THE UNIVERSITY OF AUCKLAND
Te Whare Wānanga o Tāmaki Makaurau
NEW ZEALAND

Property Services Design Standards and Guidelines

Section 6
Hydraulics

Version 1.0

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Feedback

If you spot an error in this document, or you have a suggestion on how we can improve the document, please tell us about it by printing, completing and emailing the form in Appendix A to us at PSTechServices@auckland.ac.nz.

6 Hydraulics

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6.1 Introduction

Introduction

This section shall be specifically read in conjunction with *Section 1 About this Document* and *Section 2 Project and Building Works Requirements* of the University of Auckland Property Services Design Standards and Guidelines.

6.1.1 Purpose

The purpose of this section is to outline the design considerations which need to be taken into account during the hydraulic services design of all major capital, minor capital and maintenance project building works.

The guidelines outlined within this section are not project specific. It is the responsibility of the hydraulic services Consultant or Designer to develop a design specific to the project design brief and objectives, as well as satisfying site specific end user requirements.

Where departures from these hydraulic services guidelines are necessary or recommended, these shall be highlighted to Facilities Management (FM). Failure to do so may result in rectification at no extra expense to the University.

This section does not cover:

- Civil drainage systems
- Roofing systems including guttering
- Hydraulic services within laboratories – refer to *Section 12 Chemical and Biological Laboratories* of the Design Standards and Guidelines.

6.1.2 Regulations, codes and standards

Any design requirements outlined within this section, which are in any way related to any statutory requirements and/or regulations, shall be taken as design requirements 'over and above' the specified and required statutory requirement and/or regulation.

The hydraulic services design must fully comply with the requirements of the latest revision of all applicable statutory requirements and regulations, including but not limited to:

- NZ Building Code and applicable NZ and AS/NZS Standards
- NZ Building Act
- Health and Safety in Employment Act
- Dangerous Goods Regulations
- Electricity Act
- Electricity Regulations
- Electricity Codes of Practice
- Territorial Authority Requirements.

6.1.3 Applicable standards

This table lists the standards that are applicable to hydraulics.

Note: The list is not exhaustive and if superseded by other standard(s), the latest version and/or amendment applies.

Table 1: Hydraulics Standards

Standard	No	Title
AS	1432	Copper tubes for plumbing, gas fitting and drainage applications
AS	2129	Flanges for pipes, valves and fittings.
AS	4072:1	Components for the protection of openings in fire resistant separating elements.
AS/NZS	1260	PVC-U pipes and fittings for drain, waste and vent application
AS/NZS	2032	Installation of PVC pipe systems
AS/NZS	2107	Acoustics – Recommended design sound levels and reverberation times for building interiors
AS/NZS	3500	Plumbing and drainage Glossary of terms
AS/NZS	5601.1	Gas installations – Part 1: General installations
NZS	3501	Specification for copper tubes for water, gas and sanitation
NZS	4219	Seismic performance of engineering systems in buildings.
NZS	7643	Code of practice for the installation of unplasticized PVC pipe systems
NZS	7652	Specification for plastics waste traps

This table lists the standards that are applicable to irrigation systems.

Table 2: Irrigation Standards

Standard	No	Title
NZS/AS	1254	uPVC Pipes and Fittings for Stormwater and Surface Water Applications
NZS/AS	2053	(All Parts) Conduits and fittings for electrical installations
NZS/AS	2638.2	Gate valves for waterworks purposes - Resilient-seated
NZS/AS	2845.1	Water supply - Backflow prevention devices - materials, design and performance requirements
NZS/AS	4129	Fittings for polyethylene (PE) pipes for pressure applications
NZS	4404	Land Development and Subdivision Engineering
NZS	5103	Code of practice for the design, installation and operation of sprinkler irrigation systems
NZS	7601	Specification for polyethylene pipe (Type 3) for cold water services
NZS	7602	Specification for polyethylene pipe (Type 5) for cold water services

6.1.4 Design documentation

As well as design documentation as outlined within *Section 2 Project and Building Works Requirements* of the Design Standards and Guidelines, the Consultant may be requested to make available to FM the following design information for their review:

- Details of consented systems, especially those such as:
  - Systems requiring individual consent
  - 'Special systems'
- Domestic hot water (DHW) load calculations
- Loading and sizing calculations applicable to natural gas (gas) installations
- Loading and sizing calculations applicable to cold water (CW) reticulation
- Schedules of fixtures and fittings
- Utilities connection capacities.

