To AS3798 Clause 4.4.

Material complying with the following:

- Granular material
- Maximum particle size = 75mm;
- Proportion passing 0.075mm sieve: 25% maximum;
- Plasticity index: $\geq 2\%$, $\leq 15\%$.

Imported fill additional testing: Provide test reports that confirm that imported fill complies with the specified requirements.

14.3 Execution

14.3.1 Site Preparation

14.3.1.1 Erosion and sedimentation control

Drainage, erosion and sedimentation control: To the *0172 Environmental management* worksection.

14.3.2 Geotechnical

14.3.2.1 Inspection and Testing

Inspection and testing: Conform to the following:

- Level 2 GTA required to AS3798 Clause 8.3.

14.3.3 Removal of Topsoil

14.3.3.1 General

Extent: Areas of cut or fill and areas occupied by structures, pavements and embankments.

14.3.3.2 Topsoil Stockpiles

General: Stockpile site topsoil intended for re-use and imported topsoil where necessary.

Stockpile heights: Establish stockpiles to maximum height of 1.5m.

Mark: Identify stockpiles of different soil types.

Vegetation: Do not burn off or remove plant growth which may occur during storage.

Protection: Provide the following:

- Drainage and erosion protection;
- Do not allow traffic on stockpiles;
- If a stockpile is to remain for more than four weeks, sow with temporary grass;
- Protect the topsoil stockpiles from contamination by other excavated material, weeds and building debris.

Remove: Remove topsoil that is unsuitable for re-use from the site to AS 3798 Clause 6.1.8.

14.3.4 Excavation

14.3.4.1 Extent

Site surface: Excavate over the site to give correct levels and profiles as the basis for structures, pavements, filling and landscaping. Make allowance for compaction, settlement or heaving.

Footings: Excavate for footings, pits, wells and shafts, to the required sizes and depths. Confirm that the foundation conditions meet the design bearing capacity.

14.3.4.2 Rock

General: Do not use explosives.

14.3.4.3 Existing Footings

Requirement: If excavation is required within the zone of influence of an existing footing, use methods including (temporary) shoring or underpinning that maintain the support of the footing and make sure that the structure and finishes supported by the footing are not damaged.

14.3.4.4 Existing Services

Location: Before commencing earthworks, locate and mark existing underground services in the areas which will be affected by the earthworks operations including clearing, excavating and trenching.

Utility services: Contact DIAL BEFORE YOU DIG to identify location of underground utility services pipes and cables.

Excavation: Do not excavate by machine within 1 m of existing underground services.

14.3.4.5 Proof Rolling

Extent: Proof roll excavations for pavements, filling and non-spanning slabs on ground to determine the presence of any bad ground.

Proof rolling method and equipment: To AS 3798 Clause 5.5.

Outcome: If excessive settlement, rebound or heaving is encountered, provide test pits or trenching to determine the extent of bad ground.

14.3.4.6 Disposal of Excess Excavated Material

General: Remove excess excavated material from site not required or unsuitable for fill.

Standard: To AS3798 Clause 6.1.8.

14.3.5 Subgrades Affected by Moisture

14.3.5.1 General

Requirement: If the subgrade is unable to support construction equipment, or it is not possible to compact the overlying pavement only because of a high moisture content, perform one or more of the following:

- Allow the subgrade to dry until it will support equipment and allow compaction;
- Scarify the subgrade to a depth of 150mm, work as necessary to accelerate drying, and recompact when the moisture content is satisfactory;
- Excavate the wet material and remove to spoil, and backfill excavated areas.

14.3.6 Bearing Surfaces

14.3.6.1 General

Requirement: Provide even plane bearing surfaces for loadbearing elements including footings. Step to accommodate level changes. Make the steps to the appropriate courses if supporting masonry.

14.3.6.2 Deterioration

General: If the bearing surface deteriorates because of water or other cause, excavate further to a sound surface before placing the loadbearing element.

14.3.7 Reinstatement of Excavation

14.3.7.1 General

Fill adjacent structures and trenches: To AS3798 Clause 6.2.6.

Zone of influence: Within the zone of influence of footings, beams, or other structural elements, use concrete of strength equal to the structural element, minimum 15 MPa. Make sure that remedial concrete does not create differential bearing conditions.

Below slabs or pavements: Provide fill compacted to the specified density.

Cut subgrades: Where the over excavation is less than 100mm, do not backfill. Rectify by increasing the thickness of the layer above.

Rock depressions and subsoil drains: Backfill rock depressions and over excavation of subsoil drains using coarse subsoil filter.

14.3.8 Supporting Excavations

14.3.8.1 Removal of supports

General: Remove temporary supports progressively as backfilling proceeds.

14.3.8.2 Voids

General: Guard against the formation of voids outside sheeting or sheet piling if used. Fill and compact voids to a dry density similar to that of the surrounding material.

14.3.9 Adjacent Structures

14.3.9.1 Temporary Supports

General: Provide supports to adjacent structures where necessary, sufficient to prevent damage arising from the works.

Lateral supports: Provide lateral support using shoring.

Vertical supports: Provide vertical support where necessary using piling or underpinning or both.

14.3.9.2 Permanent Supports

General: If permanent supports for adjacent structures are necessary and are not described, give notice and obtain instructions.

14.3.9.3 Encroachments

General: If encroachments from adjacent structures are encountered and are not shown on the drawings, give notice and obtain instructions.

14.3.9.4 Zone of Influence

Angle from horizontal: 30 for granular material, 45 for stiff clay

14.3.10 Preparation for Filling

14.3.10.1 Preparation

Stripping: Prepare the ground surface before placing fill (including topsoil fill), ground slabs or load bearing elements to AS3798 Clause 6.1.5. Remove materials which will inhibit or prevent satisfactory placement of fill layers, loose material, debris and organic matter.

Foundation preparation: To AS3798 Clause 6.1.7.

Compaction: Compact the ground exposed after stripping or excavation to the minimum relative compaction in AS3798 Table 5.1.

Scarify method: Loosen exposed excavation by scarifying to a minimum of 150 mm, moisture condition and compact to AS3798 Section 5.

Impact roller and impact compaction: Use an approved method.

Slope preparation: If fill is placed on a surface steeper than 4:1 (horizontal:vertical), bench the surface to form a key for the fill. As each layer of fill is placed, cut the existing ground surface progressively to form a series of horizontal steps more than 1m in width and more than 100 mm deep. Recompact the excavated material as part of the filling. Shape to provide free drainage.

14.3.10.2 Under Earth Mounds

General: Cultivate the ground to a depth of 200 mm before mound formation.

14.3.10.3 Under Slabs, Paving and Embankments

Compact the ground: To AS3798 Table 5.1. If necessary, loosen the ground to a depth of more than 200mm and adjust the moisture content before compaction to a density consistent with subsequent filling.

14.3.10.4 Rock Ledges

General: Remove overhanging rock ledges.

14.3.11 Placing Fill

14.3.11.1 General

Layers: Place fill in near-horizontal layers of uniform thickness, deposited systematically across the fill area.

Extent: Place and compact fill to the designated dimensions, levels, grades, and cross sections so that the surface is always self-draining.

Edges: At junctions of fill and existing surfaces, do not feather the edges.

Mix: Place fill in a uniform mixture.

Previous fill: Before placing subsequent fill layers, make sure that previously accepted layers still conform to requirements, including moisture content.

Protection: Protect the works from damage due to compaction operations. Where necessary, limit the size of compaction equipment or compact by hand. Commence compacting each layer at the structure and proceed away from it.

Protective covering: Do not disturb or damage the protective covering of membranes during backfilling.

14.3.11.2 Placing at Structures

General: Place and compact fill in layers simultaneously on both sides of structures, culverts and pipelines to avoid differential loading. Carefully place first layers of fill over the top of structures.

Concrete: Do not place fill against concrete retaining walls until the concrete has been in place for 28 days unless the structure is supported by struts.

14.3.12 Placing Topsoil

14.3.12.1 Stockpiled Topsoil

Cultivation: Rip to a depth of 100mm or to the depth of rippable subgrade if less. Cultivate around services and tree roots by hand. Trim to allow for the required topsoil depth.

Herbicide: Apply before placing topsoil.

Placing: Spread and grade evenly.

14.3.12.2 Disposal of excess topsoil

On-site: Dispose of surplus topsoil remaining on site by spreading evenly over the areas already placed.

Off-site: If excess topsoil is not able to be reused, remove excess topsoil from the site and dispose of legally.

Compaction: Lightly compact topsoil so that the finished surface is smooth, free from lumps of soil, at the required level, ready for cultivation and planting.

Edges: Finish topsoil flush with abutting kerbs, mowing strips and paved surfaces. Feather edges into adjoining undisturbed ground.

14.3.13 Fill Moisture Control

14.3.13.1 General

Moisture content: Adjust the moisture content of fill during compaction within the range of 95 to 105% of the optimum moisture content determined by AS1289.5.1.1 or AS1289.5.2.1, as appropriate, to achieve the required density.

14.3.14 Compaction requirements for fill and subgrade

14.3.14.1 Density

Excavated and stripped ground surface: After excavation and/or stripping, compact these surfaces to a minimum depth of 150mm.

Maximum rock and lump size in layer after compaction: To AS3798 Clause 6.2.2.

Fill batter faces: Either compact separately, or overfill and cut back. Form roughened surfaces to the faces.

Minimum relative compaction: To AS3798 Table 5.1.

14.3.14.2 Compaction Control Tests

Compaction control tests: To AS1289.5.4.1 or AS1289.5.7.1.

14.3.14.3 Compaction Control Test Frequency

Standard: To AS3798 Table 8.1.

Confined operations: 1 test per 2 layers per 50m².

14.3.15 Completion

14.3.15.1 Grading

External areas: Grade to give falls away from buildings, minimum 1:100.

14.3.15.2 Temporary Works

Tree enclosures: Remove temporary tree enclosures at completion.

Tree marking: Remove temporary marks and tags at completion.

Temporary supports: Remove temporary supports to adjacent structures at completion.

14.3.15.3 Site Restoration

Requirement: Where variation of existing ground surfaces is not required as part of the works, restore surfaces to the condition existing at the commencement of the contract.

15 Service Trenching and Road Opening

15.1 General

15.1.1 Responsibilities

Requirement: Provide trenching for installation of underground services and restoration of surfaces on completion of installation.

15.1.1.1 Design

Steel shoring and trench lining systems: To AS4744.1.

Hydraulic shoring and trench lining equipment: To AS5047.

Authority requirements: Ensure trenching for mains meet Authority requirements

15.1.2 Standards

15.1.2.1 General

Earthworks: To AS3798.

Traffic management: To AS1742.3

General: To Streets Opening Co-ordinating Council "Guide to codes and practices for street opening "<http://www.streetsopening.com.au/resources/>"

15.1.3 Interpretation

15.1.3.1 Abbreviations

General: For the purposes of this work section the following abbreviations apply:

- CBR value: California Bearing Ratio value.

15.1.4 Tolerances

15.1.4.1 General

Earthworks: To **TOLERANCES** in the *0222 Earthwork* work section.

15.1.5 Submissions

15.1.5.1 General

Extent: Submit a plan of trench works noting the location and type of service.

Notice: Advise proposed duration of open excavation.

Construction: Submit details of proposed equipment and method of excavation.

Stability: If shuttering and/or bracing of the sides of a trench is required for safety and stability, provide proposals.

Geotechnical data: Provide a geotechnical report supporting the procedures proposed for trenching and/or boring.

Hazards: Identify WHS hazards that may be encountered with deep trenches including toxic gases and liquids.

Boring: Submit proposals for the following:

- Limits on length;
- Existence of other services and method of protection;
- Pressure grouting to voids;
- The effect of pressure grouting on other services, ground heave and proposals for minimising such effects;
- Access to properties outside the site;
- Service interruptions including a plan for minimising unintended interruptions.

15.1.5.2 Traffic Management

Requirements: Submit and gain approval from SOPA for a Traffic Management Plan. The plan shall include provision of safe pedestrian routes past the works.

15.1.5.3 Permits

Prior to commencing work, submit the following permits and await approval:

- Road opening permit;
- Works permit.

15.1.5.4 Off-site Disposal

Disposal location: Submit the locations and evidence of compliance with the relevant authorities for the disposal of material required to be removed from the site.

15.1.5.5 Work-as-executed

Drawings: On completion of works, submit work as executed drawings to SOPA, detailing the location, level and size of new services. The drawings shall be in CAD format, in accordance with SOPA's CAD standards.

15.2 Products

15.2.1 Fill Materials

15.2.1.1 General

Requirement: Provide fill materials including borrow or imported fill to **FILL MATERIALS** and **IMPORTED FILL** in the *0222 Earthwork* work section.

15.3 Execution

15.3.1 Existing Services

15.3.1.1 Location

Requirement: Before commencing service trenching, locate and mark existing underground services in the areas which will be affected by the service trenching operations.

Utility services: Contact DIAL BEFORE YOU DIG and SOPA to identify location of underground utility services pipes and cables.

15.3.1.2 Excavation

General: Do not excavate by machine within 1 m of existing underground services.

15.3.1.3 Traffic Signal Loops

Locate and protect traffic signal loops and associated infrastructure. If damaged, restore in accordance with RMS requirements.

15.3.2 Traffic Management and Access

15.3.2.1 Plan

Implement the approved traffic management plan. Ensure that safe pedestrian access is available at all times.

15.3.2.2 Property Access

Ensure access is available to adjacent properties at all times. If access needs to be blocked, liaise with the property owner or tenant on the timing and length of the closure and possible alternate access arrangements.

Minimum notice of blocked access: 2 working days

15.3.3 Existing Surfaces

15.3.3.1 Concrete and Asphalt Pavements

Method: Sawcut trench set out lines for the full depths of the bound pavement layers except where the set out line is located along expansion joints.

Removal of concrete and asphalt: Break out concrete or asphalt pavement material between the trench set out lines, remove and dispose of off-site.

15.3.3.2 Segmental Paving Units

Removal: Take up segmental paving units both full and cut by hand, between the trench set out lines, and neatly stack on wooden pallets.

Concrete edging: Break out, remove and dispose of off-site.

Concrete subbase: If present, sawcut along the trench set-out lines.

15.3.3.3 Grass

Removal method: Neatly cut grass turf between trench set-out lines into 300 mm squares.

Grass suitable for re-use: Take up and store the turf and water during the storage period, otherwise remove and dispose of it off-site.

15.3.3.4 Small Plants, Shrubs and Trees

Small plants required for re-planting: Take up and store. Wrap the rootball in a hessian or plastic bag with drain holes and water during the storage period.

Unsuitable vegetation: Remove and dispose of off-site.

15.3.3.5 Stormwater Pipes

Gutter discharge: Maintain existing stormwater pipes discharging into the gutter.

15.3.4 Excavating

15.3.4.1 Site Preparation

As found site conditions: To **GEOTECHNICAL** in the *0222 Earthwork* work section.

Remove topsoil: To **REMOVAL OF TOPSOIL** in the *0222 Earthwork* work section.

15.3.4.2 Excavation

General: Excavate for underground services in conformance with the following:

- To required lines and levels, with uniform grades;
- Straight between access chambers, inspection points and junctions;
- With stable sides;
- Width tolerance: $\pm 50\text{mm}$, unless constrained by adjacent structures;
- Excavation: To **EXCAVATION** and **ADJACENT STRUCTURES** in the *0222 Earthwork* work section.

If other services existing in the vicinity of the works, obtain approval from the relevant authority for the excavation method prior to commencing works.

15.3.4.3 Trench Widths

General: Keep trench widths to the minimum, consistent with the laying and bedding of the relevant service and construction of access chambers and pits.

15.3.4.4 Trench Depths

General: As required by the relevant service and its bedding method. The minimum depth of services shall be as per Streets Opening Conference “Guide to codes and practices for street opening”

Adjacent to footings: If excavation is necessary below the zone of influence of the underside of adjacent footings, give notice, and provide support for the footings as instructed.

15.3.4.5 Obstructions

General: Clear trenches of sharp projections. Cut back roots encountered in trenches to at least 600 mm clear of services. Remove other obstructions including stumps and boulders which may interfere with services or bedding.

Tree protection: To AS4970.

15.3.4.6 Dewatering

General: Keep trenches free of water. Place bedding material, services and backfilling on firm ground, free of surface water.

Pumping: Provide pump-out from adjacent sumps or install well points.

15.3.4.7 Excess Excavation

General: If trench excavation exceeds the correct depth, reinstate to the correct depth and bearing value using compacted bedding material or sand stabilised with 1 part of cement to 20 parts of sand by volume.

15.3.4.8 Stockpiles

Excavated material for backfill: If required, segregate the earth and rock material and stockpile, for re-use in backfilling operations.

Locations: Do not stockpile excavated material against tree trunks, buildings, fences or obstruct the free flow of water along gutters where stockpiling is permitted along the line of the trench excavation.

Disposal: If stockpiling is not permitted, dispose of excavated material off-site.

15.3.4.9 Unsuitable Material

Disposal: Remove unsuitable material from the bottom of the trench or at foundation level and dispose of off-site. Replace with backfill material to **FILL MATERIALS** to the *0222 Earthwork* worksection.

15.3.4.10 Boring

Subcontractor: If under road boring is required instead of trenches, engage a suitably qualified subcontractor to do the work.

15.3.5 Existing roads

15.3.5.1 General

Where possible, traffic flow on existing roads is to be maintained during works. Traffic management measures are to be provided to manage flows. Clearance between the trench and traffic shall be in accordance with the requirement of RMS Specification M209.

15.3.5.2 Road Plates

Any trenches left open at the end of the work day must be covered with road plates. Size of plates shall be in accordance with the requirement of RMS Specification M209.

Prior to allowing traffic on road plates, ensure there is uniform bearing pressure on the plate and test using a test vehicle.

15.3.6 Existing trees

15.3.6.1 Protection during Works

Existing trees: Protect from all damage during works

Harmful materials: Conform to the following:

- Keep the area within the dripline free of sheds and paths, construction material and debris;
- Do not place bulk materials and harmful materials under or near trees;
- Do not place spoil from excavations against tree trunks;
- Prevent wind-blown materials such as cement from harming trees and plants.

Damage: Prevent damage to tree bark. Do not attach stays, guys and the like to trees.

Work under trees: Do not remove topsoil from, or add topsoil to, the area within the dripline of the trees.

Excavation: If excavation is required near trees to be retained, give notice. Minimise period of excavation under tree canopies.

Hand methods: Use hand methods to locate, expose and cleanly remove the roots on the line of excavation. If it is necessary to excavate within the drip line, use hand methods so that root systems are intact and undamaged.

Roots: Do not cut tree roots exceeding 50 mm diameter. Where it is necessary to cut tree roots, use cutting methods that do not excessively disturb the remaining root system. Immediately after cutting, water the tree and apply a liquid rooting hormone to stimulate the growth of new roots.

Backfilling: Backfill excavations around tree roots. Place the backfill in layers of 300mm maximum depth and compacted to a dry density similar to that of the original or surrounding soil. Do not backfill around tree trunks to a height greater than 200mm above the original ground surface. Immediately after backfilling, thoroughly water the root zone surrounding the tree.

Backfill material:

- Mix proportions (topsoil: well-rotted composts) by volume: 3:1;
- Neutral pH value;
- Free from weed growth and harmful materials.

Compacted ground: Do not compact the ground or use skid-steel vehicles under the tree dripline. If compaction occurs, give notice.

Compaction protection: Protect areas adjacent the tree dripline. Submit proposals for an elevated platform to suit the proposed earthworks machinery.

Watering: Water trees as necessary, including where roots are exposed at ambient temperature more than 35°C.

Mulching: Spread 100 mm thick organic mulch to the whole of the area covered by the drip line of all protected trees.

15.3.7 Trench Backfill

15.3.7.1 General

Timing: Backfill service trenches as soon as possible after laying and bedding the service, if possible on the same working day.

Marking services: Underground marking tape to AS/NZS2648.1.

Place fill: To **PLACING FILL** in the *0222 Earthwork* worksection.

15.3.7.2 Bedding, Haunch, Side and Overlay Zones

Installation and material: To the particular utility authority or utility service requirements. Secure pipes against floatation.

Overlay zone thickness: Maximum 300mm immediately over the utility service.

Topsoil areas: Complete the backfilling with at least 100 mm of topsoil.

Material in reactive clay areas: In sites classified M, M-D, H1, H1-D, H2, H2-D, E or E-D to AS2870, re-use excavated site material at a moisture content within $\pm 1\%$ of that of the adjoining in situ clay.

15.3.7.3 Selected Material Zone

Extent: The section of trench within the zone, if applicable.

Backfill material: Selected material free from stones larger than 100mm maximum dimension and the fraction passing a 19mm Australian Standard sieve to have a 4 day soaked CBR value, in conformance with AS1289.6.1.2, and not less than that of the adjacent selected material zone.

15.3.7.4 Trees

Backfill at trees: Backfill minimum 300mm thick, around tree roots with a topsoil mixture. Place and compact in layers of 150mm minimum depth to a dry density equal to that of the surrounding soil.

Do not place backfill: Above the original ground surface around tree trunks or over the root zone.

Watering: Thoroughly water immediately after backfilling the tree root zone.

15.3.7.5 Compaction

Control moisture within backfill: To **FILL MOISTURE CONTROL** in the *0222 Earthwork* worksection.

Layers: Compact all material in layers not exceeding 150 mm compacted thickness. Compact each layer to the required relative compaction before starting the next layer.

Compaction: To **COMPACTION REQUIREMENTS FOR FILL AND SUBGRADE** in the *0222 Earthwork* worksection and AS3798 Section 5.

Frequency of testing: To AS3798 Clause 8.7.

Precautions: If compacting adjacent to utility services, use compaction methods which do not cause damage or misalignment.

15.3.7.6 Density Tests

Testing authority: Carry out density tests of pipe bedding and backfilling by a registered testing authority.

Test methods: Conform to the following:

- Compaction control tests: To AS1289.5.4.1 or AS1289.5.7.1;
- Field dry density: AS1289.5.3.2 or AS1289.5.3.5;
- Standard maximum dry density: AS1289.5.1.1;
- Dry density ratio: AS1289.5.4.1;
- Density index: AS1289.5.6.1.

15.3.8 Restoration Preparation

15.3.8.1 Pavements and Pathways

Restore pavements and pathways in a continuous manner to the equivalent condition to that at the start of works.

15.3.8.2 Extent of Restoration:

Concrete paths: Pavement shall be replaced between existing joints. If there are no longitudinal joints, the full width of the path shall be replaced.

Concrete roads: Pavement replacement shall extend from the nearest longitudinal joint to a width of not less than 1m. If the existing panel is less than 2m wide, then the full panel is to be replaced. Refer Drawing SV007.

Asphalt paths: For paths less than 2m wide, the full width of the path is to be re-sheeted with asphalt. For wider paths, the asphalt is to be replaced between construction joints or a width of half the path. See Drawing SV005.

Asphalt roads: The asphalt is to be replaced between construction joints. Refer Drawing SV005.

Details: Refer to SOPA standard details for further information on restoration extents.

15.3.8.3 Structures

Set out the levels of any new pits or chambers, so that the area can be restored to existing levels, with no depressions or raised sections at the structure.

15.3.8.4 Temporary Restitution

Roadways: If the planned date for final restoration of a road that is in use exceeds 5 days, provide temporary restoration.

Pathways: If the planned date for final restoration exceeds 2 days, provide temporary restoration.

Methods:

- Bituminous cold mix: Provide a 20-40mm thick bitumen cold mix over a base of compacted base-course;
- Road plate: Provide a steel plate of suitable thickness for the loading over the backfilled trench.

Permanent restoration shall occur within one month of completion of trenching works.

15.3.9 Surface Restoration

15.3.9.1 Subbase and Base

Material: DGB20 material configured in layers and depths to match existing and adjacent work.

Supply and installation: To the *0271 Pavement base and subbase* worksection.

Compaction: Uniformly compact each layer of the subbase and base courses over the full area and depth within the trench to a relative compaction of 100% when tested in conformance with AS1289.5.4.1.

Compaction test frequency: Minimum 1/every second layer/50 m² of restoration surface area.

15.3.9.2 Pathways and Paved Areas Generally

Restoration materials: Consistent with the surface existing before commencement of the works.

Subbase: 150mm crushed stone DGB20 compacted to 100% relative compaction in conformance with AS1289.5.4.1.

Lippage at patches: Match the surface level at any point along the patch's edge with the adjoining footpath surface within ± 5 mm.

15.3.9.3 Concrete Surfaces

Construction: Conform to the following:

- Prime coat the cut edges of the existing surfaces with cement slurry. Lay and compact concrete so that the edges are flush and the centre is cambered 10mm above the adjoining existing surfaces;
- Material: 32MPa concrete.

Vary to suit particular site requirements:

- Surface finish and pattern: Match existing adjoining work;
- Minimum thickness: 110 mm or the adjacent pavement thickness, whichever is thicker;
- Reinforcement and dowels: Provide steel reinforcement with dowels into the adjacent concrete. Refer to SOPA standard details;
- Joint locations: Joints are to match the joints in adjacent pavements. Refer to *Concrete pavements* work section for details of joint types;
- Expansion joints: 15mm thick preformed jointing material of bituminous fibreboard placed where new concrete abuts existing concrete and in line with joints in existing concrete.

Control joints:

- Form control joints strictly in line with the control joints in existing concrete;
- Around electricity supply poles: Terminate the concrete paving 200 mm from the pole and fill the resulting space with cold mix asphalt.

Curing: Cure by keeping continuously wet for 7 days.

Traffic: Do not open the roadway to traffic until the concrete has reached a strength of 20MPa. For locations where the road needs to be opened early, use 40MPa concrete, with a strength of 20MPa at 24hours.

15.3.9.4 Asphalt Footpaths

Materials and installation: To the *0272 Asphaltic concrete* work section.

Thickness: Match the adjoining footpath.

Finish: Compact to a smooth even surface.

15.3.9.5 Segmental Paving Units

Materials and installation: To the *0276 Segmental pavers – sand bed* or *0275 Segmental pavers – mortar and adhesive bed* work section as appropriate and as follows:

- Laying: Re-lay to match the pattern and surface levels of the existing paving;
- Damaged paving units unsuitable for relaying: Replace paving units with new units of the same material, type, size and colour as the existing.

15.3.9.6 Landscaped Areas

In topsoil areas: Complete the backfilling with topsoil for at least the top 100mm.

Lawn: Re-lay stockpiled turf. If existing turf is no longer viable, provide new turf of the same species as the existing.

Planted areas: Overfill to allow for settlement.

16 Stormwater

16.1 General

16.1.1 Responsibilities

16.1.1.1 General

Requirement: Provide stormwater drainage.

16.1.2 Standards

16.1.2.1 Stormwater drainage

Standard: To AS/NZS3500.3.

16.1.3 Interpretation

16.1.3.1 Definitions

General: For the purposes of this work section the following definition applies:

Pipe surround: Includes pipe overlay, pipe side support, side zone and haunch zone.

16.1.4 Submissions

16.1.4.1 Products

Documentation: Produce documentary evidence that the pipes conform to the requirements of this work section.

16.1.4.2 Tests

Results: Submit results from pre-completion leak testing.

Certification: Submit certificate stating that network is leak free upon completion.

16.1.5 Inspection

16.1.5.1 Notice

Inspection: Give notice so that inspection may be made at the following stages:

- Excavated surfaces prior to placing bedding material;
- Concealed or underground services prior to being covered;
- Pipe joints before covering;
- Placing of cast in situ concrete;
- Upon completion.

16.2 Products

16.2.1 Materials

16.2.1.1 Concrete and Mortar

Concrete: To AS3500.3 Clause 2.9 and the following:

Grade: N32.

Cement: To AS 3972.

Type: GP, GL or GB.

Steel reinforcement:

Bars and machine welded mesh: To AS/NZS4671.

16.2.1.2 Joints

Solvent cement and priming fluid: To AS/NZS3879.

16.2.1.3 Type of Pipes and Fittings

Fibre reinforced cement (FRC): To AS4139 and the following:

- ≤450mm diameter: Rubber ring joints to AS4139;
- >450mm diameter: With a purpose machined internal spigot and socket system within the pipe wall.

Glass-reinforced polyester (GRP): To AS3571.1.

Cast iron access chamber covers and frames: To AS1830 or AS1831, as appropriate.

Polyvinyl chloride (PVC): To AS/NZS1254, AS/NZS1260 or AS1273, as appropriate.

Polyethylene (PE): To AS/NZS4129, AS/NZS4130, ISO8770 or AS/NZS2033, as appropriate.

Precast concrete: To AS/NZS4058.

Rubber ring joints/elastomeric seals: To AS1646.

Plastic pipe for subsoil drainage: To AS2439.1.

Vitrified clay or ceramic: To AS1741.

16.2.1.4 Bedding Material

Bed and haunch zones: Provide granular material graded to AS1141 series.

16.2.1.5 Bedding Material Grading Table

Sieve Size (mm)	Weight Passing %	
	Bed and Haunch	Bed and Haunch
75.0	-	100
19.0	100	-
9.5	-	50-100
2.36	50-100	30-100
0.60	20-90	15-50
0.30	10-60	-
0.15	0-25	-
0.075	0-10	0-25

16.2.1.6 Filter Material

General: Provide filter materials consisting of natural clean washed sands and gravels and screened crushed rock conforming to AS/NZS 3500.3 Clause 2.13.1.

16.2.2 Geotextiles

16.2.2.1 General

Requirement: Provide polymeric fabric formed from plastic yarn composed of at least 85% by weight propylene, ethylene amide or vinylidene chloride and containing stabilisers or inhibitors which provide resistance to deterioration due to ultraviolet light.

16.2.2.2 Subsoil Drainage

Filter: Conform to AS/NZS3500.3 Clause 2.13.2.

16.2.3 Prefabricated Pits

16.2.3.1 General

Requirement: Provide precast or prefabricated pits in conformance with AS/NZS3500.3 Clauses 2.12.8 and 7.5. Pit must be suitable for the loading of the pavement/ground above.

16.2.3.2 Metal Access Covers and Grates

Standard: To AS3996.

16.2.4 Gross Pollutant Traps (GPT)

16.2.4.1 General

Requirement: GPTs shall be of the same type / manufacturer as those within the same precinct. Approval must be obtained from SOPA Manager Building and Infrastructure for alternative devices.

16.3 Execution

16.3.1 Piping

16.3.1.1 General

Laying: Lay lengths separately with the barrel bearing evenly on the prepared bedding.

Sockets: Lay with sockets pointing upstream.

Cleaning: Clean pipe interior of dirt, debris, mortar and other foreign matter.

Protection: Provide temporary caps over the ends of incomplete sections to prevent the entry of foreign matter.

16.3.2 Tolerances

16.3.2.1 Pipeline Tolerances Table

	Permissible angular deviation from the documented alignment	Permissible displacement from the documented positions
Horizontal	1:300	15mm
Vertical	1:500	5mm

NOTE: These tolerances are conditional on falls to outlets being maintained and no part of a pipeline having less than the documented gradient.

16.3.3 Stormwater Drains

16.3.3.1 Location

General: Provide stormwater drains to connect surface drains, subsoil drains and drainage pits to the outlet point or point of connection. Make sure that location of piping will not interfere with other services and building elements not yet installed or built. Subject to the preceding and documented layouts, follow the most direct route with the least number of changes in direction.

16.3.3.2 Laying

General: Lay in straight lines between changes in direction or grade with socket end placed upstream. If other pipes are adjacent, set each pipe true to line and complete each joint before laying the next pipe. If work is not continuous cap open ends to prevent entry of foreign matter.

16.3.3.3 Identification

General: Lay a detectable strip or plastic tape in the trench after pipe laying, testing and initial backfilling.

16.3.3.4 Pipe Underlay (bedding)

General: Bed piping on a continuous underlay of bedding material, minimum 75mm, maximum 150mm thick after compaction. Grade the underlay evenly to the gradient of the pipeline.

Chases: If necessary, form chases to prevent projections such as sockets and flanges from bearing on the trench bottom or underlay.

16.3.3.5 Pipe Surrounds

General: Place the material in the pipe surround in layers maximum 200mm loose thickness, and compact without damaging or displacing the piping.

16.3.3.6 Trench Backfill

General: Backfill the remainder of the trench to the underside of the subgrade with fill material in conformance with the *0222 Earthwork* work section.

16.3.3.7 Lifting Holes

General: Seal lifting holes in all pipes with plastic preformed plugs or 3:1 (sand:cement) mortar, before the commencement of backfilling.

16.3.3.8 Anchor Blocks

General: If necessary, to restrain lateral and axial movement of the stormwater pipes, provide anchor blocks at junctions and changes of grade or direction conforming to AS/NZS3500.3 Clause 7.9.

16.3.3.9 Encasement

General: Provide encasement if required to protect pipes.

Location: Encase the pipeline in concrete at least 150 mm above and below the pipe, and 150mm each side or the width of the trench, whichever is the greater.

16.3.3.10 GPTs

General: Install in accordance with the manufacturer's recommendations and requirements.

16.3.4 Subsoil Drains

16.3.4.1 General

Requirement: Provide subsoil drains to intercept groundwater seepage and prevent water build-up behind walls and under pavements. Connect subsoil drains to surface drains or to the stormwater drainage system as applicable.

Piping: As documented in the **Subsoil pipeline schedule**.

Trench width: $\geq 450\text{mm}$.

Trench floor: Grade the trench floor evenly to the gradient of the pipeline. If the trench floor is rock, correct any irregularities with compacted bedding material.

Pipe depth: Provide the following minimum clear depths, measured to the crown of the pipe, where the pipe passes below the following elements:

- 100mm below subgrade level of the pavement, kerb or channel;
- 100mm below the average gradient of the bottom of footings;
- 450mm below the finished surface of unpaved ground.

16.3.4.2 Jointing

General: At junctions of subsoil pipes, provide tees, couplings or adaptors to AS2439.1.

16.3.4.3 Pipe Underlay (Bedding)

General: Bed piping on a continuous underlay of bedding material, minimum 75mm, maximum 150mm thick after compaction. Grade the underlay evenly to the gradient of the pipeline.

Chases: If necessary, form chases to prevent projections such as sockets and flanges from bearing on the trench bottom or underlay.

16.3.4.4 Pipe Surrounds

General: Place the material in the pipe surround in layers maximum 200 mm loose thickness, and compact without damaging or displacing the piping.

Depth of overlay:

- To the underside of the bases of overlying structures such as pavements and channels;
- To within 150mm of the finished surface of unpaved or landscaped areas.

16.3.4.5 Geotextiles

Marking: To AS3705.

Laying: Place geotextile as documented.

Protection: Provide heavy duty protective covering. Store clear of the ground and out of direct sunlight. During installation do not expose the filter fabric to sunlight for more than 14 days.

16.3.4.6 Filter Socks

General: Provide polyester permeable socks capable of retaining particles 0.25 mm and greater. Securely fit or join the sock at each joint.

16.3.5 Pits

16.3.5.1 Installation

General: Prepare foundation, install pit and connect pipes, to manufacturer's recommendations.

Location: At junctions, changes of gradient and changes of direction of stormwater drains, as documented.

16.3.5.2 Finish to In-situ Exposed Surfaces

General: Provide a smooth, seamless finish, using steel trowelled render or concrete cast in steel forms.

Corners: Cove or splay internal corners.

16.3.5.3 Metal Access Covers and Grates

Cover levels: Top of cover or grate, including frame:

- In paved areas: Flush with the paving surface;
- In landscaped areas: 10mm above finished surface;
- Gratings taking surface water runoff: Locate to receive runoff without ponding.

16.3.6 Testing

16.3.6.1 Pre-completion tests

Site stormwater drains and main internal drains: Air or water pressure test to AS/NZS3500.3 Section 9.

Leaks: If leaks are found, rectify and re-test.

16.3.7 Completion

16.3.7.1 Cleaning

General: Clean and flush the whole installation.

16.4 Selections

16.4.1 Stormwater

16.4.1.1 Stormwater Pipeline Schedule

Properties	100 and 150 dia	225 dia and larger
Pipe material	Sewer grade UPVC or Class 2 FRC	Class 2 RCP or Class 2 FRC
Jointing	RRJ	RRJ
Pipe support	To AS/NZS 3500.3	To AS/NZS 3500.3

16.4.1.2 Pipe Bedding Schedule: To AS/NZS3500.3

16.4.1.3 Subsoil Pipeline Schedule

Properties	All	B	C
Trench depth (mm)	600		
Pipe size (nominal)	100		

17 Pavement Base and Subbase

17.1 General

17.1.1 Responsibilities

17.1.1.1 General

Requirement: Provide base and subbase courses as documented.

17.1.2 Interpretation

17.1.2.1 Abbreviations

General: For the purposes of this worksection the following abbreviations apply:

- CBR: California bearing ratio;
- CRB: Crushed rock base;
- CRS: Crushed rock subbase;
- NGB: Natural gravel base;
- NGS: Natural gravel subbase;
- RCCB: Recycled crushed concrete base;
- RCCS: Recycled crushed concrete subbase.

17.1.2.2 Definitions

General: For the purposes of this worksection the definitions given in AS 1348 and the following apply:

- Absolute level tolerance: Maximum deviation from design levels;
- Base: Layer(s) of material forming the uppermost structural element of a pavement and on which the surfacing may be placed;
- Flexible pavement: A pavement which obtains its load-spreading properties from intergranular pressure, mechanical interlock and cohesion between the particles of the pavement material;
- Relative level tolerance: Maximum deviation from a 3 m straightedge laid on the surface;
- Subbase: Material laid on the subgrade (or selected material), below the base, either for the purpose of making up additional pavement thickness, to prevent intrusion of the subgrade into the base, or to provide a working platform.

17.1.3 Submissions

17.1.3.1 Execution Details

General: Submit details of the proposed work methods and equipment for each pathway and roadworks operation, including the following:

- Staging of the work, access and traffic control methods;

- Disposal of surface water, control of erosion, contamination and sedimentation of the site, surrounding areas and drainage systems;
- Sources of materials.

Compaction: If a layer is proposed to exceed 200mm in thickness, submit evidence that the proposed compaction equipment can achieve the required density throughout the layer.

17.1.3.2 Materials

Source of material: Submit the supplier name, material type (crushed rock, natural gravel, recycled concrete aggregate) and source quarry or recycling site.

Compliance of material: Provide certification and test results from a NATA registered laboratory confirming that the material conforms to the documented requirements.

17.1.3.3 Tests

Type tests: Submit results for each material as listed in RMS Specification QA3051.

17.2 Products

17.2.1 Base and Subbase Material

17.2.1.1 Granular Material

Requirement: Provide unbound granular materials, including blends of two or more different materials, which when compacted develop structural stability and are uniform in grading and physical characteristics.

17.2.1.2 Base Material

Requirement: Provide DGB20 in accordance with RMS Specification QA3051.

17.2.1.3 Sub-base Material

Requirement: Provide DGS40 in accordance with RMS Specification QA3051.

17.2.1.4 Tests

Material property testing: Undertake testing in accordance with the requirements of RMS Specification QA3051.

17.3 Execution

17.3.1 Subgrade Preparation

17.3.1.1 General

Requirement: Prepare the subgrade in conformance with the *0222 Earthwork* worksection.

17.3.2 Placing Base and Subbase

17.3.2.1 General

Weak surfaces: Do not place material on a surface that is weakened by moisture and is unable to support, without damage, the construction plant required to perform the works.

Spreading: Spread material in uniform layers without segregation.

Moisture content: Maintain wet mixed materials at the required moisture content before and during spreading. Add water to dry mixed materials through fine sprays to the entire surface of the layer after spreading, to bring the material to the required moisture content.

Compacted layer thickness: 200mm maximum and 100mm minimum. Provide layers of equal thickness in multilayer courses.

17.3.2.2 Joints

General: Plan spreading and delivery to minimise the number of joints. Offset joints in successive layers by a minimum of 300mm.

Start of shift: Remix last 2 m of previous days' work for continuity of compaction.

17.3.2.3 Final Trimming

General: Trim and grade the base course to produce a tight even surface with no loose stones or slurry of fines.

17.3.3 Tolerances

17.3.3.1 Surface Level

General: Provide a finished surface which is free draining and evenly graded between level points.

Base abutting gutters: ± 5 mm from the level of the lip of the gutter, minus the design thickness of the wearing course.

17.3.3.2 Surface Level Tolerances Table

Item Description	Level Tolerance	
	Absolute	Relative
Subbase surface	+10mm, - 25 mm	10 mm
Base surface	+ 10mm, - 5 mm	5mm

NOTES: The tolerances apply to the finished level of each layer, unless overridden by the requirements (including tolerances) for the finished level and thickness of the wearing course.

17.3.4 Base and Subbase Compaction

17.3.4.1 General

Construction operation: Compact each layer of fill to the required depth and density, as a systematic construction operation.

Unstable areas: If unstable areas develop during rolling or are identified by proof rolling, open up, dry back and recompact, to the requirements of this worksection. If dry back is not possible, remove for the full depth of layer, dispose of and replace with fresh material.

17.3.4.2 Minimum relative Compaction Table

Item Description	Minimum Dry Density Ratio (Modified Compaction) To AS 1289.5.2.1
Subbase	95%
Base	98%

17.3.4.3 Compaction Requirements

General: Apply uniform compactive effort, over the whole area to be compacted, until the required density is achieved or until failure is acknowledged. If failure is acknowledged, conform to **Rectification**.

Equipment: Use rollers appropriate to the materials and compaction requirements documented.

17.3.4.4 Moisture Content

General: During spreading and compaction, maintain material moisture content within the range of -2% to +1% from the optimum moisture content (modified compaction).

Spraying: Use water spraying equipment to distribute water uniformly in controlled quantities over uniform lane widths.

Dry back: Allow material to dry back to 60% to 80% of the optimum moisture content before applying the seal or wearing course.

17.3.4.5 Rectification

General: If a section of pavement material fails to meet the required density or moisture content after compaction, remove the non-conforming material, dispose of off-site or rectify for re-use, replace with fresh material, and recompact.

17.3.4.6 Level corrections

General: Rectify incorrect levels as follows:

High areas: Grade off.

Low areas: Remove layers to a minimum depth of 75 mm, lightly tyne and replace with new material and recompact.

17.3.5 Testing

17.3.5.1 Compaction Control Tests

Standard: To AS1289.5.4.1 and AS1289.5.4.2.

17.3.5.2 Frequency of Compaction Control Tests

General: Not less than the following (whichever requires the most tests):

- 1 test per layer per 100 lineal metres for two-lane roads;
- 1 test per layer per 1000m² for carparks;
- 3 tests per layer;
- 3 tests per visit.

18 Pavement Base and Subbase

18.1 General

18.1.1 Responsibilities

18.1.1.1 General

Requirement: Provide base and subbase courses as documented.

18.1.2 Interpretation

18.1.2.1 Abbreviations

General: For the purposes of this worksection the following abbreviations apply:

- CBR: California bearing ratio;
- CRB: Crushed rock base;
- CRS: Crushed rock subbase;
- NGB: Natural gravel base;
- NGS: Natural gravel subbase;
- RCCB: Recycled crushed concrete base;
- RCCS: Recycled crushed concrete subbase.

18.1.2.2 Definitions

General: For the purposes of this worksection the definitions given in AS 1348 and the following apply:

- Absolute level tolerance: Maximum deviation from design levels;
- Base: Layer(s) of material forming the uppermost structural element of a pavement and on which the surfacing may be placed;
- Flexible pavement: A pavement which obtains its load-spreading properties from intergranular pressure, mechanical interlock and cohesion between the particles of the pavement material;
- Relative level tolerance: Maximum deviation from a 3 m straightedge laid on the surface;
- Subbase: Material laid on the subgrade (or selected material), below the base, either for the purpose of making up additional pavement thickness, to prevent intrusion of the subgrade into the base, or to provide a working platform.

18.1.3 Submissions

18.1.3.1 Execution Details

General: Submit details of the proposed work methods and equipment for each pathway and roadworks operation, including the following:

- Staging of the work, access and traffic control methods;

- Disposal of surface water, control of erosion, contamination and sedimentation of the site, surrounding areas and drainage systems;
- Sources of materials.

Compaction: If a layer is proposed to exceed 200 mm in thickness, submit evidence that the proposed compaction equipment can achieve the required density throughout the layer.

18.1.3.2 Materials

Source of material: Submit the supplier name, material type (crushed rock, natural gravel, recycled concrete aggregate) and source quarry or recycling site.

Compliance of material: Provide certification and test results from a NATA registered laboratory confirming that the material conforms to the documented requirements.

18.1.3.3 Tests

Type tests: Submit results for each material as listed in RMS Specification QA3051

18.2 Products

18.2.1 Base and Subbase Material

18.2.1.1 Granular Material

Requirement: Provide unbound granular materials, including blends of two or more different materials, which when compacted develop structural stability and are uniform in grading and physical characteristics.

18.2.1.2 Base Material

Requirement: Provide DGB20 in accordance with RMS Specification QA3051.

18.2.1.3 Sub-base Material

Requirement: Provide DGS40 in accordance with RMS Specification QA3051.

18.2.1.4 Tests

Material property testing: Undertake testing in accordance with the requirements of RMS Specification QA3051.

18.3 Execution

18.3.1 Subgrade Preparation

18.3.1.1 General

Requirement: Prepare the subgrade in conformance with the *0222 Earthwork* worksection.

18.3.2 Placing Base and Subbase

18.3.2.1 General

Weak surfaces: Do not place material on a surface that is weakened by moisture and is unable to support, without damage, the construction plant required to perform the works.

Spreading: Spread material in uniform layers without segregation.

Moisture content: Maintain wet mixed materials at the required moisture content before and during spreading. Add water to dry mixed materials through fine sprays to the entire surface of the layer after spreading, to bring the material to the required moisture content.

Compacted layer thickness: 200mm maximum and 100mm minimum. Provide layers of equal thickness in multilayer courses.

18.3.2.2 Joints

General: Plan spreading and delivery to minimise the number of joints. Offset joints in successive layers by a minimum of 300mm.

Start of shift: Remix last 2m of previous days' work for continuity of compaction.

18.3.2.3 Final Trimming

General: Trim and grade the base course to produce a tight even surface with no loose stones or slurry of fines.

18.3.3 Tolerances

18.3.3.1 Surface Level

General: Provide a finished surface which is free draining and evenly graded between level points.

Base abutting gutters: ± 5 mm from the level of the lip of the gutter, minus the design thickness of the wearing course.

18.3.3.2 Surface Level Tolerances Table

Item Description	Level Tolerance	
	Absolute	Relative
Subbase surface	+10mm, - 25mm	10mm
Base surface	+ 10mm, - 5mm	5mm

NOTES: The tolerances apply to the finished level of each layer, unless overridden by the requirements (including tolerances) for the finished level and thickness of the wearing course.

18.3.4 Base and Subbase Compaction

18.3.4.1 General

Construction operation: Compact each layer of fill to the required depth and density, as a systematic construction operation.

Unstable areas: If unstable areas develop during rolling or are identified by proof rolling, open up, dry back and recompact, to the requirements of this work section. If dry back is not possible, remove for the full depth of layer, dispose of and replace with fresh material.

18.3.4.2 Minimum Relative Compaction Table

Item description	Minimum dry density ratio (modified compaction) to AS1289.5.2.1
Subbase	95%
Base	98%

18.3.4.3 Compaction Requirements

General: Apply uniform compactive effort, over the whole area to be compacted, until the required density is achieved or until failure is acknowledged. If failure is acknowledged, conform to **Rectification**.

Equipment: Use rollers appropriate to the materials and compaction requirements documented.

18.3.4.4 Moisture Content

General: During spreading and compaction, maintain material moisture content within the range of -2% to +1% from the optimum moisture content (modified compaction).

Spraying: Use water spraying equipment to distribute water uniformly in controlled quantities over uniform lane widths.

Dry back: Allow material to dry back to 60% to 80% of the optimum moisture content before applying the seal or wearing course.

18.3.4.5 Rectification

General: If a section of pavement material fails to meet the required density or moisture content after compaction, remove the non-conforming material, dispose of off-site or rectify for re-use, replace with fresh material, and recompact.

18.3.4.6 Level Corrections

General: Rectify incorrect levels as follows:

High areas: Grade off;

Low areas: Remove layers to a minimum depth of 75mm, lightly type and replace with new material and recompact.

18.3.5 Testing

18.3.5.1 Compaction Control Tests

Standard: To AS1289.5.4.1 and AS1289.5.4.2.

18.3.5.2 Frequency of Compaction Control Tests

General: Not less than the following (whichever requires the most tests):

1 test per layer per 100 lineal metres for two-lane roads;

1 test per layer per 1000m² for carparks;

3 tests per layer;

3 tests per visit.

19 Concrete Pavement

19.1 General

19.1.1 Responsibilities

19.1.1.1 General

Requirement: Provide concrete pavement as documented.

19.1.1.2 Design

Coordination: Determine the local authority requirements initially as they may affect grades, transition, zones for the works. Considerations include:

- Drainage;
- Tree's (due to settlement);
- Adjacent structures.

19.1.1.3 Performance

Requirement: Provide finished surfaces conforming to the following:

- Free draining and evenly graded between level points;
- Even and smooth riding.

Conformance: Conform to the local authority requirements for levels, grades and the minimum details of thickness, reinforcement and concrete strength for pavements within the kerb-and-gutter property boundaries.

19.1.2 Standards

19.1.2.1 Concrete

Specification and supply: To AS1379.

Materials and construction: To AS3600.

19.1.3 Interpretation

19.1.3.1 Definitions

General: For the purposes of this worksection the definitions given in AS1348 and the following apply.

- Absolute level tolerance: Maximum deviation from design levels;
- Ambient temperature: The air temperature at the time of mixing and placing of concrete;

Average ambient temperature: Average value of the maximum and minimum ambient temperatures over the relevant period at a site;

Concrete class:

- Normal: Concrete which is specified primarily by a standard compressive strength grade and otherwise in conformance with AS 1379 Clause 1.5.3;
- Special: Concrete which is specified to have certain properties or characteristics different from, or additional to, those of normal-class concrete and otherwise in conformance with AS 1379 Clause 1.5.4.

Green concrete: Concrete which has set but not appreciably hardened;

Relative level tolerance: Maximum deviation from a 3 m straightedge laid on the surface;

Weather:

- Cold: Ambient shade temperature less than 10C;
- Hot: Ambient shade temperature greater than 32C.

19.1.4 Tolerances

19.1.4.1 General

Edges abutting gutters: Within ± 5 mm of the level of the actual gutter edge.

Rigid pavement surface:

Absolute tolerance: +10mm, - 0mm;

Relative tolerance: ± 5 mm.

Joint locations in plan (rigid pavement): ± 15 mm.

19.1.5 Submissions

19.1.5.1 Testing

Compliance certificate: As an alternative to testing a product, submit the manufacturer's certificate together with the results of recent tests undertaken by the manufacturer, showing compliance with test criteria.

Test certificates and records: Submit test certificates, and also retain results on site.

19.2 Products

19.2.1 Reinforcement

19.2.1.1 Steel Reinforcement

Standard: To AS/NZS4671.

Strength grade and ductility class: Grade 500, Ductility Class N for bars and Class L for mesh.

Identification: Supply reinforcement with readily identifiable grade and origin.

Surface condition: Free of loose mill scale, rust, oil, grease, mud or other material which may reduce the bond between the reinforcement and concrete.

19.2.1.2 Steel Fibres

Fibre reinforcement: To CIA CPN35.

Steel fibre content: 75kg/m³.

19.2.1.3 Accessories

Bar chairs: Use plastic tipped wire bar chairs to AS/NZS2425.

Tie wire: Galvanized annealed steel 1.25mm diameter minimum.

19.2.1.4 Dowels

General: Provide each dowel in one piece, straight, cut accurately to length with ends square and free from burrs.

Standard: To AS/NZS4671.

Grade: 250R steel bars 450mm long.

Diameter: 32mm

19.2.1.5 Tie bars

Type: Deformed bar, 12mm diameter, grade 500N, 1m long.

19.2.2 Aggregate

19.2.2.1 Characteristics

Standards: AS2758.1.

Gravel: Nepean River Gravel, 10-20mm dia.

Quality: Provide at least 40% by mass of the total aggregates in the concrete mix of quartz sand aggregate having a nominal size of less than 5mm and containing at least 70% quartz by mass.

Durability: All constituent, fraction of constituent or aggregates to conform to AS 1141.22 and the following:

Wet strength not less than 80kN;

10% Fines Wet/Dry Variation not to exceed 35%.

Recycled concrete aggregate (RCA): Use coarse aggregates from demolition concrete or RCA.

Blending: If blending coarse RCA with natural aggregates, make sure substitution rates are below 30%.

19.2.3 Cement

19.2.3.1 General

Standard: To AS3972.

Type: GP

Transport: Cement in watertight packaging and protect from moisture until used. Do not use caked or lumpy cement.

Age: Less than 6 months old.

Storage: Store cement bags under cover and above ground.

19.2.4 Fly Ash

19.2.4.1 General

Standard: Fine grade fly ash to AS3582.1.

Fly ash quantity: Nil to 70kg/m³.

Minimum binder content (fly ash plus cement): 300 to 330kg/m³.

19.2.5 Water

19.2.5.1 General

Standard: Chloride ion to AS3583.13 and sulphate ion to AS1289.4.2.1.

Quality: Water used in the production of concrete to be potable, free from materials harmful to concrete or reinforcement, and be neither salty nor brackish.

Limits: Not containing more than:

600 parts per million of chloride ion, determined to AS3583.13

400 parts per million of sulphate ion, determined to AS1289.4.2.1.

19.2.6 Admixtures

19.2.6.1 General

Standard: Chemical admixtures to AS1478.1.

Quality: Provide admixtures free from calcium chloride, calcium formate, or triethanolamine or any other accelerator. Do not use admixtures or combinations of admixtures without prior written approval.

Dosage: Vary the dosage of chemical admixture to account for air temperature and setting time in conformance with the manufacturer's recommendations.

19.2.6.2 Types of Admixtures

Air entraining agent: Adjust mix for workability allowing up to 5% air entrainment.

Warm season retarder: During the warm season, (October to March inclusive), use a lignin or lignin-based (ligpol) set-retarding admixture (Type Re or Type WRRe) as approved to control slump within the limits stated in Concrete mix, properties.

Cool season retarder: During the cool season, (April to September inclusive), use only a lignin or lignin based set-retarding admixture containing not more than 6% reducing sugars (Type WRRe complying with AS 1478.1).

19.2.7 Curing Compounds

19.2.7.1 General

Curing compounds: To AS3799 and AS1160, Type 2, white pigmented or containing aluminium reflective pigments.

Sheet material covering: To ASTM C171, white opaque or clear polyethylene film, or white burlap-polyethylene sheet, or equivalent material.

19.2.8 Other Materials

19.2.8.1 Tactile Ground Surface Indicators

Standard: To AS/NZS1428.4.1.

19.3 Execution

19.3.1 General

19.3.1.1 Traffic Control

Traffic restriction: Do not allow traffic or construction equipment other than those associated with testing, sawcutting, cleaning or joint sealing on pavement for minimum 10 days after placing, or when the concrete has reached compressive strength of at least 20 Mpa, and joints have been completely sealed.

19.3.2 Subgrade

19.3.2.1 Preparation

Conformance: Prepare subgrade in conformance with the *0222 Earthwork* work section.

Extent: Prepare a uniform subgrade for the full pavement formation, extending at least to the back of kerbs.

Reinstatement: Make sure of uniformity for backfilling of any utility trenches.

19.3.3 Subbase

19.3.3.1 Width

Subbase width: Extend the subbase at its full depth to at least the back of kerbs or other edge stops before their installation.

No integral kerbs: Extend granular unbound subbase at least 300 mm beyond each side of the carriageway.

Unbound subbase materials and installation: Conform to the *0271 Pavement base and subbase* work section.

Bound subbase materials and installation: Conform to the *0271 Pavement base and subbase* work section.

19.3.3.2 Tolerance and Friction Reduction

Tolerance: Subbase finished surface level, +0mm to –10mm.

Friction reduction: Provide 200µm thick polyethylene sheeting with 200mm taped minimum laps and/or a 20mm thick layer of sand (silt and clay material less than 5%) directly beneath the concrete pavement.

19.3.4 Concrete Mix

19.3.4.1 Standard

Concrete mix and supply: To AS3600 Section 17 and AS1379.

Mix to incorporate 10-20mm Nepean River Gravel.

19.3.4.2 Properties

Concrete pavement thickness: 110mm minimum for footpaths, as per designer requirements for road pavements.

Concrete pavement strength: N32 min

Workability: Slump values to conform to the following:

- Fixed form paving with manual operated vibration: 50 to 60mm;
- Drying shrinkage: Maximum 450µε after 21 days of air drying.

19.3.4.3 Elapsed Time Delivery

General: Make sure that the elapsed time between the wetting of the mix and the discharge of the mix at the site is in conformance with the **Elapsed delivery time table**. Do not discharge at ambient temperature below 10°C or above 32°C.

19.3.4.4 Elapsed delivery time table

Concrete Temperature At Time Of Discharge (°C)	Maximum Elapsed Time (Hours)
10 – 24	2.00
24 – 27	1.50
27 – 30	1.00
30 – 32	0.75
10 – 24	2.00

19.3.4.5 Site Mixed Supply

Emergencies: If mixing by hand is carried out, provide details.

Plant: Mix concrete in a plant located on the construction site.

19.3.4.6 Pre-mixed Supply

Addition of water: Do not add water.

Transport: Make sure the mode of transport prevents segregation, loss of material and contamination of the environment, and does not adversely affect placing or compaction.

Concrete delivery docket: For each batch, submit a docket listing the information required by AS1379 Clause 1.7.3, and the following information:

- Any binders or additives;
- Method of placement and climate conditions during pour;
- Name of concrete delivery supervisor;
- The concrete element or part of the works for which the concrete was ordered, and where it was placed.

19.3.5 Testing

19.3.5.1 Standards

Sampling, identification, testing and recording: To the AS 1012 series.

Specimens: Sample the concrete on site, at the point of discharge from the agitator.

Type and frequency: To AS1379.

Testing authority: Concrete supplier or NATA registered laboratory.

19.3.5.2 Concrete Testing Methods

Slump: Test at least one sample from each batch before placing concrete from that batch in the work.

Standard: To AS1012.3.1.

Maximum slump variation: ± 10 mm.

Compressive strength: Test to AS1012.8.1.

Drying shrinkage: Test to AS1012.8.4 and AS1012.13.

Flexural strength: To AS1012.8.2 and AS1012.11.

Acceptance criterion: The average strength of any set of 3 consecutive project samples must be equal to or greater than the specified minimum value.

19.3.5.3 Project Assessment Sampling Frequency Table

Number of batches for each type and grade of concrete per day	Minimum number of samples
1	1
2-5	2
6-10	3
11-20	4
each additional 10	1 additional

19.3.6 Installation

19.3.6.1 Junctions with Existing Pavements

Trimming: Where the pavement is to be joined to an existing pavement, remove a strip of the existing pavement at least 300 mm wide for its full depth and trim the edge vertically before placing new pavement material.

Existing sealed pavement: Trim the seal to a neat edge.

19.3.6.2 Fixed Formwork

Description:

Steel forms;

Seasoned, dressed timber planks, free of warps, bends or kinks, with the full width of their top edges covered with steel angle sections finishing flush with the form face.

Depth: Equal to the edge thickness of the slab and in one piece.

Tolerances on position:

Absolute level tolerance: $\pm 5\text{mm}$;

Relative level tolerance: $\pm 5\text{mm}$;

Horizontal tolerance: $\pm 10\text{mm}$ (maximum departure of face from a plane surface);

Verticality: 3mm departure from vertical.

Staking: Stake forms in position using at least 3 steel stakes per form, not more than 1.5m apart. Lock joints between form sections to prevent movement.

Release agent: Before placing reinforcement, apply a release agent compatible with the contact surfaces, to the interior of the formwork, except where the concrete is to receive an applied finish for which there is no compatible release agent. Clean the reinforcement to remove all traces of release agent.

Re-use: Clean and recoat the forms each time before placing concrete.

Keyways: Form the keyways of keyed construction joints using steel form strips accurately located at the mid-depth of the slab and securely fastened flush against the formwork face.

19.3.6.3 Reinforcement

Tolerances in fabrication and fixing: To AS3600.

Locate reinforcement: Place reinforcement in the top half of the pavement.

Minimum cover to reinforcement: 30mm.

Splicing mesh: Overlap a minimum of 2 crosswires.

Supports: Provide proprietary concrete, metal or plastic supports to AS/NZS 2425 and as follows:

To withstand construction and traffic loads and maintain the concrete cover, as documented;

With a protective coating if they are ferrous metal extending to the surface of the concrete, or are used with galvanized or zinc-coated reinforcement;

Minimum spacing:

- Bars: ≤ 60 diameters;
- Fabric: ≤ 800 mm.

Supports over membranes: Prevent damage to waterproofing membranes or vapour barriers. If appropriate, place a metal or plastic plate under each support;

Projecting reinforcement: If starter or other bars project beyond reinforcement mats or cages, through formwork or from cast concrete, provide a plastic protective cap to each bar until it is incorporated into subsequent work;

Tying: Secure the reinforcement against displacement by tying at intersections with either wire ties, or clips. Bend the ends of wire ties away from nearby faces of forms so that the ties do not project into the concrete cover;

Mats: For bar reinforcement in the form of a mat, secure each bar at alternate intersections.

19.3.6.4 Cores, Fixings and Embedded Items

Position: Fix cores and embedded items to prevent movement during concrete placing. In locating cores, fixings and embedded items, reposition but do not cut reinforcement, and maintain cover to reinforcement.

Isolation: Isolate embedded items so that water cannot track to concrete providing minimum cover to reinforcement.

19.3.7 Concrete placing and compaction

19.3.7.1 Concrete Placing

General: Place concrete uniformly over the width of the slab or lane and so that the face is generally vertical and normal to the direction of placing. Hand spread concrete using shovels, not rakes.

Remove: Any water ponding on the ground.

Placing sequence: Commence from one corner (usually the lowest point) and proceed continuously out from that point.

Weather: Do not place concrete in temperatures above 30C or below 10C without adequate precautions.

19.3.7.2 Compaction

Thickness 100mm or less: Compact by placing screening and finishing processes. If required use a hand-held vibrating screed at the surface. Do not use immersion vibrators.

Thickness more than 100mm and downturns: Use an immersion vibrator.

19.3.7.3 Placing Records

General: Keep on site and make available for inspection a log book recording each placement of concrete, including the following:

- Date of concrete placement;
- Delivery dockets noting the specified grade and source of concrete;
- Slump measurements to AS1012.3.1;
- The portion of work;
- Volume placed.

19.3.7.4 Rain

General: During placement and before setting, do not expose concrete to rain.

Protection: Protect surface from damage by covering until hardened.

19.3.7.5 Concrete placing in cold weather

Cement: Do not use high alumina cement.

Placing concrete: Maintain the temperature of the freshly mixed concrete at 5°C.

Formwork and reinforcement: Before and during placing maintain temperature at 5°C.

Severe weather: If severe weather conditions are predicted, use high early strength cement.

Temperature control: Heat the concrete materials, other than cement, to the minimum temperature necessary to ensure that the temperature of the placed concrete is within the limits specified.

Admixtures: Do not use calcium chloride, salts, chemicals or other material in the mix to lower the freezing point of the concrete.

Frozen materials: Do not allow frozen materials or materials containing ice to enter the mixer, and keep free of frost and ice any forms, materials, and equipment coming in contact with the concrete.

Maximum temperature of water: 60°C when it is placed in the mixer.

Plastic concrete: Prevent plastic concrete from freezing, without using salts or chemicals.

19.3.7.6 Concrete placing in hot weather

Handling: Prevent premature stiffening of the fresh mix and reduce water absorption and evaporation losses.

Hot weather placing: Maintain freshly mixed concrete at the following temperature limits:

Normal concrete in footings, beams, columns, wall and slabs: $\leq 35^{\circ}\text{C}$;

Concrete section: ≥ 1 m in all dimensions: $\leq 27^{\circ}\text{C}$, except where concrete strength is 40 Mpa or greater;

Section thickness > 600 mm: $\leq 27^{\circ}\text{C}$.

Formwork and reinforcement: Before and during placing maintain temperature at 35°C .

Severe weather: If ambient shade temperature more than 38°C , do not mix concrete.

Temperature control: Select one or more of the following methods of maintaining the specified temperature of the placed concrete:

Cool the concrete using liquid nitrogen injection before placing;

Cover the container in which the concrete is transported to the forms;

Spray the coarse aggregate using cold water before mixing;

Use chilled mixing water.

Evaporation control barriers: Erect barriers to protect freshly placed concrete from drying winds.

19.3.8 Concrete Primary Finish

19.3.8.1 General

Finishing: Do not commence finishing until all bleed water has evaporated from the surface.

Commence: Immediately after placement and spreading and compaction of the plastic concrete, start finishing operations to achieve the documented finish.

Finish: Machine float finish:

- After levelling, consolidate the surface using a machine float;
- Cut and fill and refloat immediately to a uniform, smooth, granular texture;
- Hand float in locations inaccessible to the machine float.

Wood float finish: After machine floating use wood or plastic hand floats to produce the final consolidated finish free of float marks and uniform in texture and appearance.

Broom finish: After machine floating and steel trowelling draw a broom or hessian belt across the surface to produce a coarse even-textured transverse-scored surface.

Lightly washed: After machine floating, and once the pavement can bear the weight of a person without making impressions deeper than 2mm, using a continuous water spray and a medium bristle brush, lightly wash away the cement matrix. Exposed finish is to match existing concrete surfaces in the precinct. Work to be undertaken in accordance with CCAA recommendations by a person experienced in washing concrete.

19.3.8.2 Unformed Surfaces

General: Strike off, screed and level slab surfaces to finished levels, to the tolerance class and finish documented in the **Unformed surface finishes schedule**.

19.3.8.3 Formed Surfaces

Damage: Do not damage concrete works through premature removal of formwork.

Curing: If forms are stripped when concrete is at an age less than the minimum curing period, commence curing exposed faces as soon as the stripping is completed.

19.3.9 Concrete Curing

19.3.9.1 General

Curing: Commence curing as soon as possible after finishing and extend for a minimum period of 3 days.

End of curing period: Prevent rapid drying out at the end of the curing period.

Protection: Maintain at a reasonably constant temperature with minimum moisture loss, during the curing period.

19.3.9.2 Cold Weather Curing

General: Maintain concrete temperature between 10°C and 20°C for curing period.

19.3.9.3 Hot Weather Curing

Curing compounds: If it is proposed to use curing compounds, provide details.

Protection: Select a protection method as applicable.

If the concrete temperature exceeds 25°C or if not protected against drying winds, protect the concrete using a fog spray application of aliphatic alcohol evaporation retardant.

If ambient shade temperature is more than 35°C, protect from wind and sun using an evaporative retarder until curing is commenced.

Immediately after finishing, either cover exposed surfaces using an impervious membrane or hessian kept wet until curing begins, or apply a curing compound.

19.3.9.4 Curing Methods

Covering sheet method: Immediately after finishing operations, cover concrete using damp hessian or cotton mats overlapped at least 150 mm and anchored against displacement by wind or other interference. Keep the mats continuously damp until covered by the covering sheet material. Repair tears immediately.

Moist curing method: Immediately after finishing operations and when the concrete has set sufficiently not to be damaged by the curing process, keep the concrete surface continuously damp by ponding or spraying constantly with water, fog, or mist, using suitable spraying equipment. Continue wetting for the curing period.

Self-levelling toppings: To AS 3799, if also used for curing.

Coloured concrete: Do not cure with plastic sheeting, damp sand or wet hessian. Use only chemical curing compounds compatible with the sealer or a sealer to the manufacturer's recommendations.

19.3.9.5 Curing Compound

Application: Provide a uniform continuous flexible coating to AS 3799, without visible breaks or pinholes. Make sure coating remains unbroken at least for the required curing period after application. Respray defective areas within 30 minutes. Respray within 3 hours after heavy rain.

19.3.10 Joints

19.3.10.1 General requirements

Construct expansion, contraction and construction joints straight and plumb. Make transverse joints normal to longitudinal joints. Extend transverse expansion and contraction joints continuously from edge to edge of the pavement through interconnected slabs.

Joint layout: Install joints as documented.

Joint spacings: 1.5-2.0m max for footpaths, 4.0m for road pavements.

Joint widths: To suit the joint detail and sealant.

19.3.10.2 Contraction Joints

Installation: Construct transverse and longitudinal contraction joints by early power sawing or by placing an insert in the fresh concrete.

19.3.10.3 Dowelled Joints

Dowelled contraction joint: Place dowels at 300 mm centres orthogonal to the joint direction and parallel to the pavement surface, accurate alignment is critical, ensure proper field supervision.

Dowel assembly: Use a dowel-assembly support frame firmly secured to the subbase during concrete placement. Prevent the dowel assembly support frame from passing through the joint. Do not insert dowels during the placement of concrete.

Debond dowel: Coat with a debonding coating to 0.5 length + 25 mm. Embed the unpainted half of the dowels in the slab placed first.

Movement: Do not distort or displace beyond the alignment tolerances under testing or during construction. Do not remove and replace dowels in pre-formed holes.

19.3.10.4 Tie Bar Joints

Longitudinal contraction joints: Place tie bars at 800 mm centres. Alignment accuracy of tie bars is not critical.

19.3.10.5 Construction Joints

Installation: Place header board on the subbase or subgrade at right angles to the pavement centre line.

Planned location: Terminate each day's placing operation at a transverse construction joint located to coincide with a planned contraction or expansion joint.

Unplanned joints: If placement is interrupted for 30 minutes or longer, form a tied transverse construction joint within the middle third of the distance between planned joints but no closer than 1.5m to the nearest planned joint. If necessary remove placed concrete back to the required location.

19.3.10.6 Expansion Joints

Requirement: Provide formed full depth joints around structures and features which project through, into or against the pavement, and elsewhere as required.

Dowelled expansion joints: Cap dowels at one end with a compressible material.

19.3.10.7 Formed Joints

Full depth joints: Form the edge of the concrete placed first to provide a smooth, vertical face. After stripping and cleaning fix the joint filler with a suitable waterproof adhesive to the face of the slab, and place the adjoining concrete after the adhesive has set.

Weakened plane joint: Cut a crack-inducing groove by using a suitable tool into the plastic concrete during finishing of the concrete surface. Compact and refinish the plastic concrete around the groove after forming the joint.

Rebated groove joints: Form the rebate by securely fixing removable steel or timber form strips to the form or forms on the slab which is placed first, so that the top of the steel strip is flush with the top of the form. After stripping and cleaning, fix the joint filler in the rebate after placing the adjoining concrete.

19.3.10.8 Sawn Joints

Weakened plane joint: Saw the hardened concrete to depth at least $\frac{1}{4}$ to $\frac{1}{3}$ of the pavement thickness and to a uniform width in the range of 3 to 5mm as follows:

Timing: Commence sawing, regardless of time or weather conditions, as soon as the concrete has hardened sufficiently to permit cutting with only minor raveling of the edges of the saw cut. Complete sawing no later than 24 hours after concrete placement.

Sequence: If possible, saw every third transverse joint initially, then saw the intermediate joints. Start where concrete placement has commenced.

Cracking: If the concrete has already cracked near the location chosen for a joint, do not saw a joint in that location. If a crack develops ahead of the saw cut, discontinue sawing and submit proposals for extra sawn joints. If uncontrolled cracking occurs, suspend concrete placing.

Stand-by machines: Provide one stand-by sawing machine for each machine planned to be used.

Cleaning and protection: Immediately after each joint is sawn, flush the saw cut and adjacent concrete surface using water, until the waste from sawing is removed from the joint. Temporarily caulk the joint using plastic or rubber tubing, or a suitable Tee shaped extrusion. Leave the caulking in place until grooving and sealing.

Rebated groove joints: Saw straight, parallel sided grooves for joint seals on top of and centred on the sawn weakened plane joints.

Timing: Commence sawing after the curing period has ended, immediately before joint sealing. Saw during daylight hours.

Protection: Where there is a time elapse after sawing and before joint sealing, install a thin-splined rubber strip with a free width slightly larger than the saw cut at the bottom of the saw cut after washing slurry from sawn groove to temporarily prevent ingress of solid material.

19.3.10.9 Preparing Joints

Stripping time: At least 12 hours.

Clean: Immediately before installation of the sealer, make sure the joint space is dry, clean and free from loose material. Remove laitance, curing compound and protrusions of hardened concrete from the sides and upper edges of the joint.

19.3.10.10 Joint Sealing

Sealant type: Provide silicone sealant in conformance with the manufacturer's recommendations.

Backing rod: Compressible closed cell polyethylene foam with a bond breaking surface.

19.3.11 Completion

19.3.11.1 Protection

General: Keep traffic, including construction plant, off the pavement entirely during curing. Permit access only to necessary construction plant vehicles which conform to the predetermined load limits appropriate to the use of the concrete.

19.3.11.2 Reinstating Adjacent Surfaces

General: Reinstate surfaces next to new pavements and associated elements. Where an existing road pavement has been disturbed, trim it back to a straight and undisturbed edge, 250 to 300 mm from and parallel to the new concrete for the full depth of the slab.

19.3.11.3 Testing

Concrete pavement: Check tolerances. Where pavement does not conform submit rectification proposal.

Unplanned cracking:

0.3mm wide crack is acceptable.

>1mm must be assessed, submit a proposal for possible cause and rectification processes.

19.3.11.4 Cleaning

Excavated material: Remove from site.

19.4 Selections

19.4.1 Schedules

19.4.1.1 Unformed Surface Finishes Schedule

Property	Road	Paths
Flatness tolerance class	B	B
Primary finish	Roads	Lightly washed, to match existing surfaces in the precinct
Supplementary finish	-	-

Property	Road	Paths

19.4.1.2 Control Tests Schedule

Concrete Element	28 Day Strength	Early Strength (Mpa)	Days After Pouring
Paths, Roads	32MPa	25MPa	Prior to traffic on pavement

20 Paving

20.1 General

20.1.1 Responsibilities

20.1.1.1 General

Requirement: Provide paving, as documented.

20.1.1.2 Design

Estimated traffic: Refer to SOPA Infrastructure Technical Design and Construction Manual.

Subgrade As nominated in the geotechnical report.

20.1.1.3 Performance

General: Coordinate with drainage, adjacent structures and trees.

Conformance: Conform to local authority requirements for levels, grades and paving details (including shape, colour and laying pattern) for paving to footpaths and driveways.

Requirements: Provide paving conforming to the following:

The documented level tolerances.

Consistent in colour and finish.

To direct all water flowing from supply points to drainage outlets without leakage to the substrate or adjacent areas.

20.1.2 Standards

20.1.2.1 General

Concrete and clay pavers: To AS/NZS4455.2.

20.1.2.2 General

Concrete and clay: To AS/NZS4455.2.

20.1.2.3 Slip resistance

Classification: To AS4586.

20.1.3 Interpretation

20.1.3.1 Abbreviations

General: For the purposes of this worksection, the following abbreviations apply:

AGPT: Austroads Guide to Pavement Technology.

CBR: California Bearing Ratio.

CCAA: Cement Concrete and Aggregates Australia.

CMAA: Concrete Masonry Association of Australia.

20.1.3.2 Definitions

General: For the purposes of this worksection, the following definitions apply:

Absolute level tolerance: Maximum deviation from design levels.

Base: Layer(s) of material, forming the uppermost structural element of a pavement and on which the surfacing may be placed.

Concrete segmental pavers: Units of not more than 0.10m² in gross plan area, manufactured from concrete, with top and bottom faces parallel, with or without chamfered edges and identified by the following shape types:

- Shape Type A: Dentated chamfered units which key into each other on four sides, are capable of being laid in herringbone bond, and by plan geometry, when interlocked, resist the spread of joints parallel to both the longitudinal and transverse axes of the units;
- Shape Type B: Dentated units which key into each other on two sides, are not (usually) laid in herringbone bond, and by plan geometry, when keyed together, resist the spread of joints parallel to the longitudinal axes of the units and rely on dimensional accuracy and accuracy of laying to interlock on the other faces.
- Shape type C: Units which do not key together rely on dimensional accuracy and accuracy of laying to develop interlock.

Density ratio (soil): Percentage of the maximum density at optimum moisture content as determined by AS1289.5.2.1.

Lippage: Height deviation between adjacent pavers.

Pavers: Units made from clay, stone, precast concrete, ceramic, terrazzo and/or other inorganic raw materials, generally over 20 mm thick, used as coverings for horizontal surfaces. Larger pavers are often referred to as flags.

Relative level tolerance: Maximum deviation from a 3 m straight edge laid on the surface.

Soldier course: A course of whole or trimmed rectangular pavers at the pavement restraint edge.

20.1.4 Tolerances

20.1.4.1 Finished Surface level

General: Conform to the following:

Absolute level tolerance: ±8mm.

Relative level tolerance: 8mm.

Lippage: Less than 2mm.

20.1.5 Submissions

20.1.5.1 Authority Approvals

SOPA Approval: Submit and gain approval from SOPA Manager Building and Infrastructure for paving products, laying patterns, alignment and drainage for footpaths or crossovers.

20.1.5.2 Execution Details

Base material: Submit test results on quality, grading and compaction.

Paving pattern: If it appears that minor variations to joint widths will minimise cutting, submit proposals.

20.1.5.3 Products and Materials

Compliance certificate: Submit compliance certificates for the pavers, as documented.

Type tests: Submit results, as follows:

Slip resistance of pavers.

Accelerated wear test of pavers.

20.1.5.4 Samples

General: Submit labelled samples of pavers, illustrating the range of variation in colours and finish.

20.1.5.5 Tests

Site tests: Submit results, as follows:

Slip resistance test of completed installations.

20.1.6 Inspection

20.1.6.1 Notice

Inspection: Give notice so that inspection may be made of the following:

Completed base preparation.

Completed trial set-out for paving.

Completed paving.

20.2 Products

20.2.1 General

20.2.1.1 Marking

Identification: Marked to show the following:

Manufacturer's identification.

Product brand name.

Product type.

Quantity.

Product reference code and batch number.

Date of manufacture.

Material composition and characteristics such as volatility, flash point, light fastness, colour and pattern.

20.2.2 Sand

20.2.2.1 Bedding Sand

Quality: Free of deleterious material, such as soluble salts which may cause efflorescence.

Grading: To the **Bedding sand grading table** tested to AS1141.11.1.

Fines: Do not use single-sized, gap-graded or excessive fine material.

Cement: Do not use cement bound material.

Moisture content: Make sure moisture content is uniform and between 4 to 8%.

20.2.2.2 Bedding Sand Grading Table

Sieve Aperture	Percentage Passing (By Mass) %
9.52mm	100
4.75mm	95 – 100
2.36mm	80 – 100
1.11mm	50 – 85
600µm	25 – 60

Sieve Aperture	Percentage Passing (By Mass) %
300µm	10 – 30
150µm	5 – 15
75µm	0 – 10

20.2.2.3 Joint Filling Sand

General: Well-graded sand, free of deleterious material such as soluble salts which may cause efflorescence.

Moisture content: Use dry sand.

Cement: Do not use cement.

Grading: To the **Joint filling sand grading table** tested to AS1141.11.1.

20.2.2.4 Joint Filling Sand Grading Table

Sieve Aperture	Percentage Passing %
2.36mm	100
1.18 mm	90 – 100
600 µm	60 – 90
300 µm	30 – 60
150 µm	15 – 30
75 µm	5 – 10

20.2.3 Concrete and Clay Pavers

20.2.3.1 General

Standard: To AS/NZS4455.2.

Permeable interlocking concrete segmental pavers: To CMAA PE01.

Selection: To the **Paver schedule**.

20.2.3.2 Properties

Requirements: To AS/NZS4455.2 Table 2.8.

Application to AS/NZS4455.2 Table 2.8: Public space for pedestrians and / or vehicles.
Salt attack resistance grade to AS/NZS4455.2 Table 2.7: General purpose grade

20.2.4 Other Materials

20.2.4.1 Tactile Ground Surface Indicators

Standard: To AS/NZS1428.4.1.

20.2.5 Edge restraint

20.2.5.1 Steel

General: Provide galvanised steel edge support as per Drawing P006 in the SOPA Infrastructure Technical Design and Construction Manual.

20.3 Execution

20.3.1 Subgrade

20.3.1.1 Preparation

Extent: Prepare the subgrade to the required profile and extend to the rear face of the proposed edge restraints or to the face of existing abutting structures.

Subgrade preparation: To the *0222 Earthwork* worksection.

20.3.1.2 Drainage of subgrade

Subgrade drainage: Prepare piped or channelled stormwater and subsoil drainage to the *0224 Stormwater – site* worksection.

Service trenches: Backfill all drainage trenches to perform similar to the undisturbed ground.

20.3.2 Base Course

20.3.2.1 Preparation

Base course extent: Extend base course below the edge restraint for its full width except at walls or pits.

Base course: Conform to the *0271 Pavement base and subbase* worksection.

20.3.3 Edge Restraint

20.3.3.1 Lateral Restraint to Segmental Paving

Perimeter: If not provided by other structures, provide edge restraints to bedding and units.

Drainage: Position edge restraint and pavers so that the tops of the pavers are slightly above the front edge of the edge restraint.

Edge restraint shape: Make sure the edge restraint has a vertical or near vertical side abutting the pavers.

Type: Steel Edge Restraint

20.3.3.2 Steel Edging

General: Fix the edge restraint as per Drawing P006 in the SOPA Infrastructure Technical Design and Construction Manual.

20.3.4 Bedding Course

20.3.4.1 General

Preparation: Remove all loose material from the prepared base.

20.3.4.2 Geotextile

Position: Place fabric between the base course and the bedding sand and lap 150 mm at joints.

20.3.4.3 Bedding Sand

Spreading: Screed uncompacted sand over prepared base uniformly to achieve a 30 mm thick layer. Maintain sand at a uniform loose density and moisture content.

