LAS GROUP/QUALITAS

# 8- 12 PUNT ROAD & 3- 7 WELLINGTON STREET, ST KILDA, VIC3182

## HYDRAULIC SPECIFICATION

Question today
*Imagine tomorrow*
Create for the future

# 8- 12 Punt Road & 3- 7 Wellington Street, St Kilda, VIC3182
# Hydraulic Specification

LAS Group/Qualitas

WSP
Level 15, 28 Freshwater Place
Southbank VIC 3006

Tel: +61 3 9861 1111
Fax: +61 3 9861 1144
wsp.com

| REV | DATE | DETAILS |
|---|---|---|
| A | 15/05/2020 | TENDER ISSUE |
| B | 02/06/2020 | REVISED TENDER ISSUE |

| | NAME | DATE | SIGNATURE |
|---|---|---|---|
| Prepared by: | Bineet Sharma | 15/05/2020 | |
| Reviewed by: | Robin Taylor | 15/05/2020 | |
| Approved by: | Kanda Seyon | 15/05/2020 | |

# TABLE OF CONTENTS

# 1 PROJECT INFORMATION

## 1.1 GENERAL

The project is a new residential development, named ONE WELLINGTON, located at 8-12 Punt Road, St Kilda, Victoria.

The project delivery being ***design and construct*** has been adopted for this project.

This Technical specification is to be read in conjunction with other tender documents issued by the Project Manager including:

- Conditions of Tender
- Conditions of Contract
- Contract Preliminaries

This Specification is a technical specification and for the purpose of this Technical Specification, Works shall mean all works or work as described in this Specification and/or associated drawings

## 1.2 PROJECT TEAM

The Project Team includes the following team members:

| | |
|---|---|
| **PRINCIPAL/CLIENT** | **LAS Group / QUALITAS** |
| **PROJECT MANAGER** | PDS Group |
| **CONTRACTOR** | The company who undertakes the Works |
| **ARCHITECT** | Plus Architecture |
| **CONSULTANT ENGINEER (MECHANICAL, ELECTRICAL, VERTICAL TRANSPORTATION, FIRE PROTECTION, HYDRAULICS)** | WSP Australia Pty Ltd |
| **STRUCTURAL ENGINEER** | Webber Design |
| **FIRE SAFETY ENGINEER** | RED Fire Engineers |
| **BUILDING SURVEYOR** | Philip Chun Building Surveyors |
| **SUSTAINABILITY CONSULTANT** | WSP Austrlaia Pty Ltd |
| **ACOUSTIC ENGINEER** | Renzo Tonin & Associates |

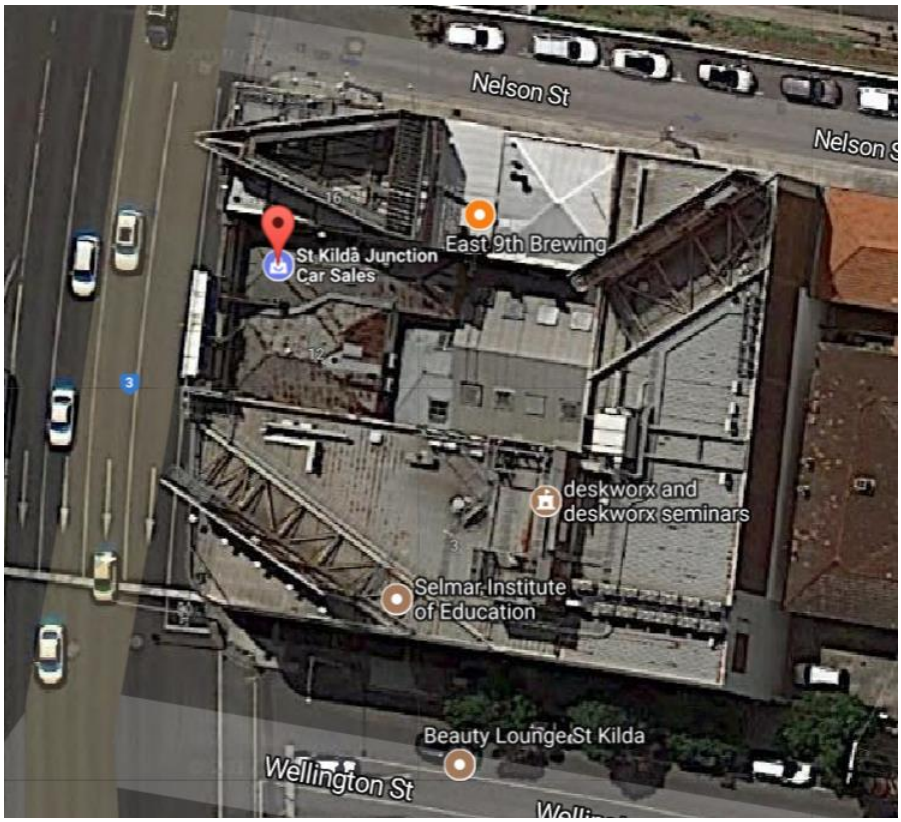
### *1.2.1 THE PROJECT DESCRIPTION*

#### 1.2.1.1 GENERAL DESCRIPTION

The project site currently consists of a low-rise office development and a car sales retail business. The existing site will be cleared to make way for the new development. The site is bounded to the North West and East by existing buildings. To the North a pedestrian laneway connects Nelson Street St and Punt Road. To the South is the Wellington Road frontage. New development is expected to contain the following attributes:

a. Two 12 and 26 story residential towers.
b. Approximately 252 residential units between the two buildings
c. Three levels (B1 to B3) basement car parks.
d. 2Nos food and beverage type tenancies in the Ground floor.
e. Communal areas (Gym, Pool, Lounge, Dinning spaces, Yoga room, Study room etc).

### 1.2.1.2 LOCATION




### 1.2.1.3 UTILITIES

The following utilities are relevant for this project;

- Electricity - Citipower
- Gas – Origin
- Water – South East Water
- Sewer – South East Water
- Telecommunications – NBNCO or equivalent
- Fire Authority (name) - MFB

# 2 GENERAL REQUIREMENTS

## 2.1 GENERAL

### 2.1.1 DEFINITIONS

Unless the context otherwise requires, the following definitions apply:

1 Supply: ‘Supply’, ‘furnish’ and similar expressions mean ‘supply only’.

Provide: ‘Provide’ and similar expressions mean ‘supply, deliver and install’ and include all testing, commissioning, tuning, interfaces etc.

Proprietary: ‘Proprietary’ means identifiable by naming manufacturer, supplier, Works Package, trade name, brand name, and catalogue or reference number.

Samples: Includes samples and prototypes.

Zinc-coated steel: Includes zinc-coated steel, zinc/iron alloy-coated steel and aluminium/zinc-coated steel.

### 2.1.2 SPECIFICATION OBJECTIVES

The intent of this Specification is to:

1 Provide a basis for competitive tendering for suitably qualified tenderers.

Allow competent Contractors to price the works.

Provide a clear statement of technical and performance requirements against which compliance can be assessed.

Provide documentation required by Authorities to demonstrate design compliance with statutory requirements for the purpose of building permit application.

Provide documentation detailing the scope and quality of the project for the purpose of Client’s confirmation of compliance to the Client’s project brief.

Define the requirements of the Contractor with respect to Quality Assurance.

Define the scope of services including project management, installation engineering, testing commissioning, maintenance and documentation to be provided.

Specify the technical requirements of the Installation.

The Specification relies upon the Contractor having the necessary specialist services resources to complete the detailed design, testing and commissioning of the installation in accordance with the design intent and the requirements of the specification.

### 2.1.3 DESIGN INTENT

1 Intent: The Contract documents are intended to call for complete, operational systems. Provide all items (major and minor), equipment, accessories and incidental work required for the completion of the installation and to ensure full integration.

Diagrammatic layouts: 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, inspect the site, obtain all necessary measurements and information.

### 2.1.4 DISCREPANCIES IN DOCUMENTS

Give immediate notice in case of any ambiguity, discrepancy or inconsistency in the Contract document. Should conflict arise between the requirements of specification, drawings, mandatory requirements, standards including Standards Australia Codes, then the higher standard or most stringent requirements shall prevail and shall be deemed to have been included in the Contract. The Contract's order of documents precedence is not intended and shall not be applicable in this case

Any ambiguities or discrepancies with the Design Requirements, Technical Requirements and / or Contract Drawings are to be highlighted at tender stage for clarification.

The Contractor is to review the tender documents, including other services, the architectural drawings, both general and detailed and satisfy themselves that the spatial allowances made for hydraulic services are adequate for the purposes of installing, testing and commissioning the works.

Any consequences of the Contractor's failure to advise the project manager, including any costs associated with relocation or modification to any area, shall be at the Contractor's risk

### 2.1.5 REFERENCED DOCUMENTS/STANDARDS

Use referenced documents/standards which are editions, with amendments, current 3 months before the closing date for tenders, except where other editions or amendments are required by Statutory Authorities.

## 2.2 QUALITY ASSURANCE

1 Provide a Quality Assurance plan in order to propose, establish, maintain, monitor and document a quality assurance system covering all aspects of the design, purchase, fabrication, installation and completion of the works. The plan shall be in accordance with ISO 9001./.2 (as appropriate).

Designate a Project Quality Inspector to discharge the quality plan, which must include the following minimum:

Inspect the installation works regularly and provide installation defects reports on regular basis in order to systematically reduce the incidences of installation defects. Submit copy of such defects lists to the Consultant Engineer upon request. This task can be delegated to qualified site foreman if applicable.

Check and sign off all shop drawings (including all third-party shop drawings) for conformance to requirements prior to submission. All such documents shall list all non-conformances with the Specification and Drawings

Check and sign off equipment compliance schedule against the particular Specification requirements and equipment schedules prior to submission. All such documents shall list all non-conformances with the Specification and Drawings

Check and sign off all samples for conformance to requirements prior to submission. All such documents shall list all non-conformances with the Specification and Drawings.

Check all tests required for proper manufacturing of the equipment.

Check and sign off all manufactured items for compliance prior to dispatch to site.

Check and sign off installation of all items under this Specification. Provide signed off installation ITPs for every elements of installation (minimum floor by floor and/or for every individual area up to 1000sqm whichever is smaller)

Check all materials, welding, joining, terminations, fixing and finishes.

Check and sign off all associated ITPs for all on-site tests required to commission the works.

Check and sign off operating and maintenance manuals to ensure they contain adequate information to permit systems to be operated by the Client at the end of defects liability period. (Including adequate training and tuition of the nominated Client's representative).

Check and sign off all associated integrated ITPs for all integrated on-site tests required to commission the works and to be carried out by various systems.

All trades works including sub trades works shall form part of overall QA and required to have their ITPs, Shop drawings, technical submissions signed off also by the Project Quality Inspector. This sign off represent all required checking that these works are consistent and compliant with the rest of the works.

Submit the following documentation:

Quality System third party certification, if any, to the Standards specified by the Joint Accreditation System of Australia and New Zealand.

Quality manual detailing, corporate Q.A. policy statement, system element description, register of procedures and project specific ITPs.

Notice:

- **a** Inspect witness points: If notice for inspection is to be given in respect of parts of the works, advise if and when those parts are to be concealed. Inspect and provide signed off installation ITPs indicating appropriate methods of installation been carried out.

Inspection hold points: If notice of inspection is to be given in respect of parts of the works, do not conceal those parts without approval.

Minimum notice for inspections to be made: 4 hours for inspections full time on-site, otherwise 2 working days for on-site inspections, and 5 working days for local pre-delivery inspections.

Concealed services: Give notice so that inspection may be made of services to be concealed. Irrespective of Consultant Engineer inspection, inspect the works, sign off relevant ITPs and highlight any noncompliance and/or defects.

Witness tests: Give sufficient notice so that designated tests may be witnessed.

- **a** Minimum notice for tests to be witnessed is 5 working days for site tests; and 10 working days for local pre-delivery tests.

Test hold points: Do not carry out designated tests without approval.

Testing Authorities:

- **a** General: Except for Site Tests, have type tests carried out by authorities accredited by NATA to test in the relevant field, or an approved organisation outside Australia recognised by NATA through a mutual recognition agreement. Co-operate as required with testing authorities.

Site tests: Use instruments calibrated by authorities accredited by NATA.

Reports:

- **a** General: Submit copies of test reports, including certificates for type tests, showing the observations and results of tests and compliance or non-compliance with requirements.

Submit Installation Defects Reports carried out on regular basis to the Consultant Engineer upon request.

Concealment:

- **a** If tests are to be carried out on parts of the work, do not conceal those parts and do not commence further work on those parts until the tests have been satisfactorily completed and compliance verified.

## 2.3 ELECTROMAGNETIC COMPATIBILITY

**1** Comply with Australian Communications Authority requirements for electrical and electronics products to limit electromagnetic interference (EMI).

Emissions:

- **a** Passive products with C-tick or Regulatory Compliance Mark (RCM) to AS/NZS 4417.3, marking of electrical products to indicate compliance with regulations – Specific requirements for electromagnetic compatibility regulatory applications.

Immunity:

- **a** Electrical and electronic apparatus: To AS/NZS 4252.1, Electromagnetic compatibility – Generic immunity standard – Residential, commercial and light industry (EN 50082-1), or

EN 5008-2, Electromagnetic compatibility – Generic immunity standard – Industrial environment.

Harmonics and Voltage Surges:

- **a** Levels of emissions to be acceptable to the electricity distribution code. Keep the THDI current to 5% maximum for all individual components/equipment and at least to that level at the first supplying control panel for all components/equipment connected to the switchboard. Provide active harmonic filters within the component, or respective control panel. Do not rely on the external harmonic filters to be installed on the Main Switchboard(s).

# 2.4 BUILDING PENETRATIONS

## *2.4.1 FIRE RESISTING BUILDING ELEMENTS*

**1** Seal penetrations to comply with NCC using a system to AS 4072.1, Components for the protection of openings in fire-resistant separating elements – Services penetrations and control joints.

Comply with Section 3 of AS/NZS 1668:1, Fire and Smoke control in Multi Compartment Buildings.

AS4072.1 inter-alia Appendix B and AS1851 inter-alia Clause 17.2.3.1 shall be complied with in as-built documentation to identify all fire and smoke containment compartment walls and barriers. To satisfy specific identification requirements to AS4072.1 Appendix B4 and AS1851 Clause 17.2.4, permanently fixed labelling, tagging and signage of all passive fire and smoke containment systems must be provided for on-site identification. Fire stopping barriers and penetrations shall comply in particular with reference to a service label affixed adjacent to each fire stop barrier and service penetration (or close proximity group) as detailed on page 25 of AS4072.1 and page 165 of AS1851. This as-built provision amongst other as-built documentation and manuals is essential as part of handing over process of the project.

## *2.4.2 NON-FIRE RESISTING BUILDING ELEMENTS*

**1** Seal penetrations around conduits and sleeves. Seal around cables within sleeves. If the building element is weatherproof, acoustic rated or subject to pressure, maintain the rating. Acoustically seal penetrations through plant room walls and floors.

## *2.4.3 CHASES*

**1** Cut, drill and chase as necessary, where possible avoiding finished work. Where chasing of finished work is essential, make good all damage to the original standards of the finishes.

## *2.4.4 LIMITATIONS*

**1** General: Do not penetrate, or chase the following without approval:

Structural building elements including external walls, core walls, fire walls, floor slabs, beams or columns.

Acoustic barriers.

Other building services.

Membrane elements including damp-proof courses, waterproofing membranes and roof coverings.

Membranes: If approval is given to penetrate membranes, provide a waterproof seal between the membrane and the penetrating compound.

## 2.5 REQUIRED SUBMISSIONS

1 Provide in good time to allow review without impediment to the programme, including possible amendment and resubmission: -

   a Copies of correspondence and notes of meetings with Authorities.

Documents showing approval of the Authorities whose requirements may apply to the work.

Certified schedule of compliance for all plant and equipment, prior to placing orders.

Factory test results where applicable.

All product data, performance test and commissioning results required by this Specification.

Shop drawings for fabrication and installation of all equipment and items supplied.

Manufacturer's product data for equipment, materials, components and systems including:

   i Technical specifications and drawings.

Size, arrangement, operating and maintenance clearances.

Operating weight.

Type test reports.

Performance and rating curves or tables marked with each selection showing for both duty point and for part load conditions the capacity; the energy consumption and power factor; and the sound power level.

Motor power requirements (both full load and starting).

Control details.

Recommendations for installation and maintenance.

Evidence of compliance with specified product certification schemes.

Inspection, test and commissioning plans for every section of the works. Detail:

   i The procedure of how to complete the task.

The skill or competency of the person undertaking the works.

The review or testing procedure to assure satisfactory completion of the task.

The person within the Works Package's organisation authorised to sign-off the task as accepted.

Client handover/training proposals.

Record and installation drawings: Record all changes to equipment and services layouts, wiring and any other items during the construction period, which may have been incorporated into these works.

Operating and Maintenance manuals.

Maintenance/service records during the defects liability period.

Give notice before commencing work affected by the submissions, unless the submissions have been reviewed with no exception taken.

Do not commence production of equipment, materials, components of equipment, components or systems until submission has been reviewed with no exception taken.

Maintain and submit monthly a schedule of shop drawings and submissions to identify all proposed drawings and submissions designated in the following categories:

**a** Accepted.

Submitted, awaiting acceptance (with submission date and revision number).

Not yet submitted.

Submit electronically (PDF or alternative agreed format).

Identify the project, Works Package, supplier/manufacturer, applicable product name, product number, included product options, and relevant specification references.

Where selected equipment or systems do not fully comply with this Specification and associated documents, submit details of proposed deviations for acceptance. Where such deviations require any changes to the structure, building works or services, these shall be provided by the Contractor without variation to the Contract. Apart from deviations listed, it will be taken that the materials and equipment proposed meets with all other specified requirements. Review of equipment and materials is undertaken on this basis, and that non-complying equipment/materials may be rejected at any time – even if already installed.

Submit amended documents as appropriate, highlighting changes since the previous submission.

## *2.5.1 SAMPLES*

### 2.5.1.1 TIMING

**1** Co-ordinate submissions of samples as listed in the Schedules. Do not cause delays by making late submissions or submitting inadequate samples.

### 2.5.1.2 QUANTITY

**1** Submit a sample of each designated item and 2 copies of supporting documentation. Include ancillary items such as fasteners and mounting brackets. Amend and resubmit samples which are not accepted.

### 2.5.1.3 IDENTIFICATION

**1** Identify the project, Contractor, their agents or supplier, manufacturer, applicable product, model number and options, as appropriate and include pertinent Specification references.

Include service connection requirements and product certification.

Identify non-compliances with project requirements, and characteristics that may be detrimental to successful performance of the completed work.

### 2.5.1.4 SAMPLE ACCEPTANCE AND RETENTION

**1** Do not commence work affected by samples until the samples have been accepted. Submit further samples as necessary.

Keep approved samples in good condition on site, until Practical Completion.

Incorporate in the works samples, which have been approved for incorporation. Do not incorporate other samples.

Installed items will match accepted samples throughout the works.

# 2.6 MATERIALS, EQUIPMENT AND COMPONENTS

## 2.6.1 GENERAL

1 Provide new materials, equipment and components shall be new, of good quality and fit for purpose, selected for a reasonable service life. Do not provide without approval products that are obsolete, discontinued or about to be discontinued.

Identification of a proprietary item does not necessarily imply exclusive preference for the item so identified, but indicates a deemed to comply item.

Manufacturers: Provide equipment and associated accessories which are the products of established manufacturers regularly engaged in the manufacture of such equipment, who issue comprehensive rating data and certified test data on their products.

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

Safety: Provide all necessary safety devices for the protection of personnel against injury and the protection of plant and equipment against damage including relief valves, belt guards, safety railing, effective earthing of electrical components, electrical interlocks, warning lights, and signs, alarms and local lighting. Provide permanent lifting eyes for equipment exceeding 40kg.

General: Select, if no selection is given, and transport, deliver, store, handle, protect, finish, adjust, prepare for use, and use manufactured items in accordance with the current written recommendations and instructions of the manufacturer or supplier.

Instructions: Submit the recommendations and instructions, and advise of conflicts with other requirements.

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

Product certification: If products must comply with product certification schemes, use them in accordance with the certification requirements.

Provide permanently fixed plates indicating manufacturer, model, serial number, capacity and electrical data for all equipment. Lettering height: 5mm maximum, 1.5mm minimum.

Provide materials or products are supplied by the manufacturer in closed or sealed containers

## 2.6.2 FINISHES AND VISUAL ELEMENTS

1 Surfaces shall be flat and free of noticeable distortion, warping and twisting.

Edges and corners accessible to users dressed to avoid injury if touched.

Pressings shall be accurate in dimension and profile to ensure consistent mating and clearance gaps and pressing shape.

Mating surfaces between adjacent pressings - flush and accurate to produce smooth distortion free joint.

Provide protection against damage until Practical Completion.

Surface shall be clean, undamaged and free of stains

## 2.6.3 MANUFACTURERS' OR SUPPLIERS' RECOMMENDATIONS

1 General: Select, if no selection is given, and transport, deliver, store, handle, protect, finish, adjust, prepare for use, and use manufactured items in accordance with the current written recommendations and instructions of the manufacturer or supplier.

Instructions: Submit the recommendations and instructions, and advise of conflicts with other requirements.

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

Product certification: If products must comply with product certification schemes, use them in accordance with the certification requirements.

### 2.6.4 CLEANING AND PROTECTION OF FINISHED WORK

During handling and installation of work at the site, clean and protect work in progress and adjoining work. Apply suitable protective covering on newly installed work where required to ensure freedom from damage or deterioration at a time of Completion; otherwise, clean and perform maintenance on newly installed work as frequently as necessary throughout remainder of construction period. Adjust and lubricate operable components to ensure operation without damaging effects.

### 2.6.5 PROHIBITED MATERIALS

**1** Do not use any of the following materials:

- **a** Lead where the metal or its corrosion products may be directly ingested, inhaled or absorbed, or any lead-based paints or primers.

Chromate paint pigment or chromate water treatment.

Urea formaldehyde foam or materials which may release formaldehyde in quantities which may be hazardous or irritant.

Synthetic mineral fibres except in accordance with Worksafe Australia National Standard and National Code of Practice.

Materials in which chlorofluorocarbons, hydrochlorofluorocarbons or hexa-fluoroacetones have been used as a blowing agent.

Chlorofluorocarbons.

Polychlorinated biphenyls.

Other substances generally known to be deleterious to health or safety or which would adversely affect the works.

Any that would be contrary to achievement of a required project Green Star or other sustainability rating.

## 2.7 INSTALLATION

### 2.7.1 GENERAL

**1** General: Carry out the work in a proper and workmanlike manner.

Arrangement: Install equipment and services parallel or perpendicular to building elements. Organise reticulated services neatly. Provide for movement in both structure and service. Under suspended ground floors, keep services at least 150mm clear above ground surface, additional to insulation.

Movement and expansion: Provide expansion facilities in ductwork, piping, cables, cable trays and supports to accommodate thermal expansion and movement at structural expansion joints.

Protection: Protect equipment from weather and the ingress of dirt, moisture, vandalism and tampering.

Access: Provide access to all components requiring entry, inspection or maintenance.

If interruptions to supply of any service are required co-ordinate the shutdowns to the satisfaction of the Superintendent, advise the occupants, minimise inconvenience, and advise when supply is reinstated. Arrange shutdowns out of hours.

## 2.7.2 SERVICES/UTILITIES CONNECTIONS

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

Connect to utility provider services or service points. Excavate to locate and expose connection points. On completion reinstate the surfaces and facilities which have been disturbed. Pay connection charges.

## 2.7.3 SYSTEM INTEGRATION

1 Interconnect system elements so that the installations perform their designated functions.

## 2.7.4 SETTING OUT OPENINGS AND MAKING GOOD

1 The Specification Drawings are diagrammatic only and unless otherwise stated shall not be used for determining the precise positions of equipment outlets and like features. The exact location of these shall be determined on site and/or from shop drawings.

All chases, ducts, recesses and penetrations in structural elements not shown on the building and structural drawings shall be subject to approval.

Provide the precise location of all openings, fixings and similar items of work required for these works.

Determine requirements at such times as not to cause delay to the work.

Check all items to ensure correct positioning.

Wrongly located or omitted openings, fixings and similar items of work resulting from incorrect or lack of inter trade coordination shall be remedied and paid for under these works.

## 2.7.5 WORKS PROGRAMME AND TIME CHART

1 Sufficient information of construction phase activities shall be provided to enable preparation of a detailed construction programme incorporating activities of every trades.

The programme of work shall be arranged in consultation with all Trades and the installation shall be completed according to the agreed programme.

The Works programme shall clearly show the start and completion dates with the typical activities listed below. The list is indicative.

Submission of shop drawings and major technical submissions.

Shop fabrication

Ordering of plant and materials.

Delivery of plant and materials.