6.1.5 Environmentally sustainable design

The conservation and responsibility for the use of the University's available resources must be considered in the design of hydraulic services solutions.

It is a requirement that efficient and effective measures to reduce consumption of resources associated with heating and recirculating water is included in the design.

Where necessitated by site location, rainwater collection systems may be considered. However, for metropolitan campuses, rainwater systems are generally not endorsed by FM.

Direct solar heating and heat pump systems may be considered on a case-by-case basis where whole of life cycle cost is of benefit to the building application.

Grey water collection systems are not to be considered.

6.2 Abbreviations and Definitions

Hydraulics abbreviations

Table 3: Hydraulics abbreviations

Abbreviation	Description	Maximo database requirement
AAV	Air admittance valve	No
BFP	Backflow preventer	Yes
BWU	Boiling water unit	Yes
DCW	Domestic cold water (potable cold water)	n/a
DHW	Domestic hot water	n/a
EXPANV	Expansion vessel or pressurization unit	Yes
HOSE	Fire hose reel	Yes
FWG	Floor waste gully	No
TRAPG	Grease trap	Yes
HC	Hose cock	No
HWf	Hot water flow	n/a
HWr	Hot water return	n/a
HWC	Hot water cylinder (electric)	Yes
IV	Isolation valve	No
IRV	Isolating regulation valve (balancing valve)	No
MCV	Motorised control valve	No
MH	Manhole	No
MCC	Motor control centre	Yes
MSSB	Mechanical services switchboard	
NPCW	Non-potable cold water	n/a
NPHW	Non-potable hot water	n/a
NRV	Non-return valve	No
ORG	Overflow relief gully	No
PE	Polyethylene	n/a
PEX	Cross linked polyethylene	n/a
PPR	Polypropylene	n/a
PRV	Pressure reducing valve	Yes
PSV	Pressure safety valve	Yes
PUMP	Pump	Yes
SS	Sanitary sewer drainage	n/a
SW	Stormwater drainage	n/a
STERIL	UV steriliser	Yes
TCV	Thermostatic control valve	No
TMV	Thermostatic mixing valve	Yes
WELS	NZ Water Efficiency Labelling Scheme	n/a
WTST	Water storage tank	Yes

Abbreviation	Description	Maximo database requirement
VSD	Variable speed drive	Yes

6.3 System Information

6.3.1 Infrastructure overview

Site services reticulation drawings are available from FM and can be provided upon request. As site reticulation is forever changing, these drawings have not been enclosed within this document.

The following is an overview of hydraulic services utilities serving the University:

Table 4: Hydraulic services utilities

Utility	Description
Natural Gas	• All internal networks are private. • External supplies are provided to City, Grafton, Newmarket, Tamaki and Epsom campuses at 400kPa by the Vector network.
Water	• All internal networks are private. • External supplies are provided by Watercare.
Wastewater	• External network connections are to Watercare network.
Stormwater	• External network connections are to Watercare network.

6.4 Design Conditions and Parameters

Introduction

The University of Auckland strives towards being a leading edge facility in New Zealand. With an awareness of ever evolving technology and engineering practice within the industry, the University has no set guidelines as to which types of system or equipment should be used for certain applications, types of building or space.

The following guidelines are an outline of some common elements associated with hydraulic systems.

The guidelines within this section do not in any way relieve the consultant or designer from obtaining and following a project specific design brief. The consultant or designer shall raise with FM any project specific requirements which may be in conflict with these guidelines.

