Temo Consulting

Technical Specification

For

Hydraulics Services

Consultancy for Engineering and Project Management

Prepared for

MFMR AUKI – MALAITA PROVINCE
SOLOMON ISLANDS



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1 SPECIFICATION REVISION AND QA STATUS

Date	Rev	Issued to	No. of Copies	Approved for Issue	Comments
October 2025	0 – Tender Issue	Client/ Architect	1	PAT	

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2 INTRODUCTION

2.1 OVERVIEW OF THE INSTALLATION

The work provided for in this specification is for the **Hydraulics Services** Installations for the **MFMR Auki – Malaita Province, Solomon Islands.**

The Hydraulics Services cover the complete water supply and waste water systems to the complex.

2.2 PRELIMINARY

This section of the work shall be carried out only by Hydraulics Services contractors who can show they have had recent and successful experience on work of a similar nature and magnitude, and evidence of this experience shall be submitted if requested.

2.3 INTENT

The intent of this specification is to provide for the work herein set out and as shown on the accompanying drawings to be fully completed in every detail for the purpose designed. The contractor shall allow to supply, construct and install everything reasonably necessary for such construction to comply with the intent of the specification and drawings not withstanding any omissions in the drawings and/or specifications.

The Contract includes all work incidentals to the work shown and specified and as necessitated by the conditions of the site or of the works or of the materials as apparent or as discovered during the progress of the Works.

The intent is that all systems supplied under this contract are complete in every respect, and all items and work necessary to this shall be deemed to be included whether specifically indicated or not.

The Hydraulics Sub-contractor warrants that he is expert in understanding the systems, capable of both design and construction, and that all work will be suitable for its intended function where located, and will comply with all requirements of statutory and other authorities having jurisdiction

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3 GENERAL INSTRUCTIONS

The following general instructions shall apply in all instances

3.1 COMMUNICATION

All communication shall be in writing and shall be with the Consulting Engineer or any person appointed by him.

3.2 CONDITIONS OF CONTRACT

Refer to the Main Building Contract for details on the "Form of Contract" for the works specified.

The said document specifies commercial, legal conditions for these works.

Any queries regarding Conditions of Contract and its interpretations for these works shall be directed to the consulting engineer before the Contract closing date.

3.3 DEFINITIONS AND ABBREVIATIONS

The term "**Contract**" used herein refers to the work included in this Specification, as does the term "Subcontract".

The term "**Hydraulic Services Subcontractor**" or "**Subcontractor**" used herein refers to the Hydraulic Services Contractor, regardless of actual contractual relationships, e.g. Hydraulic Services, Subcontractor, Nominated Subcontractor, engaged to complete all works described in this Contract.

"**Approved**" shall mean subject to the inspection and entire approval of the Engineer before being worked or fitted into the Contract works.

"**Provide**" and "**Install**" used separately shall be interpreted to mean "**Provide and Install**" and shall include all design installation and testing, setting to work and maintenance.

"**Indicated**" means as indicated on the Contract drawings and specification and by notes, figures, sketches or writing, thereon or by any combination thereof.

The terms "**Employe**r", "**Client**", "**Principal**" and "**Owner**" refers to **FMC Pacific.**

The terms "**Architect**" which are used refers to **Kearney Architecture**.

The terms **"Consultant", "Engineer"** and **"Consulting Engineer"** used herein refers to **Temo Consulting.**

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3.4 REVIEW THE SPECIFICATION

The contractor shall read, review, study and familiarise themselves with his specification and bring anything that do not understand or do not agree with, under the attention of the Engineer before or at tender closing stage in their tender letter.

Tenderers are to make use of the tender period to clarify any aspects or inconsistencies of these documents that may influence the pricing or the execution of the contract. Any such inconsistencies found subsequent to the letting of the Contract shall have the interpretation placed upon them by the Engineer. The Subcontractor shall abide by this interpretation.

Requests for alternatives or changes to the specification after tender closing shall not necessarily be accepted.

3.5 COMPLIANCE

A price for a tender complying with this specification in all respects shall be compulsory.

The intent of this specification is to provide for the work herein set out and as shown on the accompanying drawings to be fully completed in every detail for the purpose designed. The Specialist Contractor shall allow to supply, construct and install everything reasonably necessary for such construction to comply with the intent of the specification and drawings not withstanding any omissions in the drawings and/or specifications.

The Contract includes all work incidental to the work shown and specified and as necessitated by the conditions of the site or of the works or of the materials as apparent or as discovered during the progress of the Works.

The intent is that all systems designed and supplied under this contract are complete in every respect, and all items and work necessary to this shall be deemed to be included whether specifically indicated or not.

The Hydraulics Services system installation shall be carried out by an approved specialist sub-Subcontractor under the control of this Subcontractor and form part of this contract.

By submission of a tender the Tenderer warrants that he is expert in understanding the systems, capable of both design and construction, and that all work will be suitable for its intended function where located, and will comply with all requirements of statutory and other authorities having jurisdiction.

3.6 DESIGN RESPONSIBILITY

The design responsibility for the installation shall be with the Engineer.

3.7 SUBCONTRACTOR'S RESPONSIBILITY

The Hydraulics Services Subcontractor shall be deemed to have carefully examined the Contract Documents, the Specification and Drawings. If the Hydraulics Contractor has any doubt as to the meaning of any portion of these documents, he shall inform the engineer in writing before tendering on the project. The Engineer shall provide clarifications to the query in a notice to tenderers.

The Hydraulics Services Contractor must carefully consider local conditions, visit the site of the proposed work, and make any field survey necessary for proper planning and execution

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of the work. Failure to do so shall in no way relieve the Hydraulics Services Contractor of responsibility for changes or unanticipated costs due to field conditions.

After a tender has been accepted the responsibility for any misunderstanding or error shall rest with the Hydraulics Services Contractor. The Hydraulics Services Contractor shall examine carefully the Architectural, Structural and other trade's drawings and satisfy himself that the work under his contract can be satisfactorily carried out without changes to the building as shown on drawings. Before commencement of his work, he shall examine the progress of other trades and report at once any defect or interference affecting his own work or the warranty of same. No extras will be allowed subsequently for his omission to make adequate inspection or take adequate precaution.

The Hydraulics Services Contractor shall arrange his own work in co-operation with other trades so that all work is installed to the best advantage. Where equipment is installed by the Hydraulics Services Contractor without due regard to other trades, relocation of such equipment shall be performed by the Hydraulics Services Contractor at his own expense.

3.8 GENERAL RESPONSIBILITY

The Subcontractor shall comply with all proper instructions issued by the Engineer or the Main Contractor in relation to this Contract.

The Subcontractor shall be responsible for the adequacy, stability, and safety of all its site operations and method of construction.

The Subcontractor shall respect the rights of the adjoining areas occupants and shall advise the main contractor when access to areas out of construction areas is requires for the purposes of carrying out the Contract Works.

The Subcontractor warrants that at all times shall be suitably qualified and experienced, and shall exercise due skill, care and diligence in the carrying out and completion of Works under Subcontract (WUS)

The Subcontractor shall carry out and complete WUS in accordance with the design documents so that the Subcontract Works, when completed, shall:

a. be fit for their stated purpose; and

b. comply with all the requirements of the Subcontract

3.9 ERRORS, AMBIGUITIES AND OMISSIONS

Errors, ambiguities and omissions in drawings or specifications shall be reported to the Engineer for correction before any part of the work involved is started. Unless otherwise expressly stipulated, no additional allowance shall be made because of errors, ambiguities or omissions which should reasonably have been discovered during the preparation of the tender or which may become evident later and which should have been directed to the attention of the Engineer in timely manner. The written decision of the Engineer shall be final.

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3.10 CONTRACTORS PRICE

A lump sum fixed price excluding taxes is required. The price shall not be subject to variation for the duration of the contract period.

The contract includes all work shown and specified and as necessitated by the conditions of the site or of the works or of the materials as apparent or as discovered during the progress of the works.

By Submission of a contractor price the contractor warrants that he is expert in understanding the systems, capable of both design and construction, and that all work will be suitable for its intended function where located, and will comply with all requirements of statutory and other authorities having jurisdiction.

3.11 PRE-START MEETING

The Subcontractor shall prior to commencing the Subcontract Works on site, attend a pre-start meeting to be held at the address and time mutually agreed with the Main Contractor and at that time, the Subcontractor shall satisfy the Main Contractor and the Subcontract

The meeting may address the following matters:

a. construction and site-specific issues;

b. lines of communication and authority levels;

c. possession of the site;

d. frequency and venue of site meetings;

e. progress payments;

f. working hours;

g. safety requirements;

h. insurance;

i. scope of works;

j. programs; and

k. Resources.

3.12 SITE MEETINGS

A representative of the Contractor, who is fully qualified in all aspects of Hydraulic Services works shall be required to attend all site meetings called by the Project Manager. The said representative shall be fully conversant with all aspects of this current project, including the latest site developments, prior to attending meetings. The said representative shall have been authorised by the Contractor to make decisions on the Contractor's behalf which shall be deemed binding on the Contractor.

3.13 CONTRACTOR'S REPRESENTATIVE

The Subcontractor shall provide all necessary supervision during the Contract. It shall have on site at all working times a competent representative whose name shall be notified to the Main Contractor and Engineer in writing and who shall be authorised to receive on behalf of

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the Subcontractor any instructions from the Main Contractor, Engineer or Engineer's Representative.

All works shall be carried out under the supervision of the Subcontractor's representative.

3.14 APPROVAL OF DRAWINGS AND SAMPLES

Within ample time to prevent construction delay, Sub-Contractor shall submit to the Engineer samples of materials and equipment for approval. The hydraulic contractor shall also submit 2 sets of final shop drawing detailing all aspects of proposed work for approval.

The Hydraulic Contractor shall not enter into any commitments or commerce any work without the approval of the shop drawing and materials samples by the Engineer.

Consent shall not relieve the contractor from his obligation to comply with this specification. Supply without delay, any samples, information or drawings requested by the Engineer.

3.15 ALTERNATIVES

The Contractor is encouraged to forward alternatives for both the design and specified equipment and the installation, provided that full details of these alternatives and prices are forwarded with their tender under cover of their tender letter.

Nomination of particular manufacturer, reference, or source of supply shall be taken, unless specifically noted otherwise, to indicate type and quality required.

Any alternative equipment shall meet or exceed the specified equipment and installation in all respects as follows but not limited to the following: -

- Performance and duty.
- Maintenance and spare parts.
- Durability.
- Energy efficiency.
- Life cycle costs analysis.

Al costs associated to prove the above shall be borne out by the Contractor.

3.16 APPROVALS

All approvals of documents and site work shall be performed by the Consulting Engineer or any person appointed by them.

3.17 SHOP DRAWINGS

The Contractor shall prepare installation drawings for shop fabrication and working drawings for installation on site. All dimensions and locations shall be verified on site. Installation drawings shall be submitted for review by the Engineer before manufacture. The review of any

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drawings by the Engineer in no way affects the Contractor's responsibility for the satisfactory completion of the work.

The Hydraulics Services Contractor shall review all relevant drawings, including architectural, structural, other services and co-ordinate and co-operate with the main contractor and the relevant subcontractors to avoid conflict with the building structure and other building services. Any changes required due to this co-ordination shall be provided at no extra cost.

The installation drawings shall include all details necessary for the proper accommodation of the plant as a whole. This includes all pipework, foundation, and fixing bolts details, access details, etc. Accurate shop drawings are to be provided for the penetration and cast in requirements for the pre-cast concrete panels for both walls and floor panels.