Erection, testing and painting/identification of pipework/cable trays/ conduits/ducts in false ceilings.

Erection of pipe risers and installation of electrical wiring in vertical building risers before building riser walls are completed and closed.

Permanent power connection.

Commencement of fitting offs and final terminations.

Authorities acceptance tests.

Commencement of testing.

Commencement and Completion of plant commissioning.

### 2.7.6 METALWORK

1 General: Use metalwork capable of transmitting the loads imposed, and sufficient to ensure the rigidity of the assembly without causing deflection or distortion of finished surfaces. Construct to prevent rattle and nuisance.

Metal separation: Prevent contact between electrolytically dissimilar metals, by using concealed insertion layers.

Edges and surfaces: Keep clean, neat and free from burrs and indentations. Remove sharp edges.

### 2.7.7 FIXING

1 Fix all plant to structure in approved manner, either directly or via secondary structure as required. Submit details of types of fixings, locations and loads for approval.

Fix only light weight items to non-structural building elements.

Do not pierce waterproof roofs, floors or walls with fixings.

Fasteners to comply with appropriate Australian / New Zealand Standards.

Use proprietary corrosion resistant fasteners capable of transmitting the loads imposed, and sufficient to ensure the rigidity of the assembly. Use metal expansion bolts for concrete and masonry. Do not use explosive charge fixings without approval.

Corrosion protection: Use corrosion resistant, chemically and electrolytically compatible fasteners. Provide insulating spacers where necessary.

## 2.8 CO-ORDINATION

Comprehensive co-ordination of all services and associated building work form part of the Works.

These responsibilities shall include:

1 Co-ordination of the works as required.

Management of the advance procurement of equipment to meet programme.

Co-ordination of in-ground and in-ceiling services routes, including trenching, trays and pipework.

Management of the preparation and approval of fully co-ordinated drawings including penetration drawings.

Management of services testing and commissioning.

Ensuring provision of all test results and required certifications to obtain Certificate of Occupancy from the Building Surveyor.

During the construction period the works require that a competent supervisor is provided on site responsible for the comprehensive co-ordination of all engineering services, including civil, structural, electrical, mechanical, hydraulics, fire and lift services.

Responsibility for the proper direction, supervision, control and co-ordination of the work forms part of the works and shall assist all other trades in every way possible in meeting this responsibility.

All services shall be thoroughly co-ordinated prior to installation. Should work proceed without co-ordination being undertaken and authorisation by those with such responsibility and should other trades subsequently not be able to effectively proceed with their respective installation, the work initially undertaken shall be removed and reinstalled at the expense of the Contractor.

Any claims for additional costs or delays due to the lack of effective co-ordination by the various trades will be rejected.

Arrange and co-ordinate all interconnection testing with other services systems, e.g. fire mode tests, power failure testing etc.

### 2.8.1 CO-ORDINATION OF INSTALLATION WITH CEILING TILES AND FINISHES

Co-ordination shall be carried out to ensure that all building and services elements such as air ducts, outlets and light fittings, sprinklers, speakers and other ceiling elements are installed in a co-ordinated manner, such that all services can be connected and maintained as indicated on the Architectural Reflected Ceiling Plans.

## 2.9 SAFETY IN DESIGN

Safety in Design risk management shall form an integral part of these works and shall conform to the requirements of the Workplace Health and Safety (WHS) Act 2011 & WHS Regulations 2011.

The Safety in Design process shall conform to the State-relevant Compliance and Guidance documentation.

General principles of risk management to be followed shall be as AS/NZS ISO 31000 (2009) Risk Management – Principles and Guidelines.

The National Standard for Construction Work (NOHSC:1016) shall be used to align design risk management practice with construction risk management practice.

The Safety in Design Risk Assessment shall include but not be limited to:

1 Understand the range of work activities associated with the intended use of the building / structure as a work place.

Identify hazards, assess risks (quantify and rank), identify control measures, implement control measures, review and prepare risk register prior to construction of work. Monitor and review throughout construction and operation. The process includes review and acknowledgement of residual risks identified and communicated by the designer as defined by the WHS Act and Regulations.

Elimination or where this is not reasonable practicable, minimisation of any risk to health and safety of any person. The process includes, recommendation of design alternatives that will eliminate / reduce risks, recommendation of control measures for residual risks; organising participate and facilitating Safety in Design workshops as required.

Report in writing, on health and safety aspects and risks of the design identified. Implementation of control measures which shall be monitored and reviewed throughout construction and operation.

Provide at the conclusion of the project all residual risk information, in the form of a Safety in Design File and the related instruction and training as required to ensure an understanding of the safety aspects of the installation.

Where local regulatory practice differs from the above the more onerous shall be used as the basis for compliance.

# 3 PROJECT REQUIREMENTS AND DESCRIPTION OF WORKS

## 3.1 GENERAL

Unless varied by Specification Addenda, the requirements set out below in this section are mandatory and no deviation is permitted.

List and allow in your tender form all of the items called in and listed in this section. No deviation from requirements of this section is permitted unless approved by Superintendent in writings during the tender process.

## 3.2 ROLES & RESPONSIBILITIES

### *3.2.1 CONSULTANT ENGINEER*

1 During the construction phase the Consultant Engineer's role is:

a Analysis of schedule of technical data and alternatives offered.

Review of shop drawings for the purpose of establishing compliance with design intent.

Review of samples for the purpose of establishing compliance with the Specification.

Review of Contractor's Services trade inspection and test plans (ITPs) for each section of the works.

Periodic review of the progress of the works on the site, noting any observations with respect to quality of the installation or materials used.

Issue of any clarification (Consultants Advice) required to interpret the Specification or drawings.

Prepare and issue Consultants Advice if required to amend the Specification

Accompanied by the Contractor's representative, randomly inspect and verify test records achieved by witnessing Contractor's test demonstrations.

Review and with attendance by the Contractor's representative, random commissioning data achieved by witnessing Contractor's test demonstrations.

Review Contractor's Services trade Q.A. records including ITPs.

Inspect the works at Practical Completion

Review Client training proposals.

Review 'As Installed', and operating and maintenance documents.

Review maintenance records during the defects liability period.

Inspect the works at the end of defects liability period.

### *3.2.2 OBLIGATIONS OF THE CONTRACTOR*

The Contract documents depict a schematic intent of the services and are not fully co-ordinated with the Architectural drawings or other services. The Trade Contractor shall be responsible to fully develop the design in accordance with the requirements of the Brief and the Contract Documents, carry out computations, and attend meetings with the Architect/Engineer, Contractor and other trade contractor's.

1 In writing this Technical Specification the Client expects and relies upon the Contractor to provide its own personnel and its trades possessing specialist trade expertise necessary to complete the works in accordance with this Technical Specification which form part of the overall Contract documentation.

In addition, the Contractor has the following obligations:

a To raise in good time, issues requiring design input or clarification from the Consultant Engineer, particularly in respect to:

i interpretation of the Specification or drawings;

problems in complying with the Specification together with suggested alternative/substitutions;

matters in the Contractor's opinion, are omissions not discovered during the tender process, together with suggested alternatives/substitutions

To allow the design verification costs of the Consultant Engineer when suggesting alternatives and departures from this Technical Specification and accompanying Drawings.

To certify compliance with Authority requirements.

To pay all fees applicable to the works.

To obtain all Authority permits and certificates to allow the progress of the work.

To provide manufacturer's and construction drawings of sufficient detail to allow proper fabrication, co-ordination and installation and a scale not less than 1:50; incorporating all post-tender changes to architectural and structural drawings.

To provide samples and prototypes where specified.

To provide manufacturer's factory test records (type tests and witnessed tests) and site installation inspection and sign-off certifying that the completed installation comply with the manufacturer's installation guidelines and requirements

To provide the completed Services installation that is fully and correctly commissioned and fine-tuned and, that is functional and operable efficiently in compliance with all requirements of this Technical Specification.

To provide copies of all monthly/ quarterly maintenance and servicing reports required to the Consultant Engineer.

To certify compliance with Contract documents, including all variation instructions, at Practical Completion

### 3.2.3 CONTRACTOR'S DESIGN RESPONSIBILITIES

Specifically, for specialist services trades, the Contractor shall be responsible for the detailed design activities listed below, as these activities are considered to be normally undertaken through the custom and practice of the industry.

1 The Contractor shall be responsible for ensuring that the detailed design undertaken is fully co-ordinated and compatible with the remainder of the project design.

Check space requirements of equipment and services which are indicated diagrammatically in the Contract documents. Select equipment with dimensions to suit the available space.

Lay out equipment and services to be accessible for operation, maintenance and replacement and so as not to interfere with access to other installations. Make offsets as necessary.

Set out access ways 2.1m high and 1.0m wide (minimum) to all major plant clear of all obstructions, unless otherwise approved.

Co-ordinate the layout of plant and services with the building layout and structure, and with other plant and services.

Neatly group services, with separate layers for crossing services.

Interface details with other trades.

Size and location of penetrations in walls and floors.

Physical co-ordination of installation with other trades.

Provision of electrical loads to electrical trade and compare with design loads cable sizes and circuit protection devices, seeking design direction where discrepancies occur.

Co-ordination of the construction of the installation.

Thermal expansion accommodation and anchorage, including provision of bellows or bends, taking into account final installation details and consistent with specified requirements.

Mounting, support and fixing details, and fasteners, including any secondary structure which may be required.

Settings for protection equipment, time delays, time switches etc.

Acoustic design or modification of actual selected equipment that may require change, to meet with the noise levels specified. Such change to approval of the Consultant Engineer. Specified levels to be achieved with all plant operating.

Selection of all anti-vibration mountings to suit the particular application of the mounts

Valve access locations.

System water capacities.

Final locations of control sensors, detectors, thermostats, switches, outlets.

Calculate system resistances to fluid flow based upon the actual plant layout and selected equipment. Allow for dirty filters and diversified flows.

### 3.2.4 ALTERNATIVE PRODUCTS

Should the part of the work be proposed to be done quicker, better or more effectively by substitution of materials or methods other than those specified, the details of such substitutions or alternatives shall be included in the Tender, including a comprehensive Report including any performance and life cycle analysis in support of the proposals.

Where the words ‘equal or approved’ are used in this Technical Specification, permission may be requested to use a substitute for what is specified, provided it and the relevant manufacturer of the item certify in writing that the substitute is of equal, or better quality and effectiveness to that specified.

Submit for approval full details to allow verification that the alternative products comply with the Contract Documents. Provide a certificate for each alternate product confirming that the proposed alternative product complies with the contract documents. Include all compliance and non-compliance items related to Project Brief, Specifications and Contract Drawings. State if use of proposed alternatives will necessitate alteration to other parts of the works and include consequential costs.

1 Allow for additional work resulting from the utilisation of an approved alternative product, including additional or revised statutory approvals, changes to adjacent work, re-submission of shop drawings and any costs incurred by the Consultant Engineers in assessing such alternative products. Allow for Consultant Engineer Review cost based on agreed Market hourly rates. These sums are to be paid irrespective of the alternatives being selected or not.

Proposals for substitution must include details of:

1 Changes to adjacent work, if any.

Cost differences.

Life cycle cost differences

Quality differences and advantage to the Client.

Lead time and program changes.

Certificate of compliance.

## 3.3 EXISTING SERVICES

Obtain full information regarding all existing services, including, but not limited to, water, gas, sewer, stormwater, electrical and telephone - wherever new piping is to be installed.

Pay any and all costs involved in making good any service damage while excavating, installing or backfilling for any service noted herein. Investigate for exact location, depth and size of all existing services prior to any installation being carried out.

Existing services shall be maintained and operational until new works are installed. Allow tracing services as necessary to determine if services shown or found are 'live' and performing connection to new services with the minimum of downtime. All disconnections and shut downs shall be approved prior to work being commenced.

Where existing branch lines are located and are not shown on the drawings or 'As Constructed' drawing (available at request from the Superintendent) allow to trace and make connection to new services or cap off as appropriate.

Existing services shown on drawings have been documented based upon existing records. The accuracy of location and size etc shall be verified by the contractor prior to commencement of works.

## 3.4 STAGING OR SEQUENCING OF WORKS

Allow to stage works as directed by the superintendant and/or project manager. Allow for submission of plumbing approvals to match any sepearable portion handovers so as not to impede the certificate of classification process.

Existing services shall be maintained and kept operational until new works are installed. Allow for all temporary services to maintain continuity of services throughout the project as necessary

## 3.5 DESCRIPTION OF WORKS

Whether or not particular works are explicitly described in the Technical Specification, all items and materials needed for the complete works are required and shall be installed unless clearly excluded.

The drawings, scope of works and specification is intended for Design & Construct Tender purposes only and not for trade package tender purposes or construction.

These drawings, including a scope of works and technical specification are based on information provided and briefed by the Client, which may contain conflicting data, omissions and errors. At the time of issue, these design drawings are based on other consultants' drawings which are known to be partially complete. These drawings also indicate where appropriate quantities, sizes, locations, etc. of various items of equipment, e.g., pipework, equipment capacities, etc. which are preliminary and are provided purely to give an indication of design intent and these will be subject to change to suit final design. Various items of scope, equipment, etc., are similarly not shown at this stage. The contractor and installer shall make an assessment within the tender in adequate contingency based on their experience with projects of this nature, of the risks involved in changes to requirements, investigation, outcomes, scope and future design detail.

The project includes the detailed design, supply, delivery, installation, commissioning, tuning, testing, placing into service, maintenance, warranty and defects liability of materials, labour and plant of the services systems in accordance

with this Technical Specification. All components and systems shall be complete in every respect and tested and commissioned unless otherwise noted specifically.

### 3.5.1 GENERAL

1 Allow to decommission, make safe and remove any existing redundant services to be deleted within the area of works.

Site visit and familiarisation with the site conditions and scope of work required under this contract and making required allowances to complete the works.

All necessary negotiations including formal submissions as required with all Authorities/utilities having jurisdiction including obtaining of design approval and final certification of the installed systems by an independent certifier approved by the Authority. Payment of all fees associated with the authorities/utilities connections and permits for the installation

Provision of detailed safety in design analysis and ensure the installation is in compliance with the Site's safety in design proposal including all regulatory requirements.

Engagement and Coordination with the receptioin / Sustainability Consultant and the Independent Commissioning Agent, including timely preparation of documents as required by them

Allow for all requirements in relation to alternatives proposed for the project. Allow for Consultant Engineer review cost based on agreed market hourly rates. These sums are to be paid irrespective of the alternatives being selected or not.

Collaboration and working with Mechanical Trade who is responsible for the management and coordination of overall services shop drawing process including providing timely input into the process to allow fully coordinated shop drawing production for all services Active engagement and provision of nominated staff for input into the multidisciplinary coordination workshops in relation to shop drawing production as well as onsite installation methodology and integrated commissioning of multi-disciplinary interfaces

Coordinate with the Electrical trade and advise final equipment selections and their power requirements prior to their ordering and installation of submains to respective switchboard to ensure correct submain cable selections.

Provision of QA plan including inspection, testing, commissioning ITPs for all systems installed

Preparation of "For Construction" and "Shop Drawings" coordinated with other services prior to commencement of works including services layouts at the same scale as the design drawings.

Provision of all samples and technical submissions. Samples include;

a Basins

Water Closets

Tapware

Longitudinal Trench grates.

Rainwater outlets

Inspection point covers

Floor grates

Acoustic and Thermal insulation along with appropriate ESD certification.

Identification and coordination of penetrations, provision of fire / collars and sealing of all wall, floor, ceiling penetrations to the required fire rating.

Provision of vibration isolation for all rotating equipment.

Provision of seismic restraints, including design.

Provision of all painting and finishes including identification and labelling schedules,

Provision of As-Built drawings and O&M Manuals in compliance with a uniform overall Site Services Documentation System.

Provision of all training for staff in the operation and preventative maintenance of the systems. . Training of the nominated building facility management staff to the level of understanding of day by day operation of the services systems

Twelve (12) months statutory testing, servicing, maintenance, defect liability and warranty of all services systems/equipment installed under this contract from the date of Practical Completion

Fine tuning commissioning of all systems during the defects liability period as per Green Star/NABERS requirements. The tuning shall involve inspection, check and all adjustments of all systems and controls every three (3) months after the date of Practical Completion. Detailed final recommissioning of all systems shall be carried out at the end of the defect liability period.

# 3.6 SYSTEM DESCRIPTIONS

### 3.6.1.1 GENERAL

Provision of all downstream (of the primary hydraulic distribution board/control panel) power and control wiring associated with each hydraulic services

Supply and fix the taps and faucets as specified by the Architect

### 3.6.1.2 SANITARY PLUMBING AND DRAINAGE

Provision of a complete sewer drainage system including connection to the sewer mains connection, pipes, junctions, bends, pits, floor wastes, excavation, supports, backfilling, testing and sundry equipment required for the installation.

The sanitary drainage system will be a gravity / fully vented modified system and shall be designed and installed in accordance with the requirements of South East Water and AS3500.2:2018. Coordination and authority approval shall be carried out prior to any setting out, excavation and pipe installation taking place

1. Services infrastructure: The site has frontage to the following South East Water sewer mains:
   - **a** A 225 mm sewer main at the north and a 150 mm sewer main to the south of the site.
   - **b** New Sewer Manhole to South East Water regulations and approval in Nelson Street to take discharge from new 225mm sewer
   - **c** The sanitary drainage system shall gravitate to a connection point, via a boundary trap/inspection shaft as required by authority.

Provision of a sanitary drainage system complete with an overflow relief gully located on the ground level to provide a safe release from each connection point. Reflux valves shall be provided to drainage located below the overflow surcharge level.

Provision of a sanitary drainage and ventilation system designed for a high rise application. The drainage system shall be based upon fully vented modified and drainage system requirements to provide flexibility of the drainage installation.

Allow for all specialist  drainage for pool equipment and other ancillary areas as required

Provision of drainage turn-ups to all retail tenancy units as required for connection of the sanitary plumbing service.

Provision of points for connection of all fixtures and appliances.

Provision of floor wastes to all plant rooms, including fire services plant rooms, sized accordingly for the resultant services entering the drainage system. All equipment requiring provision for drainage shall be incorporated in the hydraulic services design.

Provision of basket trap floor wastes within bin stores/garbage rooms and loading dock areas.

Provision of drainage to lift pits

Provision of all necessary sewer pits and inspection chambers throughout the project.

Provision of tundish to Sauna / steam room steam generation plant complete with high temperature thermally insulated copper or similar material of sufficient length into a trapped floor waste of HDPE or Cast-iron construction for up to 3m beyond the trap.

Provision of all clear outs and inspection openings as required to effectively maintain all parts of the sanitary plumbing service.

Provision of all vents and air admittance valves to systems as required.

Provision of all fixture traps as required throughout the sewer drainage and sanitary plumbing system.

Provision of all pan collars as required to the sanitary plumbing system.

Provision of foaming prevention device in floor waste riser where charged by laundry tub.

Provision of all fire stop collars and approved sealants as required to ensure fire isolation to the structure.

Provision of all flexible / expansion joints as required throughout the sewer drainage and sanitary plumbing system.

Provision of testing of all sewer drainage and sanitary plumbing services to meet Authority requirements and ensure operational serviceability.

The sanitary plumbing and drainage installation shall be constructed of certified best practice uPVC pipes and fittings with solvent cement joints including expansion joints where required.

#### 3.6.1.3 TRADEWASTE DRAINAGE

Provision of a complete tradewaste drainage system including discharge to grease arrestor, pipes, junctions, bends, pits, floor wastes, excavation, supports, backfilling, testing and sundry equipment required for the installation.

Provision of coordination and authority approval from the of the tradewaste plumbing system design, prior to installation.

**1** Provision of tradewaste drainage system utilising drainage principal's system as required.

Provision of points for connection of all fixtures and appliances for fitted-out retail tenancy kitchen/cafe.

Provision of undersink and in floor dry basket arrestors within integrated fitout kitchen areas.

Provision of tradewaste turn-ups and venting allowance to all retail tenancies.

Provision of new in-ground grease arrestor (nominally 5,000L) with gas tight lids located within basement level 3 in accordance with South East Water's Trade Waste policy to serve each retail area. The arrestor shall comply with the requirements in the "Materials" section and be vented independently to atmosphere.

Provision of Ø80 suction pipeline from adjacent the grease arrestor and terminate in a truck accessible location in loading dock. Provision of male 'KAMLOK' fittings on either end of pump out line.

Provision of connection of the pre-treated wastewater from the arrestors to the sanitary drainage system

Provision of all clear outs and inspection openings as required to effectively maintain all parts of the tradewaste drainage service.

Provision of all vents and air admittance valves to systems as required.

Provision of all fixture traps as required throughout the tradewaste drainage system.

Provision of all fire stop collars and approved sealants as required to ensure fire isolation to the structure.

Provision of all flexible / expansion joints as required throughout the trade waste drainage and plumbing system.

Owing to the anticipated high temperature in the kitchen waste, HDPE pipework and fittings shall be used in the system. All pipework to be heat traced as required and must be supported along its length at intervals of 1.2m.

Grease stack vents shall be terminated to atmosphere in accordance with AS3500 requirements. Grease arrestor chamber vent shall reticulate independently to atmosphere in accordance with AS3500 requirements.

Provision of testing for all sewer drainage and sanitary plumbing services to meet authority requirements and ensure operational serviceability.

#### 3.6.1.4 STORMWATER DRAINAGE

Provision of a complete stormwater drainage system including connection to civil stormwater connection provisions and all necessary pipes, junctions, bends, pits, floor outlets, excavation, supports, backfilling, testing and sundry equipment required for the installation.

Roof water drainage will be designed and installed in accordance with the requirements of Australian Standard AS3500.3:2018, AS2180 and relevant council guidelines. The conventional and siphonic stormwater systems shall drain all roof areas, awnings balconies and terrace / podiums.

Provision of coordination and authority approval of the stormwater drainage service design, prior to installation.

1. Services infrastructure: The site shall connect to the civil stormwater connections provided:
    a. Refer to civil engineers stormwater drainage package for details of all connections

Provision of full capacity overflows to gutters, roof areas, balconies and the like to protect the building from flooding that may occur due to blockages and/or rainfall intensity that might exceed the capacity of the system.

Stormwater run-off from all trafficable surface areas shall be collected and discharged to authority stormwater infrastructure to civil engineers and local authority requirements and Australia Rainfall and Runoff, and based on the following minimum criteria:

a. Box Gutters – 1 in 100 year 5 minute storm event
b. Eaves Gutters – 1 in 20 year 5 minute storm event
c. Podium Areas – 1 in 100 year 5 minute storm event

Provision of rain water outlets and grated drains to all slabs on ground which are exposed to water run-off from vehicles.

Provision of channel drainage at each entrance/exit ramp to collect and discharge water entering the below ground car park from ground level, the channel shall be installed with **class D** horizontal bolt down grates. Channel drainage shall be located at all entrances to the building from outside which are not otherwise protected via a hob or raised surface, the channel shall be installed with **class B** heel guard / anti-slip grates.

Provision of planter outlets to all planter boxes as required and located by architect, including drainage cell layer with geotextile fabric and fit for purpose planter outlet with clearout riser to planter surface.

Provision of drainage droppers c/w grate to all spoon drains as required. All spoon drain outlets to reticulate to the stormwater pump out pit / stormwater system.

Provision of drainage as required to fire hydrant and sprinkler test/drain down facilities. The fire sprinkler valve room shall incorporate a 600x600mm annubar test sump to drain to the stormwater system sized in accordance to convey up to 150% of the fire services design flow rate in accordance with AS.2118.6.

Rainwater Harvesting Tank: Roof water and non-trafficable areas shall be collected through rain water outlets via a series of downpipes to discharge to a 40KL rainwater harvesting tank located inground at B3. The tank shall overflow into the stormwater pits beneath B3.

A first flush diverter shall be incorporated into the rainwater tank system.

The building shall be provided with a rainwater harvesting tank to be built in concrete. For details of the tank refer to the stuctural package. The installation of all flanges, sludge drains, overflows and filling valves all to comply to the local regulations. The tank shall have a minimum effective capacity of 40m³. All tank sections are to be flushed out with clean water before being brought into service.

Balcony stormwater and trafficable areas shall be collected through rainwater outlets via a separate series of downpipes to discharge to via gravity bypassing the rainwater re-use storage tank directly to the civil engineers stormwater infrastructure.

Provision of points for connection of the stormwater plumbing service to the rainwater retention tank and the on-site detention tank.

Provision of downpipes from roof rain water outlets and awnings / gutters.

Provision of gravity stormwater system to reticulate all trafficable and non-trafficable areas to the respective tanks or discharge points.

Provision of inspection openings as required to effectively maintain all parts of the rainwater plumbing service. Including bringing to surface clearouts for services cast within the depth of structure.

Provision of all fire stop collars and approved sealants as required to synthetic pipework and fittings to ensure fire isolation to the structure and to maintain the integrity of the building fabric.

Provision of all necessary stormwater pits and inspection chambers throughout the project.

