LANDSCAPE TECHNICAL SPECIFICATION

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GROUPGSA

REV	REASON FOR ISSUE	DATE	PREPARED BY	APPROVED BY
1	FOR CC	19/02/2025	FZ/RH	FZ/AH

Revisions: Specification sections show amendments (if any) in the following manner:

- Revisions are identified by red text and deletions are struck through
- Adjustments of format, spelling, or punctuation are not identified, unless likely to affect the sense
- The full scope and extent of revisions should be comprehended by comparison with previous editions

CONTENTS

SECTION 1 GENERAL REQUIREMENTS

1 GENERAL

1.1 PERFORMANCE

Galvanizing

Severe conditions: Galvanize mild steel components (including fasteners) to AS/NZS 1214 or AS/NZS 4680 as appropriate, if:

- Exposed to weather.
- Embedded in masonry.
- Exposed to or in air spaces behind the external leaf of masonry walls.

Noise levels

General: Install systems to operate within the noise level limits, as documented for the contract design and documented equipment performance.

Structure

General: If required, provide structures, installations and components as follows:

- Fixed accessways: To AS 1657.
- Structural design actions: To the AS/NZS 1170 series.
- Refer to architectural specifications prepared by GroupGSA
- Refer to structural engineering specifications prepared by TTW

1.2 PRECEDENCE

General

Order of precedence:

- The requirements of other worksections of the specification override conflicting requirements of this worksection.
- The requirements of worksections override conflicting requirements of their referenced documents. The requirements of the referenced documents are minimum requirements.

1.3 CROSS REFERENCES

General

Requirement: Conform to the following worksection(s):

1.0 General
2.0 Site Preparation
3.0 Earthworks
4.0 Walling and Edging
5.0 Fence and Barrier
6.0 Soil
7.0 Natural Grass surface
8.0 Planting
9.0 Plant procurement
10.0 Irrigation
11.0 Establishment
12.0 Furniture and fixture
13.0 Playground surface
14.0 Pavement base and subbase

15.0 Concrete pavement
16.0 Paving
17.0 Granular surface
18.0 Concrete finishes
19.0 Schedule of Sample , shop drawings, hold points and submission

Cross referencing styles
General: Within the text, titles are cross referenced using the following styles:

- Worksection titles are indicated by *Italicised* text.
- Subsection titles are indicated by **BOLD** text.
- Clause titles are indicated by **BOLD** text.
- Subclause titles are indicated by **Bold** text.

2 SCOPE OF WORK

2.1 GENERALLY

The work as covered by this Contract includes the ordering, supply and coordination of delivery of all materials (unless otherwise specified) and the cost of all labour, equipment, machinery, all applications, testing, certificates, supervision, profits, overheads and making good as necessary to complete the works as detailed in the Contract Documents to the satisfaction of the Principal.

All works under this contract are to be carried out by a reputable Civil/Landscape Contractor and Specialist Subcontractors required to complete the scope of works, as described below.

The Contractor shall be responsible for the setting out of the work, unless otherwise specified, and checking the work for discrepancies and ambiguities prior to undertaking the works. The Contractor shall refer any discrepancies or ambiguities to the Superintendent for resolution. No claims for delays to the works shall be accepted due to discrepancies found after the works have commenced.

2.2 SPECIFIED IN THIS SECTION

- Site works
- Landscape works associated with buildings. For buildings refer to architect specifications
- Hard landscaping including paths, pavements, retaining walls, furniture and fixtures, and structures.
- Planting including cultivation, plant and other materials, planting works, soil works, mulching, planting establishment and maintenance.
- Set out of all works including paths, furniture and tree planting is to be undertaken by a registered surveyor.

2.3 SPECIFIED IN OTHER DOCUMENTS

- Structural Engineering
- Civil Engineering
- Architectural Design
- Lighting and Electrical Design

2.4 USE OF QUALIFIED TRADESPERSONS

Use qualified tradespersons when completing the works. The use of such persons shall not relieve the contractor of liability required by the contract in terms of the quality of workmanship and compliance to standards for intended use.

3 INSPECTION

3.1 GENERALLY

In general, give sufficient notice to the Superintendent, so that inspection may be made of the following:

- Shop drawings.
- Samples and prototypes provided.
- Demolition and clearing completed.
- Earthworks undertaken.
- Sub-grades cultivated and/or prepared prior to placing topsoil.
- Setting out of footings.
- Preparation for paving materials and footings.
- Trial set out of walls, loose gravel mounding, planting and lighting.
- Setting out of completed sculptures, walls, pavements, planting and lighting.
- Delivery of materials to site.
- Delivery of plants to site.
- Sample panel for pavements and walls.
- Paving, trim, fixtures and furniture completed.
- Upon Practical Completion
- Upon completion of Defects Liability work.
- For all concrete ramps and other works required to comply with AS1528, WAE drawings shall be prepared by Registered Surveyor detailing all the dimension and levels.

Minimum notice required: Shall be forty-eight (48) hours

4 STANDARDS

4.1 COMPLIANCE

The contract requires compliance with all relevant standards, codes including the Building Code of Australia and (and NSW variations) and Australian Standards as specified. The editions current as at the closing date for tenders shall be treated as contract documents.

All work shall be executed by appropriately qualified trades people. Subcontractors shall be licensed for their respective trades and have current licenses, permits and insurances as required by law.

For all concrete ramps and other works required to comply with AS1528, WAE drawings shall be prepared by Registered Surveyor detailing all the dimension and levels.

For all type of pavement (concrete and timber) contractor shall provide slip resistance test certificate to the superintendent before practical completions. Contractor shall also issue the manufacturing slip resistance test for all the inground features (stair nosing, tactile, drainage grate, lighting, steel mesh).

4.2 REFERENCED DOCUMENTS

General

Contractual relationships: Responsibilities and duties of the principal, contractor and contract administrator are not altered by requirements in the documents referenced in this specification.

Current editions: Use referenced documents which are the editions, with amendments, current 3 months before the closing date for tenders, except where other editions or amendments are required by statutory authorities.

The following standards are referred to in this project specification:

AS 1012 Methods of testing concrete

AS 1074 (1989) Steel tubes and tubulars for ordinary service

AS 1289 (2003) Methods of testing soils for engineering purposes

AS 1316 (2003) Masonry cement

AS 1348 (2002) Glossary of terms – Roads and traffic engineering

AS 1379 (2007) Specification and supply of concrete

AS 1428.1 (2009) Design for access and mobility

AS 1554 (2010) Structural steel welding set

AS 1672.1 (1997) Limes and limestones – Limes for building

AS 1726 (1993) Geotechnical site investigations

AS 1742 (2014) Manual of uniform traffic control devices

AS 1744 (2015) Standard alphabets for road signs

AS 2699.2 (2000) Built-in components for masonry construction – Connectors and accessories

AS 2758.1 (2014) Aggregates and rock for engineering purposes – Concrete aggregates

AS 2870 (2011) Residential slabs and footings

AS 3600 (2009) Concrete structures

AS 3610 (1995) Formwork for concrete

AS 3700 (2011) Masonry structures

AS 3705 (2012) Geotextiles - identification, marking and general data

AS 3740 (2010) Waterproofing of domestic wet areas

AS 3743 (2003) Potting mixes

AS 3798 (2007) Guidelines on earthworks for commercial and residential developments

AS 3972 (2010) Portland and blended cements

AS 4100 (1998) Steel structures

AS 4373 (2007) Pruning of amenity trees

AS 4419 (2003) Soils for landscaping and garden use

AS 4454 (2012) Composts, soil conditioners and mulches

AS 4455 (2008) Masonry units, pavers flags and segmental retaining wall units

AS 4586 (2013) Slip resistance classification of new pedestrian surface materials

AS 4671 (2001) Steel reinforcing materials

HB 90.3 (2000) The Construction Industry – Guide to ISO 9001 (2000)

SA HB 198 (2014) Guide to the specification and testing of slip resistance of pedestrian surfaces

4.3 INTERPRETATION

Documentation conventions

Imperative mood and streamlined language: The words shall or shall be are implied where a colon is used following a keyword or within a sentence or sentence fragment.

Subject of sentences and phrases: Specification requirements are to be performed by the contractor, unless stated otherwise.

Abbreviations

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

- AS: Australian Standard.
- BCA: National Construction Code Series Volume One: Building Code of Australia Class 2 to 9 Buildings and Volume Two: Building Code of Australia Class 1 and Class 10 Buildings.
- GRP: Glass Reinforced Plastic.
- IP: Ingress protection.
- NATA: National Association of Testing Authorities.
- NCC: National Construction Code.
- NZS: New Zealand Standard.
- PCA: National Construction Code Series Volume 3: Plumbing Code of Australia.
- PVC: Polyvinyl Chloride.
- SDS: Safety data sheets.
- VOC: Volatile Organic Compound.
- WHS: Work Health and Safety.

Definitions

General: For the purposes of this specification, the following definitions apply:

- Access for maintenance: Includes access for maintenance, inspection, measurement, operation, adjustment, repair, replacement and other maintenance related tasks.
- Accessible, readily: Readily accessible, easily accessible, easy access and similar terms mean capable of being reached quickly and without climbing over or removing obstructions, using a movable ladder, and in any case not more than 2.0 m above the ground, floor or platform.

- Accredited Testing Laboratory:
  . An organisation accredited by the National Association of Testing Authorities (NATA) to undertake the relevant tests; or
  . An organisation outside Australia accredited to undertake the relevant tests by an authority recognised by NATA through a mutual recognition agreement; or
  . An organisation recognised as being an Accredited Testing Laboratory under legislation at the time the test was undertaken.
  . An organisation accredited for compliance with ISO/IEC 17025 to undertake the relevant tests.
- Attendance: Attendance, provide attendance and similar expressions mean give assistance for examination and testing.
- Contract administrator: Has the same meaning as architect or superintendent and is the person appointed by the owner or principal under the contract.
- Contractor: Has the same meaning as builder and is the person or organisation bound to carry out and complete the work under the contract.
- Default: Specified value, product or installation method which is to be provided unless otherwise documented.
- Design life: The period of time for which it is assumed, in the design, that an asset will be able to perform its intended purpose with only anticipated maintenance but no major repair or replacement being necessary.
- Design parameters: Information used as the basis for design. It includes design requirements, performance criteria, performance parameters and similar terms.
- Documented: Documented, as documented and similar terms mean contained in the contract documents.
- Economic life: The period of time from the acquisition of an asset to the time when the asset, while still physically capable of fulfilling its function and with only anticipated maintenance, ceases to be the lowest cost alternative for satisfying that function.
- Electricity distributor: Any person or organisation that provides electricity from an electricity distribution system to one or more electrical installations. Includes distributor, supply authority, network operator, local network service provider, electricity retailer or electricity entity, as may be appropriate in the relevant jurisdiction.
- Errors and omissions: For the design prepared by the contractor, errors and omissions have the same meaning as defects.
- Fire hazard properties: Terminology to BCA A5.5.
- Geotechnical site investigation: The process of evaluating the geotechnical characteristics of the site in the context of existing or proposed construction.
- Give notice: Give notice, submit, advise, inform and similar expressions mean give notice (submit, advise, inform) in writing to the contract administrator.
- High level interface: Systems transfer information in a digital format using an open system interface.
- Hot-dip galvanized: Zinc coated to AS/NZS 4680 after fabrication with coating thickness and mass to AS/NZS 4680 Table 1.
- Ingress protection: IP, IP code, IP rating and similar expression have the same meaning as IP Code in AS 60529.
- Joints:
  . Construction joint: A joint with continuous reinforcement provided to suit construction sequence.
  . Contraction joint: An opening control joint with a bond breaking coating separating the joint surfaces to allow independent and controlled contraction of different parts or components, induced by shrinkage, temperature changes or other causes. It may include unbound dowels to assist vertical deflection control.
  . Control joint: An unreinforced joint between or within discrete elements of construction which allows for relative movement of the elements.
  . Expansion joint: A closing control joint with the joint surfaces separated by a compressible filler to allow axial movement due to thermal expansion or contraction with changes in temperature or creep. It may include unbound dowels to assist vertical deflection control.

  - Sealant joint: A joint filled with a flexible synthetic compound which adheres to surfaces within the joint to prevent the passage of dust, moisture and gases.
  - Structural control joint: A control joint (contraction, expansion and isolation) in structural elements when used with applied material and finishes.
  - Substrate joint: A joint in the substrate which includes construction joints and joints between different materials.
  - Weakened plane joint: A contraction joint created by forming a groove, extending at least one quarter the depth of the section, either by using a grooving tool, by sawing, or by inserting a premoulded strip.
- Local authority (local council): A body established for the purposes of local government by or under a law applying in a state or territory.
- Low level interface: Systems transfer information via terminals and voltage free contacts.
- Manufacturer's recommendations: Recommendations, instructions, requirements, specifications (and similar expressions) provided in written or other form by the manufacturer and/or supplier relating to the suitability, use, installation, storage and/or handling of a product.
- Metallic-coated: Steel coated with zinc or aluminium-zinc alloy as follows:
  - Metallic-coated steel sheet: To AS 1397. Metal thicknesses specified are base metal thicknesses.
  - Ferrous open sections zinc coated by an in-line process: To AS/NZS 4791.
  - Ferrous hollow sections zinc coated by a continuous or specialised process: To AS/NZS 4792.
- 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 external stormwater drainage system.
- Obtain: Obtain, seek and similar expressions mean obtain (seek) in writing from the contract administrator.
- Pipe: Includes pipe and tube.
- Practical completion or defects free completion: The requirements for these stages of completion are defined in the relevant building contract for the project.
- Principal: Principal has the same meaning as owner, client and proprietor and is the party to whom the contractor is legally bound to construct the works.
- Professional engineer: As defined by the NCC.
- Proprietary: Identifiable by naming the manufacturer, supplier, installer, trade name, brand name, catalogue or reference number.
- Prototype: A full size mock-up of components, systems or elements to demonstrate or test construction methods, junctions and finishes, and to define the level of quality.
- Provide: Provide and similar expressions mean supply and install and include development of the design beyond that documented.
- Record drawings: Record drawings has the same meaning as as-installed drawings, as-built drawings and work-as-executed drawings.
- Referenced documents: Standards and other documents whose requirements are included in this specification by reference.
- Required: Required by the contract documents, the local or statutory authorities.
- If required: A conditional specification term for work which may be shown in the documents or is a legislative requirement.
- Sample: A physical example that illustrates workmanship, materials or equipment, and establishes standards by which the work will be judged. It includes samples and sample panels.
- Statutory authority: A public sector entity created by legislation, that is, a specific law of the Commonwealth, State or Territory.
- Supply: Supply, furnish and similar expressions mean supply only.
- Tests – completion: Tests carried out on completed installations or systems and fully resolved before the date for practical completion, to demonstrate that the installation or system, including components, controls and equipment, operates correctly, safely and efficiently, and meets performance and other requirements. The superintendent may direct that completion tests be carried out after the date for practical completion.

- Tests – pre-completion: Tests carried out before completion tests, including:
  . Production: Tests carried out on a purchased item, before delivery to the site.
  . Progressive: Tests carried out during installation to demonstrate performance in conformance with this specification.
  . Site: Tests carried out on site.
  . Type: Tests carried out on an item identical with a production item, before delivery to the site.
- Tolerance: The permitted difference between the upper limit and the lower limit of dimension, value or quantity.
- Utility service provider: Includes organisations providing power, water, sewerage, gas and telecommunications services.
- Verification: Provision of evidence or proof that a performance requirement has been met or a default exists.

4.4 CONTRACT DOCUMENTS

Services diagrammatic layouts

General: Layouts of service lines, plant and equipment shown on the drawings are diagrammatic only, except where figured dimensions are provided or calculable.

Before commencing work:

- Obtain measurements and other necessary information.
- Coordinate the design and installation in conjunction with all trades.

Levels

General: Spot levels take precedence over contour lines and ground profile lines.

Drawings and manuals for existing services

Warranty: No warranty is given as to the completeness or accuracy of drawings and/or manuals of existing services.

4.5 SUBMISSIONS

Requirement

General: Submit the following:

- Authority approvals: Notes of meetings with authorities whose requirements apply to the work and evidence that notices, fees and permits have been sought and paid, that authority connections are complete and that statutory approvals by the authorities whose requirements apply to the work have been received.
- Building penetrations: Details of the methods to maintain the required structural, fire and other properties to **EXECUTION**, **BUILDING PENETRATIONS**.
- Certification: Certification of conformance to documented requirements, including certification that the plant and equipment submitted meets all requirements of the contract documents and that each installation is operating correctly.
- Design documentation: Design data and certification of proposed work, if required and as documented.
- Electronic facility and asset management information: For the whole of the work to **EXECUTION**, **ELECTRONIC FACILITY AND ASSET MANAGEMENT INFORMATION**.
- Execution details: Execution programs, schedules and details of proposed methods and equipment. For building services include the following:
  . Embedded services: Proposed method for embedding services in concrete walls or floors or chasing into concrete or masonry walls.
  . Fixing of services: Typical details of locations, types and methods of fixing services to the building structure.
  . Inaccessible services: If services will be enclosed and not accessible after completion, submit proposals for location of service runs and fittings.

- Fire performance: Evidence of conformity to requirement for combustibility, fire hazard properties and fire-resistance of building elements.
- Marking and labelling: Samples and schedules of proposed marking and labels to **EXECUTION**, **MARKING AND LABELLING.**
- Operation and maintenance manuals: For the whole of the work to **EXECUTION**, **OPERATION AND MAINTENANCE MANUALS**.
- Products: Products and materials data, including manufacturer's technical specifications and drawings, product data sheets, type tests results, evidence of conformity to documented requirements, product certification, performance and rating tables, service connection requirements and installation and maintenance recommendations.
- Prototypes: Prototypes of components, systems or elements.
- Records: As-built documents, photographs, system diagrams, schedules and logbooks to **EXECUTION**, **RECORD DRAWINGS**.
- Samples: Representative of proposed products and materials and including proposals to incorporate samples into the works, if any to **EXECUTION**, **SAMPLES**.
- Shop drawings: To **EXECUTION**, **SHOP DRAWINGS**.
- Substitutions: To PRODUCTS**, GENERAL, Substitutions**.
- Tests:
  . Inspection and testing plan consistent with the construction program including details of test stages and procedures.
  . Test reports for testing performed under the contract.
- Warranties: To **EXECUTION**, **WARRANTIES**.

Contractor review: Before submissions, review each submission item, and check for coordination with other work of the contract and conformance to contract documents.

Submission times

Default timing: Make submissions at least 5 working days before ordering products or starting installation of the respective portion of the works.

Submission response times: Allow in the construction program for at least the following times:

- Shop drawings: 2 to 5 working days
- Samples and prototypes: 2 to 5 working days
- Manufacturers' or suppliers' recommendations: 2 to 5 working days
- Product/design substitution or modification: 2 to 5 working days

Proposed products schedules: If major products are not specified as proprietary items, submit a schedule of those proposed for use within 3 weeks of site possession.

Identification

Requirement: Identify the project, contractor, subcontractor or supplier, manufacturer, applicable product, model number and options, as appropriate and include relevant contract document references.

Non-conformance: Identify proposals that do not conform with project requirements, and characteristics which may be detrimental to successful performance of the completed work.

Errors

Requirement: If a submission contains errors, make a new or amended submission as appropriate, indicating changes made since the previous submission.

Electronic submissions

Electronic copies file format: PDF

CAD file format: DWG

4.6 INSPECTION

Notice
Concealment: If notice of inspection is required for parts of the works that are to be concealed, give notice when the inspection can be made before concealment.

Tests: Give notice of the time and place of documented tests.

Minimum notice: As documented in the **Notices schedule**.

Light levels
Refer to Electrical and lighting engineer.

Attendance
General: Provide attendance for documented inspections and tests.

5 PRODUCTS

5.1 MATERIALS AND COMPONENTS

Manufacturers' or suppliers' recommendations
General: Provide and select, if no selection is given, transport, deliver, store, handle, protect, finish, adjust and prepare for use the manufactured items to the manufacturers' or suppliers' recommendations.

Proprietary items/systems/assemblies: Assemble, install or fix to substrate to the manufacturers' or suppliers' recommendations.

Project modifications: Advise of activities that supplement, or are contrary to the manufacturers' or suppliers' recommendations.

Product identification
Sealed containers: If materials or products are supplied by the manufacturer in closed or sealed containers or packages, bring the materials or products to point of use in the original containers or packages.

Other products: Marked to show the following, as applicable:

- Manufacturer's identification.
- Product brand name.
- Product type.
- Quantity.
- Product reference code and batch number.
- Date of manufacture.

Consistency
General: For each material or product use the same source or manufacturer and provide consistent type, size, quality and appearance.

Prohibited materials
General: Do not provide the following:

- Materials, exceeding the limits of those listed, in the Safe Work Australia *Hazardous Chemical Information System* (HCIS) Workplace exposure standards.

Insulation blowing agents:

- Materials that use chlorofluorocarbon (CFC) or hydrochlorofluorocarbon (HCFC) in the manufacturing process.
- A blowing agent with a global warming potential (GWP) ≥ 700.

Substitutions

Identified proprietary items: Identification of a proprietary item does not necessarily imply exclusive preference for the identified item, but indicates the necessary properties of the item.

Alternatives: If alternatives to the documented products, methods or systems are proposed, submit sufficient information to permit evaluation of the proposed alternatives, including the following:

- Evidence that the performance is at least equal to that specified.
- Evidence of conformity to a cited standard.
- Samples.
- Essential technical information, in English.
- Reasons for the proposed substitutions.
- Statement of the extent of revisions to the contract documents.
- Statement of the extent of revisions to the construction program.
- Statement of cost implications including costs outside the contract.
- Statement of consequent alterations to other parts of the works.

Availability: If the documented products or systems are unavailable within the time constraints of the construction program, submit evidence.

Criteria: If the substitution is for any reason other than unavailability, submit evidence that the substitution:

- Is of net enhanced value to the principal.
- Is consistent with the contract documents and is as effective as the identified item, detail or method.

6 EXECUTION

6.1 SAMPLES

General

Incorporation of samples: Only incorporate samples in the works which have been endorsed for inclusion. Do not incorporate other samples.

Retention of samples: Keep endorsed samples in good condition on site, until the date of practical completion.

Unincorporated samples: Remove on completion.

6.2 SHOP DRAWINGS

General

Documentation: Include dimensioned drawings showing details of the fabrication and installation of structural elements, building components, services and equipment, including relationship to building structure and other services, cable type and size, and marking details.

Diagrammatic layouts: Coordinate work shown diagrammatically in the contract documents, and prepare dimensioned set-out drawings.

Services coordination: Coordinate with other building and service elements. Show adjusted positions on the shop drawings.

Space requirements: Check space and access for maintenance requirements of equipment and services indicated diagrammatically in the contract documents.