Shop drawings shall show at least the following general categories of information as follows:

i) Penetrations through floors, walls, and other structural members;
ii) Plinth details;
iii) Equipment positions and operating weights;
iv) Entry positions, access routes, weight of equipment or components during delivery to site;
v) Services access openings;
vi) Location, details of concealed/buried conduits, inserts, and pipes;
vii) Temporary openings in floors/walls;
viii) Detailed workshop and manufacturing drawings;
ix) Equipment schedules;
x) Electrical wiring and control diagram;
xi) General layout plans and sections (1:50 scale for plans and 1:20 scale for sections);
xii) Schematic diagram;
xiii) Support and mounting details;
xiv) Material/Component specifications;
xv) Setting out dimensions and level; and
xvi) Interfacing details and co-ordination with architectural, structural and other Sub-Contract Works.

Shop drawings shall be constantly updated to reflect modifications and changes agreed/accepted by the Engineer and to reflect design changes issued by Engineer's instructions.

If there should be any alterations that are necessary due to errors in, or late availability of information from the Contractor, all charges incurred in the correction or alteration shall be to the Hydraulics Services Contractor's expense.

Installation works carried out by the Sub-Contractor before the relevant shop drawings submitted and approved by the Engineer are at the Sub-Contractor's own risk.

3.18 MOCK-UP INSTALLATIONS

The requirements of mock-ups stated in the Main Contract or as specified in this Specification shall be included in the Sub-Contract.

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3.19 PROGRAMME

The Hydraulics Sub-contractor shall submit a programme of works with their Contract in Gantt Chart Form, specifying Tasks, Duration, Resources and dependencies between scheduled tasks. The critical path activities and milestones shall be identified. This programme shall be kept updated at all times for the entire duration of the project.

3.20 STANDARDS AND CODES OF PRACTICE

Standards of workmanship, materials, and details of construction are to conform to relevant Australian and New Zealand Standards with any amendments unless specifically noted in this specification and drawings.

All work in respect to materials and workmanship shall meet or exceed relevant local and overseas engineering standards, best practices and recommended methods.

In particular, relevant applicable sections of the following standards shall be deemed part of this specification.

All works shall comply with the National Building Code of Solomon Islands, local Authority Regulations, Municipal Authority Regulations, Health and Safety Regulations.

Where a New Zealand or Australian standard is not available, the relevant British and/or European standards shall be used and the standards shall take precedence in the above stated order. Where standards are not available, acceptable engineering standards shall be forwarded for approval.

Equipment suppliers and manufacturers' recommendations shall be closely followed with respect to both the installation and commissioning.

The latest issue/revision of all the above documents at the time of tender shall apply in each instance.

3.21 PERMITS AND FEES

The Hydraulics Services Contractor shall give all necessary notices, obtain all necessary permits and pay all fees in order that the work may be carried out, and shall furnish all certificates as evidence that the works installed comply with laws and regulations. Bring to the attention of and clarify any unusual aspects of the installation with the relevant Authority during the permit application period.

Pay all fees and costs relating to patent rights, trademarks, or other protected rights and fully indemnify the Owner against any claims arising there from.

3.22 SITE WORK

Site work shall be performed in a workman like manner and the entire site shall be kept neat and tidy.

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3.23 WORKING HOURS

For the duration of the contract works, the official working hours shall be coordinated with the Main Contractor prior to commencement of the Contract.

3.24 SITE PERSONNEL

The work shall be performed by people with the necessary experience, qualifications and registration to perform the work.

Documentation to this effect shall be submitted to the Project Manager and/or the Client's representative before any Workmen will be allowed on to the site.

3.25 SITE FACILITIES

All site facilities shall be supplied by the contractor inclusive of communication, storage, office and ablutions.

3.26 OCCUPATIONAL HEALTH AND SAFETY

The Contractor shall ensure that all personnel are fully trained in matters relating to work safety. The Contractor shall ensure that their personnel are fully equipped with safety equipment and that a strict regime of safety is followed on site that complies with local OHS (Labour Department) Authority requirements.

3.27 COORDINATION TO OTHER TRADES

The Contractor shall liaise with the Main Contractor and all other tradesmen to ensure that works of all trades are properly coordinated. Route of services shall be as such as to ensure proper coordination with other trade services.

The Contractor is responsible for any modifications required due to services not properly coordinated on site.

The Contractor shall provide all necessary technical information, details and layout of their installations to the Main Contractor and shall cooperate and coordinate with the Main Contractor and other Sub-Contractors for the smooth execution of the works on site.

3.28 HOT AND DANGEROUS WORKS

All minor and major hot work and work that could cause bodily harm or work that is a fire hazard for example grinding, sawing, cutting, welding, soldering and brazing shall not proceed without the permission of the Main Contractor OHS officers, Project Manager or from the Consulting Engineer.

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3.29 PRACTICAL COMPLETION

After all test adjustments and commissioning have been completed to the satisfaction of the Project Manager and provided all the requirements of the specification have been met to the satisfaction of the Engineer a certificate of Practical Completion will be issued.

3.30 PROGRESS PAYMENTS

Progress payments for sectional completion shall be based on work completed and commissioned less retention moneys.

Quantity measurements for the purpose of valuing Progress Claims shall be taken from the Drawings issued by the Architect and/or Engineer.

3.31 VARIATION ORDERS

Variation Orders (VO) shall be based on the prices indicated in the Schedules of Rates (SOR) that has been submitted by the Contractor during the Tender stage.

If some items and works to be claimed are not specified inside the SOR, these shall be justified by submitting the VO together with the supporting documents like, Engineer's Instructions, drawings purchased orders and receipts.

3.32 DOCUMENTATION PRECEDENCE

This specification shall take precedence over other documents except in the case where it contravenes a local law or local authority regulation.

In case of document discrepancy or ambiguity, the matter shall be referred to the Consulting Engineer for a ruling which shall be final and binding to all parties.

3.33 QUALITY ASSURANCE

The contractor shall submit with his tender a draft quality assurance plan indicating his quality control plan with hold points to be signed off by his personnel as well as the Consulting Engineer to ensure the quality of the installation.

The Consulting Engineer may add additional hold points or procedures if required.

3.34 MATERIALS FOR CONSTRUCTION AND FINISHES

The materials used in the construction of the equipment are to be of the highest quality of their respective kinds.

All parts liable to rust, including screws, bolts and nuts shall be cadmium plated or hot dipped galvanised. All metalwork in this Contract including switchboards, distribution boards, cable tray, trunking, cable ladder, support brackets etc. shall be protected against corrosion, to the satisfaction of the Engineer.

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3.35 PROTECTION OF PEOPLE AND PROPERTY

Insofar as compliance with the Subcontract permits, the Subcontractor shall:

a. Take measures necessary to protect people and property;

b. Avoid unnecessary interference with the passage of people and vehicles; and

c. Prevent nuisance and unreasonable noise, vibration and disturbance.

If the Subcontractor damages property, the Subcontractor shall promptly rectify the damage and pay any compensation which the law requires the Subcontractor to pay.

3.36 PROTECTION OF EQUIPMENT

All equipment delivered to the site for the Contract works shall be adequately protected during transport and adequately protected during storage on site and elsewhere. Damaged equipment shall be totally replaced with new items.

3.37 PROTECTION OF WORKS

The Contractor shall be responsible for taking all reasonable steps to avoid other trades or environmental conditions from damaging or disfiguring equipment or materials of this Contract by protecting the works adequately at appropriate stages of the Contract programme. The Contractor shall liaise with the Main Contractor and other trades in this regard.

The Contractor shall adequately protect equipment and incomplete works in areas exposed to the weather.

The Contractor shall arrange site access with the Construction Manager. The Contractor shall comply with all site security provisions set by the Construction Manager.

3.38 WORKMANSHIP

3.38.1 General

Carry out all work in a neat and serviceable manner. Follow best trade practices and comply with any manufacturer's recommendations.

Confirm positioning of all fixtures with the Engineer before installation. Confirm mounting height and location of all fittings before installation.

3.38.2 Finish & cleaning

The completely erected installation shall be handed over in a perfectly clean condition with all rust and dirt removed paintwork in good clean condition with erection scratches and other damage marks made good and bright parts properly cleaned and polished.

Keep the work areas clean and tidy at all times. Remove all rubbish as it accumulates. On completion, remove all debris and waste caused directly or indirectly by the work and leave the installation and surrounding areas completely clean.

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3.39 GUARANTEE

The Hydraulics Contractor shall provide a written guarantee in respect of all materials supplied under the Contract against defects which may occur or be found in workmanship, materials and design for a period of twelve (12) calendar months in service after the date of Practical Completion Certificate as detailed below.

All defects, fair wear and tear excepted, shall be made good free of all costs to the Owner, whether or not the workmanship and materials have been previously inspected and accepted.

3.40 WARRANTY

The complete installation shall be guaranteed free of defects and faulty workmanship for a period of 12 calendar months after the date of issuance of Practical Completion.

Any defects during this 12 month shall be repaired/replaced free of charge inclusive of parts and labour.

Any equipment attended to during this period shall have an extended guarantee period of another 12 months from date of repair.

Where equipment supplier's offer extended warrantees in excess of 12 months, they shall be passed unto the client for their benefit.

3.41 AS-BUILT DRAWINGS

A draft of the As-Built documents shall be provided to the Engineer four weeks prior to Practical Completion for approval. Provision and acceptance of final as-built, commissioning, and maintenance documentation shall be a prerequisite for Practical Completion.

"As Built" drawings, to the approval of the Engineer shall be provided for the Contract Work. These shall be in similar detail to the installation drawings, but shall also include any amendments and any additional detail necessary to show the functioning or installation, or particular items of plant.

The approval of any drawings by the Engineer are in no way absolves the Hydraulics Services Contractor's responsibility for the satisfactory completion of the Contract.

3.42 DEMONSTRATION AND INSTRUCTION TO CLIENT & STAFF

The Hydraulic sub-contractor shall provide all instructions to members of the Client's organisation as necessary for them to recognise defective conditions in the Contract plant. Formal instruction shall be coordinated with the Client via the Main Contractor and shall take place following provision and acceptance of final as-built, commissioning, Operation & Maintenance documentation, and prior to Practical Completion.

The Subcontractor shall also provide such informal instruction as may be required prior to the formal instruction. The Hydraulic Sub-Contractor shall assign a person thoroughly familiar with the Contract plant for the purpose of such instruction for a period of 2 complete days during which period his time shall be completely given over to instruction. Instruction shall be given as follows:

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- Explain the function and operation of all equipment, and indicate where these items are dealt with in the Operating and Maintenance instructions.
- Demonstrate all indicating instruments, gauges and settings of equipment and indicate the current readings of such items.
- Indicate where and how any item of Contract equipment can be disconnected or isolated.

3.43 COMMISSIONING, INSPECTION AND TESTING

Four weeks prior to carrying out any inspections, testing and commissioning, submit details of the test procedures proposed, together with Test/Report Sheet formats for the Engineer's review. These procedures and formats, once acceptable to the Engineer, shall be used as the basis of all Inspections, Testing and Commissioning.

Prior to inspection/commissioning of the Works by the Engineer for the purposes of certifying Practical Completion, provide the Engineer with completed, signed Local Authority Certificate of Compliance, Test/Inspection/Commissioning Reports on the equipment, services, etc., indicating that the Works are now ready for inspection. The contents and results of these Reports must be acceptable to the Engineer, and are an essential prerequisite to the Engineer proceeding with inspection/commissioning of the work for the purposes of the issue of the Certificate of Practical Completion.