Provision of all flexible / expansion joints as required throughout the stormwater system.

Provision of all reflux valves as required throughout the project.

Provision of testing of the stormwater system as described within this specification and AS/NZS3500.3.

Provision of acoustic lagging as required to meet the required noise levels.

### 3.6.1.5 DOMESTIC COLD WATER

Provision of a complete domestic cold water system including all fixtures, fittings and faucets requiring domestic cold water. Include for all pipework, bends, offsets, brackets, pumps, taps and faucets and sundry equipment required for the installation.

All water services shall be designed and installed in accordance with the requirements of South East Water / The local authority having jurisdiction and AS3500.1&4-2018.

**1** Provision of authority approval of the cold water service design, prior to installation.

Provision of all cold water service works required to obtain Developer Compliance Certificate.

Provision of a reduced pressure zone backflow prevention device for site containment on the downstream side of the cold water main authority water meter in accordance with South East Water requirements.

Services infrastructure: The site has frontage to the following South East Water water mains:

- **a** Water mains are located in Punt Road, Wellington Road and Street
- **b** Several existing water connections to be disused.

The following site connections are to be made:

2 x 150mm connections to the Wellington Road water main.

The main authority potable water meter assemblies shall be located within ground level water meter room with access from the street keyed to authority requirements. An isolation valve shall be installed on the incoming potable water service just inside the site boundary prior to any take-offs. Two (2) x 150mm automatic backwash filters c/w bypass shall be installed on the potable water service and shall be connected to the power supply.

Separate water meters connected to MDL shall be provided for the retail / tenancies areas in accordance with supply authority requirements.

Provision of automatic potable cold water top-up shall be provided to the rainwater harvesting tank on basement level 3. An RPZD backflow prevention device shall be installed on the potable cold water supply where pipes interconnect with non-potable water supply. Automatic top-up shall be initiated via tank level controllers and shall be set to operate at 10% minimum of the effective height of the tank and stop at 50% of the effective height of the tank.

Provision of 150mm blanked flanged connection from the potable cold water supply with Meter Room for extension by Fire Service contractor.

The building shall be provided with a potable water break tank sized to meet the requirements of South East Water. The tank shall be plastic type as shown on the drawings including the supply and installation of all flanges, sludge drains, overflows and filling valves all to comply to the local regulations. The tank shall have a minimum effective capacity of 3m³. All tank sections are to be flushed out with clean water before being brought into service.

One (1) triplex variable speed domestic cold water pump assembly shall be installed in the water break tank room on B3 level to provide the required flow and pressures to all levels from the break tank. Pumps shall operate as duty/duty/standby with each pump capable of 50% of the required flow and pressure. The pump set flow and pressures shall be determined by the contractor to suit the final design with appropriate pressure reduction to each branch take-off where the maximum permissible supply pressure of 500kPa is exceeded. All the pressurised pipes to be of stainless steel type.

Provision of individual control valves to control each group of fixtures and wet areas, plant, equipment and the like and as required to effectively maintain all parts of the cold water service.

All exposed control valves and exposed pipework in wet areas will be chromium plated.

Provision of points for connection of all fixtures and appliances.

Provision of pressure limiting/regulating stations on floor levels where the water pressures exceed the design limit.

Hose taps complete with backflow prevention shall be provided in the following (but not limited to) locations:

- **a** Garbage rooms
- **b** By grease arrestor c/w RPZD for grease arrestor wash down
- **c** Plantrooms
- **d** As required adjacent to the Sauna / steam room

Provision of water supply to mechanical plant. Terminate with valved branch. Extension and final termination to mechanical plant by Mechanical Services Installer

Two (2) capped off fire services provision c/w “class 35” / “Table E” flange and magflow meter, detectable double check valve shall be provided within water meter room for extension by fire services contractor.

Provision of water supply to Sauna / steam room steam generation plant complete with backflow prevention.

Provision of testing of all cold water services to meet Authority requirements and ensure operational serviceability.

Fixtures, fittings and equipment shall be provided in accordance with NatHERS requirements, see also “Water Efficiency Section”.

Metering strategy shall be as detailed in the “Metering” section.

#### 3.6.1.6 DOMESTIC HOT WATER SERVICE

Each apartment unit shall have an instantaneous hot water unit installed in allocated area in wardrobes.. All piped services to and from the HW unit to be completed by the plumber.

All hot water services shall be designed and installed in accordance with the requirements of The local authority having jurisdiction and AS/NZS 3500.1&4-2018.

1 Hot water system - Provision of a complete domestic hot water services located at each unit including all piping, fittings, supports, insulation, instantaneous type hot water heaters, valves, and other sundry items of equipment required for the installation.

Provision of tempering valves throughout the hot water system including within each unit to deliver the water to fixtures at 50°C general apartments. Tempering valve shall be located within ceiling voids and shall have an access penel located as close as possible for ease of maintenance.

Provision of thermostatis mixing valves to the hot water system to deliver the water to fixtures at 43°C for adaptable units and DDA compliant sanitary washing ablutions. Thermostatic mixing valve shall be located within ceiling voids and shall have an access penel located as close as possible for ease of maintenance.

Provision of isolation valves as required to effectively maintain all parts of the hot water service.

Provision of thermal insulation to all flow and return hot water and tempered water pipework in accordance with AS3500.4:2018 and BCA Part J requirements.

Provision of testing of all hot water services to meet Authority requirements and ensure operational serviceability

Hot water pipework and fittings will be Type A / B copper tube (dependent on required pressures) with silver soldered joints in accordance with AS3500.4:2018. All exposed control valves and exposed pipework in wet areas will be chromium plated. Alternative materials must be WATERMARK and MP52 certified and submitted for approval prior to installation.

#### 3.6.1.7 RECYCLED WATER

Provision of a complete recycled water treatment plant system and recycled water service including all piping, fittings, supports, filters, treatment devices, valves, pumps and other sundry items of equipment required for the installation.

All water services shall be designed and installed in accordance with the requirements of The local authority having jurisdiction and AS3500.1&4-2018

Provision of authority approval of the non-potable cold water service design prior to installation.

1 Provision of recycled water to the building via a rainwater harvesting tank .

Provision of a flushing device for the main runs to prevent dead legs.

Provision of a non-potable water service to supply irrigation facilities.

The recycled cold water shall be supplied via a 40,000 litre rainwater harvesting tank inground on basement level B3. Rainwater run-off from non-trafficable roof areas shall reticulate via downpipes within the building to the rainwater harvesting tank. A first flush diverter system shall be supplied upstream of the tank to reduce the amount of contaminants entering the tank. The tank shall be installed complete with level indicator. The rainwater harvesting tank shall be installed complete with a diversion valve set to the high level of the level above the civil gravity discharge pipe to allow on tank full diversion of rainwater into civil system.

One (1) duplex variable speed rainwater pump assembly shall be installed to serve the rain water tank on basement level 3 to provide the required flow and pressures to the irrigation points and amenities up to level 11 from the rainwater tank. Pumps shall operate as duty/duty/standby with each pump capable of 50% of the required flow and pressure. The pump

set flow and pressures shall be determined by the contractor to suit the final design with appropriate pressure reduction to each branch take-off where the maximum permissible supply pressure of 500kPa is exceeded.

Provision of automated filtration, UV sterilisation, (duty/standby) backwash filter set and bag filters for water treatment.

Provision of top-up to the recycled water systems from potable water supply c/w backflow prevention device and low tank level control interfaced solenoid valve (fail open). Maintain the potable cold water service system with pressure 30kPa higher than that in the non-potable / recycled water system in order to prevent the possibility of backflow.

Provision of hose taps within garbage rooms will have a backflow prevention device installed. Statutory signage shall be provided at all recycled water supply points as required indicating “RECYCLED WATER. NOT SUITABLE FOR DRINKING”. All recycled hose taps must utilise an anti-vandal handle and left handed thread. All recycled hose taps to be coloured, powder coated lilac for ease of identification.

Provision of a capped off non-potable water supply c/w reduced pressure zone device and isolation valve for irrigation purposes.

Provision of isolation valves as required to effectively maintain all parts of the non-potable cold water services and to control each group of fixtures and wet areas, plant, equipment and the like.

All exposed control valves and exposed pipework in wet areas will be chromium plated.

Provision of pressure limiting valves throughout the non-potable cold water system as required.

Provision of signage to all non-potable water supply points as required by AS3500.

Provision of all fire stop collars and approved sealants as required to ensure fire isolation to the structure.

Provision of hose-tap complete with RPZD within 5 meters of each grease arrestor location for grease removal wash down.

Provision of testing for all non-potable cold water services to meet Authority requirements and ensure operational serviceability.

Metering strategy shall be as detailed in the “Metering” section.

### 3.6.1.8 METERING

1 A system of water meters is proposed to be installed on site for all major and permanent occupant water uses allowing monitoring of cold water consumption to each of the following major water uses;

- **a** Apartments
- **b** Irrigation systems
- **c** Garbage room wash down
- **d** Recycled water supply
- **e** Potable make-up supply to Recycled water system
- **f** Spa and Sauna area
- **g** Base building amenity areas

All water meter to abse building amenity areas and commercial tenancy only are to be connected to a Meter Data Logger (MDL) and Building Management System.

### 3.6.1.9 WATER

- **a** Potable Cold Water Meters Residential

All residential potable cold water meters to be located within common water meter cupboards and shall be orientated to ensure that the meter register can be easily read without a ladder or other aids. Each meter must be securely tagged using a durable fixing, such as brass or other corrosion resistant metal, to identify the individual unit associated with the lot meter in accordance with the relevant authority's metering strategy.

**b** Water meters retail / tenancy

Capped off water provisions complete with billing meters shall be provided within each retail tenancy. All meters shall be wired to Meter Data Loggers (MDL) for remote reading

#### 3.6.1.10 WATER EFFICIENCY

Reduced water consumption is achieved through both reducing water demand through efficient fixtures and fittings and the effective monitoring of water usage through water meters.

#### 3.6.1.11 SANITARY FIXTURES, FITTINGS AND TAPWARE

Provision of all sanitary fixtures, fittings and tapware in accordance with the architectural fixture and fittings schedule

Provision of testing of all sanitary fixtures to ensure correct operation prior to practical completion.

Retain responsibility for condition and security until final handover.

Ensure all items of tapware are MP52 and Watermark approved prior to ordering.

For residential / retail tenancies, all fixtures and fittings installed shall have a minimum water efficiency labelling and standards (WELS) rating as specified below:

| FIXTURE | RATING | DETAILS |
|---|---|---|
| **Toilet** | 4 Stars | < 4.5/3 Litre per flush |
| **Basins** | 6 Stars | < 6 litres / min |
| **Kitchens** | 5 Stars | < 7 litres / min |
| **Showers** | 3 Stars | < 7.5 Litres / min |

## 3.7 SHOP DRAWING AND CONSTRUCTION DRAWING REQUIREMENTS

Prepare and submit dimensioned drawings showing details of the fabrication, layout and installation of all plant and equipment, including relationship to building structure and other services.

Prepare and submit drawings of penetrations and "built-in" components in the same form and manner as described for the processing of shop drawings. All penetration measures shall relate to grid lines, co-ordinates or relative levels.

Submit co-ordinated penetration drawings in sufficient time for review. Any failure to submit requirements within sufficient time for revision of structural drawings, resulting in re-working of the structure or re-ordering of structural components shall be responsibility of Contractor and shall not constitute any claim for variation or delay. All penetration measures shall relate to grid lines, co-ordinates or relative levels.

Provide drawings generally in accordance with the design drawings supplied with this specification.

Sheet sizes: Standard metric series, all sheets the same size. Plant room layout plans 1:50 scale, with sections and details at 1:20 scale. All services Floor plans at 1:100 scale, with detailed sections.

Drawings:

1 Access to and removal of all plant including locations and sizes of access doors to be installed in finished building surfaces.

Schematic and layout drawings of piping, tray and conduits, electrical and controls.

Switchboard and control panel layouts and schematics with terminal numbering.

Locations of all control sensors, valves and actuators.

Detail of all interfaces with other services and utilities.

Services co-ordination drawings for spatial co-ordination with building structure and other services with details for restricted locations.

Control logic diagrams with settings.

Foundations, plinths, chases, ducts, pits and penetrations through structure.

Layout and details of services cast in concrete. (for co-ordination and review by structural engineer /architect)

Structural support details and methods of fixing to structure.

Construction loadings (for structural engineer review).

Lifting point loads. (for structural engineer review)

Maintain current sets of drawings on site and progressively record variations which lead to creation of as-built drawings.

Please note when shop drawings review comments states “satisfactory subject to comments”, resubmit the revised drawings with comments incorporated within a period of no longer than 2 weeks. However, this should not stop the installation works.

## 3.8 SITE PROVISIONS & BUILDING WORKS IN CONNECTION

1 This clause is provided to highlight the project requirements in relation to the Site provisions as well as Building Works in Connection BWIC and to ensure that they have been allowed for part of the Contractor Tender submission. The Contractor is responsible for demarcation of tasks and responsibilities between various trades in relation to these items to suit his/her delivery methodology.

Site Provision include but not limited to;

a Hoisting and Lowering:

Scaffolding:

Temporary Services – Water, Electricity:

Site facilities including Sheds.

Power & Fuel for Testing and Commissioning.

### *3.8.1 BUILDING WORKS IN CONNECTION*

Allow for the following;

1 Demolition:

- a Services decommissioning, disconnection from supply, capping and sealing.

Services demolition and removal.

Ground Works: Services trenches; excavation and backfilling.

Concrete:

- a Chasing, coring, cutting and making good.

Placing, casting in and protection of pipe sleeves and conduits.

Bases and plinths for equipment (excluding galvanised steel edge surround to be provided as part of the Hydraulics Services Works Package).

Water-proof curbs round floor penetration in plant rooms.

Masonry:

- a Chasing, coring, cutting and making good.

Plant enclosures, masonry air ducts and service risers.

Structural Steel:

- a Lifting beams.

Platforms and walkways for maintenance to equipment.

Roofing:

- a Openings and under flashings including over flashings

Services works.

Roof access walkways.

External Walls

- a Setout of cut-outs including cut-out and trimming of openings

Internal walls

- a Setout of cut-outs including cut-out and trimming of openings

Doors:

- a Cut-outs in doors and trimming of openings

Undercutting of doors for ventilation purposes.

Access doors and hatches for maintenance of Services equipment.

Ceilings:

- a Removal and replacement of ceiling tiles.

Co-ordination of penetrations.

Ceiling access panels to equipment, valves, dampers and duct access panels above solid ceilings.

Sealed air Plenums for smoke exhaust systems.

Dry wall/ Plenum Construction

- a Sealed air plenums for supply and exhaust systems where show on the drawings, including fire rating and thermal insulation where required.

Co-ordination of penetrations.

Vapour barriers within walls where required.

25mm thick waterproof ply supports for sanitary fixtures on dry wall construction.

Access doors and hatches for access to hydraulic equipment.

Bollards and mechanical protection to pipework, stacks and equipment.

Roof, Gutters, Gutter Sumps, Gutter outlet and external downpipes.

Supply and installation of waterproof membranes in all wet areas.

Set out of building grids to allow set out of core holes.

Supply and install all roof/parapet/balcony overflows.

All in-situ concrete sumps and grated drains (grates and frames to be supplied and installed part of the Hydraulics Works Package) that form part of the structural slab.

Concrete pump plinths. Note: Metal forms to be provided part of the Hydraulics Works Package.

Fire hydrant and fire hose reel cupboards and necessary signs.

Fire hydrant service and sprinkler service booster valve cupboards and signage.

Pipe penetration guards for pipes in carpark

## 3.9 SERVICES INTERFACE WORKS

Contractor is responsible to carry out the works outlined under all contract documents including this Specification to achieve a fully operational installation including all required interfaces between various systems. Whilst the responsibilities for interface works and division of works is solely with Contractor the following information is provided for guidance only. Contractor has full control to alter and modify the trade allocation/demarcation of interface works to suit the Contractor's overall programme and delivery methodology in order to achieve a fully integrated, interfaced and operational whole services installations, systems and sub-systems.

Table below indicate key areas where different work packages will interface with each other. Column 1 indicate the disciplines/work packages identified and column 2 & 3 outline the key interface works between these two work packages.

| | DISCIPLINE 1 | DISCIPLINE 2 |
|---|---|---|
| **Hyd1 / Mech 2** | — Provision of HLI or LLI for generating status of equipment on BMS for (See table below)<br>  — Pump Control panels LLI<br>  — Meters HLI,<br>  — Level Sensors LLI<br>  — Tanks level sensors<br>  — Valves status<br>— Coordinate location and provision of open end tundishes for all mechanical equipment | — BMS cabling from Water meters and other BMS monitoring switchboards/control panels/tanks locations back to BMS controllers and specific BMS graphic screens to demonstrate facilities water metering and consumptions in logical subdivisions<br>— Connection of mechanical drains from equipment to tundishes.<br>— Extension from valved branches and final connections of water supplies to mechanical equipment e.g. cooling towers, boilers |

| | DISCIPLINE 1 | DISCIPLINE 2 |
|---|---|---|
| | — Provision of water supply to mechanical plant. Terminate with valved branch. | — Provision of sensor cabling from connection box outside of lift pits to the BMS. |
| **Hyd1/ Elec 2** | — Coordinate for final hydraulic equipment selections the maximum for each hydraulic switch panel or DB to ensure correct submain cable selections for the respective hydraulic switch panel and DB prior to installation of submains.<br>— Provision of sub-mains for hydraulic switchboards and final sub-circuit isolators to hydraulic plant. Terminations by Hydraulic contractor. | — Coordinate and advise after final equipment selections the maximum demand for each hydraulic switch panel or DB to ensure correct submain cable selections for the respective switch panel and DB<br>— Provision of all lugs, cable glands and gland plates for submain terminations and provision of final connections of submains to all switch panel and DBs |
| **Hyd1/ Pool2** | — Provision of potable water to pool plant room | — Coordinate the tundish and floor waste connection locations and final discharge rates<br>— Confirmation of flow and pressure requirements to plant room |
| **Hyd1 /Fire 2** | — Provision of Grade 2 water supply to site consisting 2 x 150 DN tappings to the Towns Main and required metering assemblies terminated with flange or R.G. cap within the Water Meter Room.<br>— Provision of isolating valves complete with electronic monitoring devices (Class A) on incoming fire protection water supplies.<br>— Provision of flanged overflow drain pipework in Fire Pumproom for each of the 2 fire tanks and drain pipework underneath.<br>— Provision of drain to each of the 2 Fire Tanks.<br>— Provision of floor waste drain to Fire Pump room.<br>— Provision of 50 DN floor waste drain to the Fire Brigade Suction & Boosters cupboard (drainage shall be suitable for pressure by booster assembly bleed valve). | — Provision of wiring and connection to the Fire Indicator Panel of isolation valve monitoring devices on nominated valves (valves associated with fire protection water supplies)<br>— Extension from capped water supply to fire protection system.<br>— Provision of extension of water supply from demarcation points to the fire protection systems.<br>— Connectionof fire drains from equipment to tundishes |
| **Hyd1/Civil2** | — Reticulation of RWHT overflow to civil stormwater pit/pipework<br>— Reticulation of potable break tank overflow to civil stormwater pit/pipework | — Provision of site stormwater services including:<br>— Surface drainage<br>— On-site detention<br>— Surface stormwater drainage |

| | DISCIPLINE 1 | DISCIPLINE 2 |
|---|---|---|
| | | — Overland flow paths suitable to ensure no flooding impact on buildings<br>— Capped stormwater provisions for future connection of building stormwater plumbing and drainage |
| **Hyd1/Landscape2** | — Provision and co-ordination of sub-metered/valve and capped off water provisions complete with backflow prevention device for landscape contractors extension to planter areas.<br>— Provision and co-ordination of planter box drainage outlets to each planter box as required | — Provision of site irrigation service including:<br>— Automatic irrigation extending from termination points provided by hydraulic contractor |
| **Hyd1/Struture2** | — Provide details of blockouts required<br>— Co-ordiante penentrations with post tension strands and reo<br>— Provide details of plant weights for structural acceptance | — Review plant weights.<br>— Review hydraulic block outs and penetrations for acceptance. |
| **Hyd1/Geotech2** | — During excvation coordaite with geotech engineer and validate levels of sub soil water ingress | — Provide updated information in relation to flow rates / ingress of sub soil water |
| **Hyd1 /VT2** | — Provision of drainage sumps Inspection opening to surface in lift pits as required. Manual pump out as required | |

The BMS interface works shall include points and electrical wiring from the following:

| ITEM | LOCATION | SIGNAL TYPE | INPUT / OUTPUT | NUMBER |
|---|---|---|---|---|
| Stormwater pump | Basement 3 | Failure (digital) | Output | 2 |
| Stormwater pit | Basement 3 | High level alarm (digital) | Output | 1 |
| Sewer pump | Basement 3 | Failure (digital) | Output | 2 |
| Sewer pit | Basement 3 | High level alarm (digital) | Output | 1 |
| Cold water booster pump | Basement 3 | Failure (digital) | Output | 3 |
| Rainwater tank | Basement 3 | Low level alarm (digital) | Output | 1 |
| Rainwater pump | Basement 3 | Failure (digital) | Output | 2 |
| Water meter – Master | Ground Meter Room | Pulse (digital) | Output | 1 |
| Water meter – Retail Tenancies | Ground Retail | Pulse (digital) | Output | 2 |
| Water Meter – Amenities (Common Areas) | Hydraulic Riser | Pulse (digital) | Output | 5 |

# 4 DESIGN AND PERFORMANCE CRITERIA

## 4.1 GENERAL

The following standards are applicable throughout the project.

1 National Construction Code (2016) (referred throughout this specification as NCC) including all relevant Australian Standards called in the NCC

National Construction Code (NCC) Part 3 – Plumbing Code of Australia (PCA)

Relevant Occupation/Workplace Health and Safety legislation

The Environmental Protection Authority

Workcover

Any other Authority having jurisdiction over all or part of the installation to ensure that the equipment and installation, when manufactured and installed, will comply with the rules and regulations.

1 AS/NZS 3500.1:2018 Plumbing and Drainage Part 1: Water Services

AS/NZS 3500.2:2018 Plumbing and Drainage Part: 2 Sanitary Plumbing and Drainage

AS/NZS 3500.3:2018 Plumbing and Drainage Part: 3 Stormwater Drainage

AS/NZS 3500.4:2018 Plumbing and Drainage Part 4: Heated Water Services

South East Water Corporation;

City of Melbourne Council;

VIC Department of Health,

The Hydraulic Services shall be to the approval of all local Authorities having Juridiction

The following standards are applicable throughout the project as a minimum. Where items of equipment are required the relevant Australian Standard to the equipment will apply. If clarification required contractor shall seek clarification at the time of tender.

Where Australian Standards and Codes do not exist, the appropriate British Standard or Code shall apply.

## 4.2 SEISMIC RESTRAINTS

### *4.2.1 DESIGN STANDARD*

1 NCC - Building Code of Australia.

AS1170.4 - Structural design actions - Earthquake actions in Australia

### 4.2.2 DESIGN PARAMETERS

The following design parameters shall be used to design the Engineering Services equipment and fastenings as per AS1170.4:

| | |
|---|---|
| **Importance Level** | TBA |
| **Site Sub-Soil Class** | TBA |

Design and install the scope of works to withstand the earthquake forces determined from the above design criteria in accordance with the requirements of the BCA and AS1170.4.