Bedding course drainage: If water ponding occurs at edge restraint, drain bedding course to existing subsurface drain or drainage pit using geotextile and 20 mm diameter PVC pipe.

20.3.4.4 Trial Section

Moisture content: Prepare a trial section to establish the moisture content limits which will allow paver system compaction to be achieved.

20.3.5 Laying Paving

20.3.5.1 General

Paving pattern: Prepare a trial set-out for each area.

Laying: Lay paving units on the screeded sand bedding to the documented pattern.

Joints: 2 to 5mm gap.

Cut courses: 50mm minimum plan dimension. On footpaths and other linear elements, use at least two cut courses and maintain symmetry.

Control: Control alignment and laying pattern by stringlines or chalked stringlines every 5m intervals.

Variable width areas: Include in situ concrete infill strips to make a straight area for paving and take up the variable width. If there is a concrete base, provide paving control joints as follows:

Located over base control joints.

10mm wide and filled with bitumen impregnated fibreboard.

20.3.5.2 Laying Around Obstacles

Public utility access pits and penetrations: Adjust access covers as required before commencing paving. Make sure water drains away from pits with lids and into surface inlet drainage structures concrete surrounds.

Plan shape: Square or rectangular with a smooth connection with the laying pattern of the pavers.

Pit position: Centring not required.

Minimum thickness between the pit and paving: 100 mm.

Strength grade: N32.

Colour: Natural.

Precast access chamber: Lay pavers to suit specific dimensions of authority access chambers.

Patterns around obstacles: Lay up both sides of the feature from the main or original laying face.

20.3.5.3 Compaction of Bedding

Compaction: Compact the sand bedding after laying paving units with a vibrating plate compactor and appropriate hand methods.

Sequence: Compact paving as follows:

Progressively behind the laying face.

Complete compaction of laid paving at end of each day.

Do not compact within 1 m of the laying face except where adjacent to an edge restraint.

Joint filling: Compact all paving units to design levels before starting of joint filling.

20.3.5.4 Joint Filling

Filling: Spread dry sand over the paving units and fill the joints by brooming. Carry out one or more passes with the vibrating plate compactor and refill the joints with sand. Repeat the process until the joints are completely filled.

Timing: Start joint filling immediately after compaction.

20.3.6 Testing

20.3.6.1 Completion Tests

Slip resistance of completed installation: To AS4663.

20.3.7 Completion

20.3.7.1 Protection of the Work

Protection: Prevent all vehicular and pedestrian traffic from using the pavement until all compaction and joint filling is completed and all edge restraints are in place.

20.3.7.2 Spare Pavers

General: Supply spare matching pavers of each type for future replacement purposes. Store the spare materials on site.

Quantity: At least 1% of the quantity installed.

Storage location: SOPA storage yard.

20.3.7.3 Cleaning

General: Leave pavements clean on completion.

20.3.7.4 Final Inspection

General: Before the date for practical completion carry out the following inspections:

Cracking in bound pavements: Width 1.5mm.

Subsidence: Offset less than 1.5m length of the design profile, not more than 5 mm.

Stepping: Between adjacent elements within the pavement area, not more than 5 mm.

Chipping and spalling to pavement units: Maximum 10/100 units with chipped or spalled arises.

Ponding: Maximum 10mm deep 15 minutes after rain ceases.

Paving joints: Refill joints as required.

20.4 Selections

20.4.1 Schedule

20.4.1.1 Paver schedule: Refer to SOPA UEDM for paver details.

21 Pavement Ancillaries

21.1 General

21.1.1 Responsibilities

21.1.1.1 General

Requirement: Provide channels, kerbs, linemarking, and vehicle barriers, as documented.

21.1.2 Interpretation

21.1.2.1 Definitions

General: For the purposes of this worksection the definitions given in AS1348 and the following apply:

Absolute level tolerance: Maximum deviation from design levels.

Relative level tolerance: Maximum deviation from a 3m straightedge laid on the surface

21.1.3 Tolerances

21.1.3.1 Channels and Kerbs

Absolute level tolerance: $\pm 10\text{mm}$ at any point on the finished concrete surface.

Relative level tolerance: 5mm to the top or face of kerbs, and to the surface of channels.

Plan position deviation: 25mm.

Exception: Kerb laybacks, grade changes or curves, or at gully pits requiring channel depression.

21.1.3.2 Linemarking

Longitudinal line lengths: $\pm 20\text{mm}$ from the lengths documented in AS1742.2.

Longitudinal line widths: $\pm 10\text{mm}$ from the widths documented in AS1742.2

Transverse line lengths and widths: $\pm 10\text{mm}$ from the lengths and widths documented in AS1742.2.

Other markings: $\pm 50\text{mm}$ from the documented dimensions shown on the drawings or in AS1742.2 for arrows, chevrons, painted medians, painted left turn islands and speed markings. Place arrows and speed markings square with the centreline of the traffic lane.

21.1.3.3 Raised Pavement Markers

Plan position deviation: 20mm.

Directional displacement: ± 4 .

21.1.3.4 Vehicle Barriers

Plan position deviation: 50mm.

Length: ± 20 mm.

Bollard plumb: H/100.

21.1.4 Submissions

21.1.4.1 Linemarking Materials

General: Submit NATA Registered Laboratory Test Reports, at least seven days before work is scheduled to commence, on the properties of the materials, including paint and glass beads.

21.2 Products

21.2.1 Channels and Kerbs

21.2.1.1 Concrete

Standard: To AS1379.

Grade: N20.

21.2.2 Linemarking

21.2.2.1 Pavement Marking Paint

Standard: Conform to the following:

All paints: To RMS Specification R141 and QA3351.

Solvent-borne paint: To AS4049.1.

Waterborne paint: To AS4049.3 and RMS Specification QA3356

High performance: To AS4049.4.

21.2.2.2 Glass Beads

Standard: To AS/NZS2009.

Bead type: B.

21.2.3 Raised Pavement Markers

21.2.3.1 General

Standard: To AS1906.3.

Marker type: Type A/B

Adhesive type: Hot mix bitumen adhesive or as recommended by manufacturer.

21.2.4 Vehicle Barriers

21.2.4.1 Precast Concrete Wheel Stops

Material: Precast concrete units with pre-drilled holes located 300 mm from each end for fixing to ground surface.

Size: 2000 x 150 x 100mm high.

21.2.4.2 Steel Tube Bollards

Type: Bollards fabricated from heavy steel tube, to AS1074.

Minimum nominal size: DN100.

Finish: Galvanize after fabrication.

21.3 Execution

21.3.1 Channels and Kerbs

21.3.1.1 General

Standard: Construct kerb and/or gutters in fixed forms, by extrusion or by slip forming to AS2876.

21.3.1.2 Foundation Preparation

Foundation material: Shape and compact to form a firm base before placing any kerb and/or channel.

Construction not on a pavement course: Relative compaction to AS2876.

Construction on a pavement course: To the requirements of the *0271 Pavement base and subbase* worksection.

21.3.1.3 Joints

Concrete pavement: Where kerbs and/or channels are cast adjacent to a concrete pavement, continue the same joint type, as documented for the concrete pavement, across the kerb and/or channel.

21.3.1.4 Backfill

Timing: Not earlier than three days after placing kerb and/or channel concrete, backfill and reinstate the spaces on both sides of the kerb and/or channel.

Material: Granular, free of organic material, clay and rock in excess of 50 mm diameter.

Compaction: Compact backfill in maximum 150 mm thick layers, to a relative compaction of 95%, when tested in conformance with AS 1289.5.4.1, for standard compactive effort.

Pavement: Backfill pavement material adjacent to new kerbs and/or channels in conformance with the drawings and the *0271 Pavement base and subbase* worksection.

21.3.2 Linemarking

21.3.2.1 General

Undertake all linemarking works in accordance with RMS Specification R141

21.3.2.2 Setting Out

General: Set out the work so that all markings are placed, as documented.

21.3.2.3 Surface Preparation

Surface: Clean, dry and free of any deposit which may impair adhesion of the paint finish.

Wet weather: Do not apply pavement marking during wet weather or if rain is likely to fall during the process or paint drying time.

Provision for traffic: Allow for traffic during application and protect pavement markings until the material has dried sufficiently to carry traffic without being damaged.

Mixing of paint: Before use, mix all paint in its original container to produce a smooth uniform product consistent with the freshly manufactured product.

21.3.2.4 Application of Paint

Longitudinal lines: Spray all longitudinal lines with a self-propelled machine. For a one-way or two-way barrier line pattern, concurrently spray the two sets of lines.

Hand spraying: Hand spray transverse lines, symbols, letters, arrows and chevrons using templates.

Paint thickness: Uniform wet film thickness: 0.35mm to 0.40mm.

Markings alignment: Straight or with smooth, even curves where intended.

Edges: Form clean, sharp edges. Remove any paint applied beyond the defined edge of the marking and leave a neat and smooth marking on the wearing surface of the pavement.

21.3.2.5 Glass Bead Application

Glass beads: Apply glass beads immediately after the application of the paint, at the following minimum rates:

Longitudinal lines: 0.5kg/m².

Other markings: 0.3kg/m².

21.3.2.6 Removal of Pavement Markings

General: Remove pavement markings, as documented or no longer required, from the wearing surface of pavements without causing significant damage to the surface.

21.3.3 Raised Pavement Markers

21.3.3.1 Preparation

Scabbling: For concrete wearing surfaces, scabble the full area below each marker to remove the fine mortar material.

Adhesive preparation: Freshly heat and mix the adhesive to the manufacturer's recommendations. Do not allow the adhesive to cool and do not reheat before use.

21.3.3.2 Installation

Application of adhesive: Spread the adhesive uniformly over the underside of the raised pavement marker to a depth of approximately 10 mm.

Adhesion of marker to pavement: Conform to the following:

Press the raised pavement marker onto the pavement surface in its correct position and rotate slightly until the adhesive is squeezed out around all edges of the marker.

Do not disturb the raised pavement marker until the adhesive has set.

21.3.3.3 Rough Surfaces

Adhesion of marker: Conform to the following:

Apply an initial pad of adhesive of diameter 20mm larger than the diameter of the base of the raised pavement marker.

Apply the adhesive to fill the irregularities in the pavement surface to produce a flat, smooth surface flush with the upper stone level.

Allow the adhesive pad to set.

Apply adhesive to the raised pavement marker and adhere to the adhesive pad on the pavement surface, in conformance with **Installation**.

21.3.4 Vehicle Barriers

21.3.4.1 Precast Concrete Wheel Stops

Installation: Drive 12mm diameter galvanized steel rods a minimum of 600mm into the ground and stop the top of the rod 25mm below the top of the wheel stop.

Concrete pavement/slab: Bolt the wheel stop to the concrete using masonry anchors, installed to the manufacturer's recommendations. Top of bolt to stop 25mm below the top of the wheel stop.

Finish: Grout the holes flush to match the concrete finish.

21.3.4.2 Steel Tube Bollards

Footing: Encase buried end of bollard in concrete, minimum 600mm deep x 250mm diameter.

On slabs: Weld on a 10mm thick baseplate drilled for 4 bolts, and bolt to slab using masonry anchors installed to manufacturer's recommendations.

Filling: Fill the tube with 15MPa concrete.

Open ends: Seal with fabricated end caps, spot welded and ground smooth.

22 Hydraulic Design and Install

22.1 Hydraulic Systems

22.1.1 Responsibilities

22.1.1.1 General

General: Provide the hydraulic services, as documented.

Summary: The hydraulic services are summarised as follows:

- Irrigation
- Water
- Gas
- Sewer

22.1.2 Design

22.1.2.1 Design for Durability and Maintainability

Design for durability: Develop the design so the systems achieve the documented performance, reliability, service life, energy efficiency and safety requirements, and are easily maintainable.

22.1.2.2 Hydraulic System Design

General: Design and provide systems as documented.

- Water services: Provide water main along new roads, to provide potable water to all development sites along the road. All design shall be undertaken by a Sydney Water approved Water Servicing Co-ordinator (WSC);
- Sanitary drainage: Provide sewer mains as required along new roads, to ensure sewer connection points are able to be provided for all development sites along the road. All design shall be undertaken by a Sydney Water approved Water Servicing Co-ordinator;
- Recycled water: Provide recycled water mains along new roads in all areas of Olympic Park with a recycled water system. Provide connection points to all development sites along the road;
- Irrigation: Provide irrigation systems to landscaped areas along new roads;
- Gas: Provide natural gas mains along new roads, with connection points to all development sites. All works shall be in accordance with the Authority requirements.

Authority submissions: Make submissions (including notices) to authorities relating to the works. Provide evidence of Authority approvals of the design.

Designer qualification: Use only appropriately experienced and qualified persons to undertake design work. If requested, provide documents verifying the qualification and experience. Where required, use Authority approved designers.

22.1.3 Standards

22.1.3.1 General

Plumbing and drainage: To AS/NZS3500.0, AS/NZS3500.1, AS/NZS3500.2, AS/NZS3500.3, AS/NZS3500.4 and the PCA.

Copper pipe and fittings-installation and commissioning: To AS4809.

Gas: To AS/NZS5601.1.

22.1.3.2 Authorised Products

Authorised products: Listed in the WaterMark Product Database, unless otherwise required by the Network Utility Operator.

22.1.4 Interpretation

22.1.4.1 Definitions

General: For the purposes of this worksection the following definitions apply:

Network Utility Operator: The entity undertaking the piped distribution of drinking water or natural gas for supply or is the operator of a sewerage system or an external stormwater drainage system.

22.1.5 Submissions

22.1.5.1 Authority Approvals

Authority submissions: Make submissions (including notices) to authorities relating to the works.

22.1.5.2 Certification

Certification: Submit certification that the works comply with Authority requirements.

22.1.5.3 Drawings

Standard: To AS1100.101, AS1100.201, AS1100.301, AS1100.401 and AS/NZS1100.501 as applicable.

Requirement: Submit detail drawings at minimum 1:200 scale, showing the following:

Pipework layout and sections.

Long sections of below ground drainage.

Piping and other schematic drawings including numbering of each valve to correspond to valve tags notation.

Inclusions: Include the following on the drawings:

- Valve boxes and access pits;
- Details of control panels including control and power diagrams;
- Location, type, grade and finish of piping, fittings, valves, meters and pipe supports;
- On-site detention pondage areas;
- Relevant survey levels;
- Set out points.

22.1.6 Inspection

22.1.6.1 Notice

Inspection: Give notice so that inspection may be made of the following:

- Excavated surfaces;
- Concealed or underground services.

22.1.7 Installation

22.1.7.1 Accessories

General: Provide the accessories and fittings necessary for the proper functioning of the systems.

22.2 Wastewater

22.2.1 General

22.2.1.1 General

General: Provide sanitary drainage, as documented.

22.2.2 Sanitary Drainage

22.2.2.1 Laying

General: Lay in straight lines between changes in direction or grade with sockets pointing up hill. If other pipes are adjacent, set each pipe true to line and complete each joint before laying the next pipe. If work is not continuous, cap open ends to prevent entry of foreign matter.

22.2.2.2 Materials

All materials shall be in accordance with Authority requirements.

22.2.3 Tests

22.2.3.1 Pre-completion Tests

Requirement: Test to AS/NZS3500.2 Section 15, before backfilling or concealing.

Leaks: If leaks are found, rectify and re-test.

22.2.4 Completion

22.2.4.1 Cleaning

General: On completion clean and flush the whole installation.

22.2.4.2 Authority Approval

General: Provide evidence of Sydney Water approval of the installed system.

22.3 Cold Water

22.3.1 Responsibilities

22.3.1.1 General

General: Provide cold water mains, as documented.

22.3.2 Piping

22.3.2.1 Materials

General: All materials shall be in accordance with Authority requirements.

22.3.3 Marking

22.3.3.1 Underground Installations

General: During backfilling lay plastic detectable warning tape 300mm above buried piping, for the full length of the piping.

Warning tape: Minimum 100mm width, with WATER PIPE UNDER marked continuously.

22.3.4 Hydrants

22.3.4.1 Requirements

Provide hydrants along water main as required by Authorities.

22.3.5 Testing

22.3.5.1 Pre-completion Tests

Pressure tests: Before backfilling, pressure test piping to AS/NZS3500.1 e.

Leaks: If found, rectify and re-test.

22.3.5.2 Completion Test

General: Provide a full operational test to verify conformance.

22.3.6 Completion

22.3.6.1 Commissioning

Disinfection: Disinfect to AS/NZS3500.1 Appendix J.

Cold water systems: Test and commission to AS/NZS 3500.1 Section 18.

22.3.6.2 Charging

Completion: On completion of installation, commissioning, testing and disinfection, fill the system with water, turn on control and isolating valves and the energy supply and leave the water supply system in full operational condition.

22.4 Fuel Gas

22.4.1 Responsibilities

22.4.1.1 General

General: Provide fuel gas installations, as documented.

22.4.2 Standards

22.4.2.1 Reticulated Gas Systems

General: To AS/NZS5601.1.

22.4.2.2 Steel Mains and Services

Maximum operating pressure not more than 1050kPa: To AS/NZS4645.2.

22.4.3 Piping

22.4.3.1 Materials

Requirements: Pipe materials shall be in accordance with Authority standards.

22.4.4 Marking

22.4.4.1 Underground Installations

General: During backfilling lay plastic detectable warning tape 300 mm above buried piping, for the full length of the piping.

Warning tape: Minimum 100mm width, with GAS PIPE UNDER marked continuously.

Marker plates: Provide galvanized steel or brass marker plates at ground level at each change of direction in the underground pipeline, engraved to show the direction of the line and name of the service. Inset marker plates in 150 x 150 x 150mm concrete blocks, with the tops set flush with ground level.

22.4.5 Commissioning

22.4.5.1 General

Requirement: On completion of installation and testing, turn on isolating and control valves, and purge and charge the system.

Purging: Conform to the recommendations of AS/NZS5601.1 Appendix D.

22.4.5.2 Charging

Requirement: Immediately before the date of practical completion, fully charge the system with gas.

22.5 Irrigation

22.5.1 Responsibilities

22.5.1.1 General

General: Provide irrigation system to all landscaped areas in accordance with SOPA Water Management and Irrigation Network – Standard Technical Specification.

22.5.2 Piping

22.5.2.1 Materials

General: All materials shall be in accordance with Authority requirements.

22.5.3 Testing

22.5.3.1 Pre-completion Tests

Pressure tests: Before backfilling, pressure test piping to AS/NZS3500.1

Leaks: If found, rectify and re-test.

22.5.3.2 Completion Test

General: Provide a full operational test to verify conformance.

22.5.4 Completion

22.5.4.1 Commissioning

The commissioning process must be carried out in accordance with the SOPA Water Management and Irrigation Network – Standard Technical Specification and relevant manufacturers specification pending the Authority’s approval.

22.5.4.2 Charging

Completion: On completion of installation, commissioning, testing and disinfection, fill the system with water, turn on control and isolating valves and the energy supply and leave the water supply system in working condition.

23 Electrical and Lighting Design and Install

23.1 Electrical Systems

23.1.1 Responsibilities

23.1.1.1 General

Requirement: Provide the street lighting and associated electrical for new public domain works.

IN addition of the provision of section 4.8, the following must be considered during design and construction.

23.1.2 Design

23.1.2.1 Design for Durability and Maintainability

Design for durability: Develop the design so the systems achieve the documented performance, reliability, service life, energy efficiency and safety requirements, and are easily maintainable.

Access for maintenance: Develop the design so the systems include safe access for maintenance.

23.1.2.2 Electrical System Design

General: Design and provide systems, as documented.

Designer qualifications: Use only appropriately experienced and qualified persons to undertake design work. If requested, provide documents verifying the qualification and experience.

Authority requirements: All documentation of additions, modification or removal of Ausgrid assets shall be undertaken by an Ausgrid approved Level 3 Accredited Service Provider and all installation work shall be carried out by a Ausgrid approved Level 1 Accredited Service Provider

Fault protection: Automatic disconnection to AS/NZS3000 Clause 2.4.

Maximum demand: Calculation method to AS/NZS3000 Appendix C.

23.1.2.3 Performance

Supply system: 400V, 3-phase, 4-wire, 50Hz, multiple earth neutral (MEN) system.

23.1.3 Standards

23.1.3.1 General

Electrical services: To AS/NZS3000, unless otherwise documented.

Electrical design guide: To SAA HB 301.

Selection of cables: To AS/NZS 3008.1.1.

Degrees of protection (IP code): To AS 60529.

Electromagnetic compatibility (EMC): To AS/NZS 61000.

Telecommunications systems: To AS/CAS008, AS/CAS009 and AS/NZS3008.

General: SOPA Technical Specification for ICT Communications Installation and Routine Maintenance Work.

23.1.4 Submissions

23.1.4.1 Certification

General: Submit the following:

Certification of conformance with AS/NZS3000, for electrical services.

Certification of conformance with the applicable code or standard.

Telecommunications cabling: Submit product and installation certification for the installation.

Certification of compliance with required lighting levels as per AS1158.

23.1.4.2 Design Drawings

Lighting: Submit drawings for the following:

- Location and type of light poles and luminaires;
- Location and size of electrical supply cables;
- Control systems and switchboards;
- Lighting columns;
- Lighting column mounting bases;
- Non-standard fixing brackets;
- Underground pit details.

23.1.4.3 Technical Data

Submissions: Submit design and technical data for the electrical services, all items of plant and equipment.

Data to be submitted: Include at least the following information in technical submissions:

- Assumptions;
- Calculations, including maximum demand calculations;
- Model name, designation and number;
- Capacity of all system elements;
- Country of origin and manufacture;
- Materials used in the construction;
- Size, including required clearances for installation;
- Certification of conformance to applicable code or standard;
- Technical data schedules corresponding to the equipment schedules in the contract documents. If there is a discrepancy between the two, substantiate the change;
- Manufacturers' technical literature;
- Type-test reports;
- Single line diagram(s), including fault levels at switchboards, cable size and type;
- Switchboard layouts.

Lighting: Submit technical data for the following:

- Luminaires;
- Lamps;
- Ballasts;
- Power factor correction equipment;
- Lighting control systems;
- All accessories.

23.1.4.4 Tests

Lighting efficacy: Confirm the efficacy of the following by a photometric test, carried out for the applicable CCT, from a NATA approved laboratory:

- Light-emitting diode luminaires.
- Light-emitting diode lamp replacement modules.

23.1.5 Marking

23.1.5.1 Underground Installations

General: During backfilling lay plastic detectable warning tape 300 mm above buried piping / conduits, for the full length of the piping / conduit.

Warning tape: Minimum 100mm width, with ELECTRICAL PIPE UNDER or COMMUNICATIONS PIPE UNDER marked continuously.

23.1.6 Inspection

23.1.6.1 Notice

Inspection: Give notice so inspection may be made of the following:

- Services laid in trenches, ready for backfilling.

23.1.7 Work on Existing Systems

23.1.7.1 Demolition

General: Decommission, isolate, demolish and remove from the site all existing redundant equipment including minor associated components that become redundant as a result of the demolition.

Breaking down: Disassemble or cut up equipment where necessary to allow removal.

Recovered materials: Recover all components associated with the listed items. Minimise damage during removal and deliver to the locations documented.

23.1.7.2 Existing Electrical Systems

Condition of existing systems:

- If the existing condition does not conform to the requirements in the contract documents, submit proposals to rectify the deficiencies with related costing, time and other impacts;
- Subject to the rectification works on existing systems, achieve the performance in the contract documents.

23.2 Switchboards

23.2.1 Type 2 to Type 7 Poles

All Type 2 to Type 7 poles shall be supplied with the following:

- Service Fuses in an IP56 plastic enclosure;
- 9 pole load centre with a clear cover with 32A main switch;
- All circuit breakers for lighting and power sub-circuits shall have integral RCDs.

23.2.2 Stand-alone Switchboards

Where a stand-alone Main Switchboard or Distribution Board is required it shall be a proprietary made switchboard, either free standing or wall mounted, with the following minimum requirements:

General: Provide proprietary switchboards to the following and as documented:

Rated short-circuit currents: Design for the maximum prospective symmetrical r.m.s. current values at rated operational voltage, at each assembly incoming supply terminal, excluding effects of current limiting devices.

External boards: All external boards shall be weatherproof. All external switchboards shall be bottom entry only.

23.2.2.1 Submissions

Provide workshop drawings for the switchboard for approval by the Superintendent prior to commencing fabrication:

- The drawings shall include the following:
 - Elevations and sections to show the layout of equipment, doors and labels;
 - Single Line diagram and equipment schedule giving brands and model numbers;
 - Details of door seals and locks, vermin proofing and glanding;
 - Label list.

23.2.3 Standards

23.2.3.1 General

Standard: To AS/NZS3439.1 and AS/NZS3439.3.

AS/NZS3439.1 covers the construction, testing, forms of separation and arrangement of type tested and partially type tested assemblies.

AS/NZS3439.3 covers the particular requirements for low voltage switchgear and controlgear assemblies, such as distribution boards and control panels, intended to be installed in places where unskilled persons have access for their use and where fuses or miniature circuit breakers are used for outgoing circuits.

AS/NZS3439.1 provides detailed guidance for designers specifying switchboard assemblies.

23.2.3.2 Statutory Authority's Equipment

General: Refer to network distributor service rules to determine their requirements. Install equipment supplied by the network distributor, and provide wiring to complete the installation.

23.2.3.3 Rated Short-circuit Currents

General: The rated fault capacity of the assembly enclosure, busbars and outgoing protective devices is equal to the fault level of the system at the assembly.

23.2.3.4 Busbars

General: Incorporate proprietary insulated busbar systems for the interconnection of isolators, circuit breakers and other circuit protective devices.

23.2.3.5 Earthing

General: Make provision for connection of communications systems CET at switchboard earth bar to AS/ACIFS009.

23.2.3.6 Doors

General: Provide lockable doors with a circuit card holder unless enclosed in cupboards or in an area which is not readily accessible to the public.

23.2.3.7 IP Rating

General: IP52 minimum.

Weatherproof: IP56 minimum.

23.2.3.8 Outdoor Switchboards

Weatherproof: All external switchboards shall be weatherproof.

Vermin proof: Vermin proof all external switchboards.

Cable entry: Cable entry shall be from the base of the board, to minimise water ingress.

23.2.3.9 Finishes

Interior gear plates: Off white Y35.

Indoor switchboards: Orange X15.

Outdoor switchboards: 316 stainless steel.

23.2.3.10 Supporting Structure

Assemblies: Conform to the following:

Wall mounted: $\leq 2m^2$.

Floor mounted: Assemblies $> 2m^2$.

23.2.3.11 Assembly Construction

General: Fabricate from sheet metal of rigid folded and welded construction. Obtain written approval from the Manager – Building and Infrastructure for non-welded forms of construction.

Free-standing external boards shall have a sloped roof to avoid ponding and a gutter above the doors.

23.2.3.12 Material

Indoor switchboards: metallic-coated sheet steel to AS1397.

Outdoor switchboards: 316 stainless steel.

Material thickness:

Diagonal dimension:

$< 900mm$: $\geq 1.6mm$.

$\geq 900mm$: $\geq 2.0mm$.

23.2.3.13 Ventilation

General: All ventilation louvres shall be vermin proof using a copper or stainless steel gauze. The size of the ventilation port shall allow for the additional obstruction of the gauze.

23.2.3.14 Sealing of Base

The base of the switchboard shall have gland plates that fit closely to the incoming and outgoing cables to prevent the vermin entering the switchboard. Prior to the fitting of the gland plates ant sand shall be placed under the board.

23.2.3.15 Labelling

General: Provide main label on each assembly detailing:

- Manufacturer's name and contact details;
- Serial number;
- Rated current;
- Fault level;
- IP rating;
- Form of segregation;
- Source of supply;
- Incoming supply cable size and type;
- Additionally label;
- All functional units so that current capacity is able to be determined without access to live parts;
- All outgoing submain cables with sizes and types.

23.3 Switchboard Components

23.3.1 Protective Devices

General: Select and adjust protective devices to grade and coordinate for overcurrent, and earth faults.

23.3.2 Switch-isolator and Combination Fuse-switch Units

Combined fuse switch units are not commonly used and are reserved for existing installations or for high fault levels.

Standard: To AS 60947.1 and AS/NZS 3947.3.

Rated current: To suit unit installed in enclosure.

Rated fault capacity: Provide units selected for short-circuit making capacity that is at least the fault level at assembly incoming terminals.

Breaking capacity: At least the rated full load current.

Rated duty: Uninterrupted in non-ventilated enclosure.

Operation: Independent manual operation including positive ON/OFF indicator.

Locking: Provide for padlocking in the OFF position.

Handles: Removable only when switch is in open position.

Fuse links: Isolated when switch contacts are open.

23.3.3 Moulded Case and Miniature Circuit Breakers

Moulded case circuit breakers are commonly used for current ratings less than 1600 A.

Moulded case breakers: To AS60947.1, AS2184 and AS60947.2.

Miniature circuit breakers: To AS/NZS60898.1 or AS/NZS3111.

Trip type: Conform to the following:

Moulded case breakers: Adjustable thermal, fixed magnetic.

Miniature circuit breakers: Fixed thermal, fixed magnetic.

Amend as necessary or if electronic trip units required.

23.3.4 Current Limiting

Moulded case breakers: required.

Fault capacity $\geq 10\text{kA}$: To AS60947.2 and AS60947.1.

Fault capacity $< 10\text{kA}$, current rating $< 100\text{A}$: Miniature overcurrent circuit breakers to AS/NZS60898.1 or AS/NZS3111.

Mounting: Mount circuit breakers so that the ON/OFF and current rating indications are clearly visible with covers or escutcheons in position. Align operating toggles of each circuit breaker in the same plane.

Clip tray chassis: For miniature overcurrent circuit breakers provide clip tray assemblies capable of accepting single, double, or triple circuit breakers, and related busbars. Provide moulded clip-on pole fillers for unused portions.

23.3.5 Residual Current Devices (also called Earth Leakage Devices)

Integral type: Incorporate earth leakage in circuit breaker protection operation to AS/NZS61009.1.

Maximum tripping current: 30mA.

Residual current devices Types III and IV do not provide adequate personal protection. See AS/NZS3190 Clause 5.1.

23.3.6 Fuses with Enclosed Fuse Links

Fuses are typically used for high fault current installations.

It is the designer's responsibility to ensure that fuse links are sized to ensure effective discrimination with other in-line protection devices. Refer also AS 61818 for guidance on the application of fuses.

23.3.6.1 General

Standards: To AS60269.1, AS60269.2.0 and AS60269.2.1.

Fault level: Provide fuses suitable for the fault level at the assembly, and which discriminate with other protective equipment.

Let-through energy and peak cut-off current: To suit protected equipment.

Utilisation category: Distribution/general purpose: G.

Fuse-holders: Mount fuse-holders so that fuse carriers may be withdrawn directly towards the operator and away from live parts. Provide fixed insulation which shrouds live metal when the fuse carrier is withdrawn.

Barriers: Provide barriers on both sides of each fuse link, preventing inadvertent electrical contact between phases by the insertion of screwdriver.

Fuse links: Enclosed, high rupturing capacity type mounted in a fuse carrier. If necessary for safe removal and insertion of the fuse carrier, provide extraction handles. Mount on clips within the spares cabinet.

Identification: Clearly indicate Australian manufacturer or distributor.

23.3.7 Contactors

The designer should determine the appropriate duty and rating of the contactors.

Standard: To AS60947.4.1.

Rated operational current: The greater of:

Full load current of the load controlled: 16A.

Contacts life: 1 million operations at AC-3 or DC-3.

Mounting: Mount with sufficient clearance to allow full access for maintenance, removal and replacement of coils and contacts, without the need to disconnect wiring or remove other equipment.

Auxiliary contacts: Provide auxiliary contacts with at least one normally-open and one normally-closed separate contacts with rating of 6 A at 230 V AC.

Interconnection: Do not connect contactors in series or parallel to achieve ratings.

23.3.8 Surge Protection Devices (SPD)

General: Provide shunt connected metal oxide varistor based SPDs between each phase and neutral at assembly incoming supply terminals, on the line side of incoming functional units.

Where applicable provide a gas discharge tube between neutral and earth.

Spark gap type SPDs that produce AC follow as current during operation should be avoided.

Surge Rating: $I_{max} \geq 150$ kA per phase to neutral.

Surge Rating: $I_{max} \geq 100$ kA neutral to earth if remote from the MEN earthing system.

Residual Voltage: $U_p < 800$ V.

Visual indicator: Provide visual indication of SPD status and life visible through a window in the switchboard escutcheon.

Alarm contacts: Provide one set of normally closed dry contacts indicating status.

Enclosure and installation: House SPD in a metal enclosure and protected with a suitable rated circuit breaker or 63A HRC fuse.

23.3.9 Anti-Condensation Heaters

Rating: Provide heaters rated at not less than 20 W/m² of total external area including top of weatherproof enclosure.

Type: Black heat type with surface temperature $\leq 50^{\circ}\text{C}$, mechanically protected and thermostatically controlled.

23.4 Lighting

23.4.1 Standards

23.4.1.1 Requirement

The design of lighting systems is a specialist task and guidance parameters are provided by the following standards:

The AS/NZS1158 series AS/NZS1158.0, AS/NZS1158.1.1, AS/NZS1158.1.2, AS/NZS1158.2, AS/NZS1158.3.1 and AS/NZS1158.4 provides guidance for public lighting of roadways, pathways and circulation spaces.

SOPA Urban Elements Design Manual (UEDM) – Lighting Section

23.4.1.2 Responsibilities

General: Provide a complete operational lighting system, tested and commissioned.

Proprietary equipment: Provide only proprietary luminaires, fittings and accessories.

Modifications and refurbishing: Carry out to the original manufacturer's standards.

23.4.1.3 Minimum Energy Performance Standards (MEPS)

General: To AS/NZS4783.2 and AS/NZS4782.2.

The minimum energy performance standard (MEPS) level for a particular ballast-lamp combination is the maximum permitted corrected total input power of a ballast-lamp circuit. AS/NZS4783.2 Clause 6.4 specifies MEPS for combinations of ballasts and type FD lamps. Should a higher (low loss) standard be required (B1 classification) amend this Clause and enter the required EEI classification.

23.4.1.4 Discharge Lamps (HID)

Applicable to, high-pressure sodium vapour (SON) and metal halide types.

General

Metal halide lamps rated at 150Watts or less shall have:

- Ceramic discharge arcs;
- Colour rendering index >80 ;

- 3000 K colour temperature.

Metal halide lamps rated at >150Watts shall have:

- Ceramic or quartz arc tube
- Colour rendering index: > 80
- 3200 K colour temperature

23.4.1.5 Standards

High pressure sodium vapour: To IEC60662.

Metal halide lamps: To IEC 61167.

Lamp controlgear for HID lamps: To AS/NZS61347 and AS/NZS60923.

23.4.1.6 Discharge Lamp Ballasts

General: Provide ballasts for lighting systems selected for compatibility with the lamp and control method.

High-pressure sodium vapour and metal halide type: Conform to AS/NZS61347 and AS/NZS60923.

23.4.1.7 Metal Halide Type:

≤150W: Reactors or electronic control gear.

>150W indoor: To the lamp manufacturer's recommendation.

>150W outdoor: To the lamp manufacturer's recommendation.

Igniters: If documented, provide igniters which cut out when lamp ignites and after pre-determined time period if lamp fails to ignite.

Cut out timer is separate from the igniter and may even be remote - it is not integral. Rapid start types are available.

Instant restrike igniters: If required, provide instant restrike igniters for instant restart of suitable HID lamps to the manufacturer's requirements.

23.4.1.8 HID power factor correction

General: Provide power factor correction on all luminaires to a minimum power factor of 0.9 lagging.

23.4.1.9 Capacitors

Standard: To AS/NZS61048 and AS/NZS61049.

Integral fuses

General: Provide integral fuses for reactor high intensity discharge (HID) lamp ballasts.

23.4.2 Light-Emitting Diodes (LEDS)

23.4.2.1 General

General: Provide light emitting diode (LED) luminaires, as documented in the UEDM. If compliance with the UEDM is not possible, the proposed fittings shall comply with the performance requirements below,

23.4.2.2 Light-emitting Diode Luminaires

General: Light-emitting diode luminaires include integral LEDs, reflectors, lenses, heatsinks and drivers.

Performance: Provide LED luminous efficacy of the LED luminaire at normal operating temperature in its normal position and enclosure of > 90 lumens per watt.

Life of the LED in the complete luminaire: L₇₀ to IES LM-80-2008, unless documented otherwise.

IES LM-80-2008, for the rating of the life of LEDs links life to the lumen maintenance at the LED end of life. The L70 test shall be carried out at an ambient temperature of 30⁰C or higher.

A rated life to L₇₀ is the time to reach 70% lumen maintenance irrespective of the eventual failure.

The efficacy shall be confirmed by a photometric test from a NATA approved laboratory. The test shall be carried out for the correct Correlated Colour Temperature.

Colour: CRI > 80.

CCT: 3000K.

23.4.2.3 Control Gear Enclosure

General: Provide control gear support enclosure within the body of the luminaire, except where remotely mounted control gear is documented or required by the manufacturer.

Enclosures and control gear mounting assemblies: Provide heat dissipation facilities to dissipate heat from the luminaire.

Control gear enclosure: Form a barrier against direct contact with live parts of the control gear and the area of the luminaire containing the lamp and lamp support holders.

Separate control gear enclosures: If separate control gear enclosures external to the luminaire are required, conform to the above requirements.

Fixing: Screw fixed.

23.4.3 Lighting Poles

23.4.3.1 Generally

Submit shop drawings of all poles for approval prior to fabrication.

Unless specified otherwise all poles shall be flange mounted onto ragbolt and foundation cage assemblies in reinforced concrete.

Bonding: Provide a 1m diameter grading ring of bare 16mm² cable to a depth of 300mm below ground level around the light pole/column and equipotential bond to the pole earth bar in accordance with AS1768. Provide an earth bar bolted to a strap welded to the pole. The bar shall have separate studs to terminate the incoming earth and the grading ring.

No mounting screws shall penetrate the outside surface of the pole. Any screws or bolts that are installed in the pole after galvanizing shall be painted with zinc rich epoxy paint.

The pole shall be hot dipped galvanized steel pole with a base flange to suit a ragbolt assembly. Provide the ragbolt assembly and footing. The pole shall be designed to suit the load and environment.

23.4.3.2 Type 2 to 7 and Type 9 and 9a Poles

Unless otherwise specified, where these poles are required they will be supplied by SOPA. The Contractor shall be responsible for collection of the poles from the SOPA store, cleaning, repainting and assembly of the poles.

The poles shall be installed with the Ausgrid links facing away from the road.

Typical pole footing details are also available from SOPA CADD Manager.

Drawing HSR3353X SMEC footing detail

Drawing HSR3354X SMEC footing detail

23.4.3.3 Type 8 Poles

The type 8 pole is a round steel fabricated pole and shall be fabricated as detailed in the UEDM.

The poles shall be rag bolt mounted and shall have a door opening, on the side facing away from the kerb, with a clear opening of no less than 295 x 110. The bottom of the door shall be 800mm from the top of the flange. The door shall be lockable to match the other poles on site.

The footings shall be installed so that the top of the flange is 75mm below finished ground level. The surface of the pole that is to be below ground level shall be painted inside and out in bituminous epoxy paint at the pole manufacturer's factory prior to delivery to site.

Following the installation the pole shall be adjusted for verticality using non-perishable, non-hydroscopic packers. The ragbolts and nuts will then be painted with bituminous epoxy paint prior to backfilling around the pole.

The pole shall be provided with and galvanised steel equipment tray fixed to the inside of the pole. The equipment tray shall have fixed terminals for three phases and neutral and a 5 Amp circuit breaker to protect the light. Each terminal shall be capable of accepting three 16mm² cables.

23.4.3.4 Labelling

The poles shall be labelled in accordance with SOPA pole labelling policy. SOPA shall supply the asset numbers for the poles. The labels shall match the materials, layout and fonts of the existing labels.

23.4.3.5 Pole Surface Treatment

Type 2 to 7 poles are painted as specified on the Workshop Drawings.

Type 8 Poles shall be ground back to remove all welding daps and marks and shall be heavy duty, hot-dip galvanised after fabrication. All holes and brackets are to be fixed before galvanising. The door shall be neat fitting and flush with the face of the pole.

23.4.3.6 Pole Labelling

Note: All poles, cubicles etc are to be labelled with the location of supply in accordance with the SOPA pole labelling policy.

23.4.3.7 Pole Locking

SOPA have a secure bolt system for the locking of the access doors on the Type 2 to 7 and Tyoe 9 poles. At the conclusion of the installation works the contractor shall inform the Superintendent of number of bolts that are required. The bolts shall be provided by SOPA for the contractor to install at a cost to be advised by SOPA.

23.4.4 TRENCHING AND BACKFILLING

All trenching must be designed and constructed in accordance with the following sections of this document:

- [7 Service Trenching and Reinstatement \(page 52\)](#)
- [15 :Service Trenching and Road Opening \(page 110\)](#)

23.4.5 Lighting Control

General: Provide lighting control equipment and cabling

The C-Bus cable running between the poles shall be an underground rated Cat5e with solid conductors, gel filled and heavy duty black sheath.

The C-Bus cables shall be run in a dedicated conduit. The cable shall be installed in accordance with Clipsal recommendations.

Provide a 12 way screwed telephone terminal strip in an IP56 box in each pole for the termination of the incoming and outgoing C-Bus cable and the tap off to the C-Bus relay.

Provide jumper cables to link the cables.

Provide a two channel C-Bus relay, Cat No 5101R in an IP56 enclosure in the pole. Provide a C-Bus power supply as needed.

All cable entries into the IP56 enclosures shall use circular cable in correctly sized compression glands.

23.4.6 Completion

23.4.6.1 General

Requirement: Before the date of practical completion carry out the following:

- Verify the operation of all luminaires;
- Adjust aiming and controls for all luminaires under night time conditions;
- Replace lamps which have been in service for a period greater than 50% of the lamp life as published by the lamp manufacturer.

23.4.7 Telecommunications Cabling

23.4.7.1 General

Refer to SOPA Technical Specifications for ICT Communications Installation and Routine Maintenance Work

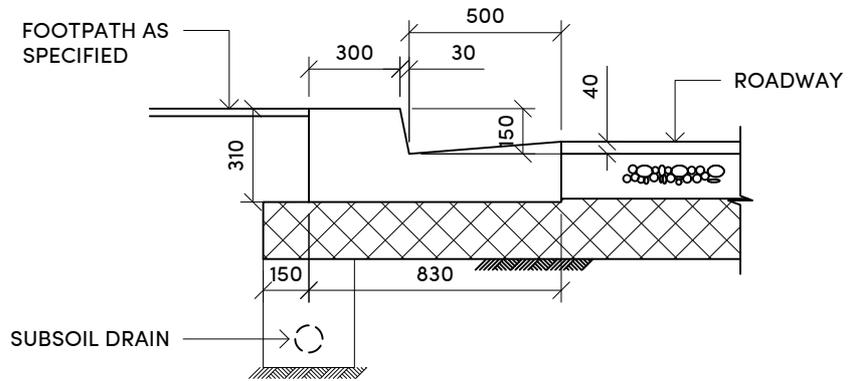
24 Standard Drawings

24.1 List of Standard Drawings

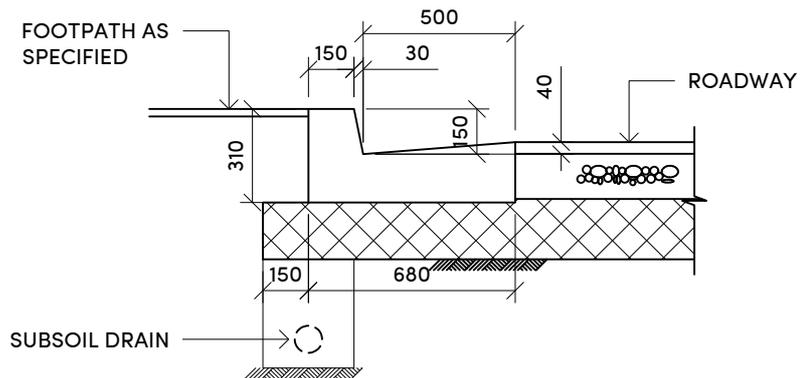
Drawing Number	Detail Name	UEDM References
K001	In-situ kerb and gutter – standard and large	E3, E4
K002	Kerb only – standard and large	
K003	In-situ flush kerb	
K004	Permeable kerb	
K005	Roll kerb only	
K006	Semi-mountable kerb	
K007	Dished Gutter	E5
K008	Rubber splitter island	
K009	Concrete median	
K010	Mowing strip	
K011	Kerb ramp large	P14, P15
K012	Kerb ramp small	P14, P15
K013	Vehicle laybacks	P16, E8
K014	Vehicle crossing	P16
K015	Rectification of pavement adjacent to new kerb	
K016	Precast Kerb	
SW001	Kerb inlet pit – Part 1	
SW002	Kerb inlet pit – Part 2	
SW003	Grated inlet and junction pit	E10, E11
SW004	Raise / lower / modify top of pit	E10, E11

Drawing Number	Detail Name	UEDM References
SW005	Pavement detail at cover / grate	E10, E11
SW006	Grated drain	E9
SW007	Subsoil drain	
SW008	Grassed swale	
SW009	Bio-swale	
SW010	Pipe bandage joint	
P001	Footpath (asphalt)	P12
P002	Footpath (concrete)	
P003	Footpath (pavers)	P8, P9, P10
P004	Road pavement (asphalt) (Local Access Road)	
P005	Asphalt edge (steel and timber)	P17, P18
P006	Paver edge support	P18
P007	Asphalt to pavers junction	P18
P008	Joint details sheet 1	
P009	Joint details sheet 2	
P010	Joint details sheet 3	
P011	Typical Footpath Section	
P012	Concrete stair	P6b
P013	Pavers on concrete stair	P6a
P014	Stair tread nosing detail	P6b
W001	Typical gabion wall	P5
W002	Seating wall in-situ concrete free standing and retaining	P5

Drawing Number	Detail Name	UEDM References
W003	Seating wall (stone retaining)	P20
B001	SOPA Bollard	SF21
CP001	Wheel Stop	
SV001	Typical Service Trench Layout	
SV002	Typical road crossing service trench	
SV003	Trench reinstatement – temporary (road plate)	
SV004	Trench reinstatement – temporary (cold mix asphalt)	
SV005	Trench reinstatement (asphalt pavement)	
SV006	Trench reinstatement (paved areas)	
SV007	Trench reinstatement (concrete pavement)	
SV008	Services pit	
SV009	Finished level of pits	
IR001	Irrigation trench	
IR002	Irrigation flushing valve	
IR003	Irrigation detail at tree pit	
IR004	Irrigation pressure control valve	
IR005	Irrigation quick couple valve	
E001	Switchboard layout	



(LARGE)



(STANDARD)

NOTE:

- TYPICALLY PROVIDE WEAKENED PLANE JOINT AT 1.2m CENTRES WITH 10mm THICK BITUMEN IMPREGNATED FIBREBOARD JOINT AT 3.6m CENTRES
- 32MPa CONCRETE

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

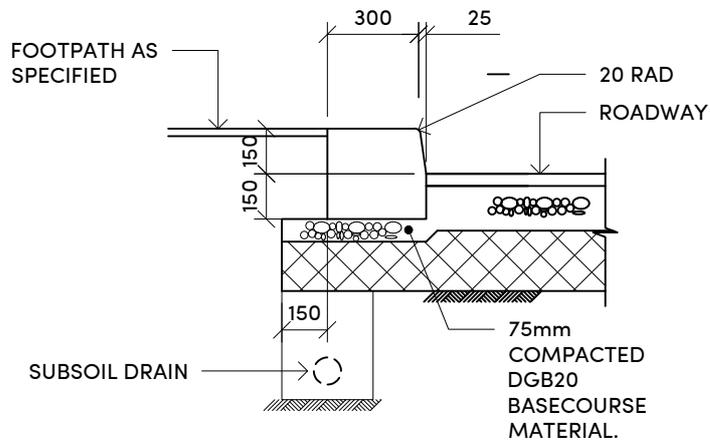
DRAWING No: K001

REVISION: REV.1, June 2018

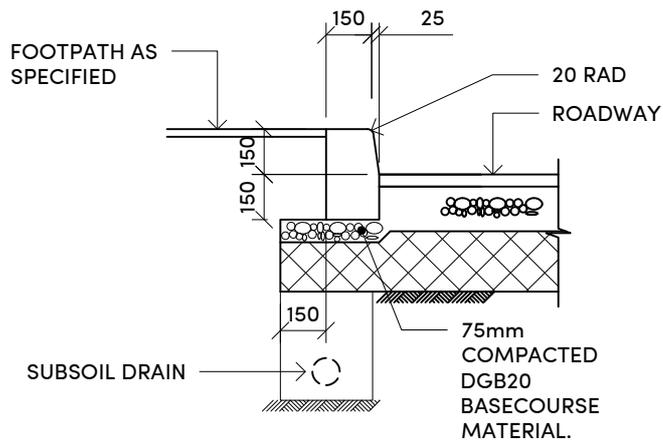
DESIGN INTENT ONLY

DRAWING TITLE: IN-SITU KERB AND GUTTER -
STANDARD AND LARGE

UEDM REF: E3, E4



(LARGE)



(STANDARD)

ENGINEER TO CONFIRM THAT 75mm DGB20 BASECOURSE IS SATISFACTORY FOR THE LOCATION AND THAT 100mm IS NOT REQUIRED.

NOTE:

- TYPICALLY PROVIDE WEAKENED PLANE JOINT AT 1.2m CENTRES WITH 10mm THICK BITUMEN IMPREGNATED FIBREBOARD JOINT AT 3.6m CENTRES
- 32MPa CONCRETE

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

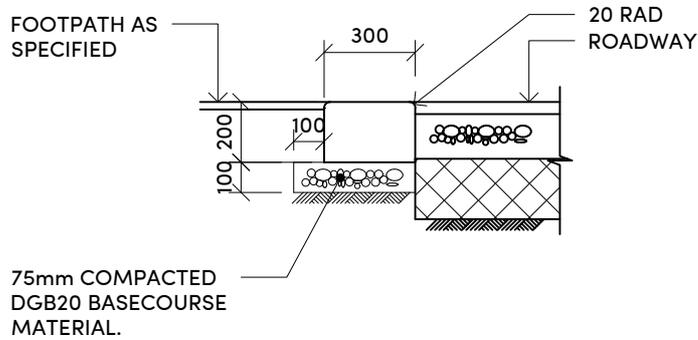
DRAWING No: K002

REVISION: REV.1, June 2018

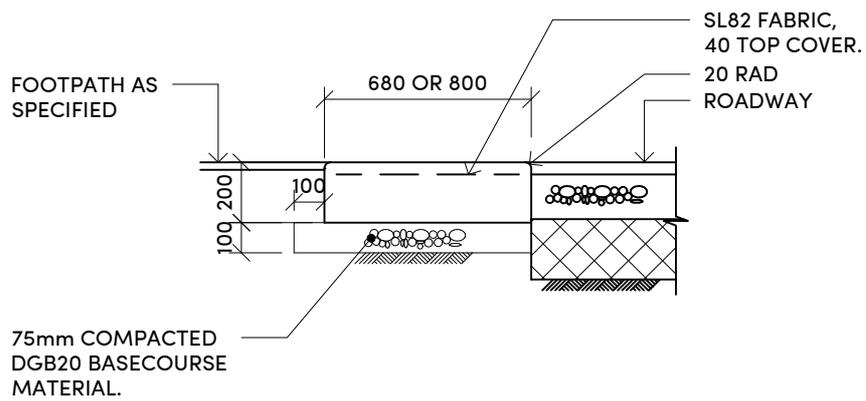
DESIGN INTENT ONLY

DRAWING TITLE: IN-SITU KERB ONLY - STANDARD AND LARGE

UEDM REF: -



(STANDARD)



(LARGE)

ENGINEER TO CONFIRM THAT 75mm DGB20 BASECOURSE IS SATISFACTORY FOR THE LOCATION AND THAT 100mm IS NOT REQUIRED.

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

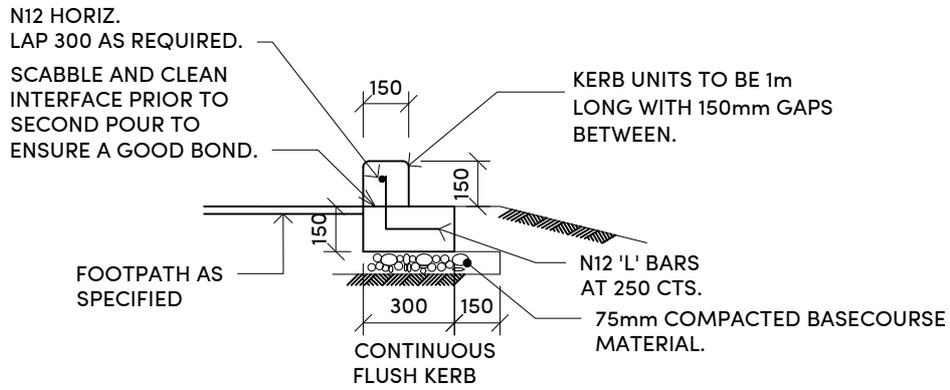
DRAWING No: K003

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

DRAWING TITLE: IN-SITU FLUSH KERB

UEDM REF: -



ENGINEER TO CONFIRM THAT 75mm DGB20
BASECOURSE IS SATISFACTORY FOR THE
LOCATION AND THAT 100mm IS NOT REQUIRED.

NOTE:

- TYPICALLY PROVIDE WEAKENED PLANE
JOINT AT 1.2m CENTRES WITH 10mm
THICK BITUMEN IMPREGNATED
FIBREBOARD JOINT AT 3.6m CENTRES
- 32MPa CONCRETE

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

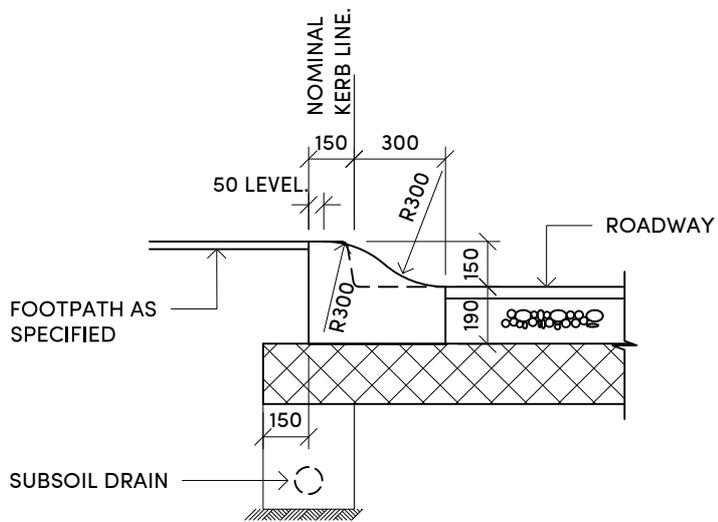
DRAWING No: K004

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

DRAWING TITLE: PERMEABLE KERB (PK)

UEDM REF: -

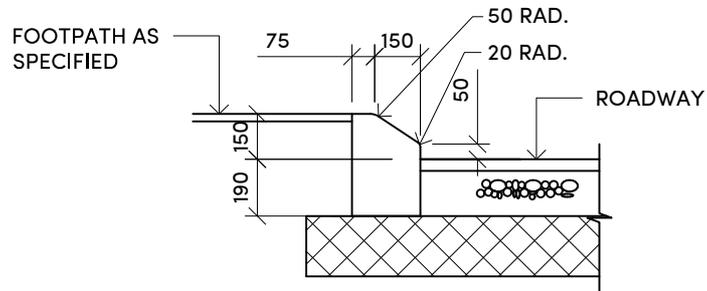


NOTE:

- TYPICALLY PROVIDE WEAKENED PLANE JOINT AT 1.2m CENTRES WITH 10mm THICK BITUMEN IMPREGNATED FIBREBOARD JOINT AT 3.6m CENTRES
- 32MPa CONCRETE

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

DRAWING No: K005	REVISION: REV.1, June 2018	DESIGN INTENT ONLY
DRAWING TITLE: ROLL KERB ONLY (RK)		UEDM REF: -



NOTE:

- TYPICALLY PROVIDE WEAKENED PLANE JOINT AT 1.2m CENTRES WITH 10mm THICK BITUMEN IMPREGNATED FIBREBOARD JOINT AT 3.6m CENTRES
- 32MPa CONCRETE

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

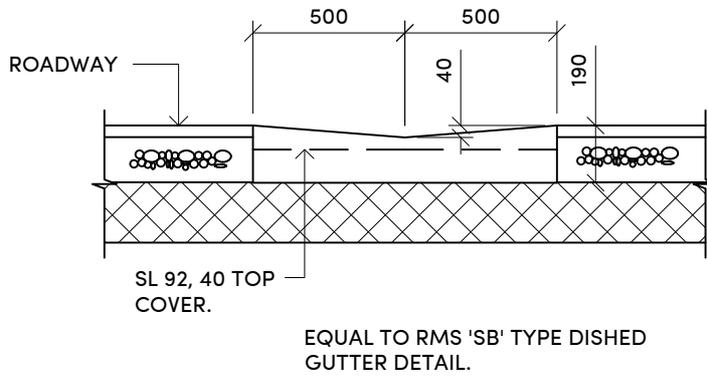
DRAWING No: K006

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

DRAWING TITLE: SEMI MOUNTABLE KERB (MK)

UEDM REF: -

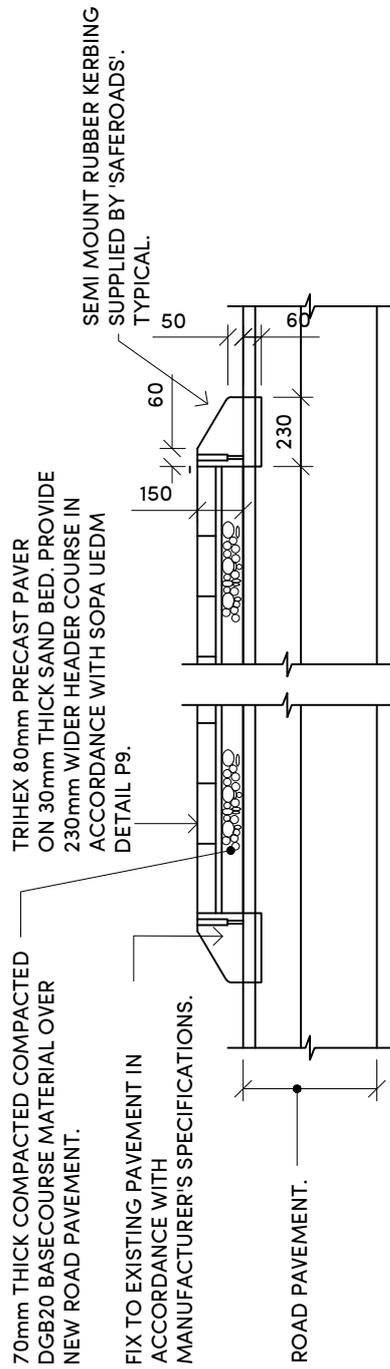


NOTE:

- TYPICALLY PROVIDE WEAKENED PLANE JOINT AT 1.2m CENTRES WITH 10mm THICK BITUMEN IMPREGNATED FIBREBOARD JOINT AT 3.6m CENTRES
- 32MPa CONCRETE

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

DRAWING No: K007	REVISION: REV.1, June 2018	DESIGN INTENT ONLY
DRAWING TITLE: DISHED GUTTER (DG)		UEDM REF: E5



TYPICAL SECTION

NOTE:

- TYPICALLY PROVIDE WEAKENED PLANE JOINT AT 1.2m CENTRES WITH 10mm THICK BITUMEN IMPREGNATED FIBREBOARD JOINT AT 3.6m CENTRES
- 32MPa CONCRETE

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

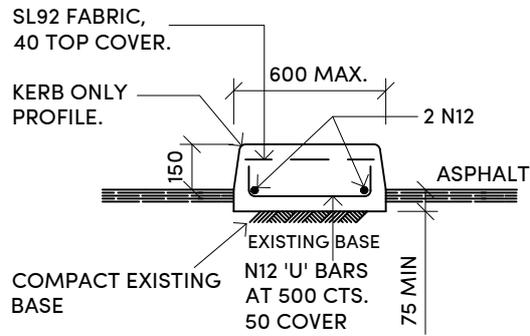
DRAWING No: K008

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

DRAWING TITLE: RUBBER SPLITTER ISLAND

UEDM REF: -



(INCORPORATE FULL DEPTH FIBREBOARD
JOINTS AT 3.5m CENTRES MAX.)

NOTE:

- TYPICALLY PROVIDE WEAKENED PLANE JOINT AT 1.2m CENTRES WITH 10mm THICK BITUMEN IMPREGNATED FIBREBOARD JOINT AT 3.6m CENTRES
- 32MPa CONCRETE

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

DRAWING No: K009

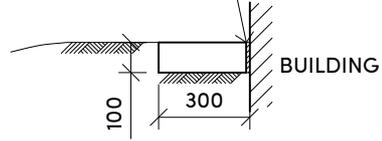
REVISION: REV.1, June 2018

DESIGN INTENT ONLY

DRAWING TITLE: CONCRETE MEDIAN

UEDM REF: -

10mm THICK BITUMEN IMPREGNATED
FIBREBOARD OR 10mm ABLEFLEX.



SCALE 1:20
PROVIDE BUTT JOINTS AT 6m CTS.
AND DUMMY JOINTS AT 2m CTS.

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

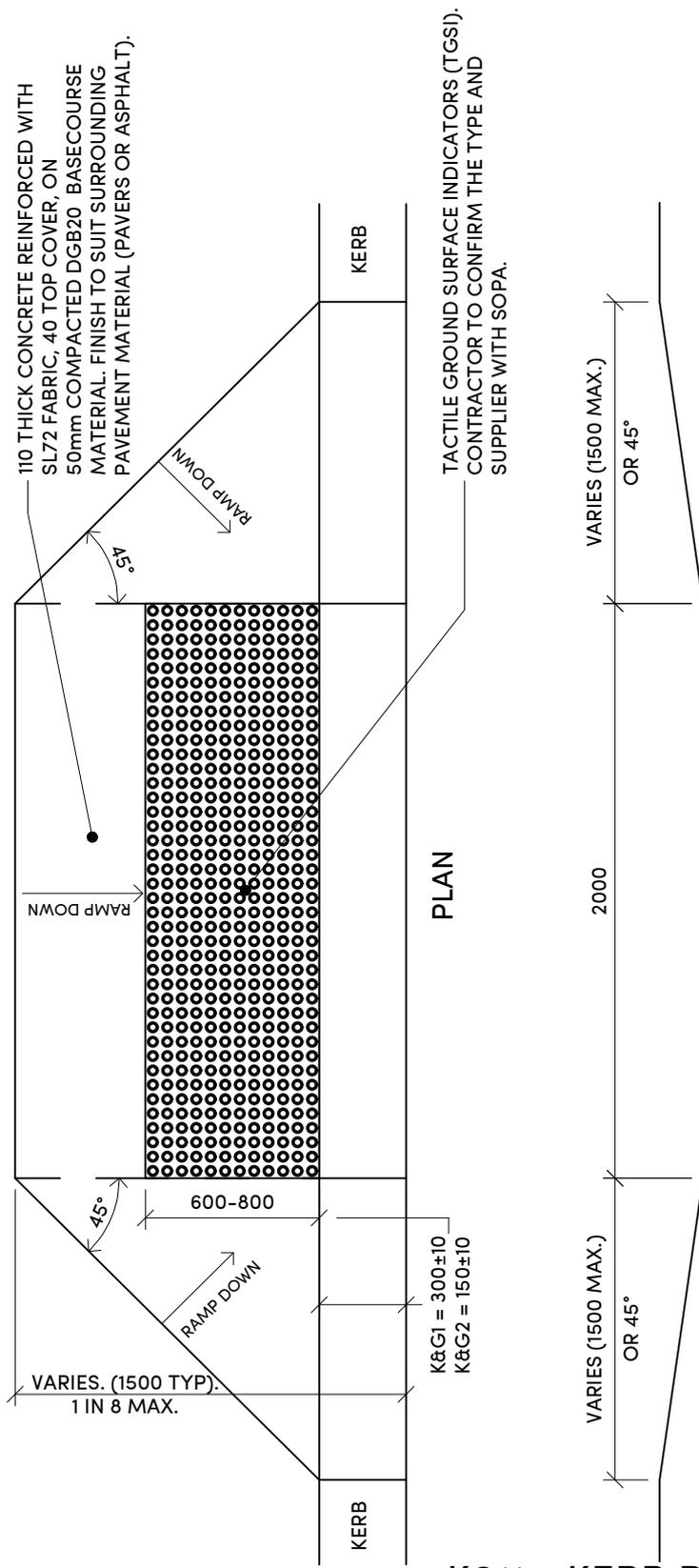
DRAWING No: K010

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

DRAWING TITLE: MOWING STRIP

UEDM REF: -

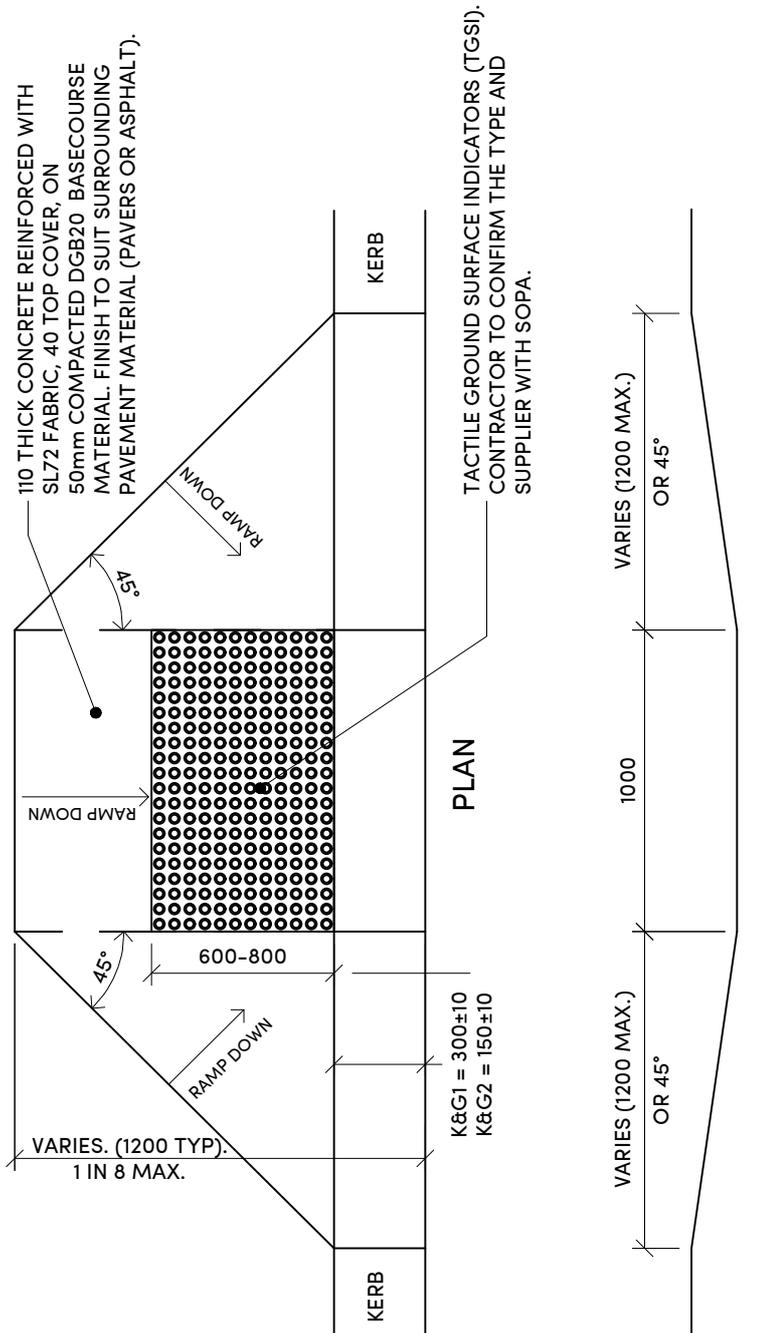


K011 - KERB RAMP 'KR' (LARGE)

- NOTES:
- TO BE IN ACCORDANCE WITH AS 1428.1, RMS STANDARDS AND SOPA STANDARD UEDM PRAM RAMP DETAIL (LARGE - P14).
 - FINISH TO MATCH SURROUNDING PAVEMENT MATERIAL ON CONCRETE BASE AS SPECIFIED.

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

DRAWING No: K011	REVISION: REV.1, June 2018	DESIGN INTENT ONLY
DRAWING TITLE: KERB RAMP 'KR' (LARGE)		UEDM REF: P14, P15



- NOTES:
- TO BE IN ACCORDANCE WITH AS 1428.1, RMS STANDARDS AND SOPA STANDARD UEDM PRAM RAMP DETAIL (LARGE - P14).
 - FINISH TO MATCH SURROUNDING PAVEMENT MATERIAL ON CONCRETE BASE AS SPECIFIED.

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

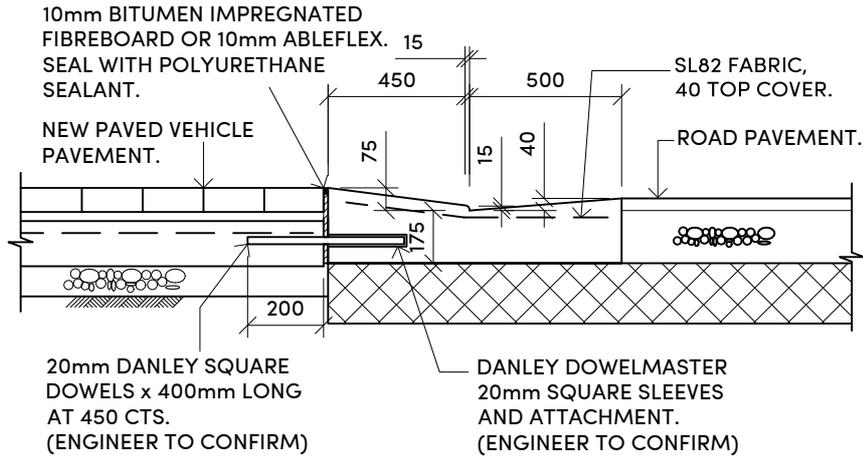
DRAWING No: K012

REVISION: REV.1, June 2018

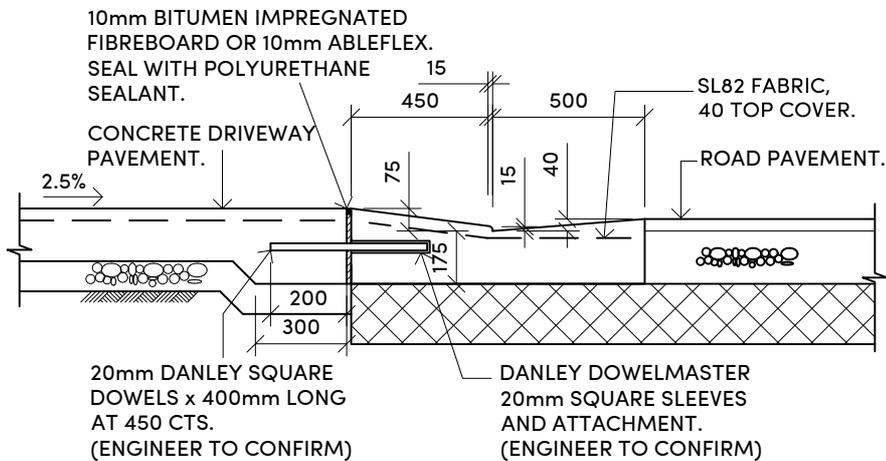
DESIGN INTENT ONLY

DRAWING TITLE: KERB RAMP 'KR' (SMALL)

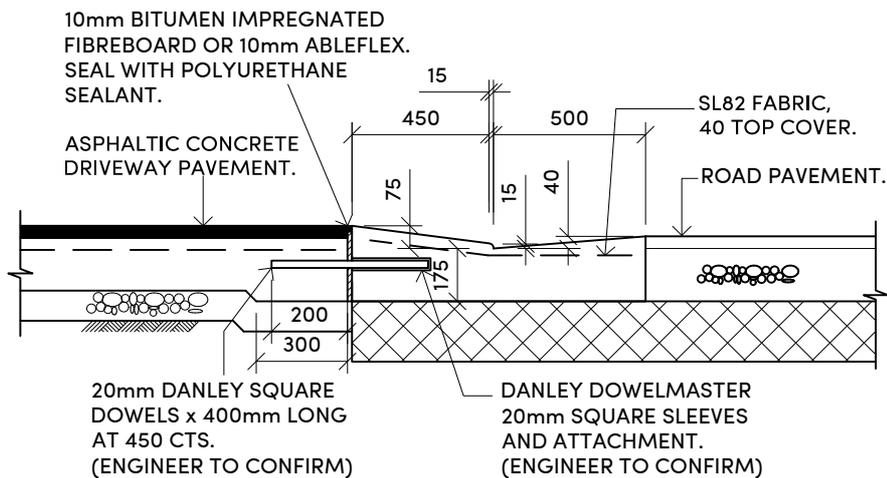
UEDM REF: P14, P15



(PAVED)



(CONCRETE)



(ASPHALT)

NOTES:
 - VERTICAL CLEARANCE CHECK MUST BE ASSURED BY DESIGN IN ACCORDANCE WITH AS 2890.1

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

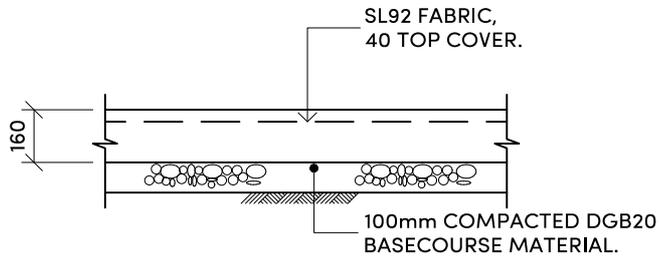
DRAWING No: K013

REVISION: REV.1, June 2018

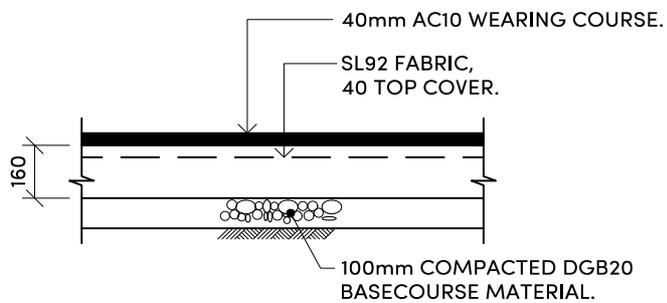
DESIGN INTENT ONLY

DRAWING TITLE: VEHICLE LAYBACKS

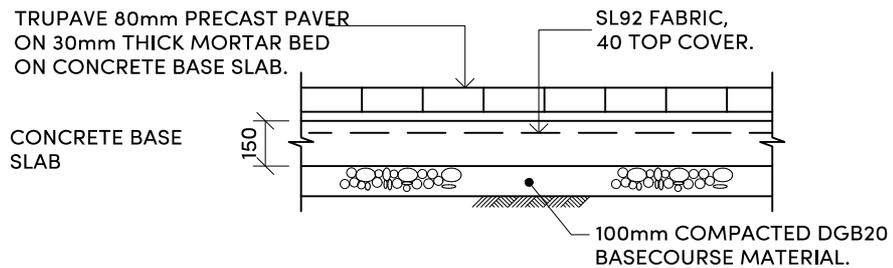
UEDM REF: P16, E8



(CONCRETE)
N32 CONCRETE



(ASPHALT)



(PAVED)
N32 CONCRETE

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

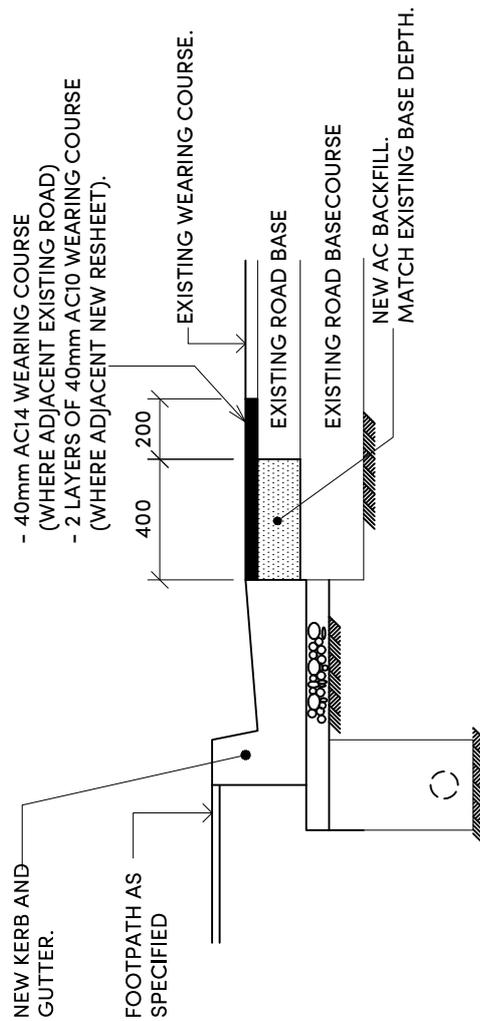
DRAWING No: K014

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

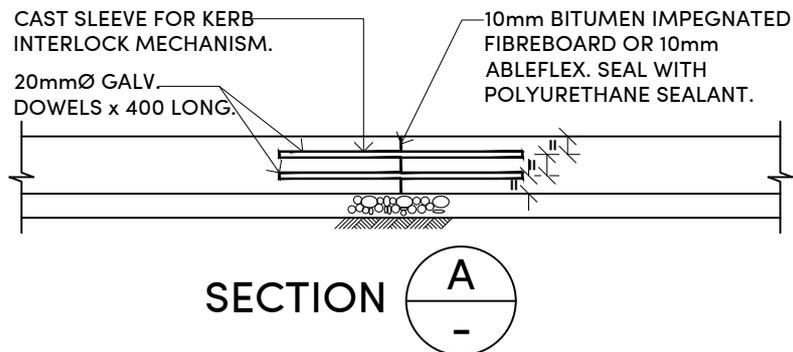
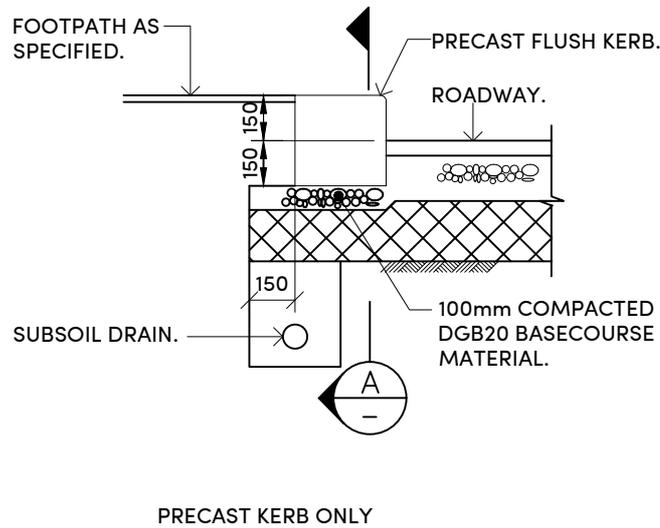
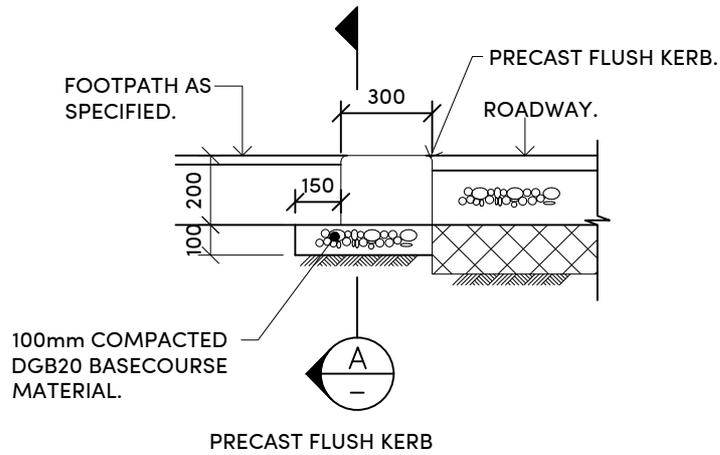
DRAWING TITLE: VEHICLE CROSSING

UEDM REF: P16



FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

DRAWING No: K015	REVISION: REV.1, June 2018	DESIGN INTENT ONLY
DRAWING TITLE: RECTIFICATION OF PAVEMENT ADJACENT TO NEW KERB		UEDM REF: -



FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

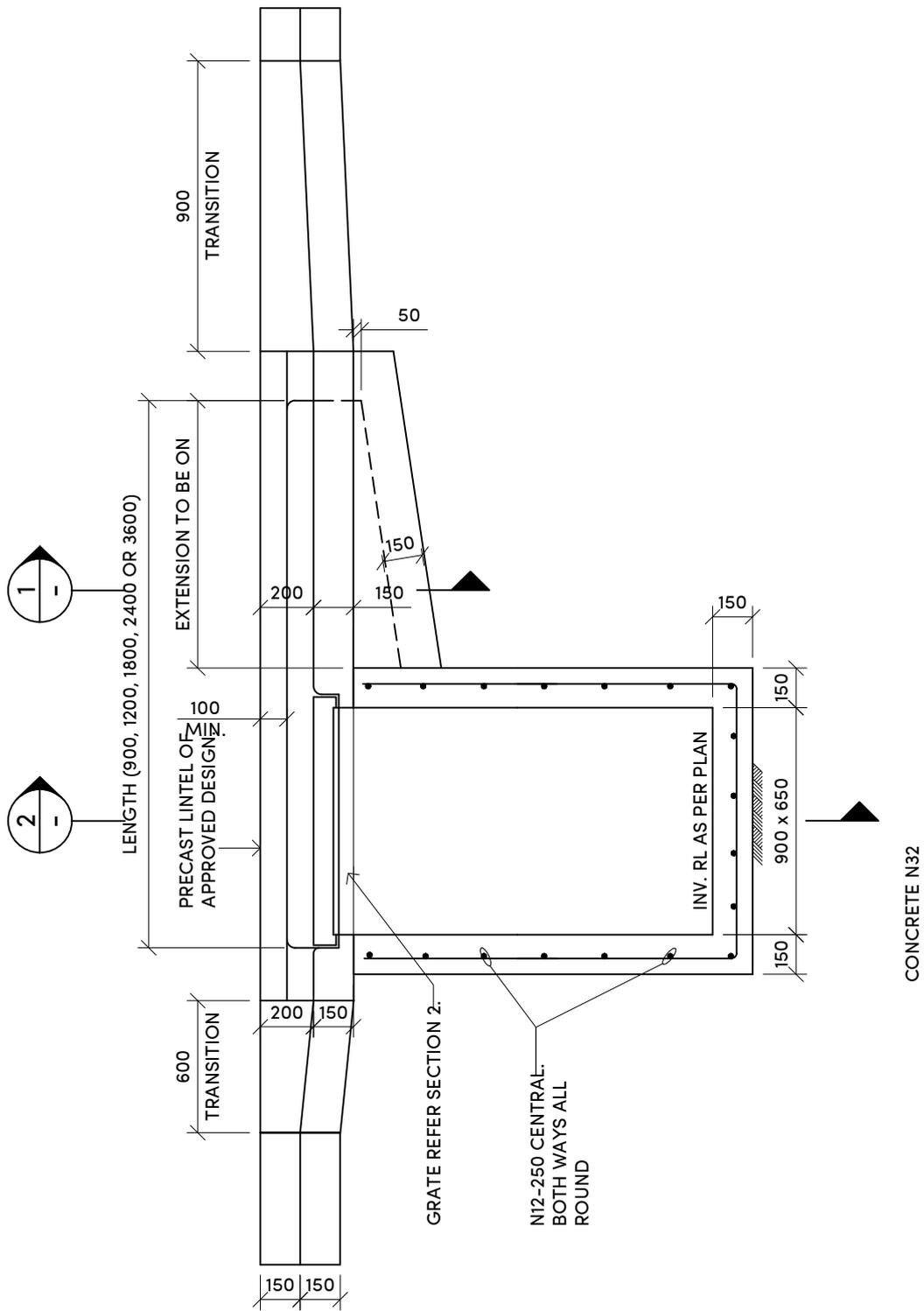
DRAWING No: K016

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

DRAWING TITLE: PRECAST KERB

UEDM REF: -



FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

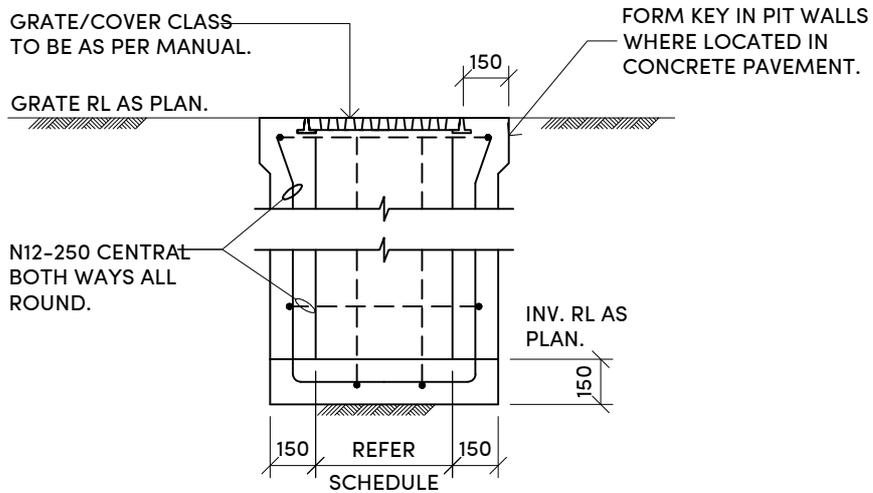
DRAWING No: SW001

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

DRAWING TITLE: KERB INLET PIT - PART 1

UEDM REF: -



PIT SCHEDULE

PIT DEPTH	SIZE
0 - 600mm	450 x 450
600 - 900mm	600 x 600
900 - 1200mm	600 x 900
OVER 1200	900 x 900

PROVIDE STEP IRONS TO AS 3500 IF DEPTH EXCEEDS 1200.