Proposed system types shall be approved by FM at Preliminary Design stage.

Joints / changes in direction shall be kept to a minimum.

When designing services, allowance shall be made for oversizing of pipework to reduce operation costs associated with pumping.

Careful consideration towards project specific design conditions and parameters must be taken into account by the Design Team in consultation with end users and FM.

6.4.1 Hot and cold water service

- Domestic hot and cold water peak demand patterns shall be derived specific to the project situation. The designer must consult with end user representatives, the Project Manager and FM when formulating a peak demand load profile. FM shall be given opportunity to review design peak demand profiles. Similarly, the Consultant shall review actual demand profiles from other existing University buildings of a similar nature (based on metering logs) available from the University's Energy Manager.
- Calculation of system flowrates shall be in accordance with AS/NZS 3500.1. For larger installations comprising of 60 loading units or greater, a recognised design standard must be used, e.g. *Selection and Sizing of Copper Tubes for Water Piping System; The Institute of Plumbing Australia Inc. by Barrie Smith*
- Hot water shall be stored at temperatures meeting the performance requirements of NZ Building Code Clause G12/AS1.
- Delivery of hot water supplied to individual fixtures shall meet the performance requirements of NZ Building Code G12/AS1.
- Hot water peak hour demand calculations can include the following design assumptions:
  - The hot water storage is full at the start of the peak period
  - Recovery starts at the beginning of the peak period and continues through to the end of the period
- At the end of the peak period, water must still be available at the building tempered conditions.
- Hot water dead leg lengths shall be avoided where practicable. Large hot water reticulation system shall be installed with return pumps.
- Delivery of potable water to individual fixtures shall meet the performance requirements of NZ Building Code G12/AS1.

- System delivery water pressure within a building shall generally not exceed 500kPa or where otherwise the required working pressure rating of any fixture or appliance installed in the building.
- Buildings or groups of connected buildings which are heavily used, of a critical business risk to the University, and/or contain operations which are of a critical nature, shall include cold water storage provisions to ensure continual water service.
- Pipe sizing water velocities shall not exceed:

Table 5: Pipe sizing water velocities

Location in building	Metallic pipe	Non-metallic pipe
Internal	3 m/s max	1.5m/s max
External	3 m/s max	3 m/s max

6.4.2 Sanitary drainage

Sanitary drainage pipework shall be designed to meet the performance requirements of NZ Building Code Clause G13.

6.4.3 Stormwater drainage

- Stormwater drainage pipework shall be designed to meet the performance requirements of NZ Building Code Clause E1.
- Stormwater internal gutters shall be avoided. Where they must be provided as part of the design solution, internal gutters shall be:
  - Minimum 450mm wide
  - Fully supported the entire length of the gutter
  - Capable of withstanding human traffic
  - Sized for 1:100 year storm with 100% overflow.
- External gutters shall be sized for 1:10 year storm.

6.5 Identification and Labelling

Introduction

Plant and equipment shall be identified in accordance with the requirements of the latest revision of appropriate Standards wherever applicable.

The guidelines mentioned in this section are to assist consultants and designers with understanding the University's standard requirements which can be considered over and above requirements of applicable Standards.

6.5.1 Plant and equipment

All plant and equipment shall be clearly identified with traffolyte labelling indicating the plant Maximo identification number.

All utilities and check meters shall be labelled to the University assigned meter number.

Traffolyte labels shall be securely fixed to plant via appropriate adhesives, or where this fixing method is not suitable, use stainless steel beaded chain or braided wire.

Refer to *Section 2 Project and Building Works Requirements* of the University's PS Design Standards and Guidelines for Maximo numbering requirements.

6.5.2 Pipework

All pipework, whether in plantrooms, in ceiling spaces or exposed, shall be clearly identified with self-adhesive labelling. Pipework identification labels shall:

- Have white lettering on relevant colour coded background
- Indicate the water or drainage service
- Indicate the flow direction with arrows as appropriate.