Building work drawings for building services: On dimensioned drawings show the following:

- Access doors and panels.
- Conduits to be cast in slabs.
- Holding down bolts and other anchorage and/or fixings required complete with loads to be imposed on the structure during installation and operation.
- Openings, penetrations and block-outs.
- Sleeves.
- Plinths, kerbs and bases.
- Required external openings.

Submission medium: PDF

CAD base drawings: DWG

Record drawings: Amend all documented shop drawings to include changes made during the progress of the work and up to the end of the defects liability period.

6.3 OFF-SITE DISPOSAL

Removal of material

General: Dispose of building waste material off site to the requirements of the relevant authorities.

6.4 FIXING

General

Suitability: If equipment is not suitable for fixing to non-structural building elements, fix directly to structure and trim around penetrations in non-structural elements.

Fasteners

General: Use proprietary fasteners capable of transmitting the loads imposed, and sufficient for the rigidity of the assembly.

6.5 SERVICES CONNECTIONS

Connections

General: Connect to utility service provider services or service points. Excavate to locate and expose connection points. Reinstate the surfaces and facilities that have been disturbed.

Utility service provider requirements

General: If the utility service provider elects to perform or supply part of the works, make the necessary arrangements. Install equipment supplied, but not installed, by the utility service provider.

6.6 SERVICES INSTALLATION

General

Fixing: If non-structural building elements are not suitable for fixing services to, fix directly to structure and trim around penetrations in non-structural elements.

Installation: Install equipment and services as follows:

- Plumb and securely fixed.
- Allow for movement in both structure and services.
- Arrange services running together, parallel to each other and adjacent building elements.

Concealment: Conceal all cables, ducts, trays and pipes except where installed in plant spaces, ceiling spaces and riser cupboards or documented to be exposed. If alternative routes are available, do not locate on external walls.

Lifting: Provide heavy items of equipment with permanent fixtures for lifting to the manufacturer's recommendations.

Suspended ground floors: Keep all parts of services suspended under ground floors at least 150 mm clear of the ground surface. Make sure services do not impede access.

Dissimilar metals
Jointing: Join dissimilar metals with fittings of electrolytically compatible material.

Temporary capping
Pipe ends: During construction, protect open ends of pipe with metal or plastic covers or caps.

Piping
General: Install piping in straight lines at uniform grades without sags. Arrange to prevent air locks. Provide sufficient unions, flanges and isolating valves to allow removal of piping and fittings for maintenance or replacement of plant.

Spacing: Provide at least 25 mm clear between pipes and between pipes and building elements, additional to insulation.

Changes of direction: Provide as follows:

- If practicable, long radius elbows or bends and sets, and swept branch connections.
- If pipes are led up or along walls and then through to fixtures, provide elbows or short radius bends.
- Do not provide mitred fittings.

Vibration: Arrange and support piping to prevent vibration whilst permitting necessary movement. Minimise the number of joints.

Embedded pipes: Do not embed pipes that operate under pressure in concrete or surfacing material.

Valve groupings: If possible, locate valves in groups.

Pressure testing precautions: Isolate items not rated for the test pressure. Restrain pipes and equipment to prevent movement during pressure testing.

Support and structure
Requirement: Provide incidental supports and structures to suit the services.

Pipe support systems
General: Provide proprietary support systems of metallic-coated steel construction.

Vertical pipes: Provide anchors and guides to maintain long pipes in position, and supports designed for the mass of the pipe and its contents.

Saddles: Provide saddle supports only on DN 25 or smaller pipes.

Dissimilar metals: If pipe and support materials are dissimilar, provide industrial grade electrically non-conductive material securely bonded to the pipe to separate them. Provide fasteners of electrolytically compatible material.

Uninsulated pipes: Clamp piping supports directly to pipes.

Insulated pipes:

- Spacers: Provide spacers at least as thick as the insulation between piping supports and pipes. Extend either side of the support by at least 20 mm.
- Spacer material: Rigid insulation material of sufficient strength to support the piping and suitable for the temperature application.

Support spacing: As follows:

- Cold and heated water pipes: To AS/NZS 3500.1 Table 5.6.4. Provide additional brackets, clips or hangers to prevent pipe movement caused by water pressure effects.
- Sanitary plumbing: To AS/NZS 3500.2 Table 10.2.1.
- Fuel gas: To AS/NZS 5601.1 Table 5.5.
- Other pipes: To AS/NZS 3500.1 Table 5.6.4.

Hanger size table

Nominal pipe size (DN)	Minimum hanger diameter for single hangers (mm)
50 maximum	10
65 to 90	12
100 to 125	16
150 to 200	20

Differential movement

General: If the geotechnical site investigation report predicts differential movements between buildings and the ground in which pipes or conduits are buried, provide control joints in the pipes or conduits, as follows:

- Arrangement: Arrange pipes and conduits to minimise the number of control joints.
- Magnitude: Accommodate the predicted movements.

6.7 BUILDING PENETRATIONS

Penetrations

- Refer to architectural and structural engineer drawings and specifications.

6.8 MARKING AND LABELLING

General

Requirement: Mark and label services and equipment for identification purposes as follows:

- Locations exposed to weather: Provide durable materials.
- Pipes, conduits and ducts: To AS 1345 throughout its length, including in concealed spaces.
- Cables: Label to indicate the origin and destination of the cable.

Consistency: Label and mark equipment using a consistent scheme across all services elements of the project.

Label samples and schedules

Requirement: For each item or type of item, prepare a schedule of marking and labelling, including the following:

- A description of the item or type of item for identification.
- The proposed text for marking or labelling.
- The proposed location of the marking and labelling.

Submission timing: Before marking or labelling.

6.9 RECORD DRAWINGS

General

Requirement: Prepare record drawings showing the following:

- Installed locations of building elements, services, plant and equipment.
- Off-the-grid dimensions and depth if applicable.
- Any provisions for the future.

Recording, format and submission

Requirement: Record changes made during the progress of the works on a set of drawings kept on site for that specific purpose.

Drawing layout: Use the same borders and title block as the contract drawings.

Quantity and format: Conform to **SUBMISSIONS.**

Endorsement: Sign and date all record drawings.

Accuracy: If errors in, or omissions from, the record drawings are found, amend the drawings and re-issue in the quantity and format documented for **SUBMISSIONS.**

Date for submission: Not later than 2 weeks after the date for practical completion.

6.10 OPERATION AND MAINTENANCE MANUALS

General

Authors and compilers: Personnel experienced in the maintenance and operation of equipment and systems installed, and with editorial ability.

Referenced documents: If referenced documents or worksections require submissions of manuals, include corresponding material in the operation and maintenance manuals.

Subdivision: By installation or system, depending on project size.

Contents of manual

Table of contents: Include a table of contents in each volume. Title to match cover.

Table of amendments: Include a table of amendments.

Directory: Include names, addresses, email addresses and telephone and facsimile numbers of principal consultant, subconsultants, contractor, subcontractors and names of responsible parties.

Record drawings: Include complete set of record drawings, full size.

Drawings and technical data: Include as necessary for the efficient operation and maintenance of the installation.

Installation description: Include a general description of the installation.

Systems descriptions and performance: Include a technical description of the systems installed including design concepts embodied, the interrelation with other systems and the building and mode of operation, presented in a clear and concise format readily understandable by the principal's staff. Identify function, normal operating characteristics, safety features and limiting conditions.

Baseline data: To AS 1851, AS 1668.1, AS 1682.2 and AS 1670.1.

Commissioning results: Include for use as baseline data for system and equipment maintenance performance.

Fire systems and equipment: Include documentation to AS 1851, including the schedule of essential functionality and performance requirements.

Digital photographic records: Include records to **MARKING AND LABELLING, Underground services**.

Equipment descriptions:

- Name, address, email address and telephone and facsimile numbers of the manufacturer and supplier of items of equipment installed, together with catalogue list numbers.
- Schedules (system by system) of equipment, stating locations, duties, performance figures and dates of manufacture. Provide a unique code number cross-referenced to the record and diagrammatic drawings and schedules, including spare parts schedule, for each item of equipment installed. Equipment schedules in tabular form including the equipment designation used on the drawings, manufacturer's name and contact details, equipment name plate data, function of item, associated system and capacity data.
- Manufacturers' technical literature for equipment installed, assembled specifically for the project, excluding irrelevant matter. Mark each product data sheet to clearly identify specific products and component parts used in the installation, and data applicable to the installation.
- Supplements to product data to illustrate relations of component parts. Include typed text as necessary.

Certificates:

- Certificates from authorities.
- Product certification.
- Test certificates for each service installation and all equipment.
- Test reports.
- Test, balancing and commissioning reports.
- Control system testing and commissioning results.
- Warranties.

Trends: 7 day record of all trends at commissioning.

Operation procedures:

- Manufacturers' technical literature as appropriate.
- Safe starting up, running-in, operating and shutting down procedures for systems installed. Include logical step-by-step sequence of instructions for each procedure.
- Control sequences and flow diagrams for systems installed.
- Legend for colour-codes services.
- Schedules of fixed and variable equipment settings established during commissioning and maintenance.
- A list of special safety devices and their set points.
- Procedures for seasonal changeovers.
- Warnings to operators.
- Recommendations for efficient plant operation.
- If the installation includes cooling towers, a water efficiency management plan.

Maintenance procedures:

- Detailed recommendations for periodic maintenance and procedures, including schedule of maintenance work with frequency and manufacturers' recommended tests.
- Manufacturer's technical literature as appropriate. Register with manufacturer as necessary. Retain copies delivered with equipment.
- Safe trouble-shooting, disassembly, repair and reassembly, cleaning, alignment and adjustment, balancing and checking procedures. Provide logical step-by-step sequence of instructions for each procedure.

- Schedule of spares, recommended to be held on site, for those items subject to wear or deterioration and that may involve the principal in extended deliveries when replacements are required. Include complete nomenclature and model numbers, and local sources of supply.
- Schedule of normal consumable items, local sources of supply, and expected replacement intervals up to a running time of 40 000 hours. Include lubrication schedules for equipment.
- Schedules for recording recommissioning data to identify changes in the system over time.
- Instructions for use of tools and testing equipment.
- Troubleshooting procedures.
- Emergency procedures, including telephone numbers for emergency services, and procedures for fault finding.
- Safety data sheets (SDS).
- Instructions and schedules conforming to AS 1851, AS/NZS 3666.2, AS/NZS 3666.3 and AS/NZS 3666.4.

Maintenance records:

- Prototype service records conforming to AS 1851 prepared to include project specific details.
- Prototype periodic maintenance records and report to AS/NZS 3666.2, AS/NZS 3666.3 and AS/NZS 3666.4 as appropriate, prepared to include project specific details.
- Hard copies: Binders to match the manuals, containing loose leaf log book pages designed for recording completion activities including operational and maintenance procedures, materials used, test results, comments for future maintenance actions and notes covering the condition of the installation. Include completed log book pages recording the operational and maintenance activities performed up to the date for practical completion.
- Number of pages: The greater of 100 pages or enough pages for the maintenance period and a further 12 months.

Emergency information: For each type of emergency, including fire, flood, gas leak, water leak, power failure, water failure, system or sub system failure, chemical release or spill, include the following:

- Emergency instructions.
- Emergency procedures including:
  - Instructions for stopping or isolating.
  - Shutdown procedures and sequences.
  - Instructions for actions outside the property.
  - Special operating instructions relevant to the emergency.
  - Contact details relevant to the emergency.

Emergency information manual

Form of emergency information: Provide one of the following:

- An index and coloured tabs identifying emergency information for each type of emergency within the Operation and maintenance manual.
- A separate Emergency manual containing copies of emergency information from the main Operation and maintenance manual.

Format – electronic copies

Scope: Provide the same material as documented for hardcopy in electronic format.

Quantity and format: Conform to **SUBMISSIONS, Electronic submissions**.

Printing: Except for drawings required in the **RECORD DRAWINGS** clause provide material that can be legibly printed on A4 size paper.

Date for submission

Draft submission: The earlier of the following:

- 4 weeks before the date for practical completion.
- Commencement of training on services equipment.

Final submission: Within 2 weeks after practical completion.

6.11 TESTING

Attendance

General: Provide attendance on tests.

Testing authorities

General: Except for site tests, have tests carried out by an Accredited Testing Laboratory.

Test instruments: Use instruments calibrated by an Accredited Testing Laboratory.

Test reports

General: Indicate observations and results of tests and conformance or non-conformance with requirements.

Notice

Inspection: Give sufficient notice for inspection to be made of the commissioning and completion testing of the installation.

Controls

General: Calibrate, set and adjust control instruments, control systems and safety controls.

Completion tests

General: Test the works under the contract to demonstrate conformance with the documented performance requirements of the installation.

Functional checks: Carry out functional and operational checks on energised equipment and circuits and make final adjustments for the correct operation of safety devices and control functions.

Type test reports: Required, as evidence of conformance of proprietary equipment.

Sound pressure level measurements: Conform to the following:

- Correction for background noise: To AS/NZS 2107 Table B1.
- External: To AS 1055.
- Internal: To AS/NZS 2107.
- Measurement positions: If a test position is designated only by reference to a room or space, do not take measurements less than 1 m from the floor, ground or walls.
- Sound pressure level analysis: Measure the sound pressure level and the background sound pressure level over the full range of octave band centre frequencies from 31.5 Hz to 8 kHz at the designated positions.
- Sound pressure levels: Measure the A-weighted sound pressure levels and the A-weighted background sound pressure levels at the designated positions.

6.12 CLEANING

Final cleaning

General: Before the date for practical completion, clean throughout, including all exterior and interior surfaces except those totally and permanently concealed from view.

Labels: Remove all labels not required for maintenance.

6.13 WARRANTIES

General

Requirement: If a warranty is documented, name the principal as warrantee. Register with manufacturers as necessary. Retain copies delivered with components and equipment.

Warranty period: Start warranty periods at acceptance of installation.

Approval of installer: If installation is not by manufacturer, and product warranty is conditional on the manufacturer's approval of the installer, submit the manufacturer's written approval of the installing firm.

7 WORKS AS EXECUTED DRAWINGS

The Contractor shall provide a plan showing the accurate location of all below ground works location and depth as completed. WAE drawings will be provided as an A1 sized paper copy and electronically as PDFs and DWGs to Principal for approval 14 days before Practical Completion is granted. Final WAE will be submitted as PDF and DWG files, to the Principal.

8 GUARANTEES AND WARRANTIES

8.1 GENERALLY

Unless otherwise specified or agreed, warranties or guarantees specified in the contract must name Billbergia as warrantee and are to be obtained by the Contractor from the warrantor and submitted to the Principal.

9 CERTIFICATION

The Contractor is responsible for obtaining all relevant certifications and approvals by a certified engineer for the works stating, as a minimum that they are comply with current standard and meet the requirements of this documentation. The Contractor shall provide the certification in writing for the following aspects of the work:

- Compaction of subgrades
- Footings / fixings
- Reinforcement placing
- Concrete placement
- Steel framing
- Retaining walls
- Hydraulics
- Irrigation
- Lighting and Electrical
- Items complete

Certification shall be provided by a suitably qualified engineer, to be approved by the Principal. Unless otherwise specified, any testing required by the Contract must be by an independent Authority and approved member of the National Associates of Testing Authorities Australia (NATA).

10 PROGRAM OF WORKS

Refer to General Conditions of Contract.

11 ORDERING

11.1 REQUIREMENT

The contractor is to provide proof of ordering the required materials (as per Program of Works) and advise immediately if any supply difficulties are encountered. No extension of time or cost variation will be granted if any material or product is not available because of late ordering.

12 SITE NEIGHBOURS AND ADJACENT WORKS

The Contractor shall notify the Superintendent within 24 hours of any complaints or requests from residents or other members of the public in relation to the works and obtain instructions. The Contractor is to act in a courteous manner in all dealings with the public in relation to the contract works.

13 POST-CONSTRUCTION MANDATORY INSPECTIONS AND MAINTENANCE

General

Requirement: For the duration of the defects liability period, provide inspections and maintenance of safety measures required by the following:

- AS 1851.
- Other statutory requirements applicable to the work.

Records: Provide mandatory records.

Certification: Certify that mandatory inspections and maintenance have been carried out and that the respective items conform to statutory requirements.

Annual inspection: Perform an annual inspection and maintenance immediately before the end of the defects liability period.

This is appropriate to defects liability periods of 12 and 24 months. Edit for other defects liability periods (e.g. 6 months).

SECTION 2 SITE PREPARATION

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide site preparation, as documented.

Performance

Areas for protection: Refer to Landscape L-ARN-1000 & L-ARN-1001 for Existing tree to be retained and protected. Contractor should take extra care for any work around existing trees as highlighted by Arborist report and assessment prepared by McArdle Arboricultural Consultancy.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *General requirements*.

1.3 INTERPRETATION

Definitions

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

- Authority: Any organisation with statutory authority relating to the project, including clearances.
- Clearances: A formal certificate, approval or condition issued by a statutory authority allowing work in a particular area.
- Plant establishment period: The period between the date of practical completion and the end of the defects liability period.
- Utility service provider: Includes organisations providing power, water, sewerage, gas and telecommunications services.

1.4 SUBMISSIONS

Certification

Vermin: Submit pest exterminator's certification as evidence that the completed site works are free from vermin.

Execution details

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

- Clearing and grubbing.
- Tree removal and transplanting.
- Protecting ground within and adjacent to tree driplines from compaction by proposed earthworks machinery.

1.5 INSPECTION

Notice

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

- Enclosures around trees requiring protection.
- Trees requiring removal.
- Trees for transplanting to determine final orientation.

2 EXECUTION

2.1 COMMUNITY LIAISON

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:

- Description of the work.
- The reason for the work.
- The expected duration.
- Changes to traffic arrangements and property access.
- The 24-hour contact number of the representative responsible.

2.2 EXISTING SERVICES

General

Requirement: Before starting earthworks, locate and mark existing underground services in the areas 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 1000 mm of existing services.

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

2.3 SITE CLEARING

Extent

Requirement: Clear only areas occupied by works such as structures, paving, excavation, regrading and landscaping or other areas documented for clearing.

Contractor’s site areas: If not included within the areas documented above, clear only to the extent necessary for the performance of the works.

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 75 mm diameter to a minimum depth as follows:

- Below subgrade under buildings, embankments or paving: 500 mm.
- Below finished surface in unpaved areas: 300 mm.

Backfilling: Fill 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 no longer required, including slabs, foundations, paving, drain, and access chambers and covers within the works zone.

Batters

Temporary protection: If the change in level between crest and toe is more than 1500 mm, protect from erosion with geofabric, hessian and tar or heavy duty black polythene sheet cover. Securely fix down at crest and toe.

Surplus material

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

2.4 STORMWATER AND SEDIMENT CONTROL

General

Erosion and sediment control measures: Refer to Civil TTW documentation.

Waterways and drains

Waterways: If required, temporarily divert ditches, field drains and other waterways affected by excavation and reinstate on completion.

Stormwater drains: Divert drains detected during excavation, clear of the building, and reconnect as documented or obtain approval.

2.5 EXISTING WORKS TO REMAIN

Marking

Requirement: Identify existing works to remain with 1000 mm high, 50 x 50 mm timber stakes connected by yellow plastic tape to prevent accidental damage.

2.6 TREE REMOVAL

Designation

Marking: Identify trees and shrubs for removal by tagging 1000 mm above ground level.

2.7 TREE PROTECTION

General

Warning signs: In a prominent position at each entrance to the site, display warnings that trees and plantings require protection during the contract. Remove on completion.

Lettering: Road sign type sans serif letters, 100 mm high to AS 4970 Appendix C.

Protection measures: Provide before starting the earthworks.

Reference

For tree protection plan and measure refer to Tree Protection Certificate Inspection & Monitoring, prepared by McArdle Arboricultureal Consultancy on the 19/11/2024.

Trees to remain

Extent: Trees not marked for removal.

Tree protection

Tree protection zone (TPZ): To AS 4970 Section 3.

Tree protective measures: To AS 4970 Section 4.

Monitoring and certification: To AS 4970 Section 5.

Work near trees

Materials placement: Conform to the following:

- Keep the area within the dripline of trees free of sheds and paths, construction material and debris.
- Do not place bulk materials and harmful materials within the dripline of 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 similar material 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, give notice. Minimise period and extent of excavation within the dripline.

Hand methods: Use hand methods to locate, expose and cleanly remove the roots on the line of excavation. If excavation is required within the dripline, use hand methods so that root systems remain intact and undamaged.

Roots: Do not cut tree roots exceeding 50 mm diameter. If required 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 300 mm maximum depth and compact to a dry density similar to that of the original or surrounding soil. Do not backfill around tree trunks to a height greater than 200 mm 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-steer vehicles under the tree dripline. If compaction occurs, give notice.

Compaction protection: Protect ground adjacent to the tree dripline.

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 within the dripline of all existing trees to remain.

2.8 TEMPORARY LANDSCAPE FENCING

Fence dimensions

Height: 1200 mm.

Maximum post spacing: 5000 mm.

Component sizes

Corner and gate posts: Hardwood or preservative-treated softwood, 250 mm diameter.

Intermediate posts: Star picket.

Gate: Provide a suitable hinged gate with a gate latch.

Wire: Top, intermediate and bottom rows of 3.2 mm plain galvanized steel wire. Thread the top wire through pieces of plastic tube and through corner posts.

Removal
Completion: Remove the fence at the end of the planting establishment period.

2.9 TREE TRANSPLANTING

General
Notice: Give notice before:
- Watering: 48 hours before watering
- Fertilising: 48 hours before watering
- Root cutting: Consult with arborist before cutting any roots

Conditions: Select a time for transplanting based on the following criteria:

- Seasonal conditions.
- Length of operation.
- Rootball diameter and depth.
- Lifting methods.
- Weather conditions.

Preparation
Watering: Establish a temporary drip irrigation system, or manually water the identified trees for two weeks before ball excavation work.

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

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

Initial cut: Conform to the following:

- Cut manually or using chain trenching machine. Do not excavate using a backhoe or an excavator.
- Cut 250 mm beyond the required finished rootball dimension to allow trimming of damaged roots to final dimensions before sealing.

Hand trimming: To 100 mm less than the required finished rootball dimension. Cut back all roots greater than 25 mm 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 that maximises the rootball for each specimen.

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

Maintenance of on-site plant material
Watering: Maintain a temporary drip irrigation system around each tree, located within the trenched rootball perimeter. Program the system to supply water at an optimum rate to encourage growth and avoid drying out through excessive transpiration following the cutting of the roots. Monitor the system continuously until the tree is lifted and transplanted.

Pruning: If pruning of branches is required to balance root loss, obtain approval. Prune only as directed and as documented in **TREE MAINTENANCE.**

Fertilising: Apply fertiliser at regular intervals during this period to maintain healthy growth.

Responsibility: Safeguard the health and well-being of all on-site plant material as required, before lifting and transplanting.

Execution

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

Storage: Transport 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: After transplanting, water the rootball thoroughly and continue to water until established.

Transplanting schedule

Species	Method	Pruning

2.10 TREE MAINTENANCE

General

Notice: Give notice before starting tree maintenance.

