

PROJECT: 1 (LOT 181) GLENBURNIE TERRACE, PLYMPTON (APARTMENTS)

HYDRAULIC SPECIFICATION

SECON Consulting Engineers
456 Pulteney Street
Adelaide SA 5000
Phone: 08 82237800

Project Number: B9025
Prepared For: Urbanize Architect

Document Revision and Status

Date	Rev	Issued By	Notes	Checked	Approved
29/04/19	0	M Fechner	BRC Issue		

Project No. B9025

Issued by Matthew Fechner

Senior Hydraulic and Fire Engineer

matthewf@secon.net.au

Table of Contents

ITEM	SCHEDULE
HYDRAULIC SERVICES	6
1 GENERAL	6
1.1 BUILDING WORKS	6
1.2 SCOPE OF WORKS	6
1.3 DOCUMENTS ISSUED	8
1.4 ASSOCIATED WORKS	8
2 DESIGN AND COORDINATION INFORMATION	9
2.1 DESIGN BASIS	9
2.2 SUBSTITUTIONS	9
2.3 APPROVALS	9
2.4 EQUIPMENT WEIGHTS, SIZES AND POWER REQUIREMENTS	9
2.5 SPACING OF PLANT AND EQUIPMENT	9
2.6 QUALIFICATIONS AND EXPERIENCE	9
2.7 LICENSED PERSONNEL	10
2.8 AUSTRALIAN STANDARDS	10
2.9 NATIONAL CONSTRUCTION CODE (NCC)	10
2.10 COORDINATION WITH OTHER TRADES	10
2.11 GUARANTEES	10
2.12 SPECIFICATION AND TENDER DRAWINGS	10
2.13 AS INSTALLED DRAWINGS	11
2.14 SAMPLES	11
2.15 AUTHORITIES TESTING	11
2.16 AUTHORITIES AND APPROVALS	11
2.17 MAINTENANCE LIFTING	12
2.18 INSPECTIONS	12
2.19 WARRANTIES	12
2.20 CERTIFICATE OF COMPLIANCE	12
2.21 EXTRANEIOUS INTERFERENCE	12
2.22 OBVIOUS WORKS	12
3 MATERIALS AND WORKMANSHIP	12
3.1 MATERIALS	12
3.2 DELIVERY TO SITE, MATERIAL HANDLING & STORAGE OF MATERIALS	13
3.3 LABOUR	13
3.4 WORKMANSHIP	13
3.5 CORROSION PREVENTION	13
3.6 ACCESSIBILITY	13
3.7 CLEANING	14
3.8 CHASES AND ENCASING	14
3.9 COVER PLATES	14
3.10 ROOF PENETRATIONS AND FLASHINGS	14
3.11 WALL, BEAM, FLOOR AND CEILING PENETRATIONS	14
4 FIXTURES	15
4.1 SANITARY WARE	15
4.2 LOCATION	15
4.3 INSTALLATION	15
5 PIPEWORK	16
5.1 GENERAL	16
5.2 SUPPORTS	16
5.3 FLEXIBILITY	17
5.4 JOINTS	17
5.5 COPPER PIPEWORK	17
5.6 UPVC PIPEWORK – SEWER – WASTE – VENTS	18
5.7 REHAU RAUPIANO PLUS – SEWER – WASTE – VENTS	18
5.8 PRESSURE CLASS CROSS LINKED HIGH-DENSITY POLYPROPYLENE	20

5.9	UNDERGROUND METALLIC PIPEWORK	21
5.10	PIPEWORK UNDER CONCRETE SLABS	21
5.11	PIPEWORK IN CONCRETE SLABS	21
6	INSULATION.....	21
6.1	GENERAL	21
6.2	STANDARD	21
6.3	THERMAL PIPE INSULATION	22
6.4	THERMAL PIPE INSULATION (EXTERNAL)	22
6.5	ACOUSTIC INSULATION.....	23
7	VALVES AND FITTING	23
7.1	SCOPE	23
7.2	TAPS	23
7.3	VALVE SELECTION TABLE	24
7.4	BACKFLOW PREVENTION DEVICES	24
7.5	THERMOSTATIC MIXING VALVES.....	25
7.6	BALANCING VALVE	25
7.7	FLUID APRON.....	26
7.8	WATER METERS.....	26
8	VALVE BOXES	26
8.1	EXTERNAL.....	26
8.2	METAL WALL VALVE BOXES	26
8.3	STAINLESS STEEL WALL VALVE BOXES.....	27
8.4	BACKFLOW VALVE HOUSINGS.....	27
9	Excavation, TRENCHING, BACKFILLING AND COMPACTION	27
9.1	EXCAVATION SERVICE TRENCHES.....	27
9.2	DEWATERING	27
9.3	SHORING OF TRENCHES	27
9.4	PROTECTION BARRIERS.....	28
9.5	THRUST BLOCKS.....	28
9.6	OBSTRUCTIONS	28
9.7	PIPELAYING	28
9.8	PIPE IDENTIFICATION SERVICE MARKER.....	28
9.9	BEDDING	28
9.10	BACKFILLING SERVICE TRENCHES.....	29
9.11	COMPACTION	29
9.12	SURFACE RESTORATION.....	30
9.13	PATHWAYS AND PAVED AREAS.....	32
9.14	LANDSCAPED AREAS	34
9.15	SPOIL	34
9.16	REACTIVE SOIL.....	34
10	PUMPING SYSTEMS.....	34
10.1	DUAL DOMESTIC HOT WATER CIRCULATING PUMPS SYSTEM.....	34
10.2	MAINS WATER PRESSURE PUMP SYSTEM	34
11	SEWERAGE	35
11.1	SEWER SYSTEM.....	35
11.2	INSPECTION OPENINGS (IO).....	35
11.3	REFLUX VALVE	35
11.4	REACTIVE SOIL.....	35
11.5	MATERIALS	35
12	SANITARY PLUMBING	36
12.1	SOIL AND WASTE SYSTEMS	36
12.2	MATERIALS	36
12.3	TRAPS.....	36
12.4	FLOOR WASTES	36
12.5	TUNDISHES	36
12.6	INSPECTION OPENINGS.....	36
12.7	PIPEWORK	36
12.8	FIXTURES.....	36
12.9	VENTS.....	36
13	Trade waste system	36
13.1	GENERAL	36
13.2	BIN WASH AREA	36

14	COLD WATER SUPPLY	36
14.1	MAIN CONNECTION.....	36
14.2	MATERIALS	36
14.3	UNDERGROUND PIPEWORK.....	37
14.4	TAPWARE	37
14.5	BACKFLOW PREVENTION	37
15	HOT WATER SUPPLY	37
15.1	RETICULATION	37
15.2	MATERIALS	37
15.3	TANK PACK - CONTINUOUS FLOW GAS HOT WATER UNITS (INTERNAL)	37
15.4	COMMISSIONING AND MAINTENANCE	37
16	GAS SERVICE	37
16.1	APA GROUP	37
16.2	MATERIALS	37
16.3	UNDERGROUND PIPEWORK.....	38
16.4	VALVES.....	38
16.5	EARTHING PIPES.....	38
16.6	PRESSURE REGULATOR.....	38
16.7	AUTOMATIC GAS SHUT-OFF CONNECTED TO FIRE ALARM PANEL.....	38
16.8	SOLENOID VALVE.....	38
16.9	INSTALLATION	38
17	PAINTING, CORROSION PROTECTION AND IDENTIFICATION.....	38
17.1	SCOPE	38
17.2	EXCLUSIONS.....	38
17.3	CORROSION PROTECTION	39
17.4	PAINTING PROCEDURES	39
17.5	PLANT, EQUIPMENT AND VALVE IDENTIFICATION	39
17.6	PIPE IDENTIFICATION.....	40
17.7	ELECTRICAL AND CONTROLS IDENTIFICATION	40
17.8	SAMPLES.....	40
18	TESTING AND COMMISSIONING	40
18.1	TESTING	40
18.2	HYDROSTATIC TEST TABLES.....	41
18.3	TESTING PLASTIC PRESSURE PIPES.....	41
18.4	BACKFLOW PREVENTION VALVES	41
18.5	COMPLETION	41
18.6	COMMISSIONING.....	41
19	MAINTENANCE	42
19.1	SCOPE	42
19.2	MAINTENANCE REQUIREMENTS.....	42
19.3	OPERATING AND MAINTENANCE MANUALS	42
19.4	SERVICE BOOK.....	43
19.5	PRINCIPAL'S INSTRUCTION	44
20	SCHEDULES.....	45
20.1	PIPEWORK AND MATERIALS	45
20.2	SCHEDULE OF TRAPS, WASTES AND INSPECTION OPENINGS	45
20.3	SCHEDULE OF INSULATION.....	46
20.4	SCHEDULE OF PAINTING AND IDENTIFICATION	46
20.5	SCHEDULE OF PUMPS	47
20.6	SCHEDULE OF HOT WATER UNIT	47
20.7	SCHEDULE OF FIXTURES, FITTINGS AND TAPWARE.....	48
21	HYDRAULIC SERVICES TENDER FORMS	49
21.1	TENDER PRICE	49
21.2	SUMMARY OF COSTS	50
21.3	PIPING SYSTEMS UNIT RATES	51
21.4	SCHEDULE OF RATES	52

HYDRAULIC SERVICES

1 GENERAL

1.1 BUILDING WORKS

This Contractor shall be responsible for all associated building works for this project.

Include for items scheduled below and all items necessary for successful and economical operation and to meet the intent of the Contract Documents, including minor items not specifically included in these document.

This Contractor shall be deemed to have inspected the site, made allowances for all difficulties of access, installation, staging, testing, commissioning, procurement, noise and vibration control etc and shall utilise their own experience and expertise determine detailed design and installation allowances to achieve the objectives of the Contract Documents.

This Contractor shall ensure that all the required authority application and connection fees for the site services connections are made to the authorities prior to commencing work onsite.

1.2 SCOPE OF WORKS

Outline Description: The works include but are not necessarily limited to the works referred to in the outline description given below.

Items not included in the specification but shown on the drawing or vice versa shall be included.

Drainage (Sewerage)

- Make application and pay all fees to upgrade existing Water Authority connection from 100 dia to 150 dia
- Reflux valve on boundary complete with riser shaft and cast iron cover
- Extend sewer drains from connections
- Wrap plumbing drains passing through footings
- Flexible pipe joints at connections between external drainage and under floor drains
- Pipework and fittings

Soil, Waste and Vents

- Soil, waste and vents
- PIPE INSULATION FOR NOISE CONTROL: Acoustic insulation or Rehau Raupiano pipes, fittings and approved pipe brackets or insulated pipe for noise control. This includes all Soil, Waste and Vents located above first floor level where pipework passes from one apartment to another.
- Wrap plumbing drains passing through footings
- Pipework and fittings
- Vents terminating above roof in vent cowl

Trade Waste Pits

- Silt Trap

Backflow prevention

- Backflow prevention valves
- External Back Flow Prevention (Testable Double Check Valve (DCV)) valve arrangement. Valve arrangement mounted above ground. Cover valve arrangement with a removable lockable cover fixed to a concrete base
- Registered Break Tank with ball float and safe tray installed at high level. Provide threaded rod and unistrut channel to support break tank from roof structure. Break tank overflow and safe tray drain connected to tundish at ground level.

Cold Water

- Make application and pay all fees for a 50mm Water Authority domestic water services (Meter in Cast Iron Valve Box)
- Make application and pay all fees to disconnect existing Water Authority domestic water services

- Mains water Pressure Boosting Pump System consisting of two automatic variable speed pressure pumps with auto changeover, control system, pressure cell, pipework, valves and fittings.
- Extend water services to fixtures
- Pipework, valves and fittings
- Pipework insulation for noise control
- PVC conduits for under floor pipework
- Buried metallic pipes protected against corrosion by continuous wrapping in petrolatum tape to AWW C217.
- Roof mounted break tank
- Connection to equipment provided by Proprietor
- Private Water meters (with pulse output) to water supply connections

Hot Water

- Gas continuous flow internal hot water units including 2 x storage tanks, gas internal hws units manifold, support brackets, coaxial flue, associated pipework, valves and fittings.
- Hot water service from units to fixtures
- Hot water return circulating pumps
- Pipework, valves and fittings
- Thermal pipe insulation
- Thermostatic Mixing Valves including valve box.
- Private Water meters (with pulse output) on hot water supply connection to each apartment

Sanitary Fixtures

- Sanitary fixtures including plug and washer

Tap ware

- Tap fittings and valves, including breeching pieces, spouts and outlets
- "Fluid Apron" to tapware

Natural Gas

- Make application and pay all fees to the APA Group for a new gas connection. APA Contact Keileigh Marra. Provide a slab boxed out section within concrete slab for gas inlet riser. Refer to drawings for dimension set outs.
- Locate and connect to existing system
- Connect to gas service provided by Mechanical Services Contractor
- Gas service from connection to equipment
- Gas pressure regulators
- Gas fire shut off valve adjacent to gas meter connected to FIP, including all electrical and control wiring to FIP by Electrical Services Contractor.
- Pipework, valves and fittings

Acoustic Pipework Insulation

- Acoustic pipework insulation to Soil, Waste and Vents and Hot and Cold water.
- Rehau Raupiano pipes, fittings and approved pipe brackets or insulated pipe for noise control. This includes all Soil, Waste and Vents located in First, Second, Third and Fourth floors where pipework passes from one apartment to another.