## 4.3 DESIGN CRITERIA

| ITEM | AUSTRALIAN STANDARDS | DESIGN CRITERIA | |
|---|---|---|---|
| **Water Supply** | AS/NZS 3500.1 Water Services | To local Water Authority Standards<br>In accordance with AS 6400 – Water Efficient Rating and Labelling<br>Plumbing Code of Australia | |
| Supply Conditions | | Max Water design velocity within Building | 2.1 m/s |
| | | Max pressure at any outlet | 500 kPa |
| | | Min pressure at any outlet | 250 kPa |
| Pipe sizing design criteria - Hot & Cold | Australian Standard 2200 | The Institute of Plumbing Australia<br>(*Selection and Sizing of Copper Tube for Water Piping Systems. B Smith*) | |
| Outlets | AS1428.1<br>Design for Access and mobility | WaterMark ™ | |
| Water conservation measures | AS 6400 | Water Efficiency Labelling and Standards (WELS) Scheme | |
| **Heating Hot Water** | AS/NZS 3500.4 Heated Water Service | To Local Authority Standards | |
| Supply Conditions | | Max personal hygiene delivery temp | 50°C |
| | | Max personal hygiene delivery temp for aged, sick, children or people with disabilities | 42°C |
| | | Max allowable flow velocity (circulatory) | 1.1 m/s |
| | | Max allowable flow velocity (other) | 2.1 m/s |
| | | Max temp loss through circulatory system | 5°C |
| | | Max wait time for hot water an any outlet | 10 sec |
| Heated water temperature control | AS/NZS 3500.4 Heated Water Service | To local Authority Standards | |

| | | | |
|---|---|---|---|
| | | | |
| **Sanitary** | AS/NZS 3500.2<br>Sanitary Plumbing and Drainage | To local Authority Standards | |
| General Discharge Conditions | | All sanitary drainage to discharge off site via authority sewer connections. | |
| Drainage Systems | | The drainage system shall be designed to allow the removal of foul gases to atmosphere via an open vent pipe<br>A barrier or water seal shall be maintained at each fixture to prevent foul gases entering the building environment. | |
| Sanitary pump Stations | | Type | Duplex submersible pumps |
| | | Tank level monitoring | Via ultrasonic sensors calibrated for effluent level (%) |
| | | Tank level warnings | High level |
| | | Emergency storage | Min 1 hour at peak inflow |
| | | Pump duty | Duty/standby |
| | | Pump Level Control | — Duty pump stop<br>— Duty pump start<br>— Standby pump start<br>— High level alarm |
| **Trade waste** | AS/NZS 3500.2<br>Sanitary Plumbing and Drainage | Trade waste drainage to the Local Authority requirements. Sewer Waste Characteristics including<br>— Hydrocarbon based product<br>— Fats Oils and Grease (FOG)<br>— BOD,<br>— TSS<br>— pH<br>shall be treated or removed to approved Local Authority limits | |
| **Stormwater** | AS/NZS 3500.3<br>Stormwater Plumbing and Drainage | To local Authority Standards<br>The stormwater installation to cater for the Annual Rainfall Intensity (ARI) for the site | |
| Stormwater pump stations | | Type | Duplex submersible pumps |
| | | Tank level monitoring | Via ultrasonic sensors calibrated for effluent level (%) |
| | | Tank level warnings | High level |

| | | | |
|---|---|---|---|
| | | Emergency storage | Min 1 hour at peak inflow |
| | | Pump duty | Duty/standby |
| | | Pump Level Control | — Duty pump stop<br>— Duty pump start<br>— Standby pump start<br>— High level alarm |

The above general design criteria are basically the deemed to satisfy criteria and shall be where required amended to suit the final Fire Safety Engineering Report.

## 4.4 ACOUSTIC

| PARAMETER | DESIGN CRITERIA |
|---|---|
| Maximum Noise Levels | Refer to Acoustic consultants Schedules / project specific requirements |

## 4.5 VIBRATION

| PARAMETER | DESIGN CRITERIA |
|---|---|
| Maximum Vibration Levels | Tactile structure vibration levels due to plant not to exceed the lower end of the range specified in AS 2670.2. |

## 4.6 SUSTAINABILITY RATING SYSTEMS REQUIREMENTS

Refer to separate “ESD Brief” document which outlines the compliance requirements to achieve a Green Star 5-star Design & As-Built v1.2 benchmark committed to through the Town Planning Process for this project.

# 5 PAINTING, PROTECTION AND IDENTIFICATION

## 5.1 GENERAL REQUIREMENTS

1 Select painting and finishes in accordance with the area environmental conditions.

Review the risk assessment and statutory and authority requirements completed as part of the system testing, commissioning and handover requirements and provide labelling and signage as determined.

Where exposed to view paint exposed equipment, cable trays, ductwork and pipework

Where ductwork, pipework, cable trays exposed to view is not specified to be painted, all factory and installation markings shall be removed.

All black steel surfaces and surfaces subject to corrosion shall be primed with at least two coats of primer and protected.

Protect all items of work during dispatch and whilst on site during progress of installation.

Fabricated pipe and steelwork shall be delivered to site prime coated

Concealed pipe work to be prime coated

If exposed to view, paint new services and equipment including in plant rooms, except chromium, anodised aluminium, GRP, UPVC, stainless steel, non-metallic flexible materials and normally lubricated machined surfaces. Repaint proprietary items only if damaged.

Do not combine paints from different manufacturers in a paint system.

Remove or protect fixtures, equipment, surfaces and labels before starting to paint, and re-instate after completion of painting.

All internal surfaces of air outlets and openings exposed to view shall be painted matt black

Repair factory finishes if damaged with identical finishes.

Finish visible joints made by welding, brazing or soldering using methods appropriate to the class of work (including grinding or buffing) before further treatment such as filling, painting, galvanising or electroplating.

If galvanised surfaces have been cut or welded after galvanising, prime the affected area using zinc rich organic binder AS/NZS 2312.

Before applying coatings to metalwork, complete cutting, drilling and other fabrication, remove all grease, oil and other contaminants and prepare surfaces to AS 1627.0

Use relevant Australian Standards for the following finishes; Galvanising, Electroplating, Anodising, Thermoset powder coating, Two-pack liquid coating, Air-drying enamel, Stoving enamel

## 5.2 SUBMISSIONS

1 Provide the following submissions or samples:

Proposed Labelling Systems.

Schedule of statutory, maintenance and operating signage.

Valve Identification

### 5.2.1 PROTECTION FOR STEEL SURFACES

Apply corrosion protection to meet the performance criteria scheduled in the table below.

1 Standards of surface preparation procedures and of corrosion treatments are to meet the specified criteria and the referenced Standards/Codes for the relevant application.

2 Surface preparation procedures and coating systems for corrosion protection are to meet all relevant requirements of the referenced Standards/Codes.

### 5.2.2 PROTECTION FOR NON FERROUS METALLIC SURFACES

Standards of surface preparation procedures and of corrosion treatments are to meet the specified criteria and the referenced Standards/Codes for the relevant application.

3 Surface preparation procedures and coating systems for corrosion protection are to meet all relevant requirements of the referenced Standards/Codes.

## 5.3 PAINTING

### 5.3.1 LOW VOC

The following additional requirements are to be met if required by the Green Star Schedule in Schedules.

1 All painted surfaces to use low-VOC paints.

VOCs are to be in accordance with The Australian Environmental Labelling Association, Inc. Standard No: AELA 23-2005 ‘Australian Voluntary Environmental Labelling Standard Architectural and Protective Coatings’. Conformance with VOC levels listed in this standard (refer to table below) shall be demonstrated by providing test reports from laboratories accredited to carry out the relevant tests and/or calculations and appropriate documentation of production methods and quality controls.

| PRODUCT TYPE | MAXIMUM VOC CONTENT (G/LITRE) |
|---|---|
| Latex Primer for galvanised iron and zincalume | 60 |
| Exterior latex undercoat | 55 |
| Interior latex undercoat | 65 |
| Interior gloss | 75 |
| Interior semi-gloss | 16 |
| Exterior gloss | 75 |

VOC limits on architectural coatings covered. Allowable levels include water content in the formulation.

For solvent-based coatings the paint shall not contain VOCs in excess of 200g/litre. For recycled paints the VOC level (averaged across batches) in the paint must not exceed 100g/litre.

The VOC content of the paint shall either be calculated from the VOC data for each of the raw materials or, experimentally by ASTM D3960, as qualified the Australian Environmental Labelling Association, Inc. Standard No: AELA 23-2005 ‘Australian Voluntary Environmental Labelling Standard Architectural and Protective Coatings’.

Where the raw material is a mixture of compounds, some of which contain VOCs, the VOC content of the mixture may in turn be calculated from the VOC content of the individual components. Where this is not known, it must be determined by the methodology detailed in AELA 23-2005.

### 5.3.2 PREPARATION OF SURFACES

1 Preparation: all surfaces shall be prepared by thorough cleaning of all dirt, grease, scale, welding flux and corrosion in accordance with AS/NZS 2312.

For galvanised surfaces that have been subsequently cut or welded, prime the affected area with organic zinc rich coating for protection of steel to AS/NZS2312, two pack or accepted alternative.

Prime/undercoat all surfaces. Galvanised and non-ferrous surfaces must be etch primed.

### 5.3.3 APPLICATION

1 First coat: apply the first coat immediately after the substrate preparation and before contamination of the substrate can occur.

Apply all paint systems in strict accordance with manufacturer's recommendations.

Finish: each coat of paint or finish shall be uniform in colour, gloss, thickness and texture and free of runs, sags or blisters.

### 5.3.4 FINISHING

1 Concrete Bases: 2 coats synthetic emulsion paint

Equipment Panels/Switchboards: 2 final coats full gloss enamel

Equipment: Factory spray application

Other surfaces: 2 final coats full gloss enamel

## 5.4 COLOURS

Paint colours nominated are to be in accordance with AS 2700 and AS 1345.

## 5.5 IDENTIFICATION AND LABELLING

### 5.5.1 GENERAL

1 Mark all systems and equipment including wiring, piping, control panels, switchboards, ductwork, equipment cabinets, conduits, controls, gauges, valves and fittings to that they are readily identifiable.

Equipment requiring special maintenance procedures or presenting occupational health and safety hazards: provide permanent labels complying with statutory requirements.

Locate labels so that they are easily seen and either attached to, below or next to item referred.

Labelling to match installation documentation schedules.

For systems containing hazardous materials provide labelling in accordance with AS 1318.

Where a pipe or duct passes through a wall, slab or partition provide labelling each side.

Equipment and Service labels shall be in accordance with the Legend of Symbols nomenclature for the respective service. Provide appropriate Emergency and Operating Instructions to every equipment and system.

Provide text and simple diagrams where practicable. Locate at a fixed point and point of operation.

Affix hazardous equipment with warning signs.

Labels shall be permanent.

Type: select from the following:

a Engraved and black filled lettering on stainless steel or brass plate, minimum 1mm thick mechanically fixed.

Stencil with black or white lettering contrasting with background.

Engraved two-colour laminated plastic mechanically fixed.

Adhesive labelling.

Painted.

Adhesive labels and laminated plastic labels shall not be used where exposed to the environment.

Painted labels shall be in the same finish paint type as the installation.

### 5.5.2 LABELLING REQUIREMENTS

| ITEMS | REQUIREMENTS |
|---|---|
| **Pipework (Hyd)** | Labelling and lettering to AS 1345 and AS1318 |
| **Valves** | Labels shall be colour coded laminated labels indicating service, function and normal position, and attached to hand wheels or spindles using a vandal resistant permanent chain/ring |
| **All equipment such as chillers, pumps, fans, air handling units, generators including controls, gauges and fittings to that they are readily identifiable** | — Label in accordance with the specification abbreviations, symbols and acronyms scheduled or otherwise approved.<br>— Locate labels so that they are easily seen from normal access adjacent to the item being marked. Do not install labels on components normally removed or replaced.<br>— Major equipment nameplates: 40mm.<br>— Minor equipment nameplates: 20mm.<br>— Danger, warning and caution notices: 10mm for heading, 5mm for test.<br>— Warning notices: 7mm.<br>— Minor lettering: 3mm.<br>— Lettering Style: Helvetica Medium.<br>— Fixing: Use mechanical fixings. Do not penetrate isolation vapour barriers.<br>— Equipment requiring special maintenance procedures or presenting occupational health and safety hazards: provide permanent labels complying with statutory requirements.<br>— Equipment requiring consumables including replacement belts, oils, filters and strainers: provide labels indicating consumable component details and quantities and corrective maintenance trigger point such as filter pressure drop. |

# 6 INSPECTION, TESTING, COMMISSIONING, HANDOVER AND DEFECTS LIABILITY PERIOD

## 6.1 GENERAL

1 This section sets out the engineering and quality assurance requirements for the completion of the installation, inspection regime, testing, commissioning, handover and defects liability period.

### *6.1.1 DESIGN*

Complete the detail engineering of the testing commissioning and handover of the works to the specified requirements.

Comply with applicable authority design guidelines and codes of practice and requirements.

As a guide, commissioning guidelines as detailed by CIBSE Commissioning Codes shall be used as a minimum to undertake the commissioning of services listed in this section.

### *6.1.2 STANDARDS & GUIDELINES*

Refer to Design and Performance Criteria section

### *6.1.3 PRACTICAL COMPLETION REQUIREMENTS*

1 Notwithstanding any other provisions of the Contract with regard to the granting of Practical Completion, the following requirements, listed in order of importance / priority, shall be completed and completion submissions made prior the date of Practical Completion:

Minimum submissions required for application for Occupancy Permit:

Submission of signed off testing and commissioning schedules to confirm that Testing and Commissioning has been finalised and that all plants and systems operate in a safe, stable and automatic manner under all conditions of full and partial load - full commissioning data.

Submission of Authority approvals including Statutory Authority approvals and Certification of Compliance with the NCC

Submission of Certification that works comply with the Contract Documents

Operating Instruction and Maintenance manual sections covering all Safety Services as required by regulations

Other submissions:

Submission of correctly and completely executed ITPs including test results completed in accordance with the Contractor Quality Plan and the satisfaction of the Consultant Engineer

Adequate training and instruction of the Principal's representatives in safe operation of the plant

Official Equipment manufacturer's acceptance certification for the installation

Completed Operating and Maintenance manuals and 'as built' drawings

The Defects Liability period may be extended in the event:

a Specific systems fail to achieve the desired outcomes after two attempts are made to rectify the drawback. These specific systems include those that are fire and life safety or business / mission critical to the Principal.

If there have been more than three (3) attempts to rectify the defect, in which instance a further 12 months of monitoring will be required after the defect is rectified to monitor that the desired outcomes are achieved without further shortfalls.

## 6.2 PRACTICAL COMPLETION REQUIREMENTS

1 Notwithstanding any other provisions of the Contract with regard to the granting of Practical Completion, the following requirements, listed in order of importance / priority, shall be completed and completion submissions made prior the date of Practical Completion.

Minimum submissions required for application for Occupancy Permit

Submission of signed off testing and commissioning schedules to confirm that Testing and Commissioning has been finalised and that all plants and systems operate in a safe, stable and automatic manner under all conditions of full and partial load - full commissioning data.

Submission of Authority approvals including Statutory Authority approvals and Certification of Compliance with the NCC

Submission of Certification that works comply with the Contract Documents

Operating Instruction and Maintenance manual sections covering all Safety Services as required by regulations

Other submissions:

Submission of correctly and completely executed ITPs including test results completed in accordance with the Contractor Quality Plan and the satisfaction of the Consultant Engineer

Adequate training and instruction of the Principal's representatives in safe operation of the plant

Official Equipment manufacturer's acceptance certification for the installation

Completed Operating and Maintenance manuals and 'as built' drawings

The Defects Liability period may be extended in the event:

a Specific systems fail to achieve the desired outcomes after two attempts are made to rectify the drawback. These specific systems include those that are fire and life safety or business / mission critical to the Principal.

If there have been more than three (3) attempts to rectify the defect, in which instance a further 12 months of monitoring will be required after the defect is rectified to monitor that the desired outcomes are achieved without further shortfalls.

## 6.3 MANAGEMENT OF INSPECTION, TESTING, COMMISSIONING, HANDOVER AND DEFECTS LIABILITY PERIOD COMMITMENTS

### *6.3.1 GENERAL*

1 Manage the whole process so as to

a Ensure complete execution of Project Specific Quality Plan and specifically Installation and Commissioning ITPs are completed progressively from commencement of the project.

Test and verify the operation of individual items of plant and equipment, sub-systems, systems and the overall installation including the interfaces with other building services systems forming part of the project.

Create and record accurately and verify all "As Built "drawings progressively prior to services being concealed by construction of ceilings, wall cavities and shafts.

Ensure completed Operating and Maintenance manuals inclusive of comprehensive system descriptions, operating modes and associated control functionality, tailored and project specific manufacturers literature.

Responsive defects rectification process during the construction phase as well as post Practical Completion during Defects Liability Period.

Ensure Responsive approach towards maintenance and operational fine tuning during the Defects Liability Period

### 6.3.2 SEQUENCE OF ACTIVITIES

Generally, follow the sequence of activities listed below. Modify to suit specific requirements of the project however no reduction of scope is allowed.

1 Submission of Project specific Project Quality Plan including generic and project Specific ITPs within the first quarter of the project programme after site possession.

Ongoing inspection of installation works by relevant Quality Manager and/or his nominated staff for meeting project quality requirements including preparing Inspection reports (listing all observed installation defects) not longer than fortnightly and also checking that all Installation ITPs are signed off.

Initiate Safety in Design process and documentation where applicable

Evidence of adequate commissioning programme allowance in construction programme.

Production and submission of commissioning Inspection and Test Plan (ITP) 12 weeks after site possession

Amendment to ITP as necessary and re-submission at least 1-2 weeks after the original submission.

Submission of controls manufacturer's functional descriptions elaborating on the methodology proposed to implement the requirements of the control strategies the manufacturer's controls functional descriptions shall be prepared and submitted at least 12 weeks prior to start of installation and commissioning of controls systems.

Nomination of those to be involved in commissioning including individuals with responsibility for management, engineering and field testing and commissioning.

Liaison with and briefing of Authorities to ensure that the connection to their assets and commissioning procedures and resultant data provided for their approval is consistent with their requirements and records.

Preparation of periodic (minimum monthly) progress reports on testing and commissioning.

Early and active engagement of Independent Commissioning Agent ICA where applicable.

Early (within the first quarter of the project construction programme) submissions of Operating and Maintenance Manual (for Safety Services and, for preliminary draft of the overall manual). Confirmation of acceptance of proposed Electronic Operating and Maintenance Manual software/platform.

Submission of detailed commissioning procedures for review by the Consultant Engineer. Submission shall be made early, at least 12 weeks prior to the commencement of commissioning when the project construction period greater than 12 months, or 6 weeks when the project construction period is less than 12 months' duration.

| EXPECTED PROJECT DURATION (UP TO PC) | SUBMISSION REQUIREMENT | RE-SUBMISSION REQUIREMENT. |
|---|---|---|
| 8 weeks | Prior to Week 1 or Prior to commitment of work whichever the sooner. | Within 3 days. |
| 12 weeks | Prior to Week 1 or Prior to commitment of work whichever the sooner. | Within 5 days |

| EXPECTED PROJECT DURATION (UP TO PC) | SUBMISSION REQUIREMENT | RE-SUBMISSION REQUIREMENT. |
|---|---|---|
| 16 weeks | Prior to Week 2 or Prior to commitment of work whichever the sooner. | Within 5 days |
| 20 weeks | Etc. | Within 5 days |
| 24 weeks | | Within 10 days. |
| 9 months | | Within 10 days. |
| 12 months + | | Within 10 days. |

Rectification of all defects likely to interfere with testing and commissioning.

Commencement of "As Built" drawing production

Carryout preliminary commissioning including pre-commissioning procedures until achievement of correct operation and performance. Providing statement that the pre-commissioning activities for each system are completed.

Testing and commissioning of major plant and equipment, complete systems, interfaces between systems and finally all systems which interact together under normal or emergency conditions.

Integrated testing and commissioning of multi systems (including multi-disciplinary systems) and their associated interfaces

Inclusion of all completed Commissioning ITPs in the Operating and Maintenance Manual.

Rectification of any further defects and deficiencies found during testing and commissioning.

Provide notification of completion of remedial work in sufficient time to permit re-inspection as necessary before the intended date for re-testing.

Repetition of sequence of activities as necessary until works comply with acceptance criteria as set out in the ITPs.

Final handover of Final Operating and Maintenance Manuals

Certification that works comply with the Contract Documents and with the NCC and Statutory Authorities and are ready for granting of Practical Completion.

### 6.3.3 SUBMISSIONS

Required submissions include but not limited to the following;

1 Installation and commissioning Inspection and Test Plans ITPs. 4 Copies of ITPs to be supplied, 3 bound into Installation Manuals and 1 bound separately

Evidence of periodic (weekly) Quality Inspection/defects reports

Testing and commissioning procedures including integrated commissioning procedures.

Evidence of Safety in Design process during the construction phase is completed where applicable

Evidence of currency of calibration of equipment to be used in commissioning procedures.

Records of all pre-commissioning checks and final commissioning data. All records/data to be certified as being conducted in accordance with agreed and approved procedures.

Manufacturers' certificates for all proprietary items, to confirm that the installation complies with their installation and maintenance requirements prior to start-up of equipment. Certificates shall also be provided at commencement of equipment installation to confirm their requirements with respect to installation are being provided for.

Manufacturers' test certificates of all capacity/performance verification checks carried out at factory prior to dispatch to site.

Accurate and verified (by QA manager) "As Built" drawings

Complete Operating and Maintenance Manuals (Electronic system/package and, unless instructed otherwise, hard copies)

Warranties

Maintenance Plan and Schedules following acceptance of technical submission and installation minimum 4-8 weeks prior to Practical Completion with priority with respect to timely completion given to plan and schedules covering Safety Services.

### 6.3.4 INSPECTION AND TEST PLANS

**1** Inspection and test plans are to be prepared specifically for the project but may be based on or customised from generic ITPs. All commissioning result forms shall be completed, including the following:

| | |
|---|---|
| Tested by: …… please print | Witnessed by: …… |
| Signed:<br>…… | Signed:<br>…… |
| Date:<br>…… | Date:<br>…… |
| Test Device used:<br>…… | |
| Serial number:<br>…… | |
| Date of Calibration:<br>…… | |
| Method of Testing:<br>…… | |

List acceptance criteria for each element and sub-element of the installation in ITPs. Acceptance criteria to include:

**a** Specification details in regard to materials, construction methods, physical requirements, performance and operational requirements.

Schedule of Technical Data in respect of make, model and performance details of equipment.

Shop drawings.

Control logic and diagrams.

Authority inspection and testing requirements.

References to specific clauses of this Specification for acceptance criteria

### 6.3.5 COMMISSIONING INSTRUMENTATION

**1** All instrumentation used in the commissioning of the installation shall be managed in accordance with the requirements of AS 3912 or NEBB.

Reference instruments are to be NATA certified.

All commissioning results to include instrument calibration documentation.

### 6.3.6 COMMISSIONING PERSONNEL

1 Provide only qualified registered / licensed personnel specific to the trades as required by local regulations, and where regulatory requirements do not apply, personnel certified by appropriate industry bodies.

Submit a schedule of key commissioning personnel together with their qualifications prior to undertaking commissioning activities on site.

## 6.4 TESTING & COMMISSIONING

### 6.4.1 PRE-ENERGISATION TESTS

Prior to energisation of any system with electrical connections, conduct the following tests:

1 Tightness of screwed and bolted connections.

Physical integrity.

Motor rotation.

Insulation resistance tests.

Test operation of all trips, interlocks, motor driven devices, contactors and control circuits and devices by instigating or simulating inputs.

### 6.4.2 TESTS

Include the following in testing of installation:

1 Pump installation including all pump controls and interfaces.

Backflow prevention devices

Ultra Violet disinfection plant

Bag filters.

BMS interface where required

Water meters and interface to the BMS, as per Green Star requirements

Thermostatic valves

Tapware operating satisfactorily.

Downpipe/overflow, planter drains, waste and drain systems clear of blockage.

Plastic inspection opening covers have been replaced with final chrome plated brass covers.

Sanitary and Stormwater pump station chamber and pump level indicators, check control panel and offline power interface

Sanitary plumbing-Provide a hydrostatic test to maximum choke level to the satisfaction of the authority

Provide a hydrostatic test to choke level for a minimum period of 15 minutes and as required by the testing authority and the Contractor and as specified under “Preliminaries” section.

On completion, all work shall be hydrostatically tested under expected maximum choke condition including box gutter sump and box gutter for a period of two (2) hours

Provide a water pressure test of 1500 kPa for a period of two hours. Disconnect any equipment connected to the service not rated to the test pressure before testing commences.”

Provide a water pressure test of 1500 kPa for a period of two hours. Disconnect any equipment connected to the service not rated to the test pressure before testing commences

Hydrostatic Tests:

a All cold-water piping shall be hydrostatically tested to a head of one and a half times the working head. Hydraulic (testing) pumps shall be disconnected immediately after pressurisation and all test heads shall be maintained until the Contractor has satisfied himself as to the soundness of the pipe work and equipment.

In no case, shall the period of test be less than 30 minutes.

Before applying specified test head, all air shall be expelled from the piping being tested. If necessary, supply and install approved air relief valves for this purpose.

Equipment is not to be connected to the respective services while hydrostatic tests are being carried out.

Provide a suitable pump and gauge and do all necessary work for carrying out the tests.

All testing of cold water piping is to be carried out before:

i Finishing trades have commenced their work;

Ceilings are installed;

Insulation of pipe work.

At completion of testing, all cold-water lines shall be kept charged full of water at all times.

Choke Tests:

a All sanitary drains, stormwater drains, sanitary plumbing, rainwater pipes, shall be choke (water) tested by plugging at the lowest, or other approved positions and filling with water to the overflow level.

Choke tests shall be maintained until the Contractor and/or Authorities have satisfied themselves as to the soundness of the pipe work.

In no case, shall be period of test be less than one hour.

Fixtures are not to be connected to the respective services while choke tests are being carried out.

Provide all necessary plugs and do all necessary work for the carrying out of the tests.

All testing of the above system shall be carried out before:

i Finishing trades have commenced their work,

Ceilings are installed,

Backfilling has commenced,

Absorption into pipe wall is complete.