The Certificate of Practical Completion does not become due until site testing and commissioning is complete to the satisfaction of the Engineer, and the completed Certificate of Compliance issued to the Engineer.

Arrange for Subcontractors to be in attendance where inspection testing and/or commissioning of the installation involves their equipment and where specifically requested herein.

Repair or replace as instructed by the Engineer, at no charge, any item or features not complying with these Documents.

Allow the Engineer and any relevant local bodies the opportunity of attending and witnessing the tests and commissioning. Include the following in the test procedures as a minimum:

- Check complete installation visually for compliance with the Specification.
- Check all control panels for operation of switches, circuit protection, contactors, controls etc.
- Leak Tests all drainage pipework.
- Pressure Test all water supply pipework.
- Check all labelling.
- Check fixings of all equipment and systems installation to ensure stability under possible seismic conditions.
- Provide approved written test result from the Local Authority having jurisdiction.
- Test and commission all components, items, circuits and systems both independently and in association with the complete installation.
- Allow to employ the manufacturers of any specialist equipment installed to test and commission that equipment.
- After commissioning give at least two weeks' notice in writing to the Engineer that the installation is ready for final demonstration.
- Demonstrate the satisfactory operation of the installation and all component parts to the satisfaction of the Engineer.
- Provide all equipment and apparatus necessary for this demonstration.

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- Carry out any tests the Engineer may require to demonstrate that the installation functions as specified or intended.
- Inspect and test the complete system in accordance with the codes specified in this specification and Local Authority Requirements.

3.44 PRESSURE TESTS

Provide duplicate test certificates for all tests duly signed by the Contractor and Engineer's representative. Repair any defects and repeat the tests until the system is free from faults. All instruments used to measure system and equipment performance are to be certified for the accuracy and are to be calibrated within the three months preceding their use on this contract.

Pipework fittings or plant not rated to withstand the test pressure shall be temporarily removed for the test with temporary pipe inserts used instead.

All tests shall be carried out in the presence of the Engineer or his appointed representative. The Engineer shall be given at least 1 days' notice of when a test will take place. Practical Completion certificates will not be issued until all testing and commissioning is complete.

3.45 FIXTURES AND FITTINGS

All plumbing fixtures shall be operated and checked for correct operation in accordance with the Manufacturer's starting and operating instructions.

3.46 NOISE AND VIBRATION CONTROL

a. The Sub-contractor shall furnish and install all necessary vibration and noise control devices, materials and related items. They are expected to perform work as shown on the drawings and described in the specifications.

b. The Sub-contractor shall co-ordinate with other trades to avoid any rigid contact which would adversely affect the vibration isolation.

c. The Sub-contractor shall bring to the Engineer's attention prior to installation any conflicts with other trades works which will result in unavoidable transmission contact with their equipment due to inadequate provision of space or other unforeseen conditions.

d. Prior to installation, the Sub-contractor shall bring to the Engineer's attention any discrepancies between the specifications and the actual site conditions or changes required due to specific equipment selection. Corrective work necessitated by discrepancies discovered after installation shall be at the Sub-contractor's expense.

e. The Sub-contractor shall correct, at no additional cost, all anti-vibration installations which are deemed defective in workmanship or materials.

f. The Sub-contractor shall be responsible for providing vibration isolators of the appropriate size and capacity to meet the specified deflection requirements and are required to follow the instructions from the manufacturer or vendor of these products.

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g. The Sub-contractor shall submit to the Engineer for approval product data, including manufacturer's specifications and installation instructions.

h. The Sub-contractor shall submit samples of vibration isolators (each type) to the Engineer for approval.

i. All spring type (whether free or restrained type) mounts used outdoors or exposed to weather or wet conditions shall be hot dipped galvanised.

j. All steel springs shall be installed in series with two layers of neoprene ribbed or waffle pattern pads (minimum 8 mm thickness) as described below.

k. The springs shall be selected to support the calculated loads with the minimum spring deflections as specified without being compressed solid, or bridged out, or exceeding the Manufacturer's maximum rated loads under any operating condition. In the selection of the springs the Sub-contractor shall also take into account the weight distribution of the equipment under normal operating conditions, weight of unsupported pipes/ducts and any large dynamic forces due to fluid movement, torque reaction and starting/stopping,. The Sub-contractor shall show, on the shop drawings submitted, the make and model number of the isolators selected and their individual calculated loads.

3.47 OPERATION & MAINTENANCE MANUALS

Provide 3 sets of Operation & Maintenance (O&M) Manuals bound and indexed in Black A4 ring binders labelled with the project name and purpose on the front cover and spine. The manuals shall include the following information:

a. Brief outline description of systems and principal design details.
b. System schematics.
c. Operating instructions for the equipment installed.
d. Schedule of all equipment showing location, maker’s name and details of local agent.
e. Provide spare parts lists, manufacturers' technical information, with detailed wiring diagrams for all composite equipment.
f. A description of recommended maintenance procedures and the desirable frequency thereof, recommended lubricants, and recommendations for locating faults and isolating equipment.
g. Commissioning results, copies of works test certificates.
h. A set of As-built drawings in A3 shall be provided for inclusion in each copy of the Manual.

3.48 MAINTENANCE AND DEFECTS LIABILITY

The Maintenance and Defects Liability Period shall extend for a period of twelve (12) calendar months from the date of Practical Completion. During the maintenance and defects liability period the Contract Plant shall be under the control of the Owner but the Contractor shall be in attendance and shall carry out all maintenance work as maybe required at no cost to the Owner.

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Repair any defect which does not compromise the effectiveness of any system, excluding fair wear and tear within 7 days during the maintenance period specified.

Defects which do comprise the effectiveness of the system shall be repaired within 24 hours. Failure to do so will result in the work being done by others at the Hydraulics Contractors expense.

3.49 PRACTICAL COMPLETION, HANDOVER AND MAINTENANCE

Practical completion and hand over shall be after approval of the commissioning results and issuing of as-built documentation.

3.50 FINAL COMPLETION

Final completion shall be considered achieved when the Maintenance and Defects Liability Period has been satisfactorily completed and all specified requirements have been met to the Engineers satisfaction.

Tender Issue

4 SCOPE AND DESCRIPTION OF WORKS

4.1 SCOPE OF DESCRIPTION OF WORKS

The scope of work includes the supply, installation, commissioning and final certification from the Local Municipal and Health Authorities for complete **Hydraulics Services** Installation for **MFMR Auki – Malaita Province, Solomon Islands.**

All works necessary to provide a fully functional and compliant system as detailed in this specification and drawings shall be carried out. These works shall include any minor works and/or materials not explicitly stated but necessary to implement the services required.

The Hydraulic Sub-Contractor shall make allowance in terms of cost and time for all necessary equipment and materials required to implement this specification whether or not explicitly stated and whether or not permanently installed upon completion. These items shall include but not be limited to hiring of equipment, fastening materials, minor building works such as penetrations for cables and support systems.

Supply all materials, labour cartage, tools, plant and equipment necessary for the completion, testing, commissioning and certification of the sanitary plumbing and drainage systems described in this specification.

Where specific plant, systems, equipment and pipework materials are described in this specification, Contractors shall base their Contract on these specific requirements. Where no specific requirements are described, the Contractor shall install systems, which comply with the standards described in these documents.

4.1.1.1 GENERAL

- Obtain all regulatory approvals, apply for and obtain building consent and pay all local authority fees.
- Issue shop drawings for approval.
- Submit Materials and Equipment Submittals for Approval
- Perform co-ordination between trades. For minor services penetrations less than 100 mm in diameter to provide sealant/enclosure and making good of the same.
- All tools, scaffoldings, platforms, scissors lifts, etc., that are necessary to perform the work.
- Follow the approved Quality Assurance plan.
- Allow for weekly site meetings.
- Provide training to Client staff, as-built drawings and O&M manuals.
- Provide for a 12-month warranty period and maintenance of all installed equipment after project turn-over.

4.1.1.2 DETAILED DESCRIPTION OF WORKS TO BE PERFORMED

The Hydraulics (Plumbing and Sanitary Drainage) subcontract shall include the supply and installation of all pipework's, fittings, plumbing fittings and fixtures as shown on the Hydraulics Civil and Architectural drawings and called up in the Specification.

Tender Issue

Hydraulic works include but not necessarily limited to the following:

- Supply and installation of all domestic cold water pipe work including pipe supports and hangers. Layout are as shown in the drawings and details.
- To provide Solomon water connection application, fees required, authority inspections, excavation/earth filling works and water pipe works necessary.
- Supply and installation of ancillary valves, pipe work, chamber structural walls and floor (refer to structural drawings) or steel/plastic fabricated, aluminium checkered plate or applicable material lids with ironmongeries, padlocks, and other necessary accessories.
- Supply and installation of all pressure gauges, pressure reducing valves, isolation & stop valves, non-return valves, balancing valves, flexible water hoses (if not included with the plumbing fixtures) and other fittings necessary for the completion of the whole domestic cold-water service systems.
- Supply and installation of water taps, water hose bibbs, lockable valves, padlocks, vacuum breaker, and accessories in locations as indicated on the drawings.
- Supply and installation of Domestic Cold Water Storage Tanks, ball float valves, vents, piping and accessories in locations as shown/indicated on the drawings.
- Supply and installation of Rain Water Storage Tanks, ball float valves, vents, piping and accessories in locations as shown/indicated on the drawings.
- Supply and installation of Domestic Cold-Water Booster Pump Set, comes with Pump Controls, Pressure Tanks, Pressure Switches, Water level indicators, vibration isolators, wirings, and accessories.
- Supply and installation of Rain-Water Booster Pump Set, comes with Pump Controls, Pressure Tanks, Pressure Switches, Water level indicators, vibration isolators, wirings, and accessories.
- Supply and installation of (3x) Media Filters and accessories in locations as indicated on the drawings.
- Supply and installation of all sanitary drainage and vent pipe works, comes with supports and hangers. Underground pipework to include trenching and other necessary earthworks. Layout are as shown in the drawings and details.
- Supply and installation of all floor drains, floor wastes, other stainless steel drain gratings, traps, gullies, inspection openings, tundish drains, Studor/AAV vents and other sanitary drain fittings as indicated in the drawings. All floor drains & wastes are each to be provided with traps before connection to the drainage line.
- Supply and Installation of inspection chambers with appropriate class cast-iron lids from the building drains.
- Supply and installation of reinforced concrete septic tanks (refer to the structural drawings for details) with ancillary pipe works in connections and locations as shown in the drawings.
- Supply and installation of soakage pits from septic tank effluent in accordance to NBC and Department of Health standards and requirements.
- Flow and pressure testing and commissioning of all installed pipe work, including sound level measurements in critical areas.
- Disinfection, chemical flushing and chemical treatment of all domestic water pipework systems.
- To provide maintenance and attendance to faults including labour and materials for the defects and liability period.
- Minor penetrations less than 100 mm in diameter and making good of the same.
- To provide all pipe/services penetrations with an acceptable fire sealant and/or fire collars similar to Hilti, 3M-Fire Stopping or approved equal.