Pruning: To AS 4373 using a fully qualified and experienced arborist. Carry out all required works in a safe manner.

Execution

Requirement: Rectify any damage to existing trees to remain.

Operations: Remove dead and decayed wood or damaged limbs. Make all cuts at branch collars. If trees show signs of deterioration after the work is completed, ameliorate the soil by 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 restitution.

Restitution by replacement tree: To be determined with local authorities.
Restitution specification: To be determined with local authorities.
Restitution fee: To be determined with local authorities.

Tree maintenance schedule

Tree species	Description of work

2.11 COMPLETION

Site restoration
Requirement: Reinstate undeveloped ground surfaces to the condition existing at the commencement of the contract.

Clean up
Progressive cleaning: Keep the works clean and tidy, and regularly remove from the site, waste and surplus material arising from execution of the work.

Waste disposal: off site as per current legislation.

Vermin management
Requirement: Employ a suitably qualified pest exterminator to remove vermin found during site preparation.

SECTION 3 EARTHWORK

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide earthworks to the dimensions and tolerances, as documented.

1.2 DESIGN

General

Designer: Refer to Engineer drawings and specifications prepared by TTW.

Geotechnical and environmental reports provided: Refer to Engineer drawings and specifications prepared by ADE consulting group.

Requirements

Design of footing or pier depths: Refer to Engineer drawings and specifications prepared by TTW.

Contract depths: The footing or pier depths shown on the drawings are provisional.

1.3 CROSS REFERENCES

General

Requirement: Conform to the following:

- *General requirements*.

1.4 STANDARDS

General

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

Description and classification of soils: To AS 1726.

1.5 INTERPRETATION

Abbreviations

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

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

Definitions

General: For the purposes of this worksection the definitions given in AS 3798 and the following apply:

- Bad ground: Ground unsuitable for the works, including fill liable to subsidence, ground containing cavities, faults or fissures, ground contaminated by harmful substances and ground that is, or becomes, soft, wet or unstable.
- Rock: Monolithic material with volume greater than 0.3 m^3 that cannot be removed until broken up by rippers or percussion tools.
- Site topsoil: Natural soil, excavated from the site, that contains organic matter, supports plant life, conforms generally to the fine-to-medium texture classification to AS 4419 and is free from the following:
  - . Stones more than 25 mm diameter.
  - . Clay lumps more than 50 mm diameter.
  - . Weeds and tree roots.

  . Sticks and rubbish.
  . Material toxic to plants.
- Subgrade: The trimmed or prepared earth material on which the pavement, footing or slab is constructed. Generally taken to relate to the upper line of the earth material.
- 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.

1.6 TOLERANCES

General

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

- Under building slabs and load bearing elements: + 0, - 25 mm.
- Pavement subgrades: + 0, - 40 mm.
- 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.

1.7 SUBMISSIONS

Design documentation

Calculations: Submit calculations by a professional engineer showing the stability and safety of proposed excavations and temporary supports, including supports required for adjacent structures.

Execution details

Report: Submit a time-based schedule detailing 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 methods proposed for excavation.

Disposal location: Submit details of the locations and evidence of compliance with the appropriate authority requirements for the disposal of material requiring removal from site.

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

Proof rolling: Submit details of proposed method and equipment for proof rolling.

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

Site records: Submit the following to AS 3798 clause 3.4 and Appendix B:

- Geotechnical site visit record.
- Earthworks summary report or daily geotechnical reports.

Products and materials

Imported fill: Submit certification or test results by a GTA registered laboratory of the imported fill as evidence of conformity with the contract, including the source.

Tests
Compaction: Submit certification and/or test results in conformance with the documented level of inspection and testing to AS 3798.

1.8 INSPECTION

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

- Items to be measured as listed in **RECORDS OF MEASUREMENT**.
- Areas to be cleared and/or stripped of topsoil.
- Areas stripped of topsoil.
- Excavation completed to contract levels or founding material.
- Proof rolled subgrade before placing fill.
- Filling completed to contract levels.
- Stockpiled topsoil before spreading.

2 PRODUCTS

2.1 FILL MATERIALS

General
Suitable material: To AS 3798 clause 4.4 including inorganic, non-perishable material suitably graded and capable of compaction to the documented density.

Unsuitable materials: To AS 3798 clause 4.3.

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

Re-use of excavated material: Only re-use suitable material to AS 3798 clause 4.4.

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

Location: Do not stockpile excavated material against tree trunks, buildings, fences or obstruct the free flow of water along drainage channels.

2.2 BORROW OR IMPORTED FILL

General
Borrow or imported material: Use only when suitable excavated material from site is not available.

- Suitable material: To AS 3798 clause 4.4.

Material conforming to the following: Consult the geotechnical and environmental engineer for specific or additional requirements applicable to the site.

2.3 GEOTEXTILE

General
Material: UV stabilised, permeable, polymeric, woven or non-woven textile material used in contact with soil/rock material.

Identification and marking: To AS 3705.

3 EXECUTION

3.1 SITE PREPARATION

Erosion and sedimentation control

Requirement: To Civil engineer drawing and specifications.

3.2 GEOTECHNICAL

As found site conditions

General: If the following are encountered, give notice and obtain instructions before carrying out any further work in the affected area:

- Bad ground.
- Discrepancy in expected conditions.
- Rock.
- Springs, seepages.
- Topsoil more than 100 mm deep.

Inspection and testing

Level of inspection and testing: Refer to geotechnical engineer report and specifications.

Frequency of testing: To AS 3798 Table 8.1.

3.3 RECORDS OF MEASUREMENT

Excavation and backfilling

Agreed quantities: If a schedule of rates applies, provisional quantities are documented, or there are variations to the contract levels or dimensions of excavations, do not backfill or place permanent works in the excavation until the following have been agreed and recorded:

- Depths of excavations related to the datum.
- Final plan dimensions of excavations.
- Quantities of excavations in rock.

Method of measurement: By registered surveyor.

Rock

Level and class: If rock is measured for payment purposes, either as extra over excavation of material other than rock or for adjustment of provisional measurements, do not remove the rock until the commencing levels and the classes of rock have been determined.

3.4 REMOVAL OF TOPSOIL

General

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

Maximum depth: 200 mm.

Disposal: Remove topsoil unsuitable for re-use from the site to AS 3798 clause 6.1.8.

Topsoil stockpiles

General: Stockpile site topsoil intended for re-use.

Stockpile maximum height: 1.5 m.

Identification: Mark and label stockpiles of different soil types.

Vegetation: Do not burn off or remove plant growth that occurs during storage.

Protection: Conform to the following:

- Provide 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.

3.5 EXCAVATION

Extent

Site surface: Excavate the site to the levels and profiles required for the documented structures, pavements, filling and landscaping. Make allowance for compaction, settlement or heaving.

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

Bearing surfaces

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

Rock

General: Do not use explosives.

Existing footings

Requirement: If excavation is required within the zone of influence of an existing footing, provide supports to the footing sufficient to prevent damage arising from the works. Use methods including temporary shoring or underpinning.

Existing services

Location: Before starting earthworks, locate and mark existing underground services in the areas that 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 1000 mm of existing services.

Proof rolling

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

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

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

Disposal of excess excavated material

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

Standard: To AS 3798 clause 6.1.8.

3.6 REINSTATEMENT

Deterioration of bearing surfaces

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

Subgrades affected by moisture
Requirement: If, due to high moisture content the subgrade cannot support construction equipment or the overlying pavement cannot be compacted, perform one or more of the following:

- Allow the subgrade to dry until it provides support for equipment and allows compaction.
- Scarify the subgrade to a depth of 150 mm, 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.

Over excavation
Requirement: If excavation exceeds the required depths, reinstate to the correct depths, levels and bearing capacity.

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: Rectify the over excavation as follows:

- Generally: Provide selected fill compacted to the documented density.
- Less than 100 mm: Do not backfill. Increase the thickness of the layer above.

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

3.7 SUPPORTING EXCAVATIONS

Removal of supports
General: Remove temporary supports progressively as backfilling proceeds.

Voids
General: If voids occur outside sheeting or sheet piling, fill and compact voids to a dry density similar to that of the surrounding material.

3.8 ADJACENT STRUCTURES

Temporary supports
General: If required, provide supports to adjacent structures, sufficient to prevent damage arising from the works.

Lateral supports: Provide lateral support with shoring.

Vertical supports: If required, provide vertical support with piling or underpinning or both.

Permanent supports
General: If permanent supports for adjacent structures are required and are not documented, give notice and obtain instructions.

Encroachments
General: If encroachments from adjacent structures are encountered and are not documented give notice and obtain instructions.

3.9 ROCK BOLTING

General
Requirement: For temporary or permanent support of rock faces, provide proprietary high strength steel bars or tubes anchored into holes drilled in the rock and tensioned against plates bearing on the rock face. Schedule the installation to conform to systematic bolting or calculated relief, as documented.

Standard: To AS 4678.

Protection
General: Protect permanent rock bolts by grouting the drilled hole with cement grout after tensioning the rock bolt. Protect the bearing plate and the exposed portion of rock bolt and anchorage with a protective coating or by embedment in concrete.

3.10 GEOTEXTILE

General
Preparation: Trim the ground to a smooth surface free from cavities and projecting rocks.

Installation: Lay the fabric flat, not stretched tight, and secure with anchor pins. Overlap joints 300 mm minimum.

3.11 PREPARATION FOR FILLING

Preparation
Stripping: Prepare the ground surface before placing fill (including topsoil fill), ground slabs or load bearing elements to AS 3798 clause 6.1.5. Remove material that inhibits or prevents satisfactory placement of fill layers, loose material, debris and organic matter.

Foundation preparation: To AS 3798 clause 6.1.7.

Compaction: Compact the ground exposed after stripping or excavation, to a minimum depth of 150 mm, to the minimum relative compaction in AS 3798 Table 5.1.

Ground treatment or improvement methods:

- Scarify method: Loosen exposed excavation by scarifying to a minimum of 150 mm, moisture-condition and compact to AS 3798 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 1 m in width and more than 100 mm deep. Recompact the excavated material as part of the filling. Shape to provide free drainage.

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

Under slabs, paving and embankments
General: If required, loosen the ground to a depth of more than 200 mm and adjust the moisture content before compaction to a density consistent with subsequent filling.

Rock ledges
General: Remove overhanging rock ledges.

3.12 PLACING FILL

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

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

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. If required, limit the size of compaction equipment or compact by hand.

Protective covering to membranes: Do not disturb or damage during backfilling.

Placing at structures
Fill adjacent structures and trenches: To AS 3798 clause 6.2.6.

Requirement: Place and compact fill in layers simultaneously on both sides of structures, culverts and pipelines to avoid differential loading. Commence compacting each layer at the structure and proceed away from structure.

Over the top of structures: Carefully place first layers of fill.

Retaining walls: 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.

Compaction
General: Compact the subgrade and each layer of fill to the required depth and density, as a systematic construction operation. Shape surface to provide drainage and prevent ponding.

Maximum rock and lump size in layer after compaction: To AS 3798 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 AS 3798 Table 5.1.

3.13 PLACING TOPSOIL

Stockpiled topsoil
Cultivation: Rip subgrade to a depth of 100 mm 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.

Herbicide product: [complete/delete]
Placing: Spread and grade evenly.

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.

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

Off-site: Remove excess topsoil from the site and dispose of legally.

3.14 FILL MOISTURE CONTROL

General

Moisture content: Adjust the moisture content of fill during compaction within the range of 85% to 115% of the optimum moisture content determined by AS 1289.5.1.1 or AS 1289.5.2.1, as appropriate, to achieve the required density.

3.15 COMPACTION TESTS

Compaction control tests

Compaction control tests: To AS 1289.5.4.1 or AS 1289.5.7.1.

Compaction control test frequency

Standard: To AS 3798 Table 8.1.

Confined operations: 1 test per 2 layers per 50 m^2.

3.16 COMPLETION

Geotechnical report

Inspection and testing report: Refer to Geotechnical report and specifications.

Grading

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

Subfloor areas: Grade the ground surface under suspended floors to drain ground or surface water away from buildings without ponding.

Site restoration

Requirement: If 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.

SECTION 4 WALLING AND EDGING

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide landscape walling and edging, as documented.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:

- *General requirements*.
- *TTW structural engineer drawing and specification*.
- *GroupGSA Architectural drawings and specification for all concrete walls*.

Samples
Submit samples as identified into the landscape schedule, refer to: L-ARN-2000series

- W1: Insitu concrete wall Groundfloor
- W2: Insitu concrete wall Groundfloor
- W3: Insitu concrete wall Groundfloor
- W4: Insitu wider concrete wall Groundfloor
- W5: Insitu seating concrete wall (Rooftops)
- SP: Insitu concrete wall with Steel cladding (Rooftops)

1.3 INSPECTION

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

- Set-out before starting constructio.
- Geotextiles and subsurface drainage in place before backfilling.

2 PRODUCTS

2.1 TIMBER

Durability
Natural durability class to AS 5604: Class 1.

Hazard class to AS 1604.1: H4

Hardwood
General: To AS 2796.1 Section 2.

Grade to AS 2796.2: Medium feature (MF)

2.2 CONCRETE

General
Refer to engineer drawings and specifications.

2.3 GEOTEXTILES

General
Type: Polymeric fabric formed from a plastic yarn composed of at least 85% by weight of propylene, ethylene, amide or vinylidene chloride and containing stabilisers or inhibitors to make the filaments resistant to deterioration due to ultraviolet light.

Identification and marking: To AS 3705.

2.4 STEEL CLADDING

General
Refer to detail.

Steel cladding generally fixed to retaining wall with countersunk screw. Screw to finish flush with cladding surface and to be painted to match finishes.

Finish to be as specified into the landscape schedule and suitable for the intended application. Contractor to provide supplier specifications and sample for approval.

2.5 EDGING

Steel
Product: Refer to detail for E1, E2, E3 Steel edging type as per landscape documentation
Size and profile: Refer to Landscape schedule L-ARN-2000D
Finish: Hot-dip galvanized.

3 EXECUTION

3.1 GENERAL

Set-out
General: Set out the position of walls and edging and mark the position of furniture.

Clearing
Extent: Except for trees or shrubs to be retained, clear vegetation within 1 m of the landscape walls. Grub out stumps and roots of removed trees or shrubs and trim the grass to ground level, but do not remove the topsoil.

Excavation
Extent: Excavate for foundations and footings.

Geotextiles
Storage and handling: 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.

3.2 EDGING

Steel
Fixing:

- Angle section: Fixed in place by bolt down to concrete base
- Flats: Fix in place with 250 mm long x 10 mm galvanized steel spikes driven through 50 x 50 mm fixing plates. Weld holed plates at right angles to the face of the flat at 1000 mm centres on alternate sides set parallel and 25 mm below the top of the edging.

SECTION 5 FENCES AND BARRIERS

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide fences and barrier systems, as documented.

Performance
Requirements:

- Complete for their function.
- Conforming to the detail and location drawings.
- Firmly fixed in position.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:

- *General requirement*
- *Refer to architectural documentation and specification for balustrade and fence along the residential town house.*

1.3 SUBMISSIONS

Certification
Custom-built items: Submit certification by a professional engineer for the structural integrity before starting fabrication.

Products and materials
Requirement: Submit the manufacturer’s standard drawings and details showing methods of construction, assembly and installation; with dimensions and tolerances.

Shop drawings
Custom-built items: Submit shop drawings to a scale that best describes the details, showing methods of construction, assembly and installation, with dimensions and tolerances.

Warranties
Requirements: Submit the manufacturer's published product warranties.

1.4 INSPECTION

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

- Boundary survey location.
- Set-out before construction.
- Foundation conditions after excavation.
- Completion of installation.

2 PRODUCTS

2.1 GENERAL

Storage and handling
General: Deliver, unload and store components and accessories in unbroken manufacturer's packaging.

Posts and rails
Stress grade: Galvanised steel fully enclosed by finishing panel.

2.2 STEEL

Steel tubes
Posts, rails: To AS/NZS 1163.

- Grade: C350L0.

Post and rail finish: Hot-dip galvanize.

2.3 CONCRETE

General
Standard: To AS 1379.

Exposure classification: To AS 3600 Table 4.3.

3 EXECUTION

3.1 CONSTRUCTION GENERALLY

Set-out
General: Set out the fence line and mark the positions of posts, gates and bracing panels.

Property boundaries: Confirm by survey.

Clearing
Fence line: Except for trees or shrubs to be retained, clear vegetation within 1 m of the fence alignment. Grub out the stumps and roots of removed trees and shrubs, and trim the grass to ground level. Do not remove the topsoil.

Excavation
Posts: Excavate post holes so that they have vertical sides and a firm base. Spread surplus material on the principal's side of the fence.

Concrete footings
In ground: Place mass concrete around posts to protect posts from waterlogged conditions and finish with a weathered top falling 25 mm from the post to ground level.

On slabs: Provide welded and drilled post base flanges for fixing with masonry anchors to the concrete.

Fixings
Through site link: Securely fix post with brackets to suspended walkway steel structure.

Erection
Line and level: Erect posts vertically. Set heights to follow the contours of natural ground, unless documented otherwise.

3.2 THROUGH SITE LINK BOUNDARY FENCE

General
Boundary fence to be installed as per landscape drawings. For the section of fence inside the TPZ of tree 109 no footings are permitted. Boundary fence to be fixed with bracket to the suspended walkway.

Fence dimensions
Height: varies. Refer to landscape drawing L-ARN-5001_SECT THROUGH SITE LINK and L-ARN-5002_SECT THROUGH SITE LINK

Maximum post spacing: Post spacing on landscape drawings are nominal. Structural engineer to provide certified shop drawings.

Component sizes
Post and Rails: Galvanised steel post and rails.

Brackets: Galvanised steel brackets fixed to suspended walkway

Footings: Outside the TPZ of tree 109 the boundary fence can be installed on pier footing onground.

Finishing panel: Prefinished FC Exterior panel. Grey precast concrete finish. All joint and fixings to be hidden. Provide capping.

3.3 COMPLETION

Cleaning
Requirement: Remove excess debris, metal swarf and unused materials. Clean all visible metal surfaces with soft clean cloth or brush and clean water or approved cleanser, finishing with a clean cloth. Do not use abrasive or alkaline materials.

Powder coated aluminium architectural applications: Clean completed assembly to AS 3715 Appendix C.

Powder coated metal, other than aluminium, architectural applications: Clean completed assembly to AS 4506 Appendix D.

Protection: Remove protective coatings using methods required by the manufacturer after completion.

Warranties
Requirement: Cover materials and workmanship in the terms of the warranty in the form of interlocking warranties from the manufacturer and the installer.

SECTION 6 SOILS

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide soil for landscaping, as documented.

Performance
Identification of fit for purpose: Site material can be ameliorated for use as topsoil

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:

- *General requirements*.
- *Earthwork*.

1.3 STANDARDS

Soils
Site and imported topsoil: To AS 4419.

Potting mixes: To AS 3743.

1.4 INTERPRETATION

Definitions
General: For the purposes of this worksection the definitions given in AS 4419 and the following apply:

- Bad ground: Ground unsuitable for the works, including fill liable to subsidence, ground containing cavities, faults or fissures, ground contaminated by harmful substances and ground that is, or becomes, soft, wet or unstable.
- Imported topsoil: Similar to local natural soil, suitable for the establishment and ongoing viability of the selected vegetation, free of weed propagules and of contaminants, and classified by texture to AS 4419 Appendix K Table K1, as follows:
  . Fine: Clay loam, fine sandy clay loam, sandy clay loam, silty loam, loam.
  . Medium: Sandy loam, fine sandy loam.
  . Coarse: Sand, loamy sand.
- Site rock: Rocks selected for salvage.
- Site topsoil: Natural soil, excavated from the site, that contains organic matter, supports plant life, conforms generally to the fine-to-medium texture classification to AS 4419 and is free from the following:
  . Stones more than 25 mm diameter.
  . Clay lumps more than 50 mm diameter.
  . Weeds and tree roots.
  . Sticks and rubbish.
  . Material toxic to plants.
- Soil blend: A landscape soil derived from the blending of two or more of sand, natural soil material or organic materials, and with a bulk density and organic matter content to meet site specific requirements.
- Top dressing: A soil which is suitable for surface application to turf and lawns.

- Topsoil: Includes landscape soil, low density soils and soils for turf and lawns.

1.5 SITE INVESTIGATION

Reports
Geotechnical and environmental reports provided: ADE Consulting Group.

Notice
Requirement: If the following are encountered, give notice immediately and obtain instructions before carrying out any further work in the affected area:

- Bad ground.
- Discrepancies.
- Rock.
- Springs, seepages.
- Topsoil > 100 mm deep.

1.6 SUBMISSIONS

Certification
Compost: Submit certification as evidence of compost pH value.

Execution details
Program: Submit a work program in the form of a bar chart, for the landscape works.

Products and materials
Supplier's data: Submit supplier's data including the following:

- Material source of supply.

Type tests: Submit a test report for the imported topsoil, including the following:

- Suitability of each soil type for documented use.
- Similarity to naturally occurring local soil.
- Suitability for establishment and on-going viability of the documented site vegetation.
- Absence of any weed propagules or contaminants.
- Soil amelioration recommendations: If required, the source of ameliorant materials, rates and methods of incorporation.

Samples
General: Submit representative samples of each material, packed to prevent contamination and labelled to indicate source and content.

Bulk materials: At least 5 working days before bulk deliveries, submit a 1 kg sample of each type documented with required test results.

Subcontractors
General: Submit names and contact details of proposed suppliers and evidence of the following, if appropriate:

- Experience in the required type of work.
- Production capacity for material of the required type, sizes and quantity.
- Lead times for delivery of materials to the site.

Tests
Site tests: Submit a test report for the site topsoil, including the following:

- Suitability of the soil for documented use.
- Suitability for establishment and on-going viability of the documented site vegetation.
- Presence of any weed propagules or contaminants.

- Recommendation:
  - . Soil amelioration: If required, the source of ameliorant materials, rates and methods of incorporation and recommendations for use in planting on grade and grass mixes.
  - . For all soil on structure refer to landscape schedule. If contractor want to propose any changed need to contact and verify with the Landscape architect and Structural engineer to confirm suitable material for the plant to thrive and structural loading capacity.
  - . Weed eradication: Species and eradication method.
  - . Contaminant removal.

1.7 INSPECTION

Notice

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

- Subgrades cultivated or prepared for placing topsoil.
- Topsoil spread before planting.
- Grassing bed prepared before turfing.

2 PRODUCTS

2.1 SUBSOIL

Source

Subsoil profile requirement: Natural subsoil from original site soil and lightweight soil for all planters on structures as per landscape detail.

2.2 TOPSOIL

General

Deliveries: Documentation to AS 4419, clauses 6 and 7.

Additives: If using additives to ameliorate topsoil conform to the relevant criteria of AS 4419.

Compost: Well-rotted vegetative material or animal manure, free from harmful chemicals, grass and weed growth to AS 4454 and to the organic content by mass, as documented.