Fixtures:

a Fixtures shall be filled to spill level with water after installation and visually checked for leaks.

b

Test of Completion:

a Upon completion, the Hydraulic Works Package shall be tested under normal working conditions and as directed by the Contractor; such tests shall continue until the Contractor is satisfied that the terms of this specification has been compiled with and that the Hydraulic Works Package are capable of meeting all requirements.

All defects disclosed during the tests shall be remedied immediately and, if required by the Contractor fresh tests shall be carried out.

The duration of the tests will be decided by the Contractor. The maximum duration of any one test will not exceed eight hours.

A certificate of compliance for each essential service installed under their contract as per requirements of the NCC is to be obtained and submitted upon completion of the works.

### 6.4.3 PRE-COMMISSIONING TESTS

Prior to commencement of the commissioning of the systems, carry out the following:

1 Progressively during the construction phase regularly purge cold water from all systems to ensure that stagnation shall not occur.

Clean and purge all cisterns, grease arrestors and pressure vessels, remove all scum lines and high water marks

Thoroughly clean out and flush out all water systems to ensure only clean water is within the systems.

Pressure and leak test all water systems as outlined in Section ‘Pipework, Valves & Fittings‘.

Thoroughly clean and flush out all water systems including package pressure system.

Protect the filtered and treated water systems by the complete flushing out of the system prior to commissioning and installation of the filters.

Provide manufacturers test certificates for all proprietary manufactured items including pumps, water filters, backflow preventers, thermostatic valves and Ultraviolet disinfection systems -. Mount test certificates for pressure vessels in glazed frames adjacent the equipment. Fix to pressure relief valves the manufacturers tags indicating the set pressure of the valves and stamp all pressure valves with the manufacturer's design and test pressure ratings.

Overhaul all installed backflow preventers including full commissioning of same by manufacturers representative

Check and prove all pressure and flow actuated controls, relief devices, bleeds, vents and drains.

Fully open all control valves during balancing of water flows. Permanently mark final settings of all regulating valves in an appropriate manner.

Check installed thermostatic mixing valves, back flow preventers and trap primers and set by the manufacturer’s representative.

Check all Backflow prevention devices and record and submit to the appropriate authorities in accordance with manufactures and local authorities’ requirements.

Check level indicators on rainwater and sewage tanks are monitored correctly by aubible and visual alarms at control panel. High and low level alarms to be generated.

Adjust period controls and activate by competent personnel provided by the manufacturer or his authorised agent. Maintain a complete log of the settings and readings of all controls, gauges and instruments throughout the Commissioning period.

Check all water meters to be commissioned and monitored via the BMS, where required by Green Star. Maintain a complete log of the settings and readings throughout the Commissioning period.

Adjust level sensors and commission pumps as required. Pumps controlled by controller provided as part of the packaged pump station. Aubible and visual alarms at control panel.

Commission all pumps.

Check control panels to monitor pump failures (all pumps) and temperature on hot water return lines.

Check the operation of all indicating and recording instruments and associated equipment and the indicating lights and associated flashers and relays under full working conditions.

### 6.4.4 COMMISSIONING

Operate the installation to prove the performance, capacities and ability to provide the required service.

Undertake commissioning in 4 stages:

1 Individual component functionality testing including verification of defects free installation

Major items of plant and equipment and components.

Systems and sub-systems.

Inter-system operation and interfaces.

Commissioning to include:

1 Performance of individual plant items and components.

Operating sequences, interlocks and safeties.

Final controls calibration.

System operation under all operating modes and under all conditions of load.

Inter-system operation and correct interfacing connections under all operating conditions and under simulated fire conditions.

Noise and vibration tests.

Thermoscan survey of switchboards.

Environmental audit as required by Authorities.

Rectification and correction of any defects and deficiencies.

Continue commissioning until achievement of correct performance and operation.

Electrical testing and verification to AS/NZS 3000.

Cleaning of plant room, switchboards and all equipment and devices.

## 6.5 FINAL CONTRACT AND HANDOVER DOCUMENTATION

### 6.5.1 GENERAL REQUIREMENTS

1 Documentation is required in electronic and hard copy format. Electronic documentation shall be supplied on the latest Microsoft and AutoCAD (or Revit if specified) Software versions at the time of Practical Completion.

Scope of the documentation and format requirements comprise:

| DOCUMENT | FORMAT | SETS |
|---|---|---|
| Operating and Maintenance Manuals, including Final commissioning data | Electronic installed on BAS File Server | 1 |
| | CD ROM – Microsoft Office Latest Version | 3 |

| | | |
|---|---|---|
| | Hardcopy | 3 |
| As Built Drawings | CD ROM – AutoCAD | 3 |
| | Hardcopy – Full Size with hanging strips | 1 |
| | A3 Size | 2 |
| Control Software | CD ROM | 1 |
| OH&S Safety Signage | Permanent | 1 |

### 6.5.2 AS BUILT DRAWINGS

1 All As Built/As Installed documents submitted shall have a stamp with similar words to the following and be signed prior to submission for review.

**AS INSTALLED DRAWING**

We certify that this drawing is an accurate record of the work installed by our company under the terms of our contract.

Contractor's Name

……

Contractor's Address

……

……..

Signed …… Date ……

Printed

……

Progressively record changes to form a record of work as installed.

Prepare and submit for approval as-built drawings covering all aspects of the work.

Show dimensions, types and locations of equipment, cables, piping, ductwork pits and markers in relation to permanent site features and other underground services.

Show the 'as-installed' locations of building elements, plant and equipment with particular emphasis on items requiring maintenance or clearing.

Show off-the-grid dimensions where applicable. Include relationship to building structure street features and other services and changes made during commissioning.

Show inverts of drainage and relative locations of gully and boundary traps

Provide As Built documentation as per Schedule of Required As Builts:

### 6.5.3 CERTIFICATION

Provide certification for all systems maintained as required under Schedule 16, S.A. Development Regulations 1993 with completion of Form 3 associated with maintenance of SA76 – 'Essential Safety Provisions'.

#### 6.5.3.1 INDEPENDENT CERTIFICATION REPORT

Engage the services of a suitably qualified organisation or person to independently certify that all aspects of the installed works comply with the relevant regulations, including the operation and performance of such services. The organisation or person shall hold a Registered Building Practitioner number and be approved by and registered with the Fire Brigade.

This Certification Report shall be issued before the Date of Practical Completion. The Building Surveyor may rely upon this Certificate in issuing a Certificate of Occupancy.

Allow for and pay all fees for the independent certifications by relevant Certifier, and include the appropriate certificates (free of defects) with the maintenance manuals as evidence of compliance.

### 6.5.4 OPERATING AND MAINTENANCE MANUALS

1 Provide comprehensive Operating and Maintenance documentation to cover all installations in order to provide a detailed understanding of the plant and its operation, an aid for training of operators, a reference for fault diagnosis and a framework for preventative and breakdown maintenance.

Submit manuals in two stages. Stage 1 include all of the sections (generally sections 1-5) of manuals excluding final testing and commissioning records and As Built drawings. This manual shall be submitted well in advance of the Practical Completion and should be signed off by the Consultant Engineer at least 4-6 weeks before programme Practical Completion Date.

First draft manuals Stage 1: Submit a first draft manual 8-10 weeks before the date for practical completion for review.

Second drafts Stage 1: Following receipt of comment on the first draft and not later than 2 weeks after submit a completed second draft for review. Incorporate comments.

Third Draft Stage 1 &2: Include all remaining sections and submit 2-3 weeks before Practical Completion. Incorporate all changes and resubmit until all comments are addressed to the satisfaction of the Consultant Engineer.

Final copies Stage 1&2: Submit 3 sets of final volumes within 2 weeks after practical completion. Incorporate feedback from review and from training of Principal's staff, including preparation and insertion of additional data. Include a section containing commissioning test reports.

Revisions: Prior to final completion, submit 3 sections sets of loose leaf amendments for insertion in the manuals, incorporating feedback from the maintenance period.

Warning and Cautions: Include to emphasise conditions hazardous to personnel or equipment, giving instructions to avoid the hazard. Format to be:

**WARNING:** An examining or testing procedure or practice which must be observed or risk loss of life or injury to personnel.

**CAUTION:** An examining or testing procedure or practice which must be followed or risk damage to equipment.

The manual shall be neatly prepared and bound in one, or a series of, vinyl hard-back folder with lettering on the front and the spine including the following information:

| | |
|---|---|
| OPERATION AND MAINTENANCE MANUAL | VOLUME NUMBER |
| PROJECT NAME | DATE OF ISSUE |
| xx SERVICES | CONTRACTOR |
| CONSULTANT ENGINEERS – WSP | SUB CONTRACTOR |

Pagination: Number pages consecutively. Double sided on A4 size (minimum 50%) recycled white (minimum CIE whiteness of 140) paper, with reinforced binder perforations.

Ring size: 50mm maximum, with compressor bars.

Dividers: Durable divider for each separate element, with typed description of system and major equipment components. Clearly print short titles under laminated plastic tabs.

Drawings: Fold illustrative drawings to A4 size and accommodate them in plastic pockets in the binder. Title block to be visible without removal of drawing

All aspects of the style and quality of the manual, including folders and contents shall be submitted for approval prior to completion.

After the draft copy, has been approved, supply 3 copies of the manuals for issue to the Principal and the Consultant Engineer.

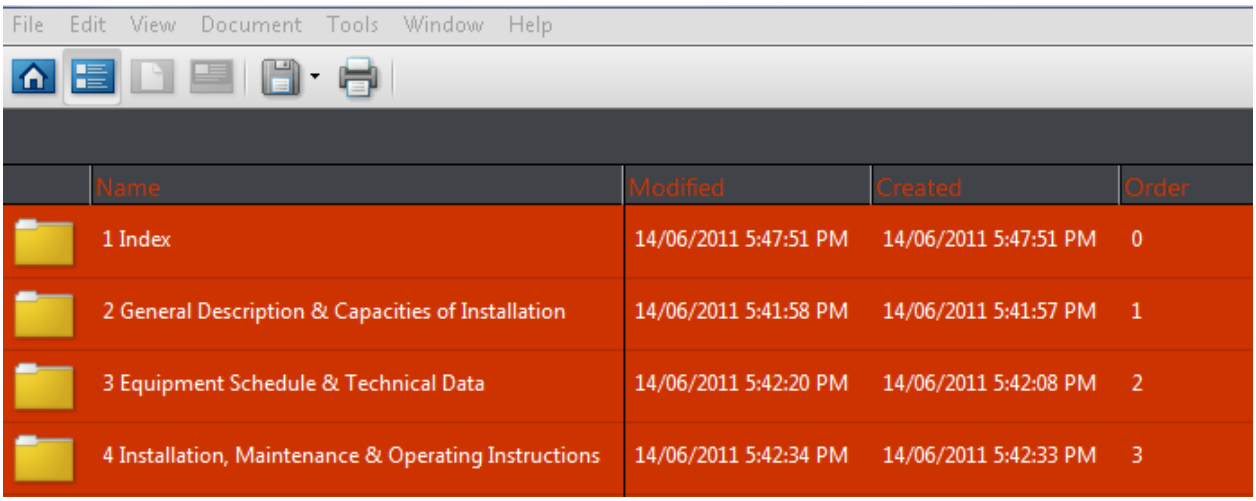
Allow for loading the manual onto the Building BAS systems (where available) and arrange to provide the manual including commissioning results.

### 6.5.4.1 ELECTRONIC/DIGITAL FORMAT

1 Documents shall be stored in DVD Disc or Potable USB Flash Drive Storage Drive. Provide labelling to the storage media.

Electronic Storage device shall not be “copy protected”.

Manual shall be contained within **a single searchable PDF** accessible via Adobe or similar PDF reader. PDF shall be indexed, divided in to folders and titled. Each folder shall contain relevant electronic/digital format documentation in line with the contents specified below. Refer below of a screen print of Adobe Reader for a typical arrangement.




“Screen Shot” for Reference

Avoid submitting manually scanned Manufacturers’ data, where possible include only searchable PDF documentation.

Include only relevant diagrams, equipment data in clear concise English. Avoid jargon and esoteric pseudonyms.

Provide each document included in the PDF with the following naming convention:

Section “X” – “Document Description”.pdf

Provide clear scanned copies of Statutory Certificates of Compliance

- **a** Accessible Dwg format CAD drawings of the as-built documentation shall be contained within the PDF.

### 6.5.4.2 INSTALLATION MANUAL FORMAT

1 Section 1 – Index

- **a** Index all sub-divisions of each section including lists of drawings, equipment, etc. for quick reference.

Include index in every volume of the manuals.

Section 2 - General Description and Capacities of Installations:

- **a** Divide into sub-sections for general items and for each individual system as appropriate and include full details

Include a directory: Names, addresses and telephone, email and facsimile numbers of Principal, Consultant Engineer, Sub-Consultants, Contractor and names of responsible parties.

Include a scope of works: Statement of scope of services and interfacing with other Contracts.

Include an installation description: General description of installation.

Systems description: Technical description of the systems installed, written to ensure that the Principal's staff fully understand the scope and facilities provided. Identify function, normal operating characteristics and limiting conditions. Include schematic diagrams.

System performance: Technical description of the modes of operation of the systems installed.

Section 3 – Equipment:

- **a** Sub-divide as for Section 2 and list all major items of equipment installed complete with manufacturer's name, agent's name, contact details, model and/or type No., serial No., size, design ratings and including all relevant data necessary for re-ordering or replacing the equipment or components of same. As far as practicable, all equipment should be broken down to individually identifiable items.

Provide 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. Do not include advertising literature. Cross out any section of literature which is not applicable to the project.

Section 4 – Installation, Maintenance and Operating Instructions:

- **a** Sub-divide as for Section 2 and include manufacturer's installation, maintenance and operating instructions for each item of equipment.

Emergency maintenance procedures, including telephone numbers for emergency services and after hour's contact for suppliers and Contractors and procedures for fault finding.

Manufacturer's technical literature as appropriate. Register with manufacturer as necessary. Retain copies delivered with equipment.

Detailed recommendations for preventative maintenance frequency and procedures which should be adopted by the Principal to ensure the most efficient operation of the systems installed. Include inspection, testing and maintenance programme in tabular form showing frequency and level of routine checks for each item.

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. Include calibration and recommissioning of controls.

Schedule of spares recommended to be held on site, being those items subject to wear or deterioration and which may involve the Principal in extended deliveries when replacements are required. Include complete nomenclature and model numbers, and local sources of supply. Include sectionalised diagrams of machines identifying component parts.

Schedule of normal consumable items, local sources of supply and expected replacement intervals up to a running time of 40,000 hours. Include lubricant and lubrication schedules for equipment where applicable.

Add to the manufacturer's technical literature, for assembly, operating, maintenance and disassembly, safety information for all plant, systems or structures installed within the project or for existing plant, systems or structures where assembly, operating, maintenance and disassembly are altered or amended by the installation of plant, systems or structures within the project.

The added safety information shall be included at relevant sections of the manufacturer's literature and not as a separate part and shall be made clear and obvious to the user of the manual.

Section 5 – Plant Operating Instructions:

a Sub-divide as for Section 2 and provide a complete description and correct sequence of all actions necessary to start-up, operate and shut-down all plant including procedures for seasonal changeovers where applicable. These instructions shall include full information on such items as normal and abnormal gauge readings, instrument settings and control points, differentials, time delays, oil levels, water temperatures, and all similar relevant variable and adjustable items, to permit checking and adjustments where practicable and identification of hazardous conditions or malfunction of plant. In addition, the instructions shall include information on the immediate action to be taken in the event of hazardous conditions arising.

Add to the manufacturer's technical literature, for assembly, operating, maintenance and disassembly, safety information for all plant, systems or structures installed within the project or for existing plant, systems or structures where assembly, operating, maintenance and disassembly are altered or amended by the installation of plant, systems or structures within the project.

The added safety information shall be included at relevant sections of the manufacturer's literature and not as a separate part and shall be made clear and obvious to the user of the manual

Section 6 – Performance Test Results:

a This section shall be sub-divided as for Section 2 and shall include all performance test results as outlined in previous Clauses.

Section 7 – Certificates & Warranties

a Statutory Certificates of Compliance for:

Electrical work.

Plumbing drainage or gas-fitting work.

Copies of manufacturers' warranties.

Certificates from authorities and utilities.

Production certification.

Copies of test certificates for the installation and equipment used in the installation.

Section 8 – Drawings

a Drawings and technical data: As necessary for the efficient operation and maintenance of the installation.

### 6.5.5 WARRANTIES

Warranty periods are deemed to end at expiry of defects liability period unless specified otherwise.

Name the Principal as warrantee. Register with manufacturers as necessary. Retain copies delivered with components and equipment.

Commence warranty periods at practical completion or at acceptance of installation, if acceptance is not concurrent with Practical Completion.

If installation is not being manufactured and product warranty is conditional on the manufacturer's approval of the Contractor, submit the manufacturer's written approval of the installing firm.

### 6.5.6 REQUIRED OPERATING INSTRUCTIONS

1 Provide operating instructions and schematic diagrams mounted alongside equipment to meet statutory requirements, e.g. Fire Brigade and Worksafe. Diagrams to be colour-coded, colour-fast, laminated and mounted.

### 6.5.7 TRAINING OF PRINCIPAL'S NOMINATED PERSONNEL

1 The service of a fully knowledgeable Commissioning Engineer shall be required for a period of 1 full working week to instruct the Owner's nominated representatives in all details of the plant operation.

Conduct training at agreed time, at system or equipment location.

Immediately after Practical Completion, explain and demonstrate to the building users or nominated representative, the purpose, function and maintenance of the installations.

Use qualified personnel who are knowledgeable about the installations.

Prior to Practical Completion, explain and demonstrate to the Principal's nominated personnel the purpose, function, operating and maintenance of the installations.

Use items and procedures listed in the Operation and Maintenance manuals as the basis for detailed instruction of Principal's nominated personnel.

Conduct training at agreed time, at each system of equipment location.

Upon completion, submit certificates of training, signed by trainer and trainees.

Provide qualified manufacturer's training representatives who are knowledgeable about the installations

During the warranty period, provide technical assistance and advice to the Principal's nominated personnel regarding the operation and maintenance of the plant.

For equipment requiring seasonal operation, demonstrate during the appropriate season and within 6 months of Practical Completion.

Include copy of training material within the O&M Manual

### 6.5.8 SPARE PARTS SCHEDULE

At least 8 weeks before the date for Practical Completion, submit a schedule of spare parts necessary for maintenance of the installation. State against each item the recommended quantity, and the manufacturer's current price, including for

Packaging and delivery to site;

Checking receipt, marking and numbering in accordance with the spare parts schedule;

Referencing equipment schedules in the operation and maintenance manual; and

Painting, greasing and packing to prevent deterioration during storage.

## 6.6 POST PRACTICAL COMPLETION AND DEFECTS LIABILITY PERIOD

### 6.6.1 WARRANTY & DEFECTS LIABILITY

Warrant the whole of the Contract Works, for the Defects Liability Period (DLP), against defective workmanship and materials and against non-compliance of equipment and/or complete system with specified performance and operation.

The Defects Liability Period shall continue for a period of 12 months after the date of issue of Practical Completion and during this period, be responsible for making good on a timely manner, defects arising from the defective design materials, premature component failures, or workmanship or from any act of the Contractor that may develop in the work.

Perform maintenance during the warranty period to maintain warranty conditions. Maintenance shall comply with the current regulatory requirements.

In the event of inclusion of equipment normally covered by a lesser time warranty, or whose warranty would otherwise normally expire during the warranty period, allow for and include the costs of extending such warranty to that covering up to the end of the Defect Liability Period.

Where warranted work or equipment has failed, the warranty shall recommence on the date of acceptance of the rectified work for an additional period of time, extended by the period during which the Principal was without the use of the work or equipment. For rectified work involving new replaced equipment, the warranty for the new component shall be from date of replacement for the 12 months or longer as required by this specification

### 6.6.2 GENERAL DLP MAINTENANCE SCOPE

Maintenance services shall include:

Preparation of a maintenance management plan which includes a detailed maintenance programme, equipment schedules, statutory and preventative maintenance schedules, OH&S risk assessment, inspection and testing schedules, breakdown rectification management and reporting systems. Submit maintenance plan and schedules prior to Practical Completion

Preventative and corrective maintenance and testing services to assure specified system reliability and availability.

Statutory maintenance and testing required by the Building Regulations and other authorities.

Breakdown and system fault responses. Attend site, ascertain cause of alarm and rectify where possible. Make system alterations at own cost to prevent future system faults. Pay any Authority charges resulting from callout on system faults.

Statutory regular system fire and life safety system control and performance verification test to be carried out after hours.

Comply with Building and Occupational Health and Safety Regulations. Comply with manufacturer's recommended maintenance programme and schedules.

Monthly maintenance and servicing in accordance with maintenance schedules recommended by equipment manufacturers.

Rectification of defects at Contractors cost. Replacement of consumables at Contractors cost during the maintenance period.

Submission of monthly reports to Principal and Consultant Engineer on maintenance activities performed.

Provision and filling out log book which must be kept on site, detailing all visits.

Service personnel to be available for call out on a 24 hours per day, 7 day per week basis. Response time for emergency and corrective maintenance must not exceed 2 hours.

Operation and verification in conjunction with other services trades, of all fire and life safety systems. Such testing to be undertaken at 6 monthly intervals.

### 6.6.3 FINAL COMPLETION

Final Completion will not be granted until maintenance records are complete and signed off and until all defects have been rectified and inspected.

The Maintenance and Defects Liability Period may be extended unless maintenance and servicing visits have been made and reported as specified.

### 6.6.4 SUBMISSIONS

1 Provide;

- a Maintenance management plan.

Monthly Maintenance reports.

Completed maintenance records

Mandatory maintenance records to include monthly maintenance and service reports, including water treatment reports, reports on all defects and their rectification, certification of the correct operation of essential services, a maintenance log book and any other records which must be kept in order to comply with legislative or OH&S requirements.

Monthly Maintenance and Service Reports to include:

Check list of all items serviced and inspected.

Description of maintenance performed.

Notes on supplementary maintenance required.

Comprehensive water treatment report.

Maintenance Log Book to include:

1 Schedule of all equipment.

Schedule of all control sensors and control set point values.

Register of maintenance visits and cross reference to service reports.

Register of work performed under headings of preventive maintenance, corrective and emergency maintenance and defects rectification.

The Maintenance Log Book is to be kept in a locked cabinet provided for the purpose in an agreed location on site.

At the conclusion of each maintenance visit the log book is to be duly completed and signed off by an authorised representative of the Principal /Building Owner and service records are to be forwarded to the Principal /Building Owner or his representative within 3 days of each visit.

## *6.6.5 DLP PREVENTATIVE MAINTENANCE AND TESTING*

### 6.6.5.1 GENERAL

1 As a minimum, carry out all maintenance and servicing recommended by the manufacturer of each piece of equipment at the recommended intervals

Maintenance and servicing shall include:

- a Maintenance, testing and servicing in accordance with maintenance schedules required by the Certificate of Occupancy/Classification.
- b Periodic maintenance, testing, servicing and inspections in accordance with regulatory requirements and relevant Australian Standards.
- c Submission of monthly reports on maintenance activities performed.

Ensure adequately qualified and experienced service personnel carry out the works.

Use approved and calibrated instruments for any required testing or servicing.

Report to the designated representative of the building on arriving at and before leaving the building/site.

Provide a service which is available for call out on a 24 hour per day, 7 day per week basis. Response time for emergency and corrective maintenance must not exceed 2 hours.

### 6.6.5.2 HYDRAULIC SERVICES REQUIREMENTS

As a minimum, regular maintenance and servicing tasks to include.

1 Monthly

Check all water storage tanks are water tight and clear all floating debris from water surface.

Check and report on necessity for replacement of filter media including UV lamps or auto chemical dosing units.

Check all water tank isolation valves are operational and in good working order

Check all water meters are operational and monthly readings are within seasonal limits

Clear as necessary drip trays, strainers and other sediment collecting items.

In large toilet or shower areas check for sewer smells, ensure all traps are being primed and sanitary vents are in good working order.

Check reduced pressure zone valves are operational and complete a test discharge of water

Check all hot water heaters are in good working order, complete a test discharge of the pressure relief valves, ensure safety tray are in good working order

Check hot water temperatures from basins are within limits and adjust where required

Check all stormwater downpipes are intact and water tight

**2** Quarterly

Check all pump control panels are clear of dust and debris. Ensure audible alarms and strobes are clear and visible. Check all building area isolation valves are in good working order. Including isolation valves to major toilet blocks or riser connections

Check and adjust boilers, burners and water levels in water heaters.

Check plumbing pipework within walk in services ducts, including wall hung cisterns, urinal flush valves and priming devices

**3** Six monthly

Check all roof sections, sumps and gutters are clear of organic debris and fines. Jet blast clean and repair all damaged over flashing and;

Check all grease interceptors and sewer tanks have lids and frames secured and no stormwater ingress.