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4.2 DRAWINGS SCHEDULE

The following drawings, including all the architectural drawings and site layout drawings forms part of this specification and shall be read in conjunction with this with this specification:

S/N	Dwg No.	Description
1	H0000	Drawing Schedule, Legends & Symbols, General Notes and Abbreviations
2	H0001	Equipment Schedule
		Water Supply Layout
3	H0010	Overall Site Plan – Water Supply Layout
4	H0100	Ground Floor – Water Supply Layout
5	H0200	First Floor – Water Supply Layout
6	H0300	Plant Yard – Enlarged Plan & Schematic Diagram
		Drainage Layout
7	H0020	Overall Site Plan – Drainage Layout And Invert Levels
8	H0110	Ground Floor – Drainage Layout
9	H0210	First Floor – Drainage Layout
10	H0310	Roof Level – Drainage Layout
		Miscellaneous Details
11	H-MISC-A	Miscellaneous Details - A
12	H-MISC-B	Miscellaneous Details - B
13	H-MISC-C	Miscellaneous Details - C

One set of all drawings shall be kept on site by the Hydraulics Services Subcontractor. The attached drawings show the system layouts, general arrangements and requirements. The Hydraulic Sub-Contractor shall carry out the detailed installation as per the design and show all the required details on the shop drawings.

4.3 EXCLUSIONS

The following work shall be performed by others – the Hydraulics shall review, verify and confirm all the requirements by others for the Hydraulics services:-

- Concrete supports structural pedestals or plinths for the Pumps, tanks, etc. by the Builder.
- Exterior wall, Indoor wall, and ceiling penetrations (with sizes Ø100mm or greater) for pipework by the Builder.
- Outdoor wall penetrations and the flashing, counter flashing and waterproofing thereof.
- Access panels shall be by the Builder. Hydraulics contractor to coordinated location of access panel with the Builder & Mechanical. Hydraulics contractor to also include locations of access panels in their shop drawings.

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- Supply and installation of plumbing fixtures.

4.4 EQUIPMENT AND MATERIALS

The equipment used and workmanship employed shall comply with the standards noted in this specification.

4.4.1 Domestic Cold-Water Supply

Provide a cold-water supply system including all valves, fittings and connection to all fixtures as indicated on the drawings. The hydraulic contractor shall allow to connect the cold-water supply to the existing town's water mains – external water main details by Civil Engineer.

All cold and hot water pipework with pipes sizes until Ø25mm, shall be Cross-linked polyethylene PEX pipe type (PEX-B) or approved equal. These pipes shall comply with AS/NZS 2492:2007, AS/NZS 2537:2011 and ANSI/NSF 61.

For pipe sizes Ø32 until Ø100mm, shall be random copolymer Polypropylene (PP-R) complying with EN ISO 15494, DIN 8078 & DIN 8077.

Larger pipes shall be High-Density Polyethylene (HDPE) pipes and associated fittings shall comply with AS-NZS 4130 & 4131.

All these potable water pipes, accessories and fittings shall be tested in accordance with AS-NZS 4020.

Plastic and/or non-metallic pipes shall be rated and be UV-resistant or weather-proof in exposed/outdoor applications. If this cannot be achieved, Code-accepted metal pipes shall be used upon review and approval of the Engineer.

For fire protection systems above-ground and exposed-to-weather installations to fire tanks and fire hose reel water supply shall use standard G.I. pipes and fittings that complies with AS 1074 or NZS/BS 3601.

4.4.4 Automatic Booster Pressure Pump set

a. The constant booster pump sets shall be designed for automatic operation. The booster pumps specification shall include a maintenance contract for 5-years included as part of the tender package.

b. The unit shall be a packaged type, assembled and pre-calibrated at the factory. It shall comprise a lead pump set and a similar capacity lag pump set, two diaphragm pressure vessel at delivery side, pre-wired control panel, pressure gauges, switches, valves, copper suction and delivery header pipework and common base steel frame.

c. The system operation shall be such that the initial small water demand shall be met by the charged diaphragm pressure vessel. If the water demand continues to rise, the system pressure shall drop until to a preset pump "cut-in" point which causes the lead pump to cease operation. However, should the lead pump be unable to maintain the system pressure due to increased water demand, the second pump shall operate. At peak demand, all pumps will operate. Similarly, if the water demand drop, the standby pump shall stop operation first followed by the others sequentially. An adjustable minimum run

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time shall be provided for each pump to prevent any short cycling of the pumps.

d. The closed diaphragm pressure vessel shall be of polyethylene material, fitted with a pressure gauge and isolating valve. The interior shall be of non-toxic lining suitable for potable water. The vessel shall be manufactured to conform to ASME pressure vessel code standards or local requirements.

e. Select pumps when operating at the specified duty, to give an efficiency of 65% lead, 60% lag or better, unless otherwise approved in writing by the Architect. Selection of pumps shall account for water temperatures and conditions, suction lift/head, static head and working pressure. Impellers shall be statistically and dynamically balanced. Pump speed shall not exceed 1500 rpm. Pump shall be directly driven by the motor. The lead pump and the standby pump shall be selected for 110% design flow rate.

4.4.5 CONTROL OF DUTY/STANDBY PUMPS

a. Operation of the duty and standby pumps shall be carried out by the following method:

   i) Automatically by means of pressure sensor (i.e. pressure switches);

   ii) Manually by means of a local start/stop push buttons on pump local motor control panel and emergency stop switch.

b. The pressure switch shall be installed next to the manual release valve. When the pressure drops to the pre-determined level, a signal will be sent to the pump local motor control panel to start the pump.

c. Automatic controls shall be operated by float-type level switches

4.4.6 GENERAL EQUIPMENT DRAINAGE

Drain to waste all equipment, drip trays and pump wells in which water may collect. Provide drains at all low points in the piping system. Drains shall be fabricated from PVC, be provided with unions to facilitate cleaning and be a minimum of 20 mm diameter piping.

4.4.7 SANITARY PIPES

General sanitary waste drainage & vent pipework shall use PVC-U pipes and fittings, DWV class, compliant to AS/NZS 1260, 3879 and with an approved solvent cement.

All plastic pipes to be used in this project shall comply with the statues and requirements AS/NZS 3500.2 for Plumbing and Drainage applications.

a. Polyvinyl chloride (PVC) pipes and fittings shall be manufactured and complies with AS/NZS 1477 and other applicable testing standards.

b. Un-Plasticised Polyvinyl chloride (PVC-U) pipes and fittings shall be manufactured and complies with AS/NZS 1260 and other applicable testing standards.

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For all these abovementioned plastic pipes, solvent cement and priming fluids shall be used as essential joining materials.

c. High-Density Polyethylene (HDPE) pipes and fittings shall be manufactured and complies with AS 2033, AS/NZS 4401, AS/NZS 5065 and other applicable testing standards. Most commonly used HDPE joining method shall be welding with an applicable proprietary welding equipment as per recommended manufacturers' instructions.

Geberit brand or approved equal grease-resistant HDPE pipes & fittings are to be used for commercial kitchen or other grease-laden pipework throughout the project.

4.4.7.1 Sanitary Drain Pipe Gradients

The minimum gradient of the sanitary drain pipes shall be as follows:

Nominal Diameter (mm)	Minimum Grade
40	1:40
65	1:40
80	1:60
100	1:60
150	1:100
225	1:150
300	1:250

4.4.8 FLOOR WASTE AND DRAINS

The toilets and other working area with wash hand basin fixtures areas shall be provided with 80 mm floor waste gullies bases and chrome plated grates and clamp rings.

All floor waste outlets shall be installed so that the top of the outlet is 3 mm below the finished floor lining level.

Final fix of these drains shall depend on the Finished Floor details of the Architect.

4.4.8.1 Floor Drains

All floor drains shall be full-bodied drain head, cast-iron body and grilles. The design and pattern of the grilles shall be coordinated with the Architect.
Kitchen trench drains shall be stainless steel thorough, drain bucket and grilles.

4.4.8.2 Sanitary Traps

All inlets into a discharge pipe of discharge stack shall be properly trapped to prevent the entry of foul air from the drainage system into the building. Traps for soil sanitary appliances and floor traps shall have a water seal of not less than 25 mm.

All traps shall be accessible and so designed as to facilitate cleaning.

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4.4.9 WASTE & SOIL RISER STACKS

Supply and Install waste and soil stack risers as indicated on the drawings to serve all plumbing fixtures. Provide at the base of each offset soil and waste stack 'Y' junction cleaning eye above the floor level.

Provide drain vents to all waste stacks and drainage as required by the relevant codes and local authority.

4.4.10 EXTERNAL PIPEWORK CONNECTION

The Hydraulics Contractor shall allow to connect all drainage pipe work to the existing town's sewer infrastructure as indicated/shown on the drawings. The Hydraulics Contractor shall allow to supply and install all pipework valves and fittings required for the satisfactory connection and operation of the sewerage and drainage system.

4.4.10.1 Ground Access Covers

Covers and frames shall be of the types approved by the local Sewerage Department. They shall be fixed in the positions shown in the Drawings. All frames shall be solidly bedded on cement mortar so that the covers when in position are fair and even with the adjacent surfaces. Heavy-duty cast-iron frames and covers shall be used in every driveway and car park or in area subject to heavy loading. Medium-duty covers shall be used in all other external inspection chambers, sumps, etc.

4.4.10.2 Excavation

a. All excavation shall be carried out as may be necessary for the construction of the works. Excavation for pipe trenches shall not be less than 600 mm wider than the diameter of the pipes and the ground under beds shall be carefully graded. Proper necessary shoring, planking, strutting, or sheet piling strutting shall be constructed and maintained to ensure that the trench will not collapse.

b. When excavating trenches in existing carriageways, the paving blocks that have already been laid or constructed shall be removed by the Contractor and stacked aside and kept separate from the general trench excavated material for re-use in reinstatement. All existing and/or constructed ground surfaces disturbed shall be reinstated.

c. All excess excavation soil shall be removed from the site.

d. All excavation shall be kept free from water at all times by pumping or temporary drainage. In the event of the excavations being made deeper than necessary they shall be filled to the proper level with lean concrete.

e. The Sub-contractor shall be completely responsible for the safety of all excavations, trenches, pits, etc. from collapse and for the safety of any surrounding structures which may become endangered by the works and he shall ensure that all safety measures necessary shall apply to any works during any excavations.

f. The Engineer shall have the right to order excavation and construction work to be carried out in such lengths and in such sections of the works as will, in his opinion, minimise the danger of such open excavations affecting the stability of any nearby structures or ground. There shall be no claim for any extra payment on this account.

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g. Trenches shall be left open for the inspection of the Engineer and the Local Authority's inspector and shall not be covered up until the drains have been properly tested and approved.

h. Where tunnel or deep excavation exceeding 3000mm is required, engage a Civil Engineer registered who has in force a practising certificate to design and supervise this work. The proposed method of construction and details of all temporary work shall be submitted to the Architect and the Relevant Authority for approval and record.

i. The tunnel shall be adequately lit by electricity and no flames or naked lights shall be used.

j. Adequate ventilation and efficient apparatus shall be provided to keep all excavations, trenches, tunnels and headings, etc. free from all gases whether generated in the strata. Precaution shall be taken to ascertain that they are in a safe condition before allowing workmen to proceed.

k. No persons shall enter any confined space (whether above or below ground) unless a responsible person has tested the space using an oxygen testing instrument and has certified that the space is suitable to enter.

4.4.11 THRUST BLOCKS

To provide concrete thrust blocks to all plumbing & drainage piping (100 mm diameter and greater) in the required locations (e.g. tees, blank ends, bends, change in pipe size, etc.). The thrust block concrete shall be poured on natural/ un-disturbed ground only.

4.4.12 SANITARY VENTS

Provide soil, waste, and vent systems from all soil and waste fixtures per AS/NZS 3500. Co-ordinate the location of all penetrations with the contractor. Vent pipes shall be UPVC.