General

- Pipework supports and fixings related to the above services
- Timber frames and supports for fixtures and fittings
- Openings in bench tops for sinks
- Openings in vanity units for basins
- Equipment concrete plinths
- Identification and labelling of pipework, valves and equipment
- Painting of equipment
- Wall and floor penetrations

- Coring wall and floor penetrations
- Sealing of wall and floor penetrations with approved fire rated sealant
- Pipework passing through walls and floors of different Apartments (Units) shall be sealed fire stop collars and/or an approved fire rated sealant
- Fire stop collars to fire wall and floor penetrations. Fire stop collars are to be approved for use for the particular pipe material.
- Sealing of wall and floor penetrations to approval
- Pipework supports and hangers to suspended pipework within concealed spaces.
- Excavation, trenching, bedding, backfilling and compaction as required for the above services
- Shoring of trenches as required.
- Provide appropriate approved safety barriers and signage around excavations
- Cut and chase brick and block walls
- Electrical wiring and controls associated with the above equipment
- Access panels and inspection openings
- Roof penetrations and upstands.
- Weatherproof overflashings to roof penetrations.
- Noise and vibration control associated with the above systems
- Testing and Commissioning of the above systems.
- Testing and labelling of Back Flow prevention valves.
- Operating and Maintenance Manuals
- "As-Installed" drawings
- Equipment warranty, maintenance and servicing of the above systems for 12 months from the date of practical completion.
- Hoisting of all equipment
- All required scaffolding
- Coordination of installation with all other trades

1.3 DOCUMENTS ISSUED

Drawings: The following drawings form an integral part of this specification:-

Drawing No:	Description:
B9025/H01	Hydraulic Services: Level 1 Plan Sanitary Drainage Layout Drawing List and Legend
B9025/H02	Hydraulic Services: Level 2 Plan Sanitary Drainage Layout
B9025/H03	Hydraulic Services: Level 3 to 5 Plan Sanitary Drainage Layout
B9025/H04	Hydraulic Services: Roof Plan Sanitary Plumbing
B9025/H05	Hydraulic Services: Level 1 Plan Water and Gas Reticulation Layout
B9025/H06	Hydraulic Services: Level 2 Plan Water and Gas Reticulation Layout
B9025/H07	Hydraulic Services: Level 3 to 5 Plan Water and Gas Reticulation Layout
B9025/H08	Hydraulic Services: Roof Plan Stormwater

1.4 ASSOCIATED WORKS

Include items scheduled below and all items necessary for successful and economical operation and to meet the intent of the Contract Documents for a fully automatic durable and trouble free system of hydraulic services, including matters of minor design not specifically included in this document, shall be provided.

The Builder shall be deemed to have inspected the site, made allowances for all difficulties of access, installation, staging, testing commissioning, procurement, noise and vibration control, etc and made allowance for the following:-

- Timber frames and supports for fixtures and fittings
- Openings in bench tops for sinks

- Openings in vanity units for basins
- Roof penetrations and upstands
- Access panels
- Electrical wiring and connection to hot water units
- Electrical wiring and connection to hot water circulating pumps
- Electrical wiring to Mains Water Pressure pump controller

2 DESIGN AND COORDINATION INFORMATION

2.1 DESIGN BASIS

Sanitary Plumbing

Office of the Technical Regulator & Water Authority

The Sanitary Plumbing system has been designed on the AS&NZ Standards 3500 and the "Schedule to the Directions under the Water Works Act 1932 and the Sewerage Act 1929" and the South Australian Variations and/or Additional Provisions.

The Gas system has been designed on the AS&NZ Standards 5601 and the requirements and regulation of the Office of the Technical Regulator.

Domestic Water

The Domestic Water system has been designed on the AS&NZ Standards 3500 and the requirements and regulations of Water Authority

Power Network Authority Main Supply System

Equipment shall be designed for operation on the Power Network Authority electrical supply system rated at 415V, 3 phase, 4 core (3phase + neutral), 50Hz and/or 240V, 1 phase, 50 Hz.

2.2 SUBSTITUTIONS

If intending to provide a substitute for the specified equipment, pipework, insulation, valve etc with an alternative product, provide full technical data and details of the proposed system (equipment etc.) to be installed for Approval at time of tender. Failure to obtain the approval at tender time will mean that the proposed alternative cannot be used

2.3 APPROVALS

Allow for all Local Regulatory Authorities, Permits, Approvals, Application Fees and costs associated with works and Certificates of Satisfactory Completion.

2.4 EQUIPMENT WEIGHTS, SIZES AND POWER REQUIREMENTS

Equipment ratings, weights, sizes and power requirements have been transmitted to architectural, structural, and electrical engineering designers during the design phase of the project for inclusion in design and estimating processes.

Check all weights, sizes and electrical loads of relevant equipment proposed to be installed on the site and brands nominated in the Tender documents prior to committing to final reticulation sizes and equipment selections. Coordinate with relevant trades to ensure proper provisions and interface arrangements have been made, and include all due allowances for such coordination and perform without charge any minor adjustments.

2.5 SPACING OF PLANT AND EQUIPMENT

Ensure that plant and equipment items are readily accessible for operation and maintenance and that sufficient space is provided to comply with the manufacturer's recommendations for overhaul, maintenance or repair.

Where other Contractors are operating in the areas concerned, determine the extent of their work and coordinate the layout of plant and equipment to be installed under this Contract, with that to be installed by the other Contractors.

2.6 QUALIFICATIONS AND EXPERIENCE

The Tenderer is deemed to have sufficient experience and expertise in Contracts of this nature and to have allowed all contingencies and minor works necessary to full fill the intent of this Contract.

Variation Orders will not be issued for other than changes to the Scope of Works or Scheduled Capacities as initiated by the Architect.

2.7 LICENSED PERSONNEL

Plumbing and Water Services: Work shall be performed by or under the direct supervision of a Registered Master Plumber.

Site Foreman: Site foreman is required to have a minimum of 5 years experience in the capacity of foreman on large projects.

Gas Services: Work shall be performed by a Registered Gas Fitter.

Electrical Services: Work shall be performed by or under the direct supervision of an 'A' Class Electrician.

Insulation: Suitably qualified approved installer.

2.8 AUSTRALIAN STANDARDS

Australian Standards: Unless otherwise specified, materials and workmanship shall be in accordance with the relevant standard of the Standards Association of Australia.

Current Edition: A standard applicable to the works shall be the edition last published prior to the closing date for tenders unless otherwise specified.

Other Standards: Overseas standards and other standard documents named in the specification shall be applicable in the same manner as Australian Standards to relevant materials and workmanship.

2.9 NATIONAL CONSTRUCTION CODE (NCC)

Unless otherwise specified, the entire installation including the supply of equipment and materials shall be in accordance to the current NCC and all clauses within associated to these works. Particularly section "J".

The NCC applicable to the works shall be the edition last published prior to the closing date for tenders unless otherwise specified.

2.10 COORDINATION WITH OTHER TRADES

Determine the extent of their work and coordinate the layout of plant and equipment to be installed under this section of the specification with that to be installed by the other trades to ensure there are no interface problems before installation commences.

Provide detailed information on all pipework layouts to other trades (mechanical, fire, electrical etc) to enable them to prepare and provide fully coordinated shop drawings to ensure there are no clashes of services. This information may be submitted on a floor-by-floor basis, but in any case in adequate time to allow the other trades to prepare the coordinated shop drawings.

2.11 GUARANTEES

Guarantee that the complete system within specified termination points shall safely, reliably, and efficiently provide the specified full load design capacity and performance, including all start up, shutdown and control functions and intermediate ratings as required, throughout the full 12-month Defects Liability period following the date of issue of the Certificate of Practical Completion.

2.12 SPECIFICATION AND TENDER DRAWINGS

Ensure you have a full understanding of the technical and physical requirements of the system described in this specification and accompanying drawings, all appropriate codes, regulations and standards, manufacturer's data, requirements of regulatory and statutory authorities, and instructions issued by the Architect.

Prior to commencement of fabrication or installation, ensure you have all current drawings and checked the dimensions of relevant site works.

Contract drawings showing fixtures, pipework runs and equipment layouts are diagrammatic only.

Before commencing work verify the exact positions of all fixtures, plant positions, existing services, etc.

If required to connect to existing sewer, soil, waste or vent pipes check the location and depths prior to commencing any work to ensure that the correct falls can be achieved.

These drawings must not be used for architectural or structural work, but shall be read in conjunction with architectural, structural and all other relevant drawings.

Principle: The services show the principle of design and do not include details of sets and bends required for the coordination between the structure and other trades. Due allowance shall be made in the tender price for all sets and bends.

Deviation: Deviation from the design principles will not be permitted without written approval.

2.13 AS INSTALLED DRAWINGS

Make AutoCAD V14 or later drawings of 'work as executed' of all work. Show accurately the installed positions of all pipes, valves, controls, access points, electrical connections, etc. The drawing shall include dimensions from fixed building elements.

Submit progressively during the Contract at the end of each calendar month for work installed to that time. Submit as one transparency hard copy and one disk copy.

'As-Installed' drawings will be reviewed for quality and content. Where drawings are determined to be of sufficient quality and content for their purpose, they will be forwarded to the Principal for acceptance. Where errors, discrepancies or omissions are identified, they will be returned to the Contractor for correction.

Where drawings or calculations are returned for amendment, allow for amendments to be carried out and re-submitted in sufficient time to prevent delays to the completion of the work or awarding of Practical Completion.

The review of Contractor's installed drawings is not intended to be a checking process, and the Contractor remains responsible at all times for the content, accuracy and scope of submitted documents.

Tender drawings may be made available for the preparation of As Installed Drawings. These drawing shall have Secon Consulting Engineers name removed from the title block and shall be upgraded to as installed. A direct copy is not acceptable for an As Installed Drawing.

2.14 SAMPLES

Submit samples of all items as Scheduled or requested by the Architect for approval.

Samples may, after approval by the Architect, be installed on the project provided they are suitably identified and their location is recorded and agreed to by the Architect.

For certain items where requested by the Builder, the first installed of each type may be accepted by the Architect as a sample.

Samples submitted during the Tender stage to determine style and appearance are not regarded as samples in relation to the Quality System, and will require to be resubmitted and approved by the Architect during the Contract.

2.15 AUTHORITIES TESTING

Carry out all tests required by the relevant authorities and perform without charge any making good necessary to obtain approvals. Give the Architect 48 hours notice of such tests. Hand over test certificates and approvals on completion, leave a copy of all such items in the Maintenance Manual. Give sufficient notice for interruptions to supply.

2.16 AUTHORITIES AND APPROVALS

Authorities: The public and other authorities whose requirements shall apply to the work in this Section in accordance with the General Conditions and the ordinances, regulations, by-laws and the like specifying those requirements, shall include the following:-

- Office of the Technical Regulator
- Local Council
- Safe Work Authority
- National Construction Code (NCC)
- Fire Service Authority
- Power Network Authority
- Gas Authorities
- Any other Authorities having jurisdiction over the Works

Lodgement: Complete and lodge all necessary forms (including technical sections) for the submission of applications and approvals to the relevant authorities.

Approvals: The documents evidencing approval of such authorities, which are to be surrendered before the Certificate or Notice of Practical Completion is issued, shall include the authority's official certificate of completion.

Authorities Mark: Pipes, fittings, accessories and the like used shall bear approval marks where and as required by the regulatory authority.

2.17 MAINTENANCE LIFTING

Where an item greater than 20kg requires to be removed for maintenance or replacement, provide the following:-

- Suitable attachments on the item for connection of lifting equipment.
- Suitable attachments from the roof structure or roof slab, such as eye bolts or lifting beams, for the equipment to be removed and positioned over a fork lift, trolley or sled. Alternatively provide purpose built lifting frames. Show all proposed maintenance lifting arrangements on shop drawings and submit to the Architect for approval.

2.18 INSPECTIONS

Give 48 hours written notice to the Architect of all items requiring inspection, including prior to the sealing of shafts and risers.

2.19 WARRANTIES

Obtain and supply to the Architect at Practical Completion the warranties offered by the manufacturers of the equipment and accessories used in the Works.

2.20 CERTIFICATE OF COMPLIANCE

A certificate of compliance shall be supplied before each section of the finished work is handed over to the client, and at the completion of the project.

2.21 EXTRANEIOUS INTERFERENCE

Requirement: The electrical wiring and equipment shall operate without interference to radio, television, computer, communications or other systems within this or other local area installations.

2.22 OBVIOUS WORKS

Minor Parts: If neither the specification nor drawings contain any mention of minor parts of work which in the opinion of the Architect is reasonable and obviously necessary for the satisfactory completion of the works, such parts shall be supplied and installed without extra charge.

3 MATERIALS AND WORKMANSHIP

3.1 MATERIALS

Provision of Materials: Supply everything necessary for the proper completion of the work and for the proper performance of the systems.

Manufacturer's Recommendations: Unless otherwise specified, use manufactured items in accordance with current published recommendations of the relevant manufacturer.

Quality of Materials: Unless otherwise specified, materials to be incorporated in the works shall be new.

Protection of Materials: Store and protect material so as to preserve their quality and fitness for the Works.

Uniformity: Uniformity of type and manufacture of fittings, equipment and accessories shall be maintained throughout the installation.

Storage: Store pipes on site in a suitable location to ensure the integrity of factory sealing up to the time of installation.

3.2 DELIVERY TO SITE, MATERIAL HANDLING & STORAGE OF MATERIALS

Requirement: The Contractor shall allow in the tender price for the delivery of all materials and equipment to site, including any heavy lifting machinery, certified slings or lifting equipment required to unload delivery vehicles in a safe manner. Unloading of material shall be done in a manner which does not damage or deform pipes, materials or equipment. Any damaged pipes, pipe fittings, valves, supports and associated materials or equipment shall be replaced by the contractor. Any associated costs in replacing of damaged pipes, materials and equipment shall be at the contractor's expense.

Storage:

Pipes: To be stored at the requirements of the manufacturer. The pipes shall be stored on a flat level surface, in a manner that prevents sagging of stored the pipes. Pipes shall be stored on timber blocks to prevent the pipes from sitting in any ground or surface water. Pipe ends shall be covered to prevent the ingress of any dirt or debris.

Fittings: Pipe fittings, valves, supports and associated materials shall be stored on pallets to prevent cartons and packaging being damaged from any ground or surface water. Fittings shall be covered to prevent ingress of stormwater.

Any water marked damaged pipe, fittings or materials shall be thoroughly cleaned or replaced at the contractor's expense.

3.3 LABOUR

Provision of Labour: Provide all qualified labour necessary for the proper completion of the work.