Bushland restoration nutrient levels: Topsoil with nutrient levels equivalent to the soils of the local natural bushland.

Source

General: If the topsoil of documented quality cannot be provided from material recovered from site, provide imported topsoil.

Imported topsoil

Requirement: Imported topsoil to AS 4419 Tables 1, 2 and 3, and as documented.

Imported topsoil particle size table (% passing by mass)

Sieve size (mm)	Soil textures		
	Fine	Medium	Coarse
2.36	100	100	100
1.18	90 – 100	90 – 100	90 – 100
0.60	75 – 100	75 – 100	70 – 90
0.30	57 – 90	55 – 85	30 – 46
0.15	45 – 70	38 – 55	10 – 22
0.075	35 – 55	25 – 35	5 – 10
0.002		2 – 15	2 – 8

Imported topsoil nutrient level table

Nutrient	Unit	Sufficiency range
Nitrate-N (NO_3)	mg/kg	> 25
Phosphate-P (PO_4) – P tolerant	mg/kg	43 - 63
Phosphate-P (PO_4) – P sensitive	mg/kg	< 28
Phosphate-P (PO_4) – P very sensitive	mg/kg	< 6
Potassium (K)	mg/kg	178 - 388
Sulfate-S (SO_4)	mg/kg	39 - 68
Calcium (Ca)	mg/kg	1200 - 2400
Magnesium (Mg)	mg/kg	134 - 289
Iron (Fe)	mg/kg	279 - 552
Manganese (Mn)	mg/kg	18 - 44
Zinc (Zn)	mg/kg	2.6 - 5.1
Copper (Cu)	mg/kg	4.5 - 6.3
Boron (B)	mg/kg	1.4 - 2.7
Method References pH in H_2O (1:5), pH in $CaCl_2$ (1:5) and Electrical Conductivity (EC) by Rayment & Higginson (1992) method 4A2, 4B2, 3A1. Soluble Nitrate-N by APHA 4500. Soluble Chloride by Rayment and Lyons 2011 modified method 5A2. Extractable P by Mehlich 3 – ICP. Exchangeable cations – Ca, Mg, K, Na by Mehlich 3 – ICP. Extractable S by Mehlich 3 – ICP. Extractable trace elements (Fe, Mn, Zn, Cu, B) by Mehlich 3 - ICP.		

Site topsoil

Requirement: Site topsoil, as documented.

Soil blend: If required, stripped natural soil with sand and/or organic matter and recommended ameliorants.

2.3 TESTING

Soil tests

Sampling: To the recommendations of AS 4419 Appendix A.

Test authority: Accredited Testing Laboratory.

Testing: Type and site tests as follows:

- Landscape soils: To AS 4419 Table 1.
- Low density soils: To AS 4419 Table 2.
- Soils for turf and lawns: To AS 4419 Table 3.
- Potting mix: To AS 3743 Table 1.

3 EXECUTION

3.1 PREPARATION

Vegetative spoil

Suitable material: To be chipped for reuse as mulch.

Unsuitable material: Remove from site. Do not burn.

3.2 EARTH MOUNDS

Construction

Placing: Place clean fill in layers approximately 150 mm thick compacted to 85% of the dry density ratio of the surrounding soil tested to AS 1289.5.4.1. Minimise slumping and further compacting.

Edges: Construct changes in grade over a minimum width of 500 mm to smooth, gradual and rounded profiles with no distinct joint.

Existing trees: Maintain the natural ground level under the canopy.

Pipes, culverts and associated structures: Construct mounding to avoid unbalanced loading.

Drainage: Construct mounds to allow free drainage of surface water and to eliminate ponding.

3.3 SUBSOIL

Ripping

General: Rip parallel to the final contours. Do not rip when the subsoil is wet or plastic. Do not rip within the dripline of trees and shrubs to be retained.

Subsoil: Rip the subsoil to the following typical depths:

- Compacted subsoil: 300 mm.
- Heavily compacted clay subsoil: 450 mm.

Planting beds

Excavated: Excavate to reduce the subsoil level to at least 300 mm below finished design levels. Shape the subsoil to fall to subsoil drains, if required. Break up the subsoil to a further depth of 150 mm.

Unexcavated: Remove weeds, roots, rubbish and other debris. Reduce the planting bed level to 75 mm below finished design levels.

Cultivation

Minimum depth: 150 mm.

Cultivation depths (mm):

- Grassed areas (seeded, turf, strip turf, stolonised): 150 mm
- Hydroseeded or hydromulched areas: 150 mm
- Planting areas: 150 mm

Services and roots: Do not disturb services or tree roots. If required, cultivate these areas by hand.

Cultivation: Cultivate manually within 300 mm of paths or structures. Remove stones exceeding 25 mm, clods of earth exceeding 50 mm, and weeds, rubbish or other deleterious material brought to the surface during cultivation. Trim the surface to design levels after cultivation.

Additives

General: Apply additives after ripping or cultivation and incorporate into the upper 100 mm layer of the subsoil as documented.

Gypsum: Incorporate at the rate of 0.25 kg/m^2.

3.4 TOPSOIL

Site topsoil preparation

Screening: By a power hydraulic screen capable of handling 100 tonne per hour, with sieves grading from 20 mm to 15 mm.

Additives: During the screening process add the following:

- 15% by weight coarse sand minimum particle size 0.2 mm.
- Ameliorants materials to the recommendations documented in **SUBMISSIONS**, **Tests**.
- Additives program: 8 weeks before stolonising or turfing.

Waste: Remove from site all clay lumps, balled compacted particles greater than 20 mm, stones and rubbish foreign to the normal composition of soil.

Contamination: If diesel oil, cement or other phytotoxic material has been spilt on the site topsoil, excavate the contaminated soil and dispose of the soil off-site.

Placing topsoil

Site topsoil: Do not incorporate site topsoil into the works until soil testing results have been approved. Remove unauthorised material from the site.

Spreading: Spread the topsoil on the prepared subsoil and grade evenly, making allowances, if appropriate, for the following:

- Required finished levels and contours after light compaction.
- Grassed areas finished flush with adjacent hard surfaces such as kerbs, paths and mowing strips.

Steep batters: If using a chain drag for spreading, make sure there is no danger of batter disturbance.

Finishing: Feather edges into adjoining undisturbed ground.

Consolidation

General: Compact lightly and uniformly in 150 mm layers. Avoid differential subsidence and excess compaction and produce a finished topsoil surface which has the following characteristics:

- Finished to design levels.
- Smooth and free from stones or lumps of soil.
- Graded to drain freely, without ponding, to catchment points.
- Graded evenly into adjoining ground surfaces.
- Ready for planting.

Topsoil depths

General: Spread topsoil to the following typical depths:

- Excavated planting areas: 300 mm
- Grassed areas generally: 150 mm.
- Irrigated grassed areas, heavy use (e.g. playing fields): 200 mm.
- Top dressing: 10 mm.

Surplus topsoil

General: Dispose of off-site.

4 SELECTIONS

4.1 SOIL FOR LANDSCAPING

Topsoil schedule – Landscape soil for planting on grade

Property	Topsoil (Type A)	Subsoil (Type B)
Bulk density (kg/L)	> 0.7	> 0.7
Texture	Loamy sand	Sand
Soil pH	5.5 – 7.5	5.5 – 7.5
Organic content by mass	7 – 10%	> 5%
Plant sensitivity to phosphorus	Sensitive P < 10mg/kg	Sensitive P < 10mg/kg
Fertiliser (N:P:K)	To individual plantings as per *0253 Landscape - Planting*	None
Fertiliser application rate		N/A
Product	Smartmix® 6 Native garden mix	Smartmix® 7 Native garden sub-soil mix
Source	ANL or Benedict Industries or approved equal	ANL or Benedict Industries or approved equal

Imported topsoil schedule – Low density media for planting on slabs or in planters

Property	Topsoil (Type D)	Subsoil (Type E)
Bulk density (kg/L)	> 0.7	< 0.7
Texture	Medium	Coarse
Soil pH	5.5 – 7.5	5.5 – 7.5
Organic content by mass	7 – 10%	> 5%
Plant sensitivity to phosphorus	Sensitive P < 10mg/kg	Sensitive P < 10mg/kg
Fertiliser (N:P:K)	To individual plantings as per *0253 Landscape - Planting*	None
Fertiliser application rate		N/A
Product	Smartmix® 4 Lightweight planter box mix (Horizon A)	Smartmix® 5 Lightweight planter box mix (Horizon B)
Source	Benedict Industries or approved equal	Benedict Industries or approved equal

Imported topsoil schedule – Turf

Property	Topsoil (Type C)
Bulk density (kg/L)	> 0.7
Texture	Sand
Soil pH	5.5 – 7.5
Organic content by mass	7 – 10%
Plant sensitivity to phosphorus	Sensitive P < 10mg/kg
Fertiliser (N:P:K)	
Fertiliser application rate	
Product	Smartmix® 1 Turf Rootzone
Source	Benedict Industries or approved equal

SECTION 7 NATURAL GRASS SURFACES

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide natural grass surfaces, as documented.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:

- *General requirements*.
- *Soils*.

1.3 SUBMISSIONS

Execution details
Program: Submit a work program in the form of a bar chart, for the natural grass surfaces landscape works.

Material storage on site: Submit proposal.

Products and materials
Supplier's data: Submit supplier's data including the following:

- Material source of supply.
- Evidence of experience in supply of the required material.
- Production capacity for material of the required type and quantity.
- Lead times for delivery of material to the site.

1.4 INSPECTION

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

- Clearing completed.
- Setting out completed.
- Grassing bed prepared before turfing
- Grassing or turfing completed.

2 PRODUCTS

2.1 GRASS

Turf
Description: Cultivated turf of even thickness, free from weeds and other foreign matter.

Supplier: A specialist grower of cultivated turf.

2.2 FERTILISER

General
Description: Proprietary fertilisers, delivered to the site in sealed bags marked to show manufacturer or supplier, weight, fertiliser type, N:P:K ratio, recommended uses and application rates.

Fertiliser schedule

Location	N:P:K ratio	Application rate
All turfed areas	8:7:5	To manufacturer's recommendation

3 EXECUTION

3.1 PREPARATION

Existing grass removal

Herbicide: Spray existing grass with a non-residual glyphosate herbicide in any registered formulae, at the recommended maximum rate.

Manual removal: Remove existing grass layer a minimum 2 weeks after application of herbicide.

Weed eradication

Herbicide: Eradicate weeds using environmentally acceptable methods, such as a non-residual glyphosate herbicide in any registered formulae, at the recommended maximum application rate.

Manual weeding: Remove weed growth throughout grassed areas.

Vegetative spoil

Disposal: Remove vegetative spoil from site. Do not burn.

Soil preparation

Subsoil: To **EXECUTION, SUBSOIL** in *Section 6 Landscape – soils*.

Site topsoil or imported topsoil: To **EXECUTION, TOPSOIL** in *Section 6 Landscape – soils*

Levelling: Remove any debris and level and shape the dry soil surface. Allow maximum 30 mm set-down to hard surfaces for turf and stolons.

Fertiliser

Soil improvement: Spread the fertiliser evenly over the cultivated bed a maximum 48 hours before placing grass as follows:

- Grass seed: Rake lightly into the surface.
- Turfing: Mix the fertiliser thoroughly into the topsoil before placing the turf or stolons.

3.2 TURFING

Supply

Elapsed time: Deliver the turf within 24 hours of cutting, and lay within 36 hours of cutting. Prevent turf from drying out between cutting and laying. If not laid within 36 hours of cutting, roll turf out on a flat surface with the grass up, and water as required to maintain a good condition.

Application

General: As documented.

Method: Lay the turf as follows:

- Stretcher bond pattern with the joints staggered and close butted.
- Parallel with the long sides of level areas, and with contours on slopes.
- Finish flush, after tamping, with adjacent finished surfaces of ground, paving edging, or grass seeded areas.

Strip turf: Close butt the end joints and space the strips 300 mm apart. Lay top dressing between the turf strips. Finish with an even surface.

Tamping: Lightly tamp to an even surface immediately after laying. Do not use a roller.

Stabilising on steep slopes: Peg the turf to prevent downslope movement. Remove the pegs when the turf is established.

Watering
General: Water immediately after laying until the topsoil is moistened to its full depth. Maintain moisture to this depth.

Initial establishment
General: Maintain turfed areas until there is a dense continuous sward of healthy grass over the whole turfed area, evenly green and of a consistent height.

Failed turf: Lift failed turf and replace with new turf.

Levels: If levels have deviated from the design levels after placing and watering, lift turf and regrade topsoil to achieve design levels.

Top dressing: Mow the established turf and remove cuttings. Lightly top dress to a depth of 10 mm. Rub the dressing into the joints and correct any unevenness in the turf surface.

3.3 COMPLETION

Existing grass
General: Where existing grass is within the landscape contract area, maintain it as for the corresponding classifications of new grass.

Grassed areas
Maintenance: Start grass maintenance works at the completion of turfing. Maintain healthy weed-free growth.

Records
Log book: Keep a log book recording when and what maintenance work has been done and what materials, including toxic materials, have been used. Make the log book available for inspection on request.

4 SELECTIONS (DELETE ALL TABLES NOT REQUIRED)

Turfing schedule

Property	A	B	C
Location			
Species or variety			
Minimum thickness			
Turf roll size (mm)			
Mowing height (mm)			

SECTION 8 PLANTING

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide landscape planting, as documented.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:

- *General requirements*.

1.3 SUBMISSIONS

Certification
Plant species: Submit the supplier's certification as evidence that plants are true to the required species and type, and free from diseases, pests and weeds at the time of delivery.

Compost: Submit a certification as evidence of compost pH value.

Execution details
Program: Submit a work program in the form of a bar chart, for the landscape works.

Planting machine: If a planting machine is to be used as an alternative to hand planting, submit proposal.

Spraying: Submit proposal.

Plants – open rooted stock: If open rooted stock is to be used, submit proposal.

Material site storage: Submit proposal.

Operation and maintenance manuals
General: Submit recommendations for maintenance of plants.

Products and materials
Supplier's data: Submit supplier's data including the following:

- Material source of supply.

Samples
General: Submit representative samples of each material, packed to prevent contamination and labelled to indicate source and content.

Bulk materials: At least 5 working days before bulk deliveries, submit a 1 kg sample of each type documented with required test results.

1.4 INSPECTION

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

- Before transplanting small trees and shrubs.
- Plant holes excavated and prepared for planting.
- Plant material set out before planting.

- Planting, staking and tying completed.
- Completion of planting establishment work.

2 PRODUCTS

2.1 SOIL CONDITIONING COMPOST

Compost

Type: Mature soil conditioning compost free from harmful chemicals, grass and weed growth.

Application rate: Apply at an application rate that accounts for the immediate fertiliser equivalence of the compost as part of the overall fertiliser management schedule.

Particle size as a soil conditioner, pH, physical and chemical contaminants: To AS 4454 Table 3.1(A).

Mature compost: To AS 4454 Appendix N Table N3.2.

Soil conditioning properties

Wettability: ≤ 2 to AS 3743 Table 2.1 as tested to Appendix C.

Total water holding capacity: ≥ 40 to AS 3743 Table 2.1 tested to Appendix B.

Nitrogen draw down index: ≥ 0.7 to AS 3743 Table 2.1 tested to Appendix E.

Chlorine content: < 1000 mg/kg to Rayment and Lyons 2011 test method.

Compost fertiliser equivalence properties values

Requirement: Establish the following values for each type of soil conditioning compost to Rayment and Lyons 2011 test methods:

- Nitrogen content (kg/ton):
  - Total N.
  - Nitrate.
- Phosphorus content (kg/ton):
  - Total P.
  - Colwell P.
- Plant-available Potassium (kg/ton).

2.2 FERTILISER

General

Description: Proprietary fertilisers, delivered to the site in sealed bags marked to show manufacturer or supplier, weight, fertiliser type, N:P:K ratio, recommended uses and application rates.

Application rate: Vary the application rate to allow for the plant-available immediate fertiliser equivalence value of the soil conditioning compost.

Fertiliser schedule

Plant pot size	Specification	N:P:K ratio	Application rate
100L – 200L tree	Typhoon Native by Langley Fertilisers (Sunpalm Australia)	20:1:10	8 x 20g tablets
75L tree			6 x 20g tablets
45L tree			4 x 20g tablets
300mm – 400mm pot			2 x 20g tablet
140mm – 200mm pot			1 x 20g tablet
75mm tubestock	Macracote Grey by Langley Fertilisers (Sunpalm Australia)	18:1:8	2kg/m2

2.3 MULCH

General

Type: Free of deleterious and extraneous matter including soil, weeds, plastic, metal, paint and sticks. Do not include fine mulch.

Properties:

- Particle size, physical and chemical contaminants: To AS 4454 Table 3.1(A).
- pH, electrical conductivity, ammonium, chlorine and other nutrients: To AS 3743 Table 2.1 for regular mix.
- Organic mulches: Free of stones.

Organic mulch types

Brush chippings and leaf litter: Vegetative material processed through a chipper to pieces not larger than 75 x 50 x 15 mm as follows:

- Material permitted: Leaf matter and tree loppings from *Eucalyptus, Tristania and Pinus species*.
- Material not permitted: Leaf matter and tree loppings from privet, camphor laurel, coral tree, poplar, willow, and declared (noxious) weeds.

Pine bark: From mature trees, graded in size from 50 x 50 x 25 mm to 25 x 15 x 15 mm, free from wood slivers.

Pine flake: Pinus species sapwood slivers in size range 250 x 25 mm to 30 x 3 mm, including fragments of pine bark.

Straw: Cereal straw, wood fibre, or other suitable vegetative material (but not meadow hay) free from weeds and seeds, applied in conjunction with a bitumen emulsion or polymer binder.

3 EXECUTION

3.1 PREPARATION

Weed eradication

Herbicide: Eradicate weeds using environmentally acceptable methods, such as a non-residual glyphosate herbicide in any registered formulae, at the recommended maximum application rate.

Manual weeding: Regularly remove weed growth by hand throughout grassed, planted and mulched areas. Remove weed growth from an area of 750 mm diameter around the base of the trees in grassed areas. Continue weeding throughout the course of the works and during the planting establishment period.

Vegetative spoil

Disposal: Remove vegetative spoil from site. Do not burn.

3.2 TRANSPLANTING – SMALL TREES

Conditions

Application: Small trees and shrubs up to 3000 mm high.

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

Method

Lifting: Two days before transplanting of each specimen, thoroughly irrigate to the full depth of the rootball. Minimise the cutting of roots. Cut roots with sharp tools. Do not fracture the ball of soil

around the root system, but maintain in firm condition during transplanting by wrapping in an appropriate open weave material (e.g. hessian), securely tied.

Planting: Avoid disturbance to the rootball and plant. Remove the rootball wrapping and ties by cutting.

Pruning: If selective pruning of branches or canopy is necessary, prune to AS 4373 and as directed.

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

Transplanting schedule
Refer to Landscape Tree removed and retain schedule and drawing. Refer to arborist report for care.

3.3 PLANTING

General
Plant location and spacing: If necessary to vary plant locations and spacings to avoid service lines, or to cover the area uniformly, or for other reasons, give notice.

Planting conditions
Weather: Do not plant in unsuitable weather conditions, including extreme heat, cold, wind or rain. In other than sandy soils, suspend excavation when the soil is wet, or during frost periods.

Watering
Timing: Thoroughly water the plants before planting, immediately after planting, and as required to maintain growth rates free of stress.

Preparation
Individual plantings in grassed areas: Prepare for planting as follows:

- Excavate a hole twice the diameter of the rootball and at least 100 mm deeper than the rootball.
- Break up the base of the hole to a further depth of 100 mm.
- Loosen compacted sides of the hole to prevent confinement of root growth.

Ripline planting: Prepare for planting as follows:

- Rip the row and excavate a plant hole for each plant large enough to accept the rootball plus 0.1 m³ of backfilling with topsoil.
- Clear weeds and other vegetative material within 300 mm radius of the plants.
- If planting holes are excavated by mechanical means, increase the hole size by 100 mm and loosen compacted sides to prevent confinement of root growth.

Placing
General: Place plants as follows:

- Remove the plant from the container with minimum disturbance to the rootball. Make sure that the rootball is moist.
- If required, root prune to make sure all circling roots have been either severed or aligned radially into the surrounding soil.
- Place the plant in its final position, in the centre of the hole and plumb, and with the topsoil level of the plant rootball level with the finished surface of the surrounding soil.

Fertilising
Pellets: In planting beds and individual plantings, place fertiliser pellets around the plants at the time of planting.

Application rate (kg/ha): Refer to fertiliser schedule

Backfilling
General: Backfill with topsoil mixture. Lightly tamp and water to eliminate air pockets. Make sure that topsoil is not placed over the top of the rootball, so the plant stem remains the same height above ground as it was in the container. Avoid mixing mulch with topsoil.

Watering basins for plants in grassed areas
Location: To each individual plant not located in irrigated grassed areas or naturally moist areas.

Watering basin: Construct around the base of each individual plant, consisting of a raised ring of soil capable of holding at least 10 L.

3.4 MULCHING

Placing mulch
General: Place mulch to the required depth and clear of plant stems, so that after settling it conforms to the following:

- Smooth and evenly graded between design surface levels.
- Flush with the surrounding finished levels.
- Sloped towards the base of plant stems in plantation bed.

Depths:

- Organic mulch: 75 mm.

Installation:

- In mass planted areas: Place after the preparation of the planting bed but before planting and other work.
- In smaller areas (e.g. planter boxes): Place after the preparation of the planting bed, planting and other work.

3.5 TREATMENT

General
Pest attack or disease: If evidence of pest attack or disease of plant material is discovered, immediately give notice.

Physical removal
General: Remove pest infestation and diseased plant material by hand if appropriate.

Pesticide
Product: Spray with insecticide, fungicide or both, as required.

3.6 TREE ANCHORING SYSTEM

Tree anchoring system.
Material: Stainless steel anchoring with stainless steel cable. Straps as per manufacture specifications.

Installation: Drive anchors into the ground as per manufacture specifications. For tree installed on Rooftops where soil depth is limited the deadman anchor is recommended.

Sizes and quantities:

- Refer to manufacture specifications related to tree size.

3.7 COMPLETION

Cleaning

Temporary fences: Remove temporary protective fences at the end of the planting establishment period.

SECTION 9 PLANT PROCUREMENT

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide plants, as documented.

Performance
Plants: Grown to a standard that allows rapid establishment and growth to maturity.

Maintenance: Encourage and maintain healthy growth for the duration of the contract.

Program: Provide a suitable irrigation, pruning, fertiliser and monitoring program for all plant materials held by the supplier. Take precautions to safeguard the health and well-being of all plant materials before and including their delivery to the project site.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:

- *General requirements*.

1.3 STANDARD

General
Tree stock supply: Conform to the recommendations of AS 2303.