Identification labels shall be at intervals of not more than 3m of straight length, and adjacent to every change in direction, branch connection, valve, wall and floor penetrations, and points of isolation and control, etc.

6.5.3 Underground pipework

Underground pipework must be accurately surveyed and then dimensioned on As-Built drawings. Surveying of the hydraulic services shall be at the contractor's own expense as part of the project requirements for As-Built documentation.

All water reticulation and gas underground pipework shall have continuous warning identification tape and tracer wire installed above the pipework with a minimum clearance of 300mm above the buried service.

All underground pipework shall be made identifiable by its service.

6.5.4 Switchboards and control panels

All hydraulic services switchboards and control panels shall be externally and internally labelled.

Internal components and controllers shall be labelled using self-adhesive labels, not pen markings. The labels must be suitable for the environment where they will be mounted (e.g. externally).

Copies of wiring and panel diagrams shall be left within permanently secured sleeves on the inside of the control panel door.

6.5.5 Valves

Valve tagging shall be project specific.

As a minimum, valves must be tagged whenever they have a functional requirement, and/or are of a critical or important nature. Such valves include but are not limited to these examples:

- Valves which are required to be left 'Normally Closed'
- Valves which serve other zones or buildings, and valves which serve groups of fixtures, i.e. where isolating a valve will have a consequence which is not apparent at the valve location
- Valves which require a specific maintenance activity
- Valves which are provided for an intended future connection
- Valves which have a specific function which may not be clear on site

Refer to *Section 4 Mechanical Services* of the University's PS Design Standards and Guidelines for a University valve tag template example.

Tagged valves must be scheduled within the O&M Manuals with the valve tag reference number, location, and specific function listed. The valve tag reference number must also be indicated on As-Built schematic drawings.

Backflow preventers, together with the following valves require Maximo identification:

- Thermo-blending valves
- Hydraulic flap valves
- Tempering valves
- Pressure reducing valves
- Safety relief valves
- Gas safety valves.
- Gas solenoid valves.

All other valve types are **not** required to be Maximo asset registered.

6.5.6 Non-potable water supply pipework and fixtures

Where a non-potable water supply is reticulated within a space, the potable and non-potable pipework shall be clearly differentiated in accordance with the requirements of AS/NZS 3500

Non potable water fixtures shall be separately colour coded and identifiable from potable water fixtures, together with the installation of safety signage in accordance with NZ Building Code G12/AS1.

Safety signage shall be appropriately installed within the space to clearly warn occupants that the non-potable water supply is not for human consumption.

6.6 Testing and Commissioning

6.6.1 General

This section must be read in conjunction with *Section 2 Project and Building Works Requirements* of the University's PS Design Standards and Guidelines.

6.6.2 Underground and concealed pipework

All underground pipework and pipework within concealed spaces such as wall cavities, risers and ceiling spaces, shall not be covered / concealed from view without testing and without having been inspected and approved by the Consultant, FM, or territorial authority as appropriate.

6.6.3 Sanitary plumbing systems

All water services pipework shall be tested and commissioned in accordance with the requirements of AS/NZS 3500.1. This shall specifically include, but not be limited to:

- Hydrostatic pressure testing to 1500kPa for a period not less than 30 minutes. Ensure systems to be pressure tested are appropriately isolated from mains and fixtures as required.
- All new potable water system installations shall be cleaned and disinfected in accordance with the requirements of Appendices I and H of AS/NZS 3500.1. On system alterations of a sizeable nature and as specified by the system designer, this requirement shall also be made. On new system installations, water quality specialists shall be engaged at the expense of the project to verify pipework decontamination.
- Correct performance of all valves, cisterns, taps, pressure relief valves etc. shall be verified as meeting their correct performance.

All DHW system fixtures shall have water temperatures verified for compliance with NZ Building Code Clause G12/AS1.

On new DHW system installations, peak demand shall be simulated to measure and verify system recovery, and heating plant operation at maximum output/capacity.