3.4 WORKMANSHIP

Best Practice: Properly and neatly execute all work to a high standard and best practice. Untidy work whether exposed to view or concealed will not be accepted.

Straight Lines: Run reticulated services in straight lines parallel or square to building surfaces with minimum joints and neat supporting systems.

Changes of Direction: Use long radius elbows or bends where practicable in preference to short radius elbows. Do not use mitered fittings.

Valves: Arrange valves together where practicable in operational grouping, in convenient and readily accessible positions.

Arrangement: Arrange pipework runs adjacent to and horizontally parallel with each other and with walls, ceilings, beams and the like. Provide adequate spacing, of at least 25mm between pipes, 50mm between pipes and electrical cables. Take off branches at right angles unless otherwise specified or shown on drawings.

Keep at least 150mm above ground surface in under suspended ground floors.

Earthing: Pipework shall be electrically earthed adjacent to the source of gas supply.

3.5 CORROSION PREVENTION

Dissimilar Metals: Do not install copper in contact with steel, zinc, or other materials likely to generate electrolytic, galvanic or corrosive action. Make junctions between dissimilar metals with special fittings manufactured in suitable compatible material.

3.6 ACCESSIBILITY

Concealment: Where practical, conceal reticulated services so they are accessible within ducts or non-habitable enclosed spaces and ensure witnessed tests are conducted before enclosing. Obtain prior approval for the location of exposed services.

Enclosed Services: If services are to be enclosed so as to be not accessible after completion, obtain prior approval and record the actual locations on work as executed drawings, prior to enclosing.

Maintenance Access: Install plant items so they are accessible to manufacturer's recommendations for access, maintenance and servicing purposes, and comply with Occupational Health and Safety Regulations and Guidelines.

Access Hatch Locations: The Tender drawings show the general location of Access Hatches. Plan the location and layout of plant and reticulated services to minimise the number and impact of maintenance access hatches. Where installation of these is unavoidable, obtain prior approval for the location and size.

Access Hatch Sizes: Unless noted otherwise, access hatches shall be 600 x 600 for full body access, and 300 x 300 for hands only access. Access hatches shall be KARP Model PF (Press-Fit) or equal approved steel door and frame installed to manufacturers recommendations.

3.7 CLEANING

Pre-Cleaning: Before installation, clean reticulated services and equipment by a suitable method. Remove loose scale, burrs, fins and obstructions.

Capping Off: During construction, temporarily seal open ends and equipment to prevent the entry of foreign matter. Provide purpose-made covers of pressed steel or rigid plastic. Do not use wood plugs, rags, paper or the like.

Cleaning Out: Remove loose scale, dirt and the like from the pipework by flushing with clear water at a velocity sufficient to remove foreign matter and until clear water discharges at outlets. Leave the system free from foreign matter on completion.

Cleaning of Plant and Equipment: On completion of the work, clean all items externally and internally and leave free of dust, dirt, overspray, finger marks, etc.

3.8 CHASES AND ENCASING

Approvals: Cut chases with a power saw unless otherwise approved. Do not chase reinforced concrete work without approval.

Expansion and Contraction: Services chased into masonry or encased in concrete shall not cross any movement joint, and shall be insulated so that expansion and contraction can take place without damage to the services or to the material or surface finish of the surrounding element.

Minimum Cover: Chased services shall have a minimum of 10mm mortar cover.

3.9 COVER PLATES

Requirement: Where pipework emerges from finished wall, floor or ceiling surfaces (other than surfaces within concealed spaces, plant rooms and the like) provide ornamental cover plates of matching colour where possible of non-ferrous metal or stainless steel, of nominal diameter 50mm greater than the diameter of the pipe (including any insulation), close-fitting and firmly fixed in place to the satisfaction of the Architect.

3.10 ROOF PENETRATIONS AND FLASHINGS

Metal Roof

Penetrations: Provide roof penetrations and upstands.

Flashings: Flash roof penetrations/upstands with weatherproof overflashing.

"Dektite" and other flexible rubber (polymer) flashings are acceptable on this project provided only a single pipe / conduit is installed in a flashing and the rubber flashing is coned and does not hold water. The flashing shall be installed in strict accordance to the manufacturer's recommendations and installed to ensure it does not block roof pans. Failure to comply will result in rejection of the flashing.

Testing: After completion test flashings are leak free and that water is free flowing past the penetration to the satisfaction of the Architect.

Concrete Roof

Up stand: Provide 100mm concrete up stand to enable weatherproof membrane to be extended over to seal water proof.

Flashings: Flash roof penetrations/upstands with metal weatherproof overflashing.

Fixing: Securely fix overflashing.

Testing: After completion test flashings are leak free and that water is free flowing past the penetration to the satisfaction of the Architect.

Visual Locations

Where flashings and pipework are in visual locations, the flashing and pipework shall be of a colour or painted to match the roof colour.

3.11 WALL, BEAM, FLOOR AND CEILING PENETRATIONS

General

Requirement: If different from those shown on service drawings, obtain approval from the Architect before proceeding.

Coring: Mark out all penetrations through existing walls and floors and obtain approval from Structural Engineer prior to carrying out any coring.

New Concrete Floors

Formwork Sleeves: Fabricated from 0.6mm galvanised steel, 20mm larger all round than the service and shall extend 50mm beyond finished surface. Position and fix these prior to wall, beam or floor construction, and remove on completion.

Making Good: Make good all penetrations to maintain the fire and/or acoustic rating of structure penetrated.

Core Holes

Core Holes: Core holes through existing floors, slabs and walls. Prior to coring holes obtain approval for the location from the Structural Engineer. Seal penetration with approved fire rating material.

Fire Rated Wall Penetrations (other than UPVC Pipes and Conduits)

Requirement: Penetrations through Fire/Smoke wall shall be sealed with an approved epoxy seal and filled with an approved fire rated material to FRL rating of penetrated structure. Use "Fyreguard", "Fyre"-Seal-IBS, "Fyre"-Mortar, or "Fyre"-Pillows together with "Fyre"-Seal-Mastic.

Fire Rated Floor Penetrations (other than UPVC Pipes and Conduits)

Requirement: Seal the space between the services and the penetration with an approved epoxy seal and filled with an approved fire rated material. Use Fyreguard, Fyre-Seal-IBS, Fyre-Mortar, or Fyre-Pillows together with Fyre-Seal-Mastic.

Fire Rated Wall and Floor Penetrations (UPVC Pipes and HDPE Pipes)

Requirement: Fire Prevention Collars to UPVC and HDPE pipes passing through floors and fire/smoke walls.

Approval: Fire Prevention Collars tested and approved to AS 1530.4 and AS 4072.1 with fire resistant rating equal to the floor or wall.

Installation: Floor Fire Prevention Collars cast into floor.

Manufacturer: "Hilti" or approved alternative.

Fire and Vapour Sealed Penetrations Through Fire Rated Walls and Floors

Requirement: Use Fyreguard galvanised steel encased Fyre-Sleeves with pipework vapour seal lapped 50mm over each end of the steel sleeve.

Cable Penetration of Fire Rated Ceiling

Fyre-Spring: Use Fyreguard Fyre-Spring system.

4 FIXTURES**4.1 SANITARY WARE**

Generally: Sanitary fixtures as specified and as shown on the Drawings. Including stoppers accessories, including bolts, brackets, putty, mastic, mortar and the like, necessary for the correct installation for the fixtures.

Installation: To manufacturer's recommendations.

Supply and install all noggins and supports in stud walls for the fixing to and support of sanitary ware.

Make allowance to co-ordinate with other trades to ensure the correct location and size of cutouts in bench tops for sanitary ware and the like.

4.2 LOCATION

Check: Prior to installing any pipework, check the exact location and dimensions of all fixtures and equipment with Architectural drawings.

4.3 INSTALLATION

Where equipment is to be installed in face brick, special finishes or tiles, locate to the approval of the Architect and in accordance with the detailed drawings. This clause applies equally to all fittings.

5 PIPEWORK

5.1 GENERAL

Requirement: Supply and erect pipework and equipment in accordance with the requirements of this specification and associated drawings. Include all incidental and ancillary equipment necessarily for the complete installation, the safe and efficient operation and maintenance of the system.

5.2 SUPPORTS

Generally: Supports including hangers, saddles, bolted clips, anchor blocks to buried pipe and the like, sufficient to secure the pipework to adjacent surfaces, to restrain the internal forces of pressure piping, and to support it at joints, at changes of direction, and at intervals suitable to the size and type of pipe, and as necessary to prevent sagging of pipework and vibration. Make provision for adjustment of gradient as required.

Saddles: Saddle brackets only acceptable where concealed and attached to masonry wall for pipes up to 32mm.

Polybutylene Pipework: Fix with clips specifically designed and manufactured for the pipework.

Vibration Isolation: Flexible connections between pipework and any equipment where vibration may be transmitted to the pipework.

Demountable Pipework Joints

Demountable joints only as follows:-

- Where permanent joints are impracticable;
- Where required for maintenance of piping or fittings;
- At connections to components of equipment including valves, instruments or the like.

Air Vents

Requirement: Ensure that there are air vents at any point in the pipework where air may collect, including:

- At high points in pipework system
- At ends of horizontal pipe runs before drops

Type: Isolating valve (15 dia) with drain pipe extended to discharge over nearest tundish.

Grading

Requirement: Grade to rise hot and cold water pipes and pumped services in direction of flow and ensure air vents are at the highest points.

Grade drains to flow at minimum 1:200 to the discharge point and adequately support against sagging. Grade fire services so all lines can be drained.

Support Spacing

(Maximum distance between pipe supports)

	SPACING (metres)			
	HORIZONTAL OR GRADED:		VERTICAL:	
	INTERNAL:	EXTERNAL:	INTERNAL:	EXTERNAL:
Copper	2m	1m	2m	2m
UPVC	1m	1m	2m	1.5m
HDPE	To manufacturers recommendations but not greater than UPVC			
Cast Iron	1.5m	1.5m	1.5m	1.5m
Rehau Raupiano	To manufacturers recommendations but not greater than UPVC			

Soil, Waste and Vents: To Office of the Technical regulator and Water Authority Corporation requirements and AS 3500.

Additional Supports: Locate supports not more than 600mm either side of any change in direction, valve or piece of equipment.

Polypropylene Pipework: Support at all joints and a maximum of 900mm for 18mm pipe and 1200mm for 22mm pipe.

Inserts at Noggins: Use purpose made nylon inserts around hot and cold pipework where passing through studs and noggins. Seal between insert and pipe using non-setting flexible acoustic sealant.

Attachment To Pipe

Hanger type supports to the pipe with clamped metal clamps as follows:-

- To sound isolate pipe - 6mm thick neoprene rubber between pipe and clamp for un-insulated pipe, and between the space and the clamp for thermally insulated pipe.
- Hot Water Pipes: Wooden spacer to be not less than twice the clamp width and of thickness equal to the insulation. If the insulation is metal sheathed, extend the sheathing over the spacer and under the clamp.

5.3 FLEXIBILITY

Expansion and contraction: Install the services with sufficient bends, expansion loops or expansion devices so that it can absorb its own expansion and contraction without developing excessive stresses in the pipework itself, in connected equipment, or in the supporting structure.

Vibration Isolation: Provide flexible connection between pipework and any equipment where vibration may be transmitted to the pipework.

5.4 JOINTS

Generally: Keep the number of joints and junctions to a minimum. Use joints applicable to the materials used. Use demountable joints where permanent joints are impractical and at connections to all equipment and components.

Joints: Fit joints tightly, seal and make water tight, with no internal projections, burrs or obstructions.

Permanent Joints: Provide welded or brazed joints where practicable, otherwise compression or screwed joints.

Kinco connections used on water services shall only be used where the floor is graded to a floor waste. The copper tube shall be correctly "croxed".

5.5 COPPER PIPEWORK

Tubes: To AS 1432.

Fittings: Shall be de-zincification resistant.

Capillary fittings: Including adaptor capillary fittings with threaded ends or compression-type connector ends: To AS 3688. Do not use soft solder or solder insert capillary fittings.

Compression fittings: Including adaptor compression fittings with connector-ends for screwed or capillary joints: To AS 3688, Type 2 (flared).

Flanges: Bronze brazing flanges (boss or plate type) and blind or blank flanges; Full face flanges to AS 2129.

- Flange material: Not inferior in joining properties to alloy C92610 to AS 1565.

Permanent Joints: Make silver brazed slip joints using 15% silver alloy. Either use a capillary fitting or expand one tube over the other leaving a minimum of clearance and an effective overlap not less than the following table:-

Pipe size:	Overlap (mm):
All	12

Demountable Joints: Use either compression fittings or flanges. Expand the pipe into the flange and braze.

Brazing

To AS 1167 Clause 3.7. Use a minimum of heat and avoid damage to pipe and fittings.

Brazing Alloy: To AS 1167 Part 1.

- Brazing copper to copper: Alloy B4 to Table 2.

Brazing Copper to Brass: A suitable copper to brass alloy

Pulled Bends: To AS 1135 Clause 3.4.3.

Press Fittings

Requirement: All personnel installing the press fit system shall be trained by the manufacturer of the chosen press fit system.

Fittings: Up to and including 100mm. To AS 3688 and suitable for use with copper tube manufactured to AS 1432, shall be "Watermarked" approved and carry a 25 year manufacturer's warranty.

Requirement: Use only press fittings from Viega, Auspress, Conex Banninger or Kembla – KemPress.

50mm Fittings: All 50mm press fittings shall use either a manufacturer approved solution compatible with the selected press system to prevent the collapse of the 50mm copper tube or the AusPress “press collar” in lieu of conventional jaws.

The contractor shall nominate the chosen press fit system with the tender submission for the Engineers approval.

If substituting the specified press fitting system with another product, provide full technical data and details on the proposed system to be installed for Engineers Approval at time of tender. Failure to obtain the approval at tender time will mean that no alternative can be used.

Installation: Press fittings shall be installed to the requirements of the manufacturer.

Tools: shall be in good working order and maintained to the requirements of the manufacturer.