1.4 INTERPRETATION

Definitions
General: For the purposes of this worksection the definitions given in AS 2303 and the following below apply:

- Destructive inspection (of trees): The washing away of all soil from a rootball to allow inspection of rootball development.
- Investigative inspection: Any method of root inspection that involves the washing away of all or portions of the soil from the rootball to expose a section or all the roots.
- Known history: Supplier documentation, demonstrating and enabling verification that the product was grown by essentially the same processes and under essentially the same system of control.
- Large tree: A tree grown in a container not less than 20 L or ex-ground with a minimum rootball diameter of 400 mm.
- Locally sourced: Stock procured from district sources that is best suited to climatic, soil and environmental conditions in the immediate area of site.
- On-site plant material: Plant material growing in natural ground conditions.
- Partial inspection (of trees): A method of exposing a section of a root system to enable inspection of root development by washing the soil away in a wedge-shaped section from the stem to the extremity of the rootball. This soil can be gently replaced so the tree is not damaged.
- Shrub: A woody perennial plant smaller than a tree, usually having permanent stems branching from or near the ground.
- Small trees: Tree or shrub grown in a container less than 20 L (other than tubes or plant cells) or ex-ground trees of size index less than 35.

1.5 SUBMISSIONS

Accreditation of plant supplier
Requirement: Submit evidence of accreditation as follows:

- Accreditation body: Nursery and Garden Industry of Australia

Certification
Plant species: Submit the supplier's certification as evidence that plants are true to the required species and type, and free from diseases, pests and weeds at the time of delivery.

Source location: Submit the supplier's certification as evidence that plants have been grown from locally sourced stock. If this is not achievable, give notice.

Test results
General: Submit a completed **TREE INSPECTION FORM** for each batch inspected.

Rejection: Non-conformity may lead to rejection of the entire batch.

Corrective action: Conform to corrective action procedures for each order as instructed.

Substitution: If non-conforming trees are proposed, submit a proposal in writing.

Authentication: Submit a copy of the written approval of substitution with any non-conforming trees.

1.6 INSPECTION

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

- Plant material at the date of commencement of delivery.
- Plant material to assess potting on procedures, if necessary.

2 PRODUCTS

2.1 ASSESSMENT CRITERIA - GENERAL

General
Requirement: Supply plants with the following properties:

- Stress: Free from stress resulting from inadequate watering, excessive shade or excessive sunlight experienced at any time during their development.
- Site environment: Grown and hardened off to suit anticipated site conditions at the time of delivery and prevent dieback.
- Pests and disease: Free from attack by pests or disease.
- Native species with a history of attack by native pests: Restrict plant supply to those with evidence of previous attack to less than 15% of the foliage and make sure actively feeding insects are absent.

Labelling
General: To the recommendations of the *National Plant Labelling Guidelines*.

Label type: To withstand transit without erasure or misplacement.

Label frequency: Minimum one per species, or one per 10 plants, whichever is greatest.

Indication of north:

- Trees in containers greater than 100 L or of Size Index greater than 140: Label the northerly aspect during growth in the nursery and maintain during transit.

2.2 ABOVE-GROUND ASSESSMENT CRITERIA - TREES

General

Requirement: Supply trees to AS 2303 clause 4.2 and with the following properties:

- Clean stem height: < 40% of total tree height.
- Trunk position: < 10% variation in distance from centre of the trunk to the extremity of the rootball.
- Tree stock in containers less than 45 L: Self-supporting at dispatch.
- Pest and diseases: No evidence of active pests and diseases.

2.3 BELOW-GROUND ASSESSMENT CRITERIA - TREES

General

Requirement: Supply trees to AS 2303 clause 4.3 and with the following properties:

- Rootball occupancy:
  - Soil retention: On shaking or handling the unsupported rootball, at least 90% of the soil volume remains intact.
- Rootball diameter:
  - Containers less than or equal to 45 L and ex-ground stock: Not less than rootball depth.
  - Bare-rooted tree stock with size index less than or equal to 57: Not less than 10 x calliper.
- Pest, diseases and weeds: No evidence of active pests, diseases and weeds.

2.4 BELOW-GROUND ASSESSMENT CRITERIA – SHRUBS

Root system

Requirement: Supply plant material with a root system as follows:

- Well-proportioned in relation to the size of the plant material.
- Conducive to successful transplantation.
- Free of any indication of having been restricted or damaged.

Root inspection: If investigative inspection is required, sample as follows:

- For more than 100 samples: Inspect 1%.
- For less than 100 samples: Inspect 1 sample.

Sample plants: Replace plants used in investigative inspection.

Defective samples: Reject the entire line represented by the defective sample

Rejection: Do not provide root bound stock.

2.5 ASSESSMENT CRITERIA - BALANCE

Small trees and shrubs

Containers (except tubes or plant cells) or rootballs: To remain flat on the ground when the stem, held at 80% of height above ground, is deflected 30° from the vertical, side to side.

Exempt: Species that naturally produce hard inflexible wood in the early stages of their development.

Small container-grown trees and shrubs table

Container size or minimum rootball diameter	Height range above soil (m)	
	Thin-stemmed species	Thick-stemmed species
Tubes or plant cells	1.5 to 2.5 x the height of the container	
150 mm (1.8 L)	0.4 – 0.6	0.3 – 0.5
170 mm (2.6 L)	0.5 – 0.7	0.4 – 0.6
200 mm pot (4 L)	0.7 – 0.9	0.6 – 0.8

Container size or minimum rootball diameter	Height range above soil (m)	
	Thin-stemmed species	Thick-stemmed species
200 mm bag (5 L)	0.8 – 1.0	0.7 – 0.9
250 mm (8 L)	1.0 – 1.2	0.8 – 1.0
300 mm (15 L)	1.2 – 1.5	1.0 – 1.2

Large trees
Size index range for trees grown in containers 18 L to 100 L and 100 L to 3000 L: To AS 2303 Appendix D Table D.1.

Minimum rootball diameter for ex-ground trees: To AS 2303 Appendix D Table D.2.

2.6 CONTINGENCY PLANT MATERIAL

Replacement
Provision: Propagate and grow on plant material for anticipated replacement of failures on the project site.

Amount: Propagate and grow on quantities 15% above typical nursery trade allowances for anticipated losses during propagation and the growing on of plant materials.

Delivery: Supply to the site within 7 days' notice.

Holding: Hold the contingency plant material until it is delivered to the project site or until the expiry of twelve months from the date of completion of the works, whichever is the earlier.

Surplus plant material: To remain the property of the supplier.

3 EXECUTION

3.1 PRE-COMPLETION TESTS

Production tests
Sampling: Select sample trees, of known history, at evenly distributed intervals within each batch.

Above ground tree inspection:

- Frequency: Inspect trees at dispatch.
- Sampling strategy: To AS 2303 Appendix A Table A1.
- Inspector: Supplier.

Investigative tree inspection:

- Frequency: Inspect trees before dispatch.
- Inspector: Qualified person authorised by the contract administrator.
- Destructive inspection: Use for trees with rootballs/containers not more than 200 mm.
- Allowance: Allow for sample trees in addition to quantity ordered.
- Partial inspection: Use for trees with rootballs/containers more than 200 mm.

Investigative tree inspection sampling table

Number of trees per batch	Number of trees to sample
0 – 20	1
21 – 50	2
51 – 100	4
101 – 500	4 for the first 100 + 2% of balance of order

Number of trees per batch	Number of trees to sample
501 – 2000	12 for first 500 + 1% of balance of order
2001+	27 for the first 2000 + 0.5% of balance of order

3.2 WARRANTIES

True-to-species
Parties: Supplier(s) to the principal.

Form: All the plants supplied under these works are true-to-species and type, and free of disease, fungal infection and/or any other impediment to their future growth and have been fully acclimatised for the conditions of the site.

Submission of warranty: At the time of each delivery.

Maintenance
Parties: Supplier(s) to the principal.

Form: Maintain all plant materials sourced and secured by the supplier throughout the procurement and pre-transplanting period.

Warranty period:

- Commencement: The date of contract.
- Completion: To cease in respect of any particular plant material upon issue of a delivery notice issued by the contractor upon delivery to site.
- Earliest delivery date: One week after the date of contract.

4 SELECTIONS

4.1 TREE INSPECTION FORM

General details schedule

Date		**Reference**	
Customer contact details			
Supplier contact details		Inspected by (supplier/purchaser/agent)	
Species		Batch identification	
Botanical name		Number of tree stock sampled	
Included bark: yes/no		Self-supporting: yes/no	
Number of trees in batch		Container/rootball size	
Height range/Average		Calliper range/Average	
Tree stock balance/Calculated using average figures		Tree stock balance conforms to AS 2303 Section 5: yes/no	
Special requirements			

Above-ground attributes schedule

Attributes	**Conforming (yes/no/not applicable)**	**Comments**
Label present		
Sufficient crown density		
Typical crown cover		
Typical crown form		
Typical leaf colour and size		
Absence of epicormic shoots		
Absence of dieback		
Symmetrical crown		
Freedom from injury		
Adequate stem taper		
Adequate branch diameter		
Apical bed and adequate stem deviation		
Sound divisions		
Divisions above clean stem requirement		
Pruning cuts and branch collar or node points		
Minimal pruning cut diameter		
Clean stem height		
Convex unions at stem and branch bark ridges		
Central trunk position		
Compatibility of graft unions		
Diameter of scion		
Freedom from pests and diseases		

Attributes	**Conforming (yes/no/not applicable)**	**Comments**
Indication of north		

Below-ground attributes schedule

Attributes to AS 2303 Appendix B	**Conforming (yes/no/not applicable)**	**Comments**
Inspection method used		
Number of trees in sample		
Adequate rootball diameter		
Adequate rootball depth		
Height of root crown		
Non-suckering rootstock		
Absence of active pests, diseases and weeds		
Adequate rootball occupancy		
Absence of circling roots		
Absence of woody circling roots		
Adequate root direction		
Absence of girdled, kinked or j-roots		
Root division		
Date of rootball assessment (dd/mm/yyyy)		
Rootball assessment valid until (dd/mm/yyyy)		

Conformance with the specification schedule

Conforming yes/no	
Comments	
Name of inspector	
Signature of inspector	
Date of inspection (dd/mm/yyyy)	
Inspection valid until (dd/mm/yyyy)	

SECTION 10 IRRIGATION

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide automatically controlled, fixed irrigation systems, as documented.

Performance
Requirements:

- Achieve the documented flow rates over the irrigated area.
- Meet statutory requirements for backflow prevention.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:

- *0171 General requirements*.
- *Refer to irrigation plan and specifications prepared by Waterwise Consulting.*

1.3 STANDARDS

Water supply
General: To AS/NZS 3500.1.

1.4 INTERPRETATION

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

- LDPE: Low-density polyethylene.

Definitions
General: For the purposes of this worksection the following definitions apply:

- Emitter: A device used to control the rate at which water is applied to a specific area.

1.5 SUBMISSIONS

Irrigation Plan
General: Refer to Irrigation plan and specifications prepared by Waterwise Consulting.

Tests
Site tests: Submit results, as follows:

- Distribution uniformity (DU) – Sprinkler.
- Distribution uniformity (DU) – Subsurface drip.

1.6 INSPECTION

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

- Excavated surfaces ready for installation.
- Concealed or underground services ready for backfilling.

2 PRODUCTS

2.1 AUTOMATIC CONTROL VALVES

General

Type: 24 V solenoid actuated hydraulic valves with flow control and a maximum operating pressure rating of at least 1 MPa and able to be serviced without removal from the line.

Materials: Cast iron body and bonnet. Stainless steel bonnet holding down bolts and internal metal parts.

Isolating valve: A gate valve of the same size immediately upstream of each automatic control valve.

Housing: House both valves in the same valve box.

2.2 FIXED LOCATION SYSTEMS

Heads

Performance: Heads conforming to the following:

- Maintain a preset arc of throw.
- Adjustable for radius during watering operations.
- Vandal-resistant.
- Protected from damage in normal operation.

Pop-up type heads:

- Type: Designed to rise at least 50 mm out of the housing under supply pressure and return to flush position on removal of pressure.
- Components: Provide wiper seals, stainless steel return springs and removable internal filters.
- Playing fields: Covers designed and constructed to prevent injury.

Sprinkler heads:

- Type: Gear driven and spray sprinklers with matched precipitation rates for the various areas of throw.
- Flow rate: Adjustable down to zero.

Impact sprinkler heads: Bronze bodies in high impact plastic cases with drainage holes.

Valves

Check valves: If a rotating head is more than 300 mm below the highest head on the same automatic valve, fit an internal or external anti-drain check valve to prevent low head drainage.

Pressure regulating valves: Provide pressure regulating valves at off-take points as follows:

- Adjustable between 100 and 700 kPa.
- Complete with 800 µm filter sized to suit the flow and installed immediately upstream from the pressure regulating valve.
- Installed with isolating valves upstream from the filter and downstream from the pressure regulating valve.
- Fitted for backflow prevention.
- Mount the assembly in an accessible position in a valve box, access pit or adjacent building.

Soil moisture sensors

Type: Fixed ceramic moisture sensors.

Connection: Fit to the irrigation controller via moisture control units.

Irrigation controllers
Type: Automatic controllers that are easily programmed and include the following:

- Manual cycle and individual control valve operation.
- Manual on/off operation of irrigation without loss of program.
- ≥ 4 on/off cycles per day.
- Day omit.
- 240 V input and 24 V output capable of operating 2 control valves simultaneously.
- ≥ 24 hour battery program backup.
- Power surge protection.
- Mounted in a lockable cabinet of minimum IP 54 to AS 60529 in external locations.
- Electrical connection: If connected to wall outlets, provide 3 core 10 A, 240 V flexible cord and plug. Provide an isolating switch at the controller.

2.3 DRIP IRRIGATION SYSTEMS

Integrated drip line systems
Type: Tubing with integral drippers inserted into the tube during manufacture.

Discrete drip emitter systems
Tubing: Polyethylene micro-irrigation pipe.

Drippers: Turbulent flow types, easily dismantled for cleaning.

Emitters
Type: If the difference in elevation between the control box and all emitters is:

- < 1500 mm: Pressure compensated or non-pressure compensated type.
- ≥ 1500 mm: Pressure compensated type only.

Fittings
Type: Barbed fittings rated for the pressure class of the pipe, fastened with ratchet type clamps.

Valve boxes
Requirement: Provide the following in each valve box:

- Automatic control valve.
- Isolating valve.
- Filter: 100 µm.
- Pressure-reducing valve with 170 kPa outlet pressure.

2.4 VALVE BOXES

General
Construction: UV-resistant high impact plastic with high impact snap lock plastic cover and adequately sized for clear access.

3 EXECUTION

3.1 FIXED LOCATION SYSTEMS

Control wiring
General: Connect the automatic control valves and soil moisture sensors to the controller as follows:

- Cable type: Double insulated.
- Cable runs: Underground in PVC conduit to AS/NZS 3000 and laid alongside piping where possible.
- Connectors: Waterproof.

- Jointing: Loop cables and join only at valves, sensors and controllers.
- Movement provision: Provide expansion loops at changes of direction and at joints.

Quick coupling valves

General: Provide DN 20 double lugged bronze quick coupling valves with neoprene seats mounted on DN 20 copper risers offset at least 150 mm from the supply pipe. Install in valve boxes.

Heads

Impact sprinkler heads: Provide granular fill for at least 75 mm around the base of the case.

Risers: Mount as follows:

- Above ground heads: Mount on fixed risers.
- Galvanized steel risers: Set in 300 x 300 x 200 mm deep concrete blocks.
- In-ground heads: Mount on reticulated risers.

Piping

Mainline and submains: Install 600 mm below the finished surface and lay marker tape along the top of the line.

Lateral piping for roof and planting areas: Install below the topsoil profile and anchor at 1500 mm maximum centres with U-shaped stakes.

3.2 MICRO-IRRIGATION SYSTEMS

Installation

General: Connect micro-tube laterals with proprietary push in or screw in fittings.

Drippers: Connect directly into piping or provide appropriately sized micro-tubes.

Microsprays: Mount microsprays 300 mm above ground on stakes and connect to the piping with appropriately sized micro-tubes.

Piping: Lay polyethylene micro-irrigation pipe on finished ground surface under planting bed mulch and anchor at 1500 mm maximum intervals with U-shaped stakes.

Air release valves: Provide at the highest point in each section to drain the system when flow stops.

3.3 DRIP IRRIGATION SYSTEMS

Installation

Discrete drippers: Connect directly into piping or provide appropriately sized micro-tubes.

Piping: Lay polyethylene micro-irrigation pipe on finished ground surface under planting bed mulch and anchor at 1500 mm maximum intervals with U-shaped stakes.

Air release valves: Provide at the highest point in each section to drain the system when flow stops.

3.4 VALVE BOXES

Installation

Requirement: Install with top of box, as follows:

- Within playing fields: 150 mm below the surface.
- Other locations: Flush with the surface.

Clearance: Allow 100 mm minimum clearance from filters and 50 mm min clearance from valves.

Base: Concrete plinth or crushed rock.

3.5 TESTING

Site tests
Distribution uniformity (DU) – Sprinkler: as per Waterwise specifications
Distribution uniformity (DU) – Subsurface drip: as per Waterwise specifications

3.6 COMPLETION

General
Requirement: On completion of the irrigation system, carry out the following:

- Flush system thoroughly. Check heads, sprays and drippers and clean if blocked.
- Clean strainers.
- Adjust for even distribution with no dry areas.

4 SELECTIONS

4.1 IRRIGATION

Refer to Waterwise irrigation plans and specifications.

SECTION 11 ESTABLISHMENT

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide plant establishment, as documented.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:

- *General requirements*.

1.3 INTERPRETATION

Definitions
General: For the purposes of this worksection the following definitions apply:

- Plant establishment period: The period between the date of practical completion and the end of the defects liability period.

1.4 SUBMISSIONS

Certification
Replacement plants species: Submit the supplier's certification as evidence that plants are true to the required species and type, and free from diseases, pests and weeds at the time of delivery.

Execution details
General: Give at least two days' notice of the following operations:

- Application of herbicide.
- Application of fertiliser.
- Watering.
- Each site maintenance visit.

Reporting: Submit monthly reports by the last Friday of each month.

Records
Log book: Record the following on a weekly basis:

- Description, time and method of application of toxic material.
- Maintenance work details.
- Inclement weather to verify inability to carry out work within the specified time frame.

Availability: Upon request.

1.5 INSPECTION

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

- Date of practical completion.
- Three monthly intervals during the plant establishment period.
- End of defects liability period.

2 EXECUTION

2.1 GENERAL

Special instructions

Requirement: If directed, attend to identified areas and procedures as a priority. Obtain approval for additional costs before starting the works.

Reporting

Monthly report: Provide regular written reports each month on the following:

- General status of works.
- Soil test results as required for the fertilising programs.
- Plant replacement requirements.

Incident reports: Report immediately verbally and confirm in writing any disturbance or incident affecting or likely to affect the day to day scheduling of works.

Disruption of works by others

Requirement: Make arrangements to work around the disturbance caused by other contractors.

Rubbish removal

Rubbish: Remove loose rubbish such as bottles, papers, and cigarette butts from the site. Execute this work regularly so that all areas are free from rubbish when observed at fortnightly intervals.

Leaf litter: Remove from all path and lawn areas.

Leaf litter distribution: Remove from mown areas and spread evenly over planted areas.

2.2 PLANTING WORKS

Planting

Requirement: Make sure the general appearance and presentation of the landscape and the quality of plant material at date of practical completion is maintained for the planting establishment period.

Existing plant material: Maintain existing planting and grass within the landscape contract area as documented for the matching classifications of new grassland or planting.

Plant replacement: Replace failed, dead and/or damaged plants at maximum 3 weekly intervals as necessary throughout the plant establishment period.

Plant pruning

Pruning: To AS 4373.

Fertilising

Soil tests: Take samples from both planting beds and lawn areas and conduct tests.

Fertilising program: Base the program on soil testing results.

Application of fertiliser: Apply either an all-purpose fertiliser or a 12 month slow release fertiliser, in two rows and cultivated into soil to a depth of 100 mm.

- Program: September and March according to seasonal growth requirement.

Sensitive native species: Apply appropriate dosage.

Insect and disease control

Responsibility for insect and disease control: Contractor

Period for treatment: Until the problem has been eliminated.

Stakes and ties

Generally: If plants are not self-supporting or if stakes are damaged, stake or re-stake the plants as follows:

- Drive three hardwood stakes placed diagonally with the first stake on the opposite side to the prevailing winds.
- Do not single stake large plants.

Removal: If plants are robust with well-developed systems and no longer require support, remove stakes and ties.

2.3 GRASS SURFACES

Mowing and trimming

Preparation: Remove litter and fallen branches before mowing.

Grass height: Consistent with the growth habit of the grass variety and maintained at 25 mm to 40 mm throughout the year. Do not remove more than one-third of the grass height at any one time.

Program: Weekly during the mowing season, November to March, and at fortnightly intervals from April to October. Do not mow during wet conditions. Carry out last mowing not more than 7 days before end of plant establishment period.

Raking: Once every month before mowing from November to March, rake the grass with a flexible rake. On alternate mowings, adopt a north-south and east-west pattern.

Edge trimming: At the same time as mowing, trim lawn edges to plant beds, pathways, base of trees and other obstacles. Do not damage trees and shrubs.

Clippings distribution: Evenly distribute over the mown areas

Topdressing

Topdressing for established lawns: Weed-free imported sandy topsoil to a depth of 5 mm.

- Program: The spring following initial establishment.

Topdressing for remediation of depressions or irregularities: Apply coarse or medium texture soil to AS 4419, suitable for application to turf or grass seeded areas.

Fertilising

Application of fertiliser: Apply lawn fertiliser at the completion of the first and last mowings of the plant establishment period, and at other times as required to maintain healthy grass cover.

2.4 WEEDING

General

Requirement: Remove unwanted broadleaf plants and grasses considered invasive to the locality.

Program:

- Lawns: Quarterly, and as required to maintain the general lawn condition.
- Trees and shrubs: As required for planted, paved and mulched areas to be weed free when observed at fortnightly intervals.

Vigorous ground covers: Keep 200 mm clear from the base of any shrub or tree. Remove as follows:

- Small areas: By hand.
- Large areas: Proprietary herbicides.

Herbicide application: Apply as follows:

- To the manufacturer's recommendations.
- When the weather is humid with moderate temperatures and maximum sunlight.
- When the ground has recommended soil moisture.
- Avoid windy days or if rain is likely to follow within 12 hours.

2.5 MULCHED SURFACES

General
Inspection: Fortnightly to determine mulch requirements.

Requirement: Maintain minimum depth as follows:

- 75 mm for organic mulch.

Remulching: Maintain the original ground levels around the base of plants.

2.6 WATERING

Establishment
Extent: All plantings, lawn areas and trees.

Water quality:

- pH between 5.5 and 7.5.
- Total soluble salts less than 1000 mg/litre.
- No substances toxic to plant growth.

Watering program: Minimum 3 complete waterings, soaking to a depth of 150 mm at fortnightly intervals for the first 6 weeks of plant establishment irrespective of natural rainfall. Confirm soaked depth and record in the log book.