CONCRETE N32

NOTES:

- GRATE SHALL BE MINIMUM CLASS 'C' IN PEDESTRIAN ONLY AREAS AND CLASS 'D' IN TRAFFICABLE AREAS INCLUDING LANDSCAPED AREA

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

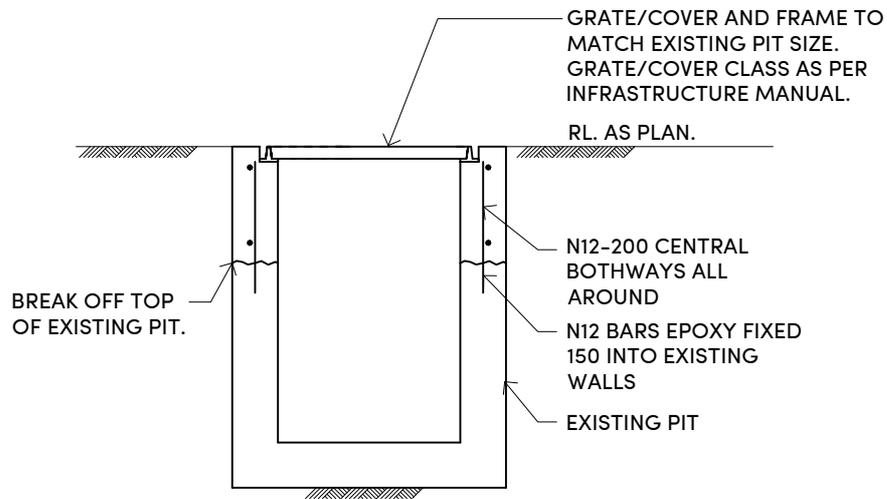
DRAWING No: SW003

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

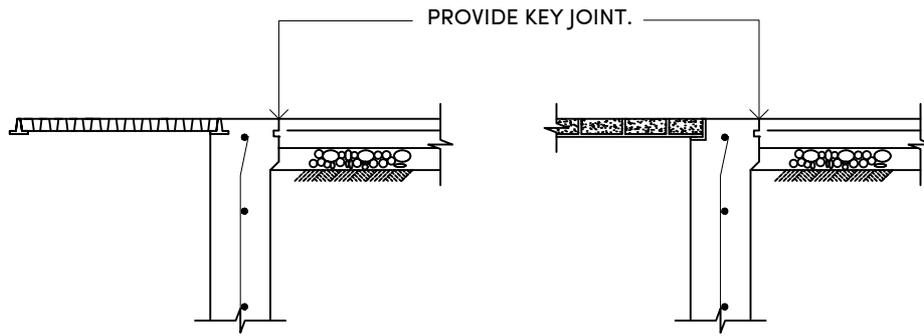
DRAWING TITLE: GRATED INLET AND JUNCTION PIT

UEDM REF: E10, E11

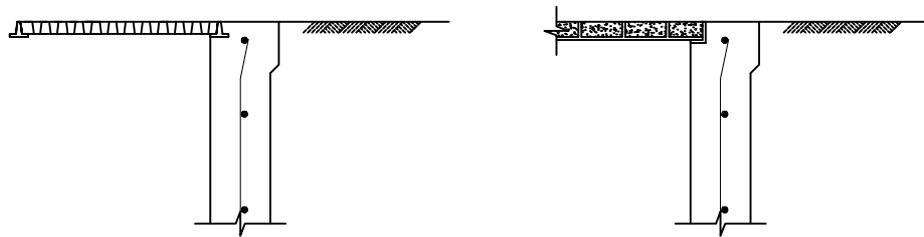


FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

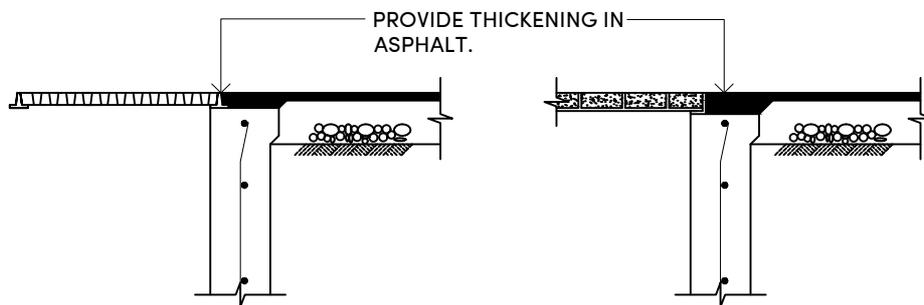
DRAWING No: SW004	REVISION: REV.1, June 2018	DESIGN INTENT ONLY
DRAWING TITLE: RAISE/ LOWER/ MODIFY TOP OF PIT		UEDM REF: E10, E11



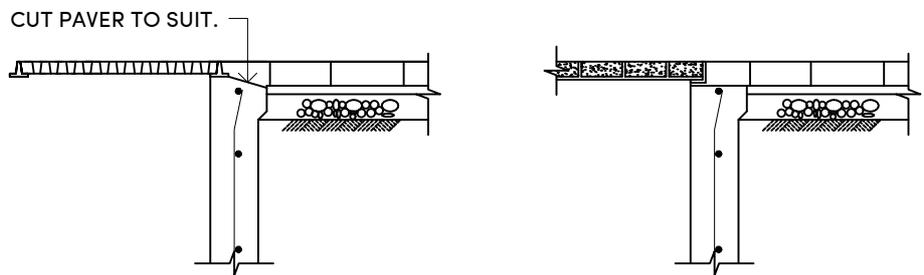
1. CONCRETE



2. LANDSCAPE



3. ASPHALT



4. PAVER

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

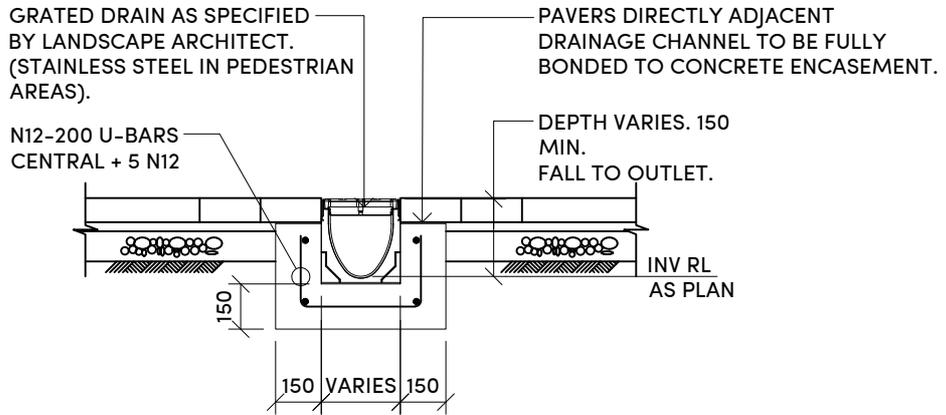
DRAWING No: SW005

REVISION: REV.1, June 2018

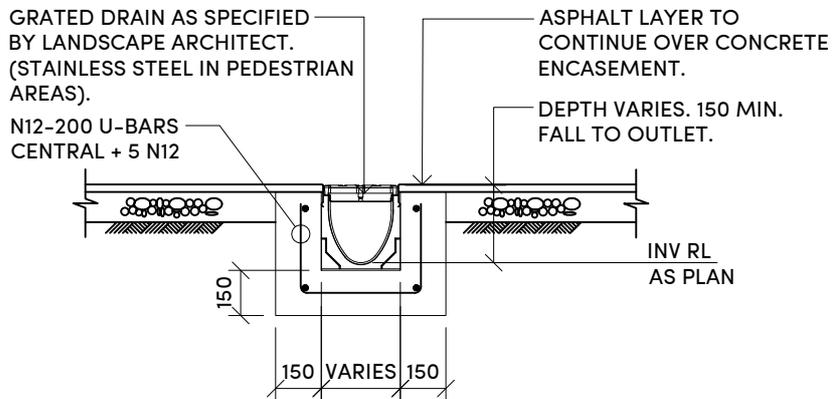
DESIGN INTENT ONLY

DRAWING TITLE: PAVEMENT DETAIL AT COVER/ GRATE

UEDM REF: E10, E11



IN PAVED PAVEMENT.
N32 CONCRETE



IN ASPHALTIC CONCRETE PAVEMENT.
N32 CONCRETE

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

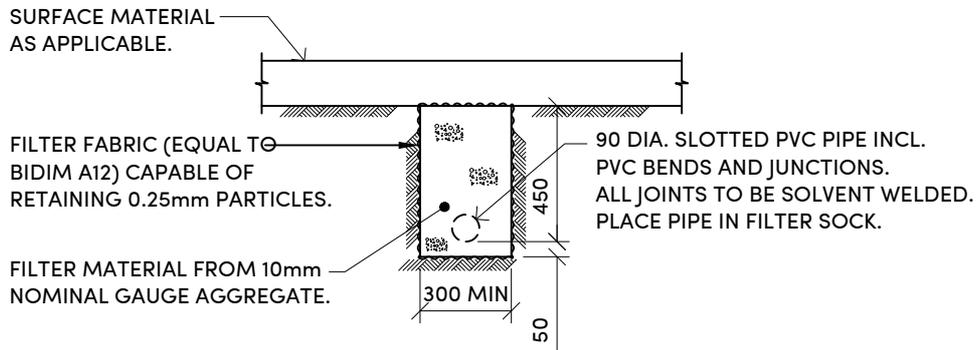
DRAWING No: SW006

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

DRAWING TITLE: GRATED DRAIN (GD)

UEDM REF: E9



FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

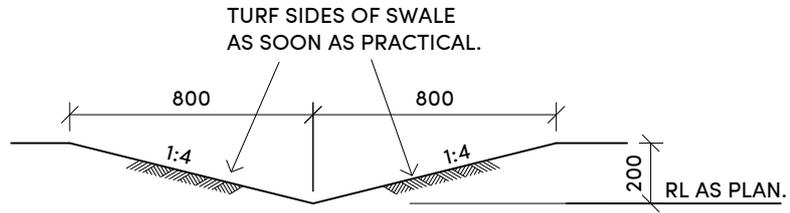
DRAWING No: SW007

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

DRAWING TITLE: SUBSOIL DRAIN

UEDM REF: -



FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

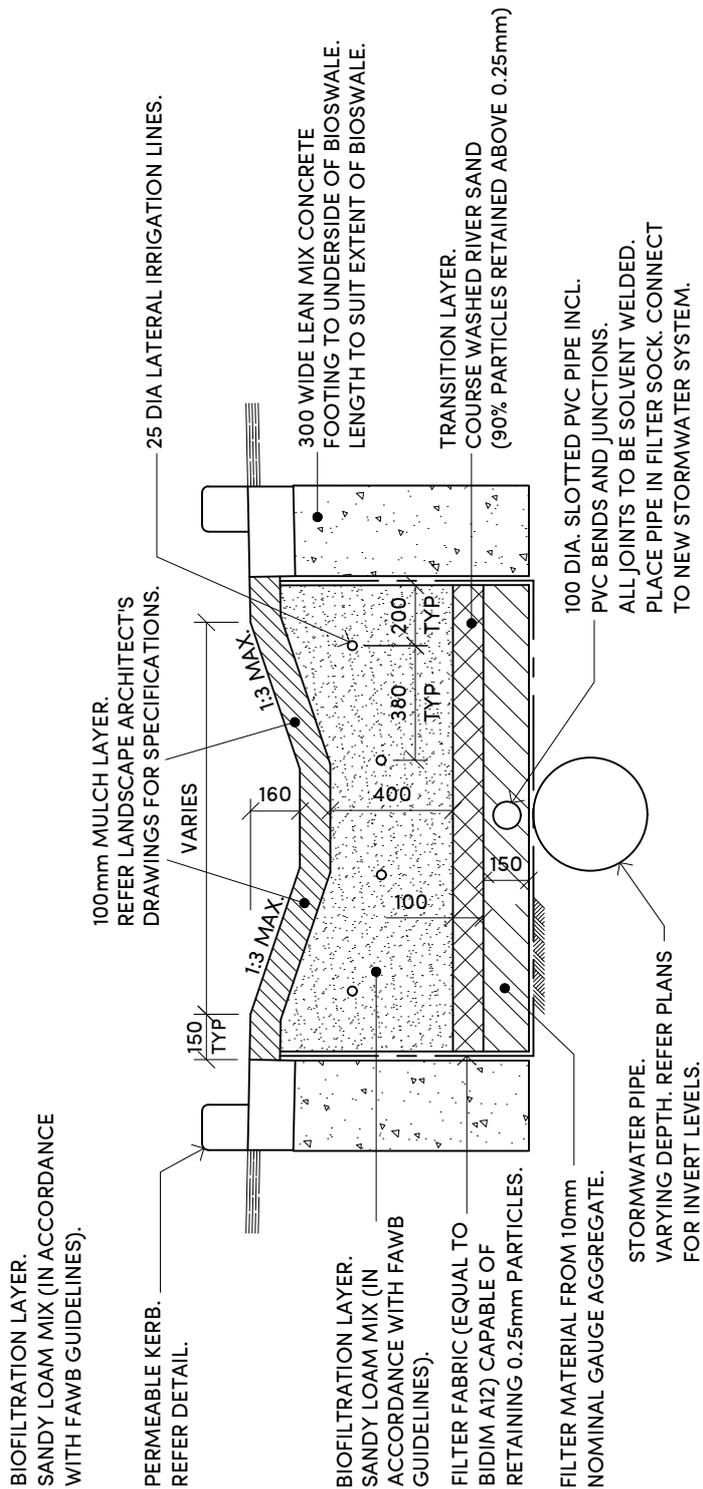
DRAWING No: SW008

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

DRAWING TITLE: GRASSED SWALE

UEDM REF: -



FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

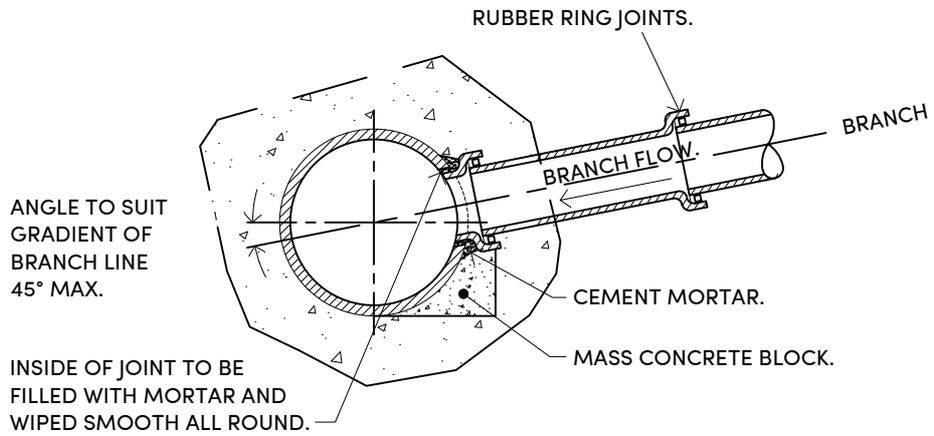
DRAWING No: SW009

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

DRAWING TITLE: BIO-SWALE

UEDM REF: -



PROCEDURE:

1. BREAK HOLE IN MAIN PIPE, AND CLEAN OUT BREAKINGS.
2. CUT INTERSECTING PIPE SO THAT COLLAR RESTS ON MAIN PIPE BARREL.
3. PLACE PIPES TOGETHER AND BUTTER JOINT WITH CEMENT MORTAR.
4. ENCASE WHOLE JOINT IN 100 MM MIN. CONCRETE.

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

DRAWING No: SW010

REVISION: REV.1, June 2018

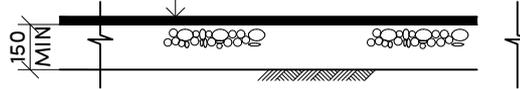
DESIGN INTENT ONLY

DRAWING TITLE: PIPE BANDAGE JOINT

UEDM REF: -

30mm AC10 WEARING COURSE.

150mm MIN.
COMPACTED DGB20
BASECOURSE MATERIAL.



FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

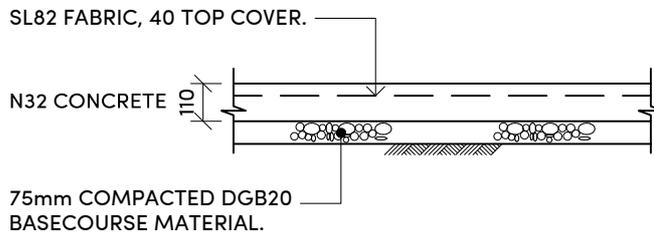
DRAWING No: P001

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

DRAWING TITLE: FOOTPATH (ASPHALT)

UEDM REF: P12



FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

DRAWING No: P002

REVISION: REV.1, June 2018

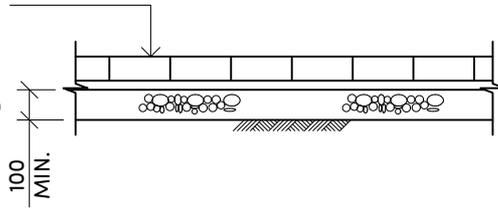
DESIGN INTENT ONLY

DRAWING TITLE: FOOTPATH (CONCRETE)

UEDM REF: -

'TRIHEX' OR 'TRUPAVE' 80mm
PRECAST PAVER ON 30mm THICK
SAND BED.

100mm MIN. COMPACTED DGB20
BASECOURSE MATERIAL.



FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

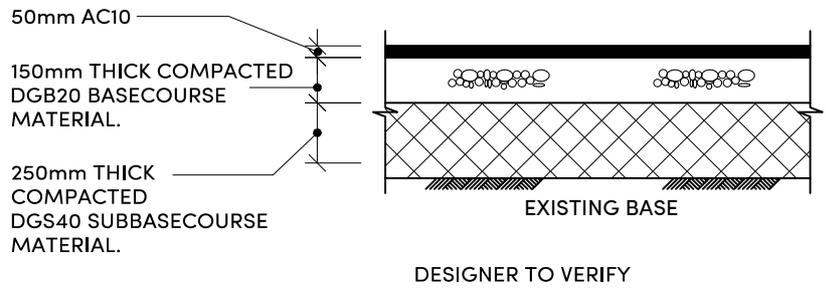
DRAWING No: P003

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

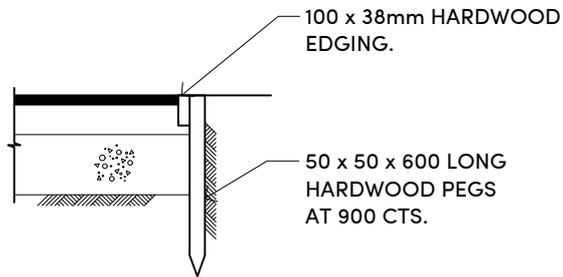
DRAWING TITLE: FOOTPATH (PAVERS)

UEDM REF: P8, P9, P10

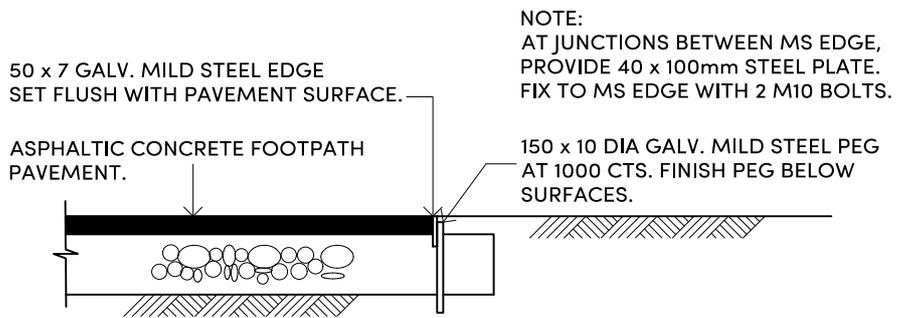


FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

DRAWING No: P004	REVISION: REV.1, June 2018	DESIGN INTENT ONLY
DRAWING TITLE: ROAD PAVEMENT (ASPHALT) (LOCAL ACCESS ROAD)		UEDM REF: -



(TIMBER)
SCALE 1:20



(STEEL)
SCALE 1:10

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

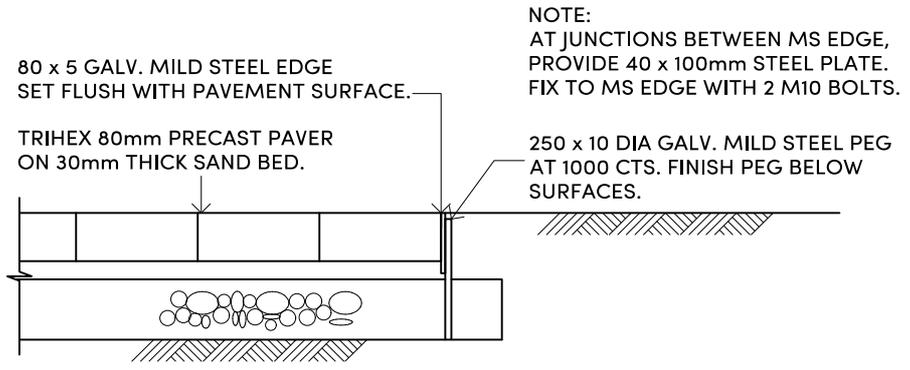
DRAWING No: P005

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

DRAWING TITLE: ASPHALT EDGE (STEEL & TIMBER)

UEDM REF: P17, P18



80 x 5 GALV. MILD STEEL EDGE
SET FLUSH WITH PAVEMENT SURFACE.

TRIHEx 80mm PRECAST PAVER
ON 30mm THICK SAND BED.

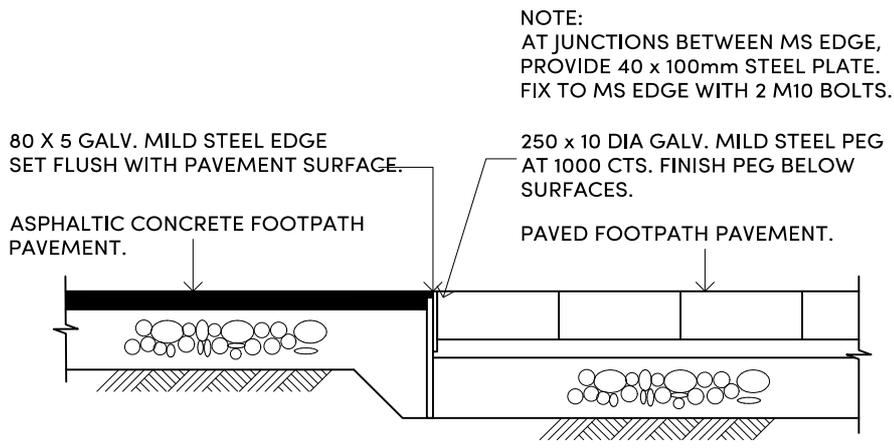
NOTE:
AT JUNCTIONS BETWEEN MS EDGE,
PROVIDE 40 x 100mm STEEL PLATE.
FIX TO MS EDGE WITH 2 M10 BOLTS.

250 x 10 DIA GALV. MILD STEEL PEG
AT 1000 CTS. FINISH PEG BELOW
SURFACES.

(STEEL)
SCALE 1:10

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

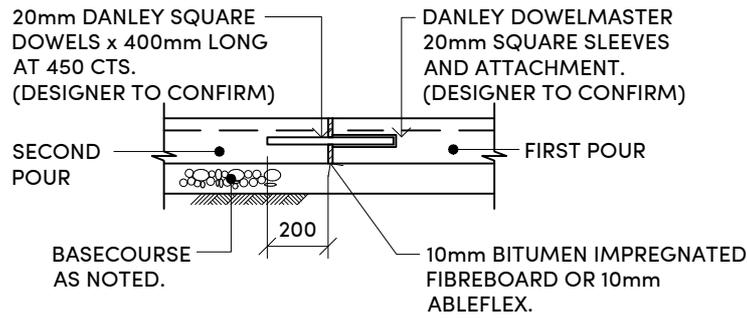
DRAWING No: P006	REVISION: REV.1, June 2018	DESIGN INTENT ONLY
DRAWING TITLE: PAVER EDGE SUPPORT		UEDM REF: P18



SCALE 1:10

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

DRAWING No: P007	REVISION: REV.1, June 2018	DESIGN INTENT ONLY
DRAWING TITLE: ASPHALT TO PAVERS JUNCTION		UEDM REF: P18



EXPANSION JOINT
SHOWN 'e' ON PLAN

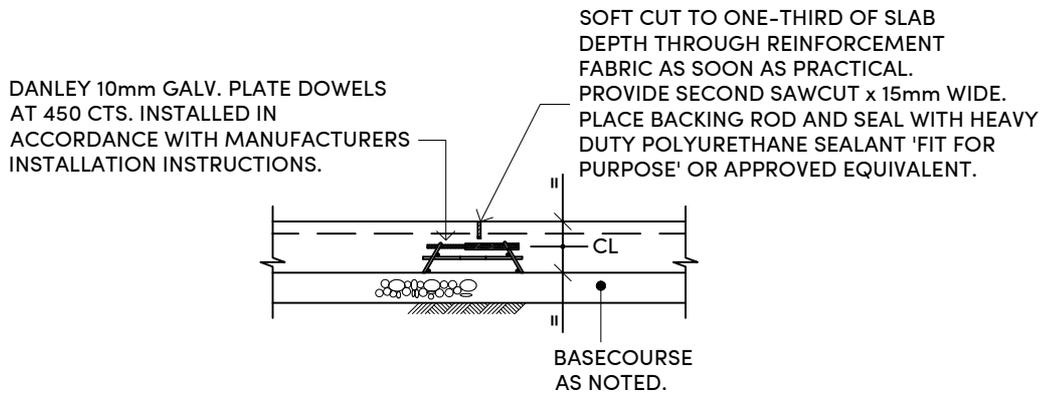
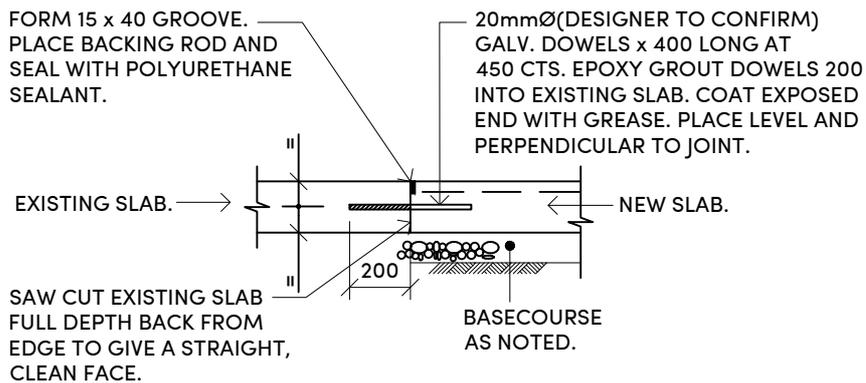


PLATE DOWEL JOINT
SHOWN 'pd' ON PLAN.



SAWCUT JOINT
SHOWN 'sc' ON PLAN.

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

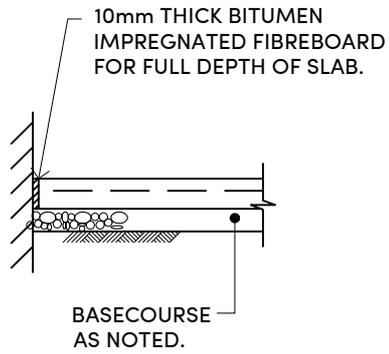
DRAWING No: P009

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

DRAWING TITLE: JOINT DETAILS SHEET 2

UEDM REF: -



BUTT JOINT
SHOWN 'b' ON PLAN

(TO BE PROVIDED ALONG BUILDING LINE AND WALLS
WHERE CONCRETE PAVEMENT ABUTS).

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

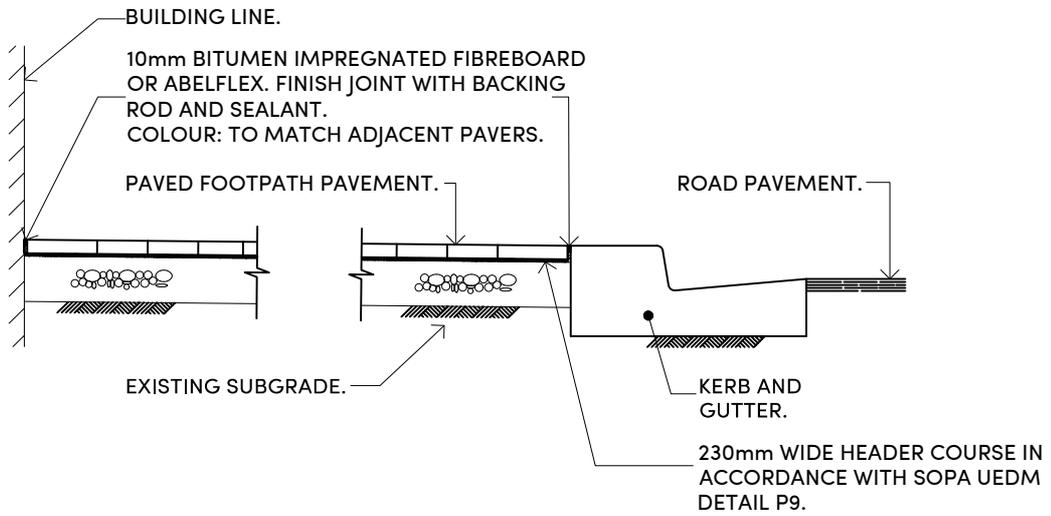
DRAWING No: P010

REVISION: REV.1, June 2018

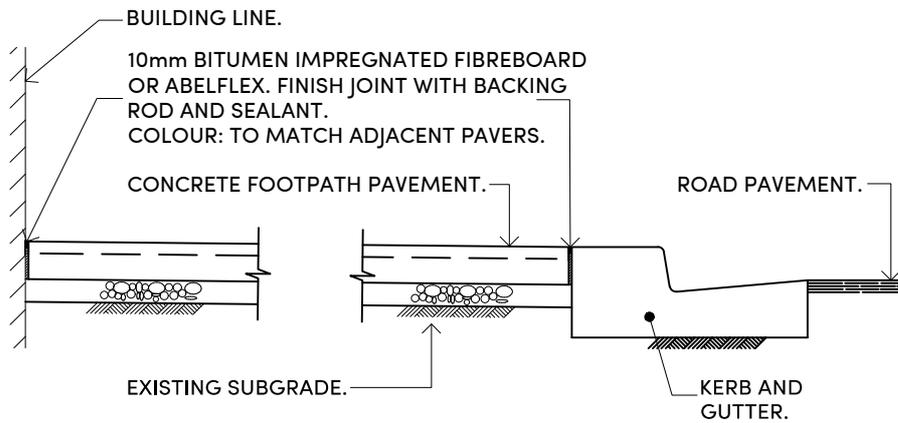
DESIGN INTENT ONLY

DRAWING TITLE: JOINT DETAILS SHEET 3

UEDM REF: -



(PAVED)



(CONCRETE)

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

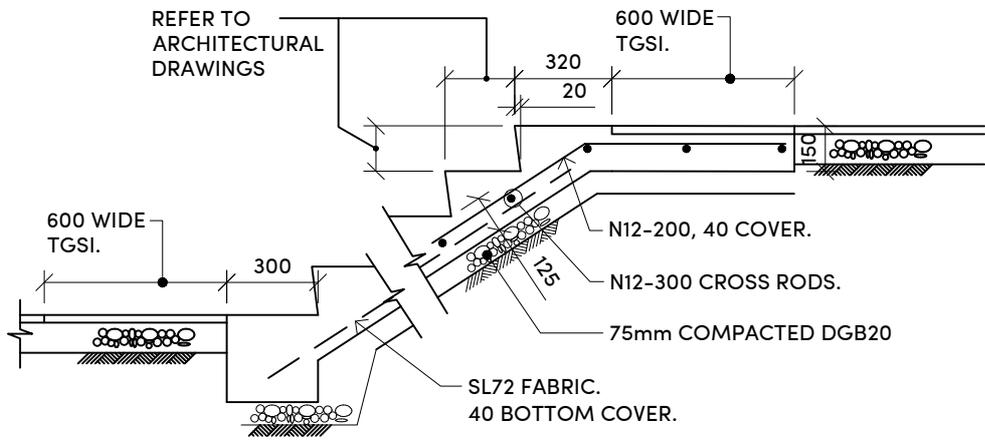
DRAWING No: P011

REVISION: REV.1, June 2018

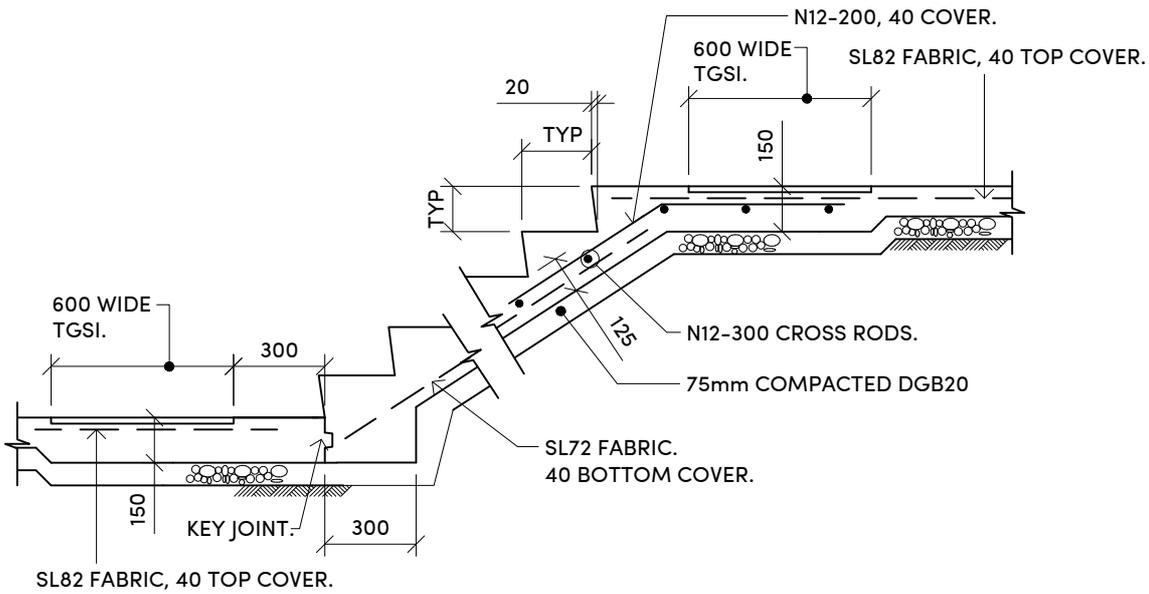
DESIGN INTENT ONLY

DRAWING TITLE: TYPICAL FOOTPATH SECTION

UEDM REF: -



(CONCRETE)

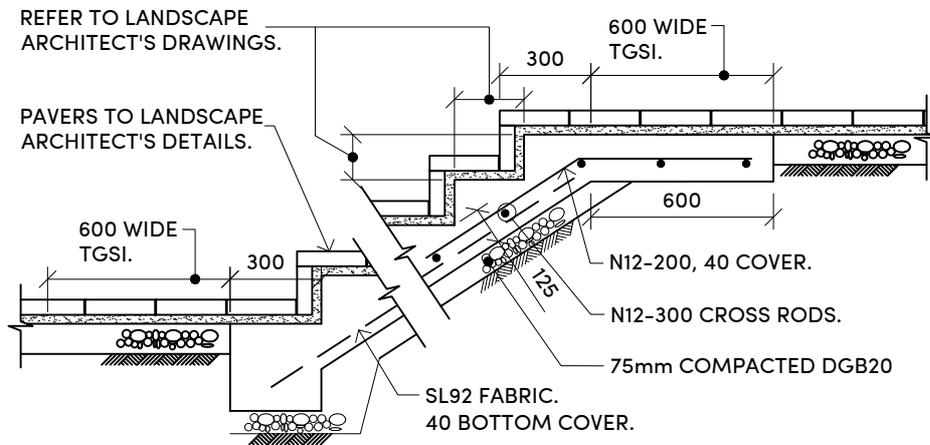


(TYPICAL)

NOTE:
PROVIDE HANDRAILS AND TGSi AS PER UEDM.

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

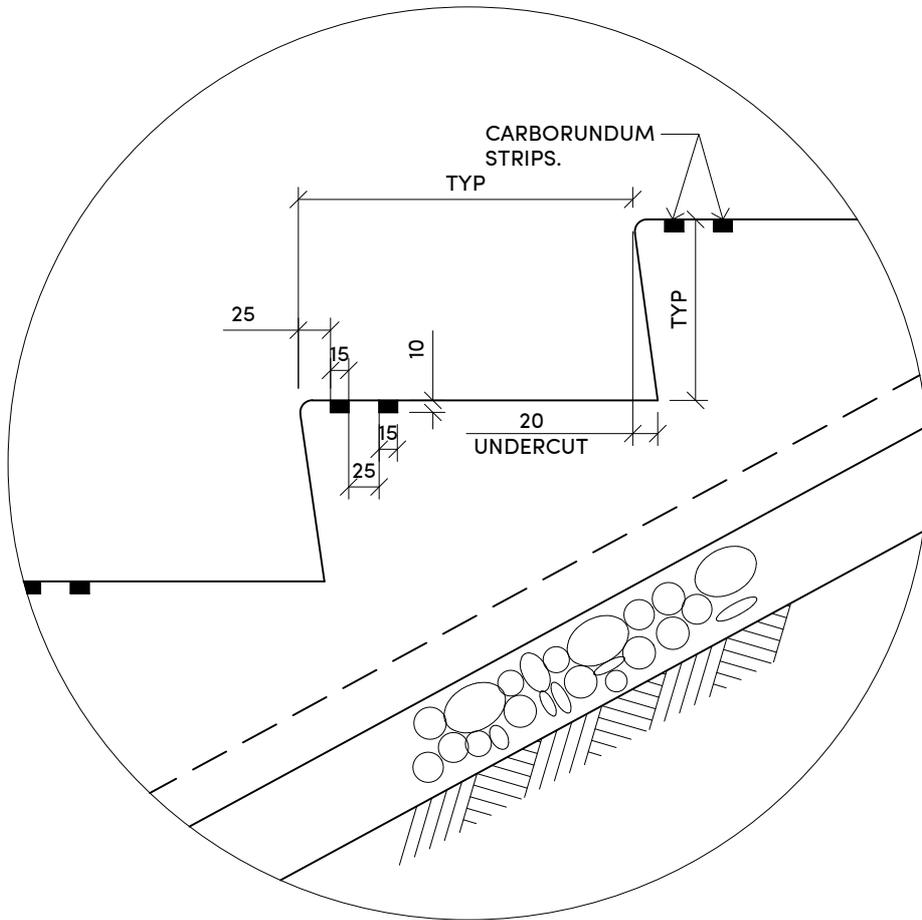
DRAWING No: P012	REVISION: REV.1, June 2018	DESIGN INTENT ONLY
DRAWING TITLE: CONCRETE STAIR		UEDM REF: P6b



NOTE:
 PROVIDE HANDRAILS AND TGSI AS PER UEDM.

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

DRAWING No: P013	REVISION: REV.1, June 2018	DESIGN INTENT ONLY
DRAWING TITLE: PAVERS ON CONCRETE STAIR		UEDM REF: P6a



FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

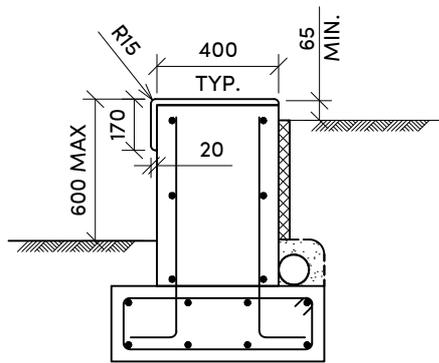
DRAWING No: P014

REVISION: REV.1, June 2018

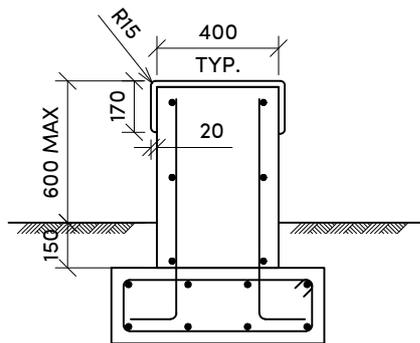
DESIGN INTENT ONLY

DRAWING TITLE: STAIR TREAD NOSING DETAIL

UEDM REF: P6b



(RETAINING WALL)



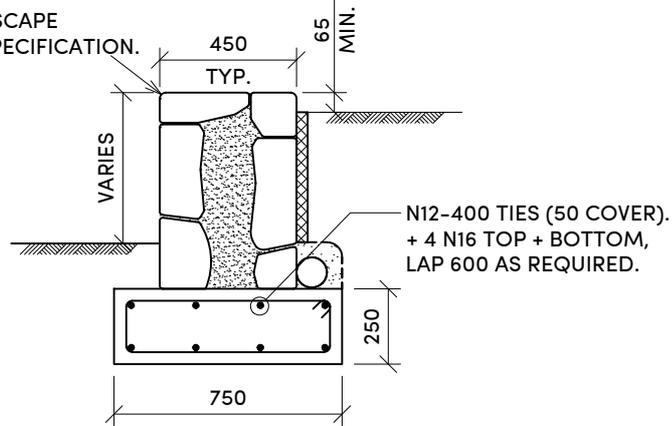
(FREE STANDING WALL)

NOTE:
CONCRETE FINISH: CLASS 1 - AS PER UEDM.

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

DRAWING No: W002	REVISION: REV.1, June 2018	DESIGN INTENT ONLY
DRAWING TITLE: SEATING WALL - IN-SITU CONCRETE FREE STANDING AND RETAINING		UEDM REF: P5

ROCK TO LANDSCAPE
ARCHITECT'S SPECIFICATION.



ENGINEER TO CONFIRM FOOTING
REINFORCEMENT.

NOTE:
FOOTING SIZE BASED ON MAXIMUM WALL
HEIGHT OF 600mm.

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

DRAWING No: W003

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

DRAWING TITLE: SEATING WALL (STONE RETAINING)

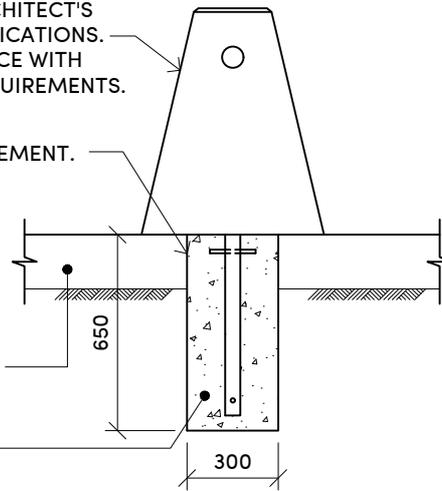
UEDM REF: P20

'FRUSTUM BOLLARD'.
REFER LANDSCAPE ARCHITECT'S
DRAWINGS FOR SPECIFICATIONS.
INSTALL IN ACCORDANCE WITH
MANUFACTURER'S REQUIREMENTS.

SAWCUT EXISTING PAVEMENT.

EXISTING PAVEMENT.

MASS CONCRETE
FOOTING.



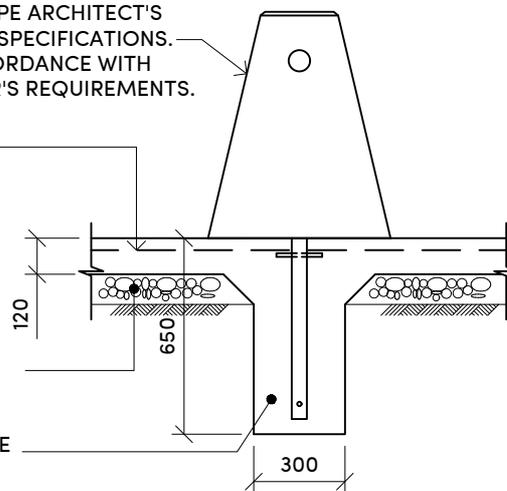
IN ASPHALTIC CONCRETE PAVEMENT
SCALE 1:20

'FRUSTUM BOLLARD'.
REFER LANDSCAPE ARCHITECT'S
DRAWINGS FOR SPECIFICATIONS.
INSTALL IN ACCORDANCE WITH
MANUFACTURER'S REQUIREMENTS.

SL72 FABRIC,
40 TOP COVER.

BASECOURSE AS
NOTED.

MASS CONCRETE
FOOTING.



IN CONCRETE PAVEMENT
SCALE 1:20

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

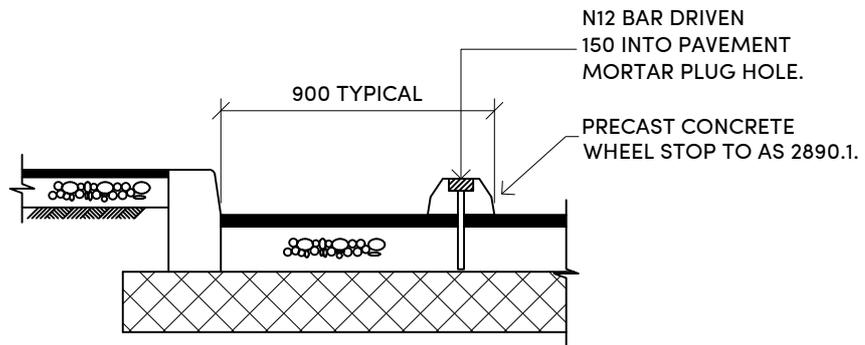
DRAWING No: B001

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

DRAWING TITLE: SOPA BOLLARD

UEDM REF: SF21



FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

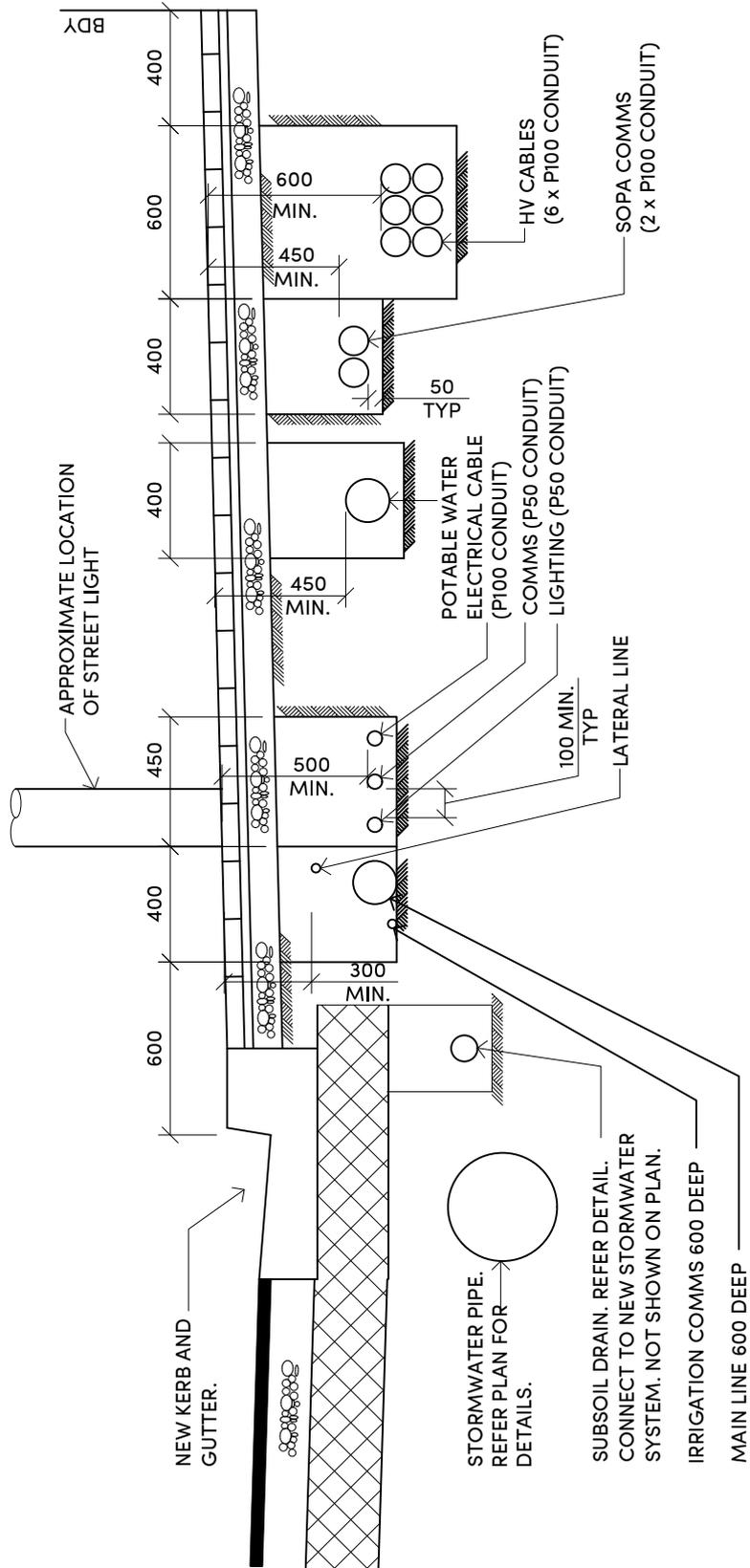
DRAWING No: CP001

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

DRAWING TITLE: WHEEL STOP (WS)

UEDM REF: -



FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

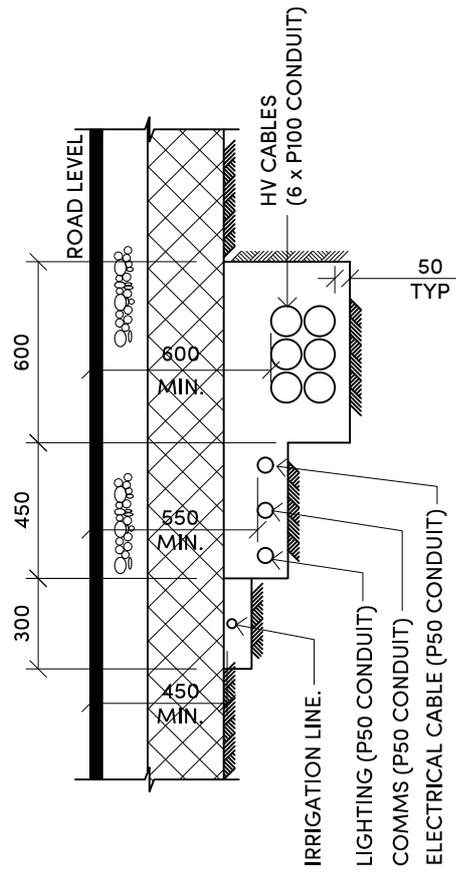
DRAWING No: SV001

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

DRAWING TITLE: TYPICAL SERVICE TRENCH LAYOUT

UEDM REF: -



FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

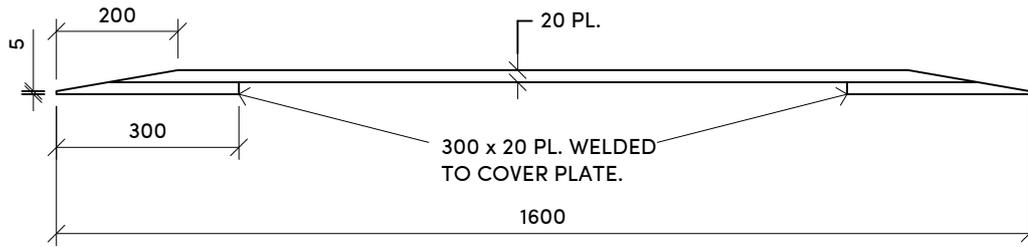
DRAWING No: SV002

REVISION: REV.1, June 2018

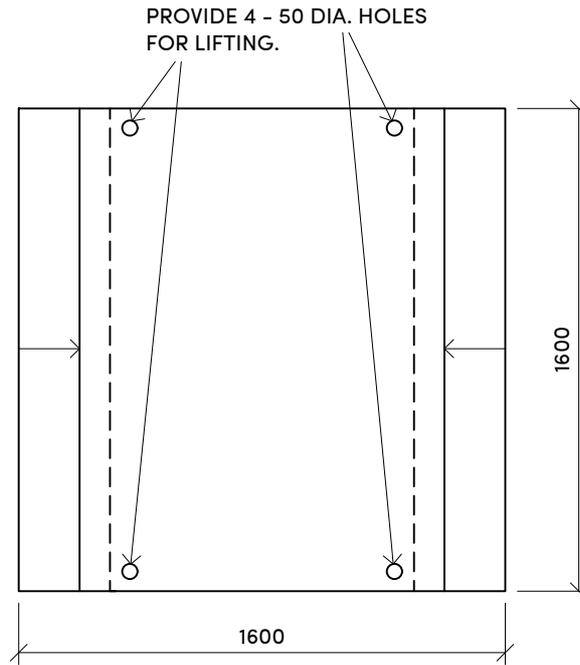
DESIGN INTENT ONLY

DRAWING TITLE: TYPICAL ROAD CROSSING SERVICE TRENCH

UEDM REF: -

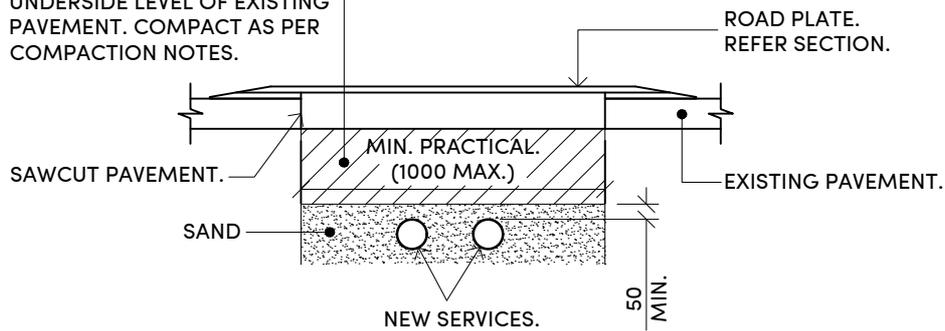


SECTION
SCALE 1:10



PLAN
SCALE 1:20

BACK FILL WITH GENERAL FILL TO
UNDERSIDE LEVEL OF EXISTING
PAVEMENT. COMPACT AS PER
COMPACTION NOTES.



FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

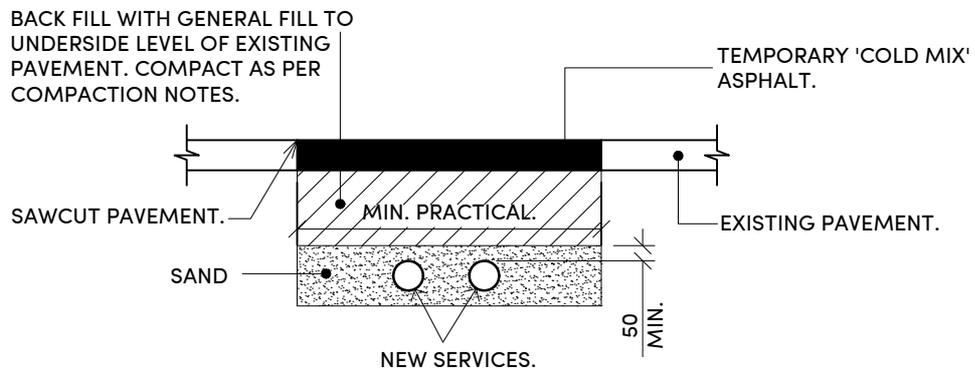
DRAWING No: SV003

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

DRAWING TITLE: TRENCH REINSTATEMENT -TEMPORARY
(ROAD PLATE)

UEDM REF: -



FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

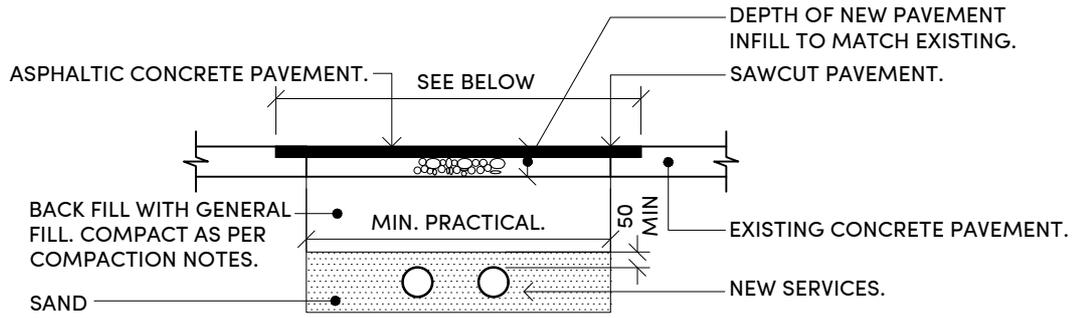
DRAWING No: SV004

REVISION: REV.1, June 2018

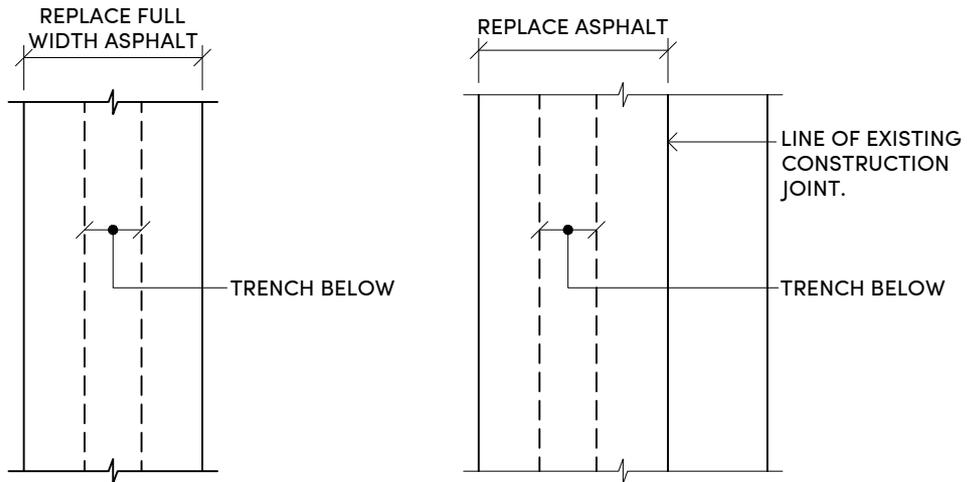
DESIGN INTENT ONLY

DRAWING TITLE: TRENCH REINSTATEMENT -TEMPORARY
(COLD MIX ASPHALT)

UEDM REF: -

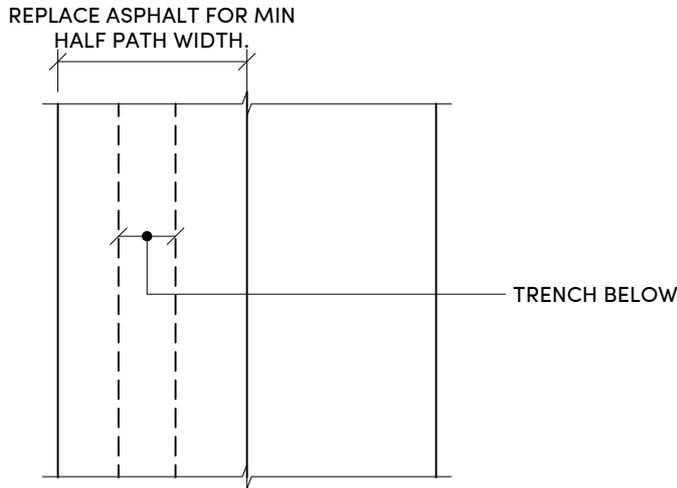


TYPICAL SECTION



PATH \leq 1.5m WIDE

ROADWAYS



PATHS $>$ 1.5m WIDE

TYPICAL PLANS

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

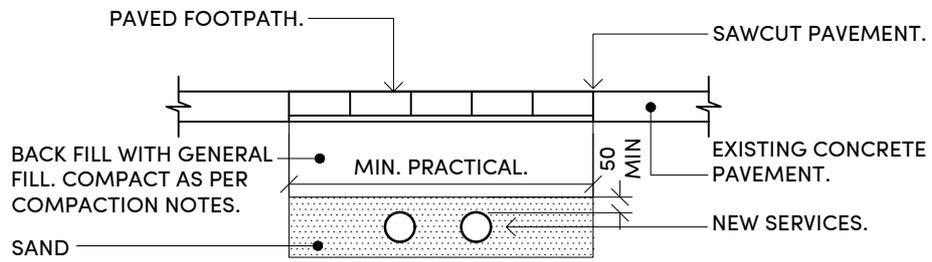
DRAWING No: SV005

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

DRAWING TITLE: TRENCH REINSTATEMENT (ASPHALT PAVEMENT)

UEDM REF: -



FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

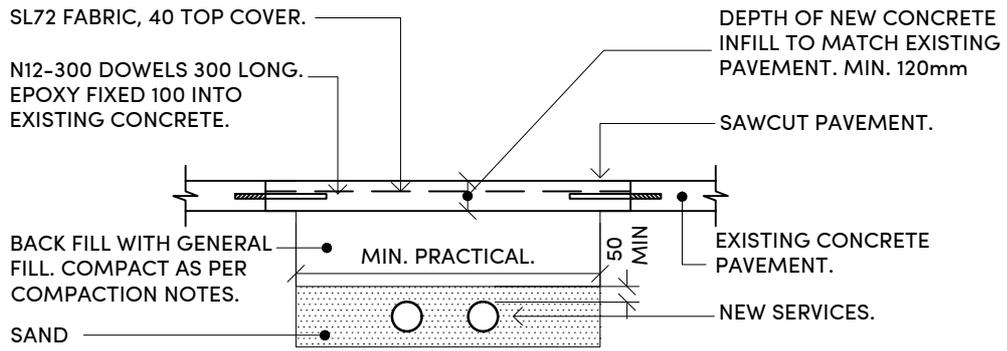
DRAWING No: SV006

REVISION: REV.1, June 2018

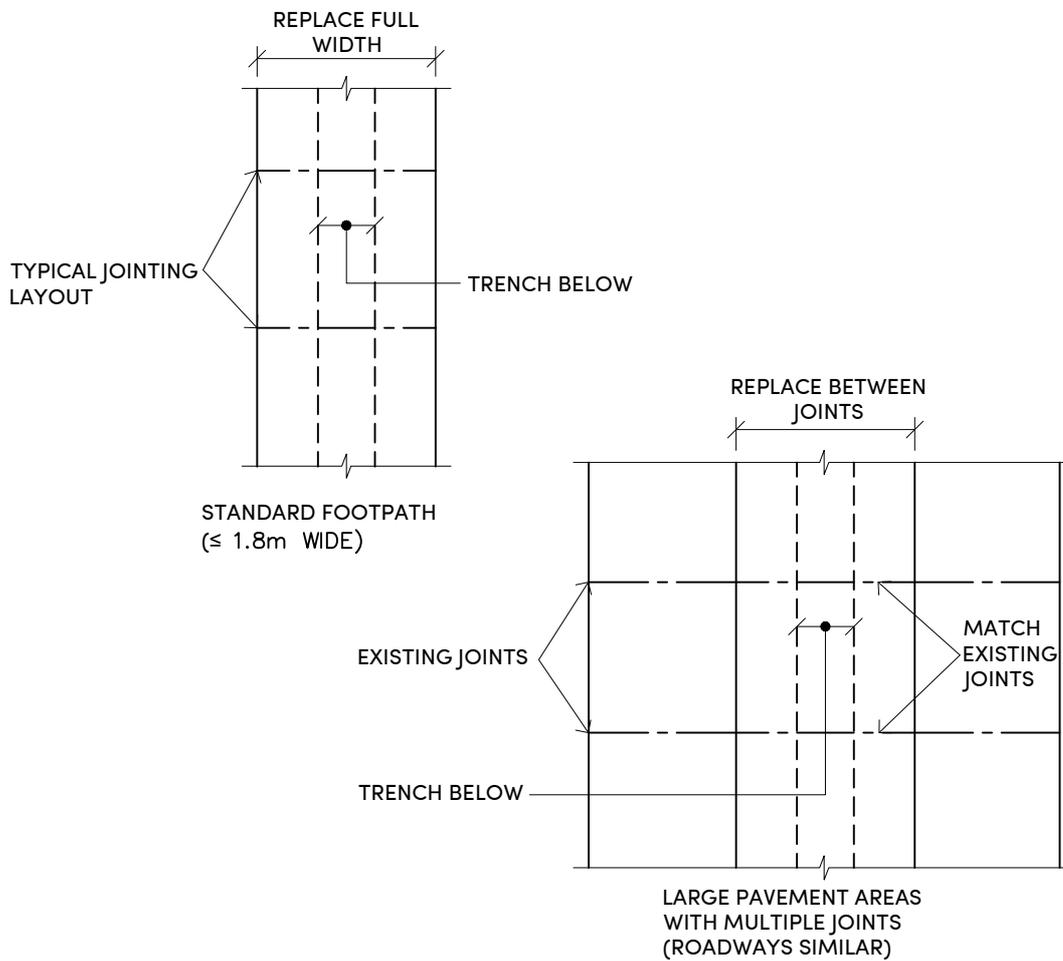
DESIGN INTENT ONLY

DRAWING TITLE: TRENCH REINSTATEMENT (PAVED AREAS)

UEDM REF: -



TYPICAL SECTION



TYPICAL PLANS

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

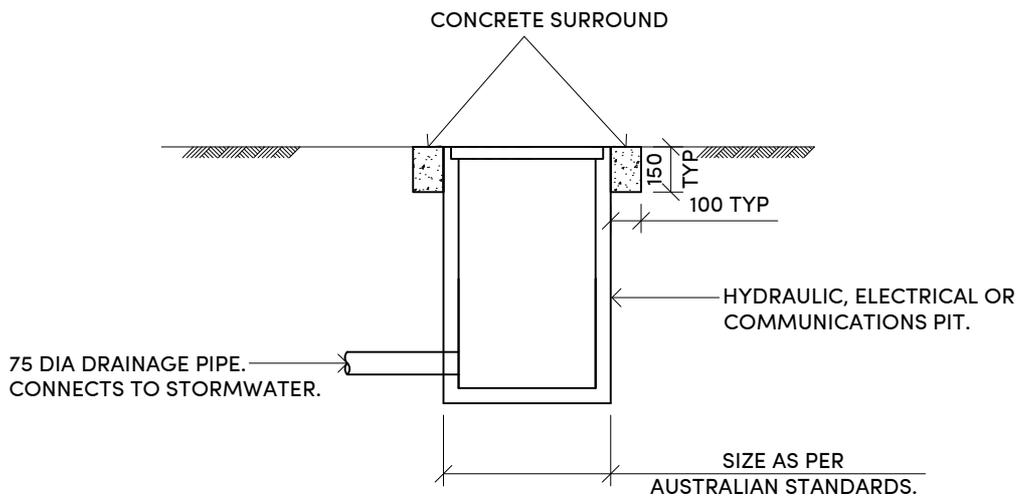
DRAWING No: SV007

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

DRAWING TITLE: TRENCH REINSTATEMENT
(CONCRETE PAVEMENT)

UEDM REF: -



FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

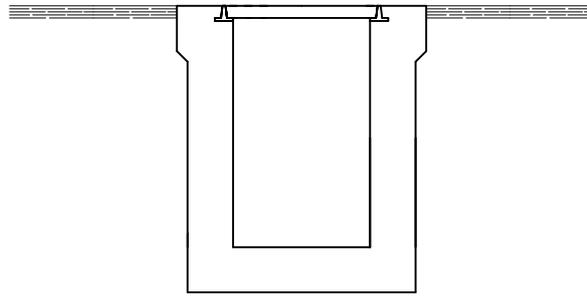
DRAWING No: SV008

REVISION: REV.1, June 2018

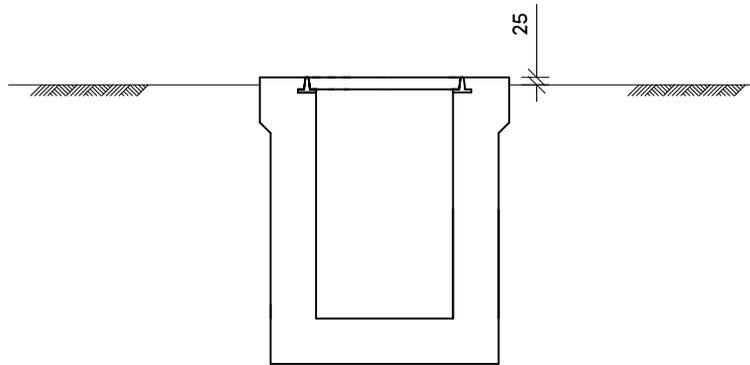
DESIGN INTENT ONLY

DRAWING TITLE: SERVICES PIT

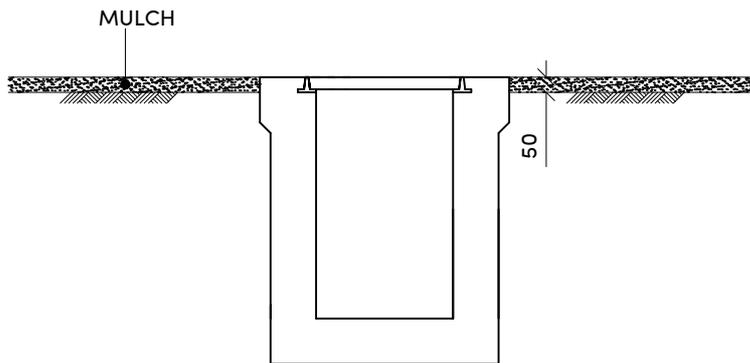
UEDM REF: -



PATH/ROAD



GRASS AREAS



MULCHED AREA

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

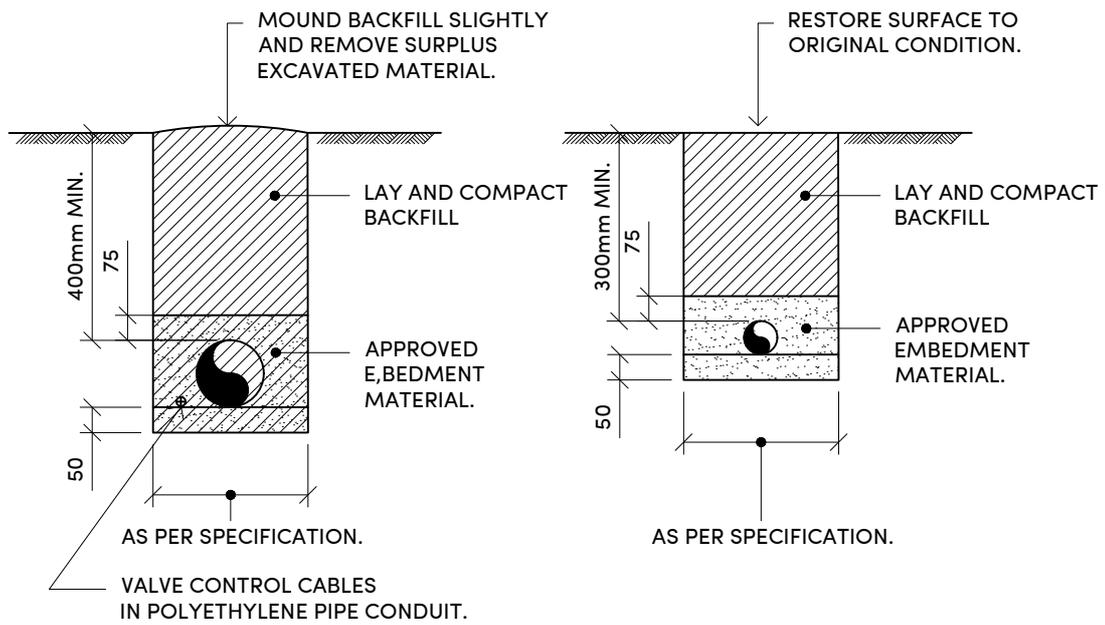
DRAWING No: SV009

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

DRAWING TITLE: FINISHED LEVEL OF PITS

UEDM REF: -



MAIN LINES

LATERAL LINES

TYPICAL DETAILS

SCALE - NTS

NOTES:

1. TRENCHING, PIPELAYING AND BACKFILLING FOR PE PIPING MUST COMPLY WITH THE REQUIREMENTS OF AS 2032.
2. WHERE MAINLINE AND LATERAL LINES ARE INSTALLED IN THE SAME TRENCH, THE LATERAL LINE SHALL BE INSTALLED WITH THE SAME SOIL COVER AS THE MAINLINE PIPE AND THE PIPES MUST BE 50mm APART.