6.6.4 Drainage systems

Complete sanitary and stormwater drainage systems shall be water tested to peak overflow conditions to confirm sufficient drainage, fall, water tightness and general performance of all fixtures, floor wastes, downpipes, horizontal pipework, gutters and the like.

Overflow drainage flows from all non-floor waste areas shall be tested.

Where siphonic drainage system is installed, contractors must follow the recommendations of manufacturers and designers.

6.6.5 Natural Gas reticulation systems

All gas pipework shall be completely purged prior to testing and commissioning.

Testing and commissioning of any gas work, shall be in accordance with the requirements and procedures of AS/NZS 5601.1 Appendix E.

All laboratory gasses shall be tested and commissioned according to HTM2022. For further information refer to *Section 12 Chemical and Biological Laboratories*.

Testing and commissioning of all gas appliances shall be conducted by the manufacturer's local agent or representative in accordance with the manufacturer's requirements.

All testing of safeties and safety interfaces associated with gas solenoid valves must be witnessed by the Consultant and/or FM.

6.6.6 Irrigation Systems

Following the installation of drippers cut into lateral lines, the end caps shall be removed, and the pipe system flushed. The end caps shall then be replaced.

All mainline pipes shall be tested in accordance with Appendix B of NZS 4404:2004 appropriate for the pipe materials installed where the test pressure shall be 1.5 times the working pressure of the system at each point in the system.

Pressure test shall be observed and approved by the engineer prior to backfilling.

Commission the system by setting the irrigation as recommended in the operation design.

Test all aspects of the system and run through all likely operation scenarios including during rainfall events.

All as-builts, operational manuals and keys for the system shall be supplied to the engineer at the commissioning of the system.

6.7 Installer Requirements

6.7.1 General

Proprietary pipework systems shall only be installed by trained and experienced installers, and in strict accordance with the manufacturer's recommendations.

6.7.2 Registered plumbers and gasfitters

Only hydraulic services contractors currently certified with the Plumbers, Gasfitters and Drainlayers Board, and who are also members of the NZ Master Plumbers Association shall carry out University work.

All work shall be carried out by competent and experienced tradespeople in strict accordance with the NZ Building Code, to the satisfaction of the territorial authority, and to the requirements of this document.

Refer to *2.10 Practical Completion in Section 2 Project and Building Works Requirements* of the University's PS Design Standards and Guidelines for information on the minimum expected requirements associated with the practical completion of the hydraulic services installation.

6.7.3 Utilities connections and connections into existing systems

Refer to Sections *3 Utilities Connections and Energy Management and 2 Project and Building Works Requirements* of the University's PS Design Standards and Guidelines for details on:

- Making applications for new utilities connections
- Procedures for making new connections into existing University systems
- Procedures for performing isolations when undertaking new connections
- Metering requirements.

No new utilities or other connections can be made without the contractor having followed the guidelines and procedures as described within the above sections. Failure to follow these guidelines will result in the contractor remedying their work at their own cost.

6.7.4 Concealment of services

All water reticulation pipework within service ducts, wall cavities, ceiling spaces and other concealed spaces, shall be pressure tested prior to concealment.

Prior to concealment, the contractor shall obtain 'approval' from the Consultant or an FM representative. 48 hours' notice shall be given by the Contractor to enable an inspection opportunity by the Consultant or FM.

Generally, no water reticulation pipework shall be cast within concrete slabs. Service trenches with accessible lids shall be provided in this case.

6.8 Pipework Materials

6.8.1 General

Unless otherwise specified, pipes shall be manufactured of the following accepted materials, and to these standards:

Note to designers:

- If higher velocities are adopted, consider adopting Stainless Steel pipework as an option
- Dissimilar materials shall not be used
- PPR and Polyethylene pipework will no longer be accepted for open or closed water systems.