Jaws: shall be compatible with the selected manufacturer of the press fittings, in good working order and maintained to the requirements of the manufacturer.

Fitting Failure: All installed fittings shall be tested, as a minimum, to the requirements of the manufacturer and this specification. Any fitting that fail's during the pressure test shall be, removed, replaced and re-tested. If fitting fails again, repeat procedure until rectified.

Any fitting that fail's during the 12 month defect and liability period shall be, removed, replaced and re-tested. The faulty fitting shall be returned to the manufacturer for further tests.

Should it be found, on further investigation by the manufacturer, that the cause of the failure is due to the incorrect installation of the fitting, poor workmanship or as a result of a faulty jaw or press tool, the costs of the repair and associated costs along with shut down delay leading to lost production time as a result of the fitting failure shall be the responsibility of the contractor.

5.6 UPVC PIPEWORK – SEWER – WASTE – VENTS

UPVC Pipes and Fittings

(Unplasticised polyvinyl chloride)

Pipes and Fittings: To AS 1260.

Solvent-Cement Joints: To AS 3879.

Rubber-Ring Joints: To AS 1260.

Installation: To AS 2032 and AS3500.

5.7 REHAU RAUPIANO PLUS – SEWER – WASTE – VENTS

General

This section relates to REHAU RAUPIANO PLUS drainage system from appliances to collection point above ground and inside building.

System Description

The REHAU RAUTITAN RAUPIANO PLUS drainage system consists of:

RAUPIANO PLUS pipe

RAUPIANO PLUS fittings

RAUPIANO PLUS brackets

REHAU or Promat fire collars

The connections between the polypropylene pipes and fittings shall be of leak-proof push-fit socket connection with SBR sealing ring inserted in the fitting. The connections shall be able to allow flexibility in case of thermal expansion.

Reference Documents

The documents referred to in this section are:

NCC / BCA Building Code of Australia

AS/NZS 3500.2 Plumbing and drainage – Sanitary plumbing and drainage

AS/NZS 7671 Plastic piping systems for soil and waste drainage (low and high temperature) inside buildings - Polypropylene (PP)

AS 2887 Plastic waste fittings

AS/NZS 1260 PVC-U pipes and fittings for drain waste and vent application

AS 1530.4 Methods for fire tests on building materials, components and structures – Fire resistance test

Manufacturer's Documents

Manufacturer's and supplier's documents relating to work in this section are:

REHAU RAUPIANO PLUS – Product book

REHAU drainage system RAUPIANO PLUS – Technical Information

The above information is available from REHAU:

Web: www.rehau.com.au

Phone: 1300 768 033 (Australia only) or +61 2 8741 4500

System Design, Installation and Commissioning

Planning, installation and commissioning to comply with:

AS/NZS 3500.2 Plumbing and drainage – Sanitary plumbing and drainage

REHAU drainage system RAUPIANO PLUS – Technical information

Installers to be a member of the REHAU Authorised Installer Network, familiar with the materials and the techniques specified.

Materials: Raupiano Plus Pipe – Polypropylene (PP-MD), Mineral Filled, Halogen Free

Pipe materials shall be composite polypropylene, consisting of polypropylene inner layer, mineral-filled polypropylene middle layer and UV-stabilized polypropylene outer layer, complying with AS/NZS 7671 for gravity drainage and storm water drainage system in residential and commercial applications, colour white (RAL 9003).

The pipes shall be designed for a temperature of 90°C and can temporarily withstand temperatures of up to 95°C and marked with ice crystal to indicated suitability for installations under extreme low temperatures up to -10°C. The pipes shall have excellent chemical resistance, withstanding acidity level from pH 2 - 12.

The pipes shall be certified under WaterMark scheme for dimensions

DN (OD) 40 – 50 – 75 – 90 – 110 – 125 – 160 – 200mm.

Available lengths shall be from 150 to 3000 mm.

Ring stiffness: > 4 KN / m²

Mean elongation: 0.09 mm / (m.K)

Resistant: up to 50kPa = 5m water column (pressure test certificate on request)

The pipe materials shall be packaged to reduce UV-radiation effect to the pipe materials themselves and to protect the pipe materials from dirt and other foreign materials.

Fittings: Raupiano Plus Fitting – Polypropylene (RAU-PP), Mineral Filled

Fitting materials shall be mineral-filled polypropylene for acoustic performance enhancement, complying with AS/NZS 7671 for gravity drainage and storm water drainage system in residential and commercial applications, colour white (RAL 9003). The fittings shall have an inserted SBR sealing ring

The fittings shall be designed for a temperature of 90°C and can temporarily withstand temperatures of up to 95°C and suitable for installations under extreme low temperatures up to -10°C. The fittings shall have excellent chemical resistance, withstanding acidity level from pH 2 - 12.

The fitting materials shall be certified under Standards Mark scheme for dimensions

DN (OD) 40 – 50 – 75 – 90 – 110 – 125 – 160 – 200mm.

Raupiano Plus Floor Gully – Acrylonitrile Butadiene Styrene (RAU-ABS)

Floor gully material shall be the Acrylonitrile Butadiene Styrene. The floor gully shall have 1 main inlet in dimension DN (OD) 110mm and 3 additional inlets in dimension DN (OD) 50mm. The outlet shall be of dimension DN (OD) 75mm. Each inlet and outlet shall have an inserted SBR sealing ring. The floor gully shall have a removable access plug. The height shall be 250 mm.

Raupiano Plus Floor Gully – Polypropylene (RAU-PP) Mineral Filled

Floor gully material shall be the Polypropylene. The floor gully shall have 1 main inlet in dimension DN (OD) 110mm and 3 additional inlets in dimension DN (OD) 50mm. The outlet shall be of dimension DN (OD) 75mm. The main inlet (DN 110mm) shall have an inserted SBR sealing ring. All other inlet and outlets shall be male connector type. The floor gully shall have a removable inserted trap. The height shall be 222 mm

Raupiano Plus Sound Dampening Bracket

Sound-dampening bracket shall be rubber-lined with vibration-decoupling system to reduce the structure-borne noise transmitted from the DWV system. Material shall be galvanized steel, including hanger bolt.

Fire Behaviour**Promat Fire Collar**

Promat fire collar devices may be used in conjunction with the REHAU RAUPIANO PLUS system.

Fire collar shall be:

- a) Promat PROMASTOP® Unicollar for 40 – 110mm wall and floor penetrations
- b) Promat PROMASEAL® FC Retrofit collar for 125 – 200mm wall and floor penetrations

Rehau Fire Collar

REHAU fire collar devices may be used in conjunction with the REHAU RAUPIANO PLUS system.

- a) REHAU compact fireproofing collar for wall and floor penetrations
- b) REHAU PLUS fireproofing collar for wall and floor penetrations
- c) REHAU angled fireproofing collar for angled wall penetrations

Refer to REHAU drainage system RAUPIANO PLUS – Technical information and the respective installation manual for notes on installation of fireproofing collars.

Acoustic Pipe Performance

System acoustic performance shall have been demonstrated to meet the BCA/NCC requirements for Sound Transmission and Insulation (NCC 2011 Volume 1 Part F5), F5.6 – Sound insulation rating of services when tested to ISO 140 methodology and sound insulation performance rated according to ISO 717.

When rated in accordance to ISO 717 the system shall meet or exceed the BCA/NCC requirements of $R_w+C_{tr} = 25$ when adjacent to non-habitable areas, and $R_w+C_{tr} = 40$ when adjacent to habitable rooms, without the use of acoustic lagging material, and with the only following additional construction:

75mm R1.5 glass wool acoustic insulation batts

13mm standard plasterboard

5.8 PRESSURE CLASS CROSS LINKED HIGH-DENSITY POLYPROPYLENE

Where used for hot or cold water install “Rehau” approved pipework and fittings rated to the pressure and temperature and to a minimum rating of PN 20. **If substituting Rehau pipework with another product, provide full technical data and details on the proposed system to be installed for Approval at time of tender. Failure to obtain the approval at tender time will mean that no alternative can be used.**

System: Fully comply with AS 3500

Compatibility: The pipes and fittings used shall be of the same manufacture to ensure compatibility.

Jointing: Compression fittings with external sleeve.

Training: All persons engaged in the installation must be trained and accredited by the manufacturer or a technical agent before they can carry out any pipe installation or pipe joining.

Pipework passing through steel framework: Rehau approved stud clips and rubber grommets shall be used to provide separation between steel framing and Rehau pipework.

Pipework

All pipework will be of the same manufacture with markings clearly visible. The sizes shown on the drawings are copper sizes and the polypropylene pipework shall have the same bore as the copper pipe.

Fittings

All fittings will be of the same manufacture with installation carried out strictly to the manufacturers instructions.

Bracketing and Support

Ensure all services have adequate space to expand and contract with approved bracketing spacing and bracing.

Jointing

Utilize persons trained in the methods of jointing. Each installer will produce evidence that they have received training from the manufacturer and understand the total system temperatures, cleaning and general handling of the materials, pipework, fittings, and jointing methods.

Insulation

HOT WATER: ALL HOT AND WARM WATER PIPES SHALL BE FULLY INSULATED FROM HOT WATER UNIT TO THE FIXTURE OUTLET.

Restrictions

Do not install Polypropylene pipes in the following locations:-

- Within 6m of a hot water unit
- Within Plantrooms
- Through floor slabs unless approved fire stop fittings used.
- Through fire/smoke walls unless approved fire stop fittings used.
- Exposed to view
- External of building
- Buried in floor slabs

5.9 UNDERGROUND METALLIC PIPEWORK

Requirement: Buried metallic pipes protected against corrosion by continuous wrapping in petrolatum tape to AWW C217. Protect piping valves and fittings utilizing the "Denso" "Superbond CPT 750" system installed to the manufacturers recommendations.

Cleaning: Prior to application clean the surface thoroughly to AS 1627-2 Class 2 Standard.

Primer: Prime the cleaned substrate with Superbond Cleaner.

Mastic: Where necessary, contour all sharp and irregular profiles with "Denso" Butyl Mastic Strip.

Tape: Spirally apply "Denso" Superbond tape without stretching with a 55% overlap to achieve consistent full double thickness. Select a tape width roughly equal to pipe diameter.

Manufacturer's Recommendations: Ensure system is applied in accordance with manufacturer's recommendations and arrange manufacturer to inspect application and forward written evidence of correct application.

Verification: Provide inspection and verification of all protective wrapping.

5.10 PIPEWORK UNDER CONCRETE SLABS

Where pipework is nominated to be installed in ground, under a concrete slab the following shall apply.

- Install a minimum of 150mm below the slab.
- Use only annealed copper pipe. Pipe shall be one continuous length terminating a minimum of 150mm above the top of the floor.
- Install pipes in PVC conduit. Conduit shall have bends terminating at floor level. Seal open ends with foam sealant.

5.11 PIPEWORK IN CONCRETE SLABS

Service pipework shall NOT be run in or encased in concrete slabs.

6 INSULATION**6.1 GENERAL**

Note: All insulation used on this project shall be manufactured without the use of ozone depleting substances. Substances that have an Ozone Depleting Potential (ODP) of greater than zero are to be avoided in the manufacture of all thermal and acoustic insulants whilst satisfying all other criteria. Provide manufacturers literature and testing that prove the insulation to be used on this project complies with the Zero ODP.

6.2 STANDARD

Standard: To AS 2002, Clause 5.8. Do not insulate pipework specified to be chrome plated.

6.3 THERMAL PIPE INSULATION

Proprietary Item: Armstrong "Armaflex FR" or equal approved.

Thermal Conductivity

Temperature: -20°C 0°C $+20^{\circ}\text{C}$

Thermal Conductivity: 0.033w(m.K) 0.036w(m.K) 0.038w(m.K)

Foam Sheath: Extruded closed cell black nitrile rubber in sleeve form.

Insulation Thickness

Pipe Dia Insulation Thickness

15 dia 13mm

20 dia 19mm

25 dia 25mm

32 dia and above 32mm

Application

Installation: Install in strict accordance with the manufacturer's recommendations slide into place before jointing pipework. Do not cut longitudinally. Where it is unavoidable and approval is given "factory slit" longitudinal insulation may be used. Mitre cut joints and tees. Glue joints with adhesive approved by manufacturer. After gluing tape joints.

External Pipe Insulation (Outside)

External insulation shall be fully covered with galvanised steel metal capping. Ensure no insulation is exposed to sun or external elements.

6.4 THERMAL PIPE INSULATION (EXTERNAL)

Mineral Wool

Description: Mineral wool, resin-bonded to form tubular sections.

Maximum thermal conductivity: 0.036 W/mK at 20°C .

Early fire hazard indices:-

- Spread of flame index: 0
- Smoke developed index: 3 (maximum)

Mineral Wool Insulation R Value (min) Table

Temperature	Nominal Pipe Size, DN				
	15-40	50-80	100-125	150	200
$\geq 20^{\circ}, < 90^{\circ}\text{C}$	0.6	0.6	0.6	0.7	0.8

Adhesives, Sealants and Mastics

Early fire hazard indices:-

- Spread of flame index: 0
- Smoke developed index: 0

Aluminium Foil Laminate

Physical characteristics:-

- Tensile strength (minimum):
 - . Machine direction: 14.5 kN/m
 - . Lateral direction: 9.8 kN/m
- Water vapour permeance (maximum):-
 - . Creased: 2.26 ng/Ns
 - . Uncreased: 1.13 ng/Ns

Early fire hazard indices:-

- Spread of flame index: 0
- Smoke developed index: 0
- Flammability index: ≤ 5

Aluminium Foil Laminate Tape

Adhesive: Non-toxic, high tack synthetic pressure sensitive type.

Liner: Silicone coated paper.

Backing: Aluminium foil laminate.

Minimum Width: 50mm

Physical Properties:

- Tensile strength: 4.8 kN/m (average minimum)
- Shear adhesion: To Table 3.2
- Peel adhesion at 180°: 0.68 kN/m (average minimum)

Water vapour permeance (maximum):

- Creased: 2.26 ng/Ns
- Uncreased: 1.13 ng/Ns

6.5 ACOUSTIC INSULATION

Requirement

General: All hydraulic services such as soil and waste pipes, water pipes, etc run above or adjacent to an Apartment shall be acoustically treated.