Water restrictions: Coordinate the water supply and conform to legislation and restrictions applying at the time.

Hand watering
Requirement: Manually water all lawn and planting areas in absence of an irrigation system or until the proposed irrigation system is fully operational. Avoid frequent dampening of the surface. Allow the surface of the soil to partially dry out between waterings.

Irrigation
Irrigation system program: Adjust to suit the following:

- The precipitation requirements of the individual zones/stations with regard to types of plants.
- The infiltration rate of the soil/medium and associated physical factors, seasons, evaporation, exposure, topography and local authority restrictions.
- Adjustment or shut down during and after periods of prolonged heavy rain.
- Water supply and watering regime of legislation and restrictions applying at the time.

Equipment maintenance:

- Check all components for proper operation.
- Repair or replace damaged components with parts from the same manufacturer.
- Flush any dirt or foreign matter from the system and clear all blockages.

2.7 CONTROL MEASURES

Weed mats
Generally: Maintain mats in a weed-free condition and reinstate missing or damaged mats to the documented standard, until completion of the plant establishment period.

Feral animal control

Generally: Implement feral animal control until the completion of the plant establishment period.

Feral animal guards: Maintain feral animal guards in a working upright and taut order with three stakes. Replace missing or damaged guards with materials as documented.

Removal: At the completion of the plant establishment period.

2.8 ROAD VERGES

Native grass

Generally: Allow native grasses planted within 2 m of road verges or 5 m of property boundaries to grow in a form consistent with the growth habit of the species.

Mowing

Native grasses: Maintain as follows:

- Do not damage regeneration areas, including tree saplings.
- Mow at a minimum of twice a year and at least once at the end of October, before bushfire season, as a fire reduction measure.
- Maintenance mowing:
  - Use a single pass of a mower along medians and verges with maximum width of 1.7 m for a slasher and 1.2 m for a slope mower.
- Fire hazard reduction mowing:
  - Use a double pass of a mower along medians and verges with maximum width of 3.4 m for a slasher, and a single 1.2 m pass by a slope mower.

Other types of grass verges: Mow to maintain a maximum 250 mm height.

Pruning

General: Cut back tree and shrub growth to road verges, to on/off ramps, and around emergency telephones and signs as required to achieve clear sight distances when viewed from a minimum of 100 m along roadway. Cut back tree and shrub growth within fire reduction zones to minimise risk to adjoining properties.

Pruning: As documented.

2.9 PAVING AND STRUCTURES

Paving

Weed and grass control: Sprayed herbicide

Furniture, signage and barriers

Maintenance guidelines:

- Furniture and pots: Keep in a good condition and move as required to carry out maintenance works.

Directional and building signs: Keep in a good condition and maintain visibility.

Boundary and car park barriers: Keep in a good condition and maintain visibility.

Drains

Maintenance: Inspect and clean all drainage structures and pit covers and maintain in working order. Remove all organic debris.

Frequency: As required, so that all overflow drains are clear when observed at fortnightly intervals.

2.10 COMPLIANCE

Criteria

Generally: Plant establishment shall be deemed complete, subject to the following:

- Repairs to plant material are complete.
- Ground surfaces are covered with the documented treatment to the documented depths.
- Pests, disease, or nutrient deficiencies or toxicities are not evident.
- Organic and gravel mulched surfaces are in a weed free and tidy condition and to the documented depth.
- Vegetation is established and well formed.
- Vegetation cover to cell, seeded and/or hydromulched areas is established
- Plants have healthy root systems that have penetrated into the surrounding, undisturbed ground and are not able to be lifted out of the planting holes.
- Vegetation is not restricting essential sight lines and signage.
- Only frangible species are growing within road side clear zones.
- Specified vegetation setbacks from services and road furniture are evident.
- All hard landscape works are installed and operating as documented.
- Litter collection and removal is complete.
- Mulch is removed from drainage and access areas.
- All non-conformance reports and defects notifications are complete.

Plant establishment compliance table

Plant material	**Acceptable failure per area**	**Acceptable concentration of failure**
Tube stock	< 10%	< 15% in any given location
140 mm	< 5%	< 15% in any given location
300 mm or larger	Nil	Nil
Turf	< 5%	Nil
Cells	< 5%	< 15% in any given location
Direct seeded native species and cover crop – including hydromulch, drilled and broadcasted areas	Not less than 3 documented species per 1 m^2 grid (determined on a testing frequency of 20 grid areas per 500 m^2)	Nil grids with < three (3) documented plant species
Direct seeded grass species and cover crop	< 15% (determined by a 1 m^2 grid on a testing frequency of 1 grid area per 500 m^2)	< 10%
Cover crop	< 5%	Nil

SECTION 12 FURNITURE AND FIXTURES

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide landscape furniture and fixtures, as documented.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:

- *General requirements*.
- *External sports and playground surfacing*.

1.3 SUBMISSIONS

Operation and maintenance manual
Requirement: Submit the manufacturer's published use, care and maintenance requirements for each item.

Products and materials
Requirement: Submit the manufacturer's standard drawings and details showing methods of construction, assembly and installation; with dimensions and tolerances.

Type test: Submit results as follows:

- Playground equipment: To AS 4685 series.

Shop drawings
Custom-built furniture and fixtures: Submit shop drawings to a scale that best describes the details, showing methods of construction, assembly and installation, with dimensions and tolerances.

Subcontractors
General: Submit names and contact details of proposed suppliers and installers.

Warranties
Requirement: Submit the manufacturer's published product warranties.

1.4 INSPECTION

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

- Custom-built furniture and fixtures fabricated and ready to be delivered to the site.
- Furniture items delivered to site before installation.
- Site locations or substrates prepared to receive furniture or fixtures before installation.
- Set-out of furniture and fixtures.
- Completed installation.

2 PRODUCTS

2.1 GENERAL

Storage and handling
General: Deliver, unload and store products and accessories in sealed manufacturer's packaging.

Preservative treatment
CCA treated timber: Do not use.

Labelling
Playground equipment: To AS 4685 series.

Weathering steel
Standard: To AS/NZS 3678.

Grade: WR350.

2.2 ELEMENTS

Playground equipment and exercise stations
Soft surfacing: To *0262 External sports and playground surfacing*.

Playground equipment: To the AS 4685 series.

Sand pits
Materials:

- Aggregate: 15 mm gauge road base.
- Agricultural pipe: 75 mm diameter slotted PVC pipe.
- Sand: Clean, sharp river sand.

Filter fabric: [complete/delete]

3 EXECUTION

3.1 INSTALLATION

Erection
Line and level: Erect posts or poles vertically. Erect furniture items level. Where installed on slopes, provide a level area around benches and seats.

3.2 COMPLETION

Cleaning
General: On completion, remove protective coatings, clean all surfaces and remove all labels not required for maintenance, or by AS 4685 series.

4 SELECTIONS

4.1 FURNITURE

Refer to Landscape schedule:

- L-ARN-2000A - FURNITURE AND MATERIAL SCHEDULE
- L-ARN-2000B - FURNITURE AND MATERIAL SCHEDULE
- L-ARN-2000E - FURNITURE AND MATERIAL SCHEDULE
- L-ARN-2000F - FURNITURE AND MATERIAL SCHEDULE

4.2 PLANTING FITTINGS

LP - Planter boxes
Type: GRC Linear planter boxer

- Description: Refer to landscape schedule L-ARN-2000B - FURNITURE AND MATERIAL SCHEDULE

4.3 FIXTURES

Barbeque

Type: Electrical. Refer to Landscape schedule and manufacture specifications

Services connection: Refer to electrical plan for electrical connection

Drinking fountain

Type: Refer to Landscape schedule and manufacture specifications

Services connection: Refer to hydraulics engineer.

Shade structures

Type: Refer landscape schedule for type

Description: Refer landscape detail for dimension and location

Supplier: Contractor custom built

Shop Drawings: Contractor to complete engineered certified shop drawings.

4.4 PLAY EQUIPMENT

Play equipment and exercise stations

- Refer to Landscape schedule L-ARN-2000E - FURNITURE AND MATERIAL SCHEDULE

4.5 CUSTOM-BUILT FURNITURE AND FIXTURES

Custom-built furniture and fixtures schedule

Properties	F1	F8	BBQ Custom Bench
Description	Concrete seating bench with timber top	Concrete seating bench with timber top	Concrete bench with BBQ area and sink.
Location	Refer plan	Refer plan	Refer plans
Size	Refer plan	Refer plan	Refer detail
Material	Base: insitu reinforced concrete class 1 finish Top seating: Hardwood fully seasoned and DAR fixed over a galvanised steel frame	Base: insitu reinforced concrete class 1 finish Top seating: Hardwood fully seasoned and DAR fixed over a galvanised steel frame	Reinforced concrete bench. Contractor to allow for sink installation and Electrical BBQ as specified. Hardwood timber doors.
Finish	Refer to landscape schedule	Refer to landscape schedule	Provide transparent penetrating sealing to all concrete surface for easy cleaning.
Fixings	Refer to detail	Refer to detail	Refer detail
Certification	Contractor to provide engineered shop drawings	Contractor to provide engineered shop drawings	Contractor to provide engineered shop drawings

SECTION 13 PLAYGROUND SURFACING

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide external sports and playground surfacing, as documented.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *General requirements*.
- *Pavement base and subbase.*
- *Asphalt.*
- *Concrete – combined.*

1.3 STANDARDS

General

Playground surfacing: To AS 4685.0 and AS 4685.1.

1.4 INTERPRETATION

Abbreviations

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

- EDPM: Ethylene propylene diene monomer (M-class) rubber.
- SBR: Styrene-butadiene rubber.

Definitions

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

- Critical fall height: The maximum free height of fall for which a surface provides an acceptable level of impact attenuation.
- Rubber: Polymeric material, either natural or synthetic that is elastomeric.
- Substrate: The surface to which a material or product is applied.
- Surfacing: An impact-attenuating surface consisting of one or more material components cast in situ, formed into a sheet, tile or other continuous surface where the underlying protective properties of the impact surfacing remain constant with consecutive and/or repeated use.

1.5 TOLERANCES

Sports surfacing

General: No ridges, bumps or hollows to cause a hazard or to deflect a ball from its true path.

Gradients: Not greater than 1:100 in any direction.

Profile: Refer to landscape typical detail.

Surface regularity: as per manufacture and supplier specifications.

Deviation from the finished plane: When checked on a 10 m grid the difference in level between adjacent grid points, after taking design gradients into account, must not exceed 25 mm.

Playground surfacing

General: No ridges, bumps or hollows to cause a hazard, with a 2.5 m gradual transition from playground surfacing to adjacent surfaces.

1.6 SUBMISSIONS

Operation and maintenance manuals
General: Submit manufacturer's published use, care and maintenance requirements for each type of surfacing.

Products and materials
Manufacturer's data: Submit the manufacturer's product data for each type of surfacing, and the manufacturer's recommendations for its application in the project including the following, as appropriate:

- Product data sheets.
- Maintenance recommendations.

Type tests: Submit results, as follows:

- Impact-attenuation performance of surfaces: To AS 4422.
- Slip resistance: To AS 4586.

Samples
Polymeric granular material: For each type, submit a 100 g sample of the material.

Identification: Label each sample, with brand, product name, and manufacturer's code reference (including the code for each coat of multi-coat work).

Shop drawings
Polymeric surfacing: Submit shop drawings to a scale that best describes the detail, showing the following:

- Installation details.
- Layout of game lines, numbers, and letters. Indicate application method of each line and marking.
- Location of equipment inserts.
- Method of joining different colours and separate pours.

Subcontractors
General: Submit names and contact details of proposed suppliers and applicators.

Substrate acceptance: Submit evidence of applicator's acceptance of the surfacing substrate before commencing installation.

Tests
Site tests: Submit results, as follows:

- Impact-attenuation performance of completed surfaces.
- Slip resistance test of completed installations.

Warranties
Requirement: Submit warranties, as documented.

1.7 INSPECTION

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

- Base preparation completed.
- Substrate preparation completed.
- Setting out completed.
- Installation completed.

2 PRODUCTS

2.1 GENERAL

Storage and handling

General: Deliver, unload and store surfacing materials in unbroken manufacturer's packaging. Inspect for damage upon delivery.

Storage: Store in a dry environment and in a location to allow installation of the surfacing without excess disturbance of the substrate.

2.2 SUBSTRATES

Base and subbase

Requirement: To *0271 Pavement base and subbase.*

Concrete

Requirement: To *0310 Concrete – combined.*

2.3 GEOTEXTILE MATERIALS

General

Material: UV stabilised polymeric fabric formed from a plastic yarn composed of at least 85% by weight.

Identification and marking: To AS 3705.

Quality: Free of flaws, stabilised against UV radiation, rot proof, chemically stable and with low water absorbency. Filaments resistant to delamination and dimensionally stable.

2.4 IMPACT-ATTENUATION LAYER

General

Description: Proprietary resilient layer between the base and surface with the following properties:

- Reduce injury risk from falls.
- Reduce lower leg stress.
- Control ball bounce.

2.5 POLYMERIC GRANULAR MATERIAL

General

Definition: Proprietary system comprising loose laid granular rubber.

Granular rubber: Shredded particles free of metal, non-metallic fibres, rubber dust and contaminants.

Edging: Water-resistant interconnected modular units.

3 EXECUTION

3.1 GENERAL

Subcontractors

Requirement: Use specialist applicators recommended by the material manufacturer.

Combinations

General: Do not combine products from different manufacturers in a surfacing system.

3.2 SUBSTRATES

Drying and shrinkage

General: Before laying surfaces, allow at least the following times to elapse for these substrates:

- Concrete slabs: 28 days.
- Asphaltic concrete: 14 to 21 days.

3.3 PREPARATION

Substrate condition

Requirement: Sound, clean and free of any deposit or finish, including laitance, efflorescence, curing compounds, dirt and grease, which may impair bonding or is incompatible with the surfacing.

Substrate alkalinity and adhesion: Verify the concrete pH is within the range recommended by the manufacturer. Perform adhesion tests to the manufacturer's recommendations, do not proceed with application unless the substrate passes the test.

Substrate correction

Substrate rectification: Conform to the following:

- Surface treatments: Mechanically remove the following surface treatments:
  - Sealers and hardeners.
  - Curing compounds.
  - Waterproofing additives.
  - Surface coatings and contamination.
- Planeness, smoothness, projections: Remove projections and fill voids and hollows with a smoothing and self-levelling compound compatible with the adhesive. Allow filling or levelling compound to dry to manufacturer's recommendations.

Ambient conditions

Ambient air temperature: If less than 5°C or more than 35°C, do not lay surfacing.

Ambient surface temperature: If less than 10°C or more than 60°C, do not lay surfacing.

Rainfall and humidity: If rainfall is imminent or high humidity may prevent drying, do not lay surfacing.

Falls

Requirement: Make sure the fall in the substrate conforms to the fall documented for the surface finish.

Geotextile

Preparation: Trim the ground to a smooth surface free from cavities and projecting rocks.

Placing: Lay the fabric flat, but not stretched tight, and secure it with anchor pins. Overlap joints 300 mm minimum.

Priming

General: If required by the surfacing manufacturer, prime the substrates with a primer compatible with the surfacing system.

3.4 POLYMERIC GRANULAR MATERIAL

Installation

General: Apply components of loose-fill surfacing to manufacturer's recommendations to produce a uniform surface.

Edging: Install and permanently secure edging in place, and attach units to each other.

Loose fill: Place loose-fill materials to required depth after installation of playground equipment support posts and foundations, including the recommended amount of additional material to offset compaction over time.

Grading: Uniformly grade loose fill to an even surface free from irregularities.

3.5 TESTING

Completion tests
Slip resistance of testing of completed installation: To AS 4663.

Impact-attenuation performance of completed surfaces: To AS 4422.

3.6 COMPLETION

Protection
General: Keep traffic off finished work for 48 hours after installation.

Reinstatement
Extent: Repair or replace faulty or damaged work. If the work cannot be repaired satisfactorily, replace the whole area affected.

Spare materials
General: Supply spare matching surfacing and accessories of each type for future replacement purposes. Store the spare materials on site where directed.

Quantity: At least 1% of the quantity installed.

Warranties
Surfacing: Cover materials and workmanship in the terms of the warranty in the form of interlocking warranties from the supplier and the applicator.

- Form: Against failure of materials and execution under normal environment and use conditions.

Warranty period: [complete/delete]

4 SELECTIONS

4.1 PERFORMANCE

Playground surfacing performance schedule

Property	A	B	C
Playground type			
Surfacing type			
Base			
Anticipated usage (hours/day) (days/week)			
Abrasion resistance			
Minimum thickness			
Permeability			
Minimum life expectancy (years)			
Slip resistance classification			
Critical fall height tested to AS 4422			

4.2 PRODUCT

Polymeric granular material schedule

Property	**A**	**B**	**C**
Location			
Product			
Uncompressed material depth			
Edging			
Colour			

SECTION 14 PAVEMENT BASE AND SUBBASE

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide base and subbase courses as documented.

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

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:

- *General requirements*.
- *Earthwork*.

1.3 INTERPRETATION

Definitions
General: For the purposes of this worksection, the following definitions apply:

- Base: One or more layers of material, forming the uppermost structural element of a pavement and on which the surfacing may be placed.
- Subbase: 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.

1.4 TOLERANCES

Surface level
Subbase: + 10 mm, - 25 mm.

Base: + 10 mm, - 5 mm.

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

Surface deviation
Base: ≤ 5 mm from a 3 m straightedge laid on the surface. Maximum ≤ 1mm from adjacent pavers.

1.5 SUBMISSIONS

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.

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.

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

Conformance: Submit type test results for each material listed in the **Base material properties and test methods table** and **Subbase material properties and test methods table** from an Accredited testing laboratory as evidence of material conformance.

Alternative materials: If proposed, submit type test results for the relevant properties listed in the **Base material properties and test methods table** and **Subbase material properties and test methods table** from an Accredited testing laboratory as evidence of material conformance.

Tests
Compaction tests: Submit results of compaction testing to **TESTING, Site tests**.

1.6 INSPECTION

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

- Prepared subgrade.
- Proof rolling of subbase before spreading of base.
- Proof rolling of base before sealing.

2 PRODUCTS

2.1 BASE AND SUBBASE MATERIAL

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.

Crushed rock
Requirement: Provide crushed rock as follows:

- Base: 20 mm nominal.
- Subbase: 40 mm nominal.

Recycled materials
Requirement: Provide recycled materials as follows:

- Base and subbase: Conform to the **Limits on use of recycled and manufactured materials as constituent materials table** and the **Undesirable material properties table**.

Natural gravel
Requirement: Provide unbound natural gravel materials as follows:

- Base: 20 mm nominal.
- Subbase: 40 mm nominal.

Subbase material properties and test methods table

Property and test method	Differentiating criteria	Material requirements	
		Crushed rock	Natural gravel
Particle size distribution or grading (% passing through sieve) to AS 1289.3.6.1	**Sieve size (mm)**	—	—
	53.0	100	100
	37.5	90 - 100	95 - 100
	26.5	74 - 96	80 - 97

Property and test method	**Differentiating criteria**	**Material requirements**	
		Crushed rock	**Natural gravel**
	19.0	62 - 86	—
	13.2	—	—
	9.5	42 - 66	48 - 85
	4.75	28 - 50	35 - 73
	2.36	20 - 39	25 - 58
	0.425	8 - 21	10 - 33
	0.075	3 - 11	3 - 21
Liquid limit (w_L) to AS 1289.3.1.1	—	max 25%	max 25%
Plasticity index (I_P) to AS 1289.3.3.1	—	max 12%	max 12%
Linear shrinkage (*LS*) to AS 1289.3.4.1	**Rainfall**	—	—
	Areas with annual rainfall > 500 mm	max 4.5%	max 4.5%
	Areas with annual rainfall < 500 mm	max 6.0%	max 6.0%
Maximum dry compressive strength on fraction passing 19 mm sieve (only applies if plasticity index is less than 1) to AS 1141.52	—	min 1.0 MPa	min 1.0 MPa
Particle shape by proportional calliper - % misshapen (2:1) to AS 1141.14	—	max 35%	—
Aggregate wet strength* to AS 1141.22	—	min 50 kN	—
Wet/dry strength variation* (dry - wet)/dry to AS 1141.22	—	max 40%	—
Los Angeles value to AS 1141.23	—	max 40%	—
4 day soaked CBR (98% modified compaction) to AS 1289.6.1.1	—	min 30%	min 30%
*Use the fraction with the highest wet/dry strength variation as the value for determining conformance. Test the fraction 19.0 to 9.5 mm. For blended materials, also test the fraction 9.5 to 4.75 mm. Test any other fraction where there is risk of failing.			

Limits on use of recycled and manufactured materials as constituent materials table

Recycled material	**Unbound or modified base and subbase**	**Bound base and subbase**
Iron and steel slag	100%	100%
Crushed concrete*	100%	100%
Brick	20%	10%
RAP	40%	40%
Fly ash**	10%	10%
Furnace bottom ash	10%	10%
Crushed glass fines	10%	10%
Notes:		

Recycled material	Unbound or modified base and subbase	Bound base and subbase
* For pavements using high percentages of crushed concrete, take into account the amount of available cement which will rehydrate when subjected to moisture to create rigid or semi-rigid pavement and result in subsequent shrinkage cracking. ** For pavements using fly ash, take into account the possibility of hydration and binding when subject to moisture to create rigid or semi-rigid pavement and result in subsequent shrinkage cracking.		