Table 6: Hydraulic pipework materials and standards

Private Service	Material and Standard	Jointing and other remarks
DCW supply (above ground)	Copper tube (NZS 3501)	• Silver brazing or mechanical jointing. • Mechanical jointing only for pipe sizes dia.25mm and below. • Approved systems shall be proprietary systems distributed by Ke Kellit (xpress) or Kempress.
	Stainless steel	• Welded EN 10312 (2005-12). • Press Fittings (EN10312) for pipes below 50mmØ.
DCW supply (below ground)	Polyethylene (PE)	• Fusion welded or mechanical coupled to manufacturers requirements.
DHW supply (above ground)	Copper tube (NZS 3501)	• Silver brazing or mechanical jointing. • Mechanical jointing only for pipe sizes dia.25mm and below. • Approved systems shall be proprietary systems distributed by Ke Kellit (xpress) or Kempress.
	Stainless steel	• Welded EN 10312 (2005-12). • Press Fittings (EN10312) for pipework smaller than 50mm Ø.
Sanitary drainage (above ground)	u-PVC (AS/NZS 1260, NZS 7643)	• Solvent jointed. • Includes urinal wastes. • Not to be used for wastewater temperatures exceeding 60°C.
	Copper tube (NZS 3501)	• Silver brazing. • Not to be used for urinal wastes.
	HDPE (high density polyethylene) SDR26 & SDR17	• Fusion welded or mechanical coupled to manufacturers requirements. • For high temperature wastewater.
Sanitary drainage (below ground)	u-PVC (AS/NZS 1260, NZS 7643)	• Rubber ring jointed. • Not to be used for wastewater temperatures exceeding 60°C.
	HDPE (high density polyethylene) SDR26 & SDR17	• Fusion welded or mechanical coupled to manufacturers requirements. • For high temperature wastewater.
Vent piping	u-PVC (AS/NZS 1260, NZS 7643)	• Solvent joined

Private Service	Material and Standard	Jointing and other remarks
Stormwater drainage (above ground)	u-PVC (AS/NZS 1260, NZS 7643)	• Solvent jointed. • Includes urinal wastes. • Not to be used for wastewater temperatures exceeding 60°C.
	Copper tube (NZS 3501)	• Silver brazing. • Not to be used for urinal wastes.
	HDPE (high density polyethylene) SDR26 & SDR17	• Fusion welded or mechanical coupled to manufacturer requirements. • For high temperature waste water.
Overflow relief drains from HWCs	Copper tube (NZS 3501)	• Silver brazing or mechanical jointing.
Condensate drainage (cold)	u-PVC (AS/NZS 1260, NZS 7643)	• Solvent joined.
Gas (above ground)	Copper tube (AS/NZS 5601.1, AS 1432)	• Silver brazing or mechanical flared compression jointing.
Gas (below ground)	Polyethylene (PE) Cross linked polyethylene (PEX)	• Fusion welded or mechanical coupled to manufacturers requirements.

6.8.2 General pipework materials

Guidelines:

- 'Crox' mechanical joints shall be limited to dia.15mm only.
- Installation of dissimilar pipework materials will not be accepted. Careful consideration must be given to installation of new pipework materials which will connect into existing systems. Consult with FM as appropriate.
- All pipework which passes through the building structure shall be protected by installation of PVC tubular sleeves, with the exception of uPVC drains cast in concrete.
- All pipework which passes through fire rated walls shall have the annulus appropriately sealed in accordance with fire specialist's details and be approved by engineer.
- Copper pipework must not come into direct contact with concrete.
- All pipework fittings shall generally be factory formed with the exception of copper welded branch connections.

6.9 Sanitary Plumbing Water Supplies

6.9.1 Codes and Standards

Design of sanitary plumbing water supplies must be in accordance with the requirements of the NZ Building Code Clause G12.

All sanitary plumbing installations and materials must be in accordance with the NZ Building Code, relevant standards and local regulatory requirements.

6.9.2 Backflow prevention

Zone backflow preventers shall be installed within purpose built enclosures or plantrooms in locations which permit easy access and at height which does not require ladder access.