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

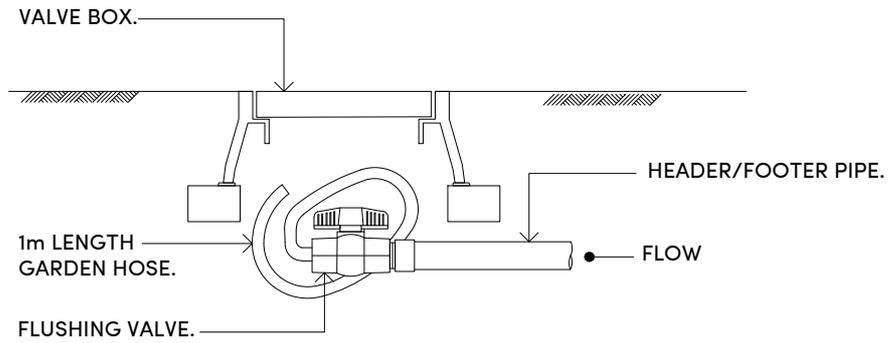
DRAWING No: IR001

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

DRAWING TITLE: IRRIGATION TRENCH

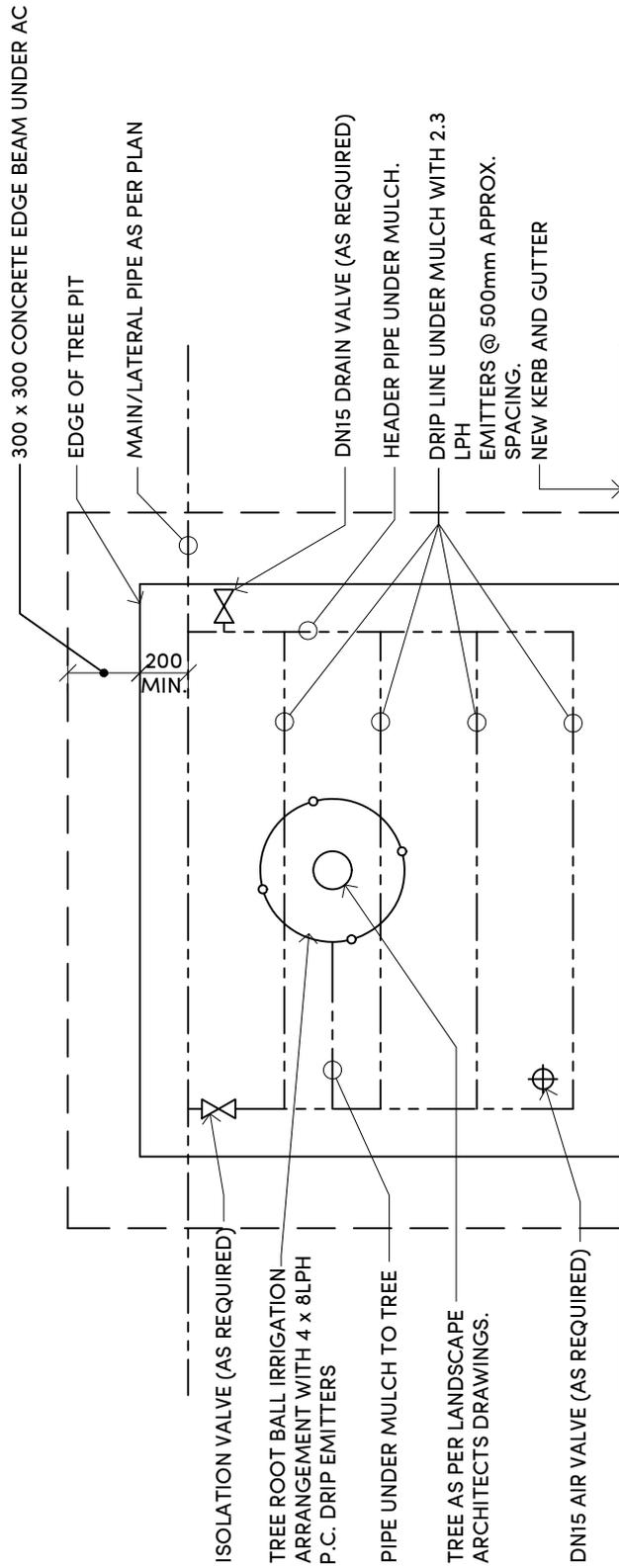
UEDM REF: -



TYPICAL INSTALLATION DETAIL
 (SHOWN 'FV' ON PLAN)
 SCALE - NTS

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

DRAWING No: IR002	REVISION: REV.1, June 2018	DESIGN INTENT ONLY
DRAWING TITLE: IRRIGATION FLUSHING VALVE		UEDM REF: -



FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

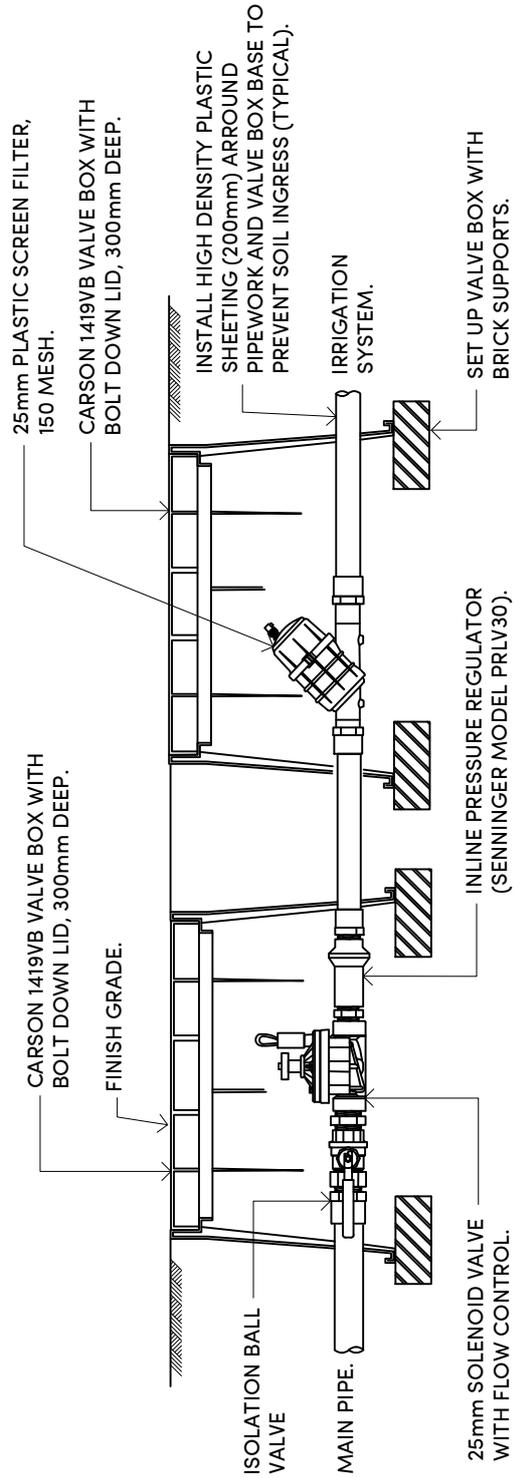
DRAWING No: IR003

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

DRAWING TITLE: IRRIGATION DETAIL AT TREE PIT

UEDM REF: -



TYPICAL INSTALLATION DETAIL
(SHOWN PV ON PLAN)
 SCALE - INTS

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

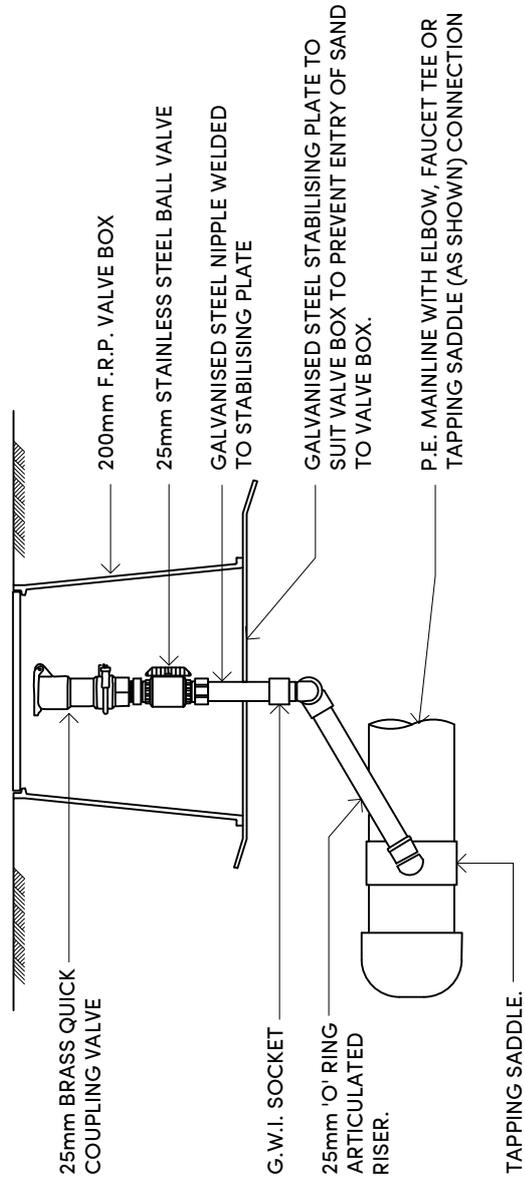
DRAWING No: IR004

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

DRAWING TITLE: IRRIGATION PRESSURE CONTROL VALVE

UEDM REF: -



(SHOWN 'O' ON PLAN)
SCALE - NTS

FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

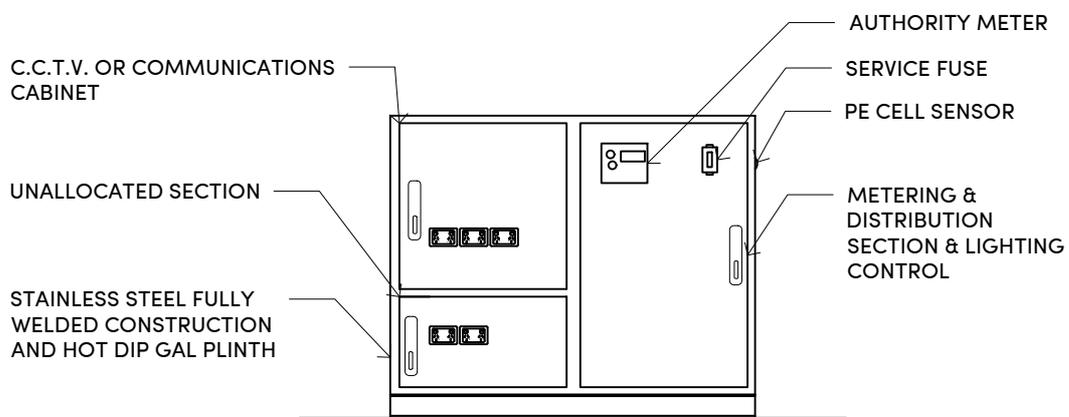
DRAWING No: IR005

REVISION: REV.1, June 2018

DESIGN INTENT ONLY

DRAWING TITLE: IRRIGATION QUICK COUPLE VALVE

UEDM REF: -



FOR MATERIALS AND DESIGN SPECIFICATION REFER TO UEDM & IECM SPECIFICATIONS.

DRAWING No: E001	REVISION: REV.1, June 2018	DESIGN INTENT ONLY
DRAWING TITLE: SWITCHBOARD LAYOUT		UEDM REF: -

APPENDICES

Appendix A: CADD Procedures Manual

Sydney Olympic Park Authority Policy

Policy Name	CADD Procedures Manual
Policy No.	POL02/12
Department File No.	F12/979
Business Unit	Business Support
Officer Responsible	Senior Manager, Spatial Information Services
Approving Officer	Executive Director, Business Support
Date of Approval	

Version	Review	Date	Approved By
4		28 October 2009	
Reviewed		November 2012	
4.1	Reviewed by CADD Manager	04 February 2014	GMCC
	Reviewed by CADD Manager	08 January 2014	
	Reviewed by CADD Manager	12 January 2016	
4.2	Reviewed by SIS Manager	13 February 2017	EDC
4.3	Reviewed by SIS Manager	22 June 2018	ED, Business Support

**Sydney Olympic Park Authority
CADD Procedures Manual**

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CADD PROCEDURES MANUAL

1. Introduction

1.1 Purpose

The purpose of this Manual is to:

- define the drawing standards and conventions used in CADD drawings for the Sydney Olympic Park Authority;
- assist in the development of a single, cohesive digital CADD data model of all design and drawing documentation;
- provide CADD procedures for each project to maintain the quality and integrity of CADD data models throughout their life; and
- ensure that a controlled environment exists to maintain security, accuracy, traceability and retrieval of all project design data.

1.2 Definitions

CADD is an acronym for Computer Aided Design and Documentation.
SIS Manager refers to the SOPA Spatial Information Services Manager

1.3 Scope

This Manual applies to all CADD drawings utilised in the planning, design and construction of works for which the Sydney Olympic Park Authority is responsible.

All design, including shop drawings, shall be carried out utilising CADD packages. All work-as-executed or as-built drawings shall be produced utilising CADD packages.

This Manual applies to all agents, developers, contractors and consultants creating such documentation either directly or indirectly for the SOPA.

1.4 Copyright

This document remains the property of the Sydney Olympic Park Authority (SOPA). All rights are reserved under international copyright law. Its use and distribution are restricted to those persons issued with controlled copies.

1.5 Background

As there can be thousands of drawings in many design and construction packages, produced by various consultants, on many CADD systems, for different agents and project managers, a controlled environment is required to maintain security, accuracy, traceability, and retrieval of the design and work-as-executed data for Sydney Olympic Park projects. The potential problems resulting from this complexity can be minimised by having one CADD management centre where the latest information resides and can be retrieved.

1.6 Imperative Case

The imperative case, (eg **Do** this, **Do** that), refers to all agents, developers, contractors or consultants providing CADD and other information to SOPA. “Shall” will be interpreted as “Must”.

2. CADD PROTOCOLS

2.1 Coordinate System

2.1.1 Map Grid of Australia

Ensure features are located on the Map Grid of Australia (MGA) coordinate system with level information on The Australian Height Datum (AHD) unless otherwise specified by SOPA.

2.2 File Formats

SOPA uses Bentley Microstation Version 8i as its primary CADD platform. As Microstation V8i can natively read either Microstation(.DGN) or Autocad(.DWG) CADD formats, either of these file formats are acceptable delivery formats to SOPA. No other CADD file formats will be accepted unless SOPA have provided previous written approval.

Carry out any conversion necessary to files developed in other formats and applications to ensure that Microstation .DGN or Autocad .DWG files are complete. Ensure all converted display files reference the required converted working files. Locate all working files in the same directory as the display file. Do not include path information in the reference. Resupply data in the correct format if variations are found between supplied hardcopy and electronic files.

2.3 Drawing Information

Information on the display (main) CADD file (drawing) should contain the following details:

- (a) Sheet Border
- (b) Drawing specific grids
- (c) Drawing Number and Titles
- (d) Revisions, (A-ZZ) including sub-categories such as “Detail Design”, “For Construction” & “As Built”
- (e) Revision Clouds
- (f) North Point, Legend, Scale and Grid indicators as appropriate and
- (g) References to Survey Datum and Grids where appropriate.

2.4 Level Structure

CADD information must rigorously conform to a precise and consistent level/layering structure.

The level/layering structure designates the separation of drawing elements for each working file. The level/layering structure philosophy shown in Appendix A has been developed from several industry, Australian and International standard level/layering structures.

While existing level/layering structures used by individual Companies may be acceptable, all proposed level/layering structures must be presented to SOPA for approval before proceeding with documentation.

Sample level/layering structures such as that shown in **Appendix A** may be used to separate major drawing elements where no pre-existing level/layering structure is in place.

The responsibility for ensuring information is placed on correct levels/layers lies solely with the consultant/contractor. It is of the utmost importance that information is correctly placed on the assigned levels/layers so that data can be transferred to other systems as required. Initiate and/or practice suitable quality management procedures to ensure that the supplied data satisfies these level/layer requirements.

Correct and reissue data without cost to SOPA if it is found that supplied data does not conform to requirements.

2.5 CADD Related Deliverables

Provide deliverables as nominated by SOPA.

Unless nominated elsewhere, the deliverables shall be provided to SOPA or SOPA's agents during the course of a project at Key Stages including:

- The end of Schematic Design
- At Formalisation of Contract
- At significant change to design during construction; and particularly
- At the end of construction incorporating all "As Built" modifications and survey.

The deliverables shall include:

1. Microstation or Autocad CADD files of all drawings prepared for SOPA in the designated level structure
2. The Font Library(ies) used for CADD file production
3. The Linestyle Library(ies) used for CADD file production
4. Any additional system support files that would be required to accurately recreate the drawing at another Site
5. An A3 plot of each drawing
6. An Adobe Acrobat PDF file of each Drawing
7. Hardcopy of the 'Incremental Drawing Register' detailing drawings transferred to the SOPA (see details following)
8. Electronic copy of the above 'Incremental Drawing Register' detailing drawings transferred to SOPA. This file must be provided in either

Comma Delimited ASCII, Microsoft Excel or Microsoft Access Formats and must include the following fields:

Field 1: Drawing Number eg. HSP001

Description: Full Drawing Number. Should not include and spaces, commas, back-slashes etc.

Field 2: Current Revision Letter eg. A

Description: Current revision letter for above Drawing Number.

Field 3: Drawing Status eg. X

A single character as follows:- 'A'-(Development Application) 'B'-(Brief Development), 'D'-(Detail Design) , 'K'(For-Construction), 'P'-(Concept Design), 'X'-(Work-As-Executed).

Field 4: Main CADD Filename eg. HSP001.DGN

Description: Full name of CADD file. This should include the '.DGN', '.DWG' etc.

Field 5: Drawing Title eg. BRIDGE OVER HASLAM'S CREEK

Description: Should be as descriptive as possible.

Field 6: Date OF drawing Revision eg. 26/6/02

Description: Date should be in the format dd/mm/yy.

Field 7: Scale(s) of Drawing eg. 1:500(|1:20|1:5)

Description: Scale should be in the format x:xxxx delineated in the case of more than one scale per drawing file by the vertical bar character (|).

Field 8: The security classification of the Drawing.

Description: Either "R" for Restricted or "U" for Unrestricted.

Use media and/or means acceptable to SOPA for data exchange.

Acceptable media includes :- CD-R or DVD disks formatted to suit IBM compatible PC computers.

:- USB Drives

The following information should be provided with delivered media:

1. Job Description
2. Name of Company Providing Data
3. Date Prepared and
4. Number in Set(if applicable)

Files may be compressed using self-extracting software acceptable to SOPA.

3. BACK-UP OF DATA

All consultants & contractors shall ensure incremental back-up electronic design files daily, and full back-up weekly.

Copies of weekly back-up tapes /disks shall be stored at a secure site remote from the CADD workstation(s).

4. DRAWING STANDARDS

Define the drawing standards to be used before commencement of each project. Unless otherwise specifically directed, all Drawing Standards should comply with the current AS-1100 series standard.

5. SECURITY

5.1 General Requirement

All agents, consultants and contractors involved in the design and documentation process must consider & manage the security risk arising from the distribution of drawings in both paper and electronic formats.

5.2 Control Objectives

The controls shall ensure:

- restricted access of information to those who need the information
- the maintenance of records of distribution of restricted CADD files and drawings
- the retrieval and destruction of surplus and used copies of the information

5.3 Classification of CADD Files

Classify, in consultation with SOPA, each CADD file as either containing "PLANNING-IN-CONFIDENCE" or "SOPA STAFF" information as defined in clauses 5.3.1 or 5.3.2.

5.3.1 PLANNING-IN-CONFIDENCE

Information in this category is data to be made available to nominated representative only. Information must not be removed from SOPA premises without authorisation from the owner.

5.3.2 SOPA STAFF

SOPA STAFF is the default classification used within SOPA. The data owner will be the Manager of the relevant Section. Information must not be taken offsite or distributed without the permission of the data owner or their delegated representative.

5.4 Controls

5.4.1 Access Rights

Establish and maintain a register of all persons allowed access to the electronic files and drawings created from "Restricted" files for the project. Restrict access to those persons.

5.4.2 File Register

Establish and maintain a registration system producing or using electronic files for the project. Register electronic files held, received and issued, the revision, the security status, the dates of receipts and issues and the names of the senders and recipients.

5.4.3 Distribution & Retrieval

Implement procedures to ensure:

- Control of the distribution of, and access to, all copies (prints, sepias, etc.) of "Restricted" files and drawings created from "Restricted" files;
- (ii) The retrieval and destruction of surplus and used copies of such files & drawings;
- (iii) The removal and separate destruction of title blocks from such drawings; and
- (iv) "Restricted" notation on such files and drawings where not prejudicial to security.

6. ACKNOWLEDGMENTS

The first edition of this Manual was produced by Peter Lean, John Maher & Pat Belcastro. This second edition was fully revised in consultation with project teams by Robert Hosking and Alan Hill of the Olympic Co-ordination Authority. All following editions have been revised by Alan Hill.

Suggestions for improvements, or advice of errors, are welcomed and should be made to the SOPA Manager, Spatial Information Services, Alan Hill, on 9714 7875.

APPENDIX A

Level Structure

Appendix A

Level Structure

Category	Table Name
General Files	
Display & Border Grids	DIS
Site & Infrastructure	
Landscape	SIT
Civil	SIT
Levels and Survey	SIT
Architecture, Interiors & Facilities Management	
Plan	APL
Elevation & Section	AEL
Electrical	
Building Management System	EPL
Security	
Infrastructure	EIN
Telecommunications & Information Technology	
Fire Protection	
Plan	FPL
Hydraulics	
Plan	HPL
Structural	
Plan	SPL

**DISPLAY & BORDER****DIS**

GROUP	DESCRIPTION	LAYER NAME	LV	CELL	AA	LC	TX	WT	LS	CO
BOUNDARIES	Sheet Extents	D-SHEET-EXTENTS	1							
			2							
			3							
			4							
SHEET FRAME	Main Sheet Frames	D-SHEET-FRAMES	5							
	Main Sheet Frame Labels	D-SHEET-LABELS	6							
	Sub-sheet divisions (eg. detail borders)	D-SHEET-DIVISIONS	7							
			8							
			9							
SHEET TITLES	SOPA Title	D-SOPA-TITLE	10							
	Consultant titles	D-CONSULT-TITLE	11							
			12							
			13							
			14							
			15							
			16							
			17							
			18							
SCALES	1:1 Scale Indicator	D-SCALE_1-1	20							
	1:2 Scale Indicator	D-SCALE_1-2	21							
	1:5 Scale Indicator	D-SCALE_1-5	22							
	1:10 Scale Indicator	D-SCALE_1-10	23							
	1:20 Scale Indicator	D-SCALE_1-20	24							
	1:50 Scale Indicator	D-SCALE_1-50	25							
	1:100 Scale Indicator	D-SCALE_1-100	26							
	1:200 Scale Indicator	D-SCALE_1-200	27							
	1:500 Scale Indicator	D-SCALE_1-500	28							
	1:1000 Scale Indicator	D-SCALE_1-1000	29							
NORTH POINT	North Point	D-NORTH-POINT	30							
			31							
			32							
			33							
			34							
			35							
			36							
			37							
			38							
			39							
LEGENDS	Site Plan	D-LEG-SITE-PLAN	40							
	Floor Plan	D-LEG-FLOOR-PLAN	41							
	Elevation	D-LEG-ELEVATION	42							
	Section	D-LEG-SECTION	43							
	Fitout	D-LEG-FITOUT	44							
			45							
		46								
		47								
		48								
		49								
CLOUDS		D-CLOUDS	50							
			51							
			52							
			53							
			54							
DIMENSIONS & TEXT			55							
	TEXT	D-TEXT	56							
			57							
	Revisions (To Drawing)	D-REVISIONS	58							
		59								
GRIDS	Horizontal	D-GRID-HOR	60							
	Vertical	D-GRID-VER	61							
	Tags	D-GRID-TAGS	62							
NON-PRINTING	FILE INFORMATION & REVISIONS TO DISPLAY FILE	D-NP	63							



SITE

SIT

GROUP	DESCRIPTION	LAYER NAME	LV	CELL	AA	LS	TX	WT	LC	CO
BOUNDARIES	DRAWING BOUNDARIES	C-SHBD-PLOT	1							
	BUILDING FOOTPRINTS & STRUCTURES	C-BLDG	2							
Contract Information, including site shed area, access, staging, & available site area.										
	CONTRACT INFORMATION	A-SITE-CONT	3							
Landscape Information										
PLANTING	TREES (EXIST, NEW, TO-BE-REMOVED)	L-PLNT-TREE	4							
	GROUNDS COVERS & VINES	L-PLNT-GRND	5							
	LANDSCAPING BEDS & PLANTING EDGES	L-PLNT-BEDS	6							
	LAWN AREAS & SPORTING SURFACES	L-PLNT-TURF	7							
	SOILS, PLANTING MEDIA, MULCHES, TREATMENTS	L-PLNT-SOIL	8							
IRRIGATION	IRRIGATION SPRINKLERS & EQUIPMENT	L-IRRG-SPKL	9							
	IRRIGATION PIPING	L-IRRG-PIPE	10							
	SUBSOIL DRAINAGE	L-IRRG-DRAN	11							
SITE IMPROVEMENTS	FENCING	L-SITE-FENC	12							
	WALLS	L-SITE-WALL	13							
	PAVEMENTS, RAMPS, STAIRS & STEPS	L-SITE-WALK	14							
	WATER FEATURES	L-SITE-WATR	15							
	SIGNAGE	L-SITE-SIGN	16							
	SITE FURNITURE & OTHER ELEMENTS	L-SITE-FURN	17							
MISCELLANEOUS	STOCKPILES & EROSION CONTROL	C-EROS	18							
			19							
Civil Information										
SERVICES	STORMWATER ABOVE GROUND	C-STRM	20							
	STORMWATER UNDERGROUND	C-STRM-UNDR	21							
	ELECTRICAL ABOVE GROUND	C-ECTR	22							
	ELECTRICAL UNDERGROUND	C-ECTR-UNDR	23							
	EXTERNAL LIGHTING ABOVE GROUND	C-COMM	24							
	EXTERNAL LIGHTING BELOW GROUND	C-COMM-UNDR	25							
	COMMUNICATIONS ABOVE GROUND	C-COMM	26							
	COMMUNICATIONS BELOW GROUND	C-COMM-UNDR	27							
	POTABLE WATER ABOVE GROUND	C-WATR	28							
	POTABLE WATER BELOW GROUND	C-WATR-UNDR	29							
	RECYCLE WATER ABOVE GROUND	C-RECY	30							
	RECYCLE WATER BELOW GROUND	C-RECY-UNDR	31							
	FIRE SERVICE ABOVE GROUND	C-FIRE	32							
	FIRE SERVICE BELOW GROUND	C-FIRE-UNDR	33							
	SEWER ABOVE GROUND	C-SSWR	34							
	SEWER BELOW GROUND	C-SSWR-UNDR	35							
	OIL	C-OIL	36							
	GAS	C-NGAS	37							
	LEACHATE	C-LEACHATE	38							
				39						
ROADS & RAIL	ROADS & PARKING LOTS, KERBING & GUTTERS	C-ROAD	40							
	CENTRE LINES	C-ROAD-CNTR	41							
	RAIL	C-RAIL	42							
				43						
				44						
Level & Survey Information										
LEVELS	ORIGINAL CONTOURS & SPOT LEVELS	C-TOPO-EXST	45							
	PROPOSED/AS EXECUTED CONTOURS (MAJOR)	C-TOPO-PROP-MAJR	46							
	PROPOSED/AS EXECUTED CONTOURS (MINOR)	C-TOPO-PROP-MINR	47							
	PROPOSED/AS EXECUTED SPOT LEVELS & SYMBOLS	C-TOPO-SPOT	48							
	BANKS, BATTER, RETAINING WALLS	C-TOPO-BATT	49							
CADASTRAL	SITE BOUNDARY	C-PROP-EXNT	50							
	EASEMENTS, R-o-W, SETBACK LINES	C-PROP-ESMT	51							
MISCELLANEOUS	BENCH MARKS, STATIONS & CONTROLS	C-PROP-CONS	52							
	SHOT CODE & NUMBER	C-PROP-SHOT	53							
	BORE HOLES	C-BORE	54							
Drawing Information.										
DIMENSIONS & TEXT	DIMENSION LINES & DIMENSIONS	A-DIMS-200	55							
	TEXT	A-TEXT-200	56							
	DIMENSIONS & TEXT FOR 1:500 PLOTS	A-TEXT-500	57							
	DIMENSIONS & TEXT FOR 1:1000 PLOTS	A-TEXT-1000	58							
CROSS REFS	BUILDING AND AREA NAMES & NUMBERS	A-SITE-IDEN	59							
	CROSS REFERENCE NOTES & SYMB.	A-SITE-SYMB	60							
GRIDS	GRIDS	S-GRID	61							
	GRID TAGS	S-GRID-SYMB	62							
NON-PRINTING	FILE INFORMATION AND REVISIONS	C-FILE	63							



ARCHITECTURAL PLANS APL

GROUP	DESCRIPTION	LAYER NAME	LV	CELL	AA	LS	TX	WT	LC	CO
BOUNDARIES	DRAWING BOUNDARIES	A-SHBD-PLOT	1							
	BUILDING OUTLINE	A-FLOR-OTLN	2							
	ROOM OUTLINES	A-ROOM-OTLN	3							
	SLAB EDGE, PENETRATIONS, SETDOWN	S-SLAB-EDGE	4							
Elements in Plan Section:- Elements cut by the Plan Section Line (1800mm above Finished Floor Level)										
STRUCTURE	CONCRETE ELEMENTS (IN-SITU)	A-COLS-CONC	5							
	CONCRETE ELEMENTS (PRECAST)	A-WALL-PCST	6							
	STEEL ELEMENTS	A-COLS-STEL	7							
	OTHER STRUCTURAL ELEMENTS	A-STRC	8							
	HATCHING FOR STRUCTURE	A-STRC-PATT	9							
WALLS	WALL MASONRY	A-WALL-FULL	10							
	WALL EXISTING TO REMAIN	A-WALL-EXIS	11							
	WALL EXISTING TO REMOVE	A-WALL-DEMO	12							
	WALL PARTITION	A-WALL-MOVE	13							
	WALL CAVITY LINE	A-WALL-CAVI	14							
	WALL HATCHING	A-WALL-PATT	15							
OPENINGS & GLAZING	FIRE RATING:- LC 1hr=4, 2hr=5, Smoke=6	A-WALL-RATE	16							
	DOORS	A-DOOR	17							
	WINDOWS & GLAZED WALLS	A-GLAZ	18							
	METALWORK & OTHER ELEMENTS	A-MCUT	19							
Lines seen in Plan Section:- ie Lines shown below the Plan Section line.										
FLOOR INFORMATION	EXTENTS - LEVEL & FINISH	A-FLOR-LEVL	20							
	EXTENTS - BULKHEADS OVER	A-FLOR-OVHD	21							
	STAIRS	A-FLOR-STRS	22							
	TOP OF WALLS	A-FLOR-RAIS	23							
	TILES, PAVING, FLOOR PATTERN	A-FLOR-PATT	24							
Lines seen in Reflected Ceiling:- ie. Lines shown above the Plan Section line.										
CEILING INFORMATION	EXTENTS - LEVEL & FINISH	A-CLNG-LEVL	25							
	FIXTURE WITH SERVICE	A-CLNG-FIXT	26							
	OTHER FITTINGS	A-CLNG-FITT	27							
	ACCESS PANELS	A-CLNG-ACCS	28							
	CEILING PATTERNS & HATCHING	A-CLNG-PATT	29							
Fitout, including fixtures, fittings, equipment and furniture.										
FITOUT	JOINERY	A-JOIN	30							
	JOINERY IDENTIFICATION NUMBERS	A-JOIN-IDEN	31							
	FIXTURE WITH SERVICE	A-FIXT	32							
	FIXTURE IDENTIFICATION NUMBERS	A-FIXT-IDEN	33							
	FURNITURE (FREESTANDING)	A-FURN-FREE	34							
	FURNITURE (FIXED)	A-FURN-FIXD	35							
	FURNITURE IDENTIFICATION NUMBERS	A-FURN-IDEN	36							
	EQUIPMENT (MOVEABLE)	A-EQPM-MOVE	37							
	EQUIPMENT (FIXED)	A-EQPM-FIXD	38							
EQUIPMENT IDENTIFICATION NUMBERS	A-EQPM-IDEN	39								
Area Information										
	AREA CALCULATION & BOUNDARY LINES	A-AREA	40							
	TENANCY INFORMATION - IDENTIFICATION	A-AREA-IDEN	41							
	OCCUPANT OR EMPLOYEE NAMES	A-AREA-OCCP	42							
	AREA CROSS-HATCHING	A-AREA-PATT	43							
			44							
Drawing Information.										
INFORMATION FOR OTHER SCALES	LINEWORK FOR 1:50 PLOTS	A-LINE-50	45							
	TEXT & DIMENSIONS FOR 1:50 PLOTS	A-TEXT-50	46							
	LINEWORK FOR 1:10 & 1:5 PLOTS	A-LINE-10	47							
	TEXT & DIMENSIONS FOR 1:10 & 1:5.	A-TEXT-10	48							
			49							
CROSS REFERENCING	ROOM NAMES & NUMBERS	A-FLOR-IDEN	50							
	CROSS REFERENCE NOTES & SYMB.	A-FLOR-SYMB	51							
	DOOR NUMBERS	A-DOOR-IDEN	52							
	WINDOW NUMBERS	A-GLAZ-IDEN	53							
			54							
DIMENSIONS & TEXT	DIMENSION LINES & DIMENSIONS	A-DIMS-100	55							
	TEXT FOR ALL DRAWING	A-TEXT-100	56							
	TEXT FOR FLOOR PLAN ONLY	A-TEXT-100-FLOR	57							
	TEXT FOR CEILINGS ONLY	A-TEXT-100-PCLG	58							
			59							
GRIDS	SITE GRIDS	S-GRID-SITE	60							
	STRUCTURAL GRIDS	S-GRID	61							
	GRID TAGS	S-GRID-SYMB	62							
NON-PRINTING	FILE INFORMATION & REVISIONS	A-FILE	63							



ARCHITECTURAL ELEVATION AEL

GROUP	DESCRIPTION	LAYER NAME	LV	CELL	AA	LS	TX	WT	LC	CO
BOUNDARIES	DRAWING BOUNDARIES	A-SHBD-PLOT	1							
	BUILDING OUTLINE	A-ELEV-OTLN	2							
			3							
			4							

Elements in Section:- ie. Elements cut by the Section Line.

STRUCTURE	CONCRETE ELEMENTS (IN-SITU)	A-SECT-COLS-CONC	5							
	CONCRETE ELEMENTS (PRECAST)	A-SECT-WALL-PCST	6							
	STEEL ELEMENTS	A-SECT-COLS-STEL	7							
	OTHER STRUCTURAL ELEMENTS	A-SECT-STRC	8							
	HATCHING FOR STRUCTURE	A-SECT-STRC-PATT	9							
WALLS	WALL MASONRY	A-SECT-WALL-FULL	10							
	WALL EXISTING TO REMAIN	A-SECT-WALL-EXIS	11							
	WALL EXISTING TO REMOVE	A-SECT-WALL-DEMO	12							
	WALL PARTITION	A-SECT-WALL-MOVE	13							
	WALL CAVITY LINE	A-SECT-WALL-CAVI	14							
	WALL HATCHING	A-SECT-WALL-PATT	15							
			16							
OPENINGS	DOORS	A-SECT-DOOR	17							
	WINDOWS & GLAZED WALLS	A-SECT-GLAZ	18							
GENERAL	ELEMENTS IN SECTION GENERALLY	A-SECT-MCUT	19							

Lines seen in Elevation:- ie. Lines shown in elevation or beyond the Section Line.

ELEVATION	EDGES	A-ELEV-EDGE	20								
	PATTERNS ON SURFACE	A-ELEV-PATT	21								
	DOOR	A-ELEV-DOOR	22								
	WINDOWS & GLAZED WALLS	A-ELEV-GLAZ	23								
	MISCELLANEOUS FIXTURES	A-ELEV-FIXT	24								
			25								
			26								
			27								
			28								
			29								
			30								
			31								
			32								
			33								
			34								
			35								
			36								
			37								
			38								
			39								
			40								
			41								
			42								
			43								
		44									

Drawing Information.

INFORMATION FOR OTHER SCALES	LINEWORK FOR 1:20 PLOTS	A-LINE-20	45							
	TEXT & DIMENSIONS FOR 1:20 PLOTS	A-TEXT-20	46							
	LINEWORK FOR 1:10 & 1:5 PLOTS	A-LINE-10	47							
	TEXT & DIMENSIONS FOR 1:10 & 1:5.	A-TEXT-10	48							
			49							
CROSS REFERENCING	ROOM NUMBERS & NAMES	A-FLOR-IDEN	50							
	CROSS REFERENCE NOTES & SYMB.	A-FLOR-SYMB	51							
	DOOR NUMBERS	A-DOOR-IDEN	52							
	WINDOW NUMBERS	A-GLAZ-IDEN	53							
			54							
DIMENSIONS & TEXT	DIMENSION LINES & DIMENSIONS	A-DIMS-100	55							
	TEXT	A-TEXT-100	56							
			57							
			58							
			59							
GRIDS	GRIDS - VERTICAL	S-GRID-VERT	60							
	GRIDS - HORIZONTAL (USUALLY SSL)	S-GRID-HORI	61							
	GRID TAGS	S-GRID-SYMB	62							
NON-PRINTING	FILE INFORMATION & REVISIONS	A-FILE	63							



ELECTRICAL PLAN

EPL

GROUP	DESCRIPTION	LAYER NAME	LV	CELL	AA	LC	TX	WT	LS	CO	
LIGHTING	CEILING MOUNTED LIGHTING	E-LITE-CLNG	1								
	WALL MOUNTED LIGHTING	E-LITE-WALL	2								
	EMERGENCY LIGHTING	E-LITE-EMER	3								
	EXIT LIGHTING	E-LITE-EXIT	4								
	SPORTS LIGHTING	E-LITE-SPRT	5								
	FLOOR MOUNTED LIGHTING	E-LITE-FLOR	6								
	SITE LIGHTING	E-LITE-SITE	7								
				8							
				9							
	LIGHTING CIRCUITS	E-LITE-CIRC	10								
	LIGHTING SWITCHES	E-LITE-SWCH	11								
	LIGHTING SCHEMATIC DIAGRAM	E-LITE-DIAG	12								
	LIGHTING CIRCUIT NUMBERS	E-LITE-NUMB	13								
	LUMINAIRE IDENTIFICATION & TEXT	E-LITE-IDEN	14								
POWER	POWER WALL OUTLETS	E-POWR-WALL	15								
	POWER CEILING RECEPTABLES AND DEVICES	E-POWR-CLNG	16								
	POWER PANELS	E-POWR-PANL	17								
	POWER EQUIPMENT	E-POWR-EQPM	18								
	POWER SWITCHBOARDS	E-POWR-SWBD	19								
	POWER CIRCUITS	E-POWR-CIRC	20								
	FLOOR DUCTS	E-POWR-FLDU	21								
	SKIRTING DUCTS	E-POWR-SKRT	22								
	CABLE TRAYS	E-POWR-CABL	23								
	FEEDERS	E-POWR-FEED	24								
	BUSWAYS	E-POWR-BUSW	25								
	SITE POWER	E-POWR-SITE	26								
	SCHEMATIC DIAGRAM	E-POWR-DIAG	27								
	POWER CIRCUIT NUMBERS	E-POWR-NUMB	28								
POWER IDENTIFICATION & TEXT	E-POWR-TEXT	29									
CONTROL SYSTEM	CONTROL SYSTEM DEVICES	E-CTRL-DEVC	30								
	CONTROL SYSTEM WIRING SCHEMATIC	E-CTRL-DIAG	31								
GROUND SYSTEM	GROUND CIRCUITS	E-GRND-CIRC	32								
	GROUND SYSTEM TEXT	E-GRND-IDEN	33								
	GROUND SYSTEM DIAGRAM	E-GRND-DIAG	34								
AUXILIARY SYSTEMS	LIGHTNING PROTECTION - CIRCUIT	E-LTNG-CIRC	35								
	LIGHTNING PROTECTION - TEXT	E-LTNG-IDEN	36								
	TELEPHONE & COMMUNICATION OUTLETS - CIRCUIT	E-COMM-CIRC	37								
	TELEPHONE & COMMUNICATION OUTLETS - TEXT	E-COMM-IDEN	38								
	DATA OUTLETS - CIRCUIT	E-DATA-CIRC	39								
	DATA OUTLETS - TEXT	E-DATA-IDEN	40								
	SOUND OR PA - CIRCUIT	E-SOUN-CIRC	41								
	SOUND OR PA - TEXT	E-SOUN-IDEN	42								
	TV ANTENNA SYSTEM - CIRCUIT	E-TVAN-CIRC	43								
	TV ANTENNA SYSTEM - TEXT	E-TVAN-IDEN	44								
	CCTV SYSTEM - CIRCUIT	E-CCTV-CIRC	45								
	CCTV SYSTEM - TEXT	E-CCTV-IDEN	46								
	SECURITY SYSTEM - CIRCUIT	E-SERT-CIRC	47								
	SECURITY SYSTEM - TEXT	E-SERT-IDEN	48								
CLOCK SYSTEM - CIRCUIT	E-CLOK-CIRC	49									
CLOCK SYSTEM - TEXT	E-CLOK-IDEN	50									
			51								
			52								
			53								
			54								
MISCELLANEOUS	ARCHITECTURAL ELEMENTS	E-ELEM	55								
	PLINTHS AND STRUCTURAL	E-PLIN	56								
	HATCHING	E-PATT	57								
				58							
			59								
CROSS REFERENCING	ROOM NAMES & NUMBERS	E-FLOR-IDEN	60								
	CROSS REFERENCE NOTES & SYMB.	E-FLOR-SYMB	61								
			62								
NON-PRINTING	FILE INFORMATION & REVISIONS	E-FILE	63								



ELECTRICAL INFRASTRUCTURE EIN

GROUP	DESCRIPTION	LAYER NAME	LV	CELL	AA	LC	TX	WT	LS	CO	
LIGHTING	EXTERNAL LIGHTING	E-LITE-SITE	1								
			2								
			3								
			4								
			5								
			6								
			7								
			8								
			9								
		EXTERNAL LIGHTING CIRCUITS	E-LITE-SITE-CIRC	10							
		EXTERNAL LIGHTING SWITCHES	E-LITE-SITE-SWCH	11							
		EXTERNAL LIGHTING SCHEMATIC DIAGRAM	E-LITE-SITE-DIAG	12							
		EXTERNAL LIGHTING CIRCUIT NUMBERS	E-LITE-SITE-NUMB	13							
		EXTERNAL LUMINAIRE IDENTIFICATION & TEXT	E-LITE-SITE-IDEN	14							
POWER	EXTERNAL POWER OUTLETS	E-POWR-OUTL	15								
	EXTERNAL FIXED CONNECTIONS	E-POWR-SITE-FIXD	16								
	POWER PANELS	E-POWR-SITE-PANL	17								
	POWER EQUIPMENT	E-POWR-SITE-EQPM	18								
	POWER SWITCHBOARDS	E-POWR-SITE-SWBD	19								
	POWER CIRCUITS	E-POWR-SITE-CIRC	20								
			21								
			22								
			23								
			24								
			25								
		SITE POWER - SUB MAINS	E-POWR-SITE-SUB	26							
		SCHEMATIC DIAGRAM	E-POWR-SITE-DIAG	27							
		POWER CIRCUIT NUMBERS	E-POWR-SITE-NUMB	28							
		POWER IDENTIFICATION & TEXT	E-POWR-SITE-TEXT	29							
			30								
			31								
		32									
		33									
		34									
GROUND SYSTEM	GROUND CIRCUITS	E-GRND-SITE-CIRC	35								
	GROUND SYSTEM TEXT	E-GRND-SITE-IDEN	36								
	GROUND SYSTEM DIAGRAM	E-GRND-SITE-DIAG	37								
			38								
			39								
HIGH VOLTAGE	CIRCUITING	E-HIVT-CIRC	40								
	CABLING	E-HIVT-CABL	41								
	EQUIPMENT	E-HIVT-EQPM	42								
	SCHEMATIC DIAGRAM	E-HIVT-DIAG	43								
			44								
			45								
			46								
			47								
			48								
			49								
			50								
			51								
			52								
			53								
			54								
MISCELLANEOUS	BUILDING OUTLINES	E-OTLN	55								
	PLINTHS AND STRUCTURAL	E-PLIN	56								
	HATCHING	E-PATT	57								
			58								
			59								
CROSS REFERENCING	BUILDING & AREA NAMES & NUMBERS	E-FLOR-IDEN	60								
	CROSS REFERENCE NOTES & SYMB.	E-FLOR-SYMB	61								
			62								
NON-PRINTING	FILE INFORMATION & REVISIONS	E-FILE	63								

APPENDIX A



FIRE PROTECTION PLAN FPL

GROUP	DESCRIPTION	LAYER NAME	LV	CELL	AA	LC	TX	WT	LS	CO
FIRE DETECTION	CIRCUITING	F-PROT-CIRC	1							
	DEVICES - ALARM	F-PROT-ALRM	2							
	DEVICES - SMOKE DETECTORS OR HEAT SENSOR	F-PROT-SMOK	3							
	EQUIPMENT	F-PROT-EQPM	4							
			5							
			6							
			7							
			8							
			9							
FIRE CONTROL ROOM	FIRE CONTROL PANELS	F-ROOM-PANL	10							
	SCHEMATICS	F-ROOM-SCHM	11							
	ROOM LAYOUT	F-ROOM-LAYT	12							
			13							
			14							
			15							
			16							
			17							
			18							
FIRE SPRINKLER SYSTEM	SPRINKLER HEAD LAYOUT - CEILING	F-SPRN-CLHD	20							
	SPRINKLER HEAD LAYOUT - OTHER	F-SPRN-OTHD	21							
	PIPING	F-SPRN-PIPE	22							
	SCHEMATICS	F-SPRN-SCHM	23							
			24							
BOOSTER SYSTE	BOOSTER PUMP CONTROLS	F-PUMP-CNTR	25							
	BOOSTER PUMP EQUIPMENT	F-PUMP-EQPM	26							
			27							
			28							
			29							
			30							
			31							
			32							
			33							
			34							
			35							
			36							
			37							
			38							
			39							
	INFORMATION FOR OTHER SCALES	LINEWORK FOR 1:50 PLOTS	F-LINE-50	45						
TEXT & DIMENSIONS FOR 1:50 PLOTS		F-TEXT-50	46							
LINEWORK FOR 1:10 & 1:5 PLOTS		F-LINE-10	47							
TEXT & DIMENSIONS FOR 1:10 & 1:5.		F-TEXT-10	48							
			49							
CROSS REFERENCING	ROOM NAMES & NUMBERS	F-FLOR-IDEN	50							
	CROSS REFERENCE NOTES & SYMB.	F-FLOR-SYMB	51							
			52							
			53							
			54							
DIMENSIONS & TEXT	DIMENSION LINES & DIMENSIONS	F-DIMS-100	55							
	TEXT FOR ALL DRAWING	F-TEXT-100	56							
	TEXT FOR FLOOR PLAN ONLY	F-TEXT-100-FLOR	57							
	TEXT FOR CEILINGS ONLY	F-TEXT-100-PCLG	58							
			59							
GRIDS	SITE GRIDS	S-GRID-SITE	60							
	STRUCTURAL GRIDS	S-GRID	61							
	GRID TAGS	S-GRID-SYMB	62							
NON-PRINTING	FILE INFORMATION & REVISIONS	F-FILE	63							

CADD LEVELS STRUCTURE



HYDRAULICS PLAN

HPL

GROUP	DESCRIPTION	LAYER NAME	LV	CELL	AA	LC	TX	WT	LS	CO	
SEWER & SANITARY	SANITARY PLUMBING	H-SANR-PIPE	1								
	SANITARY DRAINS	H-SANR-FLDR	2								
	SEWER RISING MAIN	H-SANR-RISR	3								
	CONDENSATE RISING MAIN	H-COND-RISR	4								
	OVERFLOW PIPES	H-SANR-OVFL	5								
	GREASE DRAINAGE	H-SANR-GRDR	6								
				7							
				8							
				9							
	VENT PIPE	H-VENT	10								
	GREASE VENT PIPE	H-VENT-GRES	11								
				12							
				13							
				14							
WATER RELATED ELEMENTS	COLD WATER - DOMESTIC	H-DOMW-PIPE-COLD	15								
	COLD WATER RISING MAIN	H-DOMW-RISR-COLD	16								
	FLUSHERETTE, CISTERN SUPPLY	H-FLSH-RISR	17								
	IRRIGATION	H-IRRI-PIPE	18								
	CHILLED WATER		19								
	HOT WATER	H-DOMW-PIPE-HOT	20								
	HOT WATER RETURN	H-DOMW-PIPE-HOT	21								
	WARM WATER	H-DOMW-PIPE-WARM	22								
			23								
			24								
FIRE PROTECTION	FIRE HYDRANTS	H-FIXT-HYDR	25								
	HOSE REELS	H-FIXT-HSRL	26								
	SPRINKLER MAINS	F-SPRN-MAIN	27								
	DIESEL EXHAUST		28								
				29							
AUTHORITIES ELEMENTS	SYDNEY WATER - WATER MAINS	H--MAIN	30								
	SYDNEY WATER - SEWER MAINS	H-SANR-MAIN	31								
	LOCAL AUTHORITY'S STORMWATER	H-STRM	32								
	UTILITY'S GAS MAINS	H-GAS	33								
				34							
STORMWATER	STORMWATER	H-STRM-PIPE	35								
	STORMWATER MAINS	H-STRM-MAIN	36								
	SUB - SOIL DRAINAGE	H-STRM-SSDR	37								
	ROOF DRAINS AND DOWNPIPES	H-STRM-RFDR	38								
				39							
GASES	GAS SUPPLY	H-GAS	40								
	GAS FLUE	H-GAS-FLUE	41								
				42							
				43							
				44							
INFORMATION FOR OTHER SCALES	LINEWORK FOR 1:50 PLOTS	H-LINE-50	45								
	TEXT & DIMENSIONS FOR 1:50 PLOTS	H-TEXT-50	46								
	LINEWORK FOR 1:10 & 1:5 PLOTS	H-LINE-10	47								
	TEXT & DIMENSIONS FOR 1:10 & 1:5.	H-TEXT-10	48								
				49							
CROSS REFERENCING	ROOM NAMES & NUMBERS	H-FLOR-IDEN	50								
	CROSS REFERENCE NOTES & SYMB.	H-FLOR-SYMB	51								
				52							
				53							
				54							
DIMENSIONS & TEXT	DIMENSION LINES & DIMENSIONS	H-DIMS-100	55								
	TEXT FOR ALL DRAWING	H-TEXT-100	56								
	TEXT FOR FLOOR PLAN ONLY	H-TEXT-100-FLOR	57								
	TEXT FOR CEILINGS ONLY	H-TEXT-100-PCLG	58								
				59							
GRIDS	SITE GRIDS	S-GRID-SITE	60								
	STRUCTURAL GRIDS	S-GRID	61								
	GRID TAGS	S-GRID-SYMB	62								
NON-PRINTING	FILE INFORMATION & REVISIONS	H-FILE	63								



STRUCTURAL PLAN

SPL

GROUP	DESCRIPTION	LAYER NAME	LV	CELL	AA	LC	TX	WT	LS	CO	
CONCRETE	EDGE OF SLAB	S-SLAB-EDGE	1							1	
	PENETRATIONS & SETDOWNS	S-SLAB-PENT	2							2	
	SLAB CONTROL JOINTS	S-SLAB-JOIN	3							3	
	FOOTINGS	S-FNDN	4							4	
	PILES & DRILLED PIERS	S-FNDN-PILE	5							5	
	COLUMNS	S-COL-CONC	6							6	
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**Appendix F: Sydney Olympic Park Water
Management and Irrigation Network –
Standard Technical Specification**

SYDNEY OLYMPIC PARK AUTHORITY
WATER MANAGEMENT & IRRIGATION NETWORK POLICY

STANDARD TECHNICAL SPECIFICATION

FOR

**SUPPLY, CONSTRUCTION AND
MAINTENANCE SERVICES**

FOR

CONSTRUCTION WORKS

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SYDNEY OLYMPIC PARK AUTHORITY

WATER MANAGEMENT & IRRIGATION NETWORK POLICY

STANDARD TECHNICAL SPECIFICATION

**FOR SUPPLY, CONSTRUCTION AND
MAINTENANCE SERVICES**

INTRODUCTION

This Standard Technical Specification version has been developed for SOPA to ensure that uniform standards are achieved across the whole site and these requirements should be read in conjunction with the policy and objectives for the site and any other relevant SOPA requirements and standards.

The efficient water management & irrigation of the Sydney Olympic Park Site is essential to ensure the rapid growth of the landscape to provide an effective vista, shade and healthy landscape for the future long term presentation of the site.

The central principal involved is to provide a very efficient system to deliver precise amounts of water to control the soil water deficit in the landscape in order to maximise plant growth while conserving energy, water and controlling salinity and the water table.

APPLICATION

This Supply Construction and Maintenance Services Specification shall apply to all public domain water management infrastructure provided to recycle, harvest, store, pump and deliver water for irrigation up to the outlet emitters in the Sydney Olympic Park Site and any other lands controlled or administered by SOPA.

The specific works related to each contract and the interpretation of this specification to the works shall be as set out in the *Interpretation* Section of this specification.

Consultants, Designers, Design and Construct contractors involved in the supply construction and maintenance of water management infrastructure owned, or managed by SOPA, shall use the technical specification as the minimum requirement for design, construction and maintenance services.

DISCLAIMER

The information herein was based on information available at the time and is subject to change. Therefore, the use or adoption of this specification, in full or part, as a minimum requirement, by any individual, person or corporation does not in any way limit the responsibility of that individual, person or corporation to take due care in the design and construction of any works for which they are commissioned or otherwise contracted and SOPA and other contributors shall not be responsible in any way for the use of the information contained herein.

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SYDNEY OLYMPIC PARK AUTHORITY

WATER MANAGEMENT & IRRIGATION NETWORK POLICY AND OBJECTIVES

FOR

SUPPLY, CONSTRUCTION AND MAINTENANCE SERVICES

POLICY STATEMENT

Sydney Olympic Park Authority (SOPA) is responsible for the water management and irrigation of large open space areas and high quality public spaces at Olympic Park, representing one of the largest urban amenity irrigation systems in Australia and most likely the southern hemisphere.

The key water sources are harvested storm water and recycled water from the Water Recycling and Management Scheme (WRAMS). Potable water is only used for emergency back-up purposes to ensure survival of high value landscape areas.

The efficient use of water and energy are critical elements in the distribution and management of water resources across the site. The purpose of the standard technical specification is to ensure uniformity in quality design, construction and maintenance services by adopting uniform standards, materials, equipment and control systems.

The nature and complexity of irrigation and water management systems continues to develop and the skills required now involve a range of multi-disciplinary skills generally not available from traditional contract sources. Therefore, the works, classified into separate packages under the classifications of *Irrigation Works Package*, and/or *Hydraulics Works Package*, and/or *Water Management Control Systems Package*, allows a firm to respond to one or more packages where it can demonstrate the skills base required.

For small works a combined package may be appropriate where the respondents can demonstrate the skills required for the project.

OBJECTIVES

1. To ensure the works comply with ESD principals including energy and water efficiency, standardisation of materials and equipment to minimise waste and reduce maintenance services costs.
2. To standardise water management control systems and the progressive development of back-to-base monitoring to facilitate fault and malfunction identification. Early identification of operational issues and rectification in a timely manner minimises waste (water and energy) and impacts, such as erosion and excessive surface water that may affect site amenity.
3. To standardise the selection of products and equipment across the site to minimise waste associated with incompatibility with existing products and equipment.
4. To standardise control systems in order to reduce training, servicing and operational error, this can occur when multiple operation interfaces are used.
5. To reduce manual labour and site travel by introducing back-to-base control and monitoring of all pump stations and reference water meters.
6. To adopt environmental best practice in design, construction and maintenance services.

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STANDARD TECHNICAL SPECIFICATION

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STANDARD TECHNICAL SPECIFICATION

INTERPRETATION – *(insert name of site or project)*

1.0 INTERPRETATION

2.0 EXTENT

3.0 SCOPE OF WORKS

4.0 SITE WORKS

5.0 COMPLETION

6.0 DRAWINGS AND ASSOCIATED DOCUMENTS

0.1.0 INTERPRETATION

0.1.1 General

Requirement: The Extent and Scope of Works for this project shall be in accordance with the Contract, drawings, authority regulations, standards, codes and the requirements set out below in this Section of the Specification and constructed in accordance with *Sections 1 to 12* of this standard specification and any attached annexure, schedules, tables, addendums, standard drawings and contract drawings as applicable to each project.

Requirement: Where there is any departure in this section of the specification from the *Standard Technical Specification* or on the contract drawings, this

The design consultant completes this *Interpretation Section* for the current project, in the format set out below.

otherwise available and undertake site inspections, prior to lodging a Lump Sum Tender or Quotation price, as set out in the documents, in order to ensure a full understanding and knowledge of existing site conditions, access, working conditions and other related matters. The Contractor shall rely upon, where information is requested from the Client, only information provided in writing. Where the contractor has failed to obtain all available information no additional claims are recognised. Refer to *Section 1 Preliminaries*.

0.1.2 Permits and Passes

Requirement: Prior to commencing any work, the Contractor must hold a valid SOPA Work Permit. The Contractor shall liaise with the SOPA contact person to obtain the Permit.

Requirement: Prior to commencing any work the contractor must hold valid vehicle passes for all vehicles to be used to undertake the contract works.

Note: Vehicle passes are not issued for personal vehicles of contractor's staff and dedicated parking is not available for contractors or sub-contractors staff at Sydney Olympic Park.

0.1.3 Public Safety and Access

Requirement: Provide a public safety and access plan in accordance with the Contract 14 days prior to commencement of construction.

0.1.4 Traffic Management

Requirement: Provide a traffic management (for vehicular and pedestrian) plan 14 days before construction is to commence, or during construction if conditions change, that will affect the movement of traffic and pedestrians on any road, path or access road within the construction area.

0.1.5 Site Constraints

Requirement: The site is open to the public each day and for events from time to time and the contractor shall ensure that access is not restricted without 14 days prior notice to the Project Manager. Pathways must not be restricted at weekends or public holidays.

0.2.0 EXTENT

0.2.1 Extent:

These works involve the, *(Select one classification for the works,)* Irrigation works Package or Hydraulics Works Package, or Water Management Control Systems Package *(Insert a general description and extent of the works)*

(Note: provide a separate interpretation section for each package classification)

0.2.2 Client Supplied Materials:

..... *(Insert details of any items supplied by the Client)*

Requirement: Where items are identified in the cost schedule as "labour only" they are supplied by the Client and the contractor shall include a sum for installation only for these items.

Requirement: The contractor will supply all other associated materials, including all fittings required for installation of the item/s in order to form a complete and operational system in accordance with the intent of the specification and drawings.

0.2.3 General:

Requirement: this contract involves:

- Supply and installation of all necessary*(Insert a dot point list of key systems equipment and items)*

and any other items required to provide a complete and operational system in accordance with the requirements and intent of the specification and the drawings.

0.3.0 SCOPE OF WORKS

0.3.1 General:

Requirement: This contract involves the supply (except as detailed above) and construction of a (*Insert system details*) at (*Insert location of the works*) for the Sydney Olympic Park Authority

The works are to be carried out in accordance with this section of the specification, the Standard Technical Specification, Contract Drawing/s and another related material referenced in these documents.

Requirement: Provide complying lump sum price for the works.
or separate lump sum prices for the works (*where the works are arranged in separable portions*)

Requirement: In order to assist in the fair assessment to submissions the contractor shall complete the Cost Schedule which shall only be used for assessment of submissions and variations and shall not form part of the contract.

Note 1: The main references to the standard technical specification are indicated in italics, other clauses may be applicable in some cases and or Australian Standards, codes of practice, industry standards and manufacturer's instructions need to be considered for relevance in all cases

(Instruction - Complete the following items as applicable to each item below – insert "Not Used" for items not required for the current project – Do not renumber – add any project specific item at the end. Delete this instruction before issue.)

0.3.2 Main Line Reticulation (*Section 2, Clause 1.0 and 2.0 and Section 3, Clause 1.0 & 2.0*)

Requirement: (*Insert system pipework details as required*)

0.3.3 Laterals (*Section 2, Clause 1.0 and 2.0 and Section 3, Clause 1.0 & 2.0*)

Requirement: (*Insert details as required*)

Requirement: Refer to layout drawings for lateral sizing

0.3.4 Main Line Valves (*Section 2, Clause 2.1.4, Section 7, Clause 1.0, 2.0, 6.0 & 7.0, and Table 4*)

Requirement: (*Insert details for isolating, flush, venting and automatic control valves (ACV) as required*)

0.3.5 Irrigation Control Valves (*Section 2, Clause 2.1.4, Section 7, Clause 3.0 and Table 4*)

Requirement: (*Insert general details as required*)

Requirement: Refer to Equipment Table for solenoid valve zoning and sizing

Requirement: Refer Section 2 Clause 2.1.4 for general cross connection control requirements and Clause 2.1.4.2 for Identification and Marking. Optional Clause 2.1.4.2.2 will apply across the Homebush Bay SOPA site.

0.3.6 Emitters (*Section 8*)

Requirement: (*Insert general details as required*)

Requirement: Refer to Table 3, Zone and Equipment Table for emitter details and sizing

0.3.7 Irrigation Control System *(Section 5, Clause 1.0)*

Requirement: Provide radio ready Cloudmaster controllers,
(Insert any additional details and Qty required)

0.3.8 Control Console or Panels *(Section 5, Clause 2.0)*

[Option 1] – *(Insert not used if option 2 applies)*

Requirement: *(Insert details as required)*

Or

[Option 2] – *(Insert not used if option 1 applies)*

Control consoles and control panels are part of the water management control system package.

0.3.9 Power supply

[Option 1] – *(Insert not used if option 2 applies)*

Requirement: The contractor shall determine the nearest source of power and include the complete cost of providing the power circuit to the console or control panel in the Lump Sum Price.

Or

[Option 2] – *(Insert not used if option 1 applies)*

Power supply is part of the electrical and control package

0.3.10 Hydraulic Systems *(Section 2, Clause 2.0 and Section 3, Clause 3.0)*

Requirement: *(Insert details of potable water supply, recycled water supply, harvested water supply, drainage, sewer, storm water drainage, as applicable)*

0.3.11 Pumps *(Section 10)*

Requirement: *(Insert details as required)*

0.3.12 Automatic Control Valve (ACV) *(Section 5)*

Requirement: *(Insert details as required)*

0.3.13 Filters *(Section 11)*

Requirement: *(Insert details as required)*

0.3.14 Manifolds *(Section 2, Clause 2.0 and Section 3, Clause 3.0)*

Requirement: *(Insert details as required)*

0.3.15 Water Treatment *(Section 11)*

Requirement: *(Insert details as required)*

0.3.16 Water Management Control Systems *(Section 5, Clause 1.0)*

Requirement: *(Insert details as required)*

0.3.17 Control Consoles and Panels *(Section 5, Clause 2.0)*

Requirement: *(Insert details as required)*

0.3.18 Power Supply *(Section 5, Clause 3.0)*

Requirement: *(Insert details as required)*

0.3.19 Control Cables *(Section 5, Clause 4.0)*

Requirement: *(Insert details as required)*

0.3.20 Control and Monitoring Systems *(section 5, Clause 5.0)*

Requirement: *(Insert details as required)*

0.3.21 Water Meters *(Section 5, Clause 6.0)*

Requirement: *(Insert details as required)*

0.3.22 Flow Meters and Sensors *(Section 5, Clause 7.0)*

Requirement: *(Insert details as required)*

0.3.23 Pressure Sensors and Gauges *(Section 5, Clause 8.0)*

Requirement: *(Insert details as required)*

0.3.24 Moistures Sensors *(Section 5, Clause 9.0)*

Requirement: *(Insert details as required)*

0.3.25 Rain Sensors and Gauges *(Section 5, Clause 10.0)*

Requirement: *(Insert details as required)*

0.3.26 Weather Stations *(Section 5, Clause 11.0)*

Requirement: *(Insert details as required)*

0.3.27 Support, Protection and Security *(Section 6)*

Requirement: *(Insert details as required)*

3.28 Valves *(Section 7)*

Requirement: *(Insert details as required)*

0.3.29 Tanks and Storage *(Section 9 and Section 7, Clause 2.2 & 5.0)*

Requirement: *(Insert details as required)*

0.3.30 Pumps *(Section 10)*

Requirement: *(Insert details as required)*

0.3.31 Inclusions *(Section 1, Clause 1.6)*

Requirement: Include all items required to form a complete and operational system to meet the intent of the drawings and specification in accordance with *Clause 1.6, Section 1.*

Requirement: *(Insert any site specific details as required)*

0.4.0 SITE WORKS

0.4.1 Security Fencing *(Section1, Clause 1.8)*

Requirement: All work areas shall be protected by the use of approved safety and security fencing around the work areas to the satisfaction of the Principal and where applicable Work Cover.

Requirement: *(Insert any project specific details as required)*

0.4.2 Reinstatement (*Section 3, Clause 2.10, 2.11, 2.12 & 2.13 and Section 12, Clause 1.8*)

Requirement: The contractor shall reinstate all areas disturbed by the works to the requirements set out in the contract and specification to match up to adjacent areas and to the satisfaction of the Principal

Requirement: (*Insert any project specific details as required*)

0.4.3 Site Excavation Conditions *Section 1 Clauses 1.6, 1.10, 1.11, 1.16 & 1.23*

Requirement: The contractor shall make sufficient enquires and be fully informed of the conditions prevailing in the areas to be excavated. No additional costs or variations are accepted where a contractor cannot demonstrate thorough assessment of the site conditions prior to submitting a quotation or tender.

Requirement: (*Insert any site specific details as required*)

0.4.4 Existing Services and Infrastructure (*Section 1, Clause 1.16*)

Requirement: The contractor shall locate and protect all existing services and infrastructure from any damage. The contractor shall use the service of Dial - Before-You-Dig and provide copies of the written replies to the principal before construction commences.

Requirement: Services drawings are available from the CADD section of SOPA Contact the CADD manager to arrange copies of service drawings in addition to Dial Before-You-Dig.

Requirement: Refer to the Contact and Technical Specification for required and procedures and actions regarding existing services.

Requirement: (*Insert and site specific details as required*)

0.4.5 Path Reinstatement (*Section 3, Clause 2.10*)

Requirement: The cost of replacement of all removed, damaged or disturbed paving is the responsibility of the contractor.

Requirement: The contractor is to ensure section paving is removed carefully and undamaged, stored and reused. Keep damage and removal of paving to a minimum.

Requirement: The contractor will engage the approved SOPA paving contractors (as a sub-contractor) to replace and or repair all paving to match the original. The project manager will provide details of the approved SOPA paving contractors.

Requirement: The contractor will include paving replacement costs in the lump sum quotation/tender price and *Cost Schedule*. (Attach copies of quotations as appropriate)

Requirement: (*Insert site specific details as required*)

0.4.6 Silt and Erosion Control (*Section 1, Clause 1.11*)

Requirement: Install erosion and silt controls as necessary to minimise erosion on all slopes and on to pathways and roads.

Requirement: Provide a work method statement for the management of silt and erosion control 7 days prior to the commencement of works.

Hold Point: Provide 3 days' notice to the Project Manager prior to commencing excavation work that the silt and erosion controls are in place and will be ready for inspection

Requirement: (*Insert any site specific details as required*)

0.4.7 Turf works (*Section 1, Clause 1.23*)

Requirement: (*Insert details as required*)

Requirement: refer to *Section 1, Clause 1.1.23* for turf works, underlay, machinery, equipment, turf species samples and laying requirement

Requirement: Provide a minimum of 7 working days' notice to the Project Manager to arrange inspection of samples and proposed delivery dates to the site.

Requirement: Provide a Quality Certificate for the turf from the grower, that the turf is free from weeds and or other species of grass or plants at the off-site inspection of the turf samples prior to delivery. The Contractor is responsible to removal all weeds of other species from the turf by spraying, weeding or replacement of the turf as appropriate.

Hold Point: Do not install any turf until the Project Manager approves the underlay and the turf delivered to site checked for compliance. Provide 3 days' notice prior to turf delivery

Requirement: (*Insert any site specific details as required*)

0.4.8 Scaling Down and Post Work (*Section 12, Clause 1.10*)

Requirement: (*Insert details as required*)

Requirement: The contractor will scale back all work areas, storage areas and compounds progressively as the project proceeds to the satisfaction of the project manager.

Requirement: Remove all construction materials and equipment including sheds, storage areas, fences, barriers, erosion controls, spoil, excavated materials and reinstate all areas so disturbed in compliance with the specification.

0.5. COMPLETION

0.5.1 Finishing Works (*Section 12, Clause 1*)

Requirement: ensure all testing, inspection results are completed, fill and trim trenches to existing levels, valve boxes are cleaned out, levels checked and adjusted as necessary, heads raised and plumbed as necessary.

Requirement: *(Insert any site specific details as required)*

0.5.2 Commissioning *(Section, 12 Clause 2.0)*

Requirement: *(Insert any site specific details as required)*

0.5.3 Maintenance Requirements *(Section 12, Clause 3)*

Requirement: *(Insert any site specific details as required)*

0.5.4 Work As Executed (As-Built) Drawings *(Section 12, Clause 4)*

Requirement: *(Insert any site specific details as required)*

0.5.5 Instruction and Training *(Section 12, Clause 5)*

Requirement: *(Insert any site specific details as required)*

0.5.6 Operation and Service Manuals *(Section 12, Clause 6)*

Requirement: *(Insert any site specific details as required)*

0.6.0 DRAWINGS AND ASSOCIATED DOCUMENTS

0.6.1 Contract Drawings

Requirement: The following drawings from part of the Contract Documents.

..... *(Insert list of contract drawings)*

0.6.2 Interpretation of the Drawings *(Section 1, Clauses 1.2, 1.3, 1.6, 1.7, 1.13, 1.15, 1.16, 1.21)*

Requirement: Interpret the drawings in the intent of the specifications, applicable Standards and Codes legal requirements and manufacturer's requirements.

0.6.3 Associated Documents for Contractor Information

Requirement: *(Insert details as required)*

Note: The Principal may be able to provide additional information and drawings on request. This information and any drawings do not form a part of the contract documentation and the interpretation and application of any information contained therein is at the sole risk of the contractor. Contact the SOPA CADD manager for service location drawings.

0.6.4 Information for Contractors

Note: *(Insert any site specific details as required)*

STANDARD TECHNICAL SPECIFICATION

SECTION 1 – PRELIMINARIES

1.0 PRELIMINARIES

2.0 OCCUPATIONAL HEALTH & SAFETY

3.0 WARRANTY

4.0 APPROVED CONTRACTORS

5.0 WORK CLASSIFICATIONS

6.0 PRACTICAL COMPLETION

7.0 STANDARDS, CODES & LEGISLATION

1.1.0 PRELIMINARIES

1.1.1 Approvals

Requirement: Where necessary, the obtaining of, any approvals required by any authority having jurisdiction over the works shall be the responsibility of the contractor. It is the Client's understanding that all fees have been included in the quotation price and the Client is not be responsible for the payment of any fees payable to any authorities.

Requirement: All work, materials, methods of installation and work practices shall comply with any Standards or Codes and with any Authority that has jurisdiction over the works, but not less than the standard specified herein.

1.1.2 Interpretation of Drawings

Requirement: The contractor shall check dimensions on site before proceeding with the work of the contract. Do not scale dimensions directly from drawings. The layout of the works on any drawings is diagrammatic only and the contractor must obtain measurements and other information from the Site. The Client will not be liable for any claim by the contractor for any costs, expenses or damages that it suffers or incurs from its failure to obtain measurements and other information concerning the site.

1.1.3 Acceptance of Existing Conditions

Requirement: The contractor shall undertake all necessary investigation and site inspection to ensure knowledge of existing site conditions and no additional claims recognised where the contractor has failed to be fully informed.

1.1.4 Site Meetings

Requirement: The contractor shall attend site meetings at fortnightly intervals throughout the contract period. The Project Manager will keep accurate records of each meeting and will issue to each attendee a copy of the record within three working days of each meeting.

1.1.5 Hydraulic Testing

Requirement: Carried out all hydraulic testing in accordance with *Annexure 1*, as the works progress, to the satisfaction of the Project Manager. The contractor shall keep records of all testing and certification compliance undertaken during the construction period.

1.1.6 Inclusions

Requirement: The Contractor shall include all items necessary whether or not shown or specified, to form a complete working and operational system within the intent described herein and on any design drawings.

Requirement: Notwithstanding any description of the works contained on any design drawings and or in this specification and the other documents related to the proposed works, Contractors shall be responsible for satisfying themselves as to the exact nature and extent of the specified works and any Legal, Award and physical conditions under which the works will be carried out including means of access, the nature, method and type of material to be excavated, the location and handling and disposal of any contaminated materials, disposal of the all or any excess soil of other materials, the type, size and nature of equipment required to complete the works, the checking of all sizes, dimensions and levels and any other like matters affecting the construction of the works.

Requirement: The contractor shall include an allowance for removal of surplus material, including any excess excavated material/s normally expected to occur for from the installation, including hard shale and rock from the proposed works, *Refer Clause 1.1.21*. In areas where contaminated soils are known to exist, the contractor shall include the removal of the contaminated soils in the lump sum price.

Requirement: The contractor shall include a rate per cubic metre for both onsite and offsite disposal where unforeseen excess excavation is required for clean material and separate rates for soils containing any contaminated material for onsite and offsite disposal where unforeseen contaminated soils are encountered.

Requirement: The contractor shall include in the lump sum price excavation of all material including soft shale in the contract price. Only hard shale and rock that cannot be removed with an excavator bucket on an 8 tonne machine shall be excluded and the contractor shall include a rate per cubic metre for hard shale and rock excavation.

1.1.7 Materials & Equipment

Requirement: All materials and equipment shall be new and supplied, where appropriate in original packaging. Refer *Section 2* for material and equipment requirements and prohibited materials (*Clause 1.1.17*)

Requirement: The contractor shall determine the lead times for materials and ensure sufficient allowance for order placement and delivery is included in the preliminary contract program submitted with the quotation.

Note: The quality, type, model and brand of proprietary items are in many cases are critical to the conformity of the systems in regards to operational matters, cost effective maintenance quality and reliability. Therefore, some items and specialist contractors are classified as “nominated” products, equipment, suppliers or contractors.

Note: This approach provides a consistent standard across all facilities in order to address the following matters; provide essential compatibility with existing systems, provide water and energy saving efficiencies, compatibility with central control of systems, reduce stocks held for maintenance and repairs, represent best practice, ESD, provide uniform maintenance standards, and provide standard operational procedures.

Note: Less critical items are classified as “preferred” products, equipment, suppliers or contractors.

Note: Refer to *Table 4* for nominated and preferred products, equipment, suppliers or contractors.

Requirement: Where *Table 4* permits preferred products, equipment, suppliers or contractors, an alternative item may be offered as detailed below.

Requirement: Where products, equipment, suppliers or contractors are listed in *Table 4* as the preferred minimum standard for each application, the contractor may offer alternatives, only at the time of tender/quotation. Where contractors offer alternatives, generally in circumstances where the specified item is not available, accompany such offers with a full technical specification, life cycle analysis and a fully detailed description of the advantages and cost benefits to the Client. This clause shall not be construed to be an alternative offer. No alternatives are acceptable after the contract is executed.

Requirement: Where any alternative material or equipment is offered it shall be the contractors responsibly to guarantee that such alternative shall in no way effect the performance and maintenance of the overall works.

Requirement: Where products, equipment, suppliers or contractors are classified as nominated, alternatives will not be accepted, except in the case where the nominated items or services are not procurable within an acceptable period. In cases where the contractor has failed to place orders for nominated products, equipment, suppliers or contractors in a timely manner any delay shall be the sole responsibility of the contractor, alternatives not accepted and any costs due to delays in delivery of services, materials or equipment accrued to the contractor.

Requirement: Any contracts that include alteration, restructuring or replacement of any existing systems the existing materials and equipment are the property of the Client and the contractor shall allow for any materials and equipment to be reclaimed by carefully removing these items and returning them to the Project Manager for reuse or disposal at the discretion of the Client.

1.1.8 Site Security

Requirement: The contractor shall make his own arrangements for security of the site. The Client will not be responsible for security matters. The client may not be able to provide or permit on-site storage. Client shall not accept any responsibility for any vandalised plant, equipment or materials. This includes any materials or equipment supplied by Client and the contractor has taken possession.

Requirement: All work areas shall be protected by the use of approved safety and security fencing around the work areas to the satisfaction of the Project Manager and where applicable Work Cover.

1.1.9 Temporary Site Works

Requirement: The contractor shall provide, install and maintain all necessary temporary works such as water, electrical power, project signboards, site sheds, toilets and related temporary facilities, and fencing of the Site as required. This includes all safety fencing, barricades and the like required for the safety of the public.

Requirement: The contractor shall be responsible to liaise with and meet all requirements of the relevant authorities about the provision of temporary works, and pay all fees associated with such.

1.1.10 Site & Environmental Management Plan

Requirement: The contractor must supply the Project Manager for approval a Site & Environmental Management Plan, 14 days prior to the commencement of site works, which must address, but not be limited to:

The contractor shall be responsible for activities on the site including providing access for authorised persons and restricting access by unauthorised persons including on site traffic management and take necessary precautions to secure the assets of Client;

General attendance of the contractor shall include taking delivery, assisting to unload, storing and protecting sub-contractors materials and for allowing subcontractors ample space;

The contractor shall be responsible for providing site sheds, sanitary accommodation and the like;

The contractor shall be responsible for maintaining clean roads and access and the removal of mud and building debris when such occurs;

Keep the site clean, safe and tidy at all times. All waste, excess materials and spoil is to be stockpiled in a neat and tidy manner;

The contractor shall be responsible for the transportation of waste, excess materials and spoil from the site, and disposal of such material (including tip fees) to a suitable landfill site or recycling outlet as part of the contract price;

Refuse from construction operation (including food scraps and the like) shall be removed from the site at frequent intervals. Putrescible refuse on site shall be stored at all times in vermin and animal proof containers;

No hazardous materials shall be stored on site without the authorisation of the Project Manager;

The contractor shall take proper precautions to keep poisons and other injurious substances in places secured against access by unauthorised persons;

Provide erosion and silt controls as necessary to minimise erosion on all slopes and on to pathways and roads. Provide a work method statement for the management of silt and erosion control prior to the commencement of works.

1.1.11 Environment Control

Requirement: The contractor shall comply, and ensure that sub-contractors comply, with the provisions of any environmental protection requirements in the contract including pollution incident notification for notifiable pollution incidents and with the requirements of any applicable statute, by-law or standard related to environmental protection of the site and public. Refer *Clause 1.1.23* below about excavation conditions.

Requirement: Where any hot work is required obtain a work permit from the Client prior to any hot work commencing. Strictly observe all of the work permit conditions at all times.

Requirement: The contractor shall minimise the creation of dust during site establishment, excavation and filling and construction operations by watering or other means approved by the Project Manager.

Requirement: The contractor shall not light fires on the site.

Requirement: The contractor shall take all practical precautions to minimise noise resulting from the work under the contract. The contractor shall fit all construction equipment with noise suppressors and use them so noise is minimised. All work, including demolition, excavation and building work must comply with Australian Standard 2436-1981 'Guide to Noise Control on Construction, Maintenance and Demolition Sites'.

Requirement: The contractor shall fit jackhammers and other noisy hand-held tools used in the performance of the work with effective silencers of a type recommended by the tool manufacturer. Keep tools and silencers in first class condition. The Contractor shall supervise operators of jackhammers to ensure that the silencers are always in place while the tools are in use.

Requirement: Install erosion and silt controls as necessary to minimise erosion on all slopes and on to pathways and roads.

Requirement: Provide a work method statement for the management of silt and erosion control 7 days prior to the commencement of works.

Hold Point: Provide 3 working days' notice to the Project Manager prior to commencing excavation work that the silt and erosion controls are in place and will be ready for inspection

1.1.12 Site Access, Safety of Traffic & the Public

Requirement: Access to the site shall be strictly controlled and set out in the Site & Environmental Management Plan. The contractor will be provided access to the site and will be responsible for maintaining the site security and unauthorised access during the works.

1.1.13 Setting Out & Survey Control

Requirement: All setting out and survey control of the works is the responsibility of the Contractor. Refer *Section 12, Clause 5* for details.

Requirement: The setting out shall be undertaken by a suitably qualified and experienced person and shall be in accordance with this specification and drawings.

Hold Point: Peg the location of all field main lines and cable sleeves for approval prior to excavation. Provide 3 working days' notice prior to excavation commencing in each area.

Requirement: Confirm the final position of all penetrations through any structures and the position of equipment on site, before work commences, with the Project Manager. Survey control is to be included in all sections of the works.

Note: As the drawings are generally diagrammatic and drawn at small scales it will be necessary to make minor adjustments to suit actual site conditions without a price variation.

Requirement: All contracts are to include a provision in the contract price to adjust the position of all equipment and pipes, up to five (5) metres from the position generally indicated on the drawing, without attracting a variation. Where the contractor can demonstrate changes may involve a variation written approval is required from the project manager prior to construction.

1.1.14 Protection

Requirement: The Contractor shall not damage any existing property, turf, plants, shrubs or trees and any of the existing paving, walls or other structures. In any circumstances where accidental damage occurs, repair damage within 24 hours.

Requirement: Where any damage poses a risk to persons or property immediately secure the area and undertake emergency repairs to render the area safe. Complete the repairs within 24 hours.

Requirement: The Contractor is to protect any existing area of the works to the satisfaction of the Project Manager prior to any works commencing in any area.

1.1.15 Location of Pipes Adjacent to Trees

Requirement: Keep all pipework well clear of existing trees. Do not cut tree roots larger than 50 mm without the prior approval of the Project Manager. Subject to environmental conditions, directional boring may be adopted under large trees at the contractors cost.

1.1.16 Public Utilities and Existing Services

Requirement: The contractor shall investigate and locate all utility services on the Site prior to the commencement of work whether indicated on the drawings supplied or not. This will include liaising with service utility authorities as necessary.

Requirement: The responsibility for locating all services rests with the contractor and the contractor will be responsible for any damage to disruption of services and associated costs that may occur from the work on Site.

Requirement: The contractor shall use the service of Dial-Before-You-Dig and provide copies of the written replies to the principal before construction commences unless advised in writing that the main contractor and or client waive this requirement. Refer to the contact and specification for required and procedures and actions regarding existing services.

Requirement: Services drawings are available from the CADD section of SOPA Contact the CADD manager to arrange copies of service drawings in addition to Dial Before-You-Dig.

Requirement: The contractor, at his expense, shall make good to the satisfaction of the Project Manager any damage caused to existing public utilities, footpaths or public roads caused by employees of or sub-contractors during the construction works.

1.1.17 Damaged Services

Requirement: Where existing services at or adjacent to the site are, in the opinion of the contractor, not in optimum condition, the contractor shall arrange for an inspection by the Client prior to commencement of any works.

Requirement: Project Manager and the Officer-in-charge of the area responsible for such service shall at such meeting, record the condition and issue instructions, for strict adherence by the contractor.

Requirement: Where any damage poses a risk to persons or property immediately secure the area and undertake emergency repairs to render the area safe. Complete the repairs within 24 hours. Refer *Clause 1.1.11 Paragraph 1 above*.

1.1.18 Practical Completion

Requirement: Granting of will occur when it can be demonstrated that the general intent of the works shown on the drawings and in scope of works has satisfactorily completed, the complete system is operational under automatic control and the specified requirements for practical completion have been completed. Refer to *Clause 1.6.0 below* and *Section 12, Clause 2.1* for practical completion requirements and conditions.

1.1.19 Standard Design Details and Workshop Drawings

Requirement: When provided, referred to in this specification or noted on the drawings, standard design details and workshop take precedence over general layout drawings or the construction of these portions of the works.

Requirement: Where specified, workshop drawings are the responsibility of the contractor and any associated cost included in the tender price. Submit workshop drawings for approval, with all necessary supporting information, with 14 working days' notice.

1.1.20 Works Schedule

Requirement: Provide a preliminary works schedule in the form of a Gantt chart (or similar) with the tender documents clearly setting out the proposed period to complete the works.

Requirement: Provide a detailed works schedule in the form of a Gantt chart within seven (7) days of acceptance of the Contract and keep up to date by reflecting any changes including wet weather delays as the works proceed.

Requirement: The contractor will employ sufficient staff to ensure the installation of the works can meet the works schedule.

1.1.21 Samples

Requirement: The client reserves the right to request samples of products it may consider necessary for quality control.

Requirement: When specified or indicated on the drawing/s or in the contract provide samples for examination and approval before purchase and or installation. Refer *Table 6*.

Requirement: Provide samples in any case where the goods proposed vary in any way from the preferred "bench mark" standards as detailed herein and in *Table 4*.

Requirement: Provide samples of any alternative offer of materials or equipment, where the specified items are not available,

Requirement: Alternative offers should not be made where the materials and or equipment is not available for examination by the Client during the tender/ quotation period.

All costs of providing sample materials or equipment for examination shall be borne by the Contractor.

Requirement: Provide all samples for examination during the tender/quotation period. Do not make any alternative offers for materials or equipment after the close of the tender/quotation period.

All costs incurred in providing samples will be included in any contract price.

Requirement: Samples provided by unsuccessful applicants are to be collected with 7 working days of notification. Abandoned samples not collected after this period become the property of SOPA and may be used or disposed of by SOPA.