Undesirable material properties table

Property and test method	Differentiating criteria	Material requirements		
		Crushed rock	Recycled material	Natural gravel
Undesirable constituent materials (% retained on a 4.75 mm sieve) to RMS T276	**Material type**	—	—	—
	Type I - Metal, glass, stone, ceramics and slag	—	max 2.0 %	—
	Type II - Plaster, clay lumps and other friable material	—	max 0.5%	—
	Type III - Rubber, plastic, paper, cloth, paint, wood and other vegetable matter	—	max 0.1%	—

Base material properties and test methods table

Property and test method	Differentiating criteria	Material requirements		
		Crushed rock	Recycled material	Natural gravel
Particle size distribution or grading (% passing through sieve) AS 1289.3.6.1	**Sieve size (mm)**	—	—	—
	26.5	100	100	100
	19.0	95 - 100	95 - 100	93 - 100
	13.2	77 - 93	78 - 92	—
	9.5	63 - 83	63 - 83	71 - 87
	4.75	44 - 64	44 - 64	47 - 70
	2.36	29 - 49	30 - 48	35 - 56
	0.425	13 - 23	13 - 21	14 - 32
	0.075	5 - 11	5 - 9	6 - 20
Liquid limit (w_L) to AS 1289.3.1.1	—	max 25%	max 30%	max 25%
Plasticity index (I_P) to AS 1289.3.3.1	**Rainfall**	—	—	—
	All areas	—	—	—
	Areas with annual rainfall > 500 mm	max 6%	max 6%	max 6%
	Areas with annual rainfall < 500 mm	max 10%	max 10%	max 10%
Linear shrinkage (*LS*) to AS 1289.3.4.1	**Rainfall**	—	—	—
	All areas	—	—	—
	Areas with annual rainfall > 500 mm	max 2.0%	max 2.0%	max 2.0%

Property and test method	**Differentiating criteria**	**Material requirements**		
		Crushed rock	**Recycled material**	**Natural gravel**
	Areas with annual rainfall < 500 mm	max 4.0%	max 4.0%	max 4.0%
For materials with plasticity index less than 1: Maximum dry compressive strength to AS 1141.52	—	min 1.7 MPa	min 1.7 MPa	min 1.7 MPa
Particle shape by proportional caliper (% misshapen for 2:1 caliper ratio) to AS 1141.14	—	max 35%	max 35%	—
Aggregate wet strength* to AS 1141.22	—	min 80 kN	min 80 kN	—
Wet/dry strength variation* to AS 1141.22	—	max 35%	max 35%	—
Los Angeles value (% loss or abrasion) to AS 1141.23	—	max 35%	max 40%	—
CBR (98% modified compaction) to AS 1289.6.1.1	—	min 80%	min 80%	min 80%
Unconfined compressive strength to AS 5101.4	—	max 1.0 MPa	max 1.0 MPa	—
NOTES: *Use the fraction with the highest wet/dry strength variation as the value for determining conformance. Test the fraction 19.0 to 9.5 mm. For blended materials, also test the fraction 9.5 to 4.75 mm. Test any other fraction where there is risk of failing.				

Tests

Material property testing: Conform to the **Base material properties and test methods table** and the **Subbase material properties and test methods table**.

Frequency of material property tests: Not less than the following:

- Particle size distribution: 1 per 1000 t (or part of).
- Liquid limit: 1 per 1000 t (or part of).
- Plasticity index: 1 per 1000 t (or part of).
- Linear shrinkage: 1 per 1000 t (or part of).
- Foreign materials content: 1 per 1000 t (or part of).
- Maximum dry compressive strength: 1 per 5000 t (or part of).
- Particle shape: 1 per 1000 t (or part of).
- Los Angeles value: 1 per 1000 t (or part of).
- Aggregate wet strength: 1 per 5000 t (or part of).
- Wet/dry strength variation: 1 per 5000 t (or part of).

3 EXECUTION

3.1 SUBGRADE PREPARATION

General

Requirement: Prepare the subgrade to *0222 Earthwork*.

3.2 PLACING BASE AND SUBBASE

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

Joints

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

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

Final trimming

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

3.3 BASE AND SUBBASE COMPACTION

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.

Minimum relative compaction table

Item description	Minimum dry density ratio (modified compaction) to AS 1289.5.2.1
Subbase	95%
Base	98%

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.

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 materials to dry to 60 to 80% of the optimum moisture content before applying the seal or wearing course.

Rectification
General: If a section of the 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, re-compact and test.

Level corrections
General: Rectify incorrect levels as follows:

- High areas: If the area can be rectified by further trimming to produce a uniform, hard surface by cutting without filling, trim so that the rectified area conforms to **TOLERANCES**.
- Low areas and high areas not rectifiable by further trimming: Remove layers to a minimum depth of 75 mm and replace with new material and re-compact.

3.4 TESTING

Site tests
Compaction control tests: To AS 1289.5.4.1 and AS 1289.5.4.2.

Frequency of compaction control tests: 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 2000 m^2 for carparks.
- 3 tests per layer.
- 3 tests per visit.

SECTION 15 CONCRETE PAVEMENT

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide concrete pavement as documented.

Performance
Requirement:

- Free draining and evenly graded between level points.
- Even and smooth riding surfaces.

Conformance: Conform to the local authority requirements for levels, grades and minimum thickness, reinforcement and concrete strength for pavements within the kerb-and-gutter property boundaries.

1.2 DESIGN

General
Coordination: Determine the local authority requirements that may affect grades, transitions and work zones, including the following:

- Drainage.
- Trees (due to settlement).
- Adjacent structures.

1.3 CROSS REFERENCES

General
Requirement: Conform to the following:

- *General requirements*.
- *Earthwork*.
- *Pavement base and subbase*.
- *Refer to architecture documentation and specifications prepared by GroupGSA*
- *Refer to structural engineer documentation and specifications prepared by TTW*

1.4 STANDARDS

Concrete
Specification and supply: To AS 1379.

Materials and construction: To AS 3600.

Residential pavements: To AS 3727.1.

Slip resistance
Classification: To AS 4586.

1.5 INTERPRETATION

Definitions
General: For the purposes of this worksection the following definitions apply:

- Ambient temperature: The air temperature at the time of mixing and placing of concrete.

- Concrete class – normal: Concrete that is specified primarily by a standard compressive strength grade up to 50 MPa and otherwise in conformance with AS 1379 clause 1.5.3.
- Concrete class – special: Concrete that 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.
- Weather – cold: Ambient shade temperature less than 10°C.
- Weather – hot: Ambient shade temperature greater than 30°C.

1.6 TOLERANCES

General

Surface abutting gutters: ± 5 mm from the level of the gutter edge.

Rigid pavement surface:

- From design level: + 10 mm, - 0 mm.
- From a 3 m straightedge placed anywhere on surface: 5 mm.

Horizontal position of outer concrete edge: 30 mm from documented position.

Joint locations in plan : 10 mm from documented position.

1.7 SUBMISSIONS

Certification

Test certificates and records: Submit test certificates and also retain results on site.

Compliance certificate: If product testing is not proposed, submit a manufacturer's certificate together with results of recent tests undertaken by the manufacturer, showing compliance with test criteria.

Execution details

Concrete: Submit proposals for mixing, placing, finishing and curing concrete including the following:

- Addition of water on site.
- Changes to the concrete mix.
- Temperature control, curing and protection methods.
- Cutting or displacing reinforcement.
- Handling, placing, compaction and finishing methods and equipment, including pumping.
- Sequence, size and times of concrete pours, and construction joint locations and relocations.

Cores, fixings and embedded items: If required, submit shop drawings showing the proposed locations, clearances and cover, and indicate any proposed repositioning of reinforcement.

Cutting or coring: If cutting or coring of hardened concrete is proposed, provide details.

Sawn joints: Submit proposed methods, timing and sequence of sawing joints.

Damaged galvanizing: If repair is required, submit proposals to AS/NZS 4680 Section 8.

Splicing: If undocumented splicing is proposed, submit details.

Welding: If welding of reinforcement is proposed, provide details and give notice before welding reinforcement.

Joint sealants: Submit proposals for installation methods and sealant performance.

Crack assessment: If unplanned cracks occur in the finished pavement, submit proposals for investigation.

Surface repair method: If required, submit details of the proposed method before commencing repairs.

Trial section: Submit proposal for trial pavement.

Products and materials
Aggregates: Nominate the source for all aggregates.

Reinforcement: Submit the manufacturer's certificate of compliance with AS/NZS 4671, or submit test certificates from an Accredited Testing Laboratory.

Liquid curing compounds: Submit certified test results, including the application rate and the efficiency index to AS 3799 Appendix B.

Curing by covering: Submit details of the proposed covering material.

Repair materials: Submit proposals for epoxy resin/grout and elastomeric sealant.

Concrete: Submit the concrete supply delivery dockets.

Trial mix design report: Six weeks before commencing production, submit a report for each mix design containing the information required in AS 1012.2, the individual and combined aggregate particle size distribution, and the records and reports for the tests.

Subcontractors
Pre-mixed supply: Submit names and contact details of proposed pre-mixed concrete suppliers, and alternative source of supply in the event of breakdown of pre-mixed or site mixed supply.

Tests
Site tests: Submit results, as follows:

- Slip resistance test of completed installations.

1.8 INSPECTION

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

- Base or subgrade before covering.
- Membrane or film underlay installed on the base or subgrade.
- Concrete formwork, reinforcement and dowels in position.
- Commencement of concrete placing.
- Completion of concrete placing.
- Evaluation of surface finish.

2 PRODUCTS

2.1 REINFORCEMENT

Steel reinforcement
Standard: To AS/NZS 4671.

Surface condition: Free of loose mill scale, rust, oil, grease, mud or other material that may reduce the bond between the reinforcement and concrete.

Accessories
Reinforcement supports: To AS/NZS 2425.

Tie wire: Galvanized annealed steel 1.25 mm diameter minimum.

Dowels
General: Provide each dowel in one piece, straight, cut accurately to length with ends square and free from burrs.

Standard: To AS/NZS 4671.

Grade: 250R steel bars 450 mm long.

Diameter: [complete/delete]

Tie bars
Type: Deformed bar, 12 mm diameter, grade 500N, 1 m long.

2.2 AGGREGATE

Characteristics
Standards: AS 2758.1.

Durability: Tested to AS 1141.22:

- Wet strength not less than 80 kN.
- 10% Fines Wet/Dry Variation not to exceed 35%.

Recycled concrete aggregate (RCA): If blending coarse RCA with natural aggregates, make sure substitution rates are below 30%.

2.3 CEMENT

General
Standard: To AS 3972.

Moisture: 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.

Supplementary cementitious materials
Fly ash: To AS/NZS 3582.1.

Slag: To AS 3582.2.

Amorphous silica: To AS/NZS 3582.3.

2.4 WATER

General
Quality: Drinking water free from materials harmful to concrete or reinforcement, and not salty or brackish.

Limits: Not containing more than:

- 600 parts per million of chloride ion, tested to AS 3583.13.
- 400 parts per million of sulfate ion, tested to AS 1289.4.2.1.

2.5 ADMIXTURES

General
Standard: Chemical admixtures to AS 1478.1, used to the manufacturer's recommendations.

Quality: 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 factors such as air temperature, setting time and cement content to the manufacturer's recommendations.

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) if required to control slump within the limits stated in Concrete mix, properties.

Cool season accelerator: During the cool season, (April to September inclusive), use only a lignin or lignin based set-retarding admixture, if required, containing not more than 6% reducing sugars (Type Ac or Type WRAc to AS 1478.1).

2.6 CURING COMPOUNDS

General
Curing compounds: To AS 3799 and AS 1160, Type 2.

Sheet material covering: To ASTM C171, white opaque or clear polyethylene film, or white burlap-polyethylene sheet, or equivalent material.

2.7 OTHER MATERIALS

Tactile ground surface indicators
Standard: To AS/NZS 1428.4.1.

3 EXECUTION

3.1 GENERAL

Traffic control
Traffic restriction: Do not allow traffic or construction plant other than that associated with testing, sawcutting, cleaning or joint sealing on pavement for minimum 10 days after placing, or when the concrete has reached a compressive strength of at least 20 MPa, and joints have been completely sealed.

3.2 SUBGRADE

Preparation
Conformance: Prepare subgrade to *0222 Earthwork*.

Extent: Prepare a uniform subgrade for the full pavement formation, extending at least to the back of kerbs or at least 300 mm beyond each side of the carriageway if kerbs are not proposed.

Reinstatement: Make sure of uniformity for backfilling of any utility trenches.

3.3 SUBBASE

Thickness
Subbase thickness: refer to engineer specifications

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.

Tolerance
Subbase finished surface level: + 0 mm, - 10 mm.

Placement
Bound and unbound subbase materials and placement: To *0271 Pavement base and subbase*.

Friction reduction
Requirement: Provide 200 µm thick polyethylene sheeting with 200 mm taped minimum laps and/or a 20 mm thick layer of sand (silt and clay material less than 5%) directly beneath the concrete pavement.

3.4 TRIAL PAVEMENT

General
Requirement: Provide a trial section of pavement to demonstrate that the proposed method of placement produces a conforming pavement. Remove test sections that do not comply with requirements.

Minimum area of test section: [complete/delete]
Location: [complete/delete]

3.5 CONCRETE MIX

Standard
Concrete mix and supply: To AS 3600 clause 17.1 and AS 1379.

Properties
Concrete pavement thickness: Refer to detail and engineer documentation
Slump: Maximum 100 mm.

Drying shrinkage: Maximum 450 µε after 21 days of air drying.

Elapsed delivery time
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 30°C unless approved heating or cooling measures are taken to deliver concrete within the range 5°C to 35°C.

Elapsed delivery time table

Concrete temperature at time of discharge (°C)	Maximum elapsed time (minutes)
5 – 24	120
24 – 27	90
27 – 30	60
30 – 35	45

Site mixed supply
Emergencies: If mixing by hand, provide details.

Plant: Mix concrete in a plant located on the construction site.

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, provide a docket listing the information required by AS 1379 clause 1.7.3, and the following information:

- Any binders or additives.
- Method of placement and climate conditions.
- Name of concrete delivery supervisor.
- The concrete element or part of the works for which the concrete was ordered, and where it was placed.

3.6 TESTING

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 AS 1379.

Testing authority: Concrete supplier or Accredited Testing Laboratory.

Concrete testing methods

Slump: To AS 1379 clause 5.2.

Compressive strength: Test to AS 1012.8.1 and AS 1012.9.

Drying shrinkage: Test to AS 1012.8.4 and AS 1012.13.

Flexural strength: Test to AS 1012.8.2 and AS 1012.11.

Acceptance criterion for strength: The average strength of any set of 3 consecutive project samples must be equal to or greater than the specified minimum value.

Sampling frequency: Provide a minimum of one sample from each 50 m^3 of concrete.

3.7 INSTALLATION

Junctions with existing pavements

Trimming: If new pavement is to be joined to an existing pavement, trim the edge of the existing pavement to create a neat vertical edge for its full depth before placing new pavement material.

Fixed formwork

Description:

- Steel forms.
- Seasoned, dressed timber planks, free of warps, bends or kinks.

Depth: Equal to the edge thickness of the slab and in one piece.

Tolerances on position:

- Level of top of form: - 0 mm, + 10 mm from pavement surface design level.
- Horizontal tolerance: 10 mm (maximum departure from a plane surface).
- Verticality: 3 mm departure from vertical.

Staking: Stake forms in position using at least 3 steel stakes per form, not more than 1.5 m 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.

Re-use: Clean and recoat the forms each time before placing concrete.

Keyways: Form the keyways of keyed construction joints using steel or timber form strips accurately located at the mid-depth of the slab and securely fastened flush against the formwork face.

Reinforcement

Tolerances in fabrication and fixing: To AS 3600.

Locate reinforcement: Place reinforcement in the top half of the pavement.

Minimum cover to reinforcement: 30 mm.

Splicing mesh: Overlap a minimum of 2 crosswires.

Supports: Provide reinforcement supports as follows:

- Able 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.
- Use plastic or concrete supports with galvanized or zinc-coated reinforcement.
- Spacing:
  - Bars: ≤ 60 diameters.
  - Mesh: ≤ 600 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 extend beyond reinforcement mats or cages, through formwork or from cast concrete, provide a plastic protective cap to each bar until it is cast into later work.

Tying: Secure the reinforcement against displacement at intersections with either wire ties, or clips. Bend the ends of wire ties away from nearby faces of formwork or unformed faces to prevent the ties projecting into the concrete cover.

Mats: For bar reinforcement in the form of a mat, secure each bar at alternate intersections.

Cores, fixings and embedded items

Position: Fix cores and embedded items to prevent movement during concrete placing. In locating cores, fixings and embedded items, displace but do not cut reinforcement, and maintain cover to reinforcement.

Isolation: Isolate embedded items to prevent water tracking to concrete providing minimum cover to reinforcement.

3.8 CONCRETE PLACING AND COMPACTION

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 placement. Hand spread concrete using shovels, not rakes.

Ponding: Remove any water ponding on the base or subbase before starting placement.

Placing sequence: Commence from one corner (usually the lowest point) and proceed continuously out from that point.

Weather: Do not place concrete in ambient temperatures above 30°C or below 10°C, without adequate precautions.

Compaction
Thickness 100 mm or less: Compact by placing, screeding and finishing processes. If required use a hand-held vibrating screed at the surface. Do not use immersion vibrators.

Thickness more than 100 mm and downturns: Use an immersion vibrator.

Placing records
Log book: Keep on site and make available for inspection a log book recording each placement of concrete, including the following:

- Date.
- Specified grade and source of concrete.
- Slump measurements.
- The portion of work.
- Volume placed.

Rain
Protection: During placement and before setting, protect surface from damage.

Concrete placing in cold weather
Cement: Do not use high alumina cement.

Temperature limits: Maintain the following:

- Freshly mixed concrete: ≥ 5°C.
- Formwork and reinforcement before and during placing: ≥ 5°C.
- Water: Maximum 60°C when placed in the mixer.

High early strength cement: If deteriorating weather conditions are predicted, use high early strength cement.

Temperature control: Heat the concrete materials, other than cement, to the minimum temperature necessary so that the temperature of the placed concrete is ≥ 5°C.

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 formwork, materials, and equipment coming in contact with the concrete.

Placed concrete: Prevent from freezing, without using salts or chemicals.

Concrete placing in hot weather
Handling: Prevent premature stiffening of the fresh mix and reduce water absorption and evaporation losses.

Hot weather placing: Maintain concrete at a temperature ≤ 35°C.

Formwork and reinforcement: Before and during placing maintain temperature ≤ 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 or ice.

Evaporation control barriers: Erect barriers to protect freshly placed concrete from drying winds.

3.9 CONCRETE FINISH

General

Commencement: Immediately after placement, spreading and compaction of the concrete, start initial finishing procedures to achieve the documented finish.

Final finishing: Do not commence final finishing until all bleed water has evaporated from the surface after initial finishing procedures.

Unformed surfaces

General: Strike off, screed and level slab surfaces to finished levels, to the tolerance class and finish documented.

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.

Finishing methods - primary 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.

Scored or scratch finish: After screeding, give the surface a coarse scored texture using a stiff brush or rake drawn across the surface before final set.

Sponge finish: After machine floating and steel trowelling, obtain an even textured sand finish by wiping the surface using a damp sponge.

Finishing methods - supplementary finish

Abrasive blast: After steel trowelling, abrasive blast the cured surface to provide texture or to form patterns without exposing the coarse aggregate, using hard, sharp graded abrasive particles.

Coloured applied finish: After machine floating, apply a proprietary liquid or dry shake material to the manufacturer's recommendations and trowel to achieve the required appearance.

Stamped and coloured pattern finish: Provide finishing system.

Surface repairs

Method: If surface repairs are required, detail proposals.

3.10 CONCRETE CURING

General

Curing: Commence curing as soon as possible after finishing, when the concrete has set sufficiently not to be damaged by the curing process, and extend for a minimum period of 7 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.

Cold weather curing

General: Maintain concrete surface temperatures above 5°C for the duration of the curing period.

Hot weather curing

Requirement: If the concrete temperature exceeds 25°C, or the ambient shade temperature exceeds 30°C, protect from drying winds and sun by using an evaporative retarder until curing is commenced.

Curing methods

Covering sheet method: 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: 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.

Curing compound: 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.

Self-levelling toppings: If used also as curing compounds, conform to AS 3799.

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.

3.11 JOINTS

General

Requirement: 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: [complete/delete]
Joint widths: [complete/delete]

Contraction joints

Installation: Construct transverse and longitudinal contraction joints by early power sawing at an appropriate time, tooling or by placing an insert in the fresh concrete.

Dowelled joints

Requirement: Place dowels as documented, orthogonal to the joint direction and parallel to the pavement surface, accurate alignment is critical.

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: Provide a proprietary sleeve or coat with a debonding coating to 0.5 length + 25 mm. Embed the unsleeved or unpainted half of the dowels in the slab placed first.

Dowelled expansion joints: Cap dowels at one end with a compressible material.

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.

Dowel tolerances:

- Alignment: 1:150.
- Location: ± half the diameter of the dowel.

Tie bar joints

Longitudinal contraction joints: Place tie bars at 800 mm centres. Alignment accuracy of tie bars is not critical.

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 1.5 m to the nearest planned joint. If necessary remove placed concrete back to the required location.

Expansion joints

Joint filling: Fill with jointing materials as documented. Finish visible jointing material neatly flush with adjoining surfaces.

Jointing materials: Provide jointing materials compatible with each other, and non-staining to concrete in visible locations.

Foamed materials (in compressible fillers): Closed-cell or impregnated, not water absorbing.

Isolation joints

Requirement: Provide formed full depth joints around structures and features which project through, into or against the pavement, and elsewhere as required.

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 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.

Sawn joints

Weakened plane joint: Saw the hardened concrete to depth at least ¼ to ⅓ of the pavement thickness and to a uniform width in the range of 3 to 5 mm 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 ravelling 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 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.
- 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.

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.

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.

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.

3.12 COMPLETION

Completion tests

Slip resistance of completed installation: To AS 4663.

Rectification

Reinstating adjacent surfaces: Reinstate surfaces next to new pavements and associated elements. If an existing road pavement has been disturbed, trim back to a straight, neat and undisturbed edge, parallel to the new concrete for the full depth of the slab.

Concrete pavement: If pavement does not conform to the tolerances, submit rectification proposal.

Unplanned cracking:

- Maximum 0.4 mm wide crack is acceptable.
- > 1 mm must be assessed, detail a proposal for possible cause and rectification processes.

Cleaning

Excavated material: Remove from site.

4 SELECTIONS

4.1 SCHEDULES

Unformed surface finishes schedule

Property	PA3a	PA3b	PA09
Location	Eden Street Princes Highway	Vehicular insitu concrete footpath on natural ground Eden Street Princes Highway	Park
Primary finish	Eden street - Finish: broom finish Princes Highway - Finish: Teralba Aggregate 10-20mm. Lightly honed surface finish to expose fine aggregates	Eden street - Finish: broom finish Princes Highway - Finish: Teralba Aggregate 10-20mm. Lightly honed surface finish to expose fine aggregates	Finish: broom finish
Slip resistance classification	As per Australian Standard	As per Australian Standard	As per Australian Standard

SECTION 16 PAVING

1 GENERAL

1.1 RESPONSIBILITIES

General

Requirement: Provide paving, as documented.

Performance

Requirements:

- Consistent in colour and finish.
- Firmly bonded to substrates for the expected life of the installation.
- Resistant to expected loads in use.
- Set out with joints accurately aligned in both directions.
- All surface water directed to drainage outlets.

1.2 CROSS REFERENCES

General

Requirement: Conform to the following:

- *General requirements*.

1.3 STANDARDS

Slip resistance

Classification: To AS 4586.

1.4 INTERPRETATION

Definitions

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

- Absolute level tolerance: Maximum deviation from design levels.
- Adhesives - cementitious (C): Adhesive in which the binders are hydraulic, e.g. General purpose cement, with aggregates and organic additives.
- Bedding: Mixtures of materials which are applied to substrates in a plastic state and which dry, cure and adhere tiles to substrates:
  - . Adhesive bedding: Paving/tiling adhered by adhesives.
  - . Mortar bedding: Paving/tiling adhered in a cementitious mortar bed.
- Lippage: Height deviation between adjacent units.
- Pavers: Units made from concrete, clay, stone and/or other inorganic raw materials, generally over 20 mm thick, used as coverings for horizontal surfaces.
- Relative level tolerance: Maximum deviation from a 3 m straightedge laid on the surface.
- Substrate: The surface to which a material or product is applied.