Individual fixture backflow preventers shall be installed in readily accessible locations local to the fixture such as under benches.

Backflow preventers shall be of type relevant to the hazard level as stated within table 1 of the NZ Building Code G12/AS1.

All testable backflow preventers shall have line strainers immediately upstream of the unit, together with appropriate isolation valves either side of the unit to enable unit isolation and removal.

Backflow protection from fume cupboards is documented in *Section 12 Chemical and Biological Laboratories*.

For refurbishments, maintenance projects and/or minor capital works within existing buildings where the existing sanitary plumbing system is to be altered or modified, the designer shall consult with FM to check existing backflow prevention exists. This is to ensure the prevention of contaminants entering the water reticulation system on the newly installed or modified system.

It shall be the full responsibility of the designer to ensure backflow prevention requirements associated with any new fixtures or arrangements within the new installation are included.

All non-potable systems and fire protection water supplies shall have their own dedicated backflow prevention.

6.9.3 Boosted mains cold water

It shall be the responsibility of the system designer to determine the adequacy of system mains pressure and volumetric capacity relevant to the building application.

The system designer shall ensure there are no downstream effects on connected or future buildings.

Where existing system pressure information is not available from the University, the designer shall undertake pressure tests at the expense of the project.

DCW booster pumpsets shall be dual pumpsets sized for 50% redundancy and arranged in duty-standby configuration. Pumps shall be automatically speed controllable for constant pressure-variable flow. The University favoured manufacture of mains DCW booster pumpsets are Lowara Hydrovar series.

6.9.4 Water reticulation

Water reticulation to individual buildings or special spaces/zones within buildings shall be metered.

Refer to *Section 3 Utilities Connections and Energy Management* of the University's PS Design Standards and Guidelines for metering requirements associated with sanitary plumbing reticulation.

Non-potable supply requirements shall be determined on a case-by-case basis. Generally, all laboratory water services shall be supplied with potable as determined by the project requirements. Refer to *Section 12 Chemical and Biological Laboratories* of the University's PS Design Standards and Guidelines.

Reticulation system isolation provisions shall be made to facilitate each of these:

- Building isolation
- Isolation by building level
- Isolation by risers
- Isolation of zones where appropriate, e.g. amenity blocks, laboratories, etc.
- Isolation of equipment and components including but not limited to pumps, strainers, tanks, vessels, control valves, boilers etc.
- Isolation of individual fixtures including, but not limited to, wash hand basins, sinks, showers, dishwashers etc.

Reticulation systems shall not reticulate water within the following spaces:

- Electrical and communications plantrooms, cupboards and risers
- Above electrical and control components such as electrical-for-mechanical components residing within mechanical services plantrooms
- Within concealed spaces without having been pressure tested, and without having been finally inspected by the consultant or FM representative
- Any locations whereby the installation may be subject to damage or disruption.

Where the above precautions have not been made in either design or installation, the installation shall be modified by the project at no extra cost to the University.

Generally localized potable water filtration units, such as Microlene type, shall not be considered unless these are demonstrated to be absolutely necessary.

6.9.5 Pipework installation

Pipework shall be designed for industry best trade practice and installed in a neat and tradesperson like manner, true, plumb, parallel, straight and level.

Provisions shall be made in both design and installation with specific consideration to these:

Table 7: Pipework installation considerations

Consideration	Requirements
System resistance	• Lay out pipework in a coordinated manner where crossovers and offsets are minimised in order to reduce system resistance and obstruction of water flow.
Equipment removal	• Incorporate isolation valves and breakable connections to facilitate ease of removal of all hydraulic services equipment and fixtures. • Cutting of pipework to remove equipment or fixtures is not acceptable.
Acoustic performance;	• Incorporate acoustic measures to ensure there is no objectionable noise transmission from pipework or valves.