Requirement: Samples provided by the successful tenderer will normally be available for collection up to 7 working days following granting of practical completion. Abandoned samples not collected after this period become the property of SOPA and may be used or disposed of by SOPA.

Note: The contractor may install large (new) items of acceptable equipment provided as samples with the written approval of the client.

1.1.22 Site excavation conditions

Requirement: The contractor shall allow for the following site conditions:

The area may have been subject to land fill and may include hard fill materials, inorganic fill, and organic materials in some locations.

Do not assume fill is Virgin Excavated Natural Material (VENM)

Horizon A, B and C soil type and ground conditions and depth may vary across the site

The contractor shall include the removal of any surplus material, including any excess excavated material/s that would normally be expected to occur for from the installation, including all soils, clay, and vegetation, soils containing any tree roots or other extraneous material hard shale and rock from the proposed works off site

The contractor shall include in the lump sum price excavation of all material including soft shale and under road boring (as detailed below) in the contract price. Cubic metre rates apply where removal of hard shale and rock requiring an excavator exceeding 8 tonne capacity using a 300 mm bucket.

Include a rate per cubic metre for hard shale and rock excavation in the contract price.

The contractor shall advise the Project Manager of any hard shale or rock encountered and the Project Manager shall approve a variation for additional costs based on the cubic metre rate in each specific case.

A clay capping is in place in many areas over the pre-existing fill and should not be removed without approval in each case

Contaminated fill may be present and or encountered in some areas and the contractor is to ensure that they are fully aware of these areas within the construction zone (the Client will provide details of known contaminated areas on request). Include all allowances for handling and disposing of any contaminated waste in accordance with approved procedures and these procedures are to be included in the lump sum and Environmental Management Plan.

The contractor shall include a rate per cubic metre for both onsite and offsite disposal where contaminated soils (toxins, chemicals, petrochemicals etc.) are encountered in any variations.

1.1.23 Turf Works

Turf works, Underlay, Machinery and Equipment, Species, Samples, Laying

Requirement: Reinstatement of turf areas shall be undertaken as soon as possible following the completion of the works and soil compaction in order to minimise erosion.

Requirement: Trenched areas shall be cultivated to a depth of 50 mm and a 20 mm layer of turf underlay mix (90% sand and 10% organic, certified to AS4419) applied over the entire trenched area. The whole area shall be graded and contoured into the existing adjacent areas and free from rocks and hard lumps of soil rubbish and any other extraneous material.

Requirement: SOPA will inspect all turf by prior to installation which, shall be healthy, without disease, weeds, and shall have a developed root system.

Requirements: The turf species shall be Kikuyu unless specified otherwise. Lay all turf with the joints butted and rolled with a roller not exceeding 100kg and lightly top dressed with 90/10 topdressing. Remove and replace all turf, which does not meet all the above requirements, at the contractors' expense.

Requirement: Provide samples of turf and turf underlay for approval 3 working days prior to deliver to site. Refer *Clause 0.4.7*.

Requirement: All machinery operated on turf areas shall be fitted with approved turf tyres. Bar tyres not permitted.

1.1.24 Quality Control Inspections

Requirement: The Project Manager or nominated person will carry out regular quality control inspections as the work progresses, during construction, to ensure compliance with the design & specifications.

Note: These inspections are not part of a formal Quality Assurance (QA) Program

Requirement: The contractor shall have a qualified person (supervisor) that is responsible for the works available to attend the inspections of the works and accept any instructions resulting from the inspection.

Requirement: Inspection and hydraulic testing shall be carried out as the work progresses and or as directed by the Project Manager in accordance with this specification, as set out below and as required by any authority having control over the works.

Requirement: The contractor will allow for excavating inspection holes in locations as directed by the Project Manager for visual inspection of depth of cover, backfilling material, control cable location and quality of materials used. The contractor will allow for one inspection hole for each 100 metres of main line up to the area control valve and one for each 250 metres of pipe work after the control valves. The Project Manager may randomly select locations for inspection holes.

Requirement: Following the observation of defective or unacceptable workmanship and or materials the contractors will provide further inspection holes, at their expense, each side of the first location, at the position indicated by the Project Manager for further inspection to allow assessment of the extent of the defective or otherwise unacceptable work.

Requirement: All or any sections of the works which do not comply with the quality and performance requirements, intent of the specification as detailed herein, on any drawings and is not in compliance with any standard or code applicable to the works. The contractor will remove and replace all noncomplying works at the direction of the Project Manager at the contractors' expense.

1.2.0 WORK HEALTH AND SAFETY (WHS) Act 2011

1.2.1 WHS

Requirement: The contractor and all employees and any sub-contractors shall at all times comply with all safety requirements required by Law and any site specific safety requirements, Work Health and Safety (WHS) requirements and Work Cover requirements.

Requirement: Protect all areas of the works by suitable safety barriers, signs and lights where required

1.2.2 WHS Induction

Requirement: All contractors, their employees, and any sub-contractors shall have attended an approved Safety Induction Course and present a certificate (Green Card) prior to reporting for work on site.

Requirement: The contractor shall provide appropriate site induction for all personnel (including sub-contractors) working on the site.

1.2.3 Safe Work Practices

Requirement: The contractor shall ensure the adoption of safe work practices at all times. Prepare or provide work method statements for all tasks to ensure safe work practices are used for all tasks. The contractor will keep a copy of all work method statements on site in a location accessible to all employees and the Project Manager.

Requirement: All employees shall only undertake tasks for which they are qualified or have received specific training and instruction to perform the task.

Requirement: The contractor shall assess the risks and take appropriate action to remove and or minimise the impact of potential hazards, including the cost of all shoring & bracing, scaffolding, safety harness, guarding equipment and the like in order to provide a safe work site and work environment.

Requirement: Carry out all work practices in accordance with the NSW Work Health and Safety Act 2011 and the associated regulations.

1.2.4 Confined Spaces

Requirement: Where the works involve deep pits, wet wells and the like (generally over 1000mm deep, but subject to a risk assessment in all cases), pump stations, wet wells below ground and internal work in all tanks, require staff with confined space certification and appropriate safety equipment on site, risk assessment and work method statements held on site.

1.3.0 WARRANTY

Requirement: Provide Warranties in accordance with *Section 12*.

1.4.0 APPROVED CONTRACTORS

1.4.1 Licensing

Requirement: Appropriately approved and qualified contractors, licensed by the Office of Fair Trading, shall install all works specified under the contract.

Requirement: Only appropriately qualified staff shall supervise and install the system. A person qualified by the Office of Fair Trading (supervisor) shall be on site at all times during construction.

1.4.2 Qualifications & Experience

Requirement: The firm and all employees are to hold appropriate qualifications for the tasks performed and have experience in the type and complexity of the contract works.

Requirement: The Contractor will provide details of Qualifications and Experience of all staff and employees as part of the quotation/tender documents.

Requirement: All work will be to a standard acceptable to any authority and the Project Manager having control over the works and comply with industry best practice and any conditions contained elsewhere in this Specification.

Requirement: Staff employed in an approved training scheme (i.e. apprenticeship or equivalent) are exempt from the above requirements, except that not more than one (1) employee in a training scheme shall be permitted on site for each qualified employee, unless specifically approved by the client.

Requirement: Provide certified copies of the current Accreditation of plastic welders (refer below) that will actually be undertaking the jointing electrofusion and butt fusion of the poly piping. Provide a method of tracking each joint to each certified welder on the site (i.e. allocate a number for each welder) for mains up to the solenoid valves and all lines that are concealed under paving or located within any building structure.

Note: the Plastic Industry Pipe Association (PIPA) offers accreditation or reaccreditation courses through a number of register training organisations. Contact for PIPA is www.pipa.com.au and click on training tab.

Requirement: The accreditation will include the following Nationally Accredited Training Courses as applicable to the work undertaken:

PMBWEKD301B – Butt Weld Polyethylene Pipelines

PMBWEKD302B – Electrofusion Weld Polyethylene Pipelines

Requirement: Record each joint with the welder's reference number stamped on the fitting or adjacent pipework and record joint number, welder ID and date on a diagrammatic quality control drawing (or other method approved by the Project Manager) and include a copy in each operation manual. This is a key requirement. Cut-out and replace any joints which are not traceable to the welder at the contractor's expense.

1.4.3 Sub-Contractors

Requirement: All site personnel involved in construction are to be employees of the successful Contractor. Provide schedule setting out competency and experience of any Sub-contractors for approval as part of the quotation/tender process.

Requirement: Where applicable provide details of the proposed subsoil textile irrigation sub-contractor accompanied by a statement of competency from the manufacturer in the tender/quotation documents for projects which include this technology in the current works package.

1.5.0 WORK CLASSIFICATIONS

1.5.1 Comment:

Dividing larger works into separable works packages allows the client a wider choice of securing a range of increasingly specialised services of larger specialised and complex works under the following general classifications:

Irrigation works Package: Generally includes mains, laterals, solenoid valves and emitters. Isolation valves associated with the above works. Control cable sleeves, control cables from the control point to the solenoid valve, cabling to remote sensors installed with the solenoid valve cables, valve boxes, cable pits. In addition, the works may include cross connection control, reference water meters, balance tanks, pumps and control systems at the discretion of the client.

Hydraulics Works Package: Generally includes pump stations, filtration, balance tanks, sterilisation, water harvesting, water treatment, automatic control valves, water supply to tanks, chemical & effluent injection systems and storm water drainage from tank over flows or in relation to harvesting works. Commonly referred to as mechanical engineering and or hydraulic engineering works in industry. Hydraulic works pipework and equipment installation will comply with the requirements of the standard technical specifications, applicable codes of practice, AS/NZS Standards and industry best practice.

In addition the works may include related control and monitoring systems on small projects as set out below. Where any portion of the hydraulic works include plumbing works which fall under the jurisdiction of the Plumbing Code of Australia (PCA), such portions of the works are to comply with the requirements of the PCA and installed by a suitably qualified and licensed tradesperson.

Water Management Control Systems Package: Generally includes the complete pumping, control and monitoring system, as specified in the *Interpretation Section, Section 10* of this specification and other related clauses herein. In addition the works may include pump controls, control panels, pressure tank, VFD drives, specialised cables, level and pressure transducers, associated electrical works and back-to base monitoring and control, compatible to and integrated with existing central irrigation control and monitoring systems. A suitably qualified and licensed tradesperson must install all 240 volt and 415 volt electrical works.

1.5.2 Water Management Control Systems Package

Requirement: This is a Nominated Sub-contract Supplier. Refer to *Table 4 of the Specification* for details.

Requirement: Pre-assembled, pre-wired and pre-tested by one (pump/control) sub-contractor as a complete and integrated package.

Requirement: The contractor shall arrange with the Project Manager and a representative of the Client, at least 14 days prior to delivery to site, an inspection of the all, key components including pre-wired/pre-tested control panels & associated control systems and pump stations where these are packaged arrangements. All costs associate with testing and inspections shall be included in the contract price.

Requirement: For existing projects that involve the up-grading of existing pumping control systems as part of the works the control panels or consoles shall be removed and returned to the works of the nominated (pump/control) sub-contractor/s for up-grading and the warranties on the new and existing equipment clearly set out in the lump sum price.

1.5.3 Potable Water Use

Requirement: The minimisation of potable water and highly treated recycled water use is an essential environmental objective. These sources of water may provide critical dry weather backup requirements.

Requirement: Where the use of potable water is unavoidable the connection to the irrigation system must comply with the Plumbing Code of Australia (PCA) and AS/NZS 3600. Refer to *Section 2, Clause 1.4*

1.6.0 PRACTICAL COMPLETION

1.6.1 Granting Practical Completion

Requirement: Provide 14 working days' notice to arrange a date for practical completion inspection of the works. Complete the works as set out in *Section 12* prior to giving notice for practical completion.

Requirement: Failure to have completed the works will terminate the inspection for the granting of practical completion. The contractor will pay all costs associated with reinspection, following a minimum of a further 7 working days' notice for reinspection..

1.6.2 Submissions

Requirement: The contractor shall submit the following information and or carry out the tasks, as applicable to the scope of works for this contract, 7 working days prior to the proposed date for practical completion for approval:

1.6.2.1 Requirement: General requirements undertaken and/or submitted prior to granting of practical completion;

Finishing and Commissioning (refer *Section 12*) including pit cleaning head adjustment, valve setting and pressure adjustment.

Work as executed (As Built) drawings

Survey information (may be shown on WAE drawings) and drawings

Plan (or other approved method) indicating the tracking and identification of certified welders for each joint
Maintenance requirements
Testing certificates as applicable and or specified
Contractor's compliance certification – refer *Section 12*

1.6.2.2 Requirement: Refer to *Section 12, Clause 2* for a detailed list of the requirements for practical completion.

Note: Failure to comply in providing the documents and or carrying out the required tasks prior to the time of the practical completion date will delay the timing of the practical completion inspection. Reinspection costs for staff and consultants involved, where the contractor has not been prepared, will be at the contractor's cost.

1.6.2.3 Undertaken within six (6) weeks from the date of practical completion;
Any defects noted during the practical completion inspection
Operation Manual - refer *Section 12*.
Client Training Program - refer *Section 12*

1.7.0 STANDARDS, CODES AND LEGISLATION

1.7.1 General

Requirement: The work shall be of the highest current irrigation industry best practice. Whether or not indicated on the drawings or specified the works shall conform to Australian standards (AS), Australian/New Zealand Standards (AS/NZS) and International Standards Organisation (ISO) Standards, any applicable Codes and applicable Legislation and the related regulations, in particular to, but not limited to the documents referenced in *Table 8*.

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STANDARD TECHNICAL SPECIFICATION

SECTION 2 - MATERIALS

1.0 MATERIALS

2.0 PROHIBITED MATERIALS

2.1.0 MATERIALS

2.1.1 General

Requirement: It is essential that uniform product standards are maintained across all facilities under the control of the Client. Refer to *Section 1 Clauses 1.7, 1.2, and 7.0*.

Requirement: All classifications of works shall comply with the appropriate AS/NZS Standards and applicable codes and regulations. Refer to *Section 1 Clause 7.0* for applicable standards, codes and regulations in accordance with the current works described in the Interpretation Section and any associated drawings.

2.1.2 Hydraulic and Mechanical Services Works

Requirement: Pipework and equipment installation will comply with the requirements of the standard technical specifications, applicable codes and AS/NZS Standards and best industry practice

2.1.3 Plumbing Works

Requirement: Where components the works include plumbing works which fall under the jurisdiction of the Plumbing Code of Australia (PCA), such works are to comply with the requirements of the PCA and associated AS/NZS Standards, codes of practice and best industry practice. Where applicable a qualified and licensed tradesperson is to install such components.

2.1.2 Pipe Work

Requirement: Construct all above ground works for irrigation and hydraulic works classifications from copper piping, stainless steel piping or polypropylene (PP) piping as described in the *Interpretation Section* and or as set out below with approved jointing systems.

Requirement: Hydraulic works components (plumbing systems) which fall under the jurisdiction of the Plumbing Code of Australia are to comply with the requirements of the code and AS/NZS 3600.

Requirement: Below ground works for irrigation systems are to be constructed from polyethylene pipe work for laterals up to 63 DN PE80B (where available) to in accordance with appropriate AS/NZS and ISO Standards as applicable to the current works. Refer *Table 8*.

2.1.3 Existing Pipe Work

Requirement: Repair existing PVC non pressure pipe work with PVC of the same size, type and Grade. Repairs to existing PVC pressure piping shall be PN 10 PE piping for mains and PN8 for laterals.

2.1.4 Cross Connection Control – piping, fittings, valves, valve boxes and pits

Note: At the time of compiling this technical standard specification the role of local water authorities and local government councils in relation to the proposed adoption of the Plumbing Code of Australia (PCA) and irrigation systems is unclear as irrigation is not included in the initial version of the PCA. The PCA references AS/NZS 3500 as the deemed-to-satisfy technical reference.

It is clear that the intention of the PCA (and AS/NZS 3500) in relation to non-drinking water is in relation to recycled water schemes and rain water harvesting tanks for toilet flushing etc. in buildings and the key requirement is cross connection control compliance in these circumstances..

2.1.4.1 General

Requirement: Therefore, provided the irrigation systems comply concerning:

- separation of the potable water service and irrigation pipework below ground (300mm)

- appropriate backflow devices are installed in accordance AS/NZS 3500 Part1, including mechanical devices and air gaps, when the system sources supply from a potable service and or utilises harvested water and

- the irrigation pipe work is clearly identified (as a non-drinking water service) i.e. Lilac colour coding (potentially hazardous contents), refer AS/NZS 1345

- Boundary protection of potable water connections and in some authority areas boundary protection of the recycled water scheme. This protection is required to protect the authority supply assets,

There are no other current compliance requirements for an irrigation system under the PCA.

Note: However, the contractor should check with the local water supply authority at the time of quoting and or carrying irrigation works in relation to any changes in the PCA and related standards.

2.1.4.2. Identification and Marking:

Note: The Australian Standard 1245 calls for Lilac (standard paint colour Number 23) identification of services which includes pipe, valves and fittings conveying all hazardous (non-potable) liquids.

However, as many water authorities and codes of practice have adopted lilac to identify recycled (effluent) water supplies this may cause confusion on sites where the irrigation system is not using recycled effluent and or the source of irrigation water may be harvested water, bore water, potable water (downstream of a zone backflow device), or other reuse source.

Therefore, the specification adopts the following requirements concerning Identification and marking of valve boxes and pits on a site wide basis in order to minimise the possibility of future cross connections.

2.1.4.2.1 Requirement: Where the irrigation system exclusively uses recycled (effluent) water of human or animal origin, pipes, fittings, valves and valve boxes and covers, permanently identified with lilac coloured material as part of the manufacturing process where practicable. Small reinforced plastic valve boxes are to be lilac with the word "Irrigation" cast into the covers. Where colour coding is not practicable during manufacture, i.e. cast in situ covers, paved infill covers, large valves, etc. paint with two coats of Lilac paint using approved epoxy paint or other approved paint suitable for the application. For labelling of valve boxes and pits refer to *Clause 2.1.4.2.3* below.

2.1.4.2.2 Requirement: Where the irrigation system uses any other alternative (non-potable) water source or uses blends of sources or alternately is capable of switching from one sources to others sources including recycled effluent of human or animal origin, pipes, fittings, valves, permanently identified with lilac coloured material as part of the manufacturing process where practicable. Small reinforced plastic valve boxes are to be green with the word "Irrigation" cast into the covers. Large pits with metal, concrete, paving infill etc. left in an as constructed finish with labelling as set out in *Clause 2.1.4.2.4* below.

2.1.4.2.3 Requirement: For irrigation system/networks falling under clause 2.1.4.2.1 where moulded labels are not provided on the covers, provide separate labels with engraved with the word "Irrigation".

2.1.4.2.4 Requirement: For irrigation system/networks falling under clause 2.1.4.2.2 where moulded labels are not provided on the covers, provide separate labels with engraved with the word "Irrigation", and the primary water source. I.e. "Harvested Water", Bore Water etc.

2.1.4.2.5. Requirement: For irrigation system/networks falling under clause 2.1.4.2.1 or 2.1.4.2.2 involving large pits, provide separate labels engraved with the word "Irrigation" and the primary water source. I.e. "Harvested Water", "Bore Water" etc.

2.1.4.2.6. Requirement: in all the above cases where attached labels are required, manufacture the labels from 25 mm wide strip of brushed matt finished 316 grade stainless steel 1.2 mm thick. Remove all burrs. Provide 20mm high engraved lettering in an approved type face. Provide samples of pit labels for approval, 7 days before ordering. Where it is not practical to fix labels to paving or other rough surfaces and where label may cause a hazard, other forms of labelling may be used or labels omitted with the written permission of the Project Manager.

2.1.4.2.7. Pipe Identification

Requirement: PE below ground pipes will be colour coded with co-extruded stripes in accordance with site standards to provide cross connection control in accordance with the following marking and colour coding;

Striping

25 DN to 32 DN 4 to 6 stripes

40 DN to 125 DN 6 to 8 stripes

160 DN to 315 DN 8 or more stripes

Colour

Blue - or blue stripes - Potable water only

Lilac – or lilac stripes - Standard Colour P23 – Hazardous Material – Used for reclaimed water, bore water and harvested surface irrigation and any water source that may contain low level hazards including cfu's of more than 10 parts per million, chemicals, minerals or may contain recycled (sewerage) effluent of variable quality and is not suitable or approved for human consumption.

Plain Black – low voltage (<32 V) control cables plain black with no stripes.

Requirement: Above ground piping shall be colour coded and or identified in accordance with AS/NZS 1345.

2.1.5 Pipe Standards & QA

Requirement: The pipe manufacturer shall have Standards Mark approval and third party Quality Assurance to AS 3901/3902 or other approved and audited Quality Assurance System

2.1.6 Pipe Pressure Rating

Requirement: A pressure rating of PN 10 (min) shall be used for mains upstream of the control valves with PN 10 (min) rated electrofusion or butt fusion fittings. For pipes less than 90 mm OD mechanical joint fittings may be used as detailed below.

Requirement: Downstream of the solenoid control valves a minimum of PN 8 (min) shall be used with PN 6 (min) rated electrofusion or butt fusion fittings. For pipes less than 90 mm OD approved mechanical joint fittings may be used as detailed below.

Note: Minimum PN 12.5 is required for potable town water supply in all locations or copper pipe in accordance with the PCA and AS/NZS 3500.

2.1.7 Main Branch Connections

Requirement: Branch connections the mains are to be made by the use of a electrofusion branch saddles (up to 125 DN branches) or moulded in-line tees compatible with the mains materials.

Requirement: Branches to small mains up to 63 DN shall be moulded in-line electrofusion tees. All branches over 180 DN are to be made with moulded in-line tee sections.

2.1.8 Jointing Non-Metallic Pipes

Requirement: Join all piping by using equipment approved by the manufacturer and skilled and certified operators to the manufacturer's instructions.

Requirement: Supply samples of electrofusion and butt fusion fittings for approval 14 working days before installation with technical details, origin, manufacturer and standards to which they comply.

Requirement: Supply a certified copy of the industry certification for the operators actually making the joints to the Project Manager prior to any jointing being undertaken.

Requirement: Mechanical joint fittings shall be Australian made in accordance with *Table 4* compression fittings manufactured to Australian Standards.

Note: Only install electrofusion or butt fusion joints under paved areas

Requirement: Tapping saddles shall be Australian made, in accordance with *Table 4*, and used on laterals downstream of the solenoid valves up to 90 DN with 25 and 50 DN branches except under paving.

Requirement: Use only stainless steel bolts of appropriate grade for the location in tapping saddles. Only install electrofusion or butt fusion joints under paved areas

Requirement: Do not fabricate Polypropylene and PE80B or PE100 piping, fittings, manifolds etc. on site. Only final assembly jointing permitted on site and mechanical jointing is preferred in these instances. Only competent experienced, industry recognised, and certified welders are to weld joints. Traceability of all electrofusion and butt fusion joints to the welder is required.

Requirement: Unless specifically specified fabricated fittings are not acceptable for below ground (buried) applications

2.1.9 Bending

Requirement: PE pipes may be cold formed, to the minimum radius recommended by the manufacturer, but not less than 20 times the DN of the pipe where the SDR is 21 and the installation temperature is over 20 deg. C, without the use of fittings.

Requirement: Such bending is not to deform the pipe. Bending the pipe is preferred in lieu of fittings where possible. Fittings are not to be located on bends where the joints are placed under any strain; generally fittings should be placed as least 1500 mm from the tangent point of a bend.

2.1.10 UPVC

Requirement: UPVC pipe work shall not be used pressure applications except for minor repairs to existing works.

2.1.11 Copper

Requirement: Copper pipes to AS/NZS 1432 Type B shall be used in above ground locations where the pipes are accessible to the public, where required by any water authority having control over the works and in other locations shown on the drawings or specified herein.

Requirement: Where copper is used in conjunction with other materials the copper pipe shall be selected so that the internal diameter is equivalent to the adjoining pipe work.

Requirement: Join all copper piping by the use of approved copper or non dezincifying brass fittings and approved silver solder to AS 3500 Part 1. All joints are to be slip type joints. Belled joints are not acceptable. Soft soldered joints are not permitted. Use an approved slip joint tool for Copper to copper slip joints. On larger pipe sizes (>50 DN) approved roll grooved fittings may be used on copper piping with formed roll grooved fittings in lieu of silver soldering.

Requirement: Use approved pipe benders for copper tube up to 25 DN. Use approved fittings for pipe greater than 25 DN.

2.1.12 Galvanised Steel

Requirement: Galvanised mild steel pipe is not permitted for Hydraulic applications. Use stainless steel of appropriate grade for the application as an alternative material.

2.1.13 Other Materials, Fittings & Conditions

General: Other materials, when specifically approved by the Client and or permitted under AS/NZS 3500 for plumbing systems can be used in the locations approved by the standard or materials approved under MP52, Watermarked or as specified or shown on the drawings.

Requirement: Do not use mitred style (lobster back) fabricated fittings without an internal radius on the throat of the fitting in any material. Bends in pipe over 90 mm OD are to have throat (segmental) radius on the throat and back of the fitting. Do not use fabricated lobster style fittings below ground.

Requirement: Fabricated lobster back fittings in stainless steel (of appropriate grade for the application), polypropylene (PP) piping, welded buy a qualified manufacturer under factory-controlled conditions.

Requirement: Flanges will comply with appropriate standards to match equipment. Hot dipped galvanised rolled grooved fittings may be used for connection of filters and for dismantling joints.

2.1.14 Screwed plastic fittings

Requirement: All plastic BSP threaded fittings are to be precision moulded from glass reinforced materials with a maximum working pressure of at least 1250 kPa. Refer to *Table 4*.

Requirement: Avoid excessive thread tape on any fittings. Apply tape clear from the ends of the threads by one or two threads to prevent severed portions of tape entering the system.

2.1.15 Articulated risers

Requirement: All emitters including sprinklers, sprays and bubblers are to be installed on triple jointed articulated risers (swing arms) that are side connected to the laterals. The risers are to have a minimum of 200 mm of straight pipe but selected to suit location and lateral cover.

Requirement: Select the riser length so that the riser angle is no steeper than 45 degrees from the horizontal when the emitter is at grade.

Requirement: Only high quality precision moulded M&F elbows, and rigid heavy walled pipe pieces with machine cut tapered threads shall be used to form the triple jointed risers (swing arms) on all pop-up type sprays, bubblers and sprinklers. Risers with "O" ring seals may also be used in conjunction with purpose made matching recessed fittings

Requirement: Moulded nylon elbows are not acceptable. Light duty moulded elbows with "O" rings are not acceptable.

Requirement: Provide a sample of the articulated risers for approval in each size, 7 working days before ordering the risers.

Requirement: Thread tape shall be used on the riser joints and the tape shall be kept clear from the ends of the threads by one or two threads to prevent severed portions of tape entering the emitter. Do not apply Teflon tape thread seal on articulated risers with "O" ring seals.

2.1.16 Stainless Steel Pipe and Fittings

Requirement: 316 (or other approved grade) stainless steel fittings from shall be used to provide BSP pipe fittings where connecting to stainless steel pump housings and like situations and construction of above ground manifolds and pipework where specified and or in lieu of other approved above ground materials. Refer *Table 4*.

Requirement: Above ground stainless steel pipe work may be fabricated by welding offsite in a controlled workshop environment and or assembled on site using rolled grooved pipe sections and fittings. Only trained and skilled operators are to operate roll grooving machines on site.

Note: Galvanised steel, malleable iron, ductile iron or brass fittings are not acceptable in any part of the installations.

2.1.17 Multilayer Pipes and Fittings

Requirement: For applicable applications multilayer piping with aluminium core for hot and cold water and gas installations up to 50 DN in accordance with the manufacturer's recommendations and approvals with the approved manufactures fittings. Use only crimp tools supplied by the manufacturer to install the pipe and fittings.

Requirement: For exposed above ground locations provide appropriate fixing and support and install in a neat and tidy manner.

Requirement: Select appropriate colour coding on the outer layer for the application in accordance with codes and industry practice.

2.2 PROHIBITED MATERIALS AND EQUIPMENT

2.2.1 Prohibited Materials and Equipment

Requirement: Do not use the following materials, fittings, valves and equipment:

Mitred or fabricated fittings in any type of material except where lobster throat style bends are permitted

Nylon or plain moulded plastic screwed fittings and elbows in any location, including articulated risers, are not acceptable

Galvanised pipe (& fittings) are not acceptable for hydraulic applications in any location but may be used for structural applications where specified

Plastic (moulded) un-reinforced valve boxes are not permitted unless specifically approved in special circumstances such as flush valves and air/vacuum release valves for drip systems

Low density poly pipe (LDPE) and nylon moulded fittings unless part of an approved sub-surface irrigation system

Gate valves of any type and material, except for soft seat buried isolation valves and buried sluice (flush) and drain valves. Refer *Section 7* and *Table 4*.

Leaver operated butterfly valves in any location

Blue or blue striped piping for irrigation, downstream of the cross connection control, or for water harvesting applications and for cable sleeves

UPVC pipes except for cable conduits under paving, storm water applications.

Light duty moulded plastic elbows with "O" rings on articulated risers.

Quick coupling valves (QCV's) in any location, except adjacent to a cricket pitch.

Temporary irrigation arrangements (NOTE: All irrigation systems must connect to the SOPA irrigation network water supply and water management control systems and operate under automatic control)

STANDARD TECHNICAL SPECIFICATION

SECTION 3 – PIPE WORK INSTALLATION

1.0 TRENCHING

2.0 INSTALLATION

3.0 HYDRAULIC WORKS

3.1.0 TRENCHING

Note: Read Clause 1 in conjunction with *Section 1 Clause 1.22*

3.1.1 Trenching - Mains

Requirement: Where site and soil conditions permit, i.e. dense compacted soils without sharp stones, shale, fill, rocks or stone particles that will not pass through a 13 mm sieve, the narrow trench method is acceptable using chain trenchers.

Requirement: Where the existing soil conditions are unsuitable, standard trenching methods shall be used (excavator) providing minimum 300 mm trench and a minimum 100 mm side clearance each side of the pipe and the backfilling shall comply with the requirements below. The pipe is to be located in the centre of the trench. Refer AS/NZS 2033:2008 Clause 5.3.16 Figure 5.1 for Typical Installation in a Trench.

3.1.2 Trenching - Laterals

Requirement: Where site and soil conditions permit, i.e. dense compacted soils without sharp stones, shale, fill, rocks or stone particles that will not pass through a 13 mm sieve, the narrow trench method is acceptable using chain trenchers.

Requirement: Where the existing soil conditions are unsuitable, standard trenching methods shall be used (excavator) providing minimum 250 mm trench and a minimum 100 mm side clearance each side of the pipe and the backfilling shall comply with the requirements below. The pipe is to be located in the centre of the trench.

Requirement: Where existing soil conditions are unsuitable the trench bedding & backfilling shall comply with the requirements below.

3.2.0 INSTALLATION

3.2.1 Bedding all pipes

Requirement: Take care to bed all pipes on the barrel of the pipe on suitable granular or friable non-cohesive bedding material, without sharp stones, shale, fill, rocks or stone particles that will not pass through a 13 mm sieve.

Requirement: Where the existing bedding is unsuitable, bedding consisting of single sized 6 or 10 mm recycled crushed concrete or river gravel (selected to suit the location and pipe size).

Requirement: A minimum of 50 mm thickness shall be used for pipes up to 63 DN, 80 mm for 75 to 125 DN and 100 mm for 140 to 315 DN. Recess under fittings.

3.2.2 Backfilling - Mains - Primary & Secondary Zone

Requirement: Where the narrow trench method is used primary and secondary backfill shall consist of 6mm non cohesive granular recycled crushed concrete or river gravel, up to 150 mm above the crown of the pipe. Work the granular material into any voids along the sides of the pipe to ensure side support.

Requirement: Where standard trench methods are used the primary and secondary backfill shall consist of 10 mm non cohesive granular recycled crushed concrete, river gravel or coarse/granular non-cohesive compaction sand, with a minimum compaction index of 55, up to 150 mm above the crown of the pipe, the surface levelled and identification/tracing tape installed. Refer to *Clause 2.19* below.

Requirement: Work the backfill down the sides of the pipe and compact to ensure the area below the spring line of the pipe is fully supported and free from voids.

3.2.3 Backfilling - Laterals Primary & Secondary Zone

Requirement: Backfill for laterals up to and including 63 DN (downstream of the solenoids) where chain or continuous rotary type excavators are used the spoil should be suitable for primary zone and secondary backfill over the bedding. Providing the soil does not contain sharp fragments, other foreign material, or any material that will not pass throughout a 13 mm sieve and is of a non-cohesive granular or friable nature.

Requirement: Where the excavated material available for primary and secondary backfill does not meet the above requirements, crushed recycled concrete, river gravel, 6 mm or 10 mm grade, alternatively, coarse/granular non-cohesive compaction sand, with a minimum compaction index of 55, used to provide a 150 mm cover over the crown of the pipes. Select appropriate fill to suit the location and pipe size.

3.2.4 Backfilling - All Pipes

Requirement: The remainder of the trench, above the primary and secondary zone, can be back filled with the excavated material provided that there is no foreign material or no large rocks or lumps of hard soil that are larger than 75 mm in section.

3.2.5 Prohibited backfill

Requirement: Under no circumstances will sand, brick bats, concrete pieces of any size or type or other construction materials as backfill material for PE pipes.

3.2.6 Compacting backfill

Requirement: In all cases backfill material above the primary and secondary zone is to be compacted in layers not exceeding 150 mm to a compaction index of at least 55.

Requirement: Where pipes pass under areas that are to be paved the compaction will be in accordance with a Civil Engineers and/or Civil Contractors requirements and instructions.

3.2.7 Cover for pipes - Mains and Sub-mains

Requirement: In all areas the minimum cover shall be 450 mm and 600 mm under roads, unless local circumstances prohibit these depths. Obtain written approval on a case-by-case basis where the above depths are to be shallower. Conduit all mains and sub-mains under unsealed roads, tracks etc.

3.2.8 Cover for pipes - Laterals

Requirement: The laterals shall have 300 mm cover in open spaces and playing fields. Provide a minimum of 250 mm cover in all other in all areas unless otherwise specifically approved in writing by the project manager in each case i.e., reduction in cover where damage may occur to the root system of existing trees and under paved areas.

3.2.9 Pipes under existing paving

Requirement: Where pipes are to be installed under existing paved areas, through walls, under roads and the like, it is preferred that the pipes be installed by drilling or boring under the paving, or other approved method that will not disturb the surface. Provide sleeves for all pipes under roads and sealed surfaces. All sleeves are to extend 500mm past the back of the kerb or sealed road surface where there are no kerbs or guttering.

3.2.10 Removal of paving

Requirement: Where boring or equivalent method is not feasible the paving may be removed by sawing the paving or removing and relaying the paving where the paving is segmented, with the written permission of the Project Manager.

Requirement: Sawing of continuous paving is to be carried out by an approved SOPA contractor with approved equipment.

Requirement: The irrigation contractor will ensure damage to adjacent areas is minimised and not allowed to subside. Repair of any damage or subsidence will be at the contractor's expense.

Requirement: The contractor is to ensure sectional paving is removed carefully and undamaged, stored and reused. Keep damage and removal of paving to a minimum. Where appropriate allow to a SOPA approved contractor to remove and store segmented paving.

Requirement: Provide and compact back filling of trenches under paving in layers in accordance a Civil Engineers instruction to minimise subsidence. Allow to restore the paved surface to match the existing finish to the satisfaction of the Project Manager.

Requirement: The contractor will engage the approved SOPA paving contractors (as a sub-contractor) to replace and or repair all paving to match the original. The project manager will provide details of the approved SOPA paving contractors.

Requirement: The contractor will include paving replacement costs in the lump sum quotation/tender price and *Cost Schedule*. (Attach copies of quotations as appropriate). Variations for reinstatement of paving, where the contractor has not taken due care, are not acceptable.

3.2.11 Inclusions

Requirement: The contract price is to include all boring and thrusting, under paved surfaces and or the sawing, backfilling and restoration of paved surfaces.

3.2.12 Finishing - Grading

Requirement: Allow to rake surface free from all stones and to restore the level of trenches to existing finished levels as the trenches and backfill settle with approved top dressing to the satisfaction of the Project Manager.

3.2.13 Finishing – Turfing

Requirement: Refer to *Section 1 Clause 1.23* for turf works.

3.2.14 Vibratory Ploughing

Requirement: The use of vibratory ploughing to install pipelines is subject to specific approval in writing from the Project Manager, for each section of the works. The contractor must be able to demonstrate previous experience and expertise in this method of installation.

3.2.15 Pipe on Drums

Requirement: Do not drag the pipe on the ground when uncoiling from steel drums. Use formed rollers on rough surfaces and when dragging the pipe around corners. When inserting pipe into sleeves formed rollers are to be used and the manufacturers' recommendations on feeding angles are to be strictly observed. Free coiled pipe (i.e. not on drums) will only be used where a de-coiling carousel is used.

3.2.16 Pipe Movement:

Requirement: Make allowance when cutting PE pipes to allow for contraction when the pipe cools. PE pipes should be connected when the pipes are cool and at near normal service temperatures.

3.2.17 Temporary Capping

Requirement: Cap all piping to prevent the ingress of dirt water or other materials during construction.

3.2.18 Location of Pipes

Requirement: All trenches shall be on a straight line or uniformly follow curves or contours wherever possible to permit the future location of the piping unless otherwise permitted by the Client.

3.2.19 Marking and Tracing Tape

Requirement: All main lines, sub-mains, ring mains are to have a marking tracer tape, minimum of 100 mm wide, in one continuous length between valve boxes. The tape, installed above the pipe on top of the compacted and graded, secondary zone, layer, a minimum of 150 mm above the crown of the pipe, in compliance with AS/NZS 2033:2008 Section 5 Clause 5.3.16 Marking Tape and Figure 5.1.

Requirement: Tracer tape is to incorporate a stainless steel wire to assist in the location of the pipe with tracer equipment and when excavating, before making contact with the pipe.

Note: Refer to *Section 2 Clause 1.4* with reference to the requirements for irrigation systems under the proposed adoption of the Plumbing Code of Australia (PCA). Under the current NSW plumbing and drainage code some water authorities have required the tape attached to the pipe at 3 metre intervals. This arrangement is not satisfactory, has never been acceptable, and not in compliance with AS/NZS 2033:2008 Section 5 Clause 5.3.16 Marking Tape and Figure 5.1.

Note: On-site experience demonstrates that where attached directly to the pipe it is always in direct contact with the pipe at the attachment point, however the tape ends up over the side of the pipe during back filling, and excavator usually damages the pipe before detecting the tape.

Requirement: Where necessary should check with the local authority before installation in this regard and seek adoption of AS/NZS 2033:2008, or apply for approval of an alternative solution complying with AS/NZS 2033:2008 under the PCA when adopted, if the direct attachment requirement still exists.

Requirement: The ends of tracer tapes are to be located in valve boxes to allow the connection of tracing equipment. Print on the marker the words "IRRIGATION PIPE - CAUTION DO NOT DRINK" or similarly approved wording, continuously marked in letters 50 mm in height. Lilac tape with black lettering shall be used contaminated surface water; reclaimed water and effluent reuse applications, blue tape for potable water where required by PCA, Standards or codes of practice. Provide samples of tracer tape for approval 7 working days prior to ordering.

Requirement: Check the tracer tape for electrical continuity after back filling.

3.3.0 HYDRAULIC WORKS INSTALLATION

3.3.1 Hydraulic Works

Requirement: Hydraulic works pipework and equipment installation will comply with the requirements of the standard technical specifications.

3.3.2 Plumbing Works

Requirement: Where hydraulic works include plumbing works which fall under the jurisdiction of the Plumbing Code of Australia (PCA), such works are to comply with the requirements of the PCA.

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STANDARD TECHNICAL SPECIFICATION

SECTION 4 – VALVE BOXES & EQUIPMENT PITS

1.0 VALVE BOXES AND EQUIPMENT PITS

4.1.0 VALVE BOXES AND EQUIPMENT PITS

Note: This section applies to all classifications of work as applicable

4.1.1 Valve Boxes - Trafficable Areas – Refer *Table 4*

Requirement: Valve boxes in all trafficable areas, where the access of vehicles is not restricted to tractor type mowing equipment and light commercial vehicles under 3 Tonne Gross and within 3 metres of the road edge or kerb, valve box sections or other approved precast concrete stackable sections shall be used Details shall be provided for concrete sections for approval.

Requirement: Sections should available in 450 x 450 x 150 -300 deep, 600 x 600 x 150-300 deep, 900 x 450 x 150-300 deep (other sizes may be approved) and are to be stacked up to form a variable pit depth. Support the pit sections on pre-cast reinforced bases or poured reinforced bases. Hot dipped galvanised lockable covers with a minimum 4 tonne axle loading shall be used. Drainage requirements are set out below.

Requirement: Unless specified otherwise, provide a concrete collar around the top of the box 100 x 100, flush with the top of the pit and reinforced with an R10 bar, with a minimum of 40 mm concrete cover bent around the corners of the box and lapped a minimum of 100 mm at any joints.

Requirement: In all paved areas subject to light wheel loads the above valve boxes are to be designed to accept in-fill lockable covers, refer *Table 4*, with a minimum wheel loading of 5 tonnes and in road pavements a minimum 10 tonne wheel loading or to meet the minimum standards required by the local road authority in each case. Certify all pits in road paving (by a Structural Engineer) before installation and signed off after installation.

Requirement: Cut or core drill pipe access points neatly in the riser sections with a maximum clearance of 20 mm. Pit with excessive clearances are not acceptable.

4.1.2 Valve Boxes - Non -Trafficable Areas – Refer *Table 4*

Requirement: In locations where traffic is restricted to tractor type mowing equipment and light commercial vehicles under 3 Tonne Gross and in areas such a playing fields and mass landscaped areas, valve boxes of heavy duty glass reinforced construction are permitted. Refer to *Clause 4.1.6* below for identification and marking requirements.

Requirement: The selected valve boxes are structurally capable of supporting the above loads and installed in accordance with requirements below. Provide a sample for approval 14 working days prior to ordering.

Drainage requirements are set out below.

Requirement: No cutting of plastic moulded or glass reinforced valve boxes is acceptable. Cut or stacked pits will be rejected.

Requirement: Use solid precast purpose made riser blocks or concrete blocks a minimum section of 50x100 will be used as spacers to raise the pit.

Requirement: The pipes shall enter and exit between the riser blocks and pre moulded access points and not through the sides of the valve pit. Poured or a precast concrete base a minimum of 50 mm thick shall be installed under each valve pit.

Requirement: Lay the riser blocks neatly with close fitting dry (or suitably bonded) joints. Where more than one course of riser blocks is required, lay and bond with cement mortar or an appropriate structural adhesive to prevent the pit from collapsing from external soil loading.

Requirement: Seal any gaps around any pipes, riser blocks, etc. to prevent the ingress of soil by completely wrapping the whole of the external valve pit, riser blocks and pipes with Bidium® filter fabric before back filling with granular material specified for pipe bedding.

Requirement: Light duty lockable structural and security covers are required in some areas for safety and security of assets, refer *Table 4*.

Note: Valve boxes of PVC or un-reinforced nylon construction are not acceptable except as spotter boxes for drip applications. Under no circumstances are plastic valve pits to be "piggy backed" or "stacked" on top of each other.

4.1.3 Sizing of Valve Pits & Boxes

Requirement: In paved areas select the valve pits/boxes to insure the isolating valve, solenoid valve and union are all located within the valve pit. In all cases there shall be sufficient space (to access equipment with appropriate tools) in order to allow normal dismantling, repair and servicing of the valves and equipment without excavation of the valve pit or box. Large pits shall conform to the sizes and clearances set out below.

Requirement: In paved areas the arrangement shall allow the solenoid valve to be completely removed from within the valve pit without disturbing the valve pit. Large non-standard pits shall comply with the requirements below.

4.1.4 Bedding & Supports

Requirement: Bed the box or pit base on and back fill with 6 or 10 mm crushed recycled concrete or other approved free draining non-cohesive structural backfilling material with a minimum compaction index of 55. The valve boxes and supports are to be generally installed to provide a minimum of 25 mm clearance from all pipe work and 50 mm clearance from valves in addition to clearances required above and below for access.

4.1.5 Foundation

Requirement: The contractor shall ensure that the foundation of all valve boxes and pits is of sufficient structural strength to support the valve pit and the superimposed loads, for the location of the valve pit and design loading of the pavement.

Requirement: Design all valve boxes and pit foundations & bases to take the proposed loads required. Obtain Civil Engineers advice where necessary to ensure the final method of construction is adequate for each location. The contractor will provide additional compacted sub-grade under the valve pit supports to a Civil Engineers specification.

4.1.6 Identification and Marking of Valve Boxes and Pits

Requirement: Refer to *Section 2, Clause 2.1.4* concerning cross connection control identification and marking of water reuse, harvesting and irrigation systems.

4.1.7 Location

Requirement: Unless otherwise approved by Client, valves of any type are not to be located in trafficable (road carriageway) areas or driveways. Valve pits are to be wholly within landscaped areas or paved areas.

Requirement: Valve pits are to be located adjacent to the edge of the garden beds in preference to turf areas depending on site conditions. All valve pits and boxes are to be located off the marked playing area of sports fields.

Requirement: Bury only reinforced plastic valve pits valve pits with approval of the Project Manager in each specific case. Where approved attach a galvanised metal plate, minimum of 3 mm thick to the underside of the valve box cover. The plate is to be a minimum of 50% of the valve pit lid area up to a maximum of 150 mm diameter or 150 mm square and attached with stainless steel bolts and nuts at least 6 DN.

Requirement: Install the valve pits flush with the adjacent surfaces and maintain specified clearance from the piping and valve. Where the top of the valve pit matches to adjacent paving finishes, saw and splay the concrete raising blocks to connect the pit flush to existing grades.

The contractor will allow to adjust the finished level of valve pits where necessary as part of the contract price. Fix the covers with stainless steel locking bolts or other approved arrangements.

4.1.8 Paved Areas

Requirement: In-fill pit covers shall be finished to match the adjacent surfaces. Covers and frames shall be finished flush with adjacent surfaces. Damaged frames and or covers are not accepted and replaced at the contractors cost.

4.1.9 Large Non-Standard Pits

Requirement: Where larger valve pits, equipment pits or equipment enclosures are required they may be constructed from 110 mm brickwork with a 100 mm thick reinforced concrete base, cast in situ from reinforced concrete a minimum of 100 mm thick, or precast concrete and fitted with approved close fitting lockable covers. Provide design details of all non-standard pits for review and approval 14 days prior to construction. Large non-standard pits shall comply with the requirements below.

4.1.10 Pit Covers – Refer Table 4

Requirement: All pits in paved locations, roads, foot paths and the like, only sectional water and gas seal, in-fill type, hot dipped galvanised covers and frames or cast-iron covers and frames (in-fill type in paving) set in concrete and flush with the finished grades of the surrounding ground levels, to the satisfaction of the Project Manager, shall be used. Supply a wheeled cover lifter to remove sections exceeding 40 kg.

Requirement: In other locations fabricated mild steel checker plate covers welded to braced angle iron frames (in sections where necessary) to suit the application and hot dipped galvanised after fabrication. Sections of covers should not exceed 20 kg ea or 40 kg when hinged. Provide lipped joints between cover sections with gutters, seals or removable inverted cross channels to minimise ingress of water and dirt between covers. Provide a recessed fabricated hot dipped galvanised frame and around the perimeter with gutters or seals. Where provided gutters drain either internally or externally as appropriate in each case.

Requirement: Provide a detailed CAD workshop drawing of the proposed covers in all cases with 14 days' notice prior to ordering.

Provide bollards approved by the Project Manager to prevent wheel loading where necessary.

4.1.11 Pit Extensions

Requirements: Only extend or deepened in the same material as the basic pit material to the satisfaction of the Project manager.

Requirement: Raise reinforced plastic pits/boxes by placing solid concrete blocks under the pit. Extending (or stacking) of plastic pits is not acceptable.

4.1.12 Minimum Pit Sizes

Requirement: The minimum cross section for a non standard pit enclosure is to be 600 mm wide and 600 mm deep. Where the depth is more than 600 mm the minimum width is to be 900 mm. Where the depth exceeds 800 mm the pit shall be a minimum of 900 x 900 mm.

4.1.13 Pit Clearances

Requirement: Provide the following clearances, measured from the centre line of the pipe:

In shallow pits less than 600 mm deep a minimum of 200 mm on one side, 400 mm on the other side and a minimum of 300 mm under the pipe and 200 mm above the pipe.

In other pits and enclosures the minimum width is to be 900 mm with a clearance of 250 mm on one side and 650 mm on the other side, a minimum of 300 mm under the pipe and 200 mm above the pipe.

In all cases the length will be 300 mm longer than the overall length of the equipment installed and with sufficient additional clearance for any fittings or equipment under, above and at the sides to allow for maintenance.

Requirement: Allow to dismantle all pipe work and equipment by way of dismantling joints, slip flanges or unions. Unions are acceptable up to and including up to 50 mm NB. Note: Flat faced unions may be required in some locations.

Requirement: Pits for backflow equipment shall be of sufficient size to allow access for repair and testing of the device to AS 2845.2 and have the necessary clearance and configuration required, allowing the removal of the device. Obtain the approval of the supply authority in writing prior to location of any backflow device below ground. Size the pit drain to allow full discharge of the device, in accordance with AS 2845, without surcharging the pit.

Requirement: All dimensions are clear internal sizes, increased where necessary to provide sufficient clearance to service, repair and remove all equipment.

4.1.14 Pit Access

Requirement: Fit all pits over 600 mm deep with approved step irons or access ladders with sufficient clearance for access.

4.1.15 Pit Design

Requirement: Pits or enclosures more than 900 mm deep and or with a volume of more than 1.5 cubic metres require a design prepared by a Civil Structural Engineer.

Requirement: Pits deeper than 1200 mm require access benches or platforms fitted and access ladders to provide safe access.

Requirement: Provide CAD structural workshop drawings including access arrangements and equipment clearances for review and approval 21 working days before construction and a structural certificate on completion as part of the contract price.

4.1.16 Pipe Work in Pits

Requirement: All pipe work in meter, filter and equipment pits shall be fabricated from Type B copper pipe or 316 (or other approved and fit for purpose grade) stainless steel pipe and a minimum wall thickness in relation to size for the proposed duty to Australian Standards. Roll grooved fittings are preferred in lieu of flanges. Provide CAD workshop drawing/s 21 working days before construction for review & approval. Refer *Section 6, Clause 6.1.8*.

Note: Detailed drawings of equipment are not required and block representation of the key external sizes and spacing is acceptable.

4.1.17 Valve box and Pit Drainage

Requirement: Provide a permanent drainage arrangement to solenoid valve pits. Solenoid valve pits and cable pits may be drained via a (minimum) 50 DN sub-surface drain (or where practical via the voids in trench bedding where river gravel or recycled crushed concrete is used) to a sub-soil or storm water drainage system. A minimum size drain shall be 50 mm internal diameter up to 10 m. Provide 90 DN for over 10 m Provide 100 DN access shafts at changes in direction where piped drains are not in straight lengths. Refer *Section 6, Clause 6.1.8*.

Requirement: Solenoid valve pits that remain water logged for more than 4 hrs following a rainfall event are unacceptable. Grade pit drains to the discharge point.

Requirement: Directly connect large non-standard valve and equipment pits to the storm water system. Minimum size drains shall be 100 DN. Grade pit drains to the discharge point. Grade the internal area of the floor of large pits to the drain outlet. All water must completely drain from the pit immediately following a rain fall event. Pits that any retain any water or pooling are unacceptable. Refer *Section 6, Clause 6.1.8*.

4.1.18 Cleaning Pits

Requirement: On completion clean out (washing and wet vacuuming as necessary) all valve boxes, equipment pits and cable pits prior to practical to completion.

4.1.19 Venting Pits

Requirement: Provide educt vents for all pits containing any heat generating equipment. Grade all vents to an approved termination position in a minimum size of 100 mm. PVC DWV is permitted below ground for venting. Where vents require pipework above ground use only approved metallic pipework. Terminate the vent with an approved cowl suitable for the location.

Requirement: All vented pits require a permanent un-trapped drain, minimum of 100 DN to act as an induct vent. Where the drain is unsuitable to use as an induct vent provide a separate 100 DN induct vent. Locate the vent a opposite ends of the pit. Locater the educt vent as high as possible in the side or top of the pit where practicable. Location and termination of vent must not create a trip hazard. .Where fixed bollards are used it may be practicable to use one of the bollards as a vent arrangement where approved. Refer *Section 6, Clause 6.1.8*.

STANDARD TECHNICAL SPECIFICATION

SECTION 5 - CONTROL SYSTEMS

1.0 IRRIGATION CONTROL SYSTEMS

2.0 WATER MANAGEMENT CONTROL SYSTEMS

3.0 CONTROL CONSOLES AND PANELS

4.0 POWER SUPPLY

5.0 CONTROL CABLES AND SLEEVES

6.0 CONTROLS, EQUIPMENT AND COMPONENTS

5.1.0 IRRIGATION CONTROL SYSTEMS

5.1.1 Cloudmaster Control Systems

Requirement: Supply Australian made field controllers as set out in *Table 4* as the standard network irrigation system control on all sites.

Requirement: Supply and install field controllers in accordance with the manufacturer's instructions and Clause 1.2 below.

Requirement: Link irrigation field controllers to the central dedicated water management PC control computer running propriety software on a Windows® based operating platform for central back-to-base systems where pump starting is required on non-pressurised system. Refer *Interpretation Section*.

Requirement: Provide sufficient field controllers to service all installed solenoids valves, any specified future stations and spare capacity as specified below.

Requirement: Multiple field controllers in common consoles are to be linked (daisy chained) together in one or more groups as specified in the *Interpretation Section* and only one communications interface used for each location. Provide a minimum of two spare stations for each console group in addition to any specified future capacity.

Requirement: Group the valves/zones on the irrigation controller stations in landscape classifications as follows:

- Group 1: Turf - Overhead Sprinkler
- Group 2: Turf - Textile Subsoil
- Group 3: Native Planted Areas
- Group 4: Garden/shrub Planted Areas
- Group 5: Tree Pits (Bubbler Cells)

Requirement: Leave station '0' as one of the spare stations. Depending on the number of station available and the potential to add additional classifications to each group allow one or more spare stations between each group as appropriate for the Console for future development.

Note: For design and construction purposes the solenoid valves are usually sequentially number along the main lines and not in landscape classification groups.

Requirement: Fix an as-built A3 laminated drawing inside the lid of the console and a laminated cross reference chart associating sequential valve numbers to Group number on the controller.

Requirement: For non PLC based water management sites, interface auxiliary control functions such as potable water make-up valves, water meter logging, and moisture sensor control etc. on the irrigation controller to provide programmed/remote operation as specified in the *Interpretation Section*.

5.1.2 Controller Location and Installation

Requirement: Mount the irrigation controllers (and other control equipment specified in the *Interpretation Section*) in accordance with *Clause 5.3.0* below.

5.2.0 WATER MANAGEMENT CONTROL SYSTEMS

5.2.1 Comment:

The objectives of standardizing water management control systems across all venues is to reduce recurrent direct labor costs, provide early detection of faults, monitoring water use, simplify operations and maintenance and reduce soil moisture demands while increasing efficiency and management practices from a central location.

The water management control system generally forms a separable portion of the works including the complete pumping control and monitoring systems and may include pump controls, control panels, VFD drives, specialised cables, level and pressure transducers, pressure tank monitoring, and back-to base monitoring and control, compatible to and integrated with existing central irrigation control and monitoring systems, water meter data logging and flow meter monitoring/logging, filter control, back washing and monitoring, chemical injection, effluent injection and all associated electrical works. Refer *Section 1, Clause 5* for further details of work classifications and work packages. Refer to *Table 4* for approved suppliers of water management control systems.

5.2.2 General:

Water management control system package generally includes but not limited to the following:

- Supply installation of a new proprietary, factory built electrical, control and monitoring panel as a complete unit
- Supply and installation (in the console or control panel) of a OPLC (Graphical Interface) to control, monitor and log all functions, and associated, programming, testing and commissioning
- Provide and install the associated equipment for the OPLC to allow back-to-base control and monitoring of all components in the system
- Factory testing and inspection of control panels and consoles prior to delivery to site,
- Supply and installation of variable frequency drive/s (VFD) (in the control consoles or panels) for the pumps as detailed in the *Interpretation section*

- Supply and installation of new screened power cables to the pumps
- Supply and installation of all transducers, controls and associated cables
- Supplying and installing data pulse pickup sensors and cables on water meters
- Custom programming of the OPLC to provide the required functions and operational modes as required in the *Interpretation Section*, with customized spread sheets to download and interpret the logged data
- Remote down loading of programming to field OPLC's
- Real time monitoring and data logging of all functions and equipment
- Integration of the irrigation controller/s in to the consoles or control panels where applicable, refer to *Clause 1* above and *Clause 5.3.0* below
- Factory testing and commissioning
- Client instruction and training
- Supply and installation of all necessary sundry fittings cables, connectors, switches and any other items required to provide an operational system in accordance with the requirements and intent of the specification and the drawings

5.2.3 Programmable Logic Controller (OPLC)

Requirement: Provide a OPLC as a component of the water management system, refer, *Table 4*. Ensure the OPLC has facilities to upgrade and extend the capacity for future use. Provide a OPLC colour screen.

Requirement: On back-to-base systems provide G3 (or later versions) communications interface modems to link the OPLC and central base PC for remoter control, programming and monitoring of all functions connected to the OPLC. Provide a central dedicated water management PC control computer running propriety software on a Windows® based operating platform. Note: This PC would also run the irrigation control system software.

Requirement: Refer to *Clause 5.2.1* and *5.2.2* above for general requirements of OPLC installations.

5.2.4 Control Consoles and Panels. Refer *Clause 5.3.0*.below.

5.2.5 Power supply. Refer *Clause 5.4.0* below

5.2.6 Control equipment and Components: Refer *Clause 5.6.0*. below.

5.3.0 CONTROL CONSOLES AND PANELS

5.3.1 General

Requirement: For sites involving a separate water management control system, where the water management control is a separable works package, supply the irrigation controller/s to the water management control system contractor in a timely manner in accordance with the works program, for off-site integration into the control consoles.

Requirement: Provide WAE block diagram/s of all electrical works in consoles and control panels at the completion of the works, refer *Section 12, Clause 5.4*

Requirement: It remains the irrigation contractor's responsibility to connect all irrigation control cables to the irrigation controller (or terminal blocks provided) and test and commission the irrigation controller on site.

Requirement: In all other cases where the control console or panel forms a part of a standalone contract the contractor supplies the console/s and or panel/s fits out, installs all equipment and internal cabling and tests the system off-site, all in accordance with all the provisions in *Clause 6* below.

Requirement: Terminate all in all internal cabling in in consoles and panels in labelled terminal strips in appropriate locations to allow the tidy and orderly connection of external cabling on site.

Requirement: Install, pre-wire, and connect all controllers, equipment, controls, switches etc. in console/s and panel/s and test prior to delivery to the site. All cabling shall be in cable ducting and installed in a neat and tidy manner.

Hold Point: Provide 14 working days' notice to the client when the console and of panels are ready for inspection prior to delivery to site.

Requirement: Ensure sufficient spare cable access for all consoles and panels for future works. For external consoles provide at least 2 spare 63 DN cable sleeves and 2 spare 32 mm heavy duty orange conduits all capped clear of the concrete base in an accessible location, in addition to any other future capacity specified.

5.3.2 External Locations

5.3.2.1 Consoles

Requirement: For external locations the control console shall be a one-piece stainless steel console, refer *Table 4* for details. Select the width to ensure that all current and (any specified future) control equipment shall fit in the console. Note: One-piece floor standing SS consoles are generally available up to 1200 mm wide.

Requirement: Unless specified in the *Interpretation Section* consoles are to match existing consoles as required in *Table 4*, or the client provides written permission to supply alternatives in each case during the tender/quotation phase.

Requirement: For internal installations in approved structures refer *Clause 3.3* below.

Requirement: Mount one irrigation controller and OPLC etc. in the top section on an SS piano style continuous hinge-up backplane with cables installed in cable ducts mounted on the underside of the backplane. Mount any additional (slave) controllers, VFD's etc. in the lower section of the console.

Requirement: Install the console on a stepped reinforced concrete base a minimum of 100 mm thick and minimum 50 wide on the ends and back, set a minimum of 100 mm above ground level and a concrete apron extending a minimum of 600 from the front of the console at grade with the adjacent ground level.

Requirement: If the base is set on sloping ground ensure the soil is retained on the higher side, at least 300 mm clear of the rear and sides of the base panel and any water shed diverted around the console base.

Requirement: Seal the base flange of the console to the concrete base with an approved sealer suitable for outdoor conditions and SS to concrete sealing, ensuring the sealer is placed across the full width of the underside of the base flange and any external filler excess finished flush with the concrete base a panel face. Superficial sealing around the panel with silicon sealer is not acceptable.

Requirement: Cast-in one or more cable pits in the concrete base under the control console flush with the top of the concrete base for all cable entry.

Requirement: Arrange the cables and conduits into the panel from the pit in a manner, which will permit the replacement of the cover to the cable pit. This may require cutting holes in the cover and splitting the cover into two sections in order to fit around the cables/conduits.

Requirement: The entry of cable sleeves and power conduits are to be sealed to prevent the ingress of soil and water into the pit. Provide drainage to the cable pit/s as necessary to ensure the pit/s do not retain water causing condensation in the consoles.

5.3.2 2 Panels

Requirement: Where specified external panels, wall of post mounted panels, will comply with *Clause 5.3.3* below except full 304 or higher grade stainless steel construction is required as appropriate for the location.

Requirement: Install all cables to external panels in secured galvanised ducting with fixed covers or galvanises metallic conduit or conduit protected by galvanised metal covers. The design of support post/s may incorporate the secure entry of cables to panels in accordance with any wiring rules.

5.3.3 Internal Locations

Requirement: Wall mounted panels for internal applications shall be a minimum size of 600 high, 450 wide and 300 deep where VFD pump drives are not fitted and 600 high, 600, wide and 450 deep where VFD drives are fitted. Select all panels to provide access to all equipment and appropriate layouts. Panels which are cramped, untidy and under or oversized are not acceptable.

Requirement: Powder coated steel construction is required for internal panels located in dry and approved structures. In damp, humid and or wet locations 304 or higher grade SS is required.

Requirement: Light grey or light beige powder coating is required unless the panels are to match existing panels or a specific colour as otherwise specified.

Requirement: Provide an internal swing out panel on all wall mounted panels with all switches and controls mounted internally on the swing out panel. Mount all status/indicator lights the internal swing out panel. Do not mount any switches, controls or status lights the outside of any panel or console.

Requirement: Mount controllers that require access such as irrigation, PLC pump controllers, filter controllers, UV steriliser controllers etc. on the back plane or rear of the swing out panel with front face flush with the access hole cut and trimmed in the panel.

Requirement: Provide internal mounting panels as necessary on all panels and consoles (use stainless steel on stainless panels), back planes may be zinc plated steel or powder coated for mounting equipment. Provide ventilation (natural or powered) as required to keep the internal panel temperature within the operational specifications of all equipment.

Requirement: Arrange all ventilation penetrations to prevent insect intrusion and maintain the minimum IP 54 rating of the panel.

Requirement: Before installation, the Project Manager, shall approve the final location of the control console/s and or panels.

Requirement: Refer to *Clause 5.4.0* below for power supply, surge control and power points.

5.3.4 Labelling Consoles and Panels

Requirement: All controls, switches and indicator lights shall be matching parts and shall be labelled with engraved labels using 1.5 mm 2 colour (blue with white lettering) Gravograph - Gravoply II or equal. Labels shall be a minimum of 8 mm high with minimum 5 mm high lettering. Capitals and proportional lower case letting may be used.

5.3.5 Remote Isolation

Requirement: Provide local isolation as required by regulations where equipment is installed remotely of the control console or panel

5.4.0 POWER SUPPLY

5.4.1 General

Requirement: The contractor, prior to submitting a tender shall make sufficient enquires regarding the supply of power (240v and or 415v) to the site for the current works, specified otherwise, and include all necessary work for the supply of power to the proposed installation in the lump sum price.

Requirement: The power supply shall include (if necessary) an approved meter box incorporate into the control system panel of approved matching meter panel in accordance with the supply companies' requirements.

Requirement: Where the power supply is to be provide for other uses (currently or in the future) the rating of the power supply shall be as advised by the client and the Contractor required to allow for specified future development.

Requirement: Provide a main isolating switch for the system as required by current standards.

Note: Plastic electrical conduit is not acceptable above ground in open spaces unless fully protected by secured 1.6 mm galvanised or stainless steel covers.

Requirement: Install all controls in consoles panels in accordance with *Section 3* above. Provide individual circuit breakers for each pump and overload tripping, mounted in the lower section of control consoles or back plane of control panels. Provide all necessary power cabling to connect all equipment in accordance with AS 3000.

5.4.2 Surge Protection Devices

Requirement: Protect the 3 phase mains supply from power surges by provision of an SPD module to handle 80,000 Amps fault current with fault indicator and LED status. Refer to *Table 4* for an acceptable device.

Requirement: The single phase control sub-circuit (for irrigation controller, filter controller, steriliser etc. as fitted) shall be protected from power surges by provision of an SPD module to handle 65,000 Amps fault current with replaceable cartridges and condition indicator. Refer to *Table 4* for an acceptable device

Requirement: Provide earth spike in a suitable location appropriate sized earth cable for the surge protection of the project, in accordance with manufacturer's recommendations and local standards & codes.

Requirement: In order to ensure earth continuity in dry areas the contractor shall provide separate irrigation zone and a subsoil drip ring or at least 2 bubblers in spotter boxes adjacent the earth spike.

Requirement: Test the surge earth spike for minor transient current potential to ensure the earth spike is not creating a cathodic issue for the equipment, in particular submersed equipment.

5.5.0 CONTROL CABLES AND SLEEVES

5.5.1 Control Cables

Requirement: All 24 volt control wiring shall be Australian made, multi-stranded, multi cored, multi coloured cable with minimum 240 volt standard thickness HDPE insulation. Minimum wire size is to be 1.5 mm² with 2.5 mm² common, in all cases size the control cables to provide a minimum of 22 Volts at the valve or relay. Polyethylene will form the outer covering of multi core cables. Note: PVC outer sheath is not acceptable.

Requirement: Provide a sample of the multi core cable with manufacturers specifications for approval prior to ordering the cable.

Requirement: The common cable shall be a twin 2.5 mm² sheathed cable in all locations with one common cable provided for each 12 circuits. Acceptable colour combinations for common cables are black/black, black/blue, black/white and blue/white. Reserved one core for a spare or used to create a hydrozone where required. The common core cable shall not exceed the length of the associated control cable/s. Refer to *Table 4* for details.

Requirement: Provide up to 13 colours for multi core cables including black and blue. Reserve the black and blue for cables for spare/future/redundancy uses. Use only one corresponding cable colour for each circuit from the valve to the controller.

Requirement: Waterproof printed heat shrink permanent labels or stamped/engraved stainless steel tags are to be attached to each cable at each valve box and or cable pit to identify multi core cable and each control cable identified at the with the station number on the controller.

Requirement: Provide a cable diagram showing the number and colour of each circuit from the valve to controller and the colour and quantity of spare cables.

Requirement: A minimum of two (2) spare control wires shall be available for each multi core control cable as required in *Clause 1.1* above to allow for redundancy and additional zones added to adjacent areas, in addition to any nominated spare cables for future development.

Requirement: Provide a minimum loop in all multi core cables of 1 m at each valve, cable pit or panel. Individually seal the ends of all spare cable cores with a head shrink cable cap. Seal end of unused multicore cables with a single cap.

Requirement: All control cables are to be installed in a polyethylene cable sleeve, generally in the same trench as the mains, in a minimum 63 DN, 6.3 PN sleeve to provide a minimum free space of 50% of the cross sectional area. Where more than 50% for the cross section is used provide additional sleeves.

Requirement: Twist and solder joints (use non-corrosive flux) or twist and use crimp-on copper sleeves. Separately encapsulate each joint in an approved connector epoxy filled connector. Install all cables in seals in accordance with the manufactures instructions. All joints are to be located in valve pits or cable pits.

Requirement: Install all below ground multi core cables in cable sleeves. Do not fasten cables to each other in cable sleeves.

Requirement: Installed all control cables in a neat and tidy manner in all locations. Support and secure cables off the base of valve boxes and cable pits with nylon cable ties or a spiral cable wrap, hooks etc.to keep cable from immersion in water and silt and provide a neat and tidy installation. Insulation tape is not an acceptable method of bundling or supporting cables.

Requirement: Install all control cables above ground in galvanized metal conduits or plastic conduits protected by galvanized metal covers fabricated from mild steel a minimum of 1.5 mm thick, where public access is permitted and or unrestricted. All cables in plant rooms, pump rooms etc. are to be in conduit, cable ducts or where permitted, appropriate electrical tray.

5.5.2 Cable sleeves

Note: Refer to *Section 3* for cable sleeve installation requirements

Requirement: All mains and sub-mains are to have at least one cable sleeve to provide for future works even in locations where no cables are initially required.

Requirement: Install a minimum of two spare cable sleeves between the nearest valve pit and or cable pit adjacent to the mains/sub-mains and the controller position, for future access to the controller position fitted with push-in caps.

Requirement: The control cable sleeves shall terminate in valve boxes, or control cable pits. Grade the ends of the control cable sleeve up into the valve pit or cable pits. Note: Plain or corrugated flexible (drainage) tubing or conduit is not acceptable for connection to valve pits below ground.

Requirement: Refer to *Clause 3* above for cable entry into and addition of spare cable access to consoles.

Requirement: All cable jointing and drawing pits with lockable & trafficable type covers (in-fill type in paved areas). Provide cable pits at least every 98 metres (where there are no valve boxes) at intersections in the cable sleeves and where the change of direction is more than 30 deg.

Requirement: Cable sleeves are to be in one continuous length between valve pits or cable pits. Damage cable sleeves may be repaired using electrofusion sockets.

Requirement: Seal cable sleeves ends to reduce the ingress of soil and water to the cable sleeves by the use of expanding foam. Only small amounts are to be used to effect sealing of the sleeve and allow for the easy removal of cable in the future.

5.6.0 CONTROLS, EQUIPMENT AND COMPONENTS

5.6.1 Pumps

Requirement: Refer to the *Interpretation Section* for pump specifications. Refer to *Section 10* for pump installation requirements. Refer to *Table 4* for supplier details. Refer to *Clause 2* above for water management control systems.

Requirement: Terminate all drop cables from submersibles in terminal boxes to allow disconnection and removal for repairs. Each pump shall have an individual conduit to the terminal box to allow removal of the pump drop cable.

Requirement: When specified install the VFD drive units in the lower section of the control console/s or in pump panels. Refer *Table 4* for details.

Requirement: Provide lead/lag operation on alternate starts for multi pump installations.

5.6.2 Water Meters

5.6.2.1 Authority Water Meters

Requirement: Provide water meters at the point of connection from a potable or recycled water source in accordance with the water supply authority's requirements.

Note: The water authority usually supplies water meters at the boundary connection on potable water services and in Sydney Water area and normally fitted by Sydney Water under 50 DN. Generally, the contractor installs large meters and this cost is to be included in the lump sum contract price. Fit meters with a pulse output and connected as detailed below.

5.6.2.2 Reference Water Meters

Requirement: Provide reference water meters fitted to:

- The main discharge line on all pumped systems,
- Before the zone backflow device on all directly connected potable systems in an approved location
- On all recycled systems
- On sporting fields with overhead irrigation or subsoil textile irrigation
- Bore pumps, and
- Water harvesting systems at extraction points or extraction discharge points.

Requirement: Protect all water meters in public places by fitting an enclosure over the meters in accordance with Section 6.

Requirement: Provide permanently drained pits for reference water meters located below ground to prevent submerging the meter during rainfall events.

Requirement: Small sub water meters for cold potable water applications and filtered harvested water of similar quality to potable water quality, in accordance with *Table 4*. Provide positive displacement type meters, in 15DN and 20DN sizes with approval from the National Standards Commission and to AS 3565.1 Part 1 from 25DN to 40DN where the flow rates do not exceed 10kl/hr. (2.8 l/s). Supply meters with a pulse output and connected as detailed below.

Requirement: Larger sub water meters from 40DN to 80DN for flow rates to 33 l/s for potable water applications and filtered harvested water of similar quality to potable water meters, shall be turbine type (helical vane)_water meters to AS 3565.1 Class 2 -1998. Supply meters with a pulse output and connected as detailed below.

Requirement: For lower quality raw irrigation water and flow rates from 3 l/s to 2000l/s for pipe sizes 80DN to 1050 DN supply meters in accordant with *Table 4*. Supply meters with a dual pulse output and connected as detailed below.

5.6.3 Data Logging and Monitoring of Water Meters, water pressures and rainfall events:

Requirement: For central control systems where the system has logging and monitored of the real time water flow rates, water use and rain fall events, connect all meters and a tipping bucket rain sensor with pulse output etc. to the OPLC.

Requirement: The water logging interval shall be 15 minutes (unless specified otherwise) in real time and provide a graphical output showing volume, flow rate, date and time. The tipping bucket sensor shall be logged at 6 minute intervals and provide graphical output for volume, intensity, date and time.

Requirement: The down loading of logged data shall be at maximum interval of 3 hours unless specified otherwise. All down loaded logged data shall be available for downloading into a customised spread sheet supplied with the system for further analysis.

5.6.4 General:

Requirement: Cabling for sensors shall meet the requirement of the manufacturer of the sensing device.

Requirement: Conduit all cabling for meter sensors and any other remote sensors or controls. Use cable recommended by the manufacturer. Screened grease filled cable shall be used between the water meter and the controller/s where appropriate and or specified All conduits are to enter through the base of external control consoles and panels.

Requirement: On sites without central data logging provide remote water meter readouts, located in the control console, for authority meters and each sub-water meter installed.

Requirement: Install all meters in accordance with manufacturer's instructions and requirements.

5.6.5 Flow meters

Requirement: Where specified or shown on the drawings in-install inline flow meters as detailed below and in accordance with *Table 4*.

Requirement: Size the flow meters to utilise the major portion of the turn down ratio of the meter providing a wide flow range across meter.

Requirement: In order to meet the above requirement install the flow metres in 316 stainless steel flow tubes with tapers at each end with a 22.5 deg. included angle.

Requirement: Each end of the flow tube is to be fitted with a 316 stainless steel flange to suit the mating component. The internal bore is to be equal to the internal diameter of the flow meter. The internal finish is to be smooth bore with all welds ground flush. The internal surface roughness should be 0.003 to 0.006 mm (equal or better than copper pipe).

Requirement: The effective length of flow tube (the section between the taper and the flow sensor) is to be a minimum of 10 times the internal diameter of the flow tube on each side of the flow meter.

Requirement: Provide a roll grooved dismantling joint each end of the flow tube on the larger dia. a minimum of 100 mm from the taper. A ridged ductile iron roll grooved fitting with hot dipped galvanised finish is to be used to join the flow tube sections.

Requirement: Where the complete flow meter assemblies are located below ground locate the assembly in a pit in accordance with *Section 4*.

Requirement: Install water proof gear operated isolation valves each side of the flow meters at the ends of the flow tubes.

Requirement: Install the flow transmitters in the control console or panel. Allow to provide approved transmitter cable between the flow meter and the transmitter as supplied by the manufacturer.

Requirement: All cabling is to be in approved conduit. All sleeves and conduits are to enter through the base of the control console. Provide remote readouts for monitoring use and determining flow rates. Engage the manufacturer/supplier to commission all flow meters.

Requirement: Connect the flow meter transmitter to the OPLC for monitoring, control and data logging.

5.6.6 Pressure Sensors

Requirement: Install a pressure transducer in the main discharge pipeline or manifold to control the VFD or monitor the system pressures and any additional pressure sensors specified in the *Interpretation Section*. A pressure range of twice the maximum supply or design pressure is required.

Requirement: Supply the pressure transducer as a part of the control system. For sensors remotely mounted from the pressure tapping install 6DN stainless steel tubing to connect the tapping point to the transducer. Bend Gauge piping with a standard tube bender and clipped at intervals not exceeding 500 mm.

5.6.7 Pressure Gauges

Requirement: All pressure gauges shall be liquid filled type. A pressure range of twice the maximum supply or design pressure is required. For normal online monitoring provide a minimum dial size of 65 mm.

Requirement: Provide 100 mm dial size gauges on the pump discharge manifold and provide 100 mm dial size compound gauges on the suction manifold.

Requirement: Where any gauge is located in a position where access for reading is restricted the gauge shall be supplied with a flanged case for wall or flush panel mounting and 6 DN copper or stainless steel tubing used to connect the tapping point to the gauge.

Requirement: Bend gauge piping with a standard tube bender and clipped at intervals on exceeding 500 mm. Wall mounted gauges on a suitable stainless steel back plane and not directly on the wall. Flush panel mounted gauges shall have a rear inlet connection.

5.6.8 Pressure Monitoring

Requirement: Where specified in the Interpretation Section, provide pressure sensors to monitor line pressures. Connect the pressure sensors to the OPLC

5.6.9 Pressure Taping Points

Requirement: Pressure tapping points shall be located a minimum of 5 diameters downstream of any equipment or fitting and 10 diameters where there is sufficient straight piping and 5 diameters upstream of any fitting or equipment.

Requirement: Provide pressure tapping points using tapping bands or sockets welded or brazed to the outside of the pipe. Fuse the tapping saddle to the pipe for PE piping. Provide a metal 6, 10 or 15 DN (bronze) ball valve (as appropriate, sized to match the sensor) and union to attach the sensor, gauge or pipework.

Requirement: A 6 DN pressure sensing hole shall be drilled in the pipe after the fitting is installed, ensuring that the internal face of the hole is free from burrs and is square with a sharp edge exposed to the fluid.

5.6.10 Moisture Sensors

Requirement: Moisture sensors shall be as specified in the *Interpretation Section* of the specification or as shown on the drawings

5.6.11 Rain Sensors

5.6.11.1 General

Note: Rain sensors are not required on systems with central control and weather stations unless specified in the *Interpretation Section*.

Requirement: Sensors shall be located a minimum of 5 meters above the ground on approved existing structures (formal buildings, light poles etc. not garden shed type structures) or on a capped pole a minimum of 65 DN galvanised steel pipe set in a concrete footing a minimum of 400x400 and 800 mm deep

5.6.11.2 Hydrosopic Type

Requirement: Install a hydrosopic type rain sensor, refer *Table 4*, in an open location with suitable stainless steel vandal proof shielding to minimise damage from balls rocks etc.

5.6.11.3 Tipping Bucket Type

Requirement: Where specified install tipping bucket sensors in accordance with *Table 4*. Provide an increment accuracy of 0.2mm. Max cable length up to 270 meters. The sensor shall be mounted an open location with suitable stainless steel vandal proof shielding to minimise damage from missiles, including balls rocks etc.

5.6.12 Weather Stations

Note: Where water management control system is a separate works package the weather station forms a part of the control system package.

Requirement: When specified in the *Interpretation Section* of the specification, install a complete solar powered wireless fan-aspirated weather station within radio receiving distance (approx. 100 m inside 300 m outside). Provide software modules, for Irrigation control and streaming data logger. Either connect to the OPLC or provide G3 modems to transmit the weather data back to the central control computer. Install above software and control software on the central water management computer.

Requirement: The weather station shall be located in an approved open area clear of wind turbulence and micro climates, attached to an approved building structure or on a capped pole a minimum of 65 DN galvanised steel pipe set in a concrete footing a minimum of 400x400 and 800 mm deep

STANDARD TECHNICAL SPECIFICATION

SECTION 6 – SUPPORTS, PROTECTION AND SECURITY

1.0 SUPPORTING PIPE WORK & EQUIPMENT

2.0 PROTECTION OF PIPE WORK & EQUIPMENT

3.0 EQUIPMENT SECURITY

6.1.0 SUPPORTING PIPE WORK & EQUIPMENT

6.1.1 General

Requirement: Support pipe work and equipment above ground or located in pits, wet wells, bores or other structures to prevent sagging of the pipes and resist static and dynamic loads. Support and protect all piping to the satisfaction of the Project Manager and in accordance with the current codes and standards.

6.1.2 Fastening Systems

Requirement: Fix piping in place using approved proprietary fastenings, clips and bracketing systems suitable for the size, type and mass of the piping. Generally, custom made clips and brackets are not acceptable except in special one off situations where no production option is available. Make custom fixings and brackets from approved materials off-site and treat as specified..

Requirement: Provide details to the Project Manager of any proposed custom fixings and brackets 14 days prior manufacture for approval.

6.1.3 Materials

Requirement: Select proprietary pipe clips, fixings and bracketing systems made from plastic, stainless steel, copper or mild steel hot dipped galvanised or coated with a suitable protective coating or a combination of these materials and finishes as appropriate to the application.

Requirement: The fixing and bracketing system is to be compatible with the piping system to prevent electrolysis, HDPE or nylon insulation material will be used between the bracket and the piping for this purpose as applicable. Standard PVC electrical tape is not acceptable for this purpose.

6.1.4 Supporting Large Valves

Requirement: Support all metallic valves over 80 DN (except for butterfly type valves) in plastic pipelines independently of the pipe work in above ground locations. For metallic piping systems adequately support the pipe work adjacent to valves and other devices to the satisfaction of the Project manager.

Requirement: In below ground locations large isolation or automatic control valves (ACV's) are supported by the adjacent non-metallic pipes by providing a shallow recess below valves and the pipes to be fully bedded in the trench.

6.1.5 Fixing Below Ground:

Requirement: All fixings located in tanks or wet wells above or below water level and in all large valve and equipment pits shall be a proprietary system manufactured from 316 stainless steel and approved by the Project Manager before use.