For vent pipe penetrations through the roof, the penetration shall be flashed using AQUASEAL flexible pipe flashings installed in accordance with the manufacturer's recommendations.

Terminate vent stacks 300 mm above finished roof level. A wire balloon shall be fitted to the top of every vent pipe. It shall be coated in PVC, PTFE or other approved non-metallic waterproof coating.

4.4.13 CLEANING EYES & INSPECTION OPENINGS

Provide cleaning eyes in accessible positions as shown on the drawings and in the following locations.

- In the hydraulics riser shaft easily accessible locations on each soil and waste stack.
- Near the base of each soil and waste stack.
- At all pipe junctions.
- At the ends of all horizontal combined waste or soil pipes.

Provide inspection openings in accessible positions as shown on the drawings and in the following locations.

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- At the pipe junctions at ground level in the planter area.

4.4.14 EXPANSION JOINTS

Provide expansion joints of all plumbing & drainage piping in the required locations, and in coordination with the Civil Engineer/ Architect, shall be installed in accordance with all applicable codes and local regulations.

4.4.15 GATE/ ISOLATING VALVES

All gate/isolating valves to comply with AS-NZS 2638 in the cold and hot water pipework system as shown on the drawings.

All valves shall be suitable for the working pressure involved but not less than 1 MPa. Valves up to 50 mm diameter shall have bronze bodies and trim with screwed connections. Valves greater than 50 mm diameter and above shall have cast iron or cast steel bodies, bronze trim with flanged connections. All valves shall be approved by the local authorities.

All underground service valves shall be provided as indicated on the drawing. The valves shall be located in a positioned as near as practicable to the Building. It shall be complete with a valve chamber and cover in accordance to AS/NZS 3996. The depth of the valve shall be such that the valve handle is just below the cover for easy access and operation.

4.4.16 NON-RETURN VALVES

1. For valve size 65 mm diameter and above:

   a. Provide silent check valves of the non-slam, centre-guided globe type. Valves shall be so designed such that closing action is controlled by spring to return disc to seat before zero velocity and before reversal of flow takes place in pipe line. Valves shall be provided with flanges to PN 16 and PN 25 (for valves with working pressure above 16 bars).

   b. Discs shall be free floating, centre-guided and controlled by velocity of flow without aid of grease or counter weight balance.

   c. Valves shall be designed to prevent grinding of seat and disc after assembly, with removable cap for inspection of bearings and disc movement.

   d. Valves shall be flanged (PN 16) cast iron body, 316 stainless steel trim, spring and dics.

   e. Valves for sodium hypochlorite system to be cast iron body, teflon lined seat, shaft and disc or recommended by manufacturer.

2. For valves 50 mm diameter and below:

   a. Swing-type valves to BS 5154 series ‘B’ or equivalent, bronze, with removable hinge pin and screwed cap, suitable for operation in either horizontal or vertical position. Threaded (BS 21) connection for 50 mm and smaller. Flanged (PN 16) connection for valves above

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50 mm. For valves above 16 bar working pressure, it shall be of class 300 cast carbon steel swing check valve with PN 25 flanges.

b. Provide with clean out plugs and generally with offset swing flappers. Provided with removable cap, re-grinding disc and seat ring.

c. For all sanitary/drainage pumping discharge system, only swing type check valve shall be used.

d. Valve of sodium hypochlorite system (swimming pools or similar types) are to be non-corrosive or uPVC materials.

4.4.17 DRAINING

Provide drain valves with hose unions at the low points of all piped services.
Provide permanent drain pipework to nearest drainage point.

4.4.18 AIR VENTING

On pipes which convey water automatic air release valves with 13 mm isolating valves shall be installed at all points where air can trap. Discharges from the automatic valves shall be piped to the nearest drain point.

4.4.19 BINDER PLUGS

Provide binder plugs as supplied by Livingstone Brothers Ltd or approved equal, on the inlet and outlet pipework to all:

- Domestic hot water mixing valves
- Pressure reducing valves

Where testing and commissioning of pipework services requires temperature, or pressure to be measured.

4.5 PIPEWORK INSTALLATION

4.5.1 GENERAL

Only registered plumbers and drain layers shall carry out the installation of the Hydraulic Services.

The Engineer reserves the right to call for a test certificate of all components. These certificates must use the tests listed in the appropriate standard.

All sinks and wash hand basins and cleaners sinks are to be complete with chromed brass waste outlet tail pipe and trap with cleaning eye, and plug and chain. The wastes shall be firmly clamped to the fixture with a locking collar to allow the trap to be removed. All waste outlets shall be positioned low enough to ensure complete drainage of the fixture.

All joints on stainless steel fixtures shall be welded and ground to a smooth finish. Weld discoloration shall be removed.

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4.5.2 PENETRATIONS AND CHASING OF PIPEWORK

The setting out of work and fitting of core and sleeves in floors, beams, columns, and walls will be done by the Main Contractor in conjunction with the fixing of form work and/or placing of concrete.

The Hydraulics Contractor is to advise the Main Contractor and the Engineer the location and size of all required core holes associated with his work before formwork proceeds. All penetrations are to be approved by the Engineer before work commences to avoid weakening of the structure.

The Plumbing Contractor is to advise the Contractor and the Engineer in writing of the location and size of all required chases associated with his work before formwork or layers of masonry proceeds.

Do not encase pipes in masonry or concrete walls and floors except with permission of the Engineer. Joints in pipework are not to be encased. Pipes encased in concrete are to have a minimum concrete cover of 25 mm.

All pipework is to be wrapped in foil or polythene faced "Denso Tape" with a 50% overlap where chased or encased to allow for expansion and contraction. Pipework chased or encased in masonry and concrete are not to cross any building movement joints.

4.5.3 FIRE RATING OF PENETRATIONS

All pipework penetrations through fire-rated walls, floors and partitions shall be fire rated using an approved fire rating system as recommended by the pipework manufacturer and by the relevant standards. The fire rating shall also be in accordance with the municipal authority requirements and the Building Code.

4.5.4 PIPE HANGERS AND SUPPORTS

All pipe supports are to be fabricated to BS 3974. All supports, anchors, hangers and clips are to be purpose made of material compatible with the pipe, resistant to corrosion or protected by an approved process.

Support pipework in such a manner as to permit free movement due to expansion and contraction. Devices for supporting horizontal runs of pipes are to allow for complete vertical adjustment to suit pipe grades. Provide supports at both sides of all valves, bends and take-offs.

Provide hangers or other approved supports at intervals as required by the relevant standards. Hangers for horizontal runs are to be munson rings adjustable type hung on round steel threaded rods in all concealed areas. All copper pipework shall be supported by brass munson rings with galvanised steel threaded hanger rods.

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4.5.5 PIPE SLEEVES

a. Pipe sleeves shall be provided and installed by the Contractor for casting in where pipes penetrate the concrete structure to allow freedom for expansion and contraction and other movement.

b. The minimum clearance between the pipe and pipe sleeve shall not be less than 25 mm (total).

c. Sleeves through fire-rated partitions or walls or floor shall be of galvanised wrought iron pipe. The annular space of pipe sleeves shall be tightly packed with approved fire-rated material.

d. Where sleeves occur in finished spaces, solid close fitted chrome plated steel plates secured by screws shall be provided.

4.5.6 EARTHING OF METAL PIPEWORK AND FITTINGS

Provide Hydraulics earth bonding for all metallic pipework and metal fixtures such as stainless steel sinks, etc. Co-ordinate earthing of pipework and fixtures with the Hydraulics Contractor.

4.5.7 SEISMIC RESTRAINT

Provide Seismic Restraints for all plant, pipework and equipment at all mounting points in accordance with NZS 4219 and NZS 4203.

4.5.8 JOINTING OF PIPEWORK

No mechanical joints except those connecting to plant items will be permitted in permanently enclosed spaces such as walls or floors.

4.5.8.1 Jointing to Copper Piping

1. For copper pipework up to 50 mm diameter connectors to fittings and equipment are to be brass compression fittings to permit ready disconnections. Use "Yorkeway" connectors (NZ Agent: ICI) or similar approved. Do not use compression fittings of the manipulative (CROX) type on pipes above 25 mm diameter.

2. 50 mm diameter and above connections to equipment and valves - connectors are to be flange type made of brass, gunmetal, or bronze, machine brazed to the tube. Bolts are to be non-ferrous and jointing is to comply with BS 5292. Use "Carrington Products Pty Ltd" fittings (NZ Agent: A.C. Gillies & Laird Ltd) or similar approved.

3. All other joints are to be silver brazed using 'Silfos' silver brazing alloy. Use oxyacetylene heating for all low temperature brazing. Soften and expand the pipe with a proper tool to form a slip joint to the following table.

Pipe Size Nominal Diameter Length of Slip Joint

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15 - 20 mm	10 mm
25 - 32 mm	12 mm
40 - 65 mm	16 mm
80 - 100 mm	20 mm

4. Take special care to prevent formation of weld obstruction and lodgement of brazing metal inside the pipe. No projection of branch pipe inside main pipe will be permitted.

4.5.8.2 Cross-linked polyethylene (PEX) pipes jointing

There are several methods and fitting for PEX pipes jointing, all are mechanical jointing. However, solvent cement jointing is not allowed. Pipe changes in directions and/or multiple pipe connections/jointing shall be as follows:

a. Bronze/Polymer expansion fittings with steel/PEX sleeve; the end of the PEX pipe into the joint shall be reinforced by a steel/PEX sleeve over it. The sleeves shall be tighten by a press tool in accordance to manufacturer's recommended installations instructions and as complies with AS/NZS 2537:2011.

b. PEX Crimp Connections: A copper/stainless steel crimp ring shall be placed above the PEX pipe to be inserted into the metal/polymer crimp fitting. The crimp connection shall be made by an appropriate crimp tool in accordance to manufacturer's recommended installations instructions and as complies with AS/NZS 2537:2011.

c. Push-type fittings: This type of fittings shall have interlock mechanism that locks-into-place the inserted/push-fit PEX pipe. These fittings are not recommended to be installed at inaccessible locations and underground.

4.5.8.3 Polypropylene Pipes

An approved and pipe manufacturer recommended fusion machines must be used in jointing of polypropylene pipes. Types of jointing are herein listed below:

a. Socket Fusion
b. Electro-fusion
c. Butt fusion

4.5.8.4 PVC Piping Welded Joints

1. Joints on PVC pipe shall be spigot and socket pattern jointed with solvent welding cement as follows:

   Prior to welding the pipe and fittings must be assembled and checked for position and alignment, both parts being marked with pencil, not scored, to ensure re-assembly in the correct position. The pipe end within the joint should be roughened to provide a key, all swards and dust cleaned off and degreased with cleaning fluid. The inside of the socket should also be degreased. The full depth of the spigot should be coated evenly with a heavy layer of solvent weld cement then pushed firmly into the socket and held completely immovable for a minimum of 30 seconds. The joint should not be subjected to any load for 5 minutes and not used or tested for 24 hours after jointing. No oil or grease should be allowed to foul the joint, it should not be twisted after assembly and it should be assembled immediately the solvent has been applied and before drying commences.

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For pipes 100 mm and larger, the joint shall be retained in a purpose-made jig to prevent movement for the duration of the 5 minute period.

2. PVC Piping to NZS 7648 with 'Z' Joints - Joints on PVC 'Z' jointed systems shall be jointed as follows:

   Ensure both pipe and socket are free from dust and grit, chamfer the outside end of the pipe which is to be inserted into the sockets, check seal ring is seated properly in groove of socket, apply jointing lubricant to spigot chamfer of pipe then insert pipe spigot full depth of socket, finally withdraw pipe 10 mm as an allowance for thermal movement.