Sanitary Plumbing Pipe Lagging

Insulation: Acoustic proprietary lagging system consisting of an inner layer of 25mm thick acoustic foam and an outer layer of loaded vinyl with a foil facing, having a minimum surface weight of 4kg/m².

Installation: Form the insulation to fit the pipe. Lagging must be cut and neatly fitted around all traps, bends and fittings.

Joints: All joints in the lagging shall be sealed with reinforced aluminised foil tape as supplied by the manufacturer of the lagging material.

System: Soundlagg 4525C by Bradford Insulation/Pyrotek or equal approved.

OR

Raupiano provide information

Sanitary Plumbing Support

Supports: Suspend Sanitary Plumbing pipes in ceilings from the structure above. Pipes shall not contact any lightweight ceiling support members, stud wall framing or other services. Only use Rehau Raupiano approved brackets

Pipe Support Isolation

Provide isolation between the pipe and the support (including pipes in riser shafts) using a proprietary clamp and gasket system

System: "Kwik-smart" pipe clips by Binder Engineering or equal approved

7 VALVES AND FITTING

7.1 SCOPE

Requirement: Valves and fittings for the proper functioning of the water systems including taps, valves, pressure and temperature control devices, strainers, gauges, automatic controls, alarms, and the like, to the following standards unless otherwise specified:

Size: Internal diameter of valves not less than the pipework in which it is installed.

Suitability: Ensure valves are entirely suited for the service and operating pressure of the system.

Accessibility: Ensure valves and accessories are in positions easily accessible for operation and maintenance.

7.2 TAPS

Installation: Refer to Architectural drawings layout. Co-ordinate to ensure cocks and outlets are centred as detailed on drawings.

Supply and install all noggins and supports in stud walls for the fixing to and support of tapware.

Make allowance to co-ordinate with other trades to ensure the correct location and size of cutouts in bench tops for taps and the like.

7.3 VALVE SELECTION TABLE

Service	Make	Material	Connections
<u>Mains Water</u>			
Isolation up to 50dia	Rye or similar DR brass ball valve	Brass	Screwed
Throttling up to 50dia.	John Fig. 1 (Globe)	Bronze	Screwed
Non Return (check) up to 50 dial.	John Fig. 4B	Bronze	Screwed
Larger than 50dia		Cast Iron	Flanged
Pressure Reduction up to 50 dia	Wilkins Adjustable Model NR3 set to 500 kpa	Brass	Screwed
Pressure Reduction Valve above 50dia.	Wilkins Adjustable Model 50-600 HLR set to 500kpa	Brass	Screwed or Flanged
<u>Gas</u>			
Isolation	Ball Valve	Bronze	Screwed

7.4 BACKFLOW PREVENTION DEVICES

General

Requirement: Approved by the Office of the Technical Regulator and Water Authority.

Application: Locations required by AS 3500 and Office of the Technical Regulator.

If substituting Tyco valves with another product, provide full technical data and details on the proposed valve to be installed for Approval at time of tender. Failure to obtain the approval at tender time will mean that no alternative can be used.

Caution Sign

All potable water is to be teed off before the backflow prevention device and all other taps shall be clearly and permanently labeled "CAUTION NOT FOR DRINKING" at every outlet. The caution sign shall comply with AS 1319 and the distribution pipes shall be clearly marked in accordance with AS 1345.

Reduced Pressure Zone (RPZD)

Proprietary Item: "ValvCheQ" or equal approved incorporating down stream and upstream isolating valves and strainer.

Vented Double Check Valve (VDCV)

Proprietary Item: "Combraco" or equal approved incorporating downstream and upstream isolating valves and strainer.

Double Check Valve (DCV)

Proprietary Item: "ValvCheQ" or equal approved incorporating downstream and upstream isolating valves and strainer.

Dual Check Valve

Proprietary Item: "Febco" or equal approved incorporating downstream and upstream isolating valves and strainer.

Hose Connection Vacuum Breaker (HCVB)

Proprietary Item: "Combraco" or equal approved.

Installation: Install on end of outlet prior to hose connector. Install for permanent installation by turning set screw until head breaks off. Use brass bodies except where tap is chrome plated then use chrome plated type.

REGISTERED BREAK TANK

Proprietary Item: Taurus Tanks 3000L Aquamate tank. Provide a mouthoid bitumen layer between tank and concrete slab.

Inlet Valve: Provide 2 x 40mm Apex Big Boy tank fill valves.

Outlet: Provide 80mm brass threaded tank fitting

Overflow: 100mm to tundish

- Installation: Provide threaded rod and unistrut channel to support Break tank from roof structure. Break tank overflow and safe tray drain connected to tundish at ground level.

Requirement: Provide a Trefolate engraved tag with 8mm upper case wording riveted to the side of the Registered Break Tank with the following wording,

Registered Break Tank

Size of inlet Orifice -mm

Total Height between overflow invert and inlet orifice -mm

Maximum Head between overflow invert to inlet orifice spill level -mm

Break Tank Dimensions – Heightmm x Diameter.....mm

Size of Overflow Pipe -mm

All dimensions shall be included on the engraved tag as required by AS3500.1 Section 4 and Appendix F & G

7.5 THERMOSTATIC MIXING VALVES

Standard: To AS 4032.

Type: Adjustable thermostatic type mixing tap or valve as schedule.

Requirement: Fittings mixing hot and cold water, regulating water temperature with a single hand control, capable of delivering water at the temperature of either of the supply systems and at any temperature in between, and suitable for controlling single or multiple outlets as required by the installation.

Incorporate the following features:-

- Control water temperature on unequal hot and cold water pressures to a maximum pressure loss ratio of 20:1.
- Incorporate tamper proof handle to prevent unauthorised adjustment.
- Incorporate isolating valves, strainers and non-return valves.
- Control temperature within 2°C.
- Valve body installed in pipework to allow the body to be removed without disturbing the pipework.
- A temperature sensitive automatic control which maintains temperature at the selected setting and shuts down the flow within 1 second if either supply system fails, or if the normal discharge water temperature is exceeded.
- Hot water flush facility
- Thermostatic Mixing Valves used in solar hot water systems shall be manufactured and suitable for this application.

If substituting the scheduled thermostatic mixing valves with another product, provide full technical data and details on the proposed valve to be installed for Approval at time of tender. Failure to obtain the approval at tender time will mean that no alternative can be used.

Submit details of wall boxes to Engineer for approval prior to ordering and installation. Wall boxes that have been installed that do not have a hinged lockable door will be rejected.

7.6 BALANCING VALVE

Valve size: Valves shall be sized and selected to suit the required water flow not the pipe size.

Requirement: Automatic Balancing valves supplied and installed where shown on the drawings to ensure proper balance of water flows in the domestic hot water systems.

Type: Globe valve design with a profiled plug for improved control, to reduce the risk of noise and cavitation.

Construction: Thread connections made in a dezincification resistant copper alloy with a Brineii hardness of at least 130 and a body pressure rating of at least 2000kPa at 150°C.

Flow Control: Adjustment and presetting of the flow made with a multi-turn hand wheel using a digital scale with a resolution better than 2.5% of the full scale.

Setting Lock: Valve fitted with setting lock with a mechanical stop, which allows the valve to be closed but not to be opened further than to the adjusted valve. The mechanical stop shall be hidden in the design of the valve to avoid tampering.

Shut Off: The balancing valve shall offer the possibility of watertight shut-off against the same water pressure as the body pressure rating.

Draining: Balancing valves provided with a facility for draining of water with a separate hose connection and a stop valve.

Venting: Mount the valve with the pressure nipples on the top of the valve to enable venting of air in the water.

Pressure Measuring: Integral nipples with the valve body and incorporate means for positive leak tight shut-off when not in use.

Size: Size the valves to operate in a normal measuring range of 50% to 100% of full opening to ensure maximum accuracy.

Balancing: Carry out balancing to meet specified water flows with a tolerance of $\pm 10\%$.

Testing: Flow measurement accuracy better than $\pm 5\%$ in the normal measuring range of the valve. To enable accurate and practical operation, measurement of flow and differential pressure made with a microprocessor instrument which enables the flow readings directly without use of diagrams or tables.

Test Results: Provide written test results verifying the balancing.

Make: Tour and Anderson or approved equivalent.

7.7 FLUID APRON

Requirement: Tapware installed in partitions with fluid apron manufactured from Polythene CBL 78 (AS 1463 and ISO 8779) to redirect any water leaks to wet area wall surface. To comply with the BCA, AS 3740 and Ministers Specification SAF1.7

Manufacturer: HPM Pty Ltd "Fluid Apron".

Installation: To manufacturer's recommendations.

7.8 WATER METERS

General: General: RMC Zenner or equal approved Multi Jet Pulse Water Meter. Ensure the water meters installed in the hot water system are suitable for hot water.

Provide Reed switch and connections to enable the water meters to be connected to the Building Management System (BMS). Wiring and connection to the BMS by Mechanical Contractor.

General: General: Actaris water meter with Cyble RF module factory fitted. Provide water meters on the cold and hot water lines serving each apartment.

Ensure the water meters installed in the hot water system are suitable for hot water.

Corporate Strata Manager to read water usage across all apartments.

8 VALVE BOXES

8.1 EXTERNAL

Trafficable Areas: PCP (or approved equivalent) cast iron valve boxes with heavy duty cast iron covers for access to underground valves.

Un-trafficable Areas: H-R Products size 432 * 370 *305 deep, key lockable or approved valve box with removable lid.

Valve Box And/Or Cover: Set beneath each box a shaft formed of UPVC pipe to give 50mm (min) clear access on all sides of the valve wheel or spindle. In trafficable areas set top flush with pavement surface and encase in formed concrete 150mm deep and 150mm wide to sides of box, with top surface trowelled smooth. All valves set no deeper than 300mm below finished ground level.

All valves will be clearly marked and labeled with their function

8.2 METAL WALL VALVE BOXES

Recessed metal valve box approx 300mm x 300mm x 75mm deep with flanged surround and hinged access door. The door shall be lockable with all boxes keyed alike. The box shall be manufactured from zincalume, corrosion primed and finish in a powder coated colour as nominated by the Architect.

8.3 STAINLESS STEEL WALL VALVE BOXES

Recessed metal valve box approx 300mm x 300mm x 75mm deep with stainless steel flanged surround and stainless steel hinged access door. The door shall be lockable with all boxes keyed alike.

8.4 BACKFLOW VALVE HOUSINGS

Above Ground External Housing

The testable devices shall be installed in an approved galvanised powder coated vandal resistant lockable enclosure that provides access for testing and drainage.

Provide concrete plinth under enclosure.

All valves will be clearly marked and labeled with their function

Internal Housing in Walls

Install backflow prevention valves inside building in "Tyco / Pentair" stainless steel recessed wall box complete with perspex window and lockable cover. Seal edges of chamber and plasterboard with silicon sealer. Drain as shown on drawings

All valves will be clearly marked and labelled with their function

9 EXCAVATION, TRENCHING, BACKFILLING AND COMPACTION

9.1 EXCAVATION SERVICE TRENCHES

Excavation: Excavate to the lines, levels and grades as required for underground services. Unless otherwise specified make the trenches straight between inspection points, junctions and the connection.

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

Stockpiles

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

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

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

Unsuitable material

Disposal: Remove unsuitable material from the bottom of the trench or at foundation level and dispose of off-site.

Minimum Cover Over Pipe

Unless overridden by regulatory authority requirements or otherwise specified, the following table shall apply:-

- pipes not subject to vehicular loading:	450mm
- pipes subject to vehicular loading - not in roadways:	600mm
- under sealed roadways:	600mm
- under unsealed roadways:	750mm
- pipes in embankments or subject to construction equipment loading:	750mm

9.2 DEWATERING

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

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

Adjacent subsidence: Provide recharge points to isolate the dewatering zone.

9.3 SHORING OF TRENCHES

Where safe trench conditions dictate or the OHSW regulations require, shore trenches to Work Safe Authority requirements and approval. Provide signage, safety barriers and lights around excavations as required.

9.4 PROTECTION BARRIERS

Provide appropriate approved safety barriers and signage around excavations

9.5 THRUST BLOCKS

Thrust blocks shall be provided to transmit the loads imposed on the pipeline to adjacent soil or rock.

Thrust blocks are required wherever the pipeline:-

- Changes direction
- Terminates
- Changes diameter
- Is expected to develop a thrust, eg at a valve, etc

Thrust blocks shall be designed as recommended by the manufacturer and to suit the trenching and soil condition on the site.

9.6 OBSTRUCTIONS

Cut back roots encountered in trenches to not less than 600mm clear of the service. Remove other obstructions including stumps, rocks and the like which may interfere with the proper functioning of the service.

9.7 PIPELAYING

Generally: Lay pipelines to uniform gradients falling to the outlets, straight between required changes of direction, properly supported, with watertight joints aligned flush at internal surfaces, and with spigot ends pointed in the direction of flow. Provide the necessary fittings and accessories, including junctions, branches, inspection and cleaning openings, expansion joints, and the like.

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

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

9.8 PIPE IDENTIFICATION SERVICE MARKER

Provide continuous detectable service marker tape over the pipe for the full length of the underground pipework system. The plastic marker tape shall incorporate metal strip. The marker tape shall comply with AS 2648.1. The marker tap shall be installed between 150mm and 300mm below finished ground level.

9.9 BEDDING

Pipe Bedding: Unless otherwise specified bed the pipework on a continuous underlay of pipe bedding material, compacted if granular, of minimum thickness after compaction as required by the relevant standard, but in any case not less than 75mm. Grade the bedding evenly to the required gradient of the pipework.

Bedding, haunch, side and overlay zones

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

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

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

Material in reactive clay areas: In sites classified M, M-D, H1, H1-D, H2, H2-D, E or E-D to AS 2870, re-use excavated site material at a moisture content within $\pm 1\%$ of that of the adjoining in situ clay.