6.1.6 Pipe Movement

Requirement: Make provision for expansion, contraction and Poisson's effect, (the linear contraction of flexible piping in response to diametrical increases due to internal pressures – refer to manufacturers technical data) in all fixing and support systems for all pipe work under all service conditions, whether or not shown on any drawings or specified.

Requirement: Allowance for movement will be made where all pipes pass through any part of any structure above ground by sleeving to provide a minimum of a 6 mm annular space or by wrapping the pipe with a high density styrene or urethane foamed plastic material a minimum of 6 mm thick.

6.1.7 Sealing

Requirement: Sealing small gaps around small pipes (63 DN or less) in solenoid valve boxes and pits and filling holes will be by the use of an approved cement based grout with a bonding agent, Polycrete material or polyurethane adhesive foam (refer *Table 4*) in accordance with the manufacturer's instructions. Trim all foam flush with adjacent surfaces to the satisfaction of the Project Manager.

Requirement: Do not use foam material for large openings around pipes. Use structural material of equal strength to the structure to restore the structural integrity of the box or pit.

Requirement: Wrapping or sleeving will provide necessary allowance for movement through the foam. The foam will be applied in a neat and tidy manner and trimmed flush with the surface where exposed to view. Support the pipe independently of the penetration or sleeve.

Requirement: Where any pipes pass through building structures the sealing of the pipe shall meet the requirements of the Building Code of Australia (BCA) fire stop protection as applicable to the project classification.

6.1.8 Encasement

Requirement: Under no circumstances encase PVC plastic pressure pipe or drainage pipe work in brickwork, cement, concrete or the like without the approval of the Project Manager in writing and the manufacturer's recommendations are to be strictly adhered to under these conditions.

Requirement: Where approved, demonstrate that the pipe work will not be subject to shear loading stresses at the point of interface. Wrap the pipe with urethane foamed plastic material a minimum of 6 mm thick. Provide a Work Method Statement, 7 days prior to installation, in regards to backfilling and compaction of fill around the pipes entering any structure below ground. Refer *Table 7*.

Requirement: Sleeve piping passing through structures in a sleeve of sufficient internal size to allow the removal of the pipe.

Requirement: Do not completely encase pipes in thrust blocks. Design thrust blocks to avoid encasement in accordance with manufacturer's recommendations and codes of practice.

Requirement: Do not encase copper piping under any circumstances. Provide allowance for expansion where copper pipes pass through structures.

Requirement: Where a water proof joint is required where a pipe enter structures such as tanks and below ground plant rooms, cast fittings into the structure (i.e. a puddle flange arrangement) and the pipework connected each side by flanging or roll grooved fittings. Provide Work Method Statement 7 working days prior to construction in regards to backfilling and compaction of pipes entering any structure below ground. Refer *Table 7*.

Requirement: Encasing of non-pressurised plastic pipes such as drains, sleeves, conduits, vents inlet pipes and the like through the walls of pits etc., provide allowance for differential movement between the pit and surrounding soil, by casting a Rubber Ring Joint (RRJ) socket into the pit wall and inserting the pipe into the socket providing flexible joint. Ensure the pipe work is not subject to shear loading stresses at the point of interface from back filling loading. Provide Work Method Statement 7 working days prior to construction in regards to backfilling and compaction of pipes entering any structure below ground. Refer *Table 7*.

6.2.0 PROTECTION OF PIPE WORK & EQUIPMENT

6.2.1 Protection Above ground

Requirement: All plastic piping, conduits, controls and equipment above ground shall be located in areas not normally accessible to the public.

Requirement: In areas where public access is permitted or unrestricted the contractor shall allow to provide protective covers to all pipe work, controls, and equipment to the satisfaction of the Project Manager.

Requirement: The protection shall consist of metal guards fabricated from at least 2 mm stainless steel sheet or heavy duty galvanised wire mesh with at least 6 mm wire for larger covers with a mesh spacing to suit the application and hot dipped galvanised after fabrication. Do not use wire mesh for covers over plastic piping and conduits. Ensure cover design prevents use as a climbing device. Use stainless steel s for all covers in corrosive areas as appropriate to the level of risk.

Requirement: Fabricate covers from mild steel sheet, a minimum of 1.6 mm thick, and cross break panels to increase structural integrity and minimise distortion during galvanising. Hot dip all steel covers after fabrication.

Requirement: Where covers are fabricated from galvanised sheet or similar approved material and spot-welded, The spot welds and edges shall be treated by the application of two coats of Epoxy Zinc rich primer before applying finishing coats. Refer *Table 4*.

6.2.2 Corrosion Protection

Requirement: Protect all ferrous-based metallic piping, fittings and other equipment from corrosion by approved methods not less than that detailed below.

Requirement: All steel piping and fittings, brackets clips, supports, covers, frames and the like and all nuts, bolts and screws are to be hot dipped galvanised or treated by a cold zinc electroplating processes will be accepted on nuts and bolts when not exposed to the weather and not located in humid conditions such as pits.

Requirement: The joints (flanges or rolled grooved) on all direct buried valves over 63 DN shall be fully wrapped with a corrosion resting grease filled tape in accordance with the manufacturers' instructions. Refer *Table 4*.

Hold Point: The Project Manager prior to back filling shall inspect the wrapping required above for compliance. Failure to comply will require excavation of the item for inspection. Refer *Table 5*.

Requirement: Use 304 minimum grade stainless steel bolts or 316 in aggressive conditions as appropriate for fixing buried tapping saddles of any type.

Requirement: Where not protected by a suitable factory applied finish (i.e. Nylon 11 or epoxy coated) prepare surface of all exposed cast and ductile iron products and apply two coats of approved high quality industrial paint, colour coded where required. Refer *Clauses 2.5 and 2.6* below.

Requirement: Painting of mild steel without a protective coating (i.e. galvanising) is not acceptable. Painting with zinc based type paint is not acceptable over mild steel as a primary protection system in any location.

6.2.3 Factory Finishes

Requirement: In the case of proprietary equipment alternate protective coatings such as factory applied oven baked epoxy coatings, power coating and fluidised bed coatings with approved materials and in approved locations are acceptable on fabricated steel products. Requirement: Damage to factory coatings is unacceptable and the item may require recoating by the manufacturer before acceptance.

6.2.4 Site Finishes

Requirement: The contractor shall allow to paint all exposed pipe work and or equipment and supports that forms part of any head works or pumping station and all pumps, motors, filters and other equipment not protected by the manufacturer. Supply all approved site applied finishes in unopened cans. Stainless steel and galvanised steel does not need to be painted unless specified or for identification

6.2.5 Minimum Protection

Requirement: Minimum protection shall consist of at least two coats (undercoat and finishing coat) of approved industrial quality paint, applied over a cleaned and primed or pre-treated surface, when located inside a permanent structure and colour coded as directed.

Requirement: Apply additional preparation and coats, to the satisfaction of the Project Manager if the finish is unsatisfactory.

6.2.6 Outdoor Locations

Requirement: For pipe work and equipment exposed to the weather apply one additional coat of approved high quality industrial paint to the requirement in *Clause 6.2.5* above.

Requirement: Mount internal control panels that are free standing on a concrete plinth up-stand a minimum of 100 mm above the floor. Seal the panel to the base around the edge to prevent the ingress of vermin and moisture between the concrete plinth and the metal console as necessary. Refer *Section 5* for control panel requirements.

Requirement: Unless otherwise approved do not drill, hole saw or cut through the frame or sides of the panel for the provision of cable entry, entry points are to be provided through the base. Do not site cut control panels with specific approval in each case.

Requirement: All external control panels are to be of a suitable grade stainless steel construction appropriate to the location and no further protection is required.

6.2.7 Surface Preparation

Requirement: All surfaces shall be prepared in accordance with normal trade practices and shall be clean, free from loose or flaky material and dirt, grease, oil or any material that may affect the adherence of the paint or coating. Approved etch primers will be used on all galvanised surfaces prior to undercoating and painting.

6.2.8 Application of Finishes

Requirement: Apply all paint by spraying with suitable equipment or other acceptable methods to obtain suitable finishes to the satisfaction of the Project Manager.

Requirement: Protect all adjacent equipment from over spray, drips and splashes from the painting or coating process.

6.2.9 Below Ground Protection

Refer to *Clause 6.2.2* Above

6.2.10 Protection of Bolts

Requirement: The threads on all bolts in flanges and roll grooved fittings etc., above and below ground and nuts & bolts and fittings on motor bases, pump bases and flanges, couplings and the like that may require removal for servicing are to be coated with an approved anti-seize compound before assembly. Refer to *Table 4*

Requirement: Remove any excess anti-seize where painting is required. Pipe joint compounds are to be removed before paint is applied and the surface degreased with a suitable solvent if necessary.

6.3.0 EQUIPMENT SECURITY

6.3.1 Fencing

Requirement: When specified in the *Interpretation Section*, all head works areas including control consoles, control panels, filters, pumps and any other equipment located above ground, shall be enclosed with a security fence.

Requirement: The fence shall be 1.8m high 'crimped spear top' type security fence & gate with minimum opening of 900mm, but larger where necessary allow full access and equipment removal. The fence shall be powder coated dark/federation green and the envelope sized to suit the site location allowing a minimum of 600mm clearance from all equipment.. The rails shall be 50mm square, tubes 25mm square and in ground posts 65mm square. Refer *Table 4* for complying fencing supplier.

Requirement: Provide a 100x38 hard wood edge around the outside perimeter of the enclosure, 200 mm from the fence line and flush with the surround area, secured by 50x50 hard wood pegs 300mm long. Excavate the area to remove all grass to 100 mm deep and fill with 15-20 mm river gravel mix.

6.3.2 Covers over External Meters and Backflow Devices

Requirement: Provide a cage type heavy-duty mesh cover over meters and back flow devices where these are not installed in a security fenced head works.

Requirement: Constructed the cover from a welded steel angle frame using 40x40x4 mm angle and in-filled with 4x50x50 sized mesh. Hot dip galvanise the whole cover after welding. Provide lugs to allow attachment to the concrete base with padlocks. Allow 150mm clearance from the device on all sides and the top.

Requirement: Provide a concrete base under the meter and backflow (these may be one assembly) device or other equipment. Core out around the riser pipes with a 200 diameter cores or 200x200 square cores, to allow the removal of the equipment, Place weed mat in the base of the core hole and fill the core holes with 10 mm gravel.

6.3.3 Full Covers over External Equipment

Requirement: Provide a 304 grade 1.2 mm thick stainless steel box type covers over above ground equipment (i.e. automatic filter). Cross break the panels on all sides and top. Provide a CAD workshop detail of the cover arrangement for approval 14 working days prior to placing order.

Requirement: Covers shall be constructed in sections of less than 40 kg and may have hinged lids or removable covers to reduce the mass and improve access. Provide a stainless steel angle frame around the base and lugs for padlocks.

Requirement: Provide a concrete base under the equipment. Core out around the riser pipes with a 200 diameter cores or 200x200 square cores, to allow the removal of the equipment, Place weed mat in the base of the core hole and fill the core holes with 10 mm gravel..

STANDARD TECHNICAL SPECIFICATION

SECTION 7 – Valves General

1.0 ISOLATION VALVES

2.0 AUTOMATIC CONTROL VALVES

3.0 SOLENOID CONTROL VALVES

4.0 CHECK VALVES

5.0 TANK AND WET WELL FILLING VALVES

6.0 SLUICE (FLUSH) VALVES

7.0 AUTOMATIC AIR & VACUUM RELEASE VALVES

8.0 CROSS CONNECTION CONTROL VALVES

9.0 QUICK COUPLING VALVES (QCV)

NOTE: Unless specified otherwise, all valves are to be watermarked or manufactured to an appropriate AS/NZS standard and be fit of purpose.

7.1.0 ISOLATION VALVES

7.1.1 Small Isolation Valves

7.1.1.1. Below Ground

Requirement: Small isolation valves ≤ 50 DN use spherical ball valves up to 63 DN pipelines and other isolation applications. Flow rates shall not exceed 2l/s for 25 DN, 4l/s for 40 DN and 7l/s for 50 DN. Refer *Table 4* for supply details.

Requirement: For branch take-offs install valves in pits, use 25 DN isolation valves for 25 DN solenoids and 50 DN isolating valves for 40 & 50 DN solenoids. The valves are to have lilac “T” style handles supplied by the manufacturer. Painting of valve handles for colour coding not permitted. Install the valves horizontally with the handles on top to allow valve operation with a tube type key.

7.1.1.2. Above Ground

Requirement: Install metallic ball valves ≤ 40 DN in above ground locations with lever action handles. Ball valve are to comply with Australian Standards, other applicable standards refer *Table 8* or have Watermark® certification. Refer *Table 4* for supply details.

Requirement: Use the same brand, manufacturer and valve type/ model throughout the project. Do not mix different valve styles on the same project. Match existing valves where possible when new works are adjacent to existing installations.

7.1.2 Large Isolation Valves – Type 1 - above ground

Requirement: Large isolating valves over 50 DN shall be Butterfly Valves (with SS discs) fitted with gear boxes suitable for the location, pressure rating and valve size. Refer *Table 4*. Fit the gear box so the valve closes in a clockwise direction. For above ground outdoor applications, fit weather proof gear boxes to valves. Valves located above ground inside buildings may be fitted with standard gear boxes.

Requirement: Provide lug style or roll grooved bodies on all butterfly valves to allow removal of equipment without draining the pipe work.

Note: Lever operated butterfly valves are not acceptable in any location. Butterfly valves are not acceptable in direct buried below ground applications.

Gate valves are not acceptable in any above ground application. Refer to Clause 7.1.1.2 above for small valves.

7.1.3 Large Isolation Valves – Type 2 – below ground

Requirement: For below ground applications large isolation valves ≥ 80 DN shall be resilient seated gate valves complying with AS2638.

Requirement: Supply the valves with a factory applied Fusion Bonded Epoxy (FBE) coating Nylon 11 coating or other industry approved high quality corrosion resistant finish. The complete valve shall be wrapped and protected as set out in *Section 6*

7.1.4 Installation of Large Valves – Type 2 - below ground

Hold Point: Arrange inspection of all below ground direct buried valves prior to back filling to check the compliance of the corrosion protection noted below and required in *Section 6*. Provide five working days' notice for inspections. Any valves not inspected prior to back filling are to be excavated for inspection and backfilled at the contractor's expense.

Requirement: The valve shall be fitted with "Tee Key" square drive spindles. Where the top of the "tee Key" spindle is more than 400 below ground provide manufacturers extension sleeves & shafts to raise and support the top of the spindle between 400 & 150 below the surface.

Requirement: All Large isolation valves below ground shall be fitted with a PVC riser sleeve over the spindle and an approved cast iron path box selected to suit the location. Do not provide valve boxes marked with symbol that would indicate the valve controls a (potable) water service of any type, controlled by a water or energy authority or private water supply company or may form part of a public or private reticulated recycled water scheme.

Requirement: All polyethylene flanges connected to valves shall be fitted with hot dipped galvanised backing flanges.

Requirement: Fully wrap all underground backing flanges around the joining pipes, flanges and bolts as set out in *Section 6*.

Note: Small patches of protective tape over the bolts/nuts are not acceptable. Completely wrap Flanges, bolts and nuts by encasing the flanges, bolts and nuts with protective tape a minimum of 100 mm each side of the flanged joint or other fitting.

Note: The internal shoulder/face of the stub flange may require machining to prevent the valve disc fouling the flange when connecting to butterfly valves and wafer style valves.

7.2.0 AUTOMATIC CONTROL VALVES (ACV)

7.2.1 General

Requirement: Supply automatic and remote controlled valves, used for any purpose (pressure reducing, pressure sustaining etc.) in compliance with *Table 4*.

Requirement: When the step down ratio of maximum to minimum pressure is greater than 2 (unless otherwise recommended by the manufacturer in each particular case) and or where the valve discharges to atmosphere or to a non-pressurised drain, an orifice plate or other device is to be fitted to provide back pressure and prevent cavitation.

Requirement: Where the step-down ratio is 3 or greater consult the manufacturer to ensure the valve seats are satisfactory for the application. The step-down ratio shall not exceed a ratio of 4 unless approved by the manufacturer for the application in each case. Where not specified, size the valve to suit the pressure and flow range for each application and not the connecting pipe work.

Requirement: Install ACVs downstream of the pump discharge and fittings where the flow turbulence is stabilised as recommended by the manufacturer.

Install all ACVs in permanently drained valve boxes or pits and provide access for service and repairs in accordance with *Section 4*.

7.2.2 Tank Anti Draining Arrangements

Requirement: On non-pressurised systems where the Top Water Level (TWL) of the tank is above the emitters (or other outlet device) install an automatic anti drain valve in the form of an ACV (refer clause 7.2.1 above). Configure the ACV as a pump booster valve (i.e. the valve progressively opens as the pump speed (and flow) ramp up and closes as the pump ramps down.

Supply the ACV with a pilot valves solenoid control and needle valves to provide variable opening and closing speeds. Where not specified, size the valve to suit the maximum flow rate and not the connecting pipework. Refer to *Table 4* for supplier details. Provide a finger strainer on the solenoid pilot control line.

Requirement: Provide an inter-locking arrangement with the pump control system, (GPLC where installed or other acceptable control arrangement), in order to ensure the pump cycle on of cycle does not cause water hammer or pump cavitation.

Requirement: Pressurise the ACV chambers with external water pressure from an independent source, (i.e. as small automatic pressure system) or with potable water pressure controlled by a small RPZ where permitted by the supply authority.

Requirement: Install the valve in accordance with *Clause 7.2.1* above.

7.3.0 SOLENOID CONTROL VALVES

7.3.1 General

Requirement: All zones are to be fitted with automatic control valves of Glassed reinforced nylon body, with side & angle (bottom) inlet, flow control, provision to convert to pressure regulation in the field with the addition of a Pressure Reducing (PR) module. Valves on recycled, reclaimed and reuse water systems shall have lilac coloured identification flow control knob or other approved permanent colour coding. A minimum of five years warranty is required on all solenoid control valves unless specified otherwise.

Requirement: Angle, bottom inlet, is the preferred installation arrangement for all standard installations unless the particular location prohibits this arrangement.

Requirement: Install all solenoid valves horizontally with bonnet level. Provide bottom inlet connection using high pressure precision moulded glass filled elbows and nipples (*refer Table 4*). Install an isolating valve on the inlet side of the bottom entry elbow and side connect the isolating valve to the main.

Requirement: Provide sufficient clearance to operate service the solenoid and ball valve/s in the valve boxes. Where the control valve is located away from the main refer to requirements below.

Requirement: Where valves are located in paved and or trafficable areas install a flat faced polyethylene butt or electrofusion union on the discharge side of the valve in order to allow removal from the valve pit without excavation of the pit. Group solenoid valves together where ever possible in common valve boxes or pits in accordance with *Section 4*

Requirement: Where the branch length between the main and the solenoid valve exceeds 600 mm but less than 1000 mm and a flow rate of more the 4 l/s the branch off the main size branch to reduce the pipe inlet velocity to 1.0 m/s or less.

Requirement: Where the branch exceeds 1000 mm but less than 3000 mm install a branch main with a manifold located adjacent to the valve box or pit. Size the branch main and manifold (where required) to allow the simultaneous operation of all valves on the branch with an inlet velocity in the manifold of less than 1 m/s unless otherwise approved. No branch from the main to a single or single set of valves is to exceed 3 m without approval.

Requirement: Do not install solenoid valves more than 450 mm below grade (measured from the valve bonnet joint to the top edge of the valve box) unless valve pit meets the requirements of *Section 4* (non-standard valve pits) and it is possible to enter the valve pit for adjustment and repairs.

7.4.0 CHECK VALVES

7.4.1 General

Requirement: In main lines, pumps, pump stations, filter discharge and other specified locations shall be fitted with Butterfly type, wafer style, cast iron body, 316 SS discs, Buna-N seats. Refer to *Table 4* for details.

7.5.0 TANK AND WET WELL FILLING VALVES

7.5.1 General

Note: At the time of compiling this technical standard specification the role of local water authorities and local government councils in relation to the proposed adoption of the Plumbing Code of Australia (PCA) and irrigation systems is unclear as irrigation is not included in the 2011 version of the PCA. The PCA references AS/NZS 3500 as the deemed-to-satisfy technical reference.

It is clear that the intention of the PCA in relation to non-drinking water is in relation to recycled water schemes and rain water harvesting tanks for toilet flushing etc. in buildings and the key requirement is cross connection control compliance in this instance.

The PCA does not include any requirements in respect of infrastructure or water reuse from any alternative source, i.e. harvested storm water, rivers, dams, wetlands, industrial/manufacturing sources, recycled effluent from authorities or other private schemes or recycling schemes established specifically for irrigation purposes.

However, where a potable supply is directly connected to an irrigation system the cross connection requirements of AS/NZS 3500 apply according the risk involved and an air gap required where tanks are involved.

Where a potable supply is used in conjunction with an alternative source, i.e. a potable back supply, a tank with and external air gap is required.

Therefore, provided the irrigation systems comply concerning:

- separation of the potable water service and irrigation pipework below ground (300mm)

- appropriate backflow devices are installed in accordance AS/NZS 3500 Part 1, including mechanical devices and air gaps, when the system sources supply from a potable service and or utilises harvested water and

- the irrigation pipe work is clearly identified (as a non-drinking water service) i.e. Lilac colour coding (potentially hazardous contents) per AS/NZS 1345

There are no other current compliance requirements for an irrigation system under the PCA.

However, some water supply authorities may require boundary protection in accordance with AS/NZS 3500 from reticulated recycled water schemes in order to protect their assets. Therefore, the contractor should check with the local water supply authority at the time of quoting and or carrying irrigation works in relation to any changes in the PCA and related standards.

Requirement: Ensure all inlets device/s located inside the tank are adjacent to the access covers, but do not restrict access, with an approved method of removing the device/s (unions, flanges, cam-lock style connectors roll grooved couplings etc.) without entering the tank. On potable water supplies the Codes may require Standards or Water Marked™ fittings in these locations.

Requirement: Where potable water is the only source for irrigation, AS/NZS 3500 provides two alternative arrangements for tank and wet well filling and or backup potable water supply. The first arrangement is compliance with AS/NZS 3500 air gap for zone cross connection control (generally tanks above ground) and the second arrangement requires a RPZ zone device for cross connection control, (generally for tanks below ground or where the air gap and overflow substantially reduces the effective tank capacity).

Requirement: Where the water supply is all non-potable (no potable water is connected to the irrigation) it is not necessary to meet the air gap requirements or provide an RPZ unless the local regulations require cross connection control, such as a community raw water or recycled water supply. The contractor shall meet the local (site) requirements in this regard.

Requirement: In all cases provide an automatic control valve ACV connected to the irrigation controller for programmed and or remote operation via the irrigation controller or other associated control system arrangement. The ACV shall be located outside the tank in an approved (permanently drained) pit, refer *Section 4*, or other specified location.

Requirement: Supply the ACV in accordance with *Table 4* with a heavy-duty external 3-way pilot solenoid and needle valve to provide (adjustable) slow closing operation. Select an size the valve to suit the design flow rate in accordance with *Clause 2.1* above

Note: Some water authorities require the ACV on a potable water supply in some locations to be Standards or Water Marked™ – the contractor shall allow compliance with local requirements in the lump sum price.

Requirement: The tank filling valves are to have an isolation valve located adjacent to the tank, in an approved valve pit, that is externally accessible.

7.5.2 Float Valves for Air Gaps to AS/NZS 3500

Requirement: For clean water applications where the supply pressure is normally above 40 metres head standard high pressure brass float valves with plastic floats shall be used as follows;

- up to 1.0 l/s 25 DN
- 1.0 to 1.5 l/s 32 DN
- 1.5 to 2.5 l/s 40 DN
- 2.5 to 4.5 l/s 50 DN

Requirement: Install two identical float valves in parallel to provide large flows up to a maximum of 9 l/s. Each float valve shall have a separate local isolation valve that is accessible without entering the tank.

Requirement: Float valves are to have an additional (common) external isolation valve located at the base of the tank, with an approved valve pit or path box, that is externally accessible. Arrange the pipe work to provide equal pressure drop to each valve.

Requirement: Support the pipe work in accordance with *Section 6* in order to prevent the movement of the inlet pipe work against the dynamic forces of the float valve operation.

Requirement: Where the supply pressures are normally 40 metres head or less and or the flow rate exceeds 9 l/s float tank filling valves or approved automatically controlled float valves (as detailed below) shall be used as set out in *Table 4*.

Requirement: Size tank filling valves with the following flow rates;

up to 7 l/s 40 DN

7 to 15 l/s 50 DN

15 to 30 l/s 80 DN

Requirement: As an alternative to float tank filling valves and/or for larger flow rates and dirty water applications, an hydraulic remote float controlled valve, with a heavy-duty external 3-way pilot and adjustable opening/closing time, and remote on/off control. This arrangement may replace the ACV required in *Clause 7.5.1* above.

Requirement: The ACV shall be located outside the tank in an approved, permanently drained pit, refer *Section 4*, or other specified location.

Requirement: The tank filling valves are to have an isolation valve located adjacent to the tank, in an approved valve pit, that is externally accessible.

Requirement: In all cases install the tank filling valve to discharge into a stilling pipe. The stilling pipe shall be 250 - 300 mm dia for flow rates up to 30 l/s.

Requirement: Construct stilling pipes up to 300 DN from PVC storm water pipe or fabricate as set out below.

Requirement: The stilling pipe shall extend from the bottom of the tank up to 50 mm above the normal top water level in the tank where the valve discharges directly into the stilling pipe. The stilling pipe shall have a blank base. Support the stilling pipes with stainless steel brackets in accordance with *Section 6*.

Requirement: to stabilize and minimise disturbance of the sludge in bottom of the tank, fill the base of the stilling pipe with 250 mm of concrete.

Requirement: The size of the holes in the stilling well is 10 mm and the number of holes is determined as follows;

up to 40 DN inlet 200 holes

50 DN inlet 300 holes

80 DN inlet 650 holes

Requirement: For larger ≥ 100 DN and or dual inlets, install two separate floor standing stilling pipes PE100 class 6 pipes (i.e. harvested and recycled) 400 dia. and height to suit the tank with the top of the stilling pipe finishing 100 mm above the weir of the overflow pipe. Weld a PE plate/end cap in the bottom of the pipe. Each pipe is to have 10 vertical rows of 36 holes 25 mm dia. at 50 mm spacing from the overflow weir level down 1800, total of 360 holes. Fix the stilling wells at the top to prevent movement with stainless steel brackets. Refer *Table 4* for supply details.

Requirement: The location arrangement of the holes is not critical but the hole spacing should be uniform around the circumference of the pipe, with the holes starting a minimum of 300 up from the floor of the tank and extending up to 1500 -1800 mm along the pipe at a uniform vertical spacing.

Note: As an example, a pattern of 8 holes around the circumference and 40 rows at 40 mm spacing will provide 320 holes.

Requirement: The tank filling valves shall be located adjacent to the access cover. It shall be possible to reach the isolating valves on each filling valve, where dual valves are fitted, from the access cover without entering the tank.

7.6.0 AUTOMATIC AIR & VACUUM RELEASE VALVES

7.6.1 General

Requirement: Unless otherwise shown or specified, contractors shall allow to install combination automatic air/vacuum release valves at all high points on the mainlines over 80 NB where and air pocket may form, unless it can be demonstrated that a solenoid valve or other take-off is located at the high point and will allow the air to be removed.

Requirement: Air/vacuum (kinetic) release valves will be located in permanently drained valve boxes and or in a position above ground, approved by Project Manager. The air/vacuum release valve will be fitted with an approved isolating valve as specified herein.

Requirement: Allow to direct the discharge to a point where the discharge will not cause any damage or other problems, as approved by the Project Manager. Vacuum relief valves shall not be located on pipe lines above the hydraulic gradient. Install air release type valve in these locations.

7.7.0 SLUICE (FLUSH) VALVES

7.7.1 General

Requirement: Provide sluice/flush/drain valves on all mainlines, sub-mains and the ends of branch main lines at all low points and for each section of pipe work between isolating valves, piped and graded to a suitable drainage pit below the invert of the main or other suitable discharge point approved by the Project Manager.

Requirement: Flush lines and valves are to be a minimum of, 80 DN for mains up to 125 DN, 100 DN for mains up to 180 DN and 150 DN for mains over 180 DN. Flush valves will be located in a position approved by Project Manager. All flush valves shall be resilient seated gate valves and protected in accordance with *Section 6* of the specification. Flush valves shall comply with AS 2638 on main lines and branch mains over 63 DN. Each drain and flush valve shall be fitted with a standard path box and PVC riser sleeve over the spindle.

Requirement: For mains over 110 DN and larger the drain branch shall angled down a 45 degrees from horizontal and a 45 degree elbow fitted before the drain valve to return the branch to the horizontal position. Alternatively a scour fitting (with the branch at the invert of the main) used and piped and graded to a suitable drainage pit below the invert of the main or other suitable/approved discharge point.

Requirement: In all cases provide visual access the discharge point to observe the condition of the flush water. Note that the discharge point and water quality must meet environmental guidelines.

7.8.0 CROSS CONNECTION CONTROL VALVES

Note: Installations are to meet the requirements of the Plumbing Code of Australia (PCA) and AS/NZS 3500 about potable water sources, in addition to any requirements in the standard technical specification. Refer to *Section 2, Clause 1.4* and *Clause 5* above.

7.8.1 General

Requirement: For a potable water source on a temporary or permanent basis all such connection points shall be provided with backflow protection in accordance with AS3500.

Requirement: On all sites with a secondary water supply install a containment back flow device (RPZ) at the property boundary adjacent to the water meter when required by the water authority in addition to the potable supply boundary protection. Provide zone protection where required in *Clause 5* above and to meet AS3500 requirements.

7.9.0 QUICK COUPLING VALVES (QCV)

7.9.1. QCV's are not permitted for temporary or permanent irrigation.. Refer *Section 2, Clause 1.17*.

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STANDARD TECHNICAL SPECIFICATION

SECTION 8 – Emitters

1.0 SPRAYS & BUBBLERS

2.0 SPRINKLERS

3.0 SUBSOIL TEXTILE IRRIGATION

SPRAYS & BUBBLERS

8.1.1 Sprays

Requirement: All sprays, as detailed on the drawings, are to be generally installed to maintain spacing uniformity and in uniform, and where appropriate straight lines. Install all bodies plumb and at grade and fitted on articulated risers as specified herein. All bodies are to be fitted with drain checks and are to be pressure compensating or pressuring compensating emitters installed. For the uniform supply requirements for pop-up spray bodies refer to *Table 4*.

Note: On steep slopes it may be necessary to tilt the emitter body in order to achieve coverage on the high side of the incline.

Requirement: All bodies installed in grassed, turfed or planted areas adjacent to edge treatments shall be minimum of 200 mm and maximum of 300 mm from the edge treatment or boundary lines to prevent damage from mechanical edge cutting machinery. Sprays in mass planted areas shall be a minimum 300 mm from the edge treatment.

Requirement: Provide pressure regulation in all spray emitters except where the pressure regulation is included in the body or riser assembly.

Requirement: Select emitters to suit the application with matched precipitation, selected to suit the application. For the uniform supply requirements for pop-up emitters refer to *Table 4*.

Requirement: Provide lilac colour coded identification covers on systems where recycled or harvested water is used. Do not paint emitters.

8.1.2 Bubblers

Requirement: Bubblers, as specified and detailed on the drawings, are to be installed plumb and fitted on articulated risers as specified herein. Install all bubblers pop-up bodies or articulated risers to suit the application and or as shown on the drawing/s.

Requirement: Install pop-up bodies with drain check valves or check valves on the risers directly under the bubblers to prevent low head drainage. Refer *Table 4* for supply details.

Requirement: All bubblers are to be pressure compensating Provide pressure regulation in all bubbler emitters except where the pressure regulation is included in the body or riser assembly. Select bubblers to suit the application.

Requirement: Where specified and or shown on the drawings install vertical root zone distribution cells with integral articulated risers in tree pits, or adjacent to feature trees. Refer to *Table 4* for supply details.

Requirement: Install vertical root zone cells shown on the drawings or specified in the *Interpretation Section* of the specification. Install a manufacturers supplied filter sleeve on each cell. Install the cells directly in sandy soils with a course sand content of more than 60%. In loams where the sand content is less than 60% the cell shall be gravel packed as set out below.

Requirement: The 15 DN supply pipe shall be extended to the depth of the root zone cell on the outside of the temporary packing sleeve and extend up inside the packing sleeve to connect the cell reticulated riser on the cell. Connect the cell and position the 250 DN (min dia.) temporary metal or PVC pipe sleeve over the cell and positioned centrally with the cell. Completely fill the annular space between the cell and sleeve with 10-12 mm river gravel. Back fill around the outside of the sleeve with approved soil mix and lightly compact. Slowly extract the sleeve and top up the gravel as necessary to keep the annular space full.

Finish the top of the cell at grade or as specified applicable to the location of the cell.

8.2.0 SPRINKLERS

8.2.1 Sprinklers

Requirement: All sprinklers, as detailed on the drawings, are to be generally installed to maintain spacing uniformity and in uniform, and where appropriate straight lines. All sprinklers are to be installed plumb and at grade (or below grade for sports turf sprinklers) and fitted on articulated risers as specified herein. All sprinkles are to be fitted with drain checks.

Requirement: Refer to *Table 4* for the uniform standards for pop-up sprinkler selection.

Requirement: All sprinklers installed in grassed or turfed areas adjacent to edge treatments shall be minimum of 250 mm and maximum of 350 mm from the edge treatment or boundary lines to prevent damage from mechanical edge cutting machinery.

Requirement: Provide lilac colour coded sprinklers where recycled effluent water is used. Do not paint heads. Deliver all spare nozzles on the nozzle racks to the Project Manager.

8.3.0 SUBSOIL TEXTILE IRRIGATION

8.3. Subsoil Textile Irrigation

Note: The emitter laterals, supply and flush manifolds for subsoil textile irrigation are nominated products developed and manufactured in Australia and protected by Australian and international Patents. Refer to *Table 4* for supplier details. Only install Subsoil textile irrigation is in fields with (soil) conditions spacing and flow rates approved by the product manufacturer.

Requirement: Install subsoil textile irrigation in the locations shown on the drawings in accordance with the manufactures instructions by approved installers (who may be a sub-contractor to the main irrigation contractor)

Requirement: The subsoil textile irrigation supplier will supply the emitter product in a pre-fabricated package including the emitter laterals, supply and flush manifolds to suit the design layout. A subcontractor approved by the manufacturer shall install the subsoil textile irrigation laterals and manifolds. Provide details of the proposed subsoil textile irrigation subcontractor with the tender/quotation.

Requirement: Standard design flow rates for each zone are 2, or 4 or 6 litres/second. Generally 4l/s will provide a balance between economy and small enough area to afford good water management. Provide uniform zone flows on each field where possible to assist scheduling. No Zone is to exceed 6 l/s

Requirement: The depth of cover shall comply with the recommendations of the manufacturer, plus or minus 20 mm.

Requirement: Provide each field with the following equipment in accordance with the *Interpretation Section* and *Sections 1 to12 of the standard technical specification*:

- a 130-micron disk type manual zone filter. Refer *Section11*
- a reference water meter. Refer *Section 5*
- a field pressure regulator. Refer *Section 7*
- fertigation and air inlets (approved by the manufacturer)
- a solenoid valve for each zone in accordance with *Section 7*

Requirement: System control will conform to be compatible with integrated into any existing central control system used by the client. Standalone control system are not permitted in where the client has a central system installed or is proposed.

Requirement: Provide irrigation scheduling to match the soil water demands of the field, integrated with the field controllers refer, *Section 5, Clause 1.1* and central irrigation control system. Integrate all other associated equipment with the field OPLC and central water management control and monitoring system in accordance with *Section 5, Clause 2*.

Requirement: Provide a needle type pressure test points, fitted to an approved branch saddle upstream and downstream of the filter (where pressure tapping points are not fitted to the filter) for checking the filter pressure drop, downstream of each solenoid valve and at the flush valve to check operational pressures. Refer to *Table 4* for pressure test point details. Extend test points for accessibility if necessary. Provide a new dual scale liquid filled pressure gauge 0-600 kPa (0-60 m/hd) with a short flexible tube (1 metre long) and needle adaptor to the Project Manager on completion of the works.

Requirement: provide 300 mm cover for supply manifolds in turf applications. Install flush manifolds at the same depth as the drip lines to allow air venting and vacuum relief as specified below.

Requirement: Connect the flush manifolds to the flush lateral via a check valve located in a spotter box adjacent to the flush lateral. The connection branch lateral from the flush manifold shall be level or slightly graded up to the air/vacuum relief valve position.

Requirement: Provide a 25 DN automatic air and vacuum relief valve on the flush manifold (refer *Table 4* for valve details) vertically in the spotter box adjacent to the zone flush check valve on a approved branch saddle or approved BSP tee.

Requirement: Install an automatic solenoid flush valve (using a standard solenoid valve) in a valve box (refer *Section 4 and Table 4*) located as indicated on the drawings or in a location to provide a visible discharge to a drainage swale or pit. Provide a 25 DN, PE80B, PN8 cable sleeve and cables to the automatic flush valve from the closest control valve box. Provide a separate common wire back to the irrigation controller for the flush valve.

Requirement: In turf applications on flat areas (playing fields) the supply manifolds and flush manifolds shall connected at alternate corners of the zone manifolds in order to provide equal flow characterises (pressure loss) across the zone. Mirror reversing the connections on each zone will reduce the number of valve boxes required.

Requirement: In turf applications (playing fields) where the fields have excessive grading issues, (i.e. more than 200 mm fall in the length of the zone manifold) connect the supply manifold at the highest corner of the zone and connect the flush check valve at the lowest corner of the flush manifold. Install a 25 DN automatic air and vacuum relief valve on the highest end of the flush manifold (refer *Table 4* for valve details) vertically in the spotter box on an approved branch saddle or approved BSP tee. Mirror reversing the connections on each zone is not applicable on graded fields.

Requirement: In smaller and odd shaped planted areas where flush laterals are required, flush manifolds shall be fitted with automatic flush valves in accordance with the manufactures recommendations to suit flushing capacity for each zone. The flush valve/s are to be mounted in spotter boxes or suitable sized valve box as necessary, supported on solid cement bricks at the sides of the box, over a pea gravel pit at least 400 mm deep.

Requirement: Provide a perimeter drip line on odd shaped turf areas and in other areas on turf zones to ensure that the emitters are located within 250 mm of all edges, 150 from edges at the top of slopes and 400 mm for the bottom of any slope.

Requirement: In planted areas wrap style subsoil textile irrigation is used in accordance with the manufacturer's instructions. Refer *Table 4* for details.

Requirement: In planted areas automatic air and vacuum (AAV) relief valve/s, refer *Table 4*, or larger to suit the zone flow rate, shall be fitted to the flush manifolds or at the ends of laterals.

Requirement: Intermediate AAV's shall be fitted at the high point where the drip lines shall be interconnected with plain (drip) pipe to the AAV position. Where necessary (i.e.; over mounds) a link pipe shall be provided to link the high points of laterals to the vacuum/air release valve on each grid section.

Requirement: Where low density poly-pipe is used in subsoil systems use triple barbed insert fittings secured with NomaClamp® stainless steel Cobra quick fit hose clamps using Cobra hand held pliers. Refer *Table 4*

Requirement: All buried spotter boxes shall have a galvanised metal plate attached to the underside of the cover so the box can be located with a metal detector in accordance with *Section 4, Clause 1.7*

Requirement: In planted areas where the wrap style subsoil textile irrigation is installed during the landscape construction the subsoil textile irrigation grid section shall be laid out, on a graded base without sharp rocks or hard lumps of soil present and held in position by suitable hook type staking or other approved method.

Requirement: The Project Manager shall approve each grid section layout prior to covering with soil to the approved depth.

Requirement: After the installation of the drip system use smooth, wide tracked, low surface pressure equipment that does not affect the position and location of the drip pipe placement, to place any form of mulch or plants or for any other purpose.

Requirement: The contractor shall take note of the drip layout and provide suitable temporary marker staking or other acceptable methods to indicate the location of the drip lines for the landscape contractor, who shall use appropriate methods of planting in order to ensure that no damage occurs to the subsoil textile irrigation during planting.

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STANDARD TECHNICAL SPECIFICATION

SECTION 9 - TANKS

1.0 STORAGE TANKS

2.0 CLARIFICATION TANKS - Not used

9.1.0 STANDARD CAST IN-SITU CONCRETE STORAGE TANKS

9.1.1 General

Requirement: When specified in the *Interpretation Section* of the specification, construct a concrete tank with poured concrete cover to the requirements of AS3735. Refer to *Table 4* for supplier details. The tank shall be located, in the location shown on the drawing/s and or as specified.

Requirement: The Client shall approve the setting out for the location of the tank prior to site excavation. Provide a flat level base with uniform foundation and compaction, covered with a minimum of 50 mm of 20 mm gravel and or to the tank manufacturer's requirements.

Tanks with the top located at a level which would permit vehicle (cars) access provide a 3 kPa rated roof loading. Where specified, install bollards to prevent vehicle access.

Requirement: Provide approved structural drawings for the tank and compliance certificate from a civil engineer on completion. Provide concrete test results in accordance with AS3735 for concrete used in the in the tank construction.

Requirement: Where the base of the tank is buried below the floatation displacement level, with a minimum 10% safety factor, install sub-soil drainage, covered with gravel, filter fabric, around the base of the tank, and drained to a pit piped to a storm water drain.

Requirement: For part or fully buried tanks locate below the floatation displacement level and graded gravity sub-soil drainage is not possible provide an external anti-floatation footing or other acceptable method, to prevent floatation of the tank to engineer's details.

Requirement: Provide approved, temporary, chain wire safety fencing around the tank construction site and any excavations for pit construction.

Requirement: At the direction of the Client the excavated material shall be stock piled and reused to backfill around the tanks and reshape the area around the tank. Contractor shall leave the unused material stockpiled in a location indicated by the Client.

Requirement: Provide erosion barriers as required. Maintain erosion controls until the turf is established.

Requirement: Allow for re-turfing, in the same species of turf, the restored batters around the tank and any areas of turf/grass that are damaged due to construction work, to the satisfaction of the Project Manager.

Requirement: Re-turf as soon as possible after construction to reduce erosion. Refer *Section 1, Clause 1.23*.

Requirement: Cast all tank connections below top water level in the tank during construction, as set out in the *Interpretation Section*.

Requirement: Connect the drain to the nearest site storm water drainage system via the tank over flow pit. Where no drainage system is available at a level to provide a graded drainage system delete the drain connection and direct the overflow away from the base of the tank via an approved swale constructed to the satisfaction of the Project Manager.

Requirement: Provide an overflow (located immediately under the cover). For external over flows above ground provide 150 DN copper or stainless steel piping to a grated pit (where a drainage system is available) or swale as described above at the base of the tank so any overflow can be observed prior to connection of any other drain. Use PVC, poly or concrete stormwater pipe below ground. Connect the pit to the adjacent storm water drainage system pit (core hole into the pit) with 150 DN PVC drainage pipe when there is access to a drainage system.

Requirement: All external piping above ground shall be copper or stainless steel of suitable grades to suit the location and in accordance with *Section 2*

Requirement: Refer *Section 7* for tank filling, valves, piping etc.

Requirement: Provide two (2) access holes, 600x600 minimum opening, with galvanised steel or cast-iron seal and lock infill frames and covers cast into the tank cover.

Note: A storage tank is classified a confined space and internal ladders are not appropriate and not specified as they encourage access by non-certified persons to enter the tank. Refer to *Section 7, Clause 5.1* for access requirements to inlet valves.

Requirement: Provide appropriate safety signage in accordance with AS 3600 and confined space requirements at the access points.

GENERAL TECHNICAL SPECIFICATION

SECTION 10 - PUMPS

1.0 GENERAL

2.0 PUMP STATIONS

3.0 PUMP CONTROLS

4.0 PUMP CLASSIFICATIONS

1.0 GENERAL

10.1.1 General Requirements

Requirement: Supply all pumps as complete factory assembled units with pumps and motors mounted on suitable bases ready for installation

Requirement: Supply pumps as complete units with motors and couplings guards etc. mounted on suitable bases for each application as required refer below for mounting details. Generally all controls, VFD drives, power connections and control panels for a part of the integrated control systems package, refer *Section 1, Clause 5.1 and 5.2*, and *Section 5*, unless specified otherwise in the *Interpretation Section*

Requirement: When specified turn-key style package systems (such as automatic pressure systems, chemical injection units etc.) supplied with all control systems, pressure tanks, feed tanks, valves, manifolds etc. providing complete and operational unit.

Requirement: On installations where acoustic and or vibration isolation is required mount each pump and motor assembly on separate isolated bases with independent flexible connections to the manifolds. Place the flexible connections as close to the pumps as possible i.e. after any reducer attached to the pump connection. Support the manifolds and any associated valves independently from the pumps. In addition to flexible connections on large installations, provide ridged roll grooved dismantling joints.

Requirement: On pump installations where acoustic/vibration isolation is not required provide flexible alignment roll grooved dismantling joints between the pump isolation valve on the inlet and outlet connections with ridged manifolds supported statically and dynamically independent from the pumps. Refer *Section 6, Clause 1.0*.

Requirement: Install appropriately shielded power cabling to all pumps with VFD drives.

Requirement: Refer to *Table 4* for standardised supply details

Note: Refer below for requirements for various classes of pumps. Refer to the project *Interpretation Section* for project specific requirements and design performance details.

10.2.0 PUMP STATIONS

10.2.1 General Requirements

Note: Pump stations are project specific and are classified as a ‘Hydraulic Works Package’, refer *Section 1, Clause 5*. Generally a ‘Water Management Control Systems Package’ will form a separable portion of the pump station works, refer *Section 1, Clause 5*. The client may integrate small pump station works into an ‘Irrigation Works Package’ where appropriate.

Requirement: The pumps are to comply with *Clause 1.1* above.

Requirement: The pump station shall be as specified the *Interpretation Section* of the specification and any associated drawings. Refer to *Table 4* for acceptable equipment and component suppliers

10.3.0 PUMP CONTROLS

10.3.1 General Requirements

Requirement: Pump controls, refer *Section 5*, are part of the Water Management Control Systems Package except for very small installations where the pump control forms part of the pump set, i.e. a pressure system pump set and or the works are of a minor nature and form part of the ‘Irrigation Works Package’.

10.4.0 PUMP CLASSIFICATIONS

10.4.1 General Requirements

General: Pumps are the second most manufactured industrial produced which come in many thousands of types, styles, models, qualities and configurations and perform many functions. A pump must be fit for purpose, water and energy efficient of high quality materials, manufactured from sustainable materials where available and has a minimum service life of ten years with routine maintenance in non-aggressive water applications.

While many pumps look the same, have the same technical features and attractive price, many pumps manufactured do not meet all or any the above criteria. Therefore, in order to provide a sustainable and environmental best practice outcome, the focus is to select a small number of experienced manufactures, of known product quality, to supply specific classifications of pumps as a uniform standard across all projects. Refer to *Table 4* for suppliers of pumps in various classifications selected to provide a uniform quality standard.

10.4.2 Multi Stage Water Cooled (Submersible) Pumps

Requirement: Reticulation pumps in tanks shall be submersible multi stage pumps as specified in the *Interpretation Section* of the specification, including PVC or stainless steel shroud, drop cable and screened power cable from the pumps to the VFD drives.

Requirement: Mount the pump/s horizontally in the tank 150 mm above the floor of the tank and centrally located in the shroud by suitable spider spacers. Install the pumps on stainless steel supports to bring the centre line of the pump discharge up to the tank outlet.

Requirement: Connect each pump in the tank to a copper or stainless steel manifold with quick action type couplers. Where manifold design provides for future pumps, install a quick action cap on the spare connection/s

Requirement: Install a wafer spring loaded check valve in the discharge pipe work up stream of the coupling for each pump, to prevent reverse flow and rotation.

Requirement: Provide an integrated pump control system in accordance with *Section 5*.

10.4.3 Single stage Water cooled (submersible) Pumps

General: Used for drainage and water transfer (harvesting) applications
Specify details in the *Interpretation Section* when bore-hole pumps are required.

10.4.4 Vertical Multi Stage Reticulation Pumps

Requirement: Vertical multistage pumps are to comply with *Clause 1.1* above.
Vertical multistage pumps are best suited to flooded suction applications.

Requirement: It is critical that vertical multi stage pumps are not run dry under any conditions. A spring loaded butterfly or swing type check valve is required on the inlet (suction side) of the pump to assist in keeping a positive head on the pump case and seal when the pump stops. Appropriate controls are required to ensure the pump is stopped in no-flow conditions.

10.4.5 Single Stage Reticulation pumps

Specify details in the *Interpretation Section* when bore-hole pumps are required.

10.4.6 Helical Rotor Pumps

Comment: Helical rotor pumps are positive displacement (progressive cavity) pumps with high suction lifts (allowing long suction pipes or lifts of 6 m+) and high heads. Helical rotor pumps are used for harvesting applications where suction lifts cannot be avoided and it is not practicable to install other forms of submersible pumps in the water body or near a diversion structure and or the diversion structure is subject to flooding.

Helical rotor pumps are belt or gear driven and the pump and drive separated by a column for vertical applications.

As the pumps are positive displacement they are ideal for proportional mixing applications such as effluent injection into irrigation systems with good (preferably soft) solids handling.

Requirement: Vertical multistage pumps are to comply with *Clause 1.1* above.

Requirement: The site specific requirements are set out in the *Interpretation Section*. Refer *Table 4* for acceptable suppliers.

Requirement: It is critical that helical rotor pumps are not run dry under any conditions and appropriate controls are required ensure the suction line is charged and the flow commences immediately the pump starts and if the flow ceases the pump is stopped.

Requirement: Positive displacement pumps require a fast acting pressure relief valve to discharge sufficient flow to prevent the discharge pressure rising above safe operation pressures of other equipment with controls to turn pumps off if the over pressure status persists. Sensors in the relief valve discharge will detect relief discharges and raise an alarm and log incidents.

Requirement: An external cooling fan is fitted to the pump motor by the manufacturer to allow the pump to operate at lower flow rates increasing the variable flow range with a VFD drive.

Requirement: Where helical rotor pumps draw water from a static water body a full stainless steel hydraulic self-cleaning screen (with internal rotating sprays) is required. Refer *Table 4*.

10.4.7 Chemical Injection Pumps

Requirement: Where chemical injection pumps are specified the *Interpretation Section* of the specification all controls and chemical tanks shall be included. A low level control shall be provided to prevent the system operating if the chemical tank is empty. Provide a tank empty alarm and indicator light.

Requirement: Where chemical injection pumps are specified the pump and tank shall be supplied as complete package.

10.4.8 Borehole Pumps

Specify details in the *Interpretation Section* when bore-hole pumps are required.

STANDARD TECHNICAL SPECIFICATION

SECTION 11 – WATER TREATMENT

1.0 SCREEN FILTERS

2.0 UV STERILISERS

3.0 MEDIA FILTERS

4.0 INLET SCREENS

11.1.0 SCREEN FILTERS

11.1.1 Automatic Screen Filters

Requirement: Where specified all filter units are to be fully automatic electric filters complete with a filter backwash control unit to provide pressure differential and time regime back-flush modes. Filters 80 DN or less may be plastic or stainless steel bodies. Filters over 80 DN shall have stainless steel bodies and be of modular arrangement. For general amenity landscape works provide 200 micron for sprinklers and 130 micron for micro sprays or sub-surface irrigation..

Requirement: Unless specified otherwise select filters so the design flow rate does not exceed 70% of the manufacturers nominal maximum flow rate.

Requirement: The preferred arrangement for monitoring and backwashing the filter is to connect the filter directly to the OPLC and not use an independent filter controller.. The Differential Pressure (DP) control is to be capable of back washing the filter with differential pressures as low as 0.5 meter head loss. Where this is not practicable allow to install the filter controller in the main irrigation/pump control console as specified.

Requirement: Include all cabling for the remote control unit and power to the filter scanner motor. Include all control and power switches required by electrical authorities. All cabling is to be sleeved and or conduited. All sleeves and conduits are to enter through the base of the control panel console when located externally. All power cabling shall meet the requirements of AS 3000.

Requirement: Terminate the filter flush discharge in a observable location over a pit. Size the pit drainage to prevent the pit surcharging when the filter back flushes.

Requirement: Install the filter as shown on the drawings or specified in accordance with the manufacturers' instructions.

Requirement: Only use manual filters in clean potable water applications and or for post media and zone filtration applications.

11.2.0 UV STERILISERS

11.2.1 UV Steriliser - Type 1

Requirement: Install an automatic self-cleaning UV steriliser with radiation monitor as set out below

Requirement: The construction of the steriliser requires low pressure high intensity lamps inside protective quartz tubes set centrally in individual stainless steel reaction chambers with flanged or rolled grooved inlet and outlet spigots, using SS clamps.

Requirement: Arrange the connections on the chambers to allow the chambers to be assembled in series to provide the required dose rates and in turn assembled in banks connected to equal flow manifolds to provide a range of flow rates.

Requirement: Fit each lamp/chamber with an automatic wiper assembly to clean the lamp when triggered by the radiation monitor. Where more than one chamber is used in a bank, connect the automatic wipers to a common activation mechanism to clean all lamps simultaneously. Provide a separate control box or connect directly to the OPLC water management system.

Requirement: The steriliser will meet the following minimum general construction arrangements:

- Chamber constructed from a minimum grade of 316 stainless steel Machined faces and flanges/joints and fully welded joints and finished to provide a high quality unit

- Chamber sized to provide efficient combination of flow and dose rates

- A nominal flow rate of 4l/s for a dual chamber arrangement in series

- A nominal lamp power of 160 Watts per lamp

- Minimum chamber connections 50 DN with 65 DN preferred to reduce pressure loss

- Maximum operation pressure 1000 kPa

Requirement: The unit will provide the following minimum performance:

- The unit will disinfect filtered storm water up to the design flow of up to 4 l/s on the basis of the following minimum parameters:

 - BOD<5mg/100ml

 - SS<10mg/1000ml

 - cfu< 100,000/100ml

 - Optical transmission 254nm>80%

 - UV dose of 30mWs/cm² at the end of the lamp life (based on above water quality parameters)

 - Temperature 5 to 25 degrees Centigrade

11.3.0 MEDIA FILTERS – WATER HARVESTING PHASE

11.3.1 Media Filtration, Filter to Pump Manifolds and Control Valves

Note: The media filtration tanks, connecting manifolds and control valves are an integrated system. This energy efficient package adopts low/medium pressure ($\leq 40\text{m/h}$) glass reinforced corrosion free synthetic filters and is designed to use low/medium pressure ($\leq 40\text{m/h}$) self-priming progressive cavity (helical rotor) pumps which can generally be placed above flood levels and depending on topography, considerable distance for the extraction point.

This equipment forms a complete nominated supply package consisting of the following elements refer *Table 4* for the supply of the elements.

Requirement: Provide glass reinforced corrosion free synthetic filters with under drain system and two large access ports complete with Polypropylene (PP) inlet and discharge manifolds, backwash manifolds and back wash valves. Provide a modular (manual) screen check filter, refer *Table 4*, downstream of the media filter bank.

Requirement: Provide a combined pressure sustaining and pressure-reducing valve, refer *Table 4*, to sustain a minimum head across the filters of 38m and a regulated downstream pressure to suit the discharge application. For direct discharge into irrigation pump manifold/s provide a minimum of 2 m/h or to suit the total design head of the irrigation pumps. On low pressure application such as micro sprays, above ground drip and subsoil textile irrigation the design pressures may permit direct feed into the irrigation mains. Provide a positive discharge pressure where the discharge fees into storage/buffer tanks, storage dams or ponds.

Requirement: Provide a combined pressure relief & sustaining valve, refer *Table 4*, on the harvesting pump discharge riser manifold to relive excess pump pressure over 40 m/hd and protect the filter tanks and pumps in the case of system malfunction.

Requirement: Fabricate the connecting manifolds from polypropylene (PP) piping and PP fittings are socket or butt fusion welded buy a qualified manufacturer under factory-controlled conditions.

Note: Some locations require cordial clearance for butterfly isolation valve disks and butterfly check valves and disk check valves to fully open into the PP piping – Appropriate flange adaptors with clearance are required in some locations.

Refer *Interpretation Section* for a description of the connecting manifolds.

Requirement: Provide tapping points in manifolds to connect/attach sensor and controls as indicated on the layout drawing. Provide a 15 DN BSP socket butt-fusion welded to the manifold for all pressure tapping points. Drill a 6mm hole into the pipe through the socket to provide a sharp edged hole on the inside of the pipe. Refer *Section 5* and *Table 4* for sensor details.

Requirement: Fit a 15 DN PP tee piece with 10 DN BSP ball valves on each branch. Connect a 6mm DN nylon tube and run tubing to a 100 DN liquid filled pressure gauge supplied by the hydraulic contractor and mounted on the wall of the pump room in an accessible location approved by the Project Manager.

Requirement: The filter supply package will include detailed workshop drawings ensuring all the manifolds and equipment will fit as proposed.

Hold Point: Submit a copy of the workshop drawings prior to commencing manufacturing.

Note: For technical enquires regarding the manufacture of the filtration supply package (including ACV's and manifolds) refer *Table 4*.

11.4.0 HARVESTING INLET SCREENS

11.4.1 Harvesting Inlet Screen Filter and Suction Pipe Work

Requirement: Provide a self-cleaning suction screen as indicated on the drawing/s. Attach a wafer, twin-disk type check valve to the screen using stainless steel bolts to prevent the suction pipe draining. Depending on the application, location and model selected the internal spray boom may rotate or the screen may rotate. Some models provide an electric rotation option. Refer to the *Interpretation Section* for site specific requirements and *Table 4* for supply details.

Requirement: Install a PN 10 suction pipe from the inlet-screen check valve to the PP irrigation outlet pipe manifold as indicated on the drawings. Laser grade the suction pipe from the screen to the inlet manifold to eliminate any possibility of air pockets in the suction line.

Requirement: Provide a dismantling joint (flanged or roll grooved) in suction pipe (and a union in the hydraulic drive/spray pipe) allowing the whole pipe section, check valve and screen assembly to be (excavated) and or removed if necessary.

Requirement: Provide support for any pipe overhang and screen into the water body as appropriate or as specified, adjacent to the suction screen as required, fully supporting the screen and pipe work.

Hold Point: Obtain approval from the Project Manager for the location the suction pipe and screen prior to installation.

Requirement: Install a PN8 hydraulic drive pipe to the internal sprays in the harvesting screen. The drive water must be from a clean filtered source supplied from the filter discharge (or and independent self-cleaning screen filter provided). Install a pressure reducing solenoid valve to regulate the pressure to suit the screen spray operating pressures, refer *Table 4*, and 130 micron screen check filter from the irrigation main adjacent to the pump room. Set the operating pressure as recommended by the manufacturer.

Requirement: Install a PN8 suction priming pipe with pressure regulated control valve from the irrigation main (or other specified source) to the harvesting suction pipe between screen suction check valve the harvesting pump inlet. Set the operating pressure to provide a positive pressure ($\leq 1\text{m/h}$) on the pump inlet. Interlock the valve to ensure it is closed when the pump is operating.

Requirement: Provide a manual 15 DN BSP socket tapping on the suction manifold adjacent to the pump inlet with bronze ball valve and automatic air vent (AAV) to remove air from the suction pipe.

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STANDARD TECHNICAL SPECIFICATION

SECTION 12 - COMPLETION

1.0 FINISHING AND COMMISSIONING

2.0 PRACTICAL COMPLETION

3.0 COMPLIANCE CERTIFICATION

4.0 MAINTENANCE REQUIREMENTS

5.0 WORK AS EXECUTED DRAWINGS

6.0 INSTRUCTION AND TRAINING

7.0 OPERATION MANUAL

12.1.0 FINISHING AND COMMISSIONING

12.1.1 Flow Rates, Pressures and Tank Levels

Requirement: Adjust all solenoid valves, pressure controls, pump pressures and tank level controls as necessary to suit the optimum flow rates, pressures and operational water levels of the complete system to the satisfaction of the Project Manager

12.1.2 Emitters

Requirement: Plumb and adjust all emitters (sprays, bubblers, sprinklers) to the correct grade, radius and arc for each location. Allow to change nozzles as necessary to optimise the performance of the final layout of the system and the planting.

12.1.3 System Operation

Requirement: The contractor shall demonstrate the performance of the system to the Client in respect of the following equipment that is part of the contract;

- Design pressures and flows are available
- Operation of all control systems and valves
- Operation of the pump control system
- Operation of all equipment in the system

12.1.4 Sub-Surface Textile Irrigation Systems

Requirement: Demonstrate the following performance of the sub-soil textile irrigation system:

The water meter and zone filter are operational and the filter is clean
The setting and pressure downstream of the field zone pressure regulator

Check operational pressures at each test point downstream of the solenoid valve test point and at the flush valve spotter box test point on each zone

The fertigation and air inlets have been provided

The scheduling matches the soil moisture demands and grouping on the controller is correct

12.1.5 Hydraulic Testing

Requirement: Carry out all hydraulic testing in accordance with *Annexure 1*, as the works progress, to the satisfaction of the Project Manager. Include a copy of the test reports in the Operation Manual

12.1.6 Electrical Work

Requirement: Compliance inspections and or testing are required for 240 volt and 415 volt electrical work in relation to the standards, codes, location, and supply authority.

12.1.7 Test Equipment

Requirement: The contractor is to supply all equipment required for inspection, testing and commissioning as part of the contract price.

12.1.8 Performance Testing of Equipment

Requirement: Where independently certified test and performance data is not available from manufacturers or other independent source for any equipment (pumps, filters, flow sensors and the like) that is to be supplied as part of the contract, allowance is to be made for performance testing to the satisfaction of the Project Manager. All costs associated with the performance testing of any equipment are to be included in the contract price.

12.1.9 Authorities Testing Requirements

Requirement: The specified testing requirements are the minimum requirement. Additional testing required by any authority is the responsibility of the contractor to ensure compliance with any authority's requirements and is to be included in the contract price.

12.1.10 Making Good

Requirement: Where required to remedy defects, leaks and or faulty work the contractor shall be responsible for the cost of any delays resulting and any excavation and re-work and re-paving in order to make good the defects and the cost of any subsequent restoration of the trenches and surfaces to match the original.

12.1.11 Valve Pits/Boxes

Requirement: Adjust by raising and lowering any valve pits or boxes affected by settling of the soil during the warranty period and or any pits not installed at the correct levels to match the adjacent surfaces. Clean out all soil and other material from all pits and valve boxes. Ensure pits drain as required.

12.1.12 Post Work

Requirement: Remove all construction materials and equipment including sheds, storage areas, fences, barriers, erosion controls, spoil, excavated materials and reinstate all areas so disturbed.

12.1.13 Paving Reinstatement

Requirement: A SOPA authorized contractor is to be engaged to replace all disturbed paving with material to match the original. Refer *Section 3 Clause 2.10*. Include this work in the lump sum price.

12.2.0 PRACTICAL COMPLETION

12.2.1 Practical Completion

Requirement: Practical completion shall be granted when it can be demonstrated that the works have been finished and commissioned as set out in below and the general intent of the works shown on the drawings and in scope of works has satisfactorily completed and the complete system is operational under automatic control.

Demonstrate the operation of and or compliance to the following:

- 12.2.1.1 Operation of all solenoid valves & controller grouping – *Section 5*
- 12.2.1.2 Operation of emitters on each zone - *Section 8*
- 12.2.1.3 Operation of all automatic control valves – *Section 5*
- 12.2.1.4 Operation all pumps, controls and set points – *Section 12*
- 12.2.1.5 Sealing of all cable joints and ends of spare cables - *Section 5*
- 12.2.1.6 Leveling to grade of all valve and cable pits – *Section 4*
- 12.2.1.7 On completion clean out (washing an wet vacuuming as necessary) all valve boxes, equipment pits and cable pits – *Section 4*
- 12.2.1.8 Arrangement of cabling in control panels and consoles including sealing cable entry – *Sections 3 and 5*
- 12.2.1.9 Checking the continuity of the tracer tape between valve pits and cable pits – *Section 3*
- 12.2.1.10 Test certificates (as Appropriate) are included in the Operation Manual – *Section 12.1*
- 12.2.1.11 A Compliance Certification Certificate is included in the Operation Manual – *Section 12.3*
- 12.2.1.12 Work as Executed Drawings have been submitted and approved – *Section 12.5*
- 12.2.1.13 Joint Tracking Record and Drawing/s - *Section 12.5*
- 12.2.1.14 As-built Survey Drawing - *Section 12.5*
- 12.2.1.15 Electrical and control wiring diagrams - *Section 12.5*
- 12.2.1.16 Maintenance Requirements – *Section 12.4*
- 12.2.1.16 Operational Manual - *Section 12.7*
- 12.2.1.17 Operational requirement for subsoil textile irrigation
 - 12.2.1.17.1 The water meter and zone filter are operational and the filter is clean
 - 12.2.1.17.2 The setting and pressure downstream of the field zone pressure regulator
 - 12.2.1.17.3 Check operational pressures at each test point downstream of the solenoid valve test point and at the flush valve spotter box test point on each zone
 - 12.2.1.17.4 Installation of the fertigation and air inlet points
 - 12.2.1.17.5 The scheduling matches the soil moisture demands and grouping on the controller is correct

Requirement: Granting of Practical Completion is contingent satisfactory compliance with all the requirements of Clause 12. 2.1.

12.2.2 Defects Liability

Requirement: The defects liability period will commence from the date of granting practical completion for six weeks to allow the contractor to rectify any minor defects noted during the practical completion inspection.

Requirement: The contractor is responsible for all costs for attending to rectification works during the defects liability period. The specified warranty periods will not commence until the end of the defects liability period.

12.3.0 COMPLIANCE CERTIFICATION

12.3.1 Compliance Certification

Requirement: A compliance certificate shall be issued by the contractor, prior to the end of the defects liability period, to certify that the works comply with intent of the specification, relevant codes, and standards and are acceptable to any authority having jurisdiction over the works. A copy of the certificate is to be included in each operation manual. This requirement is additional to any individual certificate/s or certification required by any Authorities.

12.4.0 MAINTENANCE REQUIREMENTS

12.4.1 Maintenance Schedules

Requirement: The contractor shall provide Maintenance Schedules for the works clearly setting out the preventive maintenance requirements.

12.4.2 Maintenance Procedures

Requirement: The contractor shall provide detailed Maintenance Procedures for carrying out the scheduled maintenance requirements.

12.4.3 Work Method Statements

Requirement: provide work method statements for all equipment maintenance procedures.

12.5.0 WORK AS EXECUTED (WAE) (As Built) DRAWINGS

12.5.1 WAE Drawings

Requirement: The contractor will keep a set of drawings on site to record progress and as the installation proceeds showing the "as built" location of all piping, valves and cables. Provide a final copy as a separate drawing of combined with the survey drawing in Clause 12.5.3 below

Requirement: The location of the pipe work and equipment is to be recorded on the WAE "as built" plans in accordance with Clause 5.3 below. Separate electrical and control cable diagrams are required. Submit the completed WAE drawings 14 working days prior to the date of the practical completion for approval.

12.5.2 Welding Joint Tracking

Requirement: The contractor will provide records (a drawing) for the traceability of certified welders to each joint. Refer *Section 1 Clause 4.2*.

12.5.3 Survey Data

Requirement: Allow a Surveyor or other competent person to locate and record the following elements of the complete system:

- all the valve boxes, valve pits, cable boxes
- isolation valves, automatic valves and solenoid valves
- turf sprinklers, sprays and bubblers
- all tanks and equipment pits

bores, wells, pump stations
meter and water service connections
air vents, flush valves, drain valves and sluice valves
pipe lines where the pipe are not in straight lines between the above parts of the system
location of all control cable and cable sleeves
location of power supply conduits and power supply to the equipment and pumps

Requirement: Survey the above elements of the system to an accuracy of 200 mm radius of the actual location of the part. For parts larger than 300 x 500 provide sufficient points to indicate the shape, size and location of the part. Identify the parts by wording or symbols as appropriate.

Requirement: Provide a 2 A1 hard copies and an electronic copy of the survey drawing in .DXF or .DWG Format. Site plans should be 1:500 scale and detailed areas and 1:250 or 1:100 as appropriate.

Requirement Adjust the Work-As-Executed (WAE) ('as built') drawings in accordance with the as built survey drawings.

12.5.4 Wiring Diagrams

Requirement: Provide a block wiring diagram of consoles and control panels, refer *Section 5, Clause 3.1*

Requirement: Provide a layout wiring diagram of the control cables or the consoles/panels to the solenoid valves, refer *Section 5, Clause 5.1*

12.6.0 INSTRUCTION & TRAINING

12.6.1 Training

Requirement: Provide training and instruction on the complete system operation and maintenance to the staff nominated by the Client during the warranty period at suitable times and prior to final handover. State the amount of training offered in the tender price.

12.7.0 OPERATION MANUAL

12.7.1 General

Requirement: Prior to the end of the six week defects liability period (from practical completion) the contractor shall supply two (2) bound copies of a comprehensive operation and maintenance manual to the Client.

12.7.2 Presentation

Requirement: The manual shall be A4 size with A3 size reductions of the "as built" drawings appended. Bind in a plastic ring binders to the satisfaction of the Project Manager.

Requirement: Allow sufficient time to submit a draft of the manual to the Project Manager for review and approval before submitting the final copies.

12.7.3 Contents

Requirement: The operation manual shall be set out under the headings and sections listed below, as applicable to each contract, and shall contain details as follows;

- A. Operating Instructions: Complete operating instructions for the system,
- B. Pump Control System: Complete operating instructions for the pump control system,
- C. Equipment Details: Full details of all equipment used in the system including spare parts drawings and lists,
- D. Maintenance Program: Full maintenance requirements, servicing instructions, Maintenance Schedules, Maintenance procedures and Work Method Statements.
- E. Records: Any requirements of relevant authorities in relation to regular maintenance, inspections and records that are to be kept,
- F. Approvals: Copies of all approvals, test certificates etc, pressure test data for pipe testing and a copy of the Certificate of Compliance, by the contractor, to the design & specification,
- G. Plans: Reduced (A3) copies of the "As Built" drawings.
- H. Control Cable Layout: Provide complete diagram of the solenoid control valve cable layout including the colour coding, valve and station circuit numbers.

TABLES

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TABLE 1 - COST PLAN

This Completed Table is a Non-Contractual Document for SOPA internal use only

This schedule is for SOPA internal budgeting purposes and is completed by the project consultants.

TABLE 2 - COST SCHEDULE

(INSERT PROJECT NAME)

(INSERT "IRRIGATION WORKS PACKAGE" or "HYDRAULICS WORKS PACKAGE" or "WATER MANAGEMENT CONTROL SYSTEM PACKAGE" (if applicable, refer Section 1, Clause 5.0)

This schedule does not form a part of the contract. This schedule is only used to assess the quotes and tenders for the works and assess any variations for the works. This schedule shall be completed and submitted with all complying quotes and tenders for works. The quantities are noted of guidance only - the contractor shall verify all quantities prior to submitting a quotation or tender and adjust as necessary. The Unit prices are to include the installed price of the units including all necessary fittings and accessories, overheads and other related costs or materials. The Total Lump Sum Price below must be the same as the contract quotation price.

ITEM	DESCRIPTION	PROJECT COST PLAN BUDGET			
		QTY	UNIT	COST	TOTAL
1		0		0	0
2		0		0	0
3		0		0	0
4		0		0	0
5		0		0	0
6		0		0	0
7		0		0	0
8		0		0	0
9		0		0	0
10		0		0	0
11		0		0	0
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54		0		0	0
55		0		0	0
56		0		0	0
57		0		0	0
58		0		0	0
59	Site Establishment and Setting Out	1	Item	0	0
60	Survey as built and Commissioning	1	Item	0	0
61				Sub-Total	0
62	ADD ANY OTHER ITEMS NOT INCLUDED ABOVE THAT THE CONTRACTOR CONSIDERS NECESSARY				
63		0		0	0
64		0		0	0
65		0		0	0
66		0		0	0
67		0		0	0
68		0		0	0
69					0
70				Sub-Total	0
				TOTAL	0

Use "ea" "m" or "item" in the Qty column

Notes; 1. This form is available as a electronic copy from the project manage on request - responsibility for use rests on the user.