3. PVC Piping to NZS 7641 and 7642 Jointed to PVC Piping to NZS 7648 Class 'B' - Joints between these pipes shall be made using a solvent welding method as follows:

   Form a socket in the end of the pressure pipe to enable a solvent welded joint to be made to the spigot of the soil weight pipe. Form the socket by heating the spigot of the pressure pipe with a gas flame being careful not to burn or scorch the pipe. When the end of the pipe becomes soft insert the end of a chamfered piece of pipe to NZS 7642. The formed socket shall be 80 mm minimum depth for 100 mm diameter pipe and 100 mm for greater diameters.

   When the socket has cooled down to ambient temperature a length of pipe to 7642 can be solvent welded into the formed socket.

4.5.8.5 Flanges – General

1. Except for dry risers all pipes 50 NB and over are to be provided with flanges. Screw joints in any form are not to be used on pipes 50 mm NB or larger.
2. Maximum installation pressure - flanges are to be chosen (if not specified elsewhere) to suit the maximum installation pressure in accordance with BS 4504, Parts 1 and 2 1969. They are to be manufactured from a similar material to the pipework and fittings to which they are to be attached.
3. Flange Type - Generally use BS 10 flanges on all services of size to suit the operating conditions.

4.5.8.6 Jointing of Flanges - General

1. Jointing flanges are to be truly paralleled and aligned before bolting.
2. The length of each bolt is to be such that when it is fixed on the joint with nut in position it extends 4 mm beyond the nut.
3. Jointing material - systems containing copper, copper alloys or stainless steel are not to use graphite based jointing compounds and materials.

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4.5.8.7 Flanges - Jointing Materials

1. Gaskets washers and other jointing materials are to be of types recommended by the manufacturer(s) of the pipe(s) being fixed, the service fluid temperature and pressure and in accordance with the Drainage and Plumbing Regulations.

4.5.8.8 Flanges - Jointing Materials

1. Jointing materials used between flanged faces are to be "Walkers Wallico", "Klingerite" or approved equal. Graphite and oil are to be used on all "Klingerite" jointing faces.

4.5.9 BENDS IN PIPEWORK

4.5.9.1 General

1. All elbows and bends are to be long radius. The use short radius bends and elbows requires specific approval from the Engineer.

2. Site pulled bends are not permitted above 40 mm for steel and 50 mm for copper unless specifically approved by the Engineer.

3. Bending radius of PEX pipes; shall not exceed 8 times pipe outer diameter (OD) free bending or 5 times pipe OD for supported bend radius, installed together with an approved bend support.

4. For Copper pipes; use bends and springs, and not elbows. Machine make pipe bends with a minimum radius of 3 times the pipe diameter wherever possible. No appreciable flattening or corrugation of the pipe will be permitted.

5. All other pipe materials shall follow the approved brand/material manufacturer's recommended installation instructions and/or applicable Code requirements.

4.5.10 PIPEWORK REDUCERS AND ENLARGERS

All reductions and enlargements in pipe bore are to be of the eccentric type and are to be proportional to provide an easy transition. Arrange horizontal pipes reductions and enlargements so as to prevent air pockets and permit draining of piping system.

4.5.11 EXPANSION AND CONTRACTION

Pipe expansion and contraction is in general to be taken by pipe bends and changes of direction and the methods of support are to ensure complete free and silent movement when expansion or contraction occurs.

Particular attention is to be paid to anchoring of pipework as a means of controlling the extent and direction of movement in any section of pipework.

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In the erection of both horizontal and vertical runs, due allowance is to be made for pipe movement in relation to the building structure. Ensure that branch pipes passing through holes in the building structure remain clear of the structure and that no pipe or fitting is unduly stressed due to lateral movement.

Accommodate expansion in PVC pipework due to temperature changes without damage to pipelines by following manufacturer's instructions and the relevant Code of Practice for pipework installation. PVC piping to NZS 7641 and 7642 - To PVC piping provide un-plasticised PVC expansion fittings incorporating a rubber-sealing ring. They shall be of the same manufacture as the pipework fittings. The fitting may be in the form of an adaptor with joint for solvent welding to a fitting or coupling with allowance for expansion at both ends.

4.6 IDENTIFICATION OF PLUMBING SERVICES

4.6.1 GENERAL

All pipes, valves, dangerous goods, and items of plant shall be identified by the following methods.

4.6.1.1 Standards

To comply with NZS 5807.

4.6.1.2 Identification of Plumbing Plant Items, Fittings, Controls and Valves –

1. Fit Traffolyte labels engraved with the identification shown on the Plumbing Schematic drawings.
2. Valves labels shall name the system - such as Hot water Flow - and state whether normally open or closed, e.g. HWF - NO.
3. A schedule showing the proposed wording of all labels shall be submitted to the Designer for review before ordering.
4. Engraving shall be of the "Line Grill" type, with black lettering on white background.
5. Sizes of letters shall be 20 mm for major plant items and 5 mm elsewhere.
6. Fixing labels shall be screwed to plant and hung from valve stems or handles.

4.6.1.3 Identification of Pipework

1. ‘De Neefe’ or equal approved adhesive labels shall be used to identify all pipework, in all locations, whether concealed or not.

4.6.1.4 Point of Identification

1. Once at each junction on the through pipe.
2. At each major change of direction.
3. At not more than 6 m intervals.
4. At valves and similar fittings.

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5. At both sides of penetrations through walls or bulkheads. Note the numerous full height walls above ceilings where this labelling will apply.
6. Valves in ceiling spaces shall identify the rooms served as well as the service carried.

4.6.1.5 Specification or Identification

1. Full identification of service. Agree with the Engineer.
2. Arrow indicating direction of flow.
3. Additional identification numbers of pipes where detailed on drawings.

Note that where there are a number of pipes of the same service installed close together a system of identification by subscript shall be used.

Arrows shall be 75mm long for pipes 50mm or less in diameter and 150mm long for other pipes or to approval. Arrows shall be white or black in colour for maximum contrast.

Colours, lettering and arrows - shall be plainly visible at the angle from which the pipes are most likely to be viewed and only one style and method of identification is to be used throughout the installation.

4.6.2 PAINTING AND CORROSION PROTECTION

All plant items and motors are to be painted. Painting shall be carried out in accordance with the relevant standards and the paint manufacturer's recommendations.

All steel bracket and bases outside the building or where noted on the drawings, shall be hot dip galvanised after manufacture. Due allowance for undercutting threads and oversizing bolt hole or slots shall be made prior to galvanising.

4.6.3 CONTACT BETWEEN DISSIMILAR METALS

The Contact between dissimilar metals shall be prevented in locations where wetting occurs by a coating of bituminous emulsion "Flintkote" or equal. Contact between aluminium, copper, and concrete or timber shall be similarly prevented.

4.7 INSPECTIONS, TESTING AND COMMISSIONING

4.7.1 INSPECTIONS

1. Concealed Services

Completed concealed services in walls, ducts, ceiling spaces will be inspected by the Engineer and approval given to the Contractor before building linings are installed. At least two days' notice is to be given for these inspections.

2. Local Authority

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Arrange with the Local Authority for inspection of the work and pay any fees for this service.

4.7.2 TESTING AND COMMISSIONING

1. Carry out the commissioning of all component parts and of the whole installation under the direction of qualified personnel competent in the relevant fields. Issue Testing and Commissioning plant to the Engineer for approval.
2. Schedule all commissioning tests and proving tests for equipment and systems to comply with the programme requirements for the Contract, with due allowance for notice of tests, re-adjustment and re-testing (where necessary). Test scheduling is to be such that all Contract work which could affect the operation of the relevant equipment or system or the testing thereof is to be completed prior to the testing.
3. Provide for the organisation and certification of test result sheets. Submit all relevant Contractor's test results to the Engineer with clear indication of any deviations from the specification.
4. Electric current, water and gases required for operating the systems during testing, adjusting and instruction of the Principal will be supplied by the Main Contractor.
5. Pressure Tests - Maintain tests for a period of not less than four hours without loss of pressure and carry out testing under the supervision of the Engineer or his representative. Provide duplicate test certificates for all tests duly signed by the Main Contractor and Engineer's representative. Repair any defects and repeat the tests until the system is free from faults.
6. All instruments used to measure system and equipment performance are to be certified for the accuracy and are to be calibrated within the three months preceding their use on this contract.
7. Requirements of Local Authorities - Where required the Contractor is to make arrangements and comply with the test requirements of the relevant authorities.
8. Pipework fittings or plant not rated to withstand the test pressure shall be temporarily removed for the test with temporary pipe inserts used instead.
9. Where temporary inserts are used, they are to be replaced by the pipe fitting on completion of a satisfactory test and the whole system then retested at the maximum working pressure. This test may be combined with the thermal expansion test detailed below.
10. All tests shall be carried out in the presence of the Engineer or his appointed representative. The Engineer shall be given at least 1 days' notice of when a test will take place.
11. Completion Certificates - Note that Practical Completion certificates will not be issued until all testing and commissioning is complete.

4.7.3 TESTING – WATER SUPPLY

1. As pipework proceeds and on completion of each section of the work, apply pressure tests as specified.

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2. Test all for pipework other than wastes, drains, vents, and overflows at 1500kPa. The test period shall be not less than 30 minutes during which no leakage is allowed.
3. Disconnect items of plant and equipment liable to damage at the test pressure during testing.

4.7.4 TESTING - SOIL, WASTE & VENT PIPEWORK

4.7.4.1 Sanitary Plumbing Testing

a. All waste, drains, overflows shall be flood tested with water after sealing off the open ends of the system, with the system inspected when full. That section of the piping shall be subjected to a hydrostatic pressure of water height from the spill level of the highest sanitary fixture but not to exceed 3 m head of water.
b. An alternative testing method shall be smoke tested by pumping smoke into the section under test until a pressure of 75 mm water gauge has been obtained. Maintain this pressure for the duration of the visual inspection.
c. Check the operation of each floor waste by flushing one bucket full (minimum 9 litres) on to each outlet.
d. All sanitary fixtures shall be tested. They shall be subjected to normal operating conditions while the seal trap shall be not be less than 25mm.
e. There shall be no water losses from the pipe for at least 15 minutes.

4.7.4.2 Sanitary Drainage Testing

a. A section of the piping to be tested shall be isolated and subjected to a hydrostatic pressure of not less than one (1) meter water height from the highest pipe invert level of the piping section to be tested, but not to exceed 3 m head of water.
b. For Ø100mm vitrified clay pipes, make-up water shall not exceed 1 litre/30 m pipe run for 10 minutes.
c. For Ø150mm vitrified clay pipes, make-up water shall not exceed 1.5 litre/30 m pipe run for 10 minutes.
d. There shall be no water losses from the pipe for at least 15 minutes.

4.7.5 CLEANING AND DISINFECTION

All cleaning and disinfection shall be completed before the handover and use of the water distribution system.

The Contractor shall disinfect the entire length of pressure tested and flushed pipe work.

A quantity of sufficient Chorine solution in correct concentration shall be introduced into the pipeline, a minimum of two (2) hours chemical contact time is required for a 60 mg/liter concentration of Free Available Chlorine (FAC). Relationship of chemical contact time and concentration shall vary as allowed by Code.