Check all gully traps and grates are secure and jet clean as required

Check all manhole lids and stormwater water headwalls are clear of debris

Check all hose taps are not leaking and have backflow device fitted where required.

Last maintenance visit at 12 Months

Complete all 6 month checks

Check test and report on the building recycling water system including inspection of the rainwater tank

Complete Hot water warranty testing as noted in manufactures warranty requirement.

Replace all filter media disposable filters and UV lamp.

Flush all WC’s and check for cistern leaks, test all sanitary fixtures with hot and cold water flush

The date for the final maintenance visit to be advised 7 days prior to the proposed visit so that a representative may be present to inspect the equipment when end covers are removed.

Check and de-sludge basement pump station.

# 7 SEWER DRAINAGE & SANITARY PLUMBING SYSTEMS

## 7.1 SEWER DRAINAGE SYSTEM

1 Make the connection to the local authority's connection branch in an approved manner and to local inspector's requirements.

2 Ascertain the depth, position and suitability of the sewer connection points prior to the commencement of any work and incorporate any adjustments required to execute the work. No claims for redundant work will be considered due to failure to comply with this requirement. Make connection to the property drainage connection branch.

3 Pipelines shall be laid true to line and bore from point to point.

4 Unless otherwise indicated on the drawings pipelines shall be graded in accordance with the Authorities requirements and as specified under "Excavation & Pipework Requirements" section.

5 Supply and install an overflow gully to provide a safe release from the connection point. Gully shall be constructed of 100mm diameter "P" trap and 100mm riser. Top of riser shall incorporate 200mm cast iron grate with concrete surround. Terminate gully top to comply with current authorities' regulations.

6 Provide a hydrostatic test to choke level for a minimum period of 15 minutes and as required by the testing authority.

7 Provide and install clear-out inspection fittings to provide rodding access to all lines. Riser from pipeline shall extend vertically to finished floor level and terminate with a brass screw out and frame.

8 Supply and install all reflux valves and maintiananhole in the locations indicated or as required by the local authority and as specified in the "Materials" section

9 Carry out all necessary concrete encasing as specified in "Excavation & Pipework Requirements" section and as shown on drawings

10 Supply and install all basket traps in the locations indicated on the drawings or as required by the local authority and as specified in the "Materials" section.

## 7.2 SANITARY PLUMBING SYSTEM

Sanitary plumbing works above ground shall include all those works generally considered by authorities and trade practice to be soil, waste, vent above ground as distinct from drainer's work.

11 Terminate all vents through roof with a cowl. Finish vents 3 metres above ground level, 300mm above roof level and 6 metres clear of openings and fresh air intakes as required by the local authority and as indicated on the drawings. Flashing of vents, which penetrate the roof, shall be carried out within the hydraulics scope of works.

12 Install inspection openings in accessible locations so that each section of pipework can be cleaned. Inspection opening sizes shall be in accordance with authorities' requirements. Install testing gates on all stacks at every 5th floor level and at the base of each stack.

13 Supply and install approved expansion joints to all soil, waste, relief and main vent lines. Expansion joints shall be installed on each line at intervals not exceeding 3000mm on both vertical and horizontal pipelines and on either side of building expansion joints

14 When a branch line enters a vertical pipe the branch fitting must be wholly outside the vertical pipe such that the internal bore of the pipe is maintained at all times. For vertical branches of up to and including 80mm a radius of at

least 25mm must be maintained on the throat of the bend and a radius of 50mm for larger junctions. All horizontal branches shall connect to the main branch line through a 45° or sweep type junction

**15** Use sweep bends of 300mm radius (or alternatively 2off 45° bend), and provide maximum fall between bends

**16** Traps shall be of the same material as the branch drainage except traps in visible locations shall be chrome plated. Refer “Materials” section for specified pipework.

**17** Unless otherwise noted all pan collars to soil type fixtures shall be of approved PVC materials and pattern. Collar shall incorporate an approved neoprene rubber ring joint

**18** Pipe wrapping shall be Soundlagg 4525C or approved equal. Ensure all drainage pipework located over retail, residential, hotel or future retail tenancies is acoustically insulated

**19** Use trap with 100mm riser and 50mm or 65mm outlet of self-cleansing pattern. Grate to be as specified in the “Materials” section.

## 7.3 FIXTURE TRAPS

75mm water seal traps shall be provided for the following fixtures:

| | | |
|---|---|---|
| **20** | Sinks | 50 mm two-part universal pattern. |
| **21** | Basin | 40 mm CP copper two-part S or P-trap with 40 mm CP extension riser. |

# 8 STORMWATER DRAINAGE AND DOWNPIPE SYSTEMS

## 8.1 GENERAL

Make the connection to the local Authorities stormwater in an approved manner and to local Authorities requirements. Ascertain the depth, position and suitability of the stormwater connection points prior to the commencement of any work and incorporate any adjustments required to execute the work

Pipelines shall be laid true to line and bore from point to point.

Provide inspection pits at changes of direction. Pits to be reinforced concrete of appropriate dimensions to Code with depths to match invert levels of pipeline

Install drainage turn up in spoon drains by terminating pipe collar at the invert of the spoon drain. Grates are only required if specifically noted on the drawings. Encase drainage turn up riser in 150mm thickness concrete surround.

Provide roof and balcony drainage outlets in the positions indicated on the drawings and as scheduled. Each outlet shall be cast into the concrete slabs complete with rubber ringed inverted adapter and connection to the vertical downpipes. Support each sump during construction with wire ties, set level both ways, to suit roof falls

The overflow system shall either directly discharge through the external walls or interconnect via a piping system then discharge independently of the main stormwater runs.

Downpipes cast in columns shall be HDPE. Internal downpipes shall be provided with test gates at the base to enable full testing. Flexible rubber ring joints are to be provided where the downpipe connects to the box gutter outlet

Test gates shall be provided at the base of all internal downpipes and of the same size as the downpipes prior to connecting to stormwater drainage lines. Inspection openings generally shall be provided at every junction, bend and change of direction

Supply and fix approved, flat or domed type roof drainage outlets cast in the concrete roof structure in positions indicated on the drawings. Set grates, flush and matching with adjoining surfaces. Grates shall have puddle flange and membrane clamp

Where a branch line enters a vertical pipe, the branch fitting must be wholly outside the vertical and horizontal pipe, such that the internal bore of the pipe is maintained at all times. All horizontal and vertical branches shall be made at 45° to the main line

# 9 DOMESTIC COLD WATER SYSTEMS

## 9.1 GENERAL

1. Locate valves behind access panels or within accessible ducts. Valves located in ground shall be provided with CI path box and lid set into concrete surround with pipe riser around valve stem
2. Provide unions at wall or floor surface and at fixtures and appliances to allow removal and replacement without the need to adjust connections.
3. To all changes of direction on rubber ring jointed pipelines below ground install concrete thrust blocks to restrain the internal operating pressures of the pipeline under all conditions. Concrete mass shall be poured around and behind fittings and bear against virgin soil material. A minimum of 0.75 cubic metres of concrete shall be used at each position.
4. Unless indicated otherwise taps and faucets shall be all brass construction. All connections and cover plates shall be bright chromium plated finish. Taps shall be fitted with anti-splash nozzles, except for hose taps and/or where otherwise specified.
5. Supply and install an approved BFPD in the domestic cold water supply and irrigation system as required by the Water Authority and as specified in the “Materials” section. Include maintenance instructions in as-built manuals to be supplied at end of project establishing an authorised maintenance programme including registration and certification of all installed devices. Provide isolation valves upstream and downstream of valve and line strainer at inlet to BFPD. Flush piping before installing device and test device after installation and prior to operation in service
6. Provide and install hose taps with anti-vandal heads. Each tap shall consist of a 20mm diameter copper riser with a back plated elbow and a 20mm diameter brass finish hose tap. The tap shall be 450mm above the floor unless otherwise directed.
7. Allow to provide a water supply connection from the cold-water service in size as nominated on the drawings and terminate with a blank Table E flange at the Water Meter Room.
8. Provide a water pressure test of 1500 kPa for a period of two hours. Disconnect any equipment connected to the service not rated to the test pressure, before testing commences

## 9.2 COLD WATER BREAK TANK

Provide and co-ordinate all connections as follows

1. Tank panel support beams (co-ordinate only).
2. All inlet and outlet connections.
3. Sludge drain and overflow.
4. Electronic water level controls and alarms.
5. “Light Proof” roof.
6. Visual water level indicators.

# 9.3 SUB-METERING

## 9.3.1 AUTHORITY

1. Approved sub-metering is to be installed in accordance with local authority
2. Wireless Automatic Meter Reading [AMR] technology shall be provided, and all meters including the master meter at the boundary shall be readable through the AMR system.
3. The AMR system shall be selected from the list of authorised providers prepared by QUU.
4. All components of the AMR shall comply with the Queensland Urban Utilities Technical Specification for the Submetering of Multi Unit Properties.

## 9.3.2 GREEN STAR

Approved sub-metering is to be installed in accordance with Green Building Council Australia (GBCA)

# 9.4 FLUSHING & CLEANING

1. Immediately after the satisfactory completion of the sectional/first fix and the whole system/final fix hydraulic pressure tests the Hydraulics Sub-contractor shall flush out, remove all foreign matter and clean all the systems.
2. Water systems shall be flushed out with clean water. Whenever possible the flushing medium shall be fed into the system at high points and flushed out at low points on the system via suitably sized valve
3. The flushing and cleaning medium shall be fed into the system at the highest pressure that the system will safely withstand and be carried out for a sufficient period of time to ensure that all foreign matter is removed.
4. The flushing shall be witnessed by the Superintendent for the duration of the flushing of each service and shall be recorded by the Hydraulics Sub-contractor and certified by the Managing Contractor

# 9.5 BACKFLOW PREVENTION

Provide approved BFPDs in the domestic water supply as required by the Authority

Provide isolation valves upstream and downstream of valve and line strainer at inlet to BFPD.

Flush piping before installing device and test device after installation and prior to operation in service

# 10 DOMESTIC HOT WATER AND WARM WATER SERVICES

## 10.1 GENERAL

Supply, install, test and commission the domestic hot water service from the hot water heaters to the fixtures and appliances. Include for all piping, fittings, supports, insulation, hot water heaters, valves and other sundry items of equipment required for the installation.

## 10.2 TESTING

Provide a water pressure test of 1500 kPa for a period of two hours. Disconnect any equipment connected to the service not rated to the test pressure before testing commences.

## 10.3 CONNECTIONS TO FIXTURES

Provide unions at wall or floor surface and at appliances to allow removal and replacement without the need to adjust connections.

## 10.4 CONTROL VALVES

Supply and install control valves to each group of fixtures. Locate behind access panels or within accessible ducts.

## 10.5 EXPANSION AND CONTRACTION

Make adequate provision for expansion and contraction by the provision of looped pipe with clips/brackets with wooden expansion blocks so that under all working conditions no strain is imposed on pipework or fittings, Pipes located in walls and floors shall be provided with sufficient insulation so that expansion and contraction does not impose a strain on the pipework or finished surfaces. No joints will be allowed within or under concrete slabs where slab is on ground or cast through slab.

Branch pipes off straight lengths of unrestrained supply pipes shall incorporate a minimum of 3 long radius pipe bends and a straight length of pipe not less than 1000mm long between the branch connection and the first branch pipe restraint to facilitate movement of the supply pipe without imposing strain on the pipe connections and fittings.

## 10.6 THERMOSTATIC MIXING VALVE

Supply and install thermostatic mixing valves to all personal hygiene fixtures to manufacturer's requirements and in accordance with the local authorities requirements. Valves shall be set to 43°C for disabled fixtures in all basins and amenities.

.

## 10.7 HOT WATER HEATERS

Supply and fix the hot water heaters in the locations indicated on the drawings. Hot water heaters to be of instantaneous type and provided one for each apartment.

Heater size are to comply with the “Schedules” sections.

## 10.8 THERMAL INSULATION

Provide all necessary insulation to hot water piping to prevent heat loss.

Insulation shall not be installed until all relevant tests and inspections have been carried out.

Refer to “Materials

# 11 RE-USE WATER SYSTEM

## 11.1 GENERALLY

Refer also to “Domestic Cold Water System” section for design parameters

Provide unions at wall or floor surface and at appliances to allow removal and replacement without the need to adjust connections.

Branch pipes off straight lengths of unrestrained supply pipes shall incorporate a minimum of 3 long radius pipe bends and a straight length of pipe not less than 1000mm long between the branch connection and the first branch pipe restraint to facilitate movement of the supply pipe without imposing strain on the pipe connections and fittings.

The system shall be supplemented with potable cold water from the metered domestic water supply. The supply shall utilise a solenoid control valve interfaced with the rainwater re-use low tank level (pump isolation) float switch.

## 11.2 RECYCLED WATER TREATMENT

The rainwater treatment system shall consist of :

duplex VSD pressure boosting pump set complete with 100 litre pressure vessel,

two (2) automatic backwash filters,

two (2) bag filters

two (2) UV sterilisation units.

Refer to “Materials and Workmanship” and “Plant and Equipment” sections for more information.

## 11.3 RECYCLED WATER HOSE TAPS

All hose-taps service via the recycled water system shall be clearly marked with a warning sign and installed in accordance with AS/NZS3500.1 section 9.

All recycled water hose-taps shall be coloured, powdered coated purple.

## 11.4 IRRIGATION CONNECTIONS

Provide irrigation connection points complete with sub-metered control valve and a testable DCV for the irrigation contractor. The control valve location shall be coordinated with the irrigation contractor.

Allow to coordinate cast in water supply conduits into each planter box separated minimum 500mm from the planter drainage outlet for irrigation contractor to feed irrigation piping into planter boxes at the completion of concrete trade works.

# 12 EXCAVATION

## 12.1 GENERAL

Excavate the ground in the form of trenches to enable the various pipelines to be constructed in the locations shown on the Drawings.

Clear trenches of sharp projections and cut back roots to at least 600mm clear of services and other obstructions including stumps and boulders, which interfere with services or bedding.

Size trench excavation to:

Provide a minimum clear space of 200mm between piping and trench face.

Allow correct bedding depth for piping.

Allow an overall depth to achieve the minimum backfill cover of 600mm in areas of normal usage or 750mm where passing under areas of vehicular traffic.

Excavate at uniform grades and in straight lines.

Provide tunnelling in lieu of trenches where required by any Authority or where directed.

Complete all forms and pay all fees where necessary.

Allow the supply, erection and withdrawal of all shoring in the cost of excavation.

Withdraw all shoring and timbering in the correct manner as the work proceeds.

Erect shoring and timbering of sufficient strength and quality where necessary for safe and efficient completion of work.

Keep adequate dewatering equipment on site and maintain excavation free of water at all times.

Carry out work in a careful, secure and tidy manner taking all precautions against damage whether arising from bad workmanship, breakage of machinery or plant, inefficient shoring, flooding or any other cause whatsoever.

Provide, erect and maintain warning signs, temporary fences, barriers and night-lights adjacent to any work such as trenches and excavation or stack of materials which could be a danger to persons or traffic of any kind.

Remove unwanted materials, fill in and make good with approved filling any extended excavation areas which exceed documented requirements as a consequence of injudicious working, slips, falls, blasting or any other cause.

Obey all directions given, with regard to the provisions of lighting and barriers.

Obtain permission from Authorities prior to any excavation and before placement of barricades.

Not permit use of explosives.

Allow all in-ground pipework to be inspected prior to backfilling with provision of a minimum of 48 hours notice prior to any inspection required.

Remove all surplus materials, broken concrete and rubble.

## 12.2 BACKFILLING OF TRENCHES

1 Obtain inspection and approval of pipework installation prior to backfilling. Prior to backfilling provide underground marking tape: To AS/NZS 2648.1

Complete hydrostatic testing prior to backfilling.

Backfill with sand or coarse sands as approved:

To a level of 150mm above the collars of pipework.

In 150mm maximum layers throughout depth of trench.

To 100% Standard Maximum Dry Density in accordance with AS 1289.0, Test E3.1 or E3.3.

Ensure all conditions, such as moisture content within the soil and correct grade or quality of soil for backfilling, are correct prior to compaction.

Select backfill materials for trench widths greater than 450mm to comply with:

No stones greater than 25mm occurring within 150mm of the service, well graded, inorganic, non perishable material maximum size 75mm, plasticity index greater than 55%.

Under roadway, paved areas – coarse sand, controlled low strength material or fine crushed rock.

In reactive clay – in sites classified M, H or E to AS 2870.1, use an impervious material if trenches fall toward footings.

In topsoil areas – complete with at least 50mm topsoil.

Select backfill materials for trench widths less than 450mm to comply with:

Under roadways and paved areas – stabilised sand using a 3% by weight cement/sand mix, poured into the service trench to match the level of the road sub grade.

Not under roadways and paved areas – sand or coarse sands as approved in 150mm maximum layers throughout depth of trench and to match the level of the surface sub grade prior final surface finish.

Water, vibratory compact and test to the correct compaction pressure rating in accordance with test method to AS 1289.5.1.1 and a test frequency of:

Applicable where trenches located within road works or car parks - one test per 50m of pipeline per 500mm depth of backfill over crown of pipe with 1 in 3 tests around stormwater structures.

Applicable for trenches located in areas for normal usage - as directed.

Reinstate surface areas to match existing surrounding area and comply with:

Lawn areas – 50mm of loam and re-sow the lawn over the trench and other disturbed areas.

Concrete surfaces – reinstate concrete surfaces to the original level and where necessary, provide steel reinforcement keyed to the adjacent concrete, laid to prevent the reinstalled concrete from subsiding and cracking.

Bituminous surfaces:

- **i** Provide crushed rock base and sub base to match the existing pavement.
- **ii** Prime coat the edges of the existing surfacing with bitumen.
- **iii** Lay and compact hot mix asphalt so that the edges are flush and the centre is cambered 10mm above the existing pavement.
- **iv** Use hot pre-mix unless not available. Cold pre-mix may be acceptable subject to approval.
- **v** Minimum asphalt thickness 25mm for normal usage areas including car parks and 50mm for roads, or where applicable to match the adjacent existing bituminous surface thickness, whichever is thicker.

## 12.3 SAND FOR BEDDING (SEWER PIPE)

Shall be approved and conform to the following: -

**1** Loss of weight after thoroughly washing with water shall not exceed 10%.

Not less than 25% by weight shall be retained on Tyler 28 mesh sieve.

## 12.4 USE OF CONCRETE (SEWER PIPES)

Provide 20 MPa concrete not less than 100 mm thick with exposed surfaces cement rendered as follows:

1 Around pipes and fittings wherever required by appropriate authority.

Around pipes and fittings pass under footing beams to the invert of the footing beam.

Under and around bases of inclined junction and bends.

Under roadways and footpaths / stabilised sand 10 MPa only.

Where regulation cover cannot be provided over drains, surround pipes with 150 mm of 20 MPa concrete.

Provide 150mm thick pads under all vertical bends and on the outside of all changes in direction.

## 12.5 PITS (STORMWATER)

Provide a smooth, seamless finish, using steel trowelled render or concrete cast in steel forms and as specified in the "Materials" section.

Cove or splay internal corners with metal access covers and grates to AS3996.

The top of cover or grate, including frame in paved areas shall be flush with the paving surface.

In landscaped areas 25 mm above finished surface and gratings taking surface water runoff located to receive runoff without ponding.

## 12.6 WARNING TAPES

All buried gas, water and fire services shall be identified with a 150mm wide polyvinyl chloride utility service warning tape placed 75 millimetres above the top of the service.

The PVC strip shall be a continuous length coil and colour coded to international standards, in addition to naming the service. e.g. BLUE - water supply.

The warning tape shall be equal in all respects to VINICOVER as distributed by VINIDEX TUBEMAKERS PTY. LTD.

# 13 TANKS

## 13.1 WATER STORAGE & BUFFER TANKS

Water storage tanks with pump suction shall have the following minimum requirements;

1. Total effective storage capacity shall not include upper freeboard (including inlet air gap), and lower freeboard (prevent air suction and pump cavitation).
2. Each half shall have ability to be isolated (inlets and outlets) to enable maintenance of tank half without effecting continual operation
3. Pump suction shall have vortex plate in tank to reduce the lower freeboard volume.

## 13.2 RAIN WATER HARVESTING TANKS

Shall have the following minimum requirements;

1. Total effective storage capacity shall not include upper freeboard, and lower freeboard (prevent air suction and pump cavitation).
2. Upper freeboard to accommodate water level above overflow during peak design inflow
3. Pump suction (where applicable) shall have vortex plate in tank to reduce the lower freeboard volume.

# 14 MATERIALS AND WORKMANSHIP

**ALL MATERIAL PROVIDED SHAL SASTIFIY ALL REQUIREMENTS WITHIN ESD REPORT, GREEN START AND WELL RATING**

## 14.1 CONSIDERATIONS FOR MATERIALS ENGINEERING

Consideration for proposed materials, used to convey, support and fix services are an essential part of the engineering design process for this project. Materials used for conveying of services could possibly be subjected to accelerated surface corrosion from the sea water spray, high humidity and exposure of Ultra-Violet radiation, if inappropriate materials and or surface treatments are selected.

All materials selected & installed for this project will be suitable for their location and environment. All materials used for conveying of services will have a minimum replacement (life) period of 20 years. All materials used for supporting & fixing of service materials will have a minimum replacement (life) period of 15 years.

## 14.2 MATERIALS AND WORKMANSHIP

All materials are to be new and the best of their respective kind. All labour shall be skilled in its particular craft and all shall be in accordance with best practices for works of this kind. The items shall include all labour, equipment, materials and transportation necessary to construct and complete the work.

All pipes and fittings must carry an Australian Standards approval, and watermark approval numbers.

All materials and workmanship not of the stated quality may be rejected.

## 14.3 CONCRETE

Concrete shall be of 25 Mpa strength, or as directed by the structural engineer. All site mixed concrete shall be of 4:2:1 mix. Mortar shall be 2:1 cement mix. Waterproof render shall be 3:1 mortar waterproofed, with approved brand of waterproofing compound used directly in accordance with the manufacturer's direction.

## 14.4 COVERS AND FRAMES

Covers and frames shall be manufactured in accordance with AS3996 and be 'Havestock' or approved equal cast iron covers and frames with all edges machine fitted and have removable plastic lifting hole plugs. Each cover shall have a brass or stainless steel plate bearing the name of the service.

The covers and frames shall be set to the level of the finished surface and filled in with the same material as used for the surrounding path or roadways, lawned areas shall be infilled with concrete. Brass edge trimmed covers and frames shall be used in areas where tile, paver or carpet finish is required. All covers and frames shall have the manufacturers recommended lubricant applied prior to installation.

All internal covers shall be lock down type.

Cover duties selected may not be appropriate for construction type traffic. Allow protecting installed covers during the construction phase. All covers damaged shall be replaced without incurring additional costs to the contract.

## 14.5 TRENCH GRATES AND SUMPS

All trench grates, roof sumps and outlets, sump grates and frames used, shall be manufactured in accordance with AS3996 and be of the required strength to carry the vehicular or pedestrian traffic. The trench grates used shall be longitudinal bar gratings suitable for vehicle and cyclist traffic, set flush with surrounding finished levels. Trench grates in pedestrian areas shall be of the “heelguard” type and “anti-slip”.

Grates and frames may not be of appropriate duties to withstand construction traffic. Allow to protect installed grates and frames during the construction phase. All grates damaged shall be replaced without incurring additional costs to the contract.

## 14.6 FIXINGS

Fixings shall be 'Dynabolts', 'Dynasets' or equal approved rawl expansion type and shall be installed in direct accordance with the manufacturer's instructions. Plastic or nylon type fixing or anchors will not be accepted.

Sure, drive metal expansion anchors will be accepted on small-bore pipes up to 20mm diameter.

## 14.7 FLEXIBLE CONNECTIONS

Flexible connections or anti-vibration couplings shall be fitted to all pumping equipment and be 'S' flex flexible couplings installed in accordance with the manufacturer's instructions. Flexible connections shall be the same size as the pipe work, not the equipment.

Flexible connections shall be installed with the aid of adjustable threaded spacers and shall be adjusted correctly to dimensions recommended by the manufacturer prior to fixing of the pipe work, the maximum angular deflection allowed on the flexible connection shall not exceed five (5) degrees and shall be installed only where indicated on the drawings.

Flexible connections on submersible pumps shall be jointed to pump/s and pipe work with male and female 'Kamlok' quick release 'cam type' couplings.

## 14.8 FLANGES

Flanges shall conform to AS 2129, AS 2528 and AS 4087. Use brass flanges for copper tubing, galvanised mild steel flanges screwed type for galvanised mild steel, cast iron flanges for cast iron pipes and PVC flanges for PVC piping.

## 14.9 GALVANISING

All galvanising of steel work shall be hot dip process in accordance with AS 1650 to give 0.1mm minimum thickness coating.