TO BE READ IN CONJUNCTION WITH THE TECHNICAL SPECIFICATION AND DRAWINGS

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TABLE 3 – ZONE EQUIPMENT SUMMARY

(INSERT PROJECT NAME)

(INSERT "IRRIGATION WORKS PACKAGE" or "HYDRAULICS WORKS PACKAGE" or "WATER MANAGEMENT CONTROL SYSTEM PACKAGE" (if applicable, refer Section 1, Clause 5.0))

The data below is for the guidance of the contractor only and the contractors shall confirm the all details and quantities required and satisfy themselves of the accuracy of the summary data provided. It should be noted that in some cases an adjustable head may be required at the end of a row to reduce overspray onto high priory paved walk ways, access roads and over fences. Smaller nozzles are to be fitted to reduced arc heads to match the precipitation as closely as possible in these locations when matched precipitation heads are not available or it has not been practical to zone these heads on separate control valves. Any of the above minor adjustments are to be included in the lump sum price. To be interpreted in conjunction with the drawing/s

ZONE*	SOLENOID VALVE SIZE DN/CONSOLE*	VALVE TYPE	DESIGN FLOW RATE L/S	ISO. VALVE PHILMAC DN	EMITTER TYPE and MODEL	NUMBER OF EMITTERS PER ZONE	MODEL DETAILS	NOMINAL HEAD SPACING
SAMPLE	50/23	Century Plus100	6	50	Hunter I-40 Ultra	6	I40-04-SS-R-B	as shown
1		Century Plus100			Hunter			
2		Century Plus100			Hunter			
3		Century Plus100			Hunter			
4		Century Plus100			Hunter			
5		Century Plus100			Hunter			
6		Century Plus100			Hunter			
7		Century Plus100			Hunter			
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56		Century Plus100			Hunter			
57		Century Plus100			Hunter			
58		Century Plus100			Hunter			
59		Century Plus100			Hunter			
60		Century Plus100			Hunter			

THIS TABLE IS TO BE COMPLETE BY THE DESIGN CONSULTANT

Notes: * Denotes project design zoning, refer Section 5, Clause 1 for landscape classification grouping of stations on the controller/s for practical completion
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TABLE 4 - PREFERRED AND NOMINATED PRODUCTS FOR ALL CLASSIFICATIONS OF WORKS

<p><i>Only critical and key components, equipment, suppliers and contractors are listed in Table 4. Refer Section 1 Clause 1.1.7. This requirement provides a consistent standard across all facilities in order to address the following matters: provide essential compatibility with existing systems, provide water and energy saving efficiencies, compatibility with central control of systems, reduce stocks held for maintenance and repairs, represent best practice, ESD, provide uniform maintenance standards, and provide standard operational procedures. There are many hundreds of other items required to form a complete an operational system. Therefore, select all additional items to comply with appropriate Australian and International Standards, Laws, regulations, codes of practice, fit for use, appropriate quality, industry and environmental best practice.</i></p>					
PRODUCTS NOT LISTED					
CATEGORY	PRODUCT DESCRIPTION	Contact	Supplier Nominated		
PIPES	PVC-U Under road conduits for Irrigation mains and control cable sleeves, plumbing and drainage, storm water applications,	Vinidex	13 1169	X	
		Iplex Pipelines	13 1840	X	
		TYCO Water	02 9612 2400	X	
	Polyethylene - PE 80B, PE100 - Irrigation mains and laterals - lilac stripes - Plain black 63 DN, PN6 pipe for control cable sleeves.	Vinidex	13 1169	X	
		Iplex Pipelines	13 1840	X	
		TYCO Water	02 9612 2400	X	
	Polypropylene (PP) - (light grey)	Georg Fischer	02 9502 8000	X	
		Waterways of Singleton	02 6571 1555	X	
	Stainless steel pipe and fittings	Prochem® Pipeline Products P/L	02 9727 0044	X	
Multilayer pipes and associated fittings	Multec Piping Systems	1300 30 14 30	X		
Clear PVC schedule 40 pipe for special (chemical) applications, sight glass tubes etc.	Merriman Controls	02 4351 4022	X		
PVCU and CPVC Schedule 80 pipes for special (chemical) application manifolds, fertigation etc.	Merriman Controls	02 4351 4022	X		
FITTINGS	Fabricated Polypropylene (PP) Manifolds and Connecting Pipework for Pump & Filtration Stations	*Waterways of Singleton	02 6571 1555		X
	Compression jointing PE	*Philmac	1800 755 899		X
	Tapping saddles PE	*Philmac	1800 755 899		X
	High Pressure Screwed Reinforced Plastic Fittings	*Philmac	1800 755 899		X
	Stainless steel	Prochem Pipeline Products P/L		X	
		Philmac	1800 755 899	X	
	Electrofusion & Butt Fusion	Vinidex	13 1169	X	
		Iplex Pipelines	13 1840	X	
PVCU Schedule 80 fittings for special (chemical) application manifolds, fertigation, leachate etc.	Merriman Controls	02 4351 4022	X		
MANUAL VALVES	Quick Connect Couplings - Material as Specified	Compatible with existing Camlock® style fittings		X	
	Butterfly Valves - Above Ground - Gear Drive 65-300 DN	*TYCO - Keystone® Fig.222 with F427 actuator	02 9612 2400		X
	Gate Valves - Below Ground - Flanged Table E	*AVR Australia - Series 57/90 - DN 65-300	08 8368 0900		X
	Gate Valves - Below Ground - PE mechanical joint	*AVR Australia - Series 01 - DN 80 - 315	08 8368 0900		X
	Gate Valves - Below Ground - Flange Adaptor	*AVR Australia - Flange adaptor to PE mechanical	08 8368 0900		X
	Ball valves - Below Ground 25-50 DN	*Philmac	1800 755 899		X
	Check Valves - Tilting Disc - external shaft + counter weight external switch options	*AVR Australia - Series 41 - DN 80-300	08 8368 0900		X
		*John Valves - John Fig.4205	1300 044 594		X
	Check Valves - Swing Wafer - Spring loaded	*TYCO Water - Keystone® Fig.86	02 9612 2400		X
	Check Valves - Butterfly/wafer Type - Spring loaded	*TYCO Water - FloCheck®	02 9612 2400		X
	Float Valves ≤ 50 DN - metal body	Philmac	1800 755 899	X	
	Float activated Tank Filling Valves ≥ 50 DN	*Philmac® Servo®	1800 755 899		X
PVCU valves for special (chemical) application manifolds, fertigation, leachate etc.	Merriman Controls	02 4351 4022	X		
AUTOMATIC VALVES	Solenoid Valves 25-80 DN	*Toro Century Plus100 series	1300 130 898		X
	Solenoid Valves - Pressure Regulated 25-80 DN	*Toro Century Plus100 series + OmniReg®	1300 130 898		X
	ACV (in various configurations) - Single Chamber	*Bermad RAM 400 series)	02 9746 1788		X
	ACV (in various configurations) - Double Chamber	*Bermad RAM 700 series)	02 9746 1788		X
	ACV Pressure Sustaining & Pressure Reducing	*Bermad 700 Series Valve Model 6-723-55-BD	02 9746 1788		X
	ACV Pressure Relief & Sustaining Valve	*Bermad 400 Series Model 4-430-DB	02 9746 1788		X
	ACV Small Pressure Regulated priming Valve	*Toro Century Plus100 series + OmniReg®	1300 130 898		X
	PVC valves for special (chemical) application manifolds, fertigation, leachate etc.	Merriman Controls	02 4351 4022	X	
IRRIGATION CONTROL	Consoles Stainless Steel	*Rittal - AP One piece 600-1200 mm wide	02 9525 2760		X
	Control Panels	*INCA Control	02 9675 3815		X
	Field and Central Irrigation Controllers	*Jeffery Electronics - Cloudmaster®	0415 222 160		X
WATER MANAGEMENT CONTROL & MONITORING	Consoles Stainless Steel	*Rittal - AP One piece 600-1200 - selected to suit	02 9525 2760		X
	Control Panels	*INCA Control - as specified	02 9675 3815		X
	Field and Central GPLC Water Management Control	*INCA Control - as specified	02 9675 3815		X
TANKS	Level Transducers	*INCA Control	02 9675 3815		X
	Reference Water Meters	*Elster	02 8536 7400		X
	Fabricated Bolted Plate Tanks 200 - 2000 kl	Tasman Tanks	02 9831 1444	X	
	Site Constructed Concrete Tanks to AS3735	Hawkesbury on Site tanks ≤110 kl	02 4573 1097	X	
		Panther Concrete Tanks - 100-500 kl	02 4773 4366	X	
Fabricated unlined Bolted Plate Tanks 500 - 5000kl				X	

TABLE 4 - PREFERRED AND NOMINATED PRODUCTS FOR ALL CLASSIFICATIONS OF WORKS

SEALING AND PROTECTION	Sealing Foam	Hilti® CF124 applied with a CF 120-P2 dispenser	13 12 92	X	
	Zinc Rich Primer	Dulux® Zinc Galv 2	02 9794 9777	X	
	Wrapping Valves Boxes	Geofabrics Australasia - Bidim® filter wrap	02 9906 1800	X	
	Wrapping Underground Valves and Fittings	Denso Australia	1300 658 590		X
	Security Fencing	Jarvis Fencing, Narellan	02 4647 1231	X	
EMITTERS	Spray and Bubbler Bodies (new and replacements)	*Hunter PRS30 pressure regulated risers			X
	Spray Nozzles (new and replacements) for PRS 30	*Hunter Pro-spray nozzles, bubblers, speciality etc.	Note: Hunter® products are distributed by HR Products 02 9725 5733 and Nelson Irrigation 07 3715 8555		X
	MP Rotator (Complete finger spray emitter)	*Hunter MP40 pressure regulated (Water Marked)			X
	Finger spray nozzles	*Hunter MP Rotator® nozzles (Water Marked)			X
	Vertical Root Zone Distribution Cells - PC Emitters	*Hunter RZWS cells (depth as specified)			X
	Sprinklers - With stainless steel risers	*Hunter I-20, I-25, I-35, I-40, I-60			X
	Bubblers - Trickle, umbrella, and stream pattern	*Hunter PC emitter or used with PRS30 PC body			X
SUB-SOIL IRRIGATION	Sub-soil Textile Irrigation	Irrigation Water Technologies	02 9679 0122		X
	Pressure Test Points (for sub soil drip)	Toro part 101PGAT	1300 130 898	X	
	Automatic Air Vent (AAV) (for sub soil drip)	Toro part code 1012879)	1300 130 898	X	
	LDPE Pipe Clamps	Noma Group -Cobra quick fit hoes clamps 7 tool	03 9761 4419		X
DRAINS	Subsoil Drains	Megaflo® Panel Drainage system - Geofabrics Australasia	02 9821 3277		X
VALVE BOXES, PITS, CABLE SLEEVES AND CABLE PITS	Valve boxes and Pits in Trafficable and Paved Areas	ACO Stackable pit sections with in-fill cover/s			X
	Valve boxes and Pits in Non-trafficable, Unpaved Areas	HR Products - Glass reinforced plastic range		X	
	PE Cable Sleeves	Refer 'Pipes' above	Refer above	X	
	Cable Pits in Trafficable and Paved Areas	ACO cable pit with in-fill covers			X
	Cable Pits in Non-trafficable Unpaved Areas	ACO cable pit with lockable cover		X	
	Approved H/duty HDPE cable pit (submit sample)		X		
LARGE EQUIPMENT PIT COVERS	Sectional Covers	Custom designed - Submit design			
PUMPS	Submersible Multi- stage Pumps	Grundfos SP range with MS or MMS motors	02 9648 0855		X
	Vertical Multi-stage Pumps	Grundfos CR range with Grundfos motors	02 9648 0855		X
	Helical Rotor Transfer and Harvesting Pumps	Mono Pumps Range	02 8536 0900		X
	Submersible Single Stage Harvesting Pumps	Grundfos KP, AP, S, SE,SEG, SEN, DW, DP	02 9648 0855		X
	End suction	Grundfos NBG/NRG range with Grundfos Motors	02 9648 0855		X
WATER TREATMENT	UV Steriliser - Stainless Steel shell, Select model to suit design flow rate	*SS double chamber (two lamps) with auto wipers and UV D24 lamp monitor - UV-Guard Australia	02 9631 4900		X
	Media Filters glass reinforced synthetic filters	*ARKAL Model AGF - 1200 Dia. - Bermad Water (NSW)	02 9746 1788 0419 741 156		X
	Manual Screen Check Filter	*ARKAL modular (manual) screen check filter - Bermad Water (NSW)	02 9746 1788 0419 741 156		X
	Water Harvesting Media Filter Package - complete with PP manifolds, isolation valves, automatic control valves, check filter, pressure regulation and pressure relief valves (no backwash controller)	*Bermad Water (NSW)	02 9746 1788 0419 741 156		X
	Stainless Steel Self Cleaning Internal Spray Powered Inlet Screens	*Dama Manufacturing Ltd, NZ - Kleenscreen Range	+64 27 493 3183		X
	Harvested Water Pre-treatment (hydrocarbons, oils, chemical reduction and fines etc.) This is not a GPT. install down stream of an existing GPT.	*Humes Water Solutions - Humeceptor	02 9832 5200		X
WEATHER INSTRUMENTS	Solar Powered Wireless Complete Weather Station	*Ecowatch - Davis Instruments wireless Vantage Pro2 Plus fan assisted weather station with weather link irrigation control software and streaming data logger	03 9761 7040		X
	Tipping Bucket Rain Gauge	*Ecowatch - Davis Instruments- Part Code 7852	03 9761 7040		X

* Component of a integrated supply package and or site wide standard component

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TABLE 7 - NOTICES, APPROVALS AND DETAIL DRAWINGS

REFERENCE		ITEM	DETAILS
Section	Clause		
Interpretation	0.1.2	Permits and Passes	Prior to commencement of any works
Interpretation	0.1.3	Public Safety and Access Plan	14 working days before commencement of works
Interpretation	0.1.4	Traffic Management Plan	14 working days before commencement of works
Interpretation	0.1.5	Site Constraints/Restrictions	14 working days notice
Interpretation	0.4.6	Silt and Erosion Control	Work Method Statement 7 working days prior to commencement of works
Interpretation	0.4.7	Turf Works - Quality Certification	Provide a Quality Certificate at the off-site inspection of turf samples
Preliminaries	1.1.10	Site & Environmental Management Plan	14 days prior to commencement of any works
Preliminaries	1.1.11	Environmental Control - Silt & Erosion Control Plan	7 working days notice
Preliminaries	1.1.14	Protection - Emergency Repairs	To render safe, immediately - complete within 24 hours
Preliminaries	1.1.17	Damaged Services - Repairs	To render safe, immediately - complete within 24 hours
Preliminaries	1.1.19	Workshop Drawings - Submit for Approval	14 working days
Preliminaries*	1.1.20	Works Schedule - Preliminary	With tender/quotation
Preliminaries	1.1.20	Works Schedule - Project Version	Within 7 working days of contract execution
Preliminaries	1.4.2	Labour Schedule and Qualifications	Included with quotations/tender documents
Preliminaries	1.4.2	Welders Schedule and Qualifications	Included with quotations/tender documents
Preliminaries	1.4.3	Sub-contractors Schedule	Included with quotations/tender documents
Preliminaries	1.4.3	Subsoil Textile Irrigation Sub-contractor Details	Included with quotations/tender documents
Preliminaries	1.5.2	Control and Monitoring Systems - Pre-delivery inspection	7 working days notice
Preliminaries	1.6.0	Practical Completion	14 working days notice to arrange a date
Preliminaries	1.6.2.1	Practical Completion - Submissions and Tasks	7 working days notice prior to date of inspection
Materials	2.1.8	Butt & Electrofusion - Copy of welders certification/s	Included with quotations/tender documents
Valve Boxes & Pits	4.1.10	Large non-standard pits - Cover design	14 working days notice prior to ordering
Valve boxes & Pits	4.1.15	Large non-standard pits - Pit and access design	21 working days notice prior to construction
Supports	6.1.2	Custom fixings & brackets - Details	14 working days prior to manufacturer
Supports	6.1.8	Encasement of pipes - Backfilling Work Method Statement	7 working day prior to installation
Security & Protection	6.2.2	Full covers over external equipment - Workshop drawing	14 working days prior to placing order
Practical Completion	12.2.1,12,13 & 14	WAE drawing/s, Weld joint Tracking & Survey Drawing/s	14 working days prior to date of practical completion
Practical Completion	12.3,4,&7	All items required to be submitted in these clauses related to practical completion	14 working days prior to date of practical completion
Annexure 1	1.1	On-site hydraulic testing	3 working days

TABLE 8 - STANDARDS, CODES AND LEGISLATION

This Table is not exhaustive and other Standards, Codes and legislation may apply to the works in addition to those listed. These documents are regularly revised and the contractor is responsible to ensure that the latest versions of these documents are applied to the current works

REFERENCE	DETAILS
STANDARDS	
AS/NZS 1200 - 2000	Pressure Equipment
AS 1345 1995	Identification of the contents of pipes, conduits & ducts
AS 1432 2004	Copper tubes for plumbing, gasfitting and drainage
AS 1463 1998	Polyethylene Pipe Extrusion Compounds
AS/NZS 2033:2008	Installation of polyethylene pipe systems
AS/NZS 2053:2001	Conduit and fittings for electrical installations - General requirements
AS 2129: 2000	Flanges for pipes, valves and fittings
AS/NZS 2436:2010	Guide to noise & vibration control on construction, demolition and maintenance sites
AS/NZS 2492:2007	Cross-linked polyethylene for pressure applications
AS/NZS 2566.2:1998	Buried flexible pipelines - Structural Design
AS/NZS 2566.2:1998	Buried flexible pipelines - Installation
AS/NZS 2638.1:2011	Gate valves for waterworks purposes - Metal seated
AS/NZS 2638.1:2011	Gate valves for waterworks purposes - Resilient seated
AS 2698.2- 2000	Plastics pipes and fittings for irrigation rural applications - Polyethylene rural pipe
AS 2698.3- 1990	Plastics pipes and fittings for irrigation rural applications - Mechanical Joint fittings for use with polyethylene micro-irrigation pipes
AS/NZS 2845.1:2010	Water Supply - Backflow Prevention Devices - materials, design & performance requirements
AS/NZS 2845.2:2010	Water Supply - Backflow Prevention Devices - Air gaps & break tanks
AS/NZS 2845.3:2010	Water Supply - Backflow Prevention Devices - Field testing & maintenance
AS/NZS 3000	SAA Wiring Rules as amended
AS/NZS 3012:2010	Electrical Installations – Construction and demolition sites
AS/NZS 3500:2003	Plumbing and Drainage Code
AS3735 2001	Concrete Structures Containing Liquid
AS/NZS 4130:2009	Polyethylene (PE) pipes for pressure applications
AS/NZS 4131:2010	Polyethylene (PE) compounds for pressure pipes and fittings
AS4176-2010	Multilayer pipes for pressure applications
CODES AND LEGISLATION	
Building Code of Australia	
	Volume 1 - Class 2 to 9 Buildings
	Volume 2 - Class 1 and 10 Buildings - Housing Provisions
	Volume 3 - Plumbing Code of Australia
NSW Government Code of Practice for the Construction Industry	
NSW Government Code of Tendering for the Construction Industry	
NSW Guidelines for Urban and Residential Use of Reclaimed Water	
NSW EPA Draft Environmental Guidelines for Industry - The Utilisation of Treated Effluent by Irrigation	
Managing Urban Stormwater – Harvesting and Reuse – Report by the Department of Environment and Conservation NSW	
MP 52 - Manual of Authorisation Procedures	
NSW Work Health and Safety Act 2011	
NSW Work Health and Safety Regulations	

STANDARD TECHNICAL SPECIFICATION

ANNEXURE 1 – ON-SITE HYDRAULIC TESTING

A1.0 GENERAL REQUIREMENTS

A2.0 CONSTANT PRESSURE (WATER LOSS) METHOD for Ductile Iron (DI), Glass (Filament) Reinforced Plastic (GPR), Polyvinylchloride (PVC-U), (PVC-O), (PVC-M), Steel (S), Stainless Steel (SS) Copper (CU)

A3.0 CONSTANT PRESSURE (WATER LOSS) METHOD FOR VISCO-ELASTIC PRESSURE PIPELINES for Polyethylene (PE), Polypropylene (PP), Acrylonitrile Butadiene Styrene (ABS),

A4.0 PRESSURE DECAY METHOD FOR VISCO-ELASTIC PRESSURE PIPELINES for Polyethylene (PE80B), (PE100)

A5.0 VISUAL TEST METHOD FOR MINOR PIPELINES for Generally all materials where the pipes and joint are (easily) accessible for leak checking.

A6.0 LOW PRESSURE AIR TEST for Pump Suction Pipelines

A1.0 GENERAL REQUIREMENTS

A1.1 Testing Program

Requirement: All pipework defined below, is to be hydraulically pressure tested by applying hydraulic pressure in accordance with Australian Standard AS/NZS 2566.2:2002, Section 6 and Appendix M and N and the requirements below.

Requirement: The following pipelines and equipment are to be tested using the appropriate method set out below for each material:

- Pressurised main lines and main branches
- Rising mains and transfer mains
- Headers, manifolds, filter bank manifolds
- Pump suction pipework
- Lateral piping (downstream of the solenoid valves) under paving before concealment.

Requirement: Lateral pipes (downstream of the solenoid valves) which are not concealed and located in open spaces, does not require testing unless specifically specified in the *Interpretation Section*

Requirement: The irrigation contractor may undertake the testing (with approved equipment as detailed below) or the contractor may engage an approved specialist independent testing contractor. If a contractor undertakes testing, the testing shall be subject to witness and audit by the Project Manager or the project managers representative.

Requirement: Test all pipework ≤ 160 DN as the work progresses in sections not exceeding 750 m and test large pipelines over 160 DN in sections not exceeding 500 metres unless otherwise approved by the Project Manager in each case..

Requirement: Carryout testing at times when rapid changes in temperature from direct sunlight or very cold conditions (where pipes are exposed) do not occur during the test period.

Requirement: A minimum of three working days' notice to the Project Manager prior to testing of any part of the system.

A1.2 Test Pressures

Requirement: Select the test pressures with reference to AS/NZS Section 6.3.2, and the design pressures set out below.

Requirement: Do not apply excessive pressures to valves or other equipment in excess of the maximum rated pressure of each component.

A1.3 Preparation for Testing – Pre-Test Procedures

Refer AS/NZS Appendix M2 (a) to (e), and

Requirement: Mechanically seal the ends of the piping by capping, blind flanges or plates placed between valves, flanges, pumps, filters, or equipment.

Requirement: Testing against any valves or other equipment it is the sole responsibility of the contractor for leaks, failure or damage of such valves or equipment and any retesting that may be required and the costs associated with such failure or retesting.

A1.4 Filling Point for Testing

Refer AS/NZS Appendix M2 (i), and

Requirement: Provide a filling and test connection point at the lowest point in the form of a tee piece to encourage the expulsion of air as the line fills. Locate air bleeding points at the end/s and any high point along the pipeline to enable the removal of all air. Firm foam swabs may assist the removal of air in larger pipe lines.

A1.5 Pre-test Filling and Stabilizing

Refer AS/NZS Appendix M2 (i), and

Requirement: After filling and stabilising at static pressure a visual check should be made of all visible joints for any initial leaks, particularly on threaded or mechanical joints. Repair any leaks detected before testing proceeds.

A1.6 Air Removal

Requirement: The removal of air is critical to all testing methods. The contractor will ensure that all air is removed from any piping or equipment under test by allowing sufficient venting points and grading of the pipe work.

A1.7 Air Entrapment Indication

Refer AS/NZS Appendix M6.2 (b), (c), (d) and Figure M3, and

Requirement: Adopt the above method described in the standard to verify the presence of air in the system for PE pipe lines.

Note: The method described in this section of the standard is a part of the decay method for testing PE pipes but the same principal applies when applying the initial test pressure for the Test described in 6.3.4.2 and Appendix M5.2 (b) to check for air entrapment.

A1.8 Typical Test Rig and Equipment Arrangement

Refer AS/NZS Appendix M2, Figure M2, and

Note: A typical test rig will consist of the following elements

A1.8.1 Pump

Requirement: Select a positive displacement helical rotor type pump with a VFD drive sized to enable filling velocity flow rates, pressurizing time, water make up rates and test pressures. The test pump is to be fitted with an adjustable, relief valve, pressure sustaining valve (that can to be set at the test pressure), and make-up tank. Arrange the make-up water inlet to the tank to minimise air entrainment into the tank via a stilling pipe and extract the water for the opposite side of the tank.

A1.8.2 Test Pressure Gauges and Transducers

Refer AS/NZS Appendix M2 (h), and

Requirement: Provide approved two (2) NATA certified test pressure gauges, a minimum face dia. of 100 mm with a mirrored scale. The gauges or transducers are to be fitted with a pressure snubbers or damping devices to prevent mechanical damage from pressure surges. Provide a pressure transducer and multi-channel streaming data logger.

A1.8.3 Volume (Flow) Measurement

Requirement: Provide an insertion type inline magnetic style flow meter with a digital readout in Litres per min. Connect the output to one of the channels on the streaming data logger.

A1.8.4 Recording Test Data

Requirement: provide a suitable OPLC with coloured graphic screen to display real time data and graphs during the test and log the data for reporting.

A1.8.5 Accuracy of Test Equipment

Requirement: The test gauges and transducer shall read within $\pm 5\%$ of each other. If they do not agree within this tolerance re-calibrate or replace the equipment.

Requirement: Select the gauges and transducer so the test pressure falls between 35% and 70% of full-scale range of the gauge's full scale.

A.1.8.6 Certification of Testing Equipment

Requirement: Provide current NATA test certificates for the gauges, pressure transduce and flow transducer with the test reports. Certificates shall be available for inspection on site at the time of any testing. Transport and store in test equipment as appropriate in suitable protective case/s.

A2.0 CONSTANT PRESSURE (WATER LOSS) METHOD for

Ductile Iron (DI), Glass (Filament) Reinforced Plastic (GFR), Polyvinylchloride (PVC-U), (PVC-O), (PVC-M), Steel (S), Stainless Steel (SS) Copper (CU)

Refer AS/NZS2566.2:2002, Section 6.3.4.1 and Appendix M4

Requirement: Use this test on pipelines made from the above materials in above and below ground locations.

The test pressure at any point in the test section shall not be;

1. Less than the design pressure
2. Not than 1.2 times the design working pressure
3. Not more than 25% above the rated pressure of any component in the pipeline

Refer A1.1 above for approved test lengths of pipework.

Report Test Results

Requirement: Report test results in accordance with M4.3 (a) to (i).

A3.0 CONSTANT PRESSURE (WATER LOSS) METHOD FOR VISCO-ELASTIC PRESSURE PIPELINES for

Polyethylene (PE), Polypropylene (PP), Acrylonitrile Butadiene Styrene (ABS)

Refer AS/NZS2566.2:2002, Section 6.3.4.2 and Appendix M5

Requirement: Use this test on pipelines made from the above materials in above and below ground locations. This is the basic test applied to PE pipelines with test lengths and sizes set out in A1.1 above.

Requirement: Apply a decay test as described in A4.0 below if an unsatisfactory test result occurs with this test.

Requirement: Larger pipelines and or longer test lengths (up to 1000 m) may require the application of the method set out in A4.0 below at the discretion of the Project Manager.

The test pressure at any point in the test section shall not be;

1. Less than the design pressure
2. Not than 1.2 times the design working pressure
3. Not more than 25% above the rated pressure of any component in the pipeline

Refer A1.1 for approved test lengths of pipework.

Report Test Results

Requirement: Report test results in accordance with M5.3 (a) to (h).

A4.0 PRESSURE DECAY METHOD FOR VISCO-ELASTIC PRESSURE PIPELINES for

Polyethylene (PE80B), (PE100)

Refer AS/NZS2566.2:2002, Section 6.3.4.3 and Appendix M6

Requirement: This is the standard test specifically developed for PE pipelines in above and below ground locations in all sizes and lengths. The test is applicable in lieu of the test set out in A3.0 above.

Requirement: Apply this test in cases where the test result in A3.0 is unsatisfactory.

Requirement: Use this test for larger pipelines, ≥ 200 DN and or longer test lengths, ≥ 1000 m

The test pressure at any point in the test section shall not be;

4. Less than the design pressure
5. Not than 1.2 times the design working pressure
6. Not more than 25% above the rated pressure of any component in the pipeline

Refer A1.1 for approved test lengths of pipework.

Report Test Results

Requirement: Report test results in accordance with M6.6 (a) to (l).

A5.0 VISUAL TEST METHOD FOR MINOR PIPELINES for

Generally all materials where the pipes and joint are (easily) accessible for leak checking. Does not apply to laterals under paving.

Refer AS/NZS2566.2:2002, Section 6.3.4.5 and Appendix M8

Requirement: Use this test on pipelines made from the above materials in above and below ground locations. This is the basic test applied to PE pipelines with test lengths and sizes set out in A1.1 above.

Requirement: Apply a decay test as described in A4.0 below if an unsatisfactory test result occurs with this test.

Requirement: Larger pipelines and or longer test lengths may require the application of the method set out in A4.0 below at the discretion of the Project Manager.

The test pressure at any point in the test section shall not be;

1. Less than the design pressure
2. Not than 1.2 times the design working pressure
3. Not more than 25% above the rated pressure of any component in the pipeline

Refer A1.1 for approved test lengths of pipework.

Report Test
Results

Requirement: Report test results in accordance with M8.3 (a) to (j).

A6.0 LOW PRESSURE AIR TEST

for
Pump Suction
Pipelines

Refer AS/NZS2566.2:2002, Section 6.4.2 and Table 6.1 and Appendix N2

Requirement: Use this test on pump suction pipelines, made from any material in above and below ground locations and submerged locations.

Requirement: Where the pipe line is located in water charged ground or submerged at the static ground water pressure or submerged depth to the test pressures.

Requirement: If the pipe line does not pass the test, check all joints and fittings by brushing with a party diluted (with water) dishwashing solution.

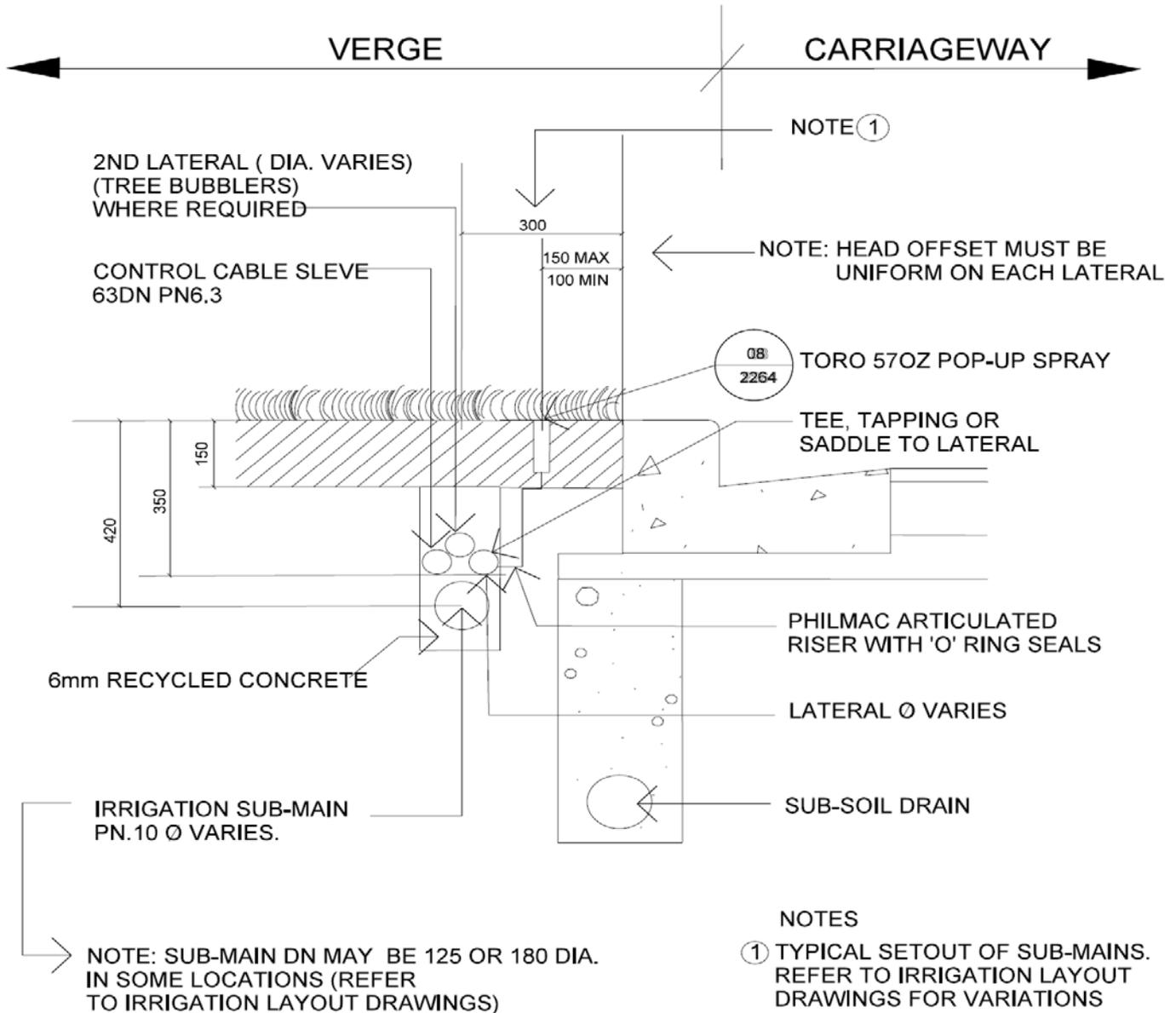
Report Test
Results

Requirement: Report test results in accordance with N2.2 (a) to (f).

IRRIGATION DETAILS

TYP. SUBMAIN TRENCH TO AVE. VERGES

4



NOTE: DIAGRAM IS PART OF HASSELL
DRAWING No. HSL 2264 X
det.069.dgn

HS-L-G-012 REV.A

PROJECT NO. 5094 CADS DATE 02/11/15

SYDNEY OLYMPIC PARK AUTHORITY
7 FIGTREE DRIVE SYDNEY OLYMPIC PARK NSW 2127
PH. (02) 9716 7300 FAX. (02) 9716 7819

SYDNEY OLYMPIC PARK
TYPICAL SUBMAIN TRENCH
TO AVENUE VERGES



D R G . NO. : 001-L-G-0003 REV. A
S C A L E : AS PER SCALE BAR

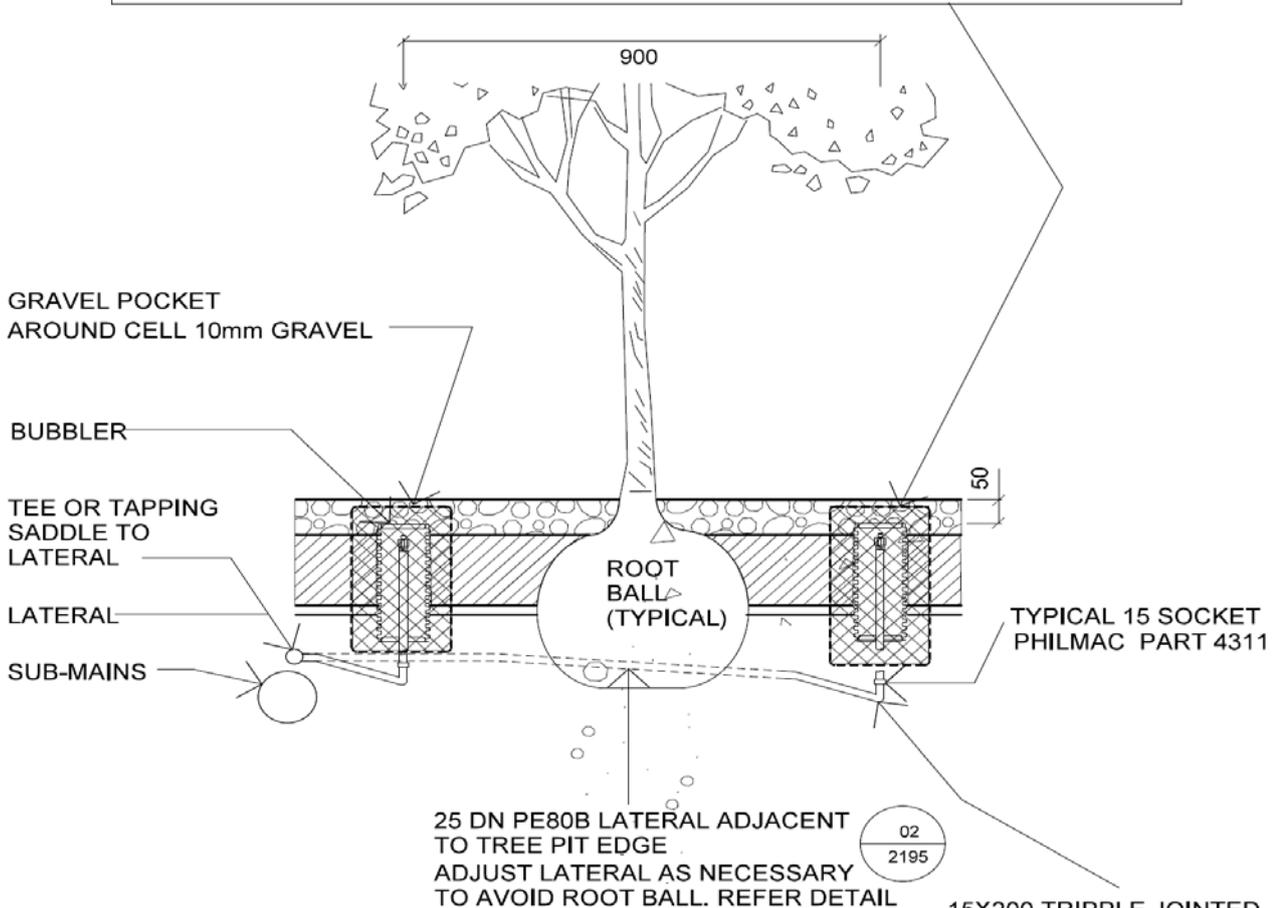
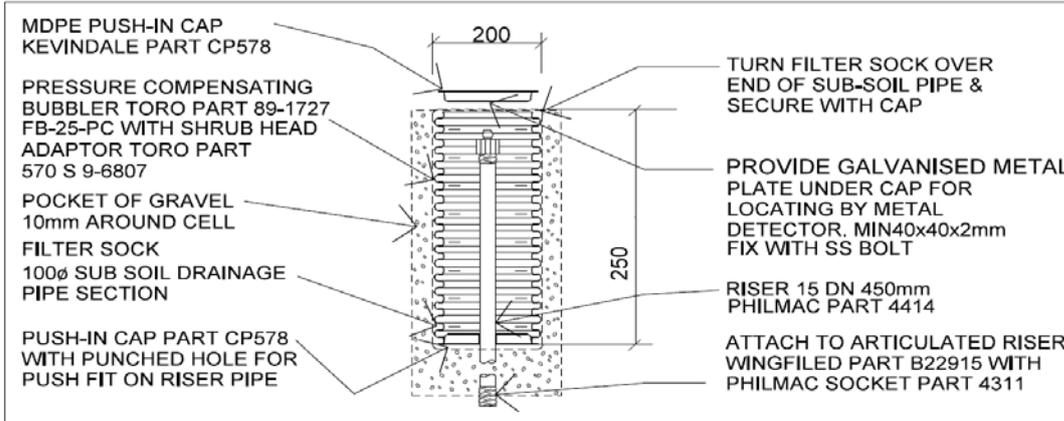


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IRRIGATION DETAILS

BUBBLER IN TREE PIT

7



15X200 TRIPPLE JOINTED ARTICULATED RISER PHILMAC PART 822915 AND ELBOW 7631

HS-L-G-013 REV.A

NOTE: DIAGRAM IS PART OF HASSELL DRAWING No. HSL 2264 X det.208.dgn

SYDNEY OLYMPIC PARK AUTHORITY
7 FETTER DRIVE, SYDNEY OLYMPIC PARK, NSW 2197
PH: (02) 9736 7300 FAX: (02) 9736 7838

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SYDNEY OLYMPIC PARK
BUBBLER IN TREE PIT



DRG. NO. : 001-L-G-0004 REV. A
SCALE : AS PER SCALE BAR



Sydney Olympic Park Authority

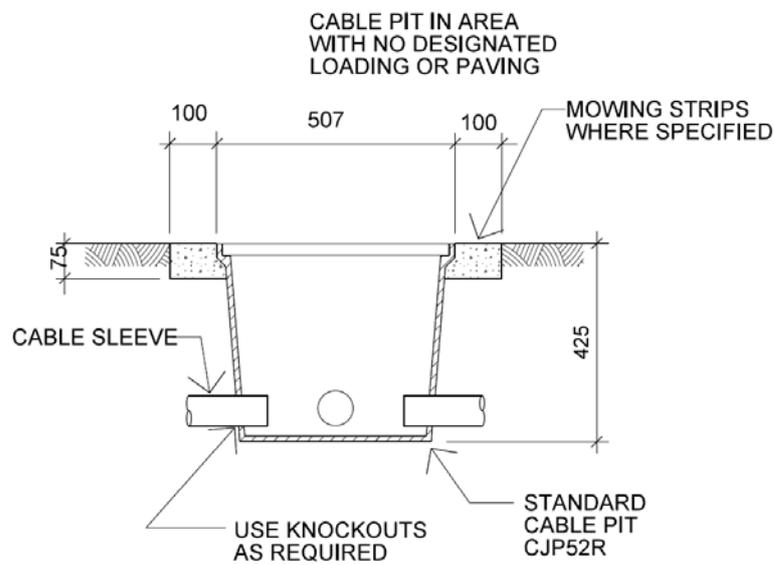
Operations & Sustainability

Handover Procedures

IRRIGATION DETAILS

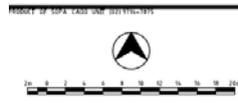
CABLE PITS IN GRASS - PLANTED AREAS

5A



NOTE: DIAGRAM IS PART OF HASSELL
DRAWING No. HSL 2264 X
det.GNVUF303.dgn

HS-L-G-014 REV.A



SYDNEY OLYMPIC PARK AUTHORITY
1 FUTURE DRIVE SYDNEY OLYMPIC PARK NSW 2007
PH:002 9556 7000 FAX:002 9556 7000

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SYDNEY OLYMPIC PARK CABLE PITS - IN GRASS & PLANTED AREAS



DRG. NO. : 001-L-G-0005 REV. A
SCALE : AS PER SCALE BAR

FILED DATE: 21/11/2014

Sydney Olympic Park Authority

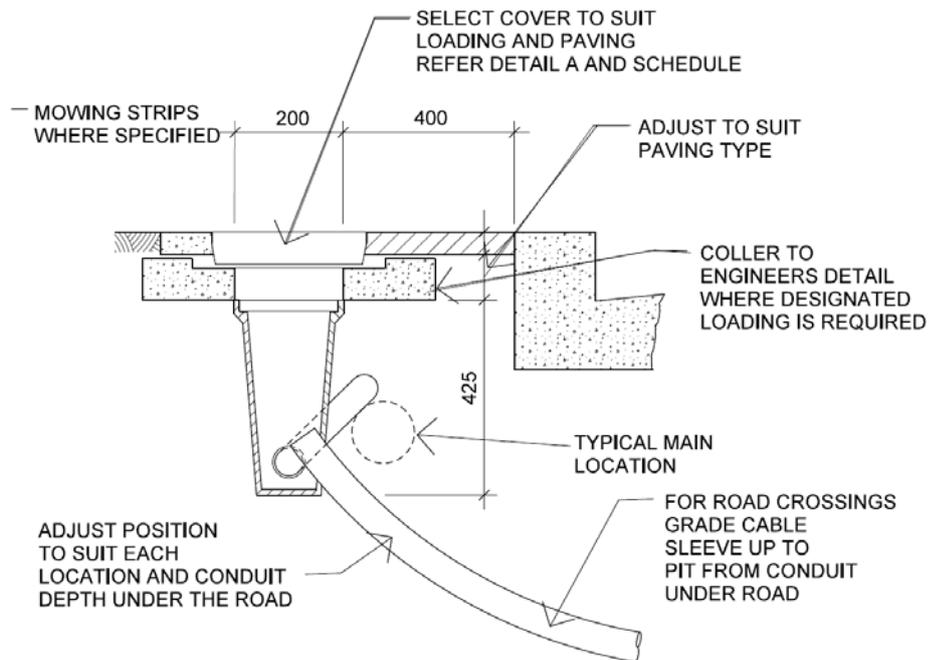
Operations & Sustainability

Handover Procedures

**IRRIGATION
DETAILS**

**CABLE PITS
IN PAVED AREAS**

5B



NOTE: DIAGRAM IS PART OF HASSELL
DRAWING No. HSL 2264 X
det.GNVWF303.dgn

HS-L-G-015 REV.A

PROJECT OF 2004 OLYMPIC GAMES INFRASTRUCTURE



SYDNEY OLYMPIC PARK AUTHORITY
7 FETTERE DRIVE SYDNEY OLYMPIC PARK NSW 2107
PHONE: 9176 7300 FAX: (02) 9176 7000

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**SYDNEY OLYMPIC PARK
CABLE PITS - IN PAVED AREA**



DRG. NO. : 001-L-G-0006 REV. A
SCALE : AS PER SCALE BAR

PLAT DATE: 21/11/2014

Sydney Olympic Park Authority

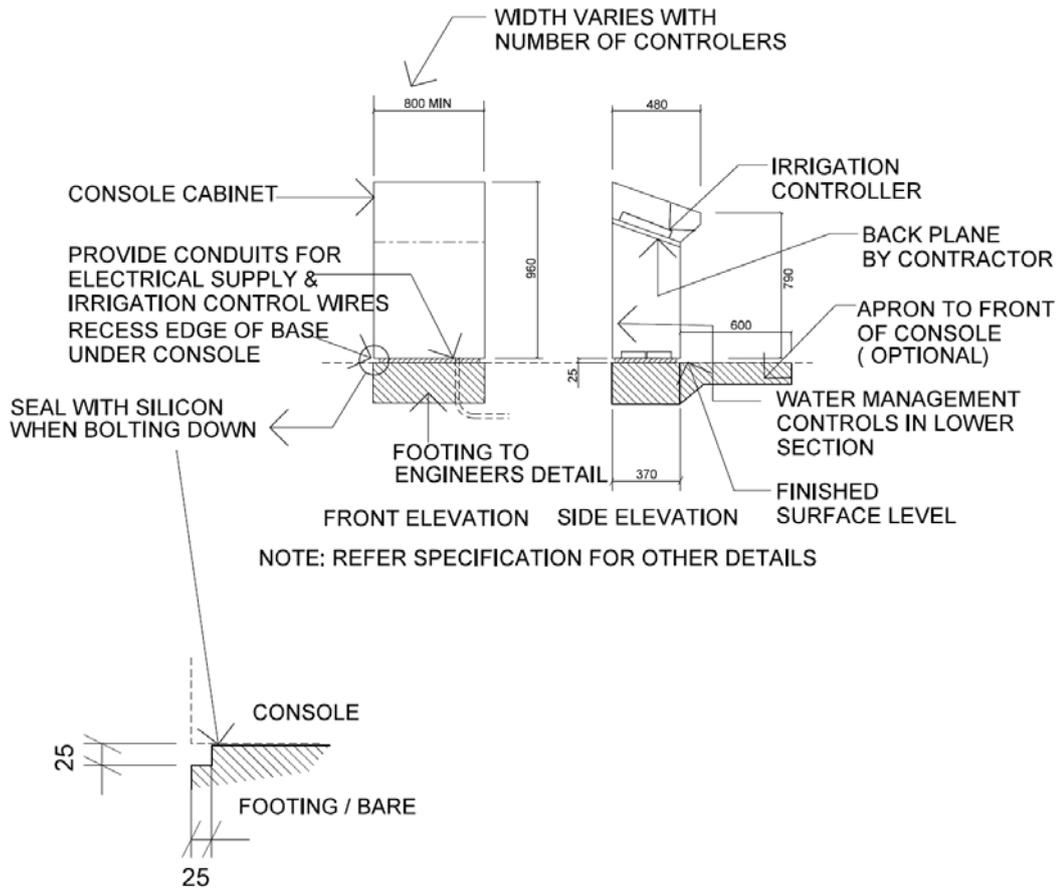
Operations & Sustainability

Handover Procedures

IRRIGATION DETAILS

CONTROL CONSOLE

9



NOTE: DIAGRAM IS PART OF HASSELL
DRAWING No. HSL 2264 X
det.GNWUF207D.dgn

HS-L-G-016 REV.A



SYDNEY OLYMPIC PARK AUTHORITY
7 FORTREE DRIVE SYDNEY OLYMPIC PARK NSW 2107
PHONE 9756 7000 FAX 902 9756 7000

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SYDNEY OLYMPIC PARK CONTROL CONSOLE



D R G . NO. : 001-L-G-0007 REV. A
SCALE : AS PER SCALE BAR

Sydney Olympic Park Authority

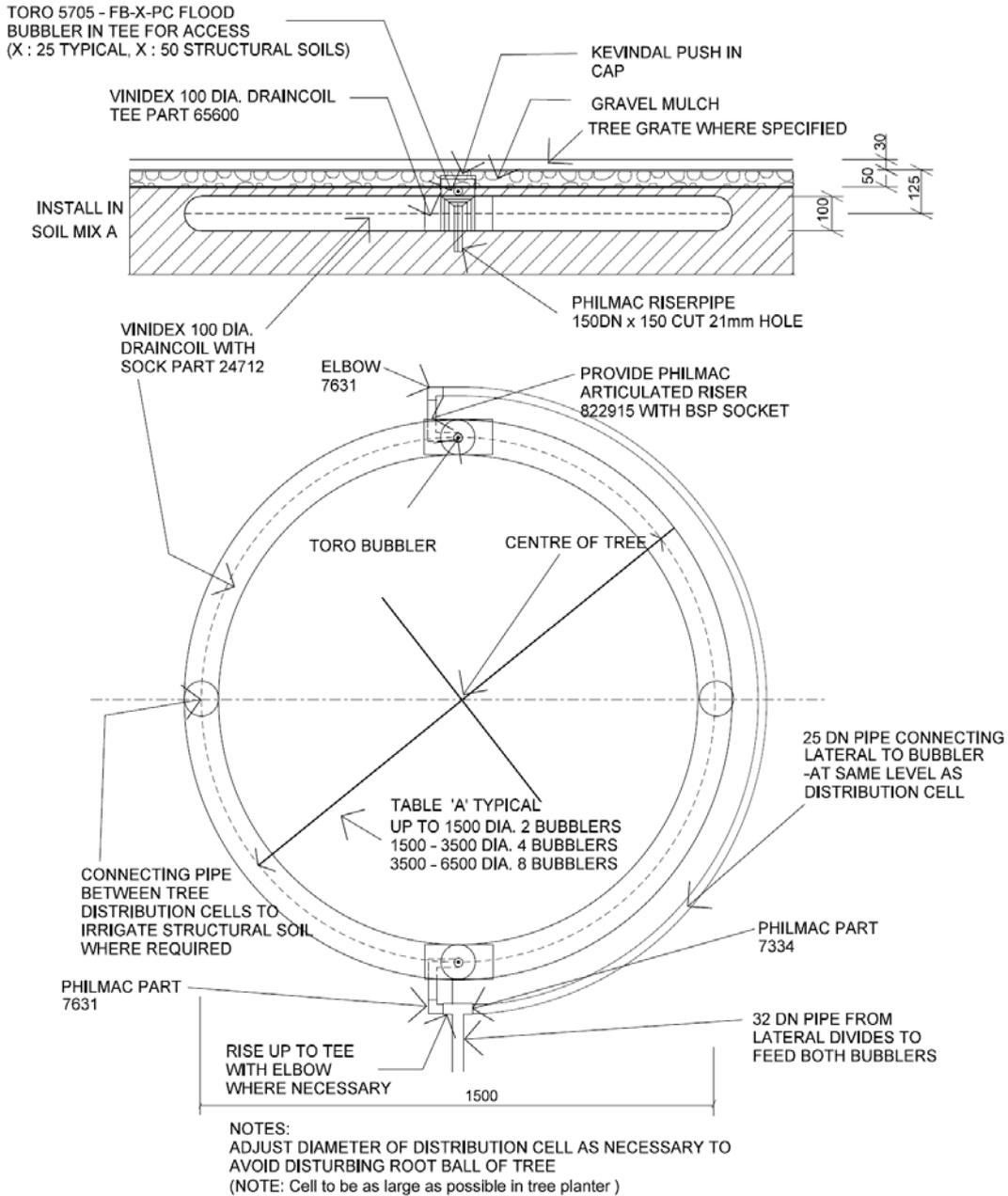
Operations & Sustainability

Handover Procedures

IRRIGATION DETAILS

WATER DISTRIBUTION CELL (TREES IN PAVED AREAS)

6



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 DRAWING No. HSL 2264 X
 det.GNWUF206.dgn

HS-L-G-017 REV.A



SYDNEY OLYMPIC PARK AUTHORITY
 7 FORTREE DRIVE, SYDNEY OLYMPIC PARK, NSW 2027
 PH: (02) 9736 7000 FAX: (02) 9736 7000

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SYDNEY OLYMPIC PARK
WATER DISTRIBUTION CELL
(TREES IN PAVED AREAS)



D R G . NO. : 001-L-G-0008 REV. A
 S C A L E : AS PER SCALE BAR

PLAT DATE: 21/11/2014

Sydney Olympic Park Authority

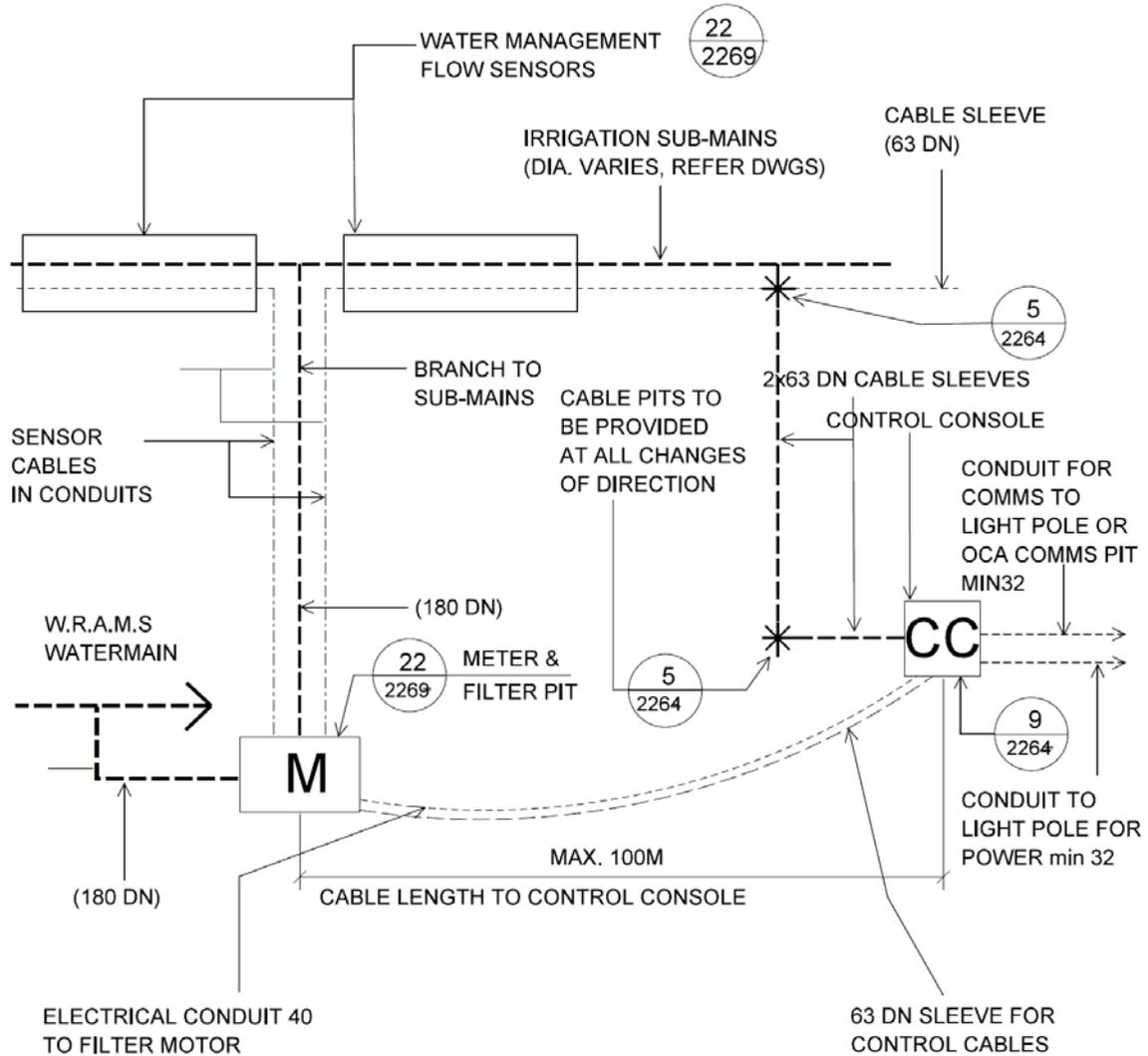
Operations & Sustainability

Handover Procedures

IRRIGATION DETAILS

TYP. METER FILTER PIT CONNECTION TO WRAMS WATERMAIN

20



NOTE: DIAGRAM IS PART OF HASSELL
DRAWING No. HSL 2269 X

HS-L-G-018 REV.A



SYDNEY OLYMPIC PARK AUTHORITY
7 FORTICE DRIVE SYDNEY OLYMPIC PARK NSW 2187
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SYDNEY OLYMPIC PARK
TYP. METER FILTER PIT
CONNECTION TO WRAMS
WATERMAIN



D.R.G. NO. : 001-L-G-0009 REV. A
SCALE : AS PER SCALE BAR

Sydney Olympic Park Authority

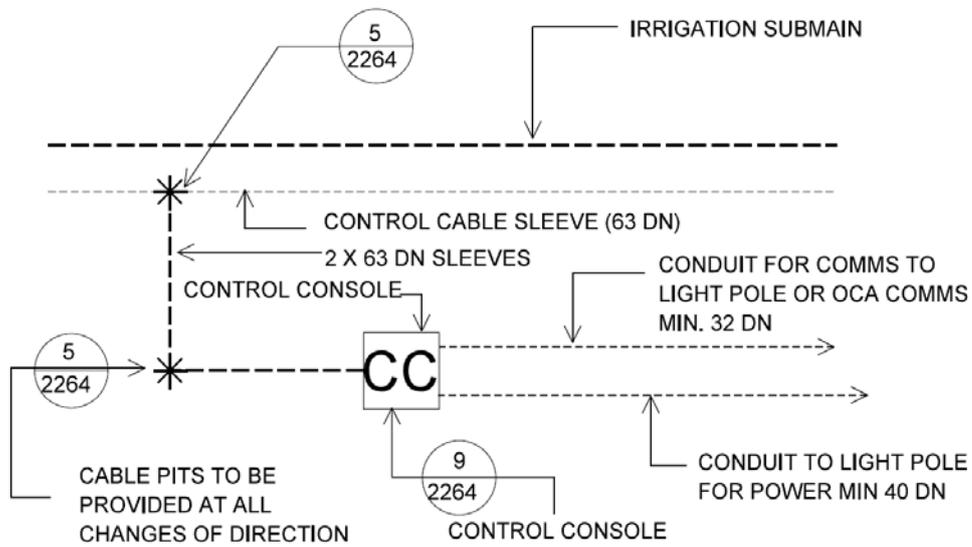
Operations & Sustainability

Handover Procedures

IRRIGATION DETAILS

TYP. (STAND ALONE) CONTROL ARRANGEMENT

21



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HS-L-G-019 REV.A



SYDNEY OLYMPIC PARK AUTHORITY
1 FRETICE DRIVE SYDNEY OLYMPIC PARK NSW 2107
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SYDNEY OLYMPIC PARK
TYP. (STAND ALONE)
CONTROL ARRANGEMENT



DRG. NO. : 001-L-G-0010 REV. A
SCALE: AS PER SCALE BAR

Sydney Olympic Park Authority

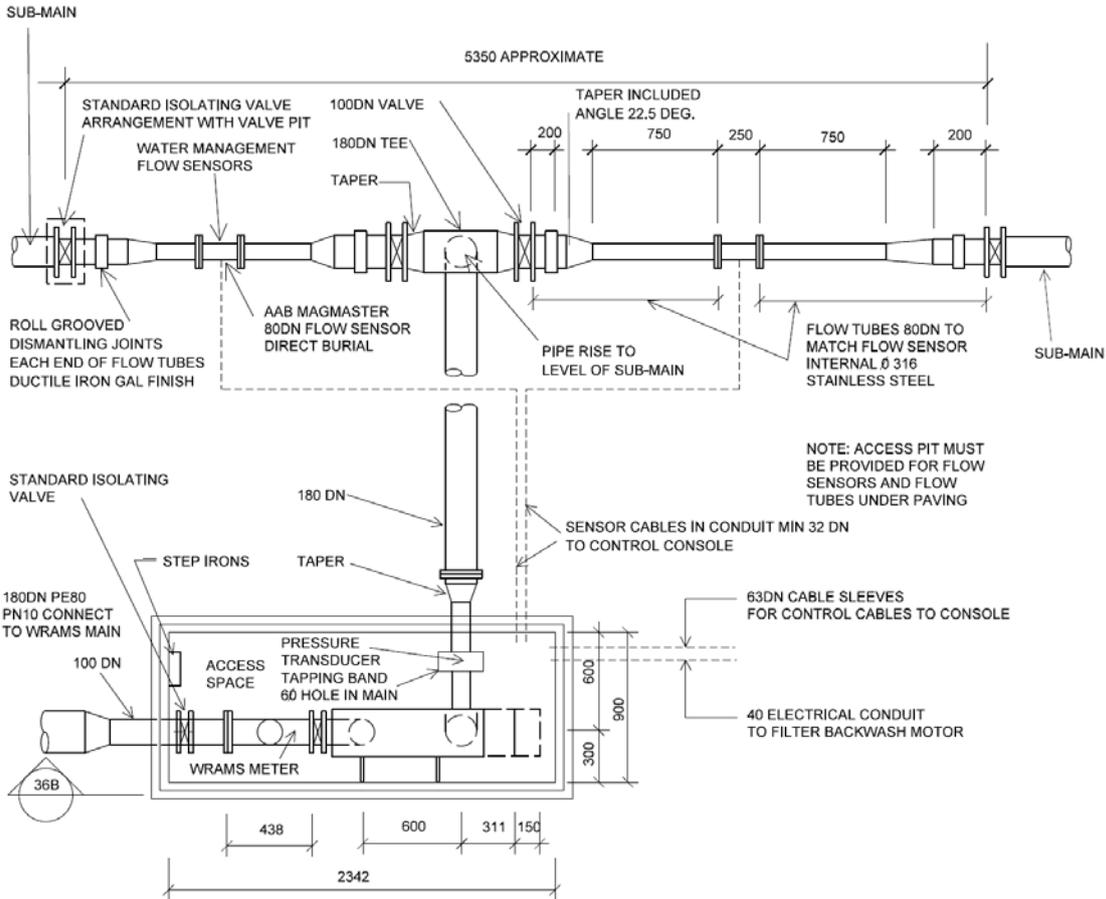
Operations & Sustainability

Handover Procedures

IRRIGATION DETAILS

TYP. METER & FILTER PIT DETAIL

22



PLAN

NOTE: DIAGRAM IS PART OF HASSELL
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HS-L-G-020 REV.A



SYDNEY OLYMPIC PARK AUTHORITY
 1 PATTERSON ROAD SYDNEY OLYMPIC PARK NSW 2157
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SYDNEY OLYMPIC PARK
 TYP. METER & FILTER
 PIT DETAILS

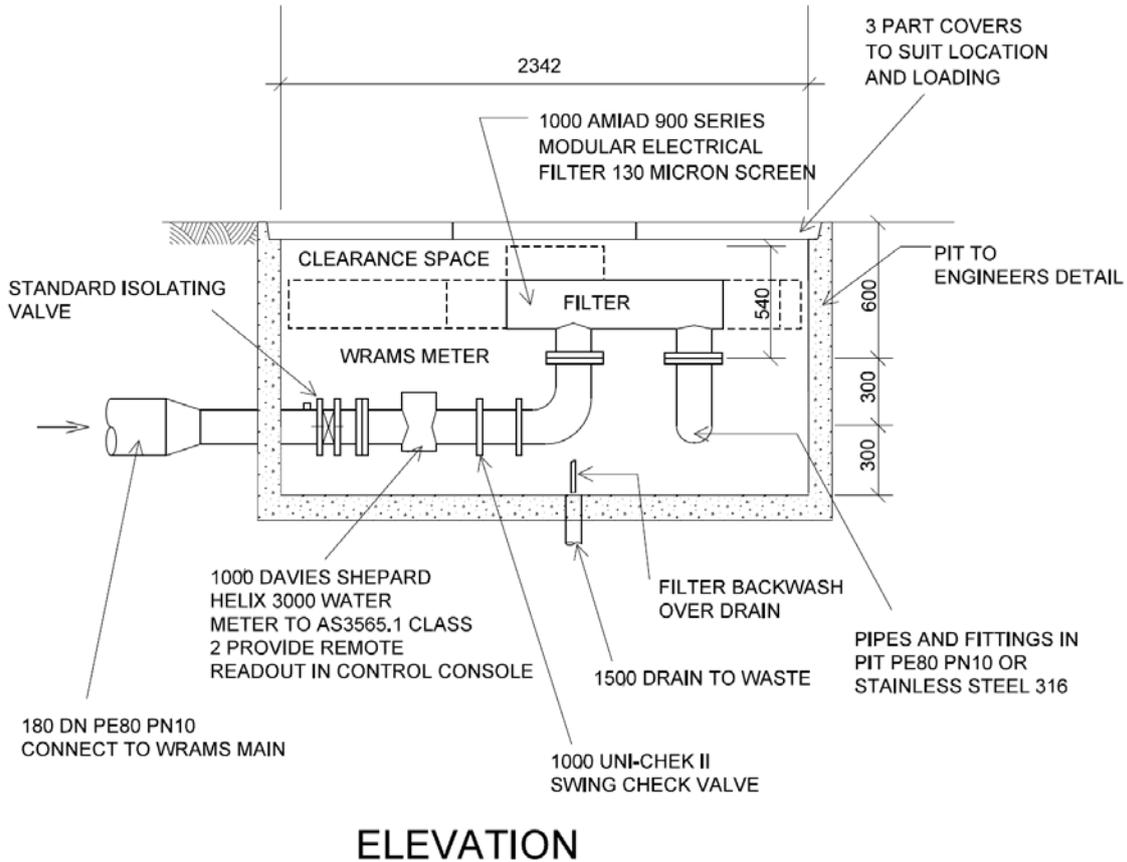


D.R.G. NO. : 001-L-G-0011 REV. A
 SCALE : AS PER SCALE BAR

**IRRIGATION
DETAILS**

**TYP. SECTION:
METER & FILTER PIT**

21



NOTE: DIAGRAM IS PART OF HASSELL DRAWING No, HSL 2269 X

HS-L-G-021 REV.A



SYDNEY OLYMPIC PARK AUTHORITY
 7 FREETREE DRIVE SYDNEY OLYMPIC PARK NSW 2107
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SYDNEY OLYMPIC PARK
**TYP. SECTION:
 METER & FILTER**



DRG. NO. : 001-L-G-0012 REV. A
 SCALE: AS PER SCALE BAR

IRRIGATION DETAILS

TABLE 1

TABLE 1

LATERAL PIPE SIZES & VALVE SIZING SCHEDULE							
		LATERAL PIPE SIZES (DN)			SOLENOID VALVE SIZES (DN)		NOTES
		UP TO 12 PITS			UP TO 24 PITS		
VERGE TYPE A 3000 - 4000	TREE PITS (BUBBLERS) 2 PER TREE	32 DN			25 DN		
	TURF BAYS (SPRAYS) 6 PER BAY	1-5 32 DN	6 - 8 40 DN	9 - 12 63 DN	UP TO 14 BAYS 40 DN	15 - 24 BAYS 50 DN	
MEDIAN 3000 - 4000	PLANTING (SPRAYS)	1 - 12 32 DN	13 - 19 40 DN	20 - 30 63 DN	UP TO 72 40 DN	73 - 120 50 DN	USE TORO 10-H-PC SPRAYS
		UP TO 12 PITS 32 DN			UP TO 24 BAYS 25 DN		
VERGE TYPE B 1200 - 2000	TREE PITS (BUBBLERS) 2 PER TREE	32 DN			25 DN		
	TURF BAYS (SPRAYS) 6 PER BAY	UP TO 12 BAYS 32 DN			UP TO 24 BAYS 25 DN		
MAX LENGTHS OF LATERALS		FROM SOLENOID VALVE - 95m IN EACH BLOCK - 155m					
	TREE PITS IN ASPHALT (VERGES / SINGLE ROWS) STRUCTURAL SOIL	TREE PITS (CIRCULAR DISTRIBUTION CELL-2 BUBBLERS PER TREE) FB-50-PC	1 - 8 32 DN	9 - 12 40 DN	13 - 20 63 DN	UP TO 26 PITS 40 DN	25 - 40 PITS 50 DN	BRANCH TO PIT 32 DN
MAX LENGTH OF LATERALS		FROM SOLENOID VALVE - 120m IN EACH BLOCK - 240m					
	TREES IN GRAVEL OR MASS PLANTER AREAS MULTIPLE ROWS (PERMEABLE SURFACE)	BUBBLERS IN VERTICAL DISTRIBUTION CELL 2 PER TREE FB-25-PC	1 - 12 32 DN	13 - 20 40 DN	21 - 40 63 DN	UP TO 26 PITS 25 DN	27 - 40 40 DN	BRANCH TO BUBBLER 25 DN
MAX LENGTH OF LATERALS		FROM SOLENOID VALVE - 120m TOTAL FOR ZONE 150m			SUPPLY LATERAL FROM VALVE 63 DN		
	MASS PLANTER AREAS OF NATIVE GRASSES MULTIPLE ROWS	SPRAYS POP-UP SELECT HEIGHT TO SUIT PLANTERS NOZZLES 10- (Q,H,F) - PC	1 - 6 (F) 1 - 12 (H) 32 DN	7 - 10 (E) 13 - 20 (H) 40 DN	11- 15 (F) 21 - 30 (H) 63 DN	UP TO 36 (F) SPRAYS OR 3.5 I/s 40 DN	UP TO 65 (F) SPRAYS OR 5.5 I/s 50 DN
MAX LENGTH OF LATERALS		FROM SOLENOID VALVE - 120m TOTAL FOR ZONE 150m			SUPPLY LATERAL FROM VALVE 63 DN		
	TREES IN ASPHALT MULTIPLE ROWS (NON - PERMEABLE SURFACE)	CIRCULAR DISTRIBUTION CELL-2 PER TREE FB-25-PC	1 - 12 32	13 - 20 40 DN	21 - 40 63 DN	UP TO 26 PITS 25 DN	27 - 40 40 DN	BRANCH TO BUBBLER 25 DN
MAX LENGTH OF LATERALS		FROM SOLENOID VALVE - 120m TOTAL FOR ZONE 150m			SUPPLY LATERAL FROM VALVE 63 DN		

NOTE: DIAGRAM IS PART OF HASSELL
DRAWING No. HSL 2268 X

HS-L-G-022 REV.A

 SYDNEY OLYMPIC PARK AUTHORITY 3 FORTREE DRIVE SYDNEY OLYMPIC PARK NSW 2107 PH: (02) 9751 7000 FAX: (02) 9751 7009 DISTRIBUTION CONTROL <small>THIS DRAWING REMAINS THE PROPERTY OF THE SYDNEY OLYMPIC PARK AUTHORITY EXCEPT AS PROVIDED IN THE CONDITIONS OF ISSUE. IT SHALL NOT BE COPIED IN WHOLE OR IN PART NOR REPRODUCED IN ANY FORM FOR ANY OTHER PROJECT WITHOUT THE WRITTEN APPROVAL.</small>	SYDNEY OLYMPIC PARK IRRIGATION DETAILS TABLE 1	 DRG. NO. : 001-L-G-0013 REV. A SCALE : AS PER SCALE BAR
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Sydney Olympic Park Authority

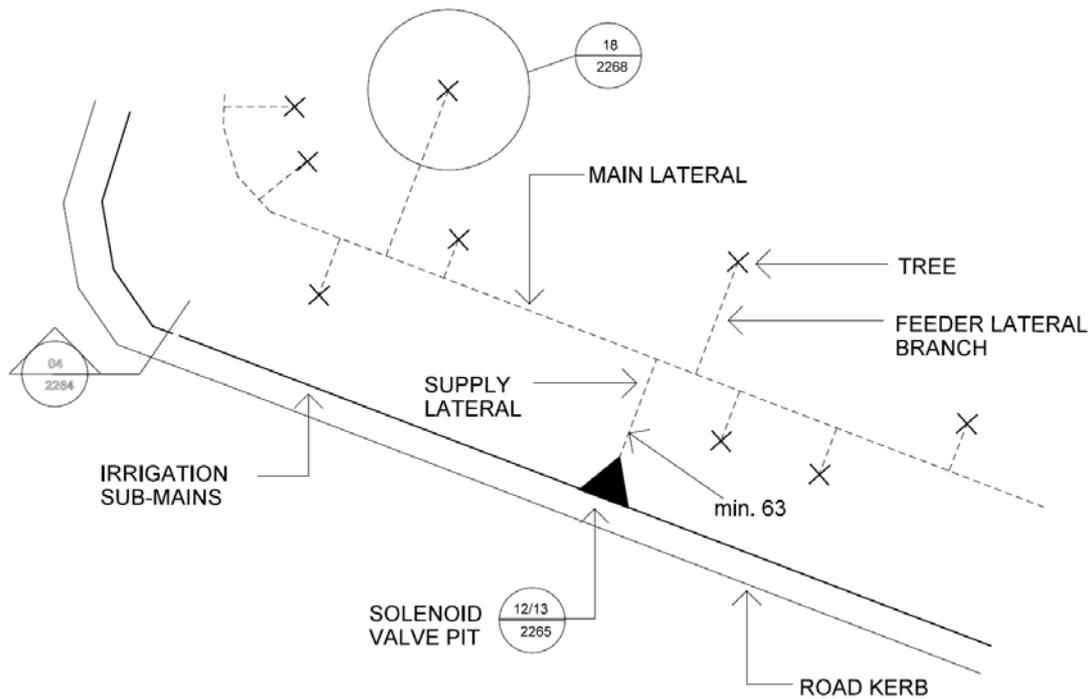
Operations & Sustainability

Handover Procedures

IRRIGATION DETAILS

TYP. IRRIGATION LAYOUT - TREES IN GRAVEL

15



NOTE: DIAGRAM IS PART OF HASSELL
DRAWING No. HSL 2268 X DET 469

HS-L-G-023 REV.A



SYDNEY OLYMPIC PARK AUTHORITY
1 PESTREE DRIVE SYDNEY OLYMPIC PARK NSW 2107
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SYDNEY OLYMPIC PARK
TYP. IRRIGATION LAYOUT -
TREES IN GRAVEL



DRG. NO. : 001-L-G-0014 REV. A
SCALE: AS PER SCALE BAR

Sydney Olympic Park Authority

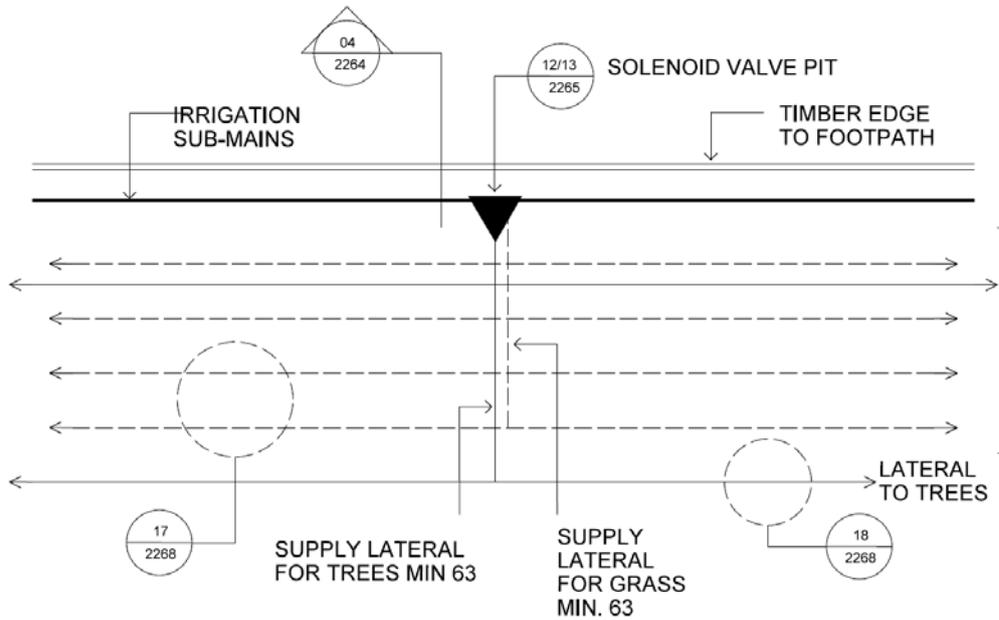
Operations & Sustainability

Handover Procedures

IRRIGATION DETAILS

TYP. IRRIGATION LAYOUT - TREES IN GRASS (MULTIPLE ROWS)

16



NOTE: DIAGRAM IS PART OF HASSELL
DRAWING No. HSL 2268 X DET. 470

HS-L-G-024 REV.A

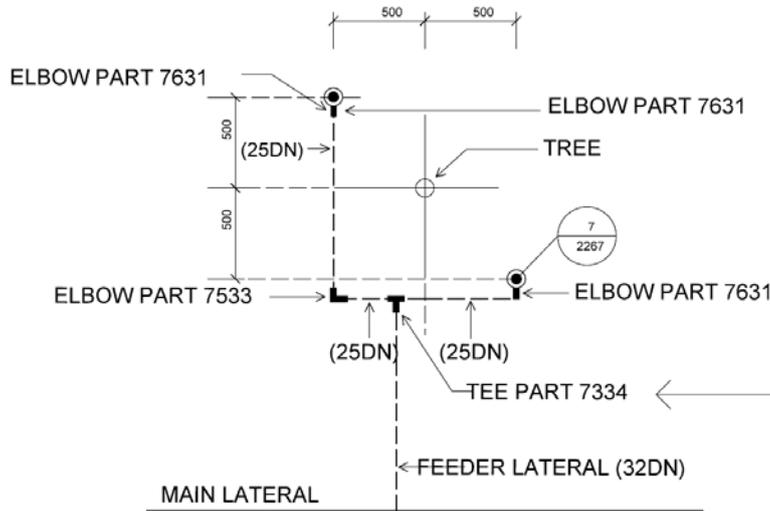
	<p>SYDNEY OLYMPIC PARK AUTHORITY 3 FETTER DRIVE SYDNEY OLYMPIC PARK NSW 1507 PH: (02) 9751 7000 FAX: (02) 9751 7009</p> <p>DISTRIBUTION CONTROL THIS DRAWING REMAINS THE PROPERTY OF THE SYDNEY OLYMPIC PARK AUTHORITY. EXCEPT AS PROVIDED IN THE CONDITIONS OF ISSUE, IT SHALL NOT BE LOANED, REPRODUCED, COPIED, REPRODUCED, OR IN ANY FORM TO ANY OTHER PARTY WITHOUT THE WRITTEN APPROVAL OF THE AUTHORITY.</p>	<p>SYDNEY OLYMPIC PARK TYP. IRRIGATION LAYOUT - TREES IN GRASS (MULTIPLE ROWS)</p>	 <p>DRG. NO. : 001-L-G-0015 REV. A SCALE : AS PER SCALE BAR</p>
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IRRIGATION DETAILS

TYP. BUBBLER LAYOUT DETAIL TO TREE PLANTING

18

- NOTES :-
1. LAYOUT OF LEVEL AREAS
 2. FOR SLOPING AREAS THE BUBBLERS SHOULD BE LOCATED ON THE HIGH SIDE OF THE TREE
 3. IN CIRCULAR PITS BUBBLERS ARE LOCATED ON OPPOSITE SIDES



NOTE : PART NO. REFER TO PHILMAC FITTINGS

REFER TO PLAN 7
(NO. HS-L-G-013 REV. A) FOR
ELEVATIONS AND CELL DETAILS

NOTE: DIAGRAM IS PART OF HASSELL
DRAWING No. HSL 2268 X DET. 472

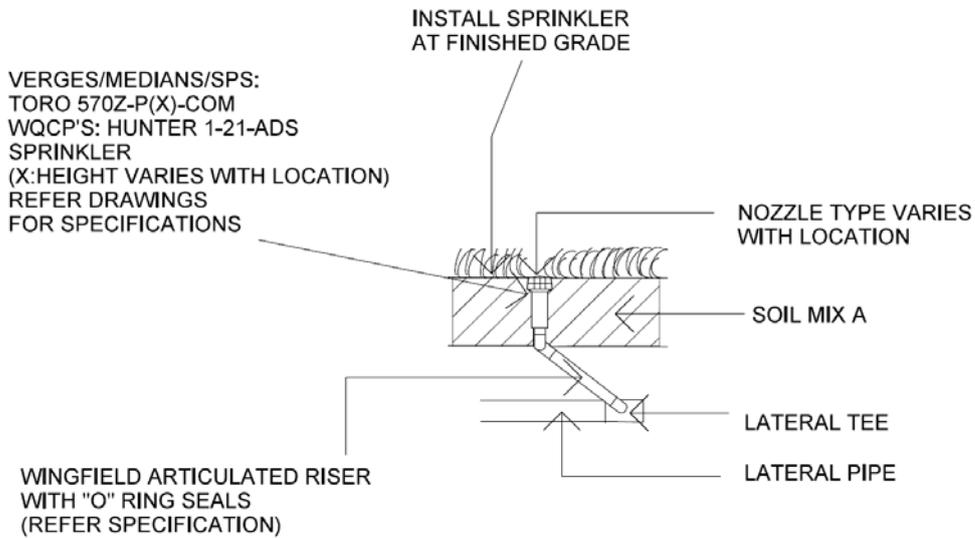
HS-L-G-026 REV.A

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**IRRIGATION
DETAILS**

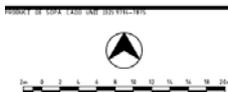
**TYPICAL
POP - UP SPRAY**

8



NOTE: DIAGRAM IS PART OF HASSELL
DRAWING No. HSL 2264 X
det.207D.dgn

HS-L-G-027 REV.A



SYDNEY OLYMPIC PARK AUTHORITY
7 FRETREE DRIVE SYDNEY OLYMPIC PARK NSW 2027
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SYDNEY OLYMPIC PARK
TYPICAL
POP - UP SPRAY



D.R.G. NO. : 001-L-G-0016 REV. A
SCALE: AS PER SCALE BAR

Sydney Olympic Park Authority

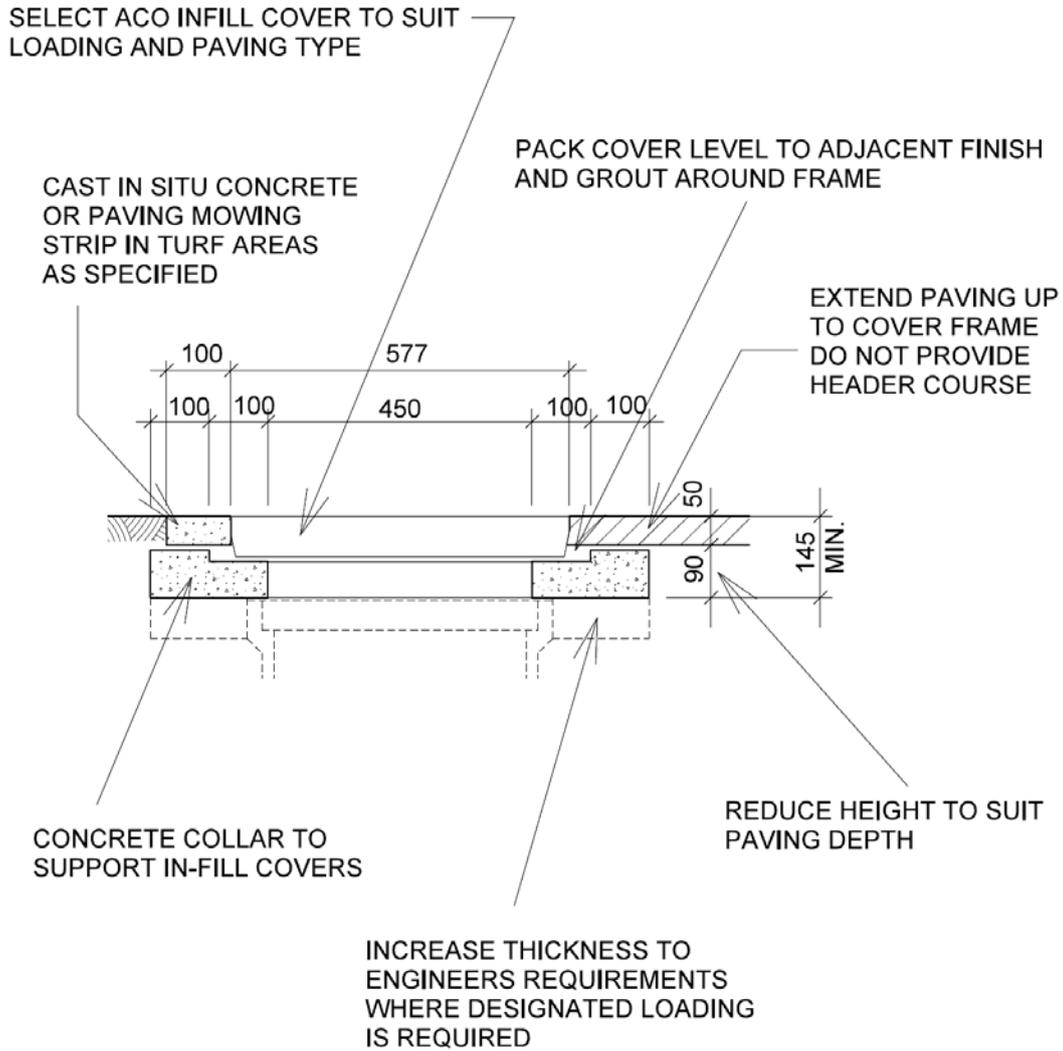
Operations & Sustainability

Handover Procedures

**IRRIGATION
DETAILS**

**COVER IN PAVED
AND DESIGNATED
LOADING LOCATION**

A



NOTE: DIAGRAM IS PART OF HARGREAVES ASSOCIATES
DRAWING NWUF303 REV.A
DETAIL A

HS-L-G-028 REV.A

	<p>SYDNEY OLYMPIC PARK AUTHORITY 7 FETTER DRIVE SYDNEY OLYMPIC PARK NSW 2057 PH: (02) 9756 7000 FAX: (02) 9756 7009</p> <p>DISTRIBUTION CONTROL THIS DRAWING REMAINS THE PROPERTY OF THE SYDNEY OLYMPIC PARK AUTHORITY EXCEPT AS PROVIDED IN THE CONDITIONS OF ISSUE. IT SHALL NOT BE COPIED IN WHOLE OR IN PART NOR REPRODUCED IN ANY FORM OR BY ANY MEANS WITHOUT THE WRITTEN APPROVAL.</p>	<p>SYDNEY OLYMPIC PARK COVER IN PAVED AND DESIGNATED LOADING LOCATION</p>	 <p>D R G . NO . : 001-L-G-0019 REV. A S C A L E : AS PER SCALE BAR</p>
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Sydney Olympic Park Authority

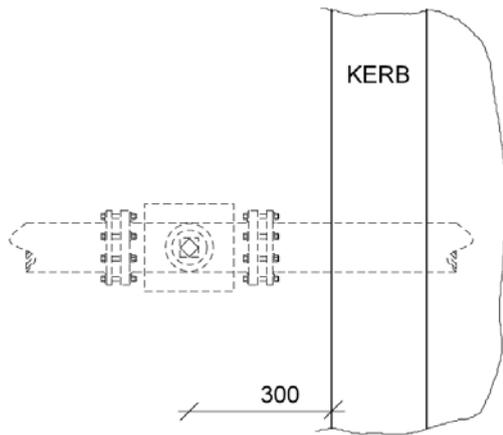
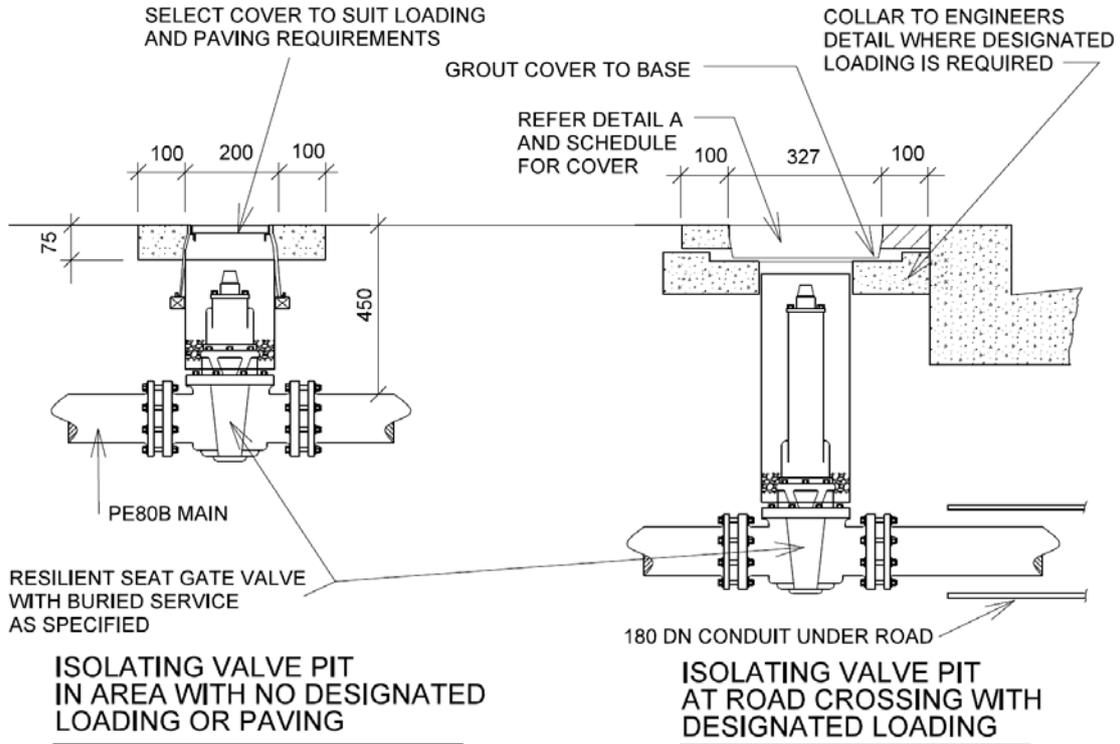
Operations & Sustainability