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4.8 INSTRUCTION AND TRAINING OF PRINCIPAL'S STAFF

1. On completion of the commissioning of each system of plant, the Contractor shall instruct and train nominated staff in the correct operation and servicing of plant, control systems and alarm systems as well as use of the Operating and Service Instructions. During this instruction and training, the Contractor shall also explain the content of the draft as-built documents.
2. This instruction and training shall be carried out by a competent engineer experienced in the work.
3. The instructions and training shall include all necessary demonstrations and explanations of the correct sequence of operation and function of each piece of equipment under both automatic and manual control and a description of the actions to be taken in the event of a system fault occurring.
4. This service shall be provided during normal working hours, before a Certificate of Completion is issued.

4.9 MAINTENANCE (DEFECTS LIABILITY PERIOD)

4.9.1 GENERAL

Maintain the work for a period terminating 12 months from the date of Practical Completion of the whole of the Contract Works, replacing or repairing any faulty equipment or materials, or the results of incompetent workmanship, free of charge.

4.9.2 SCOPE OF WORKS

a) Routine maintenance and servicing is to be carried out on a monthly basis for a period of 12 months from the date of Practical Completion to the end of the Maintenance and Defects Liability Period without cost to the Owner.

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

c) Maintenance, testing and inspections in accordance with regulatory requirements and relevant New Zealand standards.

d) Rectification of defects at Providers cost.

e) Replacement of consumables at Providers cost.

f) Provision and filling out logbook which must on site detailing all visits.

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

4.10 SCHEDULE OF MAINTENANCE CONTRACT

The contractor shall provide a price to carry out preventative maintenance of all systems installed on the expiry of the Defects & Liability Period. A brief summary of the minimum maintenance scope follows;

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4.10.1 GENERAL

a. The provision of skilled personnel fully conversant with the plant and equipment and competent to attend the same shall be included.
b. Attendance upon the plant and equipment for the purpose of routine cleaning and inspection at specified intervals shall be included.
c. All periodic maintenance services requiring system shutdown shall only be carried out after the normal operating hours and with authorization from the Employer's representative. The frequency of maintenance shall be as per Schedule of Maintenance Works of this Specification.
d. All replacement of parts and components shall be included in the comprehensive Maintenance Contract.

4.10.2 HYDRAULIC SYSTEM MONTHLY CHECKS AND TESTS

a. Check the pumps for unusual noise.
b. Unusual vibration.
c. Unusual temperature.
d. Leaks in pump or piping.
e. Pressure gauge readings.
f. Visual inspection of equipment general condition.
g. Perform a comparative field test (flow, pressures, and power) with calibrated instruments. Restore internal running clearances, if the results are unsatisfactory (install new wear rings).
h. Remove pump handhole covers to inspect the wear ring clearances. When the wear ring clearances have doubled, adjust the ring clearances to original specifications, if so supplied or install new wear rings (sewage pumps).
i. Inspect operation of all valves in system.
j. Motors not fitted with grease nipples are maintenance-free.
k. Motors fitted with grease nipples must be lubricated with a high temperature, lithium-based grease.
l. In the case of seasonal operation where the motor is idle for more than 6 months of the year, we recommend that you grease the motor when you take the pump out of operation.

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5 DOCUMENTATION AND DRAWINGS

5.1 GENERAL

Drawings and documents for approval by the client's representative and the local authority, shall be provided for at the stages as indicated and work shall not proceed with the next stage until the drawings, documents and samples have been approved and the various actions have been taken as required.

5.2 TENDER STAGE

Submit at the time of tender the completed price, rate prices and deviations schedules, draft quality control plan as well as a tender letter with any deviations.

5.3 TENDER AWARD STAGE

Within three weeks of tender award, issue the following documents:-

Issue building consent documentation to the local authority.

Issue 5 sets of paper copies of the shop drawings detailing the extent of the installation.

The shop drawings shall be drawn with AutoCAD ver. 2010 minimum or later versions to a 1:100 scale in general and 1:50 scale for plant and equipment layouts.

The shop drawings shall contain all the technical information, all air flow rates and equipment model numbers shall be shown on the drawings. It is preferable that technical information is shown on drawings rather than in the owner's manuals.

5.4 CONSTRUCTION STAGE

The Q/A plan shall be updated and signed off as and when required.

5.5 HAND OVER STAGE

5.5.1 AS-BUILT DRAWINGS

Issue 3 sets of 1:100 paper copies and a CD with the electronic version of the as built drawings.

The as built drawings shall show the actual commissioned flow rates and equipment details and capacities.

A draft of the As Built documents shall be provided to the Engineer four weeks prior to Practical Completion for approval. Provision and acceptance of final as-built, commissioning, and maintenance documentation shall be a prerequisite for Practical Completion.

`As Built' drawings, to the approval of the Engineer shall be provided for the Contract Work. These shall be in similar detail to the installation drawings, but shall also include any

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amendments and any additional detail necessary to show the functioning or installation, or particular items of plant.

The approval of any drawings by the Engineer in no way affects the Hydraulics Services Subcontractor's responsibility for the satisfactory completion of the Contract.

Acceptance of these drawings shall be required as a pre-requisite for Contract Completion.

All costs incurred for correction or alteration work due to failure of the Contractor to seek approval, or error in late submission of information supplied by the Contractor shall be to the Contractor's account.

5.5.2 MAINTENANCE MANUALS

Provide Operation & Maintenance (O&M) Manuals as specified in General Instructions clause 3.46.

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6 SCHEDULE OF PIPEWORK AND FITTINGS

6.1 SCHEDULE OF PIPEWORKS

Service	Pipe Material	Pipe Joints	Connections to fittings	Test kPa Pressure	Working Temp Water
Domestic Hot Water	PEX-B Pipe type	ditto	ditto	1500	55-70°C
Domestic Cold Water	PEX-B Pipe type	ditto	ditto	1500	5-20°C
Domestic Hot Water	PP-R Pipe type	Fusion weld	Fusion fittings	1500	55-70°C
Domestic Cold Water	PP-R Pipe type	Fusion weld	Fusion fittings	1500	5-20°C
Domestic Cold Water	HDPE Pipe type	Fusion weld	Fusion fittings	1500	5-20°C
Sanitary Vents	uPVC	Solvent cementing	-	Flood tests	N/A
Wastes and soil Horizontal pipework	uPVC generally or as shown on drawings	Solvent Cementing	Screwed union and Collars	Flood tests	N/A
Drains Vertical stack pipes	uPVC generally or as shown on drawings	Solvent Cementing	Screwed union NA	Flood tests Flood tests	N/A
Drain underground pipework	PVC	Rubber ring	N/A	Flood tests	N/A

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6.2 SCHEDULE OF PIPEWORK FITTINGS

Service	Fitting Pressure Rating kPa	Isolating Valves Type and Make	Manual Regulating Valves Type and Make	Check Valves Type and Make	Strainers Type and Make	Drain Valve	Automatic Air Vents	Manual Air Vents	Gauge Cocks	Pressure Reducing Valves
Domestic Cold Water	1000	Multiflow SS Ball, Bronze Body	Stat Bronze	Spring loaded lift type Bronze	Taylors Y-type Fine mesh	Stat Bronze	D.I. body	-	Stat Bronze	C.I. Body/ Non-slam
Domestic Hot Water	1000	Multiflow SS Ball Bronze Body	Stat Bronze	Spring loaded lift type Bronze	Taylors Y-type Fine mesh	Stat Bronze	D.I. body	-	Stat Bronze	C.I. Body/ Non-slam

Note: Domestic hot and cold water isolating valves for individual plumbing fixtures shall be wall stop valves with chromed wall disks and bonnet covers.

All butterfly valves (50mm diameter & above) are to be fully-lugged with cast-iron/steel body, bronze trimmings and with EPDM lining.

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6.3 PERFORMANCE DATA SHEET

PIPING PRESSURE TEST

No: _____

Date of Test:_____

BUILDING _____

SERVICE SYSTEM (Domestic Cold & Hot Water pipe work, Sanitary plumbing/drainage pipe work, etc.)

_____

LOCATION OF PIPEWORK _____

PIPE MATERIAL _____

PIPE STANDARD _____

TEST FLUID _____

TIME START TEST _____

TIME FINISH TEST _____

DESIGN PRESSURE _____

TEST PRESSURE _____

DURATION OF TEST _____

TESTED BY _____

ON BEHALF OF _____

WITNESSED BY _____

REMARKS

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

* Delete as necessary

Tender Issue

7 PRICE SCHEDULES

The Contractor shall complete the pages of the section and forward a completed copy to the client's representative together with their tender letter.

7.1 TENDER PRICE

…… (Contractor's company name)

…… (Street address)

…… (City)

…… (Tel.)

…… (Fax.)

…… (Email)

We, as per above, tender for the installation as per this specification inclusive of the provisional sums above for the total sum of;

$…….. (Excluding Taxes)

and in words

…….....

……..Dollars

Responsible person's first and last names ……

Signature ……

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7.2 RATE PRICES, MARGINS & SUB-CONTRACTORS

The rate prices below are for the purpose of calculating variation to the contract in addition to the work in this specification: The prices shown and the percentages shall include all the margins, P & G's as a selling price to the client and shall also be applicable to all Sub-Contractors.

Hourly charges:-

Installation technician …… $/hour excl. Taxes normal time from 8h00 to 17h00 weekdays

Commissioning …… $/hour excl. Taxes normal time from 8h00 to 17h00 weekdays

Plumber …… $/hour excl. Taxes normal time from 8h00 to 17h00 weekdays

Engineer …… $/hour excl. Taxes normal time from 8h00 to 17h00 weekdays

Overtime …… % additional to normal time.

Travelling charges …… $/per round trip excl. Taxes to site

7.3 MARGINS PERCENTAGE

The margins below are for the purpose of calculating variations to this contract in addition to the work in this specification: The prices shown and the percentages shall include all the margins, P & G's as a selling price to the client and shall also be applicable to sub-contractors.

Margin on bought out equipment and materials …… % on invoice value excl Taxes.

7.4 SUBCONTRACTORS

No work shall be performed by staff other than the Contractor's own staff except as nominated below – written permission shall be obtained from the client's representative prior to using any other sub-contractors than nominated below.

The Contactor shall complete the following table and name either their own company staff or a sub contracted company they intend to use for any work not performed by their own staff:

Sub contractor's company name	Work description
……	……
……	……
……	……

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7.5 DEVIATIONS AND ALTERNATIVES

The Contractor shall complete this page and forward a completed copy to the client's representative together with his/her tender letter.

Tenderers are welcome to offer valid savings with alternative equipment satisfying the same standard to those scheduled, subject to approval by the client's representative.