## 14.10 UNIONS

Unions shall be four (4) piece compression type unions (2 part cones) or three (3) piece brass, bull nose taper type unions. Brass and copper type union connections shall not be used under any circumstances, in concealed or inaccessible locations.

Unions shall be located on the outlet side of all control valves.

## 14.11 VALVES

All valves used shall be in accordance with AS1628 and be “Reliance Manufacturing Company” (RMC) or approved equal. All valves shall be of one type and of one manufacturer. All valves shall be placed in easily accessible positions for operation and repair. Valves in ducts shall be positioned at 600mm from the finished floor level, unless noted otherwise on the drawings.

Control valves to main branch lines and outlet positions shall be of the gate or ball valve pattern. Elsewhere the control valves shall be of the loose jumper pattern where required by code. All valves shall be tested to a pressure of 1700 kPa and marked by an approved Testing Authority.

Valves up to and including 50mm shall be screwed. Valves above that size shall be flanged with Table E flanges. All valves shall be suitable for temperatures up to 90°C.

Spindles shall be non-rising type and must not project into the bore of the valve when the valve is in the fully open position. The bore must be clear and unobstructed when in this position.

## 14.12 REFLUX VALVES

Reflux valves to remain accessible for maintenance purposes. When installed in ground shall have an access shaft to permit replacement of internal components or be located within a full access pit. Valve to be certified for use within drainage system to which it is installed.

## 14.13 BALANCING VALVES

Balancing valves shall be self regulating/adjusting type with screwed connections.

## 14.14 PRESSURE LIMITING VALVES

Pressure limiting valves shall be "Caleffi" or equal approved. Strainers shall be fitted to the inlet side of the valves. Pressure limiting valves shall be installed in parallel and under no flow conditions, still maintain the desired outlet pressure. The valves and strainers shall be suitable for operation under the pressures and flows it shall be subjected to. The valves shall be adjustable and the outlet and inlet ranges to be approved by the Consultant Engineer.

## 14.15 BALL VALVES

Ball valves shall be manufactured in accordance with AS1628, be fully dezincification resistant, watermarked to MP52, full bore, and screwed BSP connection.

Ball valves may be used in preference to loose jumper type valves where approved by the authority.

## 14.16 THERMOSTATIC MIXING VALVES

The valve must have a wax element which gives complete fail-safe and have built in stop valves for serviceability. The valve shall be a pressure balanced thermostatic mixer equal in all respects to “Enware”

All valves shall have their temperature set to code requirements and tested following completion of works and all test results shall be recorded and included within the Instruction and Maintenance Manual. Testing shall include failsafe testing with isolation of cold-water service. Provide signage where valves are concealed.

## 14.17 SLUICE VALVES

All sluice valves shall be manufactured in accordance with AS2638 and be fully approved.

## 14.18 STRAINERS

'Y' strains shall be fitted upstream of all back-flow prevention devices, solenoid and similar valves. 'Y' strainers shall be approved by the local authority and be as manufactured by RMC or equal.

## 14.19 COPPER AND BRASS TUBES AND FITTINGS

Copper tubes shall be solid drawn in accordance with the following standards: -

2 Water Service Pipe AS 1432 Type A and B.

3 Waste pipes shall be as AS1432 Type D and Type B for fabrication of junctions, fittings to AS1589.

Brass tubes shall be solid drawn with minimum wall thickness of 1.6mm. Fittings for copper and brass pipes shall be a minimum 60/40 gunmetal or brass and stamped by the approved Authority.

## 14.20 PVC PIPES AND FITTINGS

Sanitary and stormwater drainage shall be unplasticised polyvinyl chloride (PVC-U) drain waste and vent (DWV) with solvent welded jointing. Class of pipe to be equivalent of SH for above ground and in ground up to 3000mm depth, for depths greater than 3000mm class SHE or equivalent. The system shall be equal in all respects to "Iplex Pipelines".

Water services in ground 100mm and larger shall be PVC-M with a class pressure rating to suit the application with rubber ring jointing. The system shall be equal in all respects to "Iplex Pipelines BLUE Rhino". Fittings shall be ductile iron suitable for contact with potable water systems complying with AS/NZS4020. Fittings are to be equal in every aspect to "Crevet".

Sanitary and stormwater rising mains to be PVC-U Pressure Pipe class PN12 with solvent welded jointing. The system shall be equal in all respects to "Iplex Pipelines".

Where a ring seal adaptor is fitted to the socket of the fittings, care must be taken to leave the required gap between the end of the pipe and the shoulder of the socket of the fittings.

## 14.21 PE PIPES AND FITTINGS

All pipes and fittings must carry an Australian Standards approval, and watermark approval numbers.

All high density polyethylene (HDPE) pipe work and fitting joints shall be butt-welded or fused, utilising approved butt fusion welding equipment under factory controlled conditions. Butt welds shall be used only on stormwater systems, vertical plumbing stacks and vents. All sanitary and trade waste drainage (horizontal) shall have joints made with electro fusion couplings. All site welds may be either butt or fusion, utilising approved butt fusion welding equipment or electro fusion sleeves installed strictly in accordance with the manufacturer's direction. No other jointing methods are to be used. All pipes and fittings are to be equal in every aspect to "Geberit HDPE"

Pipework used for pressure applications shall be PE100, SDR13.6, PN12.5 at a minimum. Pressure rating shall be increased where required to suit the application. All pipes and fittings are to be equal in every aspect to "Iplex Pipelines Poliplex".

All persons carrying out the jointing procedure shall complete the installation course and be accredited by the manufacturer prior to commencing works.

Confirmation of accreditation numbers of all personnel intending to install the HDPE system shall be provided prior to commencement of works.

## 14.22 PE-X PIPES AND FITTINGS

Cross linked polyethylene pipes and fittings must carry an Australian Standards approval, and watermark approval numbers.

Jointing shall be by specifically designed crimp press fit fittings. Pushfit type “pipe grip” fittings will not be permitted. All fittings shall be of same manufacturer of pipework. Crimp tooling shall be approved by the manufacturer of the pipe and fittings. Crimping methods shall be in accordance with manufacturers techniques.

Where possible pipework colour shall be selected dependant on the type of service.

## 14.23 PPR PIPES AND FITTINGS

Polypropylene pipes and fittings to be used for chemical sensitive drainage and be rubber ring jointed in accordance with AS 1646. All pipes and fittings are to be equal in every aspect to “Valsir”.

Large stormwater pipework to be twin walled corrugated polypropylene with rubber ring jointing. All pipes and fittings are to be equal in every aspect to “Vinidex Stormpro”.

## 14.24 JOINTING

All joints shall be cleaned free of any foreign material, dirt, and grease etc., before any attempt is made to do the joints.

Joints shall be cut true and square, remove all burrs and swarfs, etc. and grind or file a chamfer lightly around the pipe.

Polyvinyl chloride (PVC or PVC-U) pipes jointed by solvent welding of the type recommended by the manufacturer. Clean joints with approved solvent cleaning fluid.

Silver Brazing Alloy shall contain not less than 15% silver; verification of the silver content shall be given in writing to the Consultant Engineer. Care shall be taken not to overheat the joint. Apply the correct flux as recommended by the manufacturer slightly carbonising flame shall be used. Failure to use 15% silver brazing alloy will result in rectification of all joints.

Steel Pipe Welding (Fusion Welding). The joint shall be properly prepared before commencement and will be made in accordance with AS CB15.

Bronze Welding the joint shall be chamfered and the filler rod and flux shall be of the type recommended by the manufacturer.

Sewer Drainage - Rubber Ring Joints shall be in accordance with AS 1646 and installed in accordance with AS 1260.4, AS 2032. All rubber rings shall be of the type recommended by the manufacturer and approved by the local Authority.

Rubber ring jointed in accordance with the AS 1646 and the local Authority, and to be of the type and size recommended by the manufacturer. Where the pipe connecting is of a different material - a varying size ring as supplied by the manufacturer shall be used.

Flange type gaskets shall be material canvas or fibre reinforced rubber of 3 mm minimum thickness.

Lubricant for lubricating the rubber ring and insertion type gaskets and the outside surfaces of the spigot ends or pipes shall be of an approved non-toxic vegetable based type and shall be applied in accordance with the manufacturer's instructions.

Nuts and Bolts generally shall conform to AS 2451 and be heavily galvanised by the hot dip process. Where galvanised iron to cast iron, and cast iron to cast flanges butt, brass bolts shall be used.

Silicone shall be Selleys or approved equal, have low VOC content and used as recommended by the manufacturer, white shall be used around vitreous china sanitary ware and clear for seal under fixing taps stainless steel etc.

## 14.25 EXPANSION

Expansion for pressure type services where expansion shall be allowed for because of either excessively long runs exposed to temperature variations (i.e. in excess or 20m), shall be allowed for by means of expansion loops or approved mechanical expansion device.

They shall be of the type, material and manufacture approved by the Authority governing the works or meeting applicable certification level where required, and installed in such a manner that the axial movement of adjacent sections of the pipe and to the extent that the pipe work is above to extend to its possible maximum expansion in both directions without any restrictions.

Expansion joints shall be installed at intervals of no more than 20m and between fixed points exceeding three metres (3m) on all horizontal lines and branches that experience temperature variations and pipes crossing structural expansion joints.

## 14.26 TEMPERATURE GAUGES

Provide 100mm diameter waterproof temperature gauges on the outlet side of central hot water plant.

## 14.27 PRESSURE GAUGES

Gauges shall be AMBIT Model ME – AS B522 - 75L or equal. The face on the gauge shall be minimum of 100mm diameter and gauges shall be waterproof and oriented so that the gauge can be read at a height of 1600mm above floor level.

Each gauge shall be complete with approved gunmetal stopcock and copper piping connected to the relevant pipe work. Provide pressure gauges upstream and downstream of all pumping or pressure reduction devices and plant.

## 14.28 THERMAL INSULATION MATERIALS

Pipes shall be lagged to the manufacturer's standards or as specified in hot water insulation section. Where joints, fittings, bends, branches and valves etc., the lagging shall be cut and trimmed to fit around the section and then taped over.

Insulation shall be close celled polyethylene from Thermotec or approved equal. Insulations shall have no Ozone Depleting Potential (ODP) in either its composition or its manufacture.

## 14.29 PRESSURE SWITCHES

Shall be 'Honeywell' pressuretrol or approved equal and adjusted in strict accordance with the manufacturer's instructions.

## 14.30 ACOUSTIC TREATMENT TO PIPEWORK

Acoustic treatment, where necessary, shall be supplied and fixed as required to comply with BCA standards, and the acoustic report. Acoustic insulation shown on drawings is indicative only and does not alleviate the contractors responsibility to insulate all pipework as required

Pipe wrapping shall be Sound lag 4525C or approved equal.

## 14.31 ELECTRIC PIPE TRACE

Pipe trace fixed to the outside wall of any noted service shall be tied with approved cable ties at a maximum 600 mm centres. Heat trace is to extend up to the isolation valve for the area served. All pipe work is to be insulated in accordance with the Manufacture's recommendations.

All tracing used shall be equal in all respects to the WARM TRACE system as manufactured by THERMON. Temperature settings of the cable is to be as nominated on the drawings.

On completion of the insulated installation, the Hydraulic Services Works Package shall fix purpose-made adhesive labels to all warm traced reticulation advising of the cable at a maximum of four metre centres.

All heat trace installation and a licensed Electrician in accordance with the Manufacturer's recommendations shall carry out commissioning works. Allow testing heat trace installation prior to installation of insulation and providing test results. Following finalisation of installation, the entire system shall be tested and test results provided.

## 14.32 PROTECTIVE PIPE WRAPPING/COATING

All in ground metal pipes 80mm diameter and greater shall be protected by a polyethylene continuous sleeve (green sock) sealed with a waterproof duct tape. The sleeving shall be fitted to affect a smooth, closely contoured envelope with minimum barrel and socket gaps. There should be sufficient slack in contouring to allow the sleeving to follow the profile of the spigot-socket interface to prevent damage during backfill.

Sleeving shall be equal to MAC-WRAP protective sleeving as distributed by CHARMAC INDUSTRIES PTY. LTD.

All in ground metal pipes smaller than 80mm diameter shall be wrapped with a layer of petrolatum impregnated fully synthetic woven carrier tape.

All clean pipes and fittings shall be primed with a compatible priming paste prior to wrapping of the tape.

All pipes and fittings shall be covered with a minimum overlap of 30 millimetres.

Tape shall be equal in all respects to DENSO.

## 14.33 ROOF PENETRATION FLASHINGS

All service pipes penetrating the roof shall be made watertight by use of a flexible pipe flashing prior to fitting a cowl.

The pipe flashing shall be designed and installed to conform closely to the roof profile.

Seal the flashing by use of a neutral cure silicone sealant (HILTI CS204 or equal approved) prior to fixing the flashing with 10-gauge zinc plated self-drilling steel screws, or equal approved.

Pipe flashings shall be equal in all respects to the standard round 'DEKTITE' roof flashings manufactured from ethylene propylene dilne monomer polymer (E.P.M.D.) and distributed by DEKS INDUSTRIES PTY. LTD.

## 14.34 COLD WATER METERS

Master authority water meters for both domestic and fire services shall comply with local authority requirements including method of flow measurement, and method of authority meter reading requirements. This may include electromagnetic and ultrasonic.

Metering of fire services shall be via an ultrasonic flow measurement water meter.

Domestic cold-water services shall be fitted with a low friction turbine meter with integral line strainer, modular meter insert and non-return valve.

All meters shall be fitted with upstream and downstream unions and an upstream control valve, and comply in total with AS 3565.

All meters shall be fitted with upstream and downstream flanges and an upstream control valve.

All meters shall have provision for pulse output to future connection to BMS system. Pulse output shall be 1 pulse per 10 litres.

All meters shall have provision for pulse output to future connection to BMS system. Pulse output shall be 1 pulse per 10 litres.

## 14.35 VALVE BOXES

Shall be "Havestock" or approved equal cast iron with an identification mark stamped on top.

## 14.36 CONCRETE THRUST BLOCKS

Concrete thrust blocks shall be constructed at all stop ends, fittings, changes of direction and on every fourth straight and continuous length of pipe and where indicated on the drawings.

Thrust blocks shall be constructed for a minimum length of 500mm along the pipe and 300mm over the barrel of the pipe, the trench shall be undercut for a depth of 150mm into both sides and the bottom of the trench, reinforcing steel F82 shall be installed to tie the concrete around the pipe and into the rebates at the sides of the trenches.

The thrust blocks shall be supported or backed during the pour with approved formwork and the quantity of concrete shall be not less than 0.5 cubic metres, concrete to be as previously specified, all joints in the pipe work shall be left exposed.

## 14.37 BACKFLOW PREVENTION VALVES

Supply and install backflow prevention valves in accordance with AS/NZS 3500. All valves shall comply with AS 2845.1. Allow all costs to register each valve with the local regulatory Authority and provide certification. Valves shall be “Tyco” or approved equal.

# 15 PLANT AND EQUIPMENT

## 15.1 SANITARY DRAINAGE PUMP STATIONS

Provide a sanitary drainage pumping system, generally comprising:

4 Identical submersible pumps.

5 Controls and wiring.

6 Rising main.

7 Chamber vent.

8 Integrated valve box with independent air tight lid

9 Holding well with independent air tight lid.

10 Control panel, untrasonic level sensors/controllers and wiring to give automatic operation of sewage pumps.

11 Hose tap to be provided with BFPD within 5m of pump station access lids.

12 Site commissioning by trained Service Personnel after installation by others.

All to form a complete and approved installation as indicated on the drawings.

Refer “schedules” section for details.

### *15.1.1 PUMPS TO COMPLY WITH THE FOLLOWING REQUIREMENTS*

13 Submersible type with shredding impeller.

14 Have casing made of GG-25 and stainless steel shaft.

15 Have lubricated for life, maintenance free motor shaft bearings and high quality silicon carbide mechanical seal independent of direction of rotation; lip seal oil lubricated.

16 Have waterproof cabling.

17 Shall be auto-coupling (to fixed pipework), on fixed stainless steel guide rail(s)

### *15.1.2 PUMP WELL BODY TO COMPLY WITH THE FOLLOWING REQUIREMENTS*

18 Incorporate emergency storage volume of minimum 1 hour at peak inflow (measured from pump stop to inlet invert level)

19 If not structural, shall be of fibre reinforced plastic or equal perfoming material

20 Valve box, and pump access lids shall be rated for relevant trafficable conditions

21 All pipe penentrations to be fully sealed and waterproof with threaded couplings or similar

22 Valve box to contain manual bleed/tapping point

23 Valve box to have drain to main chamber with check valve

24 Pump operation/switching shall be via ultrasonic type sensors mounted within pump well. Level switching to operate;

- a Pump Stop
- b Duty pump start
- c Standby pump start
- d High level alarm

### 15.1.3 CONTROL PANEL

Provide control panel, level controllers and wiring to give automatic operation of sanitary drainage pumps.

Control panel to be located where shown on plans and fixed to wall and shall be suitable for external installation exposed to weather conditions. Location to be confirmed prior to installation.

For control panel requirements refer to “Pump Control Panels” section.

## 15.2 DOMESTIC COLD WATER /RAIN WATER BOOSTER & PRESSURE PUMPS

### 15.2.1 PUMPS TO COMPLY WITH THE FOLLOWING REQUIREMENTS

Pump set is to incorporate the following:

25 Multiple vertical variable speed displacement pumps.

26 Separate distribution board fitted with main power supply isolating switch with separate circuit breakers for each unit.

27 Inlet side of each pump pre-plumbed with an isolating valve and non-return valve, connected to a common inlet manifold with a neoprene vibration eliminator.

28 Discharge side of each pump fitted with an isolation valve and a common manifold is to be provided with a separate main isolating valve, neoprene vibration eliminator and a full flow bypass. On the discharge manifold 65mm pressure gauge is provided together with a single pressure tank in accordance with the manufacturers specification. This system will maintain a set pressure with a maximum variation of 2.0%.

29 Site commissioning by trained Service Personnel after installation by others.

Refer “Schedules” section for details.

### 15.2.2 CONTROL PANEL

Provide control panel, tank level controllers (for tank suction pressure pump sets) and wiring to give automatic operation of pumps.

For control panel requirements refer to “Pump Control Panels” section.

.

# 15.3 PUMP CONTROL PANELS

Supply and install all equipment necessary to operate the pumps specified under hydraulic services.

Allow for all control cabinets, mounting brackets, contactors, isolating and control switches, auxiliary switches, alarms, wiring between pump and panel, panel and level controls, and other associated equipment necessary for the safe and effective operation of the pumps as required for the installation and in accordance with statutory requirements to AS 3000.

Provide a complete specification and drawings of pumps and control equipment prior to installation.

## *15.3.1 FUNCTIONS*

### 15.3.1.1 ALL CONTROL PANELS

Each control panel shall contain the following minimum.

**30** Circuit breakers for each pump.

**31** Control circuit breaker.

**32** Auto/Off/manual switch to each pump.

**33** Automatic alternation of pumps.

**34** Audible alarm complete with reset type mute button.

**35** Individual digital hour meters for each pump operation.

**36** All switches to be fitted in inner door to prevent unauthorised usage.

**37** Individual digital hour run meters for each pump operation.

### 15.3.1.2 PUMP STATION CONTROL PANELS

**38** Indicating lights for the following:

| | | |
|---|---|---|
| **a** | power on | 1 off |
| **b** | pumps run | 1 off for each pump |
| **c** | pump fail | 1 off for each pump |
| **d** | high level alarm | 1 off. |

**39** Volt free terminals on separate terminal strip for each pump run, each pump fail, high level alarm, wiring to remote indication panel by other nominated Works Packages.

### 15.3.1.3 BOOSTER/TRANSFER PUMPS CONTROL PANELS

**40** Indicating lights for the following:

| | | |
|---|---|---|
| **a** | power on | 1 off |
| **b** | pumps run | 1 off for each pump |
| **c** | pump fail | 1 off for each pump |
| **d** | low discharge alarm (will stop pumps) | 1 off. |

**41** Volt free terminals on separate terminal strip for each pump run, each pump fail and low discharge pressure.

**42** Low discharge pressure switch to stop pumps when pressure drops below 100 kPa.

#### 15.3.1.4 PRESSURE PUMPS CONTROL PANELS

**43** Indicating lights for the following:

- **a** power on 1 off
- **b** pumps run 1 off for each pump
- **c** pump fail 1 off for each pump
- **d** low storage tank level (will stop pumps) 1 off
- **e** low suction (will stop pump) 1 off.
- **f** low discharge alarm (will stop pumps) 1 off.

**44** Volt free terminals on separate terminal strip for each pump run, each pump fail, low storage tank level, low suction, low discharge, wiring to remote indication panel by other nominated Works Packages.

### *15.3.2 CONTROL PANELS – CONSTRUCTION*

**45** Control panel shall be provided to house electrical switchgear associated with pumps, and any other equipment requiring electrical controls for proper operation and safety. The control panels shall be wall mounted adjacent to equipment or in location shown with top at approximately 1800mm high above floor. In some cases, approval, will be given for control panels to be mounted on equipment.

**46** Control panels shall be totally enclosed cabinet type.

**47** Control panels shall be designed for ease of access to all equipment and wiring and shall be provided with at least 10% spare space for the addition of future equipment.

**48** Control panels shall comply with AS 1339 as follows:

- **a** IP50 for internal locations.
- **b** IP54 for external locations or where a weatherproof cabinet or enclosure is specified.

**49** Doors shall have concealed hinges and an approved key operated lock.

**50** Two locks for doors in excess of 1000mm.

**51** Vertical locking bars to provide top and bottom fastening shall be provided on all doors exceeding 1500mm in height.

**52** A dustproof seal consisting of a substantial mould neoprene rubber strip shall be provided for doors or removable panels and covers. Escutcheon panels need not be provided with seals.

**53** Switches, indicators, etc. to which wiring is connected shall not be fitted on removable plates.

**54** Where conduits or cables enter cabinets, (cables must enter from the bottom), drill the cabinet and locknut the conduits or the cable glands to the cabinet. Note: No top or side entry without approval.

### *15.3.3 EQUIPMENT*

**55** DIN standard rail mounted terminal strips shall be provided for the termination of all external control circuit wiring and BAS identification.

**56** Equipment shall be neatly arranged and readily accessible for maintenance.

**57** Each control panel shall be provided with an isolating switch, neutral and earth link.

**58** Control switches shall be rotary type complying with AS 1431.

**59** Indicator lights shall match control switches with colours as follows:

a RED Pump fail, alarm – e.g. High and low level.

b AMBER Pump running.

c GREEN Power supply on.

60 Circuit breakers shall be approved by Australian supply authorities and comply with Australian Standards.

61 Time clocks shall be quartz crystal oscillator type with an accuracy of plus/minus 5 minutes per annum and complete with nickel cadmium battery to proved a 50-hour reserve/digital 100 hour.

62 Covered terminal strips with labelled terminals shall be provided for connection of the Building Management System (BMS) wiring by others. Wiring to terminals shall provide voltage free contacts for all alarms and faults and for pump running indication. Contacts to be either normally open or normally closed contacts.

### 15.3.4 LABELLING

63 All control panels and equipment shall be labelled with engraved laminated type labels. Labels shall be black and white lettering. Size of lettering shall match importance and location. Labels shall be screw fixed.

64 Cabinets shall be labelled to indicate function

65 Equipment shall be labelled to indicate function and to identify any associated equipment e.g.:

a "PUMP CONTROL SELECTOR"

b AUTO/OFF/MANUAL.

### 15.3.5 TESTING

Test the system on completion. Furnish two copies of the manufacturer's test certificate.

## 15.4 TANK WATER LEVEL CONTROLS

Provide a system of water level controls to the storage tank, to automatically operate the pumps and activate the alarms, including wiring/connection to the pumps panel.

The water level controls shall be ultrasonic sensing type.

The sensor shall be mounted within the tank where it remains accessible and has an uninterrupted reading of water levels over the entire height of the tank.

Functions shall include:

66 Activate High Level Alarm.

67 Stop Duty Pump.

68 Start Duty Pump.

69 Stop Standby Pump.

70 Start Standby Pump.

71 Activate Low Level Alarm.

Provide all control wiring between pumps in the pump room, and water storage level controls. The system shall be installed in accordance with the manufacturer's instructions and Authorities requirements. A 240-volt power supply shall be provided by others.

## 15.5 FLEXIBLE PUMP COUPLINGS

Flexible connections or anti-vibration couplings similar to ‘S’ flex flexible couplings installed on the suction and discharge side of each pump in accordance with the manufacturer’s instructions. Each flexible connector shall have a hose length of not less than four (4) times the pipe diameter installed with a maximum angular deflection not exceeding five (5) degrees.

## 15.6 PUMP MOUNTINGS

Pump mountings shall be Silentbloc or approved equal spring isolating mountings on an appropriate size to provide a minimum 95% vibration absorption.