Underlay Material

Requirement: Sand or selected excavated material free from hard or sharp objects or lumps, to AS 2032 Clause 4.2.1.2.

For Plastic Pipes: Fine aggregate graded as follows to AS 1152 sieves:-

Sieve aperture (mm):	Percentage passing (by mass):
6.7	100
4.75	90 to 100
2.36	60 to 100
1.18	40 to 100
0.6	20 to 90
0.3	8 to 50
0.15	0 to 20
0.075	0 to 10

9.10 BACKFILLING SERVICE TRENCHES

General

Backfill service trenches as soon as possible after the service has been laid and bedded, if possible on the same working day. Place the backfill in layers 150mm thick and compact to the density which applies to the location of the trenches to minimise settlement, and so that pipes are buttressed by the trench walls.

Selected material zone

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

Backfill material: Selected material free from stones larger than 100 mm maximum dimension and the fraction passing a 19 mm Australian Standard sieve to have a 4 day soaked CBR value, in conformance with AS 1289.6.1.2, and not less than that of the adjacent selected material zone.

Backfill Material

General: General fill with no stones greater than 25mm occurring within 150mm of the service, or other materials as required for particular services or locations. Well graded, inorganic, non-perishable material, maximum size 75mm, plasticity index $\leq 55\%$.

Under roads and paved areas and within 4m of building.

- PM32 Crushed Rock – 20mm
- PM63 Sand – Type C
- Controlled low strength material

In Topsoil Areas: Complete the backfilling with topsoil for at least the top 150mm.

In Reactive Clay: In sites classified M, H or E to AS 2870, provide an impervious material where trenches fall towards footings.

Placing Filling

Extent: Place and compact filling so that the surface is constantly self draining.

Layers: Placing filling in layers not exceeding the thickness stated below measured loose and compact each layer.

Maximum Layer Thickness: 150mm.

9.11 COMPACTION

General

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

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

Compact each layer to the required density.

Minimum density ratio of not less than:-

- Under Roads, Paved Areas and within 4m of Building: 95% modified maximum dry density.
- In other Areas: 90% standard maximum dry density.

Protection: Protect the works during compaction from damage by compaction operations, compact by hand if necessary to prevent damage or disturbance to services, pipe joints and the like.

Compaction in accordance with AS 1289 E5 1.1

Compaction requirements for fill and subgrade

Density: Other than rolled fill, to AS 2870 clause 6.4.2(b). Compact the subgrade and each layer of fill to the required depth and density, as a systematic construction operation and to conform to the **Compaction table**. Shape surfaces to provide drainage and prevent ponding.

Compaction Table

Location	Cohesive soils. Minimum dry density ratio (standard compaction) to AS 1289.5.4.1	Cohesionless soils. Minimum density index to AS 1289.5.6.1
Residential: Lot fill, house sites.	95	70
Commercial: Fills to support minor loadings incl. floor loadings < 20 kPa and isolated pad or strip footings < 100 kPa.	98	75
Pavements: Fill to support pavements	95	70
Subgrade to 300 mm deep	98	75

Excavated and stripped ground surface: After excavation and/or stripping, compact these surfaces in conformance with the **Compaction table** to a minimum depth of 150 mm.

Maximum rock and lump size in layer after compaction: 2/3 compacted layer thickness.

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

Compaction control tests

Compaction control tests: To AS 1289.5.4.1 or AS 1289.5.7.1.

Compaction control test frequency

Standard: To AS 3798 Table 8.1.

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

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

Density tests

Testing authority: Have density tests of pipe bedding and backfilling carried out by a Registered testing authority.

Test methods:

- Compaction control tests: To AS 1289.5.4.1 or AS 1289.5.7.1.
- Field dry density: AS 1289.5.3.2 or AS 1289.5.3.5.
- Standard maximum dry density: AS 1289.5.1.1.
- Dry density ratio: AS 1289.5.4.1.
- Density index: AS 1289.5.6.1.

9.12 SURFACE RESTORATION**Subbase and base**

Material: Provide crushed rock, DGS20 or DGB20 material and configure in layers and depths to match existing and adjacent work.

Placing base and subbase

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

Spreading: Spread material in uniform layers without segregation.

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

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

Joins

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

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

Final trimming

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

Tolerances

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

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

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

Surface level tolerances table

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

Subbase and base compaction

Construction operation: Compact each layer of fill to the required depth and density, as a systematic construction operation and to conform to the **Minimum relative compaction table**.

Minimum relative compaction table

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

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

Compaction requirements

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

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

Moisture content

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

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

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

Rectification

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

Level corrections

General: Rectify incorrect levels as follows:

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

Testing

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

Frequency of compaction control tests

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

- 1 test per layer per 100 lineal metres for 2-lane roads.
- 1 test per layer per 2000 m² for carparks.
- 3 tests per layer.
- 3 tests per visit.

9.13 PATHWAYS AND PAVED AREAS**General**

Materials: Provide material consistent with the surface existing before commencement of the works.

Sub base: 150 mm crushed stone DGB20 compacted to 100% relative compaction in conformance with AS 1289.5.4.1.

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

Sand Bedding

Quality: Free of deleterious material, such as soluble salts which may cause efflorescence.

Grading: To the **Bedding sand grading table** when tested to AS 1141.11.1.

Fines: Do not use single-sized, gap-graded or excessive fine material.

Cement: Do not use cement bound material.

Moisture content: Make sure uniform moisture content between 4 to 8 %.

Bedding Sand Grading Table

Sieve aperture	Percentage passing (by mass) %
9.52 mm	100
4.75 mm	95 – 100
2.36 mm	80 – 100
1.18 mm	50 – 85
600 μ m	25 – 60
300 μ m	10 – 30
150 μ m	5 – 15
75 μ m	0 – 10

Joint Filling Sand

General: Well-graded sand and free of deleterious material such as soluble salts which may cause efflorescence.

Grading: To the **Joint filling sand grading table** when tested to AS 1141.11.1.

Joint Filling Sand Grading Table

Sieve aperture	Percentage passing %
2.36 mm	100
1.18 mm	90 – 100
600 μ m	60 – 90

Sieve aperture	Percentage passing %
300 µm	30 – 60
150 µm	15 – 30
75 µm	5 – 10

Moisture content: Use dry sand.

Cement: Do not use cement.

Edge Restraint

Lateral Restraint to Segmental Paving

Perimeter: If not provided by other structures, provide edge restraints to bedding and units.

Drainage: Position edge restraint and pavers so that the tops of the pavers are slightly above the front edge of the edge restraint.

Edge restraint shape: Make sure the edge restraint has a vertical or near vertical side abutting the pavers.

Sleeper Edging

General: Fix sleepers in position by spiking with two 13 mm diameter galvanized mild steel rods per sleeper, penetrating at least 400 mm into the subgrade. Drive the rods flush with the upper surface of the sleeper. Arris the upper exposed sleeper edges to produce a 15 mm wide chamfer at 45° to the edges.

Concrete Edging or Kerb

Construction: Fixed form, extrusion or slip forms to AS 2876.

Edging or kerb: Place in a shallow trench between timber forms. Wood float finish flush with the adjacent finished grass level.

Joints: Provide contraction joints 20 mm deep every 5 m.

Timing: Carry out concrete edge restraints before bedding course. Allow concrete edge restraints to harden before vibration of the surface course.

Brick

Setting: On a 1:1:6 (cement:lime:sand) mortar haunch.

Joints: 3 mm struck flush.

Alignment: Even and free from dips, humps and bends.

Cleaning: Wash off mortar progressively.

Bedding Course

General

Preparation: Remove all loose material from the prepared base.

Geotextile

Position: Place fabric between the base course and the bedding sand and lap 150 mm at joints.

Bedding Sand

Spreading: Screed uncompacted sand over prepared base uniformly to achieve a 30 mm thick layer. Maintain sand at a uniform loose density and moisture content.

Bedding course drainage: If water ponding occurs at edge restraint, drain bedding course to existing subsurface drain or drainage pit using geotextile and 20 mm diameter PVC pipe.

Trial Section

Moisture content: Prepare a trial section to establish the moisture content limits which will allow paver system compaction to be achieved.

Final Inspection

General: Before the date for practical completion carry out the following inspections:

- Cracking in bound pavements: Width 1.5 mm.
- Subsidence: Offset less than 1.5 m length of the design profile, not more than 5 mm.
- Stepping: Between adjacent elements within the pavement area, not more than 5 mm.
- Chipping and spalling to pavement units: Maximum 10/100 units with chipped or spalled arrises.

- Ponding: Maximum 10 mm deep 15 minutes after rain ceases.
- Paving joints: Refill joints as required.

9.14 LANDSCAPED AREAS

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

Lawn: Re-lay stockpiled turf. If existing turf is no longer viable, re-sow the lawn over the trench and other disturbed areas.

Planted areas: Overfill to allow for settlement.

9.15 SPOIL

Surplus Excavated Material: Remove from the site excavated material not reusable as backfilling.

Disposal: The Contractor shall be solely responsible for the safe and harmless disposal of surplus excavated material away from the site.

Re-Useable Spoil: Store where directed.

9.16 REACTIVE SOIL

General

Swivel and expansion joints will be required on the underground plumbing and sewer drainage system on this site.

Provide a clay plug where the service trench exits the external footings of the building.

The clay plug shall extend from surface level to the bottom of the trench and shall meet the requirements of AS 2870-2011 Clause 5.6.3

Extent: Place and compact clay filling so that the surface is constantly self draining.

Layers: Placing filling in layers not exceeding the thickness stated below measured loose and compact each layer.

Maximum Layer Thickness: 150mm.

Swivel and expansion joints

The selection of type, position and installation of fittings required shall be undertaken in consultation with Stormplastic's

requirements and installation guidelines.

10 PUMPING SYSTEMS

10.1 DUAL DOMESTIC HOT WATER CIRCULATING PUMPS SYSTEM

Type: Rheem Rediset Dextrux dual circulation, consisting of two hot water circulating pumps complete with control panel mounted on support frame.

Pumps: UPS 20-60B Speed 2

Control: The pump control shall incorporate automatic alternation of pumps, adjustable temperature set point minimum temp 60°C.

Electrical: Connect pump to 240V GPO mounted adjacent. Provide a programmable time switch set to isolate the pump when the building is unoccupied

External Pumps: Provide weather proof enclosure around circulation pumps and associated equipment. Enclosure to be made from 1.2mm steel, galvanized steel or powder coated finish, colour to architect's selection.

All valves, fittings associated with the circulation pumps and hot water pipework to be mounted onto galvanized steel unistrut support system or equal approved system.

10.2 MAINS WATER PRESSURE PUMP SYSTEM

General: Supply and install mains water pressure pump system consisting of multi stage variable speed pressure pumps, automatic lead lag changeover, pressure tank, control system, foot valve, pipework, valves and fittings mounted on base frame

Pump: Grundfos Hydro Multi E 2 CME 15-3 Pump Duty 4.5 l/sec at 600kpa

Control Panel: The system shall incorporate a pressure switch to automatically start and stop the pump and control the variable speed motor. The panel shall incorporate the following features:-

- Metal lockable weatherproof enclosure
- Isolating switch
- Automatic lead lag changeover
- Provide SMS/GSM/GPRS module within Pump Control Panel with additional Sim Card Plan. Control Panel to notify Corporate Strata Manager when in fault via SMS message.
- Pump Alarms – Low Water Level, Pump Failure
- Visual Alarm - Provide a two tone formica sign with 25mm high letters worded “MAINS WATER PRESSURE PUMP ALARMS”, in lower case 15mm high “when sounding, advise building manager immediately”.

Pump cables shall be heavy duty.

Provide all wiring between control panel, pumps and level controllers in existing basement mains water storage tank and high level storage tank to enable pumping system to operate automatically and raise alarms as necessary.

Incorporate into the controls low level lockout to prevent the pump from operating at low liquid level.

Electrical: Electrical connection to the control panel by the Electrical Contractor.

11 SEWERAGE

11.1 SEWER SYSTEM

Extent: Lay sewer drains from the connections as shown on the Drawings or specified.

11.2 INSPECTION OPENINGS (IO)

Required: Inspection openings as required by the regulatory authority and in any case so that each straight length of sewer line can be inspected in at least one direction. Seal the openings with purpose-made covers fixed by a jointing method appropriate to the pipework.

Raise the IO openings to surface level and finish with an approved cover as scheduled. Ensure the IO riser is located central of and within 50mm clearance of the cover.

Where there are multiple IO's outside a building ensure they are equally distance from the external wall of the building.

11.3 REFLUX VALVE

Reflux valve on boundary complete with concrete manhole riser shaft and cast iron cover.

Installation to fully comply with Water Authority approvals.

11.4 REACTIVE SOIL

Swivel and expansion joints will be required on the underground plumbing and sewer drainage system on this site.

Swivel and expansion joints

The selection of type, position and installation of fittings required shall be undertaken in consultation with Stormplastic's

requirements and installation guidelines.

Refer to Stormplastic's technical data sheet SP102A (Appendix A) for installation guidelines for CLASS E soil conditions.

LAGGING

Closed cell polyethylene lagging shall be used around all sanitary plumbing penetrations through footings.

The lagging shall be a minimum of 40mm thick on CLASS E Sites.

11.5 MATERIALS

Refer Schedule.

12 SANITARY PLUMBING

12.1 SOIL AND WASTE SYSTEMS

Extent: Soil and waste pipes from fixtures to the AS/NZS 3500.

Connections To Fixtures: Make connections to sanitary fixtures by a jointing method appropriate to the pipework and the fixture.

12.2 MATERIALS

Refer Schedule.

12.3 TRAPS

Material: Refer Schedule.

12.4 FLOOR WASTES

Grates: Screw-in type or screw fixed as scheduled.

Material: Refer Schedule

12.5 TUNDISHES

Type: Refer to schedule and drawings.

12.6 INSPECTION OPENINGS

Requirement: Inspection openings as required by the regulatory authority and as shown on the drawings. Seal opening and raise to surface level.