1.5 TOLERANCES

Completed paving

Level tolerance:

- Absolute: ± 8 mm.
- Relative: 8 mm.

Lippage: Less than 2 mm.

1.6 SUBMISSIONS

Execution details

Grouting: Submit proposals for grouting methods and materials.

Margins: If it appears that minor variations in joint widths or overall dimensions will avoid cut pavers, submit a proposal.

Operation and maintenance manuals

General: Submit a manual describing care and maintenance of the paving, including procedures for maintaining the slip-resistance classification stating the expected life of the slip-resistance classification.

Products and materials

Product conformity: Submit evidence of conformity as follows:

- Marking and classification of adhesive to AS ISO 13007.1.
- Clay and concrete paver properties to AS/NZS 4455.2.

Type tests: Submit results, as follows:

- Slip resistance of pavers.
- Accelerated wear test of pavers.
- Stone paver properties.

Waterproof membrane: Submit evidence of the waterproofing membrane's suitability for pavers to be installed over.

Samples

General: Submit labelled samples of pavers, grout and sealants, showing the range of variation in colour and finish.

Sample panel: Prepare a sample panel of each type of finish as follows:

- Size: ≥ 2 m^2.
- Include samples of junction details and trim.
- Preserve each panel until related work is complete.

Sample panel location: A sample was carried out by Surface Gallery Australia and approved by the Client. Contractor to coordinate new Sample panel 1200x1200mm for approval.

Tests

Site tests: Submit results, as follows:

- Slip resistance of completed installation.
- Salt efflorescence of paver prototype testing.

Warranties

Requirement: Submit warranties to **COMPLETION**, **Warranties**.

1.7 INSPECTION

Notice

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

- Substrate immediately before paving.
- Trial set-outs before execution.
- Control joints before sealing and grouting.
- Completed paving.

2 PRODUCTS

2.1 MORTAR

Materials
Cement: To AS 3972.

- Type: GP.
- Iron salt content:
  . White cement: ≤ 1%.
  . Off-white cement: ≤ 2.5%.

Lime: To AS 1672.1.

Sand: Fine aggregate with a low clay content selected for grading, sharp and free from efflorescing salts.

Water: Clean and free from any deleterious matter.

Measurement of volume: Measure binders and sand by volume using buckets or boxes. Do not allow sand to bulk by absorption of water.

Bedding mortar
Mix proportion (cement:sand): Select from the range 1:3 to 1:4 to obtain satisfactory adhesion. Provide minimum water.

Mixing: To AS 3958.1 clause 2.15.

2.2 GROUT

Type
Portland cement-based grout: Mix with fine sand. Provide minimum water to achieve workability.

- Mix proportion (cement:sand): 1:3.

Pigments
Pigments for coloured grout: Provide colourfast pigments compatible with the grout material. For cement-based grouts, provide inorganic mineral pigments or lime-proof synthetic metallic oxides compatible with cement.

Water
General: Clean and free from any deleterious matter.

2.3 STONE PAVERS

Natural stone
Description: Natural stone pavers of uniform quality and sound. Reject stone pavers with any of the following defects liable to affect strength and durability:

- Vents.
- Cracks.
- Fissures.
- Seams.
- Porous inclusions.
- Foreign material.
- Loose surface material.
- Discolouration.

Matching: Select for optimum matching of colour and pattern.

Split flagging thickness: Minimum 50 mm, maximum 75 mm.

Face size: Use smaller sizes for pathways and larger sizes for open areas and maintain traditional stone flagging appearance.

Cast stone
Description: Reconstituted stone manufactured from selected aggregates and cement.

Stone setts
Description: Igneous stone, cubed, cobble-style setts.

2.4 PORCELAIN TILES

Porcelain tiles
Description: Porcelain tiles of uniform quality and sound. Reject tiles with any of the following defects liable to affect strength and durability:

- Vents.
- Cracks.
- Fissures.
- Seams.
- Porous inclusions.
- Foreign material.
- Loose surface material.
- Discolouration.

Matching: Select for optimum matching of colour and pattern.

Thickness: Minimum 20 mm, or as per manufacture specification.

2.5 OTHER MATERIALS

Tactile ground surface indicators
Standard: To AS/NZS 1428.4.1.

Control joint types
General: As documented.

Divider strip: A proprietary expansion joint consisting of a neoprene filler sandwiched between plates with lugs or ribs for mechanical keying. Set flush with the finished surface.

Proprietary slide plate divider strip: An arrangement of interlocking metal plates grouted into pockets formed in the concrete joint edges.

Sealant: Two-pack self-levelling flexible mould resistant, one-part silicone or polyurethane sealant applied over a backing rod. Finish flush with the paver surface.

- Floors: Trafficable, shore hardness more than 35.

Backing rod: Compressible closed cell polyethylene foam with a bond-breaking surface.

3 EXECUTION

3.1 PREPARATION

Ambient temperature
General: If the ambient temperature is less than 5°C or more than 35°C, do not lay pavers.

Substrates
General: Make sure substrates are as follows:

- Clean and free of any deposit or finish which may impair adhesion or location of pavers.
- Projections are hacked off and voids and hollows are filled with a cement:sand mix not stronger than the substrate nor weaker than the bedding.

Drying and shrinkage: Before paving, allow at least the following times to elapse (for curing and initial shrinkage) for these substrates:

- Concrete slabs: 28 days.
- Toppings on slabs: A further 21 days.

Absorbent substrates: If suction is excessive, control it by dampening but avoid over-wetting and do not apply mortar bedding to substrates showing surface moisture.

Dense concrete: If not sufficiently rough to provide a mechanical key, roughen by scabbling or the like to remove 3 mm of the surface and expose the aggregate then apply a bonding treatment.

Fixtures
General: Before paving make sure that fixtures interrupting the surface are accurately positioned in their designed or optimum locations relative to the paving layout. Allow for movement between paving and fixtures.

3.2 INSTALLATION

Trial set-out
General: Prepare a trial paving set-out to each area as follows to:

- Maximise the size of equal margins of cut pavers.
- Locate control joints.
- Note minor variations in joint widths to eliminate cut pavers at margins.

Variations
General: If necessary, distribute variations in hue, colour, or pattern uniformly, by mixing pavers or paving batches before laying.

Paving joints
Joint widths: Set out pavers to give uniform joint widths of 6 to 12 mm.

Margins
General: Provide whole or purpose-made pavers at margins where practicable, otherwise set out to give equal margins of cut pavers. If margins less than half paver width are unavoidable, locate the cut pavers where they are least conspicuous.

Protection
Traffic: Keep pedestrian and vehicular traffic off paving until the bedding has set and attained its working strength.

Cleaning: Keep the work clean as it proceeds and protect finished work from damage.

3.3 MORTAR BEDDING

Preparation of pavers
Suction: Soak porous pavers in water for half an hour and then drain until the surface water has disappeared.

Bedding
General: Use bedding methods and materials that are appropriate to the paver, the substrate, the conditions of service, and that leave the paver firmly and solidly bedded in the bedding material and adhered to the substrate. Form falls integral with the substrate.

Mortar beds
Substrate preparation: Either lightly dust the screeded bed surface with dry cement and trowel level until the cement is damp, or spread a thin slurry of neat cement, on to the paver back. Do not provide mortar after initial set has occurred.

Nominal thickness: Refer to engineer and architecture specifications
- Grout joints.

3.4 MOVEMENT JOINTS

General
Requirement: Provide control joints as follows:

- Location:
  . Over structural control joints.
  . At internal corners.
  . Close to external corners in large paved areas.
  . Around the perimeter at abutments.
  . At junctions between different substrates.
  . To divide large paved areas into bays, maximum 5 m wide, maximum area 16 m^2.
  . At abutments with the building structural frame and over supporting walls or beams where flexing of the substrate is anticipated.
- Depth of joint: Right through to the substrate.
- Sealant width: 6 to 25 mm.
- Depth of elastomeric sealant: One half the joint width, or 6 mm, whichever is the greater.

3.5 GROUTED JOINTS

Grouting
General: Commence grouting as soon as practicable after bedding has set and hardened sufficiently. Clean out joints as necessary before grouting.

Face grouting: Fill the joints solid and tool flush. Clean off surplus grout and wash down as the grouting proceeds.

3.6 TESTING

Site tests
Prototype testing of cementitious tiles for salt efflorescence as follows: provide site testing for approval

Completion tests
Slip resistance of completed installation: To AS 4663.

3.7 COMPLETION

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.

Cleaning
General: Leave pavements clean on completion.

Warranties
To manufacture specifications.

4 SELECTIONS

4.1 SCHEDULES

Paving schedule
Refer to landscape schedule L-ARN-2000C, L-ARN-2000D, L-ARN-2000G

SECTION 17 GRANULAR SURFACES

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide geotextile, base, granular surfacing and edging, as documented.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:

- *General requirements*.
- *Landscape – walling and edging.*

1.3 INTERPRETATION

Definitions
General: For the purposes of this worksection the following definitions apply:

- Absolute level tolerance: Maximum deviation from design levels.
- Base: One or more layers of material, forming the uppermost structural element of a pavement and on which the surfacing may be placed.

1.4 TOLERANCES

Base
Absolute level tolerance: + 10 mm, - 5 mm.

Finished granular surface
Absolute level tolerance: ± 10 mm.

1.5 SUBMISSIONS

Samples
Granular surfacing: Submit a sample of the granular material.

Sample size: 1Kg

Tests
Site tests: Submit results, as follows:

- Compaction tests.

1.6 INSPECTION

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

- Completed base preparation.
- Completed granular surfacing.

2 PRODUCTS

2.1 GENERAL

Storage and handling

Geotextile: Store clear of the ground and out of direct sunlight. During installation, do not expose to sunlight for more than 14 days.

2.2 BASE MATERIALS

General

Description: Fine crushed rock, free of sand and coatings of clay or organic material, and containing not more than 1% disintegrated, weathered, soft fractured, friable or poorly indurated fragments.

2.3 GEOTEXTILE

General

Standard: To AS 3705.

Quality: Free of flaws, stabilised against UV radiation, rot proof, chemically stable and with low water absorbency. Filaments resistant to delamination and dimensionally stable.

2.4 EDGE RESTRAINTS

General

Requirement: To *0241 Landscape – walling and edging*.

2.5 GRANULAR SURFACE MATERIAL

Gravel

Description: Natural stone.

Stone type and source: Refer landscape schedule

Grade: Up to 10 mm maximum with 30% to 40% less than 5 mm, including fines.

3 EXECUTION

3.1 SUBGRADE

Preparation

Excavation: Cut and trim 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.

Weed eradication: [complete/delete]

3.2 BASE

Placement

Method: Mechanically spread material to the loose thickness required to achieve the finished compacted thickness. Do not transport new material over uncompacted material.

Moisture: Bring base material to the optimum moisture content before and during placing. Do not add water during compaction except as required to replace evaporation.

Repair: If the subgrade is disturbed during placing or becomes mixed with new material, remove all contaminated material and replace, regrade and compact.

3.3 COMPACTION

Subgrade and base
Hand compaction: Condition the material by moisture adjustment before compaction.

Compaction: 95% of the maximum dry density.

Finished compacted base thickness: [complete/delete]

3.4 GEOTEXTILE

Installation
General: To the manufacturer's requirements.

Joint lapping: Lap minimum 150 mm at joints.

3.5 EDGE RESTRAINTS

General
Requirement: If edging is not provided by other structures, install edge restraints to *0241 Landscape – walling and edging* before placing the granular surfacing.

3.6 SURFACING

General
Falls: Slightly camber surface to fall to adjacent surfaces and edge restraints.

Finished surface: Firm, even and flush with adjacent surfaces and edge restraints.

Gravel
Requirement: Spread loose material over the compacted base.

Thickness: Screed to minimum 25 mm thick.

3.7 TESTING

Site tests
Compaction:

- Subgrade, base and decomposed granite surface:
  - Sampling: To AS 1289.1.2.1.
  - Testing: To AS 1289.5.1.1, AS 1289.5.3.1, AS 1289.5.4.1 or AS 1289.5.8.1.

3.8 COMPLETION

General
Adjacent surfaces: Rake and finish granular surface flush against adjacent existing surfaces.

SECTION 18 CONCRETE FINISHES

1 GENERAL

1.1 RESPONSIBILITIES

General
Requirement: Provide finishes to formed and unformed concrete surfaces, as documented.

Performance
Requirement: Compatible with documented applied finishes.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:

- *General requirements*.

1.3 STANDARDS

General
Formed surfaces: To AS 3610.1.

Slip resistance
Classification: To AS 4586.

1.4 INTERPRETATION

Definitions
General: For the purposes of this worksection the following definition applies:

- Green concrete: Concrete which has recently set but has not achieved any design strength.

1.5 TOLERANCES

Formed surfaces
Form face deflections: To AS 3610.1 Table 3.3.4.1.

Straight elements: To AS 3610.1 Table 3.3.5.1.

Unformed surfaces
Flatness: To the **Flatness tolerance class table,** using a straightedge placed anywhere on the surface in any direction, for the documented class of finish.

Flatness tolerance class table

Class	Measurement	Maximum deviation (mm)
A	2 m straightedge	4
B	3 m straightedge	6
C	600 mm straightedge	6

1.6 SUBMISSIONS

Execution details
Surface repairs: If surface repairs are required, submit proposed methods.

Prototypes
Test panels: Provide test panels to AS 3610.1 clause 3.7 and as documented in the **Test panels schedule**.

Manufacture: Cast the panels using the form, concrete, compaction equipment, form release agents, curing and formwork removal methods which are to be used in the final work.

Storage: Once accepted, maintain the panels on site undamaged and protected from the weather, as reference prototypes for evaluation of completed work.

Surface treatment: Do not proceed with the related work until the acceptable range of surface treatments has been determined.

Tests
Site tests: Submit test results, as follows:

- Slip resistance test of completed installations.

1.7 INSPECTION

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

- Completed formwork before placing concrete.
- Evaluation of the off-form finishes.
- Evaluation of surface finish.

2 PRODUCTS

2.1 MATERIALS

Surface modifiers
Hardeners, sealants and protectors: If documented, proprietary products conforming to the manufacturer's recommendations.

Slip resistance treatment: If documented, proprietary products conforming to the manufacturer's recommendations.

3 EXECUTION

3.1 SURFACE MODIFIERS

General
Application: Apply to clean surfaces, to the manufacturer's recommendations.

3.2 FORMED SURFACES

General
Surface finish: To AS 3610.1 Table 3.3.3.1 and as documented in the **Surface finish class schedule** and the **Formed surface finishes schedule.**

Damage: Do not damage concrete works through premature removal of formwork.

Curing
Requirement: If formwork is stripped before the minimum curing period for the concrete has elapsed, continue curing the exposed faces as soon as the stripping is completed.

Evaluation of formed surfaces
General: If evaluation of formed surface is required, complete the evaluation before surface treatment.

Finishing methods
Requirement: If soffits of horizontal concrete elements or faces of vertical concrete elements are to have a finish other than an off-form finish, provide finishes as documented.

Form removal: If vertical face formwork needs to be removed for finishing methods, while the concrete is green, make sure the concrete has sufficiently set to prevent slump.

Exposed aggregate finish: While the concrete is green, wet the surface and scrub with stiff fibre or wire brushes, flushing continuously with clean water, until the aggregate is uniformly exposed. Do not use acid etching. Rinse the surface with water.

Broom finishes:

- Broom finish: While the concrete is green, wet the surface and rub using a large broom. Pass over the surface until a uniform texture are produced.

3.3 UNFORMED SURFACES

General
Surface finish: As documented in the **Unformed surface finishes schedule**.

Finished levels: Strike off, screed and level slab surfaces to finished levels and to the flatness tolerance class documented.

Finishing methods – primary 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.

Steel trowel finish: After machine floating, finish as follows:

- Use power or hand steel trowels to produce a smooth surface relatively free from defects.
- When the surface has hardened sufficiently, re-trowel to produce the final consolidated finish free of trowel marks and uniform in texture and appearance.

Broom finish: After machine floating and steel trowelling use a broom or hessian belt drawn across the surface to produce a coarse even-textured transverse-scored surface.

Exposed aggregate finish: After floating and when concrete has stiffened, wet the surface and scrub with stiff fibre or wire brushes, flushing continuously with clean water, until the aggregate is uniformly exposed. Rinse the surface with water.

3.4 TESTING

Completion tests
Slip resistance of completed installation: To AS 4663.

4 SELECTIONS

4.1 SCHEDULES

Refer to landscape schedule.

SECTION 19 SCHEDULE OF SAMPLES, SHOP DRAWINGS, SUBMISSIONS, NOTICES AND CERTIFICATIONS

SPEC SECTION (Refer to relevant specification sections for details)	**WORK ITEM**	**SUBMISSION TEST RESULTS/DOCKETS**	**INSPECTION**	**HOLD POINT**	**SAMPLE**	**SHOP DRAWING**	**CERTIFICATION**	**RECEIVED/DATE**
A. Preliminaries	Environmental management plan approved			✓				
Inspections	Clearing, weed and rubbish removal complete		✓					
	Any works involving excavation or disturbance to levels in the vicinity of existing trees.		✓					
	Contractor to contact Relevant Service Authorities prior			✓				
	Services identified before disconnection or diversion			✓				
	Earthworks and demolition in progress and complete		✓					
	Setting out of all construction works completed			✓				
	Setting out of service installation complete		✓					
	Subgrade preparation for pavement works and footings complete			✓				
	Subgrade preparation for walling and footings complete			✓				
	Excavation for footings and placement of reinforcement			✓				
	Concrete placement for footings and base course		✓					
	Water service and drainage set out and installed			✓				
	Setout of ancillary items		✓					
	Plant material at source of supply		✓					

SPEC SECTION (Refer to relevant specification sections for details)	**WORK ITEM**	**SUBMISSION TEST RESULTS/DOCKETS**	**INSPECTION**	**HOLD POINT**	**SAMPLE**	**SHOP DRAWING**	**CERTIFICATION**	**RECEIVED/DATE**
	Cultivation of existing topsoil prior to planting			✓				
	Plant material delivered on site			✓				
	Setting out of planting works completed			✓				
	Tree holes excavated and prepared for planting and plants placed		✓					
	Planting, staking and tying completed		✓					
	Achievement of Practical Completion			✓				
	Plant establishment period		✓					
	Completion of Defects Liability Period		✓					
Public Utilities Services	**Disconnect Meters** Contractor shall contact Relevant authorities prior to disconnection of any services or lights to establish ownership of asset and develop work method statement for removal and disconnection	✓						
	Contractor shall contact Relevant authorities - Water prior to disconnection of any services to establish ownership of asset and develop work method statement for removal and disconnection	✓						
Environmental Management Plans	**Environmental Management Plan (EMP-C) Construction Phase** Provide contact details of Contractor's personnel who shall be available 24 hours	✓						
Dilapidation Report	**Dilapidation Report** – Provide 2 copies or report accurately recording state of all finishes retained, prior to commencing site work.	✓						
Guarantees & Warranties	**Guarantees & Warranties** – Unless otherwise specified supply all warranties & guarantees specified in the contract	✓						
Works as Executed Drawings	**Works as executed drawings** – accurately recording completed works	✓						

SPEC SECTION (Refer to relevant specification sections for details)	**WORK ITEM**	**SUBMISSION TEST RESULTS/DOCKETS**	**INSPECTION**	**HOLD POINT**	**SAMPLE**	**SHOP DRAWING**	**CERTIFICATION**	**RECEIVED/DATE**
Workmanship & Certification	Placement & compaction of fill under structures						✓	
	Excavation for footings and slabs		✓				✓	
	Reinforcing placement		✓	✓			✓	
	Concrete placement and finishing			✓			✓	
	Shop drawing as required.					✓	✓	
	Sample as required.				✓			
	Subgrade preparation		✓	✓				
	Items complete						✓	
	Contractor to complete certification schedule prior to Practical Completion						✓	
Soil Works Refer also schedule Samples	**Submissions** Provide product data sheets for each material provided	✓						
	Imported topsoils – 1kg sample				✓			
	Improved site soils	✓						
	Compost – 1kg sample				✓			
	Mulch – 1kg sample of each mulch type				✓			
Construction Concrete works	**Tests** Sampling & testing of specimens to AS 1012: Submit test certificates, and also retain results on site for: Compressive Strength: as specified	✓						
	Slump: 1 sample each batch	✓						
	Core Testing: as required by the superintendent	✓						
	Control Tests: Determine strength using site cured specimens	✓						

SPEC SECTION (Refer to relevant specification sections for details)	**WORK ITEM**	**SUBMISSION TEST RESULTS/DOCKETS**	**INSPECTION**	**HOLD POINT**	**SAMPLE**	**SHOP DRAWING**	**CERTIFICATION**	**RECEIVED/DATE**
	Sample construction 1 m^2				✓			
Concrete BBQ Bench	Provide sample of finishes				✓			
	Provide shop drawings for approval			✓	✓	✓	✓	
Pergola and shelter	Provide sample of finishes				✓			
	Provide shop drawings for approval			✓	✓	✓	✓	
Fencing and balustrade	Provide fencing and balustrade prototype							
	Provide sample of colours				✓	✓		
	Provide engineers shop drawing for approval			✓	✓	✓	✓	
Steel cladding wall	Provide sample for Steel cladding and fixing detail		✓	✓	✓	✓	✓	
Tactile Ground surface indicators	Submit manufacture certification						✓	
	Provide sample of discrete pieces – 2 pieces				✓			
Concrete pavement	Provide sample panel as specified		✓		✓			
Tile pavement	Provide sample panel as specified. Provide sample panel for installation on Mortar bed with grouted joint. Provide sample of installation on pedestal.		✓		✓	✓		
Furniture	Provide shop drawing for approval					✓		
	Sample of timber and metal finishes and welds				✓			
	Inspection of finished metalwork prior to delivery to site		✓					
Planting	Submit planting samples 3x each species of groundcovers and shrubs.		✓		✓			
	Submit tree photo for each species of tree and size		✓		✓			

SPEC SECTION (Refer to relevant specification sections for details)	**WORK ITEM**	**SUBMISSION TEST RESULTS/DOCKETS**	**INSPECTION**	**HOLD POINT**	**SAMPLE**	**SHOP DRAWING**	**CERTIFICATION**	**RECEIVED/DATE**
Electrical	Installation of conduit		✓				✓	
	Installation of switchboard		✓				✓	
Irrigation	Installation with AS certification		✓				✓	
Drainage	Provide sample for the following: Geotextile (300mm x 300mm sample) All filter material Subsoil drainage pipes Trench grate Clear outs Rainwater outlets Pit grate		✓	✓	✓			
Maintenance	**<u>Maintenance Inspection Reports</u>** Provide monthly written plant establishment reports	✓						

END OF SPECIFICATION