# 16 NOISE AND VIBRATION

## 16.1 GENERAL REQUIREMENTS

Acoustically seal pipe and cable penetrations through noise rated walls and acoustic enclosures.

Statically and dynamically balance rotating machinery.

Support rotating and reciprocating equipment on anti-vibration/vibration absorbing mounts on hangers.

All static equipment in plantrooms with suspended floors to be separated from the structure with double thickness neoprene pads or equal.

All connections to rotating equipment or assemblies containing rotating equipment shall be rendered flexible by anti-vibration hangers supporting pipework and/or by flexible connections as specified.

Plinths for all floor mounted equipment.

## 16.2 VIBRATION CONTROL

### *16.2.1 ACCEPTANCE CRITERIA*

Complete systems including individual components not to exceed satisfactory levels as set out in AS 1359 and AS 2625.

Select anti-vibration mounts/hangers for life cycle of building and install in accordance with the requirements of the Earthquake Code AS 1170.4–1993.

Select and install anti-vibration mounts and hangers in locations to prevent transmission of vibration to adjoining areas and to prevent undue vibration, distortion or fatigue of equipment and connecting piping and cabling.

Select vibration isolation mounts/hangers to allow for deflections of building structures and finishes and for minimum static deflection as specified.

### *16.2.2 SPRING MOUNTS*

Free standing and positioned for uniform deflection of all springs.

Spring mounting plates and frames hot dip galvanised.

Ratio of mean coil diameter to compressed length at specified static deflection of 0.8.

Minimum additional travel to solid of 50%.

Holding down bolts to be provided.

Surge frequency to be beyond 30% of predominant machine frequency of vibration.

### *16.2.3 NEOPRENE PADS*

Use up to 9mm static deflection.

Loading not greater than 400kPa.

### *16.2.4 ANTI-VIBRATION HANGERS*

Spring and double neoprene cup type in series.

Total hanger deflection 25mm minimum.

Provide secondary adjustment to transfer load to spring.

## 16.3 NOISE MEASUREMENTS

Measure and submit noise measurements in areas nominated above using sound level meter complying with AS 1259 during the noisiest operating condition.

Where noise measurements exceed specified criteria, take additional noise readings in each octave band (125Hz to 4000Hz inclusive) in selected locations with reference to AS 1045-1988, AS 1055, AS 1081, AS 1089, AS 1217 and AS 1469–1983.

## 16.4 VIBRATION MEASUREMENTS

1 Where a noise hazard exists and all practicable noise attenuation has been carried out, hazardous areas shall be defined by the erection of signs reading:

NOTICE

HEARING PROTECTION MUST BE WORN

IN THIS AREA

or

NOTICE

HEARING PROTECTION MUST BE WORN

WHEN THIS MACHINE IS RUNNING

Signs shall be 'Brady' Indoor/Outdoor, Personal Hazard Warnings or approved equivalent.

# 17 SCHEDULES

## 17.1 GENERAL

A The following schedules have been prepared for tendering purposes and to convey design intent. They form a summary of the preceding Clauses in the Specification and must be read in conjunction with these Clauses and the Project Drawings.

Where reference Clauses are referred to, they shall be taken as the major Clause, but equipment shall also comply with all other relevant Clauses in the Specification.

Water quantities and temperatures may be changed slightly to suit the particular manufacturer's equipment, however full details shall be submitted for review. Changes shall not be in conflict with any By-Laws, Statutory Requirements (including BCA Section J where applicable), Public Health Requirements or the overall design in general including achievement of any energy compliance criteria.

Pump duties have been calculated from typical equipment and have been given as a guide only.

The following schedules show details of hydraulic equipment only.

The equipment pages of this schedule must be submitted with the tender offer in the current tabulised form with 'tender' columns and rows completed.

Schedule of equipment submitted on alternate forms, manufacturers' data sheets, contractor work sheets, etc. will not be accepted.

Completion of the technical schedule for tender review does not constitute approval of proposed equipment nor does it absolve the requirement to satisfy the requirements of the specification.

## 17.2 SCHEDULE OF EQUIPMENT

| SEWER PUMP STATION | |
|---|---|
| **Location** | Inground B3 – control panel on wall adjacent |
| **No off** | 1 packaged pump station |
| **Operation / Rating** | 3 Phase |
| **Type** | Submersible macerating heavy duty |
| **System** | 2 Pumps (100% flow rate each)<br>duty / standby (6 hour timed rotational operation) |
| **Accessories** | High level and fault alarm at control panel of device |
| **Duty** | 4 L/sec @ 15m head |

| STORMWATER PUMP STATION | |
|---|---|
| **Location** | Inground B3 – control panel on wall adjacent |
| **No off** | 1 packaged pump station |
| **Operation / Rating** | 3 Phase |
| **Type** | Submersible heavy duty |
| **System** | 2 Pumps (100% flow rate each)<br>duty / standby (6 hour timed rotational operation) |
| **Accessories** | High level and fault alarm at control panel of device |
| **Duty** | 4 L/sec @ 15m head |

| RAINWATER TANK | |
|---|---|
| **Location** | Inground B3 |
| **Capacity** | 40,000 litres |
| **System** | Concrete construction |
| **Accessories** | 2 x access risers and covers (trafficable Class C)<br>2 x access ladders<br>2 x ø300 inlet (TBC)<br>1 x ø50 outlet<br>1 x ø50 outlet (conduits) |
| **Make / Model** | By structural |
| **Treatment System** | Single pass |
| **Treatment Make / Model** | UV Guard or Similar approved |
| **System** | 2 bag filters parallel |

| POTABLE WATER BREAK TANK | |
|---|---|
| **Location** | Basement 3 below ramp |
| **Capacity** | 3,000 litres |
| **System** | Plastic |
| **Accessories** | 1 x ø150 inlet<br>1 x ø150 outlet<br>1 x ø50 outlet (level controls conduits) |
| **Make / Model** | Tasman Tanks or similar approved |

| GREASE ARRESTOR | |
|---|---|
| **Location** | Inground B3 |
| **Treatment rate** | 5,000 litres / hr |
| **Dimensions** | 3100 length x 1850 width x 1550 height |
| **Make / Model** | Halgan or similar approved |

| RAINWATER TRANSFER PUMP | |
|---|---|
| **Location** | Basement 3 (submersible) |
| **No off** | 1 |
| **Type** | Vertical, multi-stage variable speed, submercible |
| **System** | 2 Pumps – 100% duty each (duty / standby rotational operation) |
| **Pressure Vessel** | 100 litre |
| **Duty** | 2 L/sec @ 100m head |

| COLD WATER BOOSTER PUMP STATION | |
|---|---|
| **Location** | Basement 3 Below Ramp |
| **No off** | 1 |
| **Operation** | 3 Phase |

| | |
|---|---|
| **Type** | Vertical, multi-stage variable speed |
| **System** | 3 Pumps – shared duty (duty / stand by rotational operation) |
| **Pressure Vessel** | 100 litre |
| **Duty** | 8 L/sec @160m head |

| HOT WATER PLANT | |
|---|---|
| **Location** | As indicated on the drawing |
| **No off** | 1 per apartment |
| **Make / Model** | Stiebel Eltron Instantaneous Water Heater [DBH-E27] |

| WATER METERS 50mm and over | |
|---|---|
| **Type** | Pulse |
| **Pulse** | 1 pulse / 10 litres |
| **Model / Make** | Authority listed |
| **Accessories** | Isolation valves upstream and downstream<br>Strainer upstream |

# 17.3 SCHEDULE OF VALVES

| PRESSURE LIMITING VALVE | |
|---|---|
| **Location** | As shown |
| **Operation** | Adjustable between, 350 kPa - 500 kPa as shown on schematics |
| **Make / Model** | RMC, PSL |
| **WATER METERS up to 50mm** | |
| **Type** | Pulse |
| **Pulse** | 1 pulse / 10 litres |
| **Model / Make** | Authority listed |
| Accessories | Isolation valves upstream and downstream<br>Strainer upstream<br>Barrel unions upstream and downstream |

| PRESSURE REDUCING VALVE | |
|---|---|
| **Location** | As shown – installed in parallel |
| **Operation** | Preset to max 1200 kPa, reduce to 350 kPa - 500 kPa as shown on schematics |
| **Make / Model** | Caleffi (5335, 5335H), RMC(PRV015-050), Bayard, Bermad |
| **Connection** | DN 50 |
| **Dimension** | L x W x H 400 x 400 x 900 |
| **Screen** | 10 micron |

| TEMPERING VALVE | |
|---|---|
| **Location** | All |
| **Model / Make** | Caleffi (5213-2522HP Grey Cap) |

| ISOLATION VALVE | |
|---|---|
| **Location** | All wet areas, personal hygiene washing fixtures, kitchens |
| **Model / Make** | Up to and including 50mm - with upstream and downstream unions.<br>Over 50mm - Flanged |

| SINGLE CHECK VALVE | |
|---|---|
| **Location** | All |
| **Model / Make** | Caleffi |

| DOUBLE CHECK VALVE up to 50mm | |
|---|---|
| **Location** | All |
| **Model / Make** | Wilkins Zurn |
| **Accessories** | Isolation valves upstream and downstream<br>Strainer upstream<br>Barrel unions upstream and downstream<br>Bypass with isolation valve |

| DOUBLE CHECK VALVE 50mm and over | |
|---|---|
| **Location** | All |
| **Model / Make** | Wilkins Zurn |
| **Accessories** | Isolation valves upstream and downstream<br>Strainer upstream<br>Bypass with isolation valve |

| REDUCED PRESSURE ZONE DEVICE (RPZD) VALVE up to 50mm | |
|---|---|
| **Location** | All |
| **Model / Make** | Pentair (RP03), FEBCO (Series 860, 860RPZD), Zurn Wilkins (375) |
| **Accessories** | Isolation valves upstream and downstream<br>Strainer upstream<br>Barrel unions upstream and downstream<br>Bypass with isolation valve |

| REDUCED PRESSURE ZONE DEVICE (RPZD) VALVE 50mm and over | |
|---|---|
| **Location** | All |
| **Model / Make** | Pentair (RP03), FEBCO (Series 860, 860RPZD), Zurn Wilkins (375) |
| **Accessories** | Isolation valves upstream and downstream<br>Strainer upstream<br>Bypass with isolation valve |

| TANK FILLING VALVE | |
|---|---|
| **Location** | All |
| **Model / Make** | Philmac (SS Horizontal Float Valve, Servo tank filling valve), Bermad (700 series) |

| “Y” Strainer | |
|---|---|
| **Location** | All |
| **Model / Make** | RMC, ZETCO (Series 1504, 1505) |

| Pressure Gauge | |
|---|---|
| **Location** | All |
| **Model / Make** | AMBIT (600 Series) |
| **Requirements** | Ø100 |

| STORMAWATER DIVERSION VALVE | |
|---|---|
| **Location** | On the level where a gravity connection to the civil legal point of discharge |
| **Model / Make** | Mifab |

| TRAP PRIMING VALVE | |
|---|---|
| **Location** | All |
| **Model / Make** | AKS Industries or equivalent |

## 17.4 SCHEDULE OF FLOOR DRAINS

Refer architectural, interior, kitchen, pool, and landscape consultant schedules

## 17.5 SCHEDULE OF INSULATION

| TYPE | LOCATION | DESCRIPTION | SPECIFICATION |
|---|---|---|---|
| **Thermal** | All hot water pipework (flow return and deadlegs) | 25mm wall thickness. Closed cell polyethylene | Thermotec 4-zero |
| **Acoustic** | All sanitary and stormwater drainage lines above habitable / office / retail areas | Achieve minimum levels specified in acoustic report | Soundlag 4525C |

Note: Alternative insulations must satisfy the stricter of the BCA Section J requirements and the above WSP requirements. In addition, alternatives must have zero ODP in both product and manufacture.

## 17.6 SCHEDULE OF PIPE MATERIALS

| SERVICE | LOCATION | MATERIAL | NOMINAL PIPE SIZE |
|---|---|---|---|
| **Stormwater** | Above + Below ground | PVC – 'DWV' grade | 100-300 |
| **Stormwater Downpipes** | Internal within risers | Best Practice uPVC | 100-300 |
| **Sewer Drainage** | All | PVC – 'DWV' grade | 100-300 |
| **Drainage pipework (Cast in slab)** | All | HDPE | 50-150 |
| **Sanitary stack** | Above ground | PVC – 'DWV' grade | 100-225 |
| **Vent pipes** | Above ground | PVC – 'DWV' grade | 50 -150 |
| **Sewer rising main** | Above and below ground | PE100 PN16<br>or<br>PVC-U pressure PN 12 | 32–150 |
| **Trade waste drainage** | All | HDPE with fusion couplings | 100-150 |
| **Trade waste vent** | Above ground | HDPE or PVC- 'DWV' | 50-100 |
| **Trade Waste Plumbing (High Temp / Heat Traced)** | All | Cast Iron | 100-300 |
| **Sanitary Plumbing** | Above ground | PVC – 'DWV' grade | 40-300 |
| **Cold water mains** | Below ground | Copper tubes to AS 1432-1990 Type B wrapped with petroleum impregnated tape<br>Or<br>PVC – pressure PN20 | 50-150 |
| **Cold water service** | Above ground | Copper tubes to AS 1432-1990 Type A and Type B according to pressure requirements | 15-200 |
| **Cold water service – high pressure** | Main Riser | Stainless steel 316 – Schedule 10S - Prochem Roll Groove | 50-150 |
| **Hot water service** | Above ground | Copper tubes to AS 1432-1990 Type A and Type B according to pressure requirements | 65-150 |

| SERVICE | LOCATION | MATERIAL | NOMINAL PIPE SIZE |
|---|---|---|---|
| **Hot and cold water rough-ins** | Above ground | Copper tube Type B<br>Cross–linked polyethylene (PEX), Rehau | 15-25 |
| **Non potable water (recycled water)** | Above and below ground | Polypropylene pipe | 25-100 |
| **Non potable water (recycled water) – high pressure** | Main Riser | Stainless Steel | 50-150 |
| **Non potable water, rough-ins** | Above and below ground | Cross–linked polyethylene (PEX) Rehau, labeled “RECYCLED WATER” | 15-25 |

## 17.7 SCHEDULE OF TAPWARE AND FIXTURES

### SANITARY FIXTURES

REFER TO ARCHITECTS SCHEDULE

# 18 TENDER FORM

*FOR*

*HYDRAULIC SERVICES*

*AT*

*8- 12 PUNT ROAD & 3- 7 WELLINGTON STREET, ST KILDA, VIC3182*

I/We, the undersigned, hereby tender to carry out and complete the works in accordance with the Specification, proposed General Conditions of Contract and Addenda for the sum set out hereunder:

| | | |
|---|---|---|
| Fixed Lump Sum Tender Excluding Goods & Services Tax (GST) for the complete Hydraulic Service Works Package as Specified | | $ |
| Provisional Sums: | | $ |
| **GST:** | | $ |
| **TOTAL INCLUDING GST:** | | $ |

*ADDENDUM*

We, the undersigned, acknowledge having received the following addenda and have incorporated them in our tender proposal.

| NUMBER | DESCRIPTION | DATE RECEIVED |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

DATED THIS ..... DAY OF ..... 2020

SIGNATURE OF TENDERER .....

COMPANY .....

ADDRESS .....

.....

**Sections Costs**

| SECTION COSTS | ITEM COST |
|---|---|
| Sanitary drainage and plumbing | $ |
| Trade waste drainage | $ |
| Trade waste treatment devices. | $ |
| Acoustic Insulation | $ |
| Conventional stormwater drainage | $ |
| Backflow Protection | $ |
| Rainwater harvesting pumps, controls and filters | $ |
| Rainwater tanks | $ |
| Rain water reticulation | $ |
| Cold water reticulation | $ |
| Hot water reticulation | $ |
| Hot Water Plant | $ |
| Thermal Insulation | $ |
| Siphonic Stormwater | $ |
| Authority Fees and Charges | $ |
| Concrete Cutting | $ |
| Sanitary Fixtures and Tapware as scheduled | $ |
| Painting | $ |
| Electrical Services for Hydraulic Plant | $ |
| Shop Drawings | $ |
| Testing & Commissioning | $ |
| Maintenance & Servicing | $ |
| As Built Documentation | $ |
| Operation and Maintenance Manuals | $ |
| Sub-Total (excluding GST) | $ |
| GST | $ |
| Total INCLUDING GST | $ |

**Schedule of labour and mark-up rates**

Labour rates applicable to the contract including all on costs, loading, allowances, overhead recovery and profits.

| | NORMAL TIME | TIME & HALF | DOUBLE TIME |
|---|---|---|---|
| Project Manager | $ | $ | $ |

| | NORMAL TIME | TIME & HALF | DOUBLE TIME |
|---|---|---|---|
| Site Manager | $ | $ | $ |
| Tradesman – site | $ | $ | $ |
| Apprentice – site | $ | $ | $ |
| Maintenance Technician – site | $ | $ | $ |

Mark-Up to be applied on the cost to purchase materials %

Mark-Up to be applied on the Sub-Contractors %

**Schedule of personnel**

The following persons will be assigned to the contract.

*IN OVERALL CHARGE FOR THE CONTRACTOR*

| | | | |
|---|---|---|---|
| **Name** | | **Years with company** | |
| **Experience** | | | |

*CHIEF SUPERVISOR*

| | | | |
|---|---|---|---|
| **Name** | | **Years with company** | |
| **Experience** | | | |

*FOREMAN IN CONTINUOUS ATTENDANCE – ON SITE*

| | | | |
|---|---|---|---|
| **Name** | | **Years with company** | |
| **Experience** | | | |

*DRAFTING PERSONNEL TO PRODUCE CONSTRUCTION AND AS INSTALLED DRAWINGS*

| | | | |
|---|---|---|---|
| **Name** | | **Years with company** | |
| **Experience** | | | |

**Schedule of specialist installers**

We advise that our Tender includes work as described below to be carried out in each case by the Specialist Installer Stated (complete for all items not to be installed directly by the Hydraulic Sub-Contractor's personnel).

| ITEM | COMPANY |
|---|---|
| **1** | |
| **2** | |
| **3** | |
| **4** | |
| **5** | |
| **6** | |

| ITEM | COMPANY |
|---|---|
| 7 | |
| 8 | |
| 9 | |
| 10 | |

**Schedule of major equipment manufacturers**

We advise that our Tender includes equipment of manufacturers listed below. All necessary modifications to equipment shall be provided to fully meet the requirements of the Specification

| ITEM | MANUFACTURER & TYPE |
|---|---|
| Hot Water Plant | |
| Rainwater Pressure Pump | |
| Trade Waste Plant | |
| Settling / Dilution Pit | |
| Basket traps | |
| Rainwater Filtration | |
| Grated Trench Drains | |
| Backflow Protection Valves | |
| Isolation valves | |
| BMS Water Meters | |
| Rainwater Harvesting Tank | |

**Schedule of unit rates**

Unit rates applicable to the Contract including all labour materials, on costs, loading, allowances, overhead recovery and profits but excluding Goods and Services Tax.

1 Unit rate schedule – drainage piping systems

Unit rates including the supply and installation of in-ground straight lengths of pipework per meter run. Depth 1 metre to 2 metres deep (average 1.5 metres).

| MATERIAL<br>PIPE DIAMETER MM | UPVC DWV | HDPE |
|---|---|---|
| **40/50** | $ | $ |
| **65** | $ | $ |
| **100** | $ | $ |
| **150** | $ | $ |
| **225** | $ | $ |
| **300** | $ | $ |

Unit rates including the supply and installation of suspended straight lengths of pipework per metre run.

| MATERIAL<br>PIPE DIAMETER MM | UPVC DWV | HDPE |
|---|---|---|
| **40/50** | $ | $ |
| **65** | $ | $ |
| **100** | $ | $ |
| **150** | $ | $ |
| **225** | $ | $ |
| **300** | $ | $ |

Unit rates including the supply and installation of suspended straight lengths of pipework per metre run including acoustic insulation.

| MATERIAL<br>PIPE DIAMETER MM | UPVC DWV | HDPE |
|---|---|---|
| **40** | $ | $ |
| **50** | $ | $ |
| **65** | $ | $ |
| **100** | $ | $ |
| **150** | $ | $ |
| **225** | $ | $ |
| **300** | $ | $ |

Unit rate schedule – reticulation piping systems – domestic hot water

Unit rates including the supply, installation and insulation (where applicable) of suspended straight lengths of pipework per metre run.

| MATERIAL<br>PIPE DIAMETER MM | COPPER TUBE<br>TYPE B | PEX |
|---|---|---|
| **15** | $ | $ |
| **20** | $ | $ |
| **25** | $ | |
| **40** | $ | |
| **50** | $ | |
| **65** | $ | |
| **80** | $ | |
| **100** | $ | |

Unit rate schedule – reticulation piping systems – domestic cold water

Unit rates including the supply, installation of straight lengths of suspended pipework per metre run.

| MATERIAL<br>PIPE DIAMETER MM | COPPER TUBE<br>TYPE B | PEX |
|---|---|---|
| **15** | $ | $ |
| **20** | $ | $ |
| **25** | $ | |
| **40** | $ | |
| **50** | $ | |
| **65** | $ | |
| **80** | $ | |
| **100** | $ | |

Unit rate schedule – reticulation piping systems – reclaimed cold water

Unit rates including the supply, installation of straight lengths of suspended pipework per metre run.

| MATERIAL<br>PIPE DIAMETER MM | POLYPROPYLENE | PEX |
|---|---|---|
| **15** | $ | $ |
| **20** | $ | $ |
| **25** | $ | |
| **40** | $ | |
| **50** | $ | |
| **65** | $ | |
| **80** | $ | |
| **100** | $ | |

Unit rate schedule – sanitary fixtures

Unit rates including the supply, installation of fixture, bracket, tapware, fixture trap, connection to drainage and water supply.

| SANITARY FIXTURES | UNIT RATE |
|---|---|
| **WC type 1** | **$** |
| WC type 2 | $ |
| WC type 3 | $ |
| WC type 4 | $ |
| Urinal type 1 | $ |
| Urinal type 2 | $ |
| Hand basin type 1 | $ |

| SANITARY FIXTURES | UNIT RATE |
|---|---|
| Hand basin type 2 | $ |
| Hand basin type 3 | $ |
| Hand basin type 4 | $ |
| Shower type 1 | $ |
| Shower type 2 | $ |
| Cleaner sink type 1 | $ |
| Trough type 1 | $ |
| Eyewash type 1 | $ |
| Eyewash / Safety Shower | $ |
| Sink type 1 | $ |
| Sink type 2 | $ |
| Drinking Fountain type 1 | $ |
| Boiling/Chilled Water unit type 1 | $ |

**Schedule of deviations**

List below all details of instances where the tender submission does not fully comply with the specified requirements.

**Schedule of Alternatives**

List below all details of alternative offers associated with the tender submission.

**Schedule of technical data**

*TRADE WASTE PLANT*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*SETTLING PIT*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*RAIN WATER PRESSURE PUMP*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*HOT WATER RETURN CIRCULATING PUMP*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*HOT WATER PLANT*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*BOILING / CHILLED WATER UNITS*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*DRINKING FOUNTAINS*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*WATER SERVICES ISOLATING VALVES UP TO 50MM*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*WATER SERVICES ISOLATING VALVES OVER 50MM*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*WATER SERVICES NON-RETURN VALVES UP TO 50MM*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*WATER SERVICES NON-RETURN VALVES OVER 50MM*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*WATER SERVICES SOLENOID VALVES*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*WATER SERVICES STRAINERS UP TO 50MM*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*WATER SERVICES STRAINERS OVER 50MM*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*WATER SERVICES BACKFLOW PREVENTION – REDUCE PRESSURE ZONE DEVICES*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*WATER SERVICES BACKFLOW PREVENTION – TESTABLE DOUBLE CHECK VALVE*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*WATER SERVICES THERMOSTATIC MIXING VALVES – AMENITY*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*PRESSURE GAUGES*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*TEMPERATURE GAUGES*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*PRESSURE LIMITING VALVES*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*PRESSURE REDUCING VALVES*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*HOT WATER BALANCING VALVES*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*AUTO FLUSH VALVE*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*GRATED OUTLET*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*PLANTER DRAIN OUTLET*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*SPOON DRAIN OUTLET*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*FLOOR WASTE – SHOWER*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*FLOOR WASTE – AMENITY*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*INSPECTION OPENING TO SURFACE*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*INSPECTION OPENING TO SURFACE - EXTERNAL*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*BASKET FLOOR WASTE*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*ACOUSTIC INSULATION*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*THERMAL INSULATION*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*GRATED TRENCH DRAIN*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*FLEXIBLE CONNECTIONS*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*WATER SERVICES FLOAT CONTROL VALVES*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |

*WATER SERVICES VACUUM BREAKERS*

| | |
|---|---|
| **MANUFACTURER** | |
| **MODEL** | |
| **TYPE** | |