Material: Refer Schedule.

12.7 PIPEWORK

Materials: Refer schedule.

12.8 FIXTURES

Type: Refer schedule.

12.9 VENTS

Vent Terminations: Unless otherwise specified, terminate at the height required by the regulatory authority. Terminate 6 metres minimum from windows or air intakes. Provide approved type vent cowls, of material to match the vent pipe.

Where possible interconnect vents below the roof level to minimise roof penetrations.

13 TRADE WASTE SYSTEM

13.1 GENERAL

Provide shop drawings of the pits, baskets and Ph control system etc. for checking and comment prior to manufacture.

13.2 BIN WASH AREA

Silt Trap

HDPE (refer to drawing for details).

14 COLD WATER SUPPLY

14.1 MAIN CONNECTION

General: To AS 3500.

14.2 MATERIALS

Refer Schedule.

14.3 UNDERGROUND PIPEWORK

- Protective Wrap: Buried metallic pipes protected against corrosion by continuous wrapping in petrolatum tape to AWW C217.

14.4 TAPWARE

Type: Refer schedule.

14.5 BACKFLOW PREVENTION

Refer to drawings.

15 HOT WATER SUPPLY

15.1 RETICULATION

General: To AS 3500. Hot water piping from hot water units to the tapware or outlet as shown on the Drawings or specified.

15.2 MATERIALS

Refer Schedule.

Insulation: Fully Insulate all hot water and warm water pipework including hot water return pipework, from hot water unit to fixture outlet including final dead leg to fixture.

15.3 TANK PACK - CONTINUOUS FLOW GAS HOT WATER UNITS (INTERNAL)

Description: Mains pressure unit with water flow sensor, modulating gas valve and heat exchanger. The unit shall have electronic ignition and electronic temperature control.

Gas Burner: The gas burner shall be suitable for natural gas.

Flue: The hot water unit flue shall be of the manufacturers supplied flue system. The flueing system shall be a system designed specifically for the heaters and shall be installed in strict accordance with the manufacturer's recommendations.

Multiple Unit Applications: The units shall be manifolded together. The valves shall be as recommended by the heater manufacturer and installed to their recommendations.

Installation: To AS 3500 and the Australian Standard AS 5601 "Gas installations."

Make and Model: Refer to schedule of Technical Data.

Storage Heaters: Displacement and accumulation types to AS 1056.

Flues: Provide gas flue from the unit terminating above the roof in an approved cowl. Flues shall be double skin galvanised. Paint flue and cowl above roof in a colour to match the roof.

Proprietary Item: Refer to Schedule.

15.4 COMMISSIONING AND MAINTENANCE

Allow for Hot Water Unit manufacturer to commission the plant and provide 12 months maintenance.

16 GAS SERVICE

16.1 APA GROUP

Allow for all co-ordination and arrange and pay all fees to the APA Group for a new gas connection 1,250 mj/hour at 2.75kPa

The contact person Keileigh Marra of APA Group – Phone: 0418 853 508

Allow for a sleeve through the ground floor slab to APA Group requirements. Allow for all sleeves through the slabs and sealing to approval.

Gas Meter Enclosure to be fire rated to FRL 90/90/90

Provide ventilated louvre doors to enclosure – Refer to Architectural Documents for details

16.2 MATERIALS

Refer Schedule.

16.3 UNDERGROUND PIPEWORK

Protective Wrap: Buried metallic pipes protected against corrosion by continuous wrapping in petrolatum tape to AWW C217.

16.4 VALVES

Isolating

Bronze ball valves

16.5 EARTHING PIPES

Earthing: Pipework shall be electrically earthed adjacent to the source of gas supply.

16.6 PRESSURE REGULATOR

Requirement

Gas pressure regulator complete with valves, vents and filters installed in accordance with the requirements of the Supply Authority.

Over Pressure

Fit regulator with over pressure shut off. Pipe vents to discharge outside the building.

Pressure Regulator Capacity

Refer to Gas Schedule.

16.7 AUTOMATIC GAS SHUT-OFF CONNECTED TO FIRE ALARM PANEL

Requirement: Supply and install a solenoid valve in the position nominated on drawings. The solenoid is to be sized to the designed gas demand and operating pressure. The solenoid valve shall be suitable for the service installed and shall be 24 Volt DC activated and connected to the FIP.

Wiring to solenoid valve and connection to the FIP shall be carried out by the Electrical Contractor.

16.8 SOLENOID VALVE

Supply and install a solenoid valve in the position nominated on drawings. The solenoid valve shall be suitable for the service installed and shall be 240 Volt activated and connected to FIP. Wiring to solenoid valve shall be carried out by the Electrical Contractor.

16.9 INSTALLATION

Inaccessible Locations

Use minimum joints in pipework installed in concealed location or inaccessible locations including cavities.

Underfloor

Install underfloor pipework in PVC conduits.

Buried pipes

Warning tape: During backfilling, lay plastic warning tape above and for the full length of buried gas pipes.

Type: Minimum 100 mm wide, with "GAS PIPE UNDER" marked continuously

17 PAINTING, CORROSION PROTECTION AND IDENTIFICATION

17.1 SCOPE

Corrosion protection, painting and identification of all items to ensure the following:-

- Protection against moisture or corrosive agents which may be encountered during the service life of installed items.
- Painting to provide an attractive durable and cleanable surface in areas exposed to view including plantrooms.
- Identification of all plant, controls, valves, wires, terminals, pipes, etc with durable labels and painted markers.

17.2 EXCLUSIONS

The following surfaces shall not be fully painted:-

- Fibreglass, PVC, stainless steel, chrome plated surfaces
- Pipework in roof spaces, riser ducts etc where not normally exposed to view.
- Bearings, motor rails, adjusting screws, valve bodies and actuators etc.
- Flexible pipework connectors.
- Proprietary equipment if supplied in manufacturers standard paint colours and finishes and if not specified elsewhere to suit Architectural finishes.

17.3 CORROSION PROTECTION

Equipment and the total installation shall be designed to prevent the accumulation of moisture. Sharp corners shall be radiused and crevices shall be sealed by continuous seal welds, or use of an approved filler.

Dissimilar metals shall be prevented from contact by a 3mm air gap or 1.5mm of PVC insulator. Bolts, rivets and clips shall have a corrosion resistance equal to the component to which they are attached and shall be of the same noble metal.

Surface Preparation

Surfaces shall be prepared as follows:-

- Black Steel
Shall be degreased and loose rust, scale and other matter removed by hand or power tool cleaning. The surface shall immediately be given one coat of zinc based primer.
- Galvanised Steel, Copper, Aluminium
Shall be degreased and coated with vinyl etch primer.
- Zinccanoeal
Shall be degreased and etch primed.
- Surfaces Subject To Oil Spillage
Shall be degreased and coated with oil resistant undercoat and finishing coat.

Metal Coatings

Repair steel surfaces damaged by welding, or rust, by the application of a cold phosphating (phosphoric acid) solution. Wash off residue after the reaction is complete.

Galvanised steel pipe supports, fabricated components, bolts, nuts etc. installed in damp locations, in the ground, or exposed to the weather.

17.4 PAINTING PROCEDURES

Protect all adjacent surfaces from paint splatter and remove all spillage or spots so that adjacent finishes are in a clean and unmarked condition.

Use first quality lead free paints pre-mixed and delivered to site clearly labelled in the manufacturers sealed containers.

Thinning, mixing or adding of other colours or brands will not be accepted.

Paints for priming, undercoating, finishing and re-coating shall be compatible with each other and the surface conditions to be painted.

Primers shall be an approved zinc chromate or other metal work primer.

Steel surfaces shall be cleaned of oil and other manufacturing lubricants and etch primed prior to applying finishing coats. Galvanised surfaces are not required to be painted.

Damage to a manufacturers surface finish shall be restored to the original corrosion resistance of the finish. Epoxy coated surfaces shall be lightly abraded followed by an active solvent wipe and restoration of original coating thickness.

Weld spatter, slag, burrs and other surface irregularities shall be removed or repaired before surface protection is applied.

Submit details of paint materials and samples of surface preparation and paint finish to the Architect prior to proceeding. Surface preparation and paint finish samples may be the first installed items of each type.

17.5 PLANT, EQUIPMENT AND VALVE IDENTIFICATION

Provide the following identification systems.

Equipment Nameplates: Engraved plates permanently fixed by mechanical means to factory-assembled items of equipment.

Lettering: Except for plant items shall be 5mm upper case engraved black lettering on a white background.

Lettering for plant items shall be 50mm high or appropriate smaller lettering if approved by the Architect.

17.6 PIPE IDENTIFICATION

Pipework shall be identified to AS 1345.

Identification shall be by means of the basic identification colours of AS 1345, applied to the pipework either as full-length painting, or as painting in bands at intervals to AS 1345 clause 6, or as securely attached pipeline markers to AS 1345 clause 6 and figs. 1 and 2.

Location of Bands or markers shall be to AS 1345 clause 6.2

Bands of markers shall be provided in the following locations:-

- Pipework both insulated and non insulated in concealed spaces including risers, roof and ceiling spaces, and pipework exposed in all areas including plant rooms including pipework specified to be painted full-length in decorative or protective colours;
- Exposed pipework external to the building

Corrosion protection, painting and identification of all items to ensure the following:-

- Protection against moisture or corrosive agents which may be encountered during the service life of installed items.
- Painting to provide an attractive durable and cleanable surface in areas exposed to view, excluding plantrooms.
- Identification of all plant, controls, valves, wires, terminals, controls, pipes, ducts, etc with durable labels and painted markers.

17.7 ELECTRICAL AND CONTROLS IDENTIFICATION

Every piece of equipment and plant control item, instrument or gauge, switchboard item including incoming and outgoing circuit wiring shall be clearly labelled using the full English language description.

For wiring this may be achieved via numbered labels referenced to an English language description on an adjacent permanently mounted drawing.

Labels shall consist of 5mm upper case black lettering on a white background of engraved laminated plastic.

Labels shall be permanently attached by screws and adhesive.

17.8 SAMPLES

Submit samples of all identification systems to the Architect for approval.

18 TESTING AND COMMISSIONING

18.1 TESTING

Requirement: Apparatus, material, equipment and instruments shall be properly calibrated and all labour necessary, and carry out the tests required by the Specification or regulatory authorities, in the presence of the clients representative and the authorised representative of the relevant authority for the service under test.

Compliance: On successful completion of tests, if required for identifiable elements of the installation, supply a certificate of compliance and affix a compliance plate.

Hydrostatic Tests: Fill the pipework with water and test at the pressure and for the duration stated in the HYDROSTATIC TEST TABLES, unless overridden by regulatory authority requirements.

18.2 HYDROSTATIC TEST TABLES

Service	Test Fluid	Test Pressure	Duration	Allowable Loss
Sewer/ Soil & Waste	Water	Static head to Water Authority Corporation requirements and AS 3500		
Mains Water Copper	Water	1800 kPa	2 hrs	Nil
Natural Gas	AS 5601			

18.3 TESTING PLASTIC PRESSURE PIPES

This document includes the requirements set out for hydrostatic testing of pressure pipeline for Blue Brute (PVC) and PE.

All pressure pipeline shall be properly calibrated in the presence of the clients representative and the authorized representative of the relevant authority for the service under test.

Compliance: On successful completion of tests, if required for identifiable elements of the installation, supply a certificate of compliance and affix a compliance plate.

PE Hydrostatic Testing Method

- Testing of Polyethylene pipe work shall be in accordance with AS 2033:2008.

A section of pipework is deemed to have passed the test provided the quantity of makeup water is less than that calculated in equation 6(1).

The quantity of make-up water necessary to maintain the test pressure shall comply with the following Equation:

$$Q \leq 0.14LDH \dots 6(1)$$

where

Q = allowable make-up water, in litres per hour

D = nominal diameter of the test length, in metres

L = length of the test length, in kilometres

H = average test head over length of pipeline under test, in metres

Test pressure = pipe class + 25%

Test pressure for each service is specified below.

Service	Test Fluid	Test Pressure	Duration	Allowable Loss
Polyethylene Pressure	Water	1500 kPa	2 hrs	As per above

The make-up water is not a leakage (loss) allowance, but is an allowance to cover the effects of the test head forcing small quantities of entrapped air into solution.

18.4 BACKFLOW PREVENTION VALVES

The person performing the tests and issuing the Certificate for Backflow Prevention Valves shall be suitably qualified to do so by Water Authority. Provide a test certificate prior to placing the valve in service. The valve shall be retested twelve months after the original test. Provide the owner with an ongoing maintenance schedule and costing.

18.5 COMPLETION

Completion: Check pipe joints, valve seats, tap washers, strainers and the like. Replace if damaged and re-test.

Commissioning: After satisfactory completion, turn on control and isolating valves and leave the systems in full operating condition.

18.6 COMMISSIONING

Installation: Carry out tests necessary to prove that the installation meets the specified requirements and all the tests required by Authorities during and on completion of the works, and furnish details in writing of the tests carried out, test results and all certificates of approval issued.

Operation: Test all control equipment, pressure switches, alarms and similar equipment for correct sequence of operation and adjust as necessary.

General: In general, the operation of each piece of equipment individually and each completed service as a whole, shall be tested and correctly balanced to achieve the required satisfactory performance.

19 MAINTENANCE

19.1 SCOPE

Provide a comprehensive maintenance service from the date of Practical Completion during the 12 months Defects Liability Period for all items in the Contract, including regular preventative maintenance and attendance at breakdown call-outs on 24 hours per day, 7 days per week.

Maintenance shall include routine servicing in accordance with manufacturers recommended procedures to achieve safe and reliable operation, the attendance at all emergency call outs, and the repair of break downs including provision of associated consumables and replacement components.

Maintenance shall be at manufacturer's recommended intervals or 3-monthly, whichever is the most frequent.

Service Contract: Prior to the expiration of the Defects Liability Period, prepare and submit an annual service contract for consideration.

19.2 MAINTENANCE REQUIREMENTS

Faults: Make good faults or damage cause by defects in the installation, and replace defective parts.