Handover Procedures

IRRIGATION DETAILS

TYPICAL SECTION ISOLATING VALVES RESILIENT SEAT GATE VALVE

B



DETAIL H
TYPICAL LAYOUT
ISOLATING VALVES

PROJECT OR SUPPLY INFORMATION NOTIFIED HERE

SYDNEY OLYMPIC PARK AUTHORITY
4 AUSTRALIA AVENUE SYDNEY OLYMPIC PARK NSW 2007
PHONE: 9756 7300 FAX: 9621 9176 7800

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SYDNEY OLYMPIC PARK
TYPICAL SECTION
ISOLATING VALVES
RESILIENT SEAT GATE VALVE



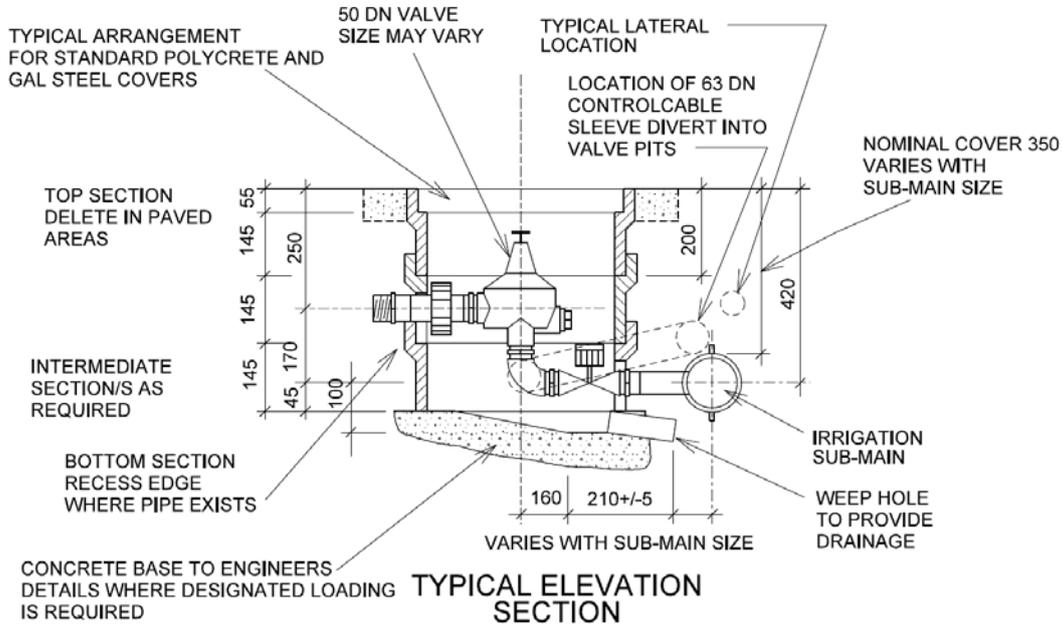
SydneyOlympicPark 

D.R.G. NO. : 001-L-G-0020 REV. B
SCALE : AS PER SCALE BAR

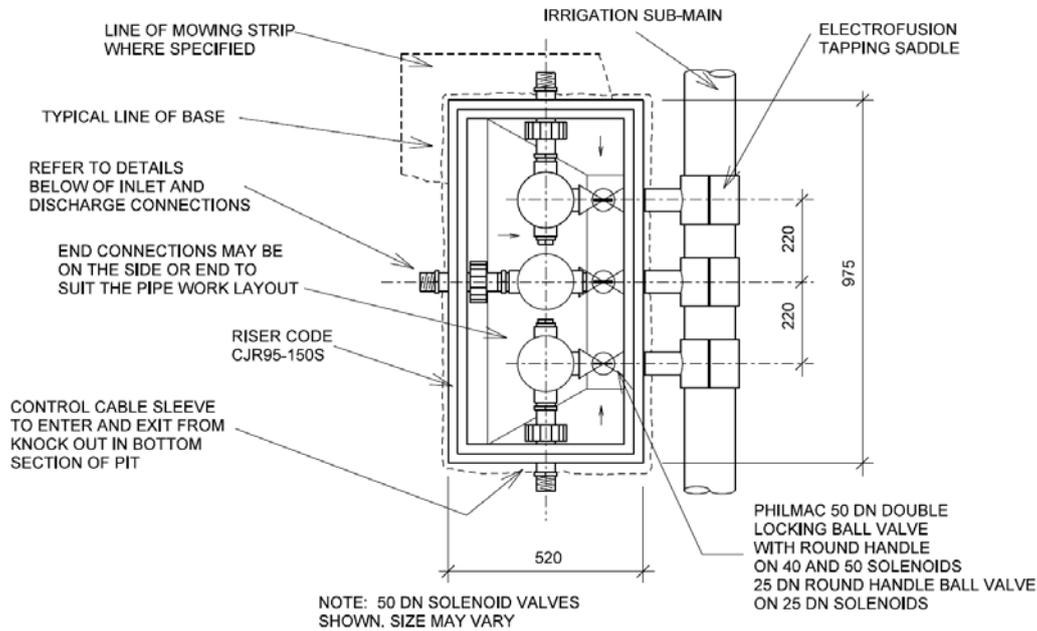
IRRIGATION DETAILS

TYPICAL LAYOUT LARGE VALVE PIT

C



TYPICAL ELEVATION SECTION



**TYPICAL LAYOUT
LARGE VALVE PIT**

NOTE: DIAGRAM IS PART OF HARGREAVES ASSOCIATES
DRAWING NWUF303 REV.A
DETAIL C

HS-L-G-030 REV.A



SYDNEY OLYMPIC PARK AUTHORITY
3 FETTER DRIVE SYDNEY OLYMPIC PARK NSW 1507
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SYDNEY OLYMPIC PARK
TYPICAL SECTION & LAYOUT
LARGE VALVE PIT



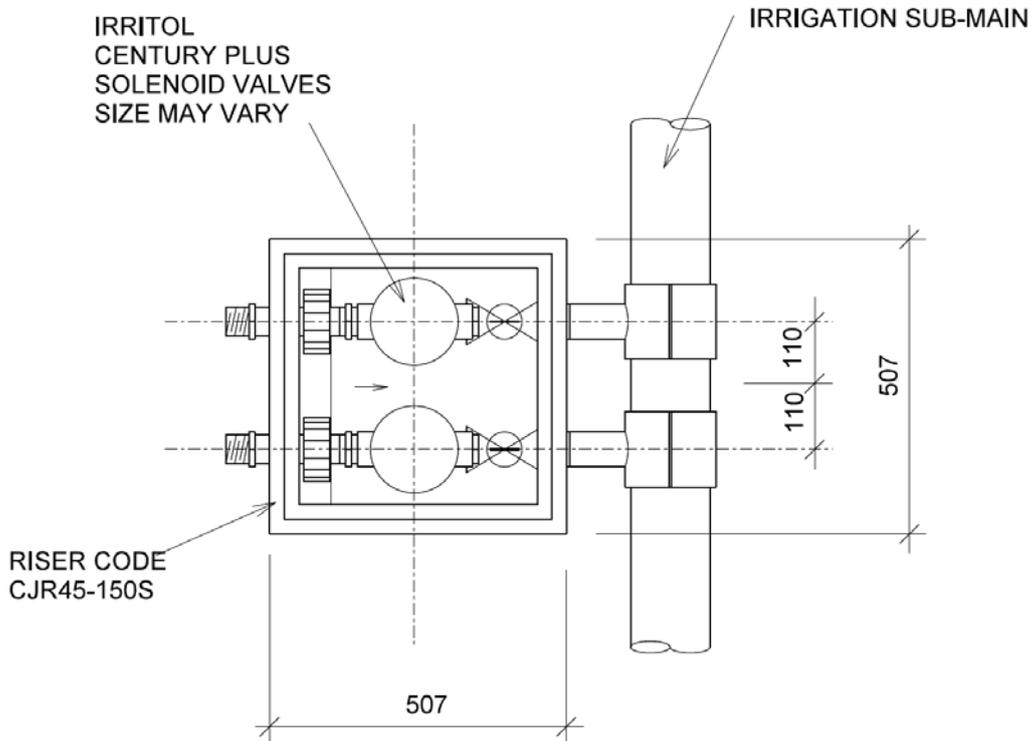
D.R.G. NO. : 001-L-G-0021 REV. A
SCALE : AS PER SCALE BAR

PLANT DATE: 21/11/2014

**IRRIGATION
DETAILS**

**TYPICAL LAYOUT
SMALL VALVE PIT
TWO VALVES**

D



NOTE: DIAGRAM IS PART OF HARGREAVES ASSOCIATES
DRAWING NWUF303 REV.A
DETAIL D

HS-L-G-031 REV.A



SYDNEY OLYMPIC PARK AUTHORITY
1 FETTER DRIVE SYDNEY OLYMPIC PARK NSW 2107
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SYDNEY OLYMPIC PARK
TYPICAL LAYOUT
SMALL VALVE PIT - TWO VALVES

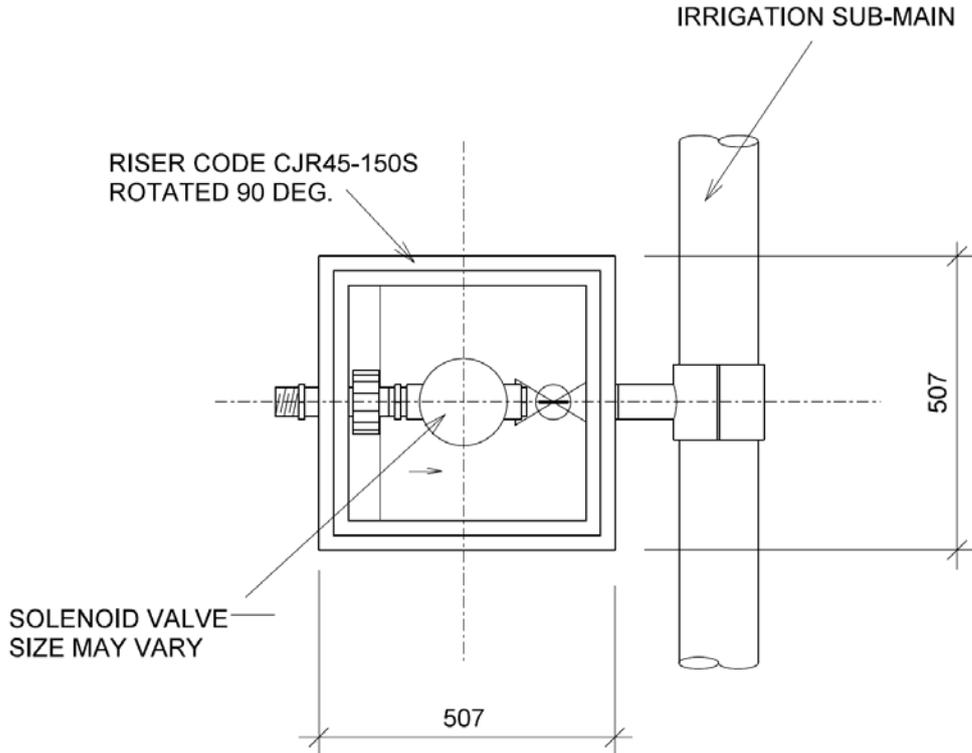


D R G . N O . : 001-L-G-0022 REV. A
S C A L E : AS PER SCALE BAR

**IRRIGATION
DETAILS**

**TYPICAL LAYOUT
SMALL VALVE PIT
ONE VALVE**

E



NOTE: DIAGRAM IS PART OF HARGREAVES ASSOCIATES
DRAWING NWUF303 REV.A
DETAIL E

HS-L-G-032 REV.A

	<p>SYDNEY OLYMPIC PARK AUTHORITY 7 FETTER DRIVE, SYDNEY OLYMPIC PARK, NSW 2197 P.O. BOX 9706, SYDNEY NSW 1585</p> <p><small>DISTRIBUTION CONTROL: THIS DRAWING REMAINS THE PROPERTY OF THE SYDNEY OLYMPIC PARK AUTHORITY EXCEPT AS PROVIDED IN THE CONDITIONS OF ISSUE. IT SHALL NOT BE LOANED, REPRODUCED, COPIED, REPRODUCED, OR ANY PART OF IT, WITHOUT THE WRITTEN APPROVAL OF THE SYDNEY OLYMPIC PARK AUTHORITY.</small></p>	<p>SYDNEY OLYMPIC PARK TYPICAL LAYOUT SMALL VALVE PIT - ONE VALVE</p>	 <p>DRG. NO. : 001-L-G-0023 REV. A SCALE : AS PER SCALE BAR</p> <p><small>PLAN DATE: 01/21/2014</small></p>
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IRRIGATION DETAILS

FITTINGS FOR VALVE PITS

F

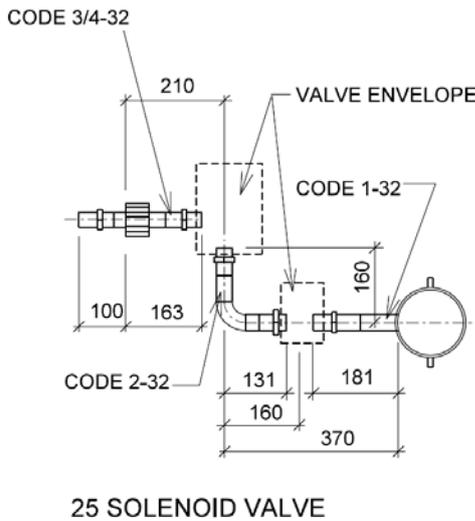
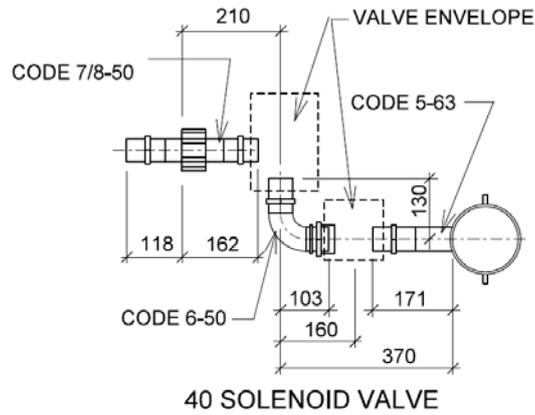
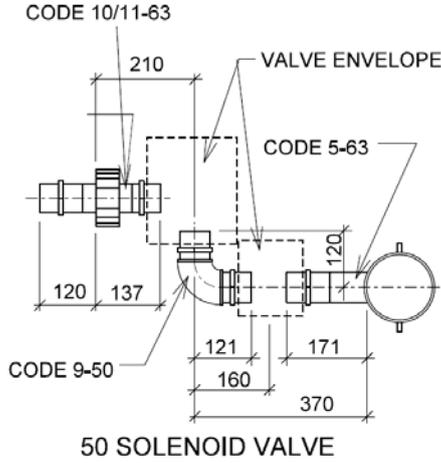


TABLE 2 FOR SOLENOID VALVE PITS

PART CODE No.	DESCRIPTION	SIZE DN mm	CONNECTION TYPE & SIZE
1-32	MAIN CONNECTION FITTING TO ISOLATING VALVE	32	TAPPING SADDLE X 25 BSP
2-32	ELBOW BETWEEN ISOLATION VALVE AND SOLENOID VALVE		25 BSP
3-32	DISCHARGE FITTING - SCREWED DISCHARGE	32	25 BSP
4-32	DISCHARGE FITTING - PLAIN DISCHARGE	32	32 PLAIN END
5-63	MAIN CONNECTION FITTING TO ISOLATING VALVE	63	TAPPING SADDLE X 50 BSP
6-50	ELBOW BETWEEN ISOLATION VALVE AND SOLENOID VALVE WITH 40X50 PHILMAC BUSH	50	40 BSP
7-50	DISCHARGE FITTING - SCREWED DISCHARGE	50	50 BSP
8-50	DISCHARGE FITTING - PLAIN DISCHARGE	50	50 PLAIN END
9-50	ELBOW BETWEEN ISOLATION VALVE AND SOLENOID VALVE - PHILMAC 50 BSP NIPPLES & ELBOW	50	50 BSP
10-63	DISCHARGE FITTING - SCREWED DISCHARGE	63	50 BSP
11-63	DISCHARGE FITTING - PLAIN DISCHARGE	32	63 PLAIN END

NOTES:

- ISOLATING VALVES ARE SPECIAL PHILMAC PRODUCTS WITH THE LILAC ROUND HEAD FOR THE RECYCLED WATER APPLICATION AND SUIT THE VALVE PIT DESIGN. ONLY 25 AND 50 VALVES ARE USED TO MINIMISE HEAD LOSS. LEAD TIMES AND MINIMUM ORDERS MAY APPLY.
- THE FABRICATED FITTINGS CAN BE SUPPLIED BY PLASBON P/L 02 9712 2177 SUBJECT TO FIRM ORDERS. LEAD TIMES MAY APPLY.

NOTE: DIAGRAM IS PART OF HARGREAVES ASSOCIATES
DRAWING NWUF303 REV.A
DETAIL F

HS-L-G-033 REV.A



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SYDNEY OLYMPIC PARK FITTINGS FOR VALVE PITS



D R G. NO. : 001-L-G-0024 REV. A
SCALE : AS PER SCALE BAR

IRRIGATION DETAILS

TABLE 1

MODULAR VALVE PIT SECTION CODES AND COVER CODES

PIT TYPE REF. CODE	ACO PRODUCT CODE	DESCRIPTION
		PIT SECTIONS
1	CJR95 - 150S	LARGE MODULAR VALVE PIT RISER 900 X 450 X 150
2	CJR45 - 150S	SMALL MODULAR VALVE PIT RISER 450 X 450 X 150
3	CJP52R	CABLE JOINTING PIT 450 X 150 X 425 (LARGER SIZES ARE AVAILABLE)
4	PEP22NNC	ISOLATING VALVE ACCESS PIT - NO COVER
5	PEP22I	ISOLATION VALVE ACCESS PIT - LOCKABLE POLYCRETE COVER
6	PEP22SI	ISOLATION VALVE ACCESS PIT - LOCKABLE GAL. STEEL COVER(A.S. CLASS & D LOADING)
		COVERS LIGHT DUTY - A.S. CLASS B (5 TONNE WHEEL LOADING - SINGLE COVER)
A	7349AS	450 X 450 LOCK & SEALED INFILL TYPE ACCESS COVER -SMALL
B	ZZ59AS	900 X 450 LOCK & SEALED INFILL TYPE ACCESS COVER -LARGE
C	ZZ52AS	450 X 200 LOCK & SEALED INFILL TYPE ACCESS COVER - CABLE
D	ZZ22AS	200 X 200 LOCK & SEALED INFILL TYPE ACCESS COVER -ISOLATING
		COVERS HEAVY DUTY - A.S. CLASS C & D (10 TONNE WHEEL LOADING - SINGLE COVER)
E	7379AS	450 X 450 LOCK & SEALED INFILL TYPE ACCESS COVER -SMALL
F	ZZ95AS	900 X 450 LOCK & SEALED INFILL TYPE ACCESS COVER -LARGE
G	ZZ52HD	450 X 200 LOCK & SEALED INFILL TYPE ACCESS COVER - CABLE
H	ZZ22HD	200 X 200 LOCK & SEALED INFILL TYPE ACCESS COVER -ISOLATING
		COVERS LIGHT DUTY - PEDESTRIAN ONLY OR IN PLANTER BEDS(NOT PERMITTED IN EXCLUSION ZONES ON VERGES OR MEDIANS)
J	CJL95LD	POLYMER CONCRETE LOCKABLE COVER TO SUIT CJR95 PIT
K	CJL45LD	POLYMER CONCRETE LOCKABLE COVER TO SUIT CJR45 PIT
L	CJL52LD	POLYMER CONCRETE LOCKABLE COVER TO SUIT CJR52 PIT
		COVERS MEDIUM DUTY - (UP TO 4 TONNE WHEEL LOADING)
M	SC95LD	GAL STEEL LOCKABLE COVER TO SUIT CJR95 PIT
N	SC45LD	GAL STEEL LOCKABLE COVER TO SUIT CJR45 PIT
O	SC52LD	GAL STEEL LOCKABLE COVER TO SUIT CJR52 PIT

NOTE: ALL DESIGNATED LOADINGS ARE SUBJECT TO ENGINEERS APPROVALS.

NOTE: DIAGRAM IS PART OF HARGREAVES ASSOCIATES
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IRRIGATION DETAILS

TABLE 2

NOTES:

1. ALL ARRANGEMENTS SHOWN ARE TYPICAL. STRUCTURAL ENGINEERS APPROVAL IS REQUIRED WHEN LOCATED IN DESIGNATED LOADING AREAS.
2. REFER TO ACO TECHNICAL INFORMATION FOR ADDITIONAL DESIGN DETAIL IF REQUIRED.
3. COVER FINISHES ARE TO BE SPECIFIED BY THE LANDSCAPE ARCHITECT.
4. REFER TO SCHEDULE FOR DETAILS OF PIT SECTION CODES AND COVER CODES
5. REFER TO DRWAINGS FOR DETAILS OF VALVE IN EACH LOCATION.
6. THE SUB-MAIN DEPTH IS CRITICAL AND SHOULD NOT BE LESS THAT 450 CENTRE LINE FROM THE FINISHED SURFACE LEVEL. WHERE THE MAIN IS DEEPER THAN 450 ADDITION THICKNESS OF THE TOP COLLAR WILL BE NECESSARY OR A CUT SECTION REQUIRED TO COMPENSATE. WHERE MAINS ARE DEEPER ADDITIONAL INTERMEDIATE PIT SECTIONS MAY BE REQUIRED.
7. THE VALVE PITS HAVE BEEN DEVELOPED IN CLOSE COOPERATION WITH THE MANUFACTURES OF THE VARIOUS COMPONENTS. ALL COMPONENTS ARE INTERRELATED AND ARE NOT INTERCHANGEABLE WITH OTHER COMPONENTS AS THEY MAY NOT FIT IN THE VALVE PITS.
8. ALL SOLENOID VALVE SHOWN ARE 50 DN (WORST CASE) AND SMALLER SOLENOID VALVES (25 & 40 DN) ARE TO BE USED AS REQUIRED.
9. NO MECHANICAL OR SCREWED JOINTS ARE PERMITTED UNDER PAVED AREAS, ONLY ELECTROFUSION OR BUTT FUSION SHALL BE USED IN THESE LOCATIONS.
10. LEAD TIMES MAY VARY ON COMPONENTS AND MINIMUM ORDER QUANTITIES MAY APPLY TO SOME ITEMS THAT ARE PRODUCED IN PRODUCTION RUNS.
11. THE ISOLATION VALVES ARE SPECIAL PHILMAC VERSIONS TO SUIT THE VALVE PITS IN 25 & 50 DN WITH ROUND LILAC HANDLES FOR THE RECYCLED EFFLUENT WATER.
12. CABLE PITS ARE REQUIRED IN CABLE SLEEVES AT ALL ROAD CROSSINGS WHERE CONDUITS HAVE BEEN PROVIDED FOR CONTROL CABLES, EVERY 100 METRES WHERE THERE ARE NO SOLENOID VALVE PITS AND EVERY CHANGE OF DIRECTION IN EXCESS OF 30 DEGREES.
13. WRAP ALL MAIN ISOLATING VALVES, FLANGES AND STEMS WITH DENSO TAPE IN ACCORDANCE WITH THE MANUFACTURERS INSTRUCTIONS.
14. PACK ALL ISOLATING VALVES AND STEM SLEEVES IN 10 mm RECYCLED CRUSHED CONCRETE.
15. DRAIN AND FLUSH VALVES, AS SPECIFIED, ARE TO BE INSTALLED IN A SIMILAR MANNER TO ISOLATING VALVES.

<small>SHOWN BY 10% STATION INFORMATION SERVICE (SIS)</small>	SYDNEY OLYMPIC PARK AUTHORITY 8 AUSTRALIA AVENUE SYDNEY OLYMPIC PARK NSW 2057 PH: (02) 974 7300 FAX: (02) 974 7109 <small>DISTRIBUTION CONTROL THIS DRAWING REMAINS THE PROPERTY OF THE SYDNEY OLYMPIC PARK AUTHORITY EXCEPT AS PROVIDED IN THE CONDITIONS OF ISSUE. IT SHALL NOT BE COPIED OR REPRODUCED IN ANY FORM FOR ANY OTHER PARTY WITHOUT THE WRITTEN APPROVAL OF THE SYDNEY OLYMPIC PARK AUTHORITY.</small>	SYDNEY OLYMPIC PARK IRRIGATION DETAIL TABLE 2	  D.R.G. NO. : 001-L-G-0026 REV. B SCALE : AS PER SCALE BAR <small>PLANT DATE: 8/21/2014</small>
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Appendix G: Project Handover Procedures

Policy Name

Project Hand Over Procedure

Policy No.

?

Department File No.

F??/??

Business Unit

Operations & Sustainability

Officer Responsible

Manager, Buildings and Infrastructure

Approving Officer

General Manager,
Operations & Sustainability

Date of Approval

Version	Review	Date	Approved By
1	Version 1	XXXXX 2015	GMOS

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PROJECT HANDOVER PROCEDURE

1.1 Objective

The objective of this guideline is to facilitate consistency in, and provide guidance to project delivery team regarding, the management of handover activities to facilitate a smooth transition between project delivery and operations/maintenance.

At the time of transition from project completion to commencement of operations, all construction issues are resolved and the asset/facility is deemed ready for use. Commissioning and handover activities should be thoroughly planned from an early stage to ensure that:

- Operational requirements are met;
- Current and future maintenance needs are identified;
- Operational and maintenance personnel have received all the information and knowledge they require to strategically and physically manage the new assets.

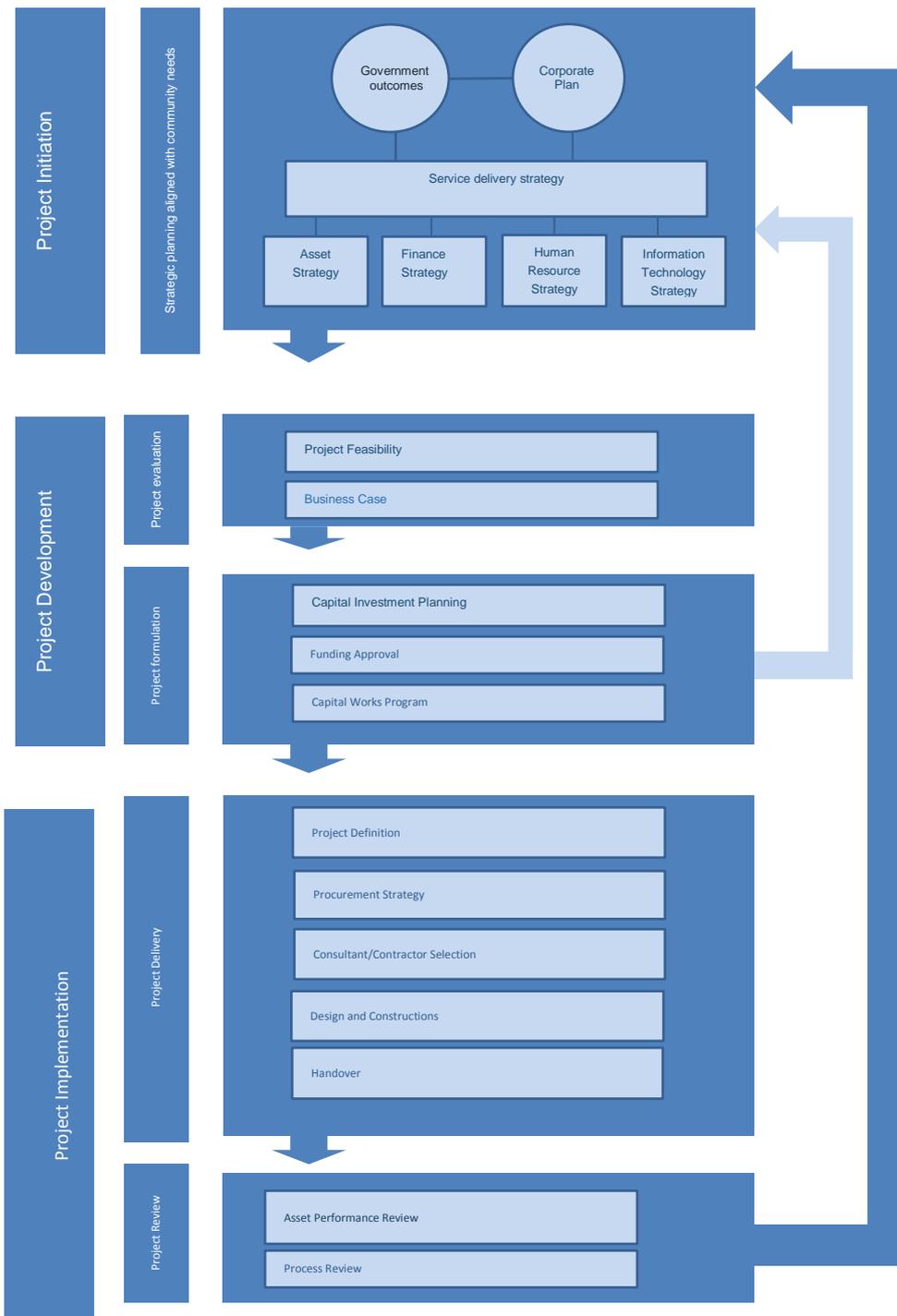
Introducing agreed and clearly documented procedures will significantly improve the commissioning and handover process. These procedures will assist SOPA to identify and implement adequate management strategies to maximise efficiency and minimise risks.

The risks associated with a poor commissioning and handover process include:

- Financial risks, such as:
 - financial loss due to inaccurate accounting and asset management reporting;
 - unnecessary financial exposure due to underutilised warranties and defect liability periods;
 - unnecessary financial exposure due to a lack of knowledge and documentation,
 - Unnecessary financial exposure due to defective works not identified and documented during the handover process.
- Operational risks, such as:
 - deficient asset management due to inadequate asset knowledge caused by a lack of documentation (manuals, specifications, certificates, as-built drawings etc.);
 - potential disruptions and inefficiencies in asset operations/maintenance due to a lack of asset information;
 - non-compliance with statutory and/or government policy requirements, including those of the Maintenance Management;
- Design risks in future refurbishments/improvements due to lack of accessible and accurate asset information;
- Health and safety risks to maintenance personnel due to inadequate training and knowledge of assets, systems, plant and equipment.

1.2 Introduction

Process map below provides management frame work for management of projects from project initiation to project implementation:



As illustrated in the frame work, hand over is the last step of the project delivery phase. The handover marks the transition from project delivery to occupation and operations. The purpose of the handover stage is to ensure the assets are fully functional and operational, and to prevent disruption to operations during the handover transition. An efficient handover strategy will also ensure the required asset information and knowledge is transferred from the design and construction team to the operational and maintenance team, providing them with the ability to manage the short and long term performance of the asset.

Although handover activities may vary in accordance with the specific project and contractual arrangements, the hand over process will generally include the following:

- 1) Pre-handover meeting and inspection to understand scope of works and agree on a hand over process and program.
- 2) Commissioning and testing to ensure various engineering systems/installations/works actually performed in accordance with the design criteria
- 3) Receipt of asset information such as assets register, "As Built" Drawings and Operations and Maintenance manuals.
- 4) Receipt of licences, certifications and registrations required by legislative requirements.
- 5) Confirmation that all engineering infrastructure has been designed, installed and commissioned in accordance with legislated requirements, relevant standards, the "SOPA Design and Construction Technical Manual", UDEM and any other SOPA technical manual.
- 6) Provision of training and familiarisation for the maintenance team and service providers.
- 7) Ensuring arrangements are made for maintenance management of the new infrastructure/assets.
- 8) Receipt of information on warranties and guarantees
- 9) Agree on a defects management process including arrangement for after hours call outs.

The handover may be progressively staged (during project delivery), with each stage following the completion of an agreed level of works as specified in the contract.

1.2 Scope

This guideline applies to the commissioning and handover of all type of assets. In addition to the construction of new assets, this definition includes other project types such as asset upgrades/replacements, major maintenance projects and asset improvements. This guideline is generic; each project will have its own specific issues, so the purpose and scope of the commissioning and handover requirements should be clearly defined in the project specification.

1.3 Stakeholders

This document is relevant to the following parties:

- Project Manager / Commercial Manager (and their representatives);
- Asset owners/users;
- Project contractors/consultants;
- Maintenance providers.

1.3.1 Project Manager / Commercial Manager

The Project Manager is the person who is delivering the projects on behalf of an organisation. The Commercial Manager is the person that manages/facilitates the delivery of development sites and where applicable related public domain infrastructure or assets on behalf of an organisation via an agreement with a Developer. This includes their nominated representatives, such as the principal's representative(s), superintendent(s), client representative(s), or project coordinator(s); depending on their roles and the specific form of contract. These nominated representatives are generally responsible for managing and coordinating.

1.3.2 Asset Owners/Users

The asset owners/users are the individuals who own and/ manage the assets on behalf of an organisation. The asset owner may also be the 'project sponsor' under the contract.

1.3.3 Project Contractors/Consultants

The contractors/consultants are individuals or organisations responsible for providing specialist or technical advice to the 'project manager' and/or 'commercial manager' during the design and/or construction stages of the project.

1.3.4 Maintenance Providers

The maintenance providers are individuals or organisations that undertake ongoing asset maintenance works to the asset owners/users.

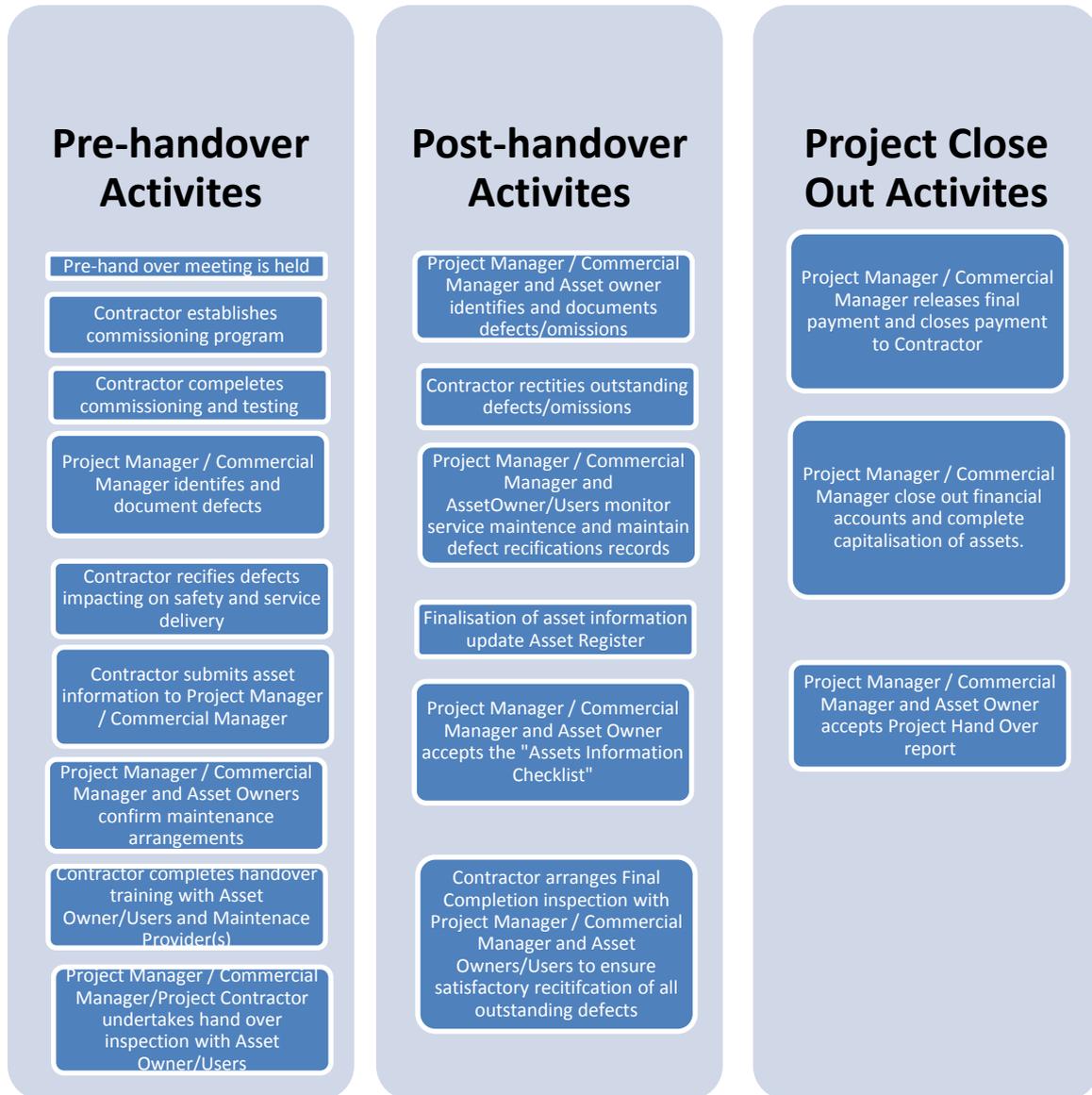
2.0 Handover

Diagram 1 illustrates the handover process. Handover activities may vary in accordance with the specific project and contractual arrangements. The handover may be progressively staged (during project delivery), with each stage following the completion of an agreed level of partial asset works as specified in the contract.

The handover stage consists of:

- Pre-handover activities (including commissioning);
- Post-handover activities;
- Project close activities.

Diagram 1: Handover Process



2.1 Stakeholders Roles and Responsibilities

The roles and responsibilities of the key stakeholders in the handover stage may vary based on the specific contractual arrangements associated with the delivery of the project.

The table below (Table 1) summarises the responsibilities of key stakeholders, highlighting the lead and participatory responsibilities.

Key Stakeholder Responsibilities

Responsibility		Project Manager / Commercial Manager	Asset owners/ Users	Project Contractors/ consultants	Maintenance Providers
Pre-handover activities	Pre Hand Over meeting	L	P	P	
	Develop commissioning program, including the calibration and testing of all services, systems and equipment where required.	P	P	L	-
	Complete commissioning and testing	P	P	L	
	Identify and document outstanding defects.	L	P	P	-
	Prepare and submit all required asset documentation including asset register.	L	P	L	-
	Confirm maintenance arrangements (during and after defects liability period) with maintenance providers (s).	P	L	-	P
	Delivery of handover training program	L	P	L	P
	Completion of hand over Training	P	P-	L	P
	Undertake hand over inspection.	L	P	P	P
Post-handover Activities	Identify outstanding defects.	L	P	-	P
	Rectify all outstanding defects prior to final completion.	P	P	L	-
	Finalisation of assets information and update asset records.	P	L	P	P
	Completion and acceptance of "Assets Information Checklist"	P	P-	L	-
	Undertake final completion inspection to ensure satisfactory rectification of all outstanding defects.	L	P	L	P
Project Close Out Activities	Close project files and financial accounts and release final contractor payments after final completion.	L	-	P	-
	Complete asset capitalisation	L	-		
	Complete Project Close out report	P	P	L	

Legend: L = Lead P = Participant

Note: Where lead responsibilities are assigned to more than one stakeholder, division of those responsibilities should be determined based on the specific contractual arrangements.

2.2 Pre-handover Activities

2.2.1 Project Handover Site meeting

Projects will require a dedicated project meeting to discuss the project handover process and to agree on the following requirements and outcomes.

- Connection and commissioning;
- “As Built” CAD information;
- Asset register and other relevant information;
- Operations and Maintenance manuals;
- Maintenance during the defects liability period (DLP);
- Training and familiarisation;
- Hand Over Inspection;
- Defects management and after-hours callouts;
- Licences and certificates;
- Warranties and guarantees;
- Security systems (includes key handover process).

The Project Manager / Commercial Manager will arrange a meeting with all the relevant stakeholders (may include architects, engineers, head contractor, major subcontractors or delegates). Asset Owners, their staff and maintenance providers will be nominated to attend various elements of project handovers, meetings and operational training sessions.

The meeting should be held no less than four weeks prior to the proposed project completion date.

2.2.2 Commissioning

The depth of the commissioning process should be appropriate to the complexity of the project. Specific testing and commissioning requirements and programs for individual projects will be those that are agreed at a pre-hand over meeting attended by the Contractor, Project Manager / Commercial Manager and Asset Owner. Connection testing and commissioning of all systems, services, plant and equipment shall be complete to the satisfaction of relevant stakeholders.

Commissioning and handover should be adequately planned and undertaken as required under relevant asset and development codes, including production of documents, certificates, warranties, inspection and maintenance schedules.

An asset is commissioned prior to handover to ensure that it is functioning, operational and fit for purpose. Defects or any outstanding work under the contract should be identified and documented during commissioning. This approach will ensure a clear understanding of work to be completed during the project’s final stages. The project contractors/consultants should

prepare an asset commissioning program (which should include key dates and activities) for the Project Manager / Commercial Manager and asset owners/users. Generally, under the contractual arrangements, the contractor is responsible for the commissioning of the asset, including.

- Provide testing and commissioning procedures at least a week in advance of the event that the Asset Owner will witness;
- Provide relevant authorities inspection reports, manufacturers and consultant's witness/acceptance test reports and commissioning data as part of the as-constructed information documentation;
- Label all equipment, switches and controls legibly in accordance with relevant authorities requirements/standards.

2.2.3 Receipt of Asset Documentation

Prior to handover, the contractors/consultants will transfer all asset documentation to the Project Manager / Commercial Manager. Copies of this documentation should then be provided (by the Project Manager / Commercial Manager) to the asset owners/users and the maintenance provider(s).

The asset documentation may include:

- 'as-built' asset plans and commissioning data;
- Asset Register as per the SOPA Asset Data Standards Manual;
- Statutory authority permits and approvals, including progressive asset certifier approvals;
- Plant, equipment, services and system information/schedules, including recommendations related to lifecycle costing;
- Service maintenance requirements;
- Operation and maintenance manuals covering design and operating parameters, service maintenance schedules, maintenance tasks, maintenance and cleaning products/tools and spare parts;
- Certificates, warranties and guarantees;
- Occupational instructions and/or any training packages;
- Lists of outstanding defects identified during commissioning which are to be rectified prior to completion.
- Specifications of materials or components used including manufacturer, supplier, quantities and contact details of supplier.
- Cost and lifetime for different types of assets as per the SOPA's asset classification for the capitalisation of assets and the future evaluation purposes.

All above asset information to be provided in draft format to the Asset owner for review. Upon comments from Asset Owner, asset information can be finalised.

Finalised asset documentation must be stored as hardcopy i.e. paper based files. However, given the space-saving potential and improvements to accessibility, electronic storage media such as DVDs or USB's should also be considered. The mode of storage should be clearly

noted in both the contract document(s) and handover requirements. All Asset documentation must be registered in SOPA's HP Trim Record System by the Project Manager / Commercial Manager.

2.2.3.1 As-Built Information

Following requirements will apply to the Work-As-Executed Plans:

- a) Work-As-Executed Plans in both PDF and CADD formats. Acceptable CADD formats will be either Autocad DWG or Bentley DGN. All supporting files such as Reference Files, Font Libraries, Linestyle Libraries etc. should also be provided.
- b) All discipline Drawings should be provided including but not limited to: Architectural, Civil, Communications, Electrical, Fire Protection, Gas, Hydraulics, Landscape, Mechanical, and Structural Drawings.
- c) All surveys of the Land in possession or control of the Developer including a survey of the completed Development should be provided in PDF and DWG/DGN formats.
- d) A digital Drawing Register of all provided Work-As-Executed Drawings in logical Discipline Groupings such as Architectural, Hydraulic, Mechanical etc. should be provided.
- e) Where new buildings are constructed, Service plans should not be limited to just those within the Building Envelope but rather should importantly also include detailed external connections such as Sewer, Potable Water, Recycled Water, Electrical, Fire, Optus, Telstra etc. In the cases where separate Authority Plans are available, such as Sydney Water connection plans, these should also be provided.
- f) Documentation that clearly identifies what previously existing services/assets have been removed, capped or upgraded should be provided.

In addition to Work-As- Executed Plans, a full set of the latest For-Construction plans prior to construction should be provided in PDF format.

It is recognised that it is very difficult to gather all as-constructed information prior to project handover due to completing projects in the final stages and also the process of commissioning plant during the same period. Submit progressive as installed drawings especially for those concealed/underground. Cable and piping routes shall be provided prior to backfilling of excavation or concreting of floor slab or installation of non removable ceiling. Provide critical dimensions and access points.

It is suggested that collection of required information is a managed process by the Project Manager / Commercial Manager. Collecting information as tasks are completed or the equipment is installed helps avoid the rush at the end of the project.

These must be provided, at a minimum in draft format prior to the final project handover for comments by Asset owner and Manager, Spatial Information Services. Final set of *Work-As-Executed Plans* must incorporate comments provided by Asset owner and Manager, Spatial Information Services and must be submitted prior to project close out.

2.2.3.2 Operation and Maintenance Manuals

Operations and maintenance manuals includes information such as schedules of equipment, technical data and manufacturer's technical information including performance information on individual plant and equipment; original software programmes and all passwords; copies of certifications and warranties; all test results, maintenance schedules, list of suppliers; list of

programmed operational time periods, thermostatic settings. An Operations and Maintenance manual template is provided in Appendix C.

- Operations and Maintenance Manuals shall be provided in duplicate (1 x original and 1 x copy) hard copy, bound into folders. These folders shall contain compact disks or USB's of electronic copies of the information supplied in the folders.
- For small projects, an alternative to providing the information in folders may be approved. As an example the information required for the installation of a split system air conditioner may take the form of operational instructions, schematic updates, warranties and appropriate asset detail forms. These could all be supplied on a CD.
- Manuals shall be sectioned, indexed and labelled.
- Manuals must not contain superfluous information such as product catalogues that 'add bulk' and make it look a healthy presentation. Only useful information shall be provided such as instructions, schedules, and maintenance plans.
- Where necessary update of existing SOPA maintenance manuals to be supplied with information as required.
- Supplier and/or manufacturer contact details.

2.2.3.3 Asset Register - Maintainable Assets

The 'Asset Register of Maintainable Assets' lists the fixed plant and equipment types and descriptions for assets that will be required to be maintained/serviced.

SOPA requires all asset maintenance activity to be reportable by asset at a minimum. In most cases it shall be reported at individual asset level. The asset level data rolls up for reporting at each asset category. Refer to SOPA's "Asset Data Standards Manual" for further details.

Asset information must be provided in the format shown in the attached template (Appendix D).

2.2.4 Confirming Maintenance Arrangements

Prior to handover, maintenance requirements under the project scope are to be clarified. Where the project scope doesn't include maintenance during defects liability period, the Project Manager / Commercial Manager and contractors/consultants should assist the asset owner/maintenance provider(s) to determine the asset maintenance requirements. Their determination should be used by the asset owner/maintenance provider(s) to facilitate planning and budgeting for maintenance management.

2.2.5 Handover Training

Commissioning and handover is required to ensure that training associated with handover is undertaken, utilising the services of members of the design and construction teams where appropriate. The Project Manager / Commercial Manager is required to coordinate training sessions to familiarise the asset owner/user and maintenance provider personnel with asset equipment and systems. Effective training will ensure asset owners/users have the required knowledge to successfully manage/operate the assets, equipment, services and systems. It is

recommended that handover training be commenced as early as possible during commissioning to prevent disruptions to operations once handover is complete.

Successful operational, familiarisation and maintenance training sessions will have been held to the satisfaction of Asset Owner in each field of expertise prior to handing over the works for occupation or use.

- The contractor shall submit a draft training program to the Project Manager / Commercial Manager for each system or specialised item of plant for approval based on the commissioning program and where possible prior to the pre-project handover meeting held at least four weeks prior to the proposed handover date;
- Sample training information documentation shall be submitted with the above mentioned proposed program. Ensure adequate and appropriate training materials inclusive of as installed drawings and operation and maintenance manuals as the basis for training. Final dates for training sessions shall be scheduled by the Project Manager / Commercial Manager with all stakeholders to ensure adequate contractor and Asset Owner staff availability;
- Use only qualified and competent trainers. These shall be people like the manufacturer's representatives or others duly trained by the manufacturers who are knowledgeable about the installations/systems.
- Where applicable adequate and effective training must be arranged for early, partial or staged handovers;
- These early handovers must be reviewed and reinforced during final project handover training program development.

2.2.6 Handover Inspection

The Project Contractor must facilitate a handover site inspection that must occur prior to the formal handover under the contract. Project Manager / Commercial Manager, Asset Owner and Maintenance Providers will attend the handover inspection.

2.2.7 Accepting the Project as being Handed Over

Accepting project as handed over (for occupation or use) will not occur until the following occurs:

1. Connection and commissioning of all systems, plant and equipment is complete and all testing data and reports are included in the maintenance manuals.
2. Licences, certifications and registrations required by legislation are provided.
3. Submission of reports certifying that all engineering infrastructure has been designed, installed and commissioned in accordance with legislated requirements, the "SOPA Design and Construction Technical Manual", UDEM and any other SOPA technical manual and that they are in full operational modes, before the installations are deemed to be practically completed;

4. Submission of a report from the various engineering consultants identifying how the various engineering systems/installations/works actually performed as compared to the design criteria; including achievement of environmental targets including energy and water consumptions;
5. Defect liability period (DLP) defect management and maintenance management processes are in place and confirmed by the Project Manager / Commercial Manager and or by the maintenance service provider.
6. Training sessions have been successfully held to the satisfaction of operational managers in each field of expertise.
7. Receipt of all Asset information including as-constructed or as-removed information, Operations and Maintenance manuals, Asset Register etc.

2.3 Post Hand over Activities

2.3.1 Finalisation of Asset Information

All draft documents such as “As Built” drawings, Asset Register and Operations and Maintenance Manuals to be reviewed by Project Manager / Commercial Manager, Project Consultants and asset Owner and comments provided to the project contractor. Project contractor must finalise these documentation within 4 weeks of project hand over.

On receipt of the final asset information the attached “Asset Information Checklist” (Appendix A) to be completed.

2.3.2 Defects Liability Period - Maintenance and Certifications

Maintenance does not include construction defect repairs. Defects are dealt with separately under the relevant contract.

If the scope of the project includes maintenance during the defects liability period, the following requirements will apply:

- Certification of all prescribed essential safety and health features and measures to be provided to Asset Owner.
- All necessary information required for the maintenance program to be provided to Asset Owner who will record the maintenance program in the SOPA maintenance management system.;
- Contractor’s DLP maintenance service reports must be supplied to the Asset Owner as evidence of compliance;
- Maintenance activity will be monitored by the contractor and compliance reports will be provided to the Asset Owner through Project Manager / Commercial Manager. Non compliance of maintenance tasks must be remedied by the relevant contractor immediately.

2.3.3 Defects Liability Period - Defects Management

Defects will be raised by the Asset Owner and Maintenance Service Provider throughout the defects liability period.

A defect register with clear defects rectification time line must be prepared and maintained. Project Manager / Commercial Manager is responsible for coordination of defects rectification works during DLP and to ensure defects are rectified within the acceptable time frame to minimise operational disruption and maintain safe environment. When defects are completed by the project contractor each defect must be signed off by the Project Manager / Commercial Manager and the Asset Owner as completed

The final bank guarantee must not be released until all defects are completed to the satisfaction of the Asset owner.

At the conclusion of the DLP, final inspections must be certified, including final seasonal adjustments undertaken to ensure proper operation of all systems.

2.3.4 Asset Capitalisation on Completion

On project completion, the Project Manager / Commercial Manager must capitalise all new assets in accordance SOPA's financial section's requirements and with the TMF Guidelines.

This should be done on the practical completion of the project when the project is ready for use by the Asset Manager.

Information required for capitalisation is detailed in Appendix E.

2.4 Project Close out Activities

2.4.1 Completion of Hand Over Report

Appendix B provides a best practice template of handover report. This report is generally prepared by the Project Contractor. The scope of this report will depend on the complexity of the project. The handover report confirms that all elements of the project have been delivered.

APPENDIX A

ASSET INFORMATION CHECKLIST			
Project:	Insert Project Name	Date:	
Description:	Insert Project Description	Project no.:	Insert PN
Location:	Insert Location	Bldg. No:	Insert BN.(s)
Project Manager / Commercial Manager:	Insert PM's/CM's Name		
Principal Consultant:	Insert Principal Consultant		
Contractor:	Insert Contractor's Name		
Client :	Insert Client Company, Phone Number and Email address		

1. APPROVALS CHECKLIST					
	Description	Yes	No	NA	Comments
1	Manuals, Asset register and As-Built drawings received for:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	• Fire Services (including EWIS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	• Electrical Services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	• Public Area Lighting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	• Mechanical Services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	• Hydraulic Services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	• Building Services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	• Security System (electronic)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	• Landscaping	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	• Irrigation system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	• Stormwater Systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	• Road and path systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	• Leachate System	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	• Urban Elements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	• Playground Equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2	Certificate of Occupancy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3	Trade Waste Agreements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4	Warranties and Maintenance Agreements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5	Compliance Certificates for:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Sydney Olympic Park Authority

Operations & Sustainability

Asset Information Check List

	• Fire Services including fire doors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	• Electrical Services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	• Public Area Lighting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	• Mechanical Services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	• Hydraulic Services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	• Landscaping Services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	• Irrigation system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	• Stormwater Systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	• Road/path pavements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	• Leachate System	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	• Urban Elements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	• Playground Equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6	Security	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7	Telecommunications	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
8	Contractor's Liability for Site Cleaning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
9	Contact Details – Contractor/s	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
10	Training – Operation and Maintenance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

2. ESSENTIAL SERVICES					
	Description	Yes	No	NA	Comments
1	Fire Matrix	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2	EWIS Commissioning Reports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3	Sprinkler Commissioning Reports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4	Fire & Smoke Damper Reports as per Fire Matrix	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5	Fire Detection Commissioning Reports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6	Emergency & Exit Lighting Commissioning Reports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7	Fire Door Commissioning Reports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
8	Equipment Lists for all Identified Essential Services Requirements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

3. ELECTRICAL SERVICES including STREET LIGHTING					
	Description	Yes	No	NA	Comments
1	Street Lighting Commissioning Reports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2	C-Bus Commissioning Reports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3	RCD Lists and Test Reports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4	UPS Commissioning Reports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5	Stand-by Generator/s Commissioning Reports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Sydney Olympic Park Authority

Operations & Sustainability

Asset Information Check List

6	<i>Roller Door List & Commissioning Reports</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7	<i>Automatic Doors List & Commissioning Reports</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
8	<i>Power Factor Devices Commissioning Reports</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
9	<i>All assets identified, numbered and listed</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

4. MECHANICAL SERVICES					
	Description	Yes	No	NA	Comments
1	<i>BAS Commissioning Reports</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2	<i>Chemical Servicing Requirements for Plant</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3	<i>Equipment Lists (Essential and Non-Essential)</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4	<i>Cooling Tower Registrations & Risk Management Plans</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5	<i>Plant Risk Assessments</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6	<i>Lift Registrations & Commissioning Reports</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7	<i>Fume hood Commissioning Reports</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
8	<i>Pressure Vessel Registrations & Risk Assessments</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
9	<i>All assets identified, numbered and listed</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

4. HYDRAULICS SERVICES					
	Description	Yes	No	NA	Comments
1	<i>Backflow prevention devices identified, numbered and commissioning reports</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2	<i>Thermostatic mixing valves identified, numbered and commissioning reports</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3	<i>Equipment Lists (Essential and Non-Essential)</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4	<i>Oil separators and grease traps commissioning reports</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5	<i>Sewer pump stations commissioning reports</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6	<i>All assets identified, numbered and listed</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5	<i>Sewer pump stations commissioning reports</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

5. SITE PRESENTATION - CLEANING					
	Description	Yes	No	NA	Comments
1	<i>Hand towel dispensers commissioned</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2	<i>Toilet paper dispensers commissioned</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3	<i>Details of consumables provided</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4	<i>Soap dispensers commissioned</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5	<i>All assets identified, numbered and listed</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

6. SITE PRESENTATION - LANDSCAPING					
	Description	Yes	No	NA	Comments
1	Landscape plants identified, listed and numbered	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2	Landscape turf material identified, listed including sub surface ground material	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3	Trees identified, listed and numbered	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4	Imported soil reports and analysis	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5	Imported mulch reports and analysis	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

7. SECURITY					
	Description	Yes	No	NA	Comments
1	Security equipment commissioned	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2	Security cameras commissioned	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3	Details of security equipment and cameras provided	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4	Monitoring contracts established for security equipment and cameras	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5	Maintenance contracts established for security equipment and cameras	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6	All assets identified, numbered and listed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

8. STORMWATER					
	Description	Yes	No	NA	Comments
1	Stormwater pipes identified, listed with sizing/type, including roof guttering	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2	Stormwater GPT systems commissioning reports, assets identified, listed with capacity/type	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

9. ROADS AND CYCLE PATHS					
	Description	Yes	No	NA	Comments
1	Sub base material verification reports on materials and installation/compaction tests	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2	Asphalt material verification reports on material type and installation/ tests	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3	Asphalt binder verification reports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4	Level and profile verification reports/tests	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5	Line marking verification reports on materials and application	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

10. IRRIGATION SYSTEM					
	Description	Yes	No	NA	Comments
1	Controllers commissioning reports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

2	<i>Pumps commissioning reports</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3.	<i>Pipes commissioning reports</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4	<i>SCADA system commissioning report</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5	<i>Sprinkler commissioning report (flow rates)</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6	<i>All assets identified, numbered and listed</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

11.	LEACHETE SYSTEM				
	Description	Yes	No	NA	Comments
1	<i>Controllers and instrumentation commissioning reports</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2	<i>Pumps commissioning reports</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3.	<i>Pipes commissioning reports</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4	<i>SCADA system commissioning report</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6	<i>All assets identified, numbered and listed</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

11.	URBAN ELEMENTS AND PLAYGROUND EQUIPMENT				
	Description	Yes	No	NA	Comments
1	<i>Commissioning report for all equipment</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2	<i>All assets identified, numbered and listed</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

10.	INPUT from RESPONDENTS		
<i>Please provide any information that you consider might be relevant to the successful delivery of the project in the space provided below</i>			
1.			
2.			
3.			
4.			
NAME, TITLE		SIGNATURE	DATE
		

11	ENDORSEMENTS	
<i>The contents of this Asset Information Checklist are hereby endorsed by:</i>		
<i>Project Manager / Commercial Manager</i>	.....	DATE
<i>Executive Manager, Major Projects</i>	.....	DATE

<i>Manager, CADD Services</i>	.....	<i>DATE</i>
<i>Asset Owner 1 –</i>	.....	<i>DATE</i>
<i>Asset Owner 2 –</i>	.....	<i>DATE</i>
<i>Operations and Sustainability – General Manager</i>	.....	<i>DATE</i>

APPENDIX B

HANDOVER REPORT

FOR

PROJECT NAME

Guidelines for Completing Templates

- Every section of the template should be addressed. If the section is not relevant to the project, use 'not applicable to this project'. This enables the Project Manager / Commercial Manager to tailor the documentation to the needs of the project, while ensuring the knowledge areas of project management have been addressed.
- For an overview of the finalisation phase of project management within the methodology.
- While deleting the guidance box streamlines the appearance of the document it is also useful to save a version with all guidance intact. This allows you to review the guidance again if any changes are required to the document, following review by other parties.
- Information can be presented in table form.
- This document should be managed in accordance with the Sydney Olympic Park Authority and NSW Government Recordkeeping Policy.
- Any appendices at the back of the document are tools to assist in documenting the relevant information. The appendices have generally been developed for major projects and may need to be tailored to the size and complexity of the project. It is important therefore to take the time to determine which ones are relevant to the project. In order for the approving officers to know that the appendices have been considered, use 'not applicable' where appropriate, rather than just omitting or deleting an appendix.
- It could be useful to refer to a completed handover/completion report as an example of how to complete this document.
- Templates should be completed in a language that is:
 - clear and easy to understand
 - pleasant to read
 - well-punctuated and grammatically correct.

To delete this guidance text box, double mouse click in the left margin and then press delete.

Document Control Sheet

Action statement

Date	Name	Position	Action required (Review/Endorse/Approve)	Due date

Version History

Version no.	Date	Changed by	Nature of amendment
	dd/mm/yyyy		Initial draft.

Prepared by: Name
Title: Job title
Branch: Branch
Business Unit: Business Unit
Location:
Version no: 0.1
Version date: dd mmmm yyyy
Status: Initial Draft / Consultation Draft / Approved Document / Minor Revision / Major Revision
Reference Number: reference number
File/Doc no: File number/document number

Project Sponsor (accountable for ensuring the stated benefit(s) of the project to the business have been measured and achieved)

Name _____

Position _____

Signature _____ Date _____

Project Manager / Commercial Manager (accountable for representing the department(s) delivering the project)

Name _____

Position _____

Signature _____ Date _____

Asset Owner (accountable for representing the department (s) taking over the assets for on going management)

Name _____

Position _____

Signature _____ Date _____

The following key stakeholders critical to the project's success have endorsed this document.

Name _____

Position _____

Signature _____ Date _____

Add further names as required.

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Executive Summary

Provide a summary of the handover report focussing on:

- status of the implementation (are the outcomes operational)
- outline of outstanding project or operational issues
- how outstanding issues will be managed
- outline of any major ongoing risks and suggested mitigation.

To delete this guidance text box, double mouse click in the left margin and then press delete.

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1.0 Introduction

1.1 Purpose of this Document

- State the purpose of this document, generally this will include, obtaining formal acceptance from the customer that:
 - all deliverables have been delivered
 - all training is complete
 - product or service is fully tested and operates to specification
 - all appropriate documentation is provided
 - service support arrangements are in place.
- Documentation of all variations to the original contract
- Documentation of outstanding project issues and determining who is responsible for resolving them (operational area or project team).

To delete this guidance text box, double mouse click in the left margin and then press delete.

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1.2 References

List any documents to which this document refers, include all previous documentation prepared as part of this project.

To delete this guidance text box, double mouse click in the left margin and then press delete.

Type here

1.3 Definitions

In the table below, define any term the audience may not understand, including specific terms, abbreviations and acronyms.

To delete this guidance text box, double mouse click in the left margin and then press delete.

Terms, abbreviations and acronyms	Meaning

2.0 Governance

2.1 Project Sponsor

- Accountable for ensuring the stated benefit(s) of the project to the business have been measured and achieved.

- Enter the name of the project customer.

To delete this guidance text box, double mouse click in the left margin and then press delete.

Insert name

2.2 Project Manager / Commercial Manager

- Accountable for representing the organisation that is delivering the project.

- Enter the name of the project sponsor.

To delete this guidance text box, double mouse click in the left margin and then press delete.

Insert name

2.3 Asset Owner

- Accountable for representing the department (s) taking over the assets for on-going management).

- Enter the name of the Project Manager / Commercial Manager.

To delete this guidance text box, double mouse click in the left margin and then press delete.

Insert name

3.0 Stakeholders

- List all internal and external stakeholders with an interest in this document.

- Stakeholders may be listed in tabular form (as below).

To delete this guidance text box, double mouse click in the left margin and then press delete.

Stakeholder Area	Stakeholder Representative	Responsibility	Interest or Context
------------------	----------------------------	----------------	---------------------

Stakeholder Area	Stakeholder Representative	Responsibility	Interest or Context

4.0 Project Purpose

4.1 Background

Provide a brief history of the project including details of:

- who initiated the project and how it was initiated.
- a clear statement of the real underlying problem addressed.
- a brief history of past community engagement, issues and outcomes.
- the impact of problems or issues over time.

To delete this guidance text box, double mouse click in the left margin and then press delete.

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4.2 Outcomes and Benefits

- Define the outcomes and benefits that were required from this project.
- Identify which of these outcomes and benefits were achieved.
- Identify any additional outcomes and benefits achieved.

To delete this guidance text box, double mouse click in the left margin and then press delete.

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4.3 Links with the SOPA's Objectives

- Describe how the project links to departmental objectives.
- If the project has not originated from SOPA objectives, state how it supports the strategic direction.

To delete this guidance text box, double mouse click in the left margin and then press delete.

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5.0 Scope of Project

List all items that were included in the scope of this project and note performance of the project against scope items.

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6.0 Outstanding Project Issues

Identify any unresolved or outstanding issues that still exist at the date of becoming operational:

- list any assumptions made about these issues.
- what action is envisaged to resolve the issue(s).
- who is responsible for the issue(s).
- when a resolution will be achieved.
- the outstanding issues may best be presented in a table as outlined below.

To delete this guidance text box, double mouse click in the left margin and then press delete.

Issue	Action to complete	Responsible	Date
For example: Training incomplete or ineffective			

7.0 Operational Handover

7.1 Documents for Handover

Identify the documents that have been assembled for handover to operations, this may include such items as:

- *Connection and commissioning data;*
- *“As Built” CAD information;*
- Asset register and other relevant information;
- Operations and Maintenance manuals;
- Maintenance arrangement during the defects liability period (DLP)
- Training and familiarisation packages.
- Defects management procedure and after-hours callouts;
- Licences and certificates;
- Warranties and guarantees;

- Security systems (includes key handover process);
- List of outstanding defects.

To delete this guidance text box, double mouse click in the left margin and then press delete.

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7.2 Maintenance and Support

- Outline any maintenance arrangements that have been established.
- Confirm that maintenance agreements and contracts are documented.
- Outline any other support arrangements that have been established for project outputs.

To delete this guidance text box, double mouse click in the left margin and then press delete.

Type here

7.3 Overview of Impacts

- Outline the major impacts the project has had on the business.
- Outline the potential future impacts that may eventuate under certain conditions (for example, an increase or decrease in customer demand and so on).

To delete this guidance text box, double mouse click in the left margin and then press delete.

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7.4 Risks

List the major ongoing risks as identified by the project suggest mitigation strategies where applicable.

To delete this guidance text box, double mouse click in the left margin and then press delete.

Type here

7.5 Operational Issues

- Define any issues relevant to the operational areas and suggested follow-up actions or instructions.
- These will be issues outside of the project scope, but which may impact on the ongoing operation of the deliverables.

To delete this guidance text box, double mouse click in the left margin and then press delete.

Type here

When all information has been put into this document and the guidance text boxes have been deleted, it will be necessary to reformat the document. To update the table of contents:

- right click mouse in the table of content, 'click update fields'.
- click on 'update entire table', then click 'ok'. (This will update the table of contents to show the new page numbers).

To delete this guidance text box, double mouse click in the left margin and then press delete.

**Appendix H: Sydney Olympic Park
Technical Specifications for ICT
Communications Installation
and Routine Maintenance Work**

Technical Specifications

FOR ICT COMMUNICATIONS INSTALLATION AND ROUTINE MAINTENANCE WORK

Sydney Olympic Park Authority, 8 Australia Avenue, Sydney Olympic Park
NSW 2127
Tel +61 2 9714 7300 Fax +61 2 9714 7818 www.sydneyolympicpark.com.au ABN 68 010
941 405

TECHNICAL SPECIFICATION FOR INSTALLATION AND MAINTENANCE OF THE COMMUNICATIONS NETWORK AT SYDNEY OLYMPIC PARK

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21/05/2014

1. GENERAL INFORMATION

- 1.1. Sydney Olympic Authority has put together a specifications document to provide the technical requirements and the guidelines relating to the installation and maintenance of SOPA ICT communications systems in the precinct. The document may be reviewed to cater for the emerging technologies, materials, improved practices and new or altered Australian Standards.
- 1.2. All matters concerning this quotation should be directed to **Rakesh Mudaliar [Manager Information Technology], Sydney Olympic Park Authority, 8 Australia Avenue, Sydney Olympic Park NSW 2127.**
- 1.3. The Sydney Olympic Park Authority is responsible for the management and operation of the Sydney Olympic Park precinct.
- 1.4. The vision of this specification is to provide a framework for the continued high standard of technical infrastructure for the communication and telephone network at Sydney Olympic Park.

2. SPECIFICATION

2.1. Conduits and conduit installation;

- a. Where conduits are used for the mechanical protection of cables and wires the overall cross sectional area of the installed cables shall not exceed 75% of the internal diameter of the conduit.
- b. All conduits shall be rigid conduit. Corrugated conduits are not permitted for use on conduit runs, it is however permitted to use corrugated [flexible] conduit for the final connection to a device, where the length of the corrugated conduit should be kept to a minimum.
- c. Underground [buried] conduits shall have a minimum diameter of 50mm.
- d. All buried conduits shall have a minimum separation of 100mm from other services
AS/NZS 3000 rule 3.11.5.
- e. Underground conduits shall be buried at a depth of not less than 300mm.
AS/NZS 3000 rule 7.5.11.3 (as amended) does not require a minimum burial depth for ELV cables, however it is a requirement of this specification that a minimum depth of 300mm be maintained for ELV cables.
- f. Where communication conduits are buried they shall have, at a depth of 100mm,
 above the conduit, a marker strip warning of the conduit below.
- g. All underground conduits shall have a 'draw rope' installed. The draw rope is intended to facilitate the installation of possible future additional cables.' Jet-line' is not an acceptable alternative to a draw rope. Where a draw rope is used to install an additional cable, a new draw rope shall be drawn into the conduit to replace the original. Where rope is drawn into conduits, it is to be installed in such a manner that it does not twist or tangle around other cables.

- h. When selecting conduit bends, the minimum bending radius of the intended cable is to be taken into account. This provision may in some case result in larger conduit sizes being required in order to satisfy the bending radius of the cable.
- i. All conduit and cable installations shall satisfy the requirements for the separation of services. The requirements vary from service to service, the installer is to observe all prescribed separation distances. The installers attention is drawn to [but not limited to] the following provisions; **AS/NZS 3000** rule 3.11.5 also table 3.7 with particular attention to water services with pipe diameter greater than 65mm and to the separation distances to earthing electrodes.
- j. The requirements of **AS5601** shall be adhered to in respect to gas services.
- k. The requirements of **AS/NZS 3500** shall be adhered to in respect to water services.
- l. Where conduits are run on the surface they shall be fastened by means of metal saddles. [or other manufacturer approved device]
- m. The spacing of the saddles shall not exceed 450mm, and in any case shall be spaced so as to prevent sagging of the conduit.

2.2. Cable pits and lids;

- a. In general cable pits must comply with the applicable Australian Standard. Standards include; **AS/NZS 3084, AS/NZS 203.1** and **AS/NZS 3084**.
- b. Instrumentation cable pits are to be minimum size of 450mm x 450mm x 450mm constructed from polyethylene. Similar to Fulton Industries cat: E450PP. Where vehicle traffic is not possible class 'B' lids are acceptable. Fulton lid number is E450CMD. For all other locations class 'D' lids are required. Fulton number CICST44D, prefix with PLA for concrete surround. ACO type 8 plastic pits and lids also satisfy this specification.
- c. Telecommunication pits are generally to be of a minimum size similar to ACO type 8 plastic pits where class 'B' lids are acceptable [no vehicle access], or type 8 polymer/concrete where class 'D' lids are required [vehicle access].
- d. All pit lids are to be supplied with a name plate affixed indicating that the pit is a communication cable pit. Similar to Fulton Industries name plate 'BPC'.
- e. Cable pits and lids supplied by other manufacturers [e.g. LINPAC] are also acceptable provided they similar to the above mentioned pits in size and material.
- f. Cable connections are not to be made with-in cable 'draw-in' pits. Cables must pass continuously (unbroken) through such pits.
- g. Cables passing through 'draw-in' pits must be installed with a 2 metre loop of cable remaining in the pit.

- h. Loops in 'drawn-in' pits are to be provided with a permanent label indicating the following; (a) installation date, (b) origin of the cable, (c) destination of the cable, and (d) the purpose of the cable.
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- i. Draw-in rope where they pass through a 'draw-in' pit, at each end shall have a permanent label indicating the origin and destination of the draw-in medium.

2.3. Cable installation;

- a. All telecommunication cables shall be installed in accordance with **AS/NZS ISO/IEC 14763.3.2012** [as amended] Telecommunication installations – Implementation and Operation of Customer Premises Cabling. **Part 3** of this standard – Testing of Optical Fibre Cabling – is also to be observed, as are all other relevant Australian standards.
- b. Manufacturers bending radius to be maintained.
- c. All cables [other than patch cables] when within enclosures, are to be secured in position. Where additional length is provided for future re-termination, the additional length is also to be fastened.
- d. Cables are to be protected throughout their entire length, either by conduit or a suitable enclosure. Where there is a potential of mechanical damage to any protecting conduit or enclosure, then additional mechanical protection is to be provided e.g. bollards protecting external enclosures.
- e. Should a cable be damaged either during installation or at other times, then it is to be replaced. The replacement cable should be continuous [without joints] between termination points.
- f. No cable shall be buried directly in the ground. All buried cables shall be protected by an underground conduit or duct system.
- g. All user devices must be connected to the structured cable system via a patch panel.
Direct connection of user devices to the structured system is not permitted.

2.4. Cable type;

- a. In general, the cable selected for a particular application must be approved and manufactured for the particular application.
- b. Where telephone cables are to be installed externally to a building, whether or not they are enclosed in a conduit or duct, they are to be of the type manufactured for external use. This provision includes any instance where any part of the wiring is installed external to a building.
- c. The above provision for telephone cables, in relation to their external use also applies to fibre cables.

- d. Copper and fibre cables manufactured by Pirelli [now Prysmain Cables & Systems], Amp [Tyco] are acceptable, as are cables manufactured by Olex.
- e. FibreNet are the preferred suppliers of fibre cables and termination equipment.
- f. Australian standard colour code of cores is to be observed. Where single wires are used for the connection to termination points [pig tails] then the appropriate core colour is to be used for the 'pig tail'.

2.5. Cable joints;

- a. In general, where cable joints are made they must be made in such a manner that there is no undue stress placed on the joint.
- b. Cable joints are not permitted in the length of a cable between termination points.
- c. Should a joint in a cable be unavoidable [or existing], then the joint must be accessible and the location of the joint noted on drawings or other documentation such that the existence of the joint is apparent.
- d. Joints must only be made using industry standard best practice methods, which includes; numbered terminal strips, suitable plug and sockets, LAN and voice cables are to be terminated using RJ connectors or disconnection modules similar to that manufactured by Krone, or other suitable terminating devices. Numbered or un- numbered "twisted" wire connectors [PB] are not acceptable. In any case AS 4028-192 [as amended] Information Technology – Communication Interface Connectors Used in Local Area Networks - is to be observed.
- e. Where terminals are used for the termination of cables, duplex connectors are not permitted; all terminals are to be of the single through type.
- f. Fibre terminations must be made using 'fusion splicing' only. Hot melting is not acceptable.
- g. All terminations must be of the type suitable to their intended use e.g. Fibre cables are to be terminated via FibreNet (or similar) 'Fibre Optic Breakout Trays' [FOBOTS] or approved industry standard 'best practice' methods.

2.6. Patch cables UTP;

- a. Patch cables [cat 5 & 6] are only to be used where necessary for connections **within** patch panels.
- b. Patch cables are to be pre-manufactured similar to those manufactured by Krone P/L. c. The length of the patch cable should be made to the minimum length necessary to make the connection without placing stress on the connection and without having excess length.

- d. Where information is exchanged between systems then AS/NZS 4134:1995 [as amended] is to be followed – Telecommunications and information exchange between systems – Numbering and sub-addressing in private integrated service networks.

2.7. Patch panels and enclosures;

- a. All patch panels should be size to suite the application with a minimum of 25% spare capacity.
- b. Patch panels, frames and covers should be equal in quality to Krone products.
- c. Patch panels should be suitable for use for category 6 UTP, as a minimum.
- d. Indoor enclosures are to be manufactured from powder coated 2mm zinc anneal.
- e. Powder coat to be grey in colour.
- f. Exterior enclosures to be fabricated from 1.5mm stainless steel.

2.8. Drawings, labelling and documentation;

- a. Upon completion of all work ‘as-built’ drawings are to be provided in CAD format [DWG] to SOPA’s Manager – Spatial Information Services.
- b. Where DWG formatted drawings are not available, then alternate formats may be acceptable. Advice should be sought from SOPA’s Manager – Spatial Information Services.
- c. If CAD drawings are not available or should the alteration or addition be to a large existing drawing such that a large re-draw draw be required, then a direction from the Manager – Spatial Information Services should be sought.
- d. All wires and cables are to be numbered and labelled. The numbers and labels should match the numbers and labels indicated in the drawings.
- e. The documentation accompanying the drawings [in some cases, on the drawing] is to indicate; the type, source, manufacturer and catalogue number of each installed component for future reference.
- f. Where any additions or alterations are carried out, then the ‘on-site records are to be updated in addition to the above mentioned Spatial Information Services Department drawing updates.

2.9. Reporting;

- a. The Contractor must report to the Manager Information Technology [Rakesh Mudaliar] or his appointed representative, prior to undertaking any work.
- b. The Contractor must provide to the Manager Information Technology a monthly schedule of works. The schedule of works is to be provided during the month preceding the month in which the work is to be undertaken.
- c. The Contractor must provide a written monthly report outlining the work that has been completed during the preceding month.
- d. Prior to commencing any work the contractor must inform the Manager Information Technology of the method to be used to undertake any work and the expected outcomes. The Manager Information Technology

must be made aware of any impacts on the information and technology system the proposed works may impose.

3. Workplace health and safety;

- a. The Contractor shall make themselves, employees and sub-contractors familiar with SOPA's WHS requirements.
- b. Where vehicular traffic is involved, the contractor must submit a 'traffic control plan', prior to commencing any work.
- c. Where pedestrian traffic is involved, the contractor must submit a 'pedestrian control plan', prior to commencing any work.
- d. The Contractor must comply with all statutory WHS requirements.
- e. The Contractor shall at all times ensure that public safety is taken into account, prior to undertaking any work.
- f. SOPA's site rules require that the Contractor shall prepare, display and implement site safety rules.
- g. The contractor shall take all due care and ensure that attendance at the site is continuous during the working period. Contractors or their employees or sub- contractors shall not leave any potential hazards unattended.
- h. Signs, barriers and other appropriate methods shall be employed to minimise risks. i. All hazards must be immediately addressed.
- j. **Safe Work Method Statements** must be prepared prior to the commencement of any work. The SWMS shall address all activities that pose a risk. The activities shall include (but not limited to) working at height, working with or near hazardous substances, working in trenches, working in confined spaces.
- k. The SWMS shall include; (a) A description of the work to be undertaken, (b) Name of the person or persons undertaking the work, including the Supervisor, (c) All identifiable potential risks associated with the work, (d) Precautions to be undertaken to minimise the risks, (e) Precautions to be undertaken to minimise public risk, (f) Outline of the health and safety instructions given to employees and others within the work area.
- l. All persons entering the work area must provide their own PPE. All PPE must be carry compliance identification and must be in good condition. PPE includes compliant eye protection, hearing protection, head protection [where necessary] foot protection, and high visibility vests.

4. Site management;

- a. All personnel must report to the Manager Information Technology or his appointed representative when entering the site.
- b. The work area is to be kept clean and tidy at all times.
- c. All safety signs and barriers, hoardings, lighting etc. [where necessary] to be in place prior to commencement of any work. All such items shall comply with the requirement of SOPA and the requirements at law.

- d. All items in (c) above shall be removed from the work area and stored appropriately upon completion of the work.
- e. Noise levels are to be kept to a minimum, and in any case must not exceed the statutory limit.

5. Plant and equipment;

- a. All plant and equipment must be in good condition and suitable for its task.
- b. All electrical equipment must have a current 'test' tag attached.
- c. All plant and equipment operators must be competent in the operation of the equipment.
- d. All plant and equipment may be subject to an inspection by SOPA at a time and place indicated by SOPA.
- e. SOPA accepts no responsibility for the training of equipment operators. The responsibility for safe operation of equipment rests with the contractor.
- f. All test and measuring instruments shall have valid calibration certificates. SOPA may request proof that the calibration certificates are within date.
- g. The Contractor must provide sufficient plant and equipment to ensure the continuous progress of the work. Delays due to insufficient plant or equipment are not acceptable.
- h. The Contractor must make available to the site at all times; (a) a fusion splicer, (b) either an ODTR or light source power meter.

6. Contractors labour;

- a. The principal person undertaking any task involving the communication network within SOPA's jurisdiction must have an unrestricted ACMA/Austel license in structured cabling, fibre optic, coaxial, aerial and underground cabling.
- b. Contractors labour must have (and be able to demonstrate) the technical knowledge, to a high level of detail, when carrying out the assigned tasks. 10 years (or more) industry experience will be an advantage.
- c. The Contractor [or the onsite representative] must have the ability to understand and explain issues that cross multiple system platforms.
- d. The contractor or his onsite representative must have a thorough understanding of IP networks, Ethernet networks, inter-com systems, and CCTV, voice and data systems.
- e. The work performed by the contractor may be subject to inspection by SOPA [at any time].
The work must be completed to the satisfaction of SOPA's appointed representative.
- f. The Contractor shall provide all tools and resources necessary to complete the assigned tasks, including an on site vehicle.
- g. The Contractor will be at times required to work with ICT during the installation and commissioning of equipment.
- h. The Contractor may at times be required to represent SOPA in respect to capital infrastructure projects; authorisation from the Manager Information Technology will be required prior to any such representation.

- i. Routine Maintenance duties will include, but not limited to; (a) clean-up of nodes, (b) Labelling, (c) up-date of records, (d) monthly reports, (e) supervision of external communications contractors (f) work with ICT when installing and commissioning ICT equipment (g) represent SOPA in capital communication infrastructure projects.
- j. Due to the importance SOPA places on the communication system and therefore the critical nature of the communication infrastructure, the contractor is required to have personnel, at short notice, and in any case within 4 hours, available for site attendance.
- k. Please indicate in the tables in the tender schedules template of the proposed onsite personnel.