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8 CONTRACT PRICE BREAKDOWN:

8.1 MFMR AUKI – MALAITA PROVINCE, SOLOMON ISLANDS – HYDRAULICS PRICE SUMMARY

Item No.	Description	Amount ($)
1	Supply and installation of all domestic cold water pipe work including pipe supports and hangers, as shown in the drawings and details.	$
2	To provide Solomon water connection application, fees required, authority inspections, excavation/earth filling works and water pipe works necessary.	$
3	Supply and installation of ancillary valves, pipe work, chamber structural walls and floor (refer to structural drawings) or steel/plastic fabricated, aluminium checkered plate or applicable material lids with ironmongeries, padlocks, and other necessary accessories.	$
4	Supply and installation of all pressure gauges, pressure reducing valves, isolation & stop valves, non-return valves, balancing valves, flexible water hoses (if not included with the plumbing fixtures) and other fittings necessary for the completion of the whole domestic cold-water service systems.	$
5	Supply and installation of hose bibbs, lockable valves, padlocks, vacuum breaker, and accessories in locations as indicated on the drawings.	$
6	Supply and installation of Domestic Cold Water Storage Tanks, ball float valves, vents, piping and accessories in locations as shown/indicated on the drawings.	$
7	Supply and installation of Rain Water Storage Tanks, ball float valves, vents, piping and accessories in locations as shown/indicated on the drawings.	$
8	Supply and installation of Domestic Cold-Water Booster Pump Set, comes with Pump Controls, Pressure Tanks, Pressure Switches, Water level indicators, vibration isolators, wirings, and accessories.	$
9	Supply and installation of Rain-Water Booster Pump Set, comes with Pump Controls, Pressure Tanks, Pressure Switches, Water level indicators, vibration isolators, wirings, and accessories.	$
10	Supply and installation of (3x) Media Filters and accessories in locations as indicated on the drawings.	$
11	Supply and installation of (2x) UV-disinfectant and accessories in locations as indicated on the drawings.	
12	Supply and installation of all sanitary drainage and vent pipe works, supports and hangers as shown on the drawings.	$
13	Supply and installation of all floor drains, floor wastes, stainless steel drain gratings, traps, gullies, inspection openings, tundish drains, Studor/AAV vents and other sanitary drain fittings as indicated in the drawings. All floor drains & wastes are to be provided with a trap on the drainage line.	$

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Item No.	Description	Amount ($)
14	Supply and Installation of inspection chambers with appropriate class cast-iron lids from the building drains.	$
15	Supply and installation of reinforced concrete septic tanks (refer to the structural drawings for details) with ancillary pipe works in connections and locations as shown in the drawings.	$
16	Supply and installation of soakage pits from septic tank effluent in accordance to NBC and Department of Health standards and requirements.	$
17	Flow and pressure testing and commissioning of all installed pipe work, including sound level measurements in critical areas.	$
18	Disinfection, chemical flushing and chemical treatment of all pipework systems.	$
	General	
19	To obtain all regulatory approvals, apply for and obtain building consent and pay all local authority fees.	
20	Provision of all tools, scaffoldings, platforms, scissors lifts, and other preliminaries that are necessary to perform the scope of works.	$
21	Provision of detailed shop drawings, O&M Manuals and As-Built Plans and to implement Client Instructions / Trainings,	$
22	To provide all pipe/services penetrations with an acceptable fire sealant and/or fire collars similar to Hilti, 3M-Fire Stopping or approved equal.	$
23	Any other items not covered in the above-described scope, herein listed below:	$
		$
	Taxes	$
	Total Hydraulics Services Costs	**$**

Total Fixed Lump Sum Price. . . . . $_____

Amount in Words: _____

_____ Dollars

The prices to be set out in this schedule are to provide a breakdown of the tender sum and shall be inclusive of all incidentals in accordance with the specifications. This is a comprehensive supply and installation contract and the tenderer shall take all responsibility for all items required to complete the Contract Works in accordance with the Contract Documents.

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8.2 MAINTENANCE COST FOR HYDRAULICS SERVICES

(i) Maintenance Cost for Hydraulics Services.

Hydraulics Services Maintenance	Per Month ($VEP)	Per Year ($VEP)
1st Year		
2nd Year		
3rd Year		
4th Year		
5th Year		

Note: Proposed maintenance costs are for post-DLP regular checking and maintenance of the whole Hydraulics Services system.

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8.3 SCHEDULE OF UNIT RATES - HYDRAULICS

Item No.	Description	Unit	Unit Cost
1	**PEX-B Water Supply Pipes**		
1.1	Ø 20 mm Pipe	m.	$
1.2	Ø 25 mm Pipe	m.	$
1.3	Ø 32 mm Pipe	m.	$
1.4	Ø 40 mm Pipe	m.	$
1.5	Ø 50 mm Pipe	m.	$
1.6	Ø 80 mm Pipe	m.	$
1.7	Ø 100 mm Pipe	m.	$
2	**PEX-B Pipe fittings (Elbows)**		
2.1	Ø 20 mm	Ea.	$
2.2	Ø 25 mm	Ea.	$
2.3	Ø 32 mm	Ea.	$
2.4	Ø 40 mm	Ea.	$
2.5	Ø 50 mm	Ea.	$
2.6	Ø 80 mm	Ea.	$
2.7	Ø 100 mm	Ea.	$
3	**PEX-B Pipe fittings (Tees)**		
3.1	Ø 20 mm	Ea.	$
3.2	Ø 25 mm	Ea.	$
3.3	Ø 32 mm	Ea.	$
3.4	Ø 40 mm	Ea.	$
3.5	Ø 50 mm	Ea.	$
3.6	Ø 80 mm	Ea.	$
3.7	Ø 100 mm	Ea.	$
4	**uPVC Drainage Pipes**		
4.1	Ø 20 mm Pipe	m.	$
4.2	Ø 25 mm Pipe	m.	$
4.3	Ø 32 mm Pipe	m.	$
4.4	Ø 40 mm Pipe	m.	$
4.5	Ø 50 mm Pipe	m.	$
4.6	Ø 80 mm Pipe	m.	$
4.7	Ø 100 mm Pipe	m.	$
4.8	Ø 150 mm Pipe	m.	$
4.9	Ø 200 mm Pipe	m.	$
5	**uPVC (Elbows)**		
5.1	Ø 20 mm	Ea.	$
5.2	Ø 25 mm	Ea.	$
5.3	Ø 32 mm	Ea.	$
5.4	Ø 40 mm	Ea.	$
5.5	Ø 50 mm	Ea.	$
5.6	Ø 80 mm	Ea.	$
5.7	Ø 100 mm	Ea.	$
5.8	Ø 150 mm	Ea.	$
5.9	Ø 200 mm	Ea.	$

Tender Issue

Item No.	Description	Unit	Unit Cost
6	**uPVC (Whye)**		
6.1	Ø 20 mm	Ea.	$
6.2	Ø 25 mm	Ea.	$
6.3	Ø 32 mm	Ea.	$
6.4	Ø 40 mm	Ea.	$
6.5	Ø 50 mm	Ea.	$
6.6	Ø 80 mm	Ea.	$
6.7	Ø 100 mm	Ea.	$
6.8	Ø 150 mm	Ea.	$
6.9	Ø 200 mm	Ea.	$
7	**Isolation Valves**		
7.1	Ø 15 mm	Ea.	$
7.2	Ø 25 mm	Ea.	$
7.3	Ø 32 mm	Ea.	$
7.4	Ø 40 mm	Ea.	$
7.5	Ø 50 mm	Ea.	$
7.6	Ø 80 mm	Ea.	$
7.7	Ø 100 mm	Ea.	$
7.8	Ø 150 mm	Ea.	$
8	**Check/ Non-Return Valves**		
8.1	Ø 25 mm	Ea.	$
8.2	Ø 32 mm	Ea.	$
8.3	Ø 40 mm	Ea.	$
8.4	Ø 50 mm	Ea.	$
8.5	Ø 80 mm	Ea.	$
8.6	Ø 100 mm	Ea.	$
8.7	Ø 150 mm	Ea.	$
9	**Water Pressure Reducing Valves**		
9.1	Ø 50 mm	Ea.	$
9.2	Ø 65 mm	Ea.	$
9.3	Ø 80 mm	Ea.	$
9.4	Ø 100 mm	Ea.	$
9.5	Ø 150 mm	Ea.	$
10	**Galvanised Iron Pipe**		
10.1	Ø 25 mm	m.	$
10.2	Ø 32 mm	m.	$
10.3	Ø 40 mm	m.	$
10.4	Ø 50 mm	m.	$
10.5	Ø 80 mm	m.	$
10.6	Ø 100 mm	m.	$
10.7	Ø 150 mm	m.	$
11	**Galvanised Iron Pipe fittings (Elbows)**		
11.1	Ø 25 mm	Ea.	$

Tender Issue

Item No.	Description	Unit	Unit Cost
11.2	Ø 32 mm	Ea.	$
11.3	Ø 40 mm	Ea.	$
11.4	Ø 50 mm	Ea.	$
11.5	Ø 80 mm	Ea.	$
11.6	Ø 100 mm	Ea.	$
11.7	Ø 150 mm	Ea.	$
12	**Galvanised Iron Pipe fittings (Tees)**		
12.1	Ø 25 mm	Ea.	$
12.2	Ø 32 mm	Ea.	$
12.3	Ø 40 mm	Ea.	$
12.4	Ø 50 mm	Ea.	$
12.5	Ø 80 mm	Ea.	$
12.6	Ø 100 mm	Ea.	$
12.7	Ø 150 mm	Ea.	$
13	**HDPE Pipes**		
13.1	Ø 40 mm	m.	$
13.2	Ø 50 mm	m.	$
13.3	Ø 80 mm	m.	$
13.4	Ø 100 mm	m.	$
13.5	Ø 150 mm	m.	$
14	**HDPE Pipe fittings (Elbows)**		
14.1	Ø 40 mm	Ea.	$
14.2	Ø 50 mm	Ea.	$
14.3	Ø 80 mm	Ea.	$
14.4	Ø 100 mm	Ea.	$
14.5	Ø 150 mm	Ea.	$
15	**HDPE Pipe fittings (Tees)**		
15.1	Ø 40 mm	Ea.	$
15.2	Ø 50 mm	Ea.	$
15.3	Ø 80 mm	Ea.	$
15.4	Ø 100 mm	Ea.	$
15.5	Ø 150 mm	Ea.	$
16	**Pipe Hangers and Supports**		
16.1	3/8” threaded rods, galvanized	m.	$
16.2	1/2” threaded rods, galvanized	m.	$
16.3	5/8” threaded rods, galvanized	m.	$
16.4	3/4” threaded rods, galvanized	m.	$
16.5	25mm x 25mm x 4mm thick angle bars, galvanized	m.	$
16.6	40mmx 4mm thick flat bars, galvanized	m.	$
16.7	Munson clamps	Ea.	$
17	**Floor Traps**		

Tender Issue

Item No.	Description	Unit	Unit Cost
17.1	100 x 100	Ea.	$
17.2	100 x 75	Ea.	$
17.3	75 x 75	Ea.	$
18	**Floor Gully Traps**		
18.1	100 x 100	Ea.	$
18.2	100 x 75	Ea.	$
18.3	75 x 75	Ea.	$
19	**P.E. Grease Traps/Interceptors**		
19.1	500L	Ea.	$
19.2	1000L	Ea.	$
19.3	2000L	Ea.	$
20	**Water Hammer Arrester**		
20.1	Ø 20 mm	Ea.	$
20.2	Ø 32 mm	Ea.	$
20.3	Ø 40 mm	Ea.	$
20.4	Ø 50 mm	Ea.	$
20.5	Ø 65 mm	Ea.	$
21	**Air Admittance Valve**		
21.1	Ø 50 mm	Ea.	$
21.2	Ø 65 mm	Ea.	$
22	**Vibration Isolators**		
22.1	10.5 mm thick Pad, 50mm x 50mm, Neoprene	Ea.	$
22.2	Spring type, hanging and floor mounting, 25mm deflection	Ea.	$
24	**Miscellaneous Sanitary Fittings**		
24.1	Inspection Chamber assembly with Class D – Heavy Duty Cast Iron Lid/Cover	Ea.	$
24.2	Inspection Chamber assembly with Class C – Light Duty Cast Iron Lid/Cover	Ea.	$
24.3	Inspection openings Ø 80 mm	Ea.	$
24.4	Inspection openings Ø 100 mm	Ea.	$
24.5	Inspection openings Ø 150 mm	Ea.	$
24.6	Inspection openings Ø 200 mm	Ea.	$

Tender Issue