Materials: Supply the necessary maintenance materials including lubricants and cleaning materials.

Program: Before the start of the maintenance period, submit to the Architect a maintenance program showing the proposed dates of required service visits. State the contact telephone numbers of the service operators to be provided, and describe the arrangements for the prompt attention to emergency calls.

Results: Record the result of each service visit in the log book, including comments on the functioning of the system, work carried out, items requiring corrective action, adjustments made, name of service operator and obtain the signature of the Principal's designated representative.

Report: Report to the Principal's designated representative on arriving and before leaving the site.

End of Defects: At the end of the defect's liability period, make a final service visit and upon satisfactory completion of the above procedures, certify in writing that the system is operating correctly and has been fully and properly maintained during the Maintenance Period.

- Building Code of Australia
- The requirements of the Fire Service Authority

19.3 OPERATING AND MAINTENANCE MANUALS

Requirement: Prior to Practical Completion submit for approval one (1) copy of the Operating and Maintenance Instructions.

Operation: Include all necessary demonstrations and explanations of the correct sequence of operation and the function of each piece of equipment under both automatic and manual control.

Size: Pages shall be reinforced loose leaf A4 size.

Plans: "As Installed" plans (hard copy and computer disc copy) showing the layout and location of all equipment installed.

Electronic Format: Provide an electronic copy of the entire manual within each manual.

Submission: Following submission and approval of draft copies, prepare three (3) copies of an approved manual.

Typed: The manuals shall be written in clear concise English, printed or typed on durable printing paper with each page consecutively numbered. Provide dividers between sections with plastic covered labelled tags.

Binding: Bind the manual in a black vinyl hardback A4 folder.

The front cover to include the following wording:-

- **1 (LOT 181) GLENBURNIE TERRACE, PLYMPTON (APARTMENTS)**
- Hydraulic Services
- Secon Consulting Engineers

- "Contractors Name"

The spine to include the following wording:-

1 (LOT 181) GLENBURNIE TERRACE, PLYMPTON (APARTMENTS)

- Hydraulic Services

Components: The components of the manuals shall include the following:-

- Title page with telephone numbers of maintenance personnel.
- Index and sub-index for each section.
- Description of each system and operating instructions. Include setting up, control, alarm, test and emergency procedures.
- Schedule of inspection and preventative maintenance and repair instructions for each item of equipment.
- Parts list and equipment details and source of supply of replacement components.
- Set points of controls and test sheets.
- Test results including settings.
- Corrected "As-Installed" drawings on DWG CAD format (print copies and one disc copy).
- Copy of the sewer drawing submitted to the OTR
- Safety in maintenance issues

Technical Manuals: The Manuals shall include but not be limited to the following items:-

- Certificate of Compliance
- Pipework, valves and fittings
- Isolating valves
- Check valves
- Backflow prevention valves information and test certificate
- Sanitaryware
- Tapware
- Thermostatic Mixing Valves
- Tempering valves
- Hot water Systems
- Circulating pump
- Ovens and cook tops
- Gas systems
- Mains pressure pump system

Manufacturer's Catalogue: Manufacturer's catalogues, instructions and generally descriptive pamphlets as appropriate shall be included, both to reduce the text and to provide prime source information.

19.4 SERVICE BOOK

Arrange all service personnel whether for routine or breakdown maintenance to:-

- 'log in' in the log book on arrival in site
- provide a written report in the log book describing nature of the call out, problems identified and action taken
- have the report witnessed by the Principal Representative or his delegate.
- 'log off' on completion of the work.

19.5 PRINCIPAL'S INSTRUCTION

At times to be agreed instruct the Principal's operational maintenance staff in the recommended methods of operation and maintenance of the systems.

Include information in the front of the Maintenance Manual indicating:

- What training was carried out
- Who was present at the training
- Date that training was carried out

20 SCHEDULES**20.1 PIPEWORK AND MATERIALS****Material:**

Service

Sewer Pipes

UPVC DWV Class

Soil Waste & Vent

UPVC DWV Class or

Cast Iron or Copper or Brass (Refer to drgs)

Soil Wastes & Vent
(acoustic)UPVC DWV Class (acoustically insulated) or Rehau
RaupianoMains Water
(Underground)Copper Type B (protective wrap underground pipework) or
Polyethylene Pressure PipeMains Water (Above
ground concealed)Copper Type B or
Pressure Class Cross Linked High Density PolyethyleneMains Water (concealed)
in BuildingCopper or Pressure Class Cross Linked High Density
Polyethylene

Mains Water (exposed)

Copper Type B (Chrome Plated)

Hot Water (Concealed)

Copper Type B (Fully Insulated) or
Pressure Class Cross Linked High Density Polyethylene
(Fully Insulate)Hot Water (concealed) in
BuildingCopper (Fully Insulated) or Pressure Class Cross Linked
High Density Polyethylene (Fully Insulate)Hot Water (Exposed
Inside)

Copper Type B (Chrome Plated)

Hot Water (Exposed
Outside)Copper Type B (Fully Insulate with Insulation Metal
Sheathed)Hot Water (Under
Ground)Copper Type B (Fully Insulate and installed within PVC
Sheath. Foam seal ends)

Natural Gas

Above Ground: Copper Type A
Below Ground: Copper Type A (Denso wrapped or
Kemlagged coated underground) or Polyethylene**Jointing:**

Copper

Generally Silver brazed
Taps Compression fittings
Valves Screwed

UPVC

DWV Class Solvent Welded

UPVC

Pressure Solvent Welded

Polyethylene (HDPE)
Drainage

Fusion welded

Pressure Class
Polyethylene

Fusion welded

Pressure Class
Polypropylene

Refer to Manufacturer

20.2 SCHEDULE OF TRAPS, WASTES AND INSPECTION OPENINGS**Fixtures:**

Basins/Vanity (fully concealed)

Trap and Waste:

Polypropylene "P" Trap with waste built into wall.

Basins/Vanity (exposed)

Chrome Plated Copper "P" Trap with waste built into
wall

Basins/Vanity (exposed)

Chrome Plated Copper "S" Trap.

Sinks (concealed)	Polypropylene.
Sinks (exposed)	Chrome Plated Copper "S" Trap
Floor Waste Gully (FWG)	Screw-in chrome plated brass grate.
Floor Waste Gully (FWG) in Vinyl Floored	"Betafit" vinyl grate with chrome plated brass inserts.
Floor Waste Gully (FWG)	Screw-in chrome plated brass grate.
Floor Waste Gully (FWG) in Vinyl Floored	Galvin # 303176X - Stainless Steel 316 Exl Floor Drain Grate Assembly Vinyl 100X80 PVC Slip-In.
Kitchen Floor Drain in Vinyl Floored	Galvin # 303176X - Stainless Steel 316 Exl Floor Drain Grate Assembly Vinyl 100X80 PVC Slip-In.
Kitchen Floor Drain	Galvin # 302380X - Stainless Steel 316 Exl Floor Drain Grate Assembly Round 100X80 PVC Slip-In.
Bin Wash Silt Trap	PVC silt trap with silt basket, fixed 2mm mesh secondary filter and Grate. Refer to drawings for location and inlet dimensions to silt trap.
Inspection Opening (I.O.)	External:
	Paved Areas: Everlevel type 1 cast I.O. marked "SEWER" with concrete support block or equal approved
	Concrete Path: Everlevel type 1 cast I.O. marked "SEWER" with concrete support block or equal approved
	Unpaved Area: Everlevel type 2 cast I.O. marked "SEWER" with precast concrete surround or equal approved
	Internal:
	General: Galvin # 67717X - Stainless Steel 316 Exl Slip-Safe Bolted Cleanout Round 150X100 PVC/HDPE/CU Slip-In.
	Vinyl Floors: Galvin # 69468X - Stainless Steel 316 Exl Slip-Safe Bolted Cleanout Vinyl 150X100 PVC/HDPE/CU Slip-In.
Inwall Tundish	Modtec stainless steel inwall tundish.
Box Tundish	150mm x 150mm x 1.6mm thick copper box with 80mm removable dome grated outlet.
Plantroom Floor Drain	300 * 300 * 300 (1.6 mm) copper box with removable brass grate and brass dome outlet.

Note: Install puddle flanges to floor trap risers, box tundish and silt traps. Drill 4 x 3mm weep holes above puddle flange into riser pipe.

20.3 SCHEDULE OF INSULATION

Requirement: Insulate pipes as follows:-

- Hot water pipework
 - . Fully insulate (including final pipework to fixtures) - Flexible pipe insulation
- Cold water pipework for noise control
 - . Flexible pipe insulation (Where shown on drawings and specified)
- 6mm thick Polyethylene between all brackets and pipework.

20.4 SCHEDULE OF PAINTING AND IDENTIFICATION

- Sanitary Plumbing
 - . White lettering on black background with direction arrow
- Cold Water
 - . White lettering on green background with direction arrow
- Hot Water
 - . White lettering on green background with direction arrow
- Natural Gas or LPG
 - . Black lettering on light yellow background with nominated gas pressure in kPa
- Labelling
 - . Valves, equipment, gauges, instruments and similar items

- Equipment . Protection from corrosion or weathering
- Equipment Exposed . Fully paint (colour to be nominated)

20.5 SCHEDULE OF PUMPS

Location:	Make:
Mains Pressure Boosting pump	Grundfos Hydro MPC-E 3 CRIE 5-12 Pump Duty 4.5 l/sec at 600kpa Pumps to operate on duty / standby arrangement
Hot Water Circulating Pump	Rheem Hot Water Pump Set Redi Set Deluxe 890666 with 2 x Grundfos UPS 20-60B pumps or equal approved bronze housing with stainless steel shaft and impeller.

20.6 SCHEDULE OF HOT WATER UNIT

Location:	Unit:
	Rheem Tank Pack Series 2 TPI03N*D/2430 615 mj/hour NG internal manifolded hot water system, complete with galvanised frame, pipework, valves, dual circulation pumps and coaxial flue kit.

20.7 SCHEDULE OF FIXTURES, FITTINGS AND TAPWARE

Note: Prior to ordering fixtures and tapware provide technical information and samples and obtain approval from the Architect.

Refer to Architectural Specification and Drawings for sanitary ware and tapware number.

Isolating valves for equipment, etc shown on the Drawings may not be nominated in the schedule below but shall be included in tender price.

General: All vitreous china fixtures shall be white unless otherwise specified. Provide chrome plated plug and washer, supports and fixings. Number and location of tap holes to match tapware.

General: Tapware shall be chrome plated on brass unless otherwise noted.

Tapware shall incorporate ceramic disc technology unless otherwise noted.

Fluid Aprons: Provide "Fluid Apron" to all tapware (wall mounted).

Vacuum breaks: Provide vacuum breaker backflow prevention valve to all screw nose bib cocks.

Internal vacuum breaker shall be chrome plated. External vacuum breaker shall be brass.

Final connections: Final connections from wall flanges to basins, sinks (concealed), etc, and from isolating valves to equipment use "Ryco" braided stainless steel flexible connectors. Where connections are exposed use chrome plated copper pipe.

All tapware shall be water efficiency labeling and standards (WELS) compliance.

21 HYDRAULIC SERVICES TENDER FORMS

21.1 TENDER PRICE

We the undersigned hereby provide our Fixed Lump Sum Tender Offer to carry out the entire works in accordance to the specification, drawings, addenda's and general conditions of contract

TENDER PRICE: \$.....

ADDENDA'S No: \$.....

GST: \$.....

TOTAL TENDER PRICE: \$.....

Amount in words:

.....

.....

21.2 SUMMARY OF COSTS

The costs indicated below make up the "Tender Price", including supply, delivery, installation, testing and warranty maintenance, overhead and profits for the various sections of the work.

Item	Fixed Lump Sum
Sewer and Sanitary Plumbing	\$
Water Services	\$
Sanitary Fixtures and Tapware	\$
O & M manuals incl client tuition	\$
Testing, Commissioning & balancing	\$
52 Weeks Preventative Maintenance & service	\$
Sundries / Misc	\$
GST where applicable	\$
TOTAL TENDER PRICE	\$

COMPANY:

ADDRESS & CONTACT Ph:

SIGNED BY:

TITLE:

DATE:

HYDRAULIC SERVICES TENDER FORMS**21.3 PIPING SYSTEMS UNIT RATES****SEWER UPVC PIPING UNDER GROUND rate per metre cost**

Material: uPVC	100mm uPVC	150mm uPVC		
Up to 1m Deep				
1.1m to 2m deep				
2.1 – 3m deep				

WATER MDPE PIPING UNDER GROUND rate per metre cost

Material: MDPE	25mm PN12.5	32mm PN12.5	40mm PN12.5	50mm PN12.5
Up to 1m Deep				

WATER REHAU PIPING ABOVE GROUND rate per metre cost

20mm PN20	25mm PN20	32mm PN20	40mm PN20	50mm PN20

WATER REHAU STABIL RAUTITAN PIPING ABOVE GROUND rate per metre cost

20mm PN20	25mm PN20	32mm PN20	40mm PN20	50mm PN20

WATER COPPER TUBE ABOVE GROUND rate per metre cost

20mm type B	25mm type B	32mm type B	40mm type B	50mm type B

COMPANY:

ADDRESS & CONTACT Ph:

SIGNED BY:

TITLE:

21.4 SCHEDULE OF RATES**Labour and Mark-Up**

Labour rates applicable to the contract and include all on-costs, loading, allowances, overhead recovery and profits, excluding GST.

	Normal Time	Time & Half	Double Time
Electrician – installation	\$	\$	\$
Plumber – installation	\$	\$	\$
Fire Contractor – Installation	\$	\$	\$
Foreman / Leading Hand – Site	\$	\$	\$
Commissioning Technician – Site	\$	\$	\$
Project Manager – Site / Office	\$	\$	\$
CAD Draftsperson – Site / Office	\$	\$	\$
Maintenance / Service Technician	\$	\$	\$

Mark-up to be applied on the total costs to purchase goods and materials:- %

Mark-up to be applied on the total costs of sub-contractors:- %