Consideration	Requirements
Expansion movement and settlement	• Wherever possible, expansion compensation shall be achieved by the method of using the system installation flexibility rather than proprietary expansion compensators. • In larger installations all large pipework systems shall be thoroughly modelled for stress analysis. AutoPipe software is a means of achieving this. • Pipe anchors and guides shall be used as appropriate.
Equipment and pipework supports	• Pipework shall be adequately supported from building structural elements, not other building services or building services supports. • Pipework fixing clips shall generally be munzing ring with rubber separation between the fixing ring and pipework. • All fixings and fastenings shall be correct for the application and be suitable for the anticipated load. • Pipework support spacings shall be in accordance with manufacturer's recommendations and in accordance with NZS 4219.
Venting and draining	• Where venting cannot be achieved via the fixtures due to pipework and fixture levels, air vents shall be provided at high points. • Automatic air release vents shall only be installed in plantroom and service areas. • Drain cocks shall be provided at system low points to facilitate system drain down.
Separation from structure and other services	• Ensure sufficient separation between pipework and structure. • Provide fire stopping and acoustic stopping as per section 10 Passive fire guides • Provide metal cover flanges/escutcheon plates to conceal exposed penetrations through walls and joinery units.

No screwed or mechanical joints shall be made within fully concealed and inaccessible spaces (e.g. wall cavities, etc.).

Pipework of dia.15mm can be used only whereby the pipework serves one fixture, the pipework length does not exceed 5m, and where the fixture served is not immediately adjacent to another fixture such as wash hand basin, sink or tub.

6.10 Domestic Hot Water

6.10.1 System types

New hot water system solutions for University projects shall be assessed on a case-by-case basis in consultation with FM.

FM case studies have determined that up to 70% of heat energy is lost in a reticulated DHW system if the circulating pump remains running when the building is unoccupied and there is no demand for DHW.

Based on this evidence, the University preference for new hot water systems is generally localised point of supply water heating. Wherever possible, such localised systems shall be single pipe. Where flow and return systems are required, recirculation pumps shall be BMS controllable to facilitate time scheduling out of demand hours.

Centralised systems utilising energy efficient heating appliances will be considered and are acceptable. Cases where centralised systems may provide life cycle cost benefit to the University include applications where high water heating demand / consumption is apparent. Examples include accommodation buildings and laboratory buildings. In these cases it is preferred that hot water is blended at the production source and reticulated at tempered temperature.

To avoid inefficient operation of large boiler plant, the heating production associated with centralised hot water systems shall be kept separate from building space heating production plant.

6.10.2 Hot water reticulation

All thermo-blending, thermostatic control and tempering valves shall be installed in completely accessible locations. Valves shall be centralised or grouped in such a manner to reduce the number of valves required on the system. UV sterilisation units, in accordance with NZ Building Code G12/AS1, are endorsed by the University where benefit can be made as such in reducing the number of mixing valves in centralised systems. All UV unit lamps shall be BMS monitored.

All hot water reticulation pipework must be thermally insulated. Insulation shall be applied only by specialist insulation installers in accordance with the manufacturer's recommendations. Insulation shall be continuous over the complete pipework length. Insulation shall be polyolefin type insulation such as Thermobreak and meet or exceed the following requirements Thermal conductivity to be ≤ 0.032W/mK @23°C and tested to Material Group Number 1S or 2S (when tested in accordance with the requirements of C/VM2 / ISO5660.1)

Insulation of domestic hot water pipes shall be installed up to the local thermostatic mixing valves. Blended water from these thermostatic mixer valves will be insulated up to the outlets. These requirements exceed the requirements of the NZBC.

6.11 Equipment – DHW and DCW Services

6.11.1 General

The University, being owner-operators of their built environment, seeks equipment which is cost effective over whole life cycle cost.

The consultant shall review all final equipment selections prior to procurement. FM shall also be given opportunity to review all final equipment selections prior to procurement.

All equipment shall be designed, supplied, and installed in accordance with the requirements of the NZ Building Code, local regulations and territorial authority requirements, and AS/NZ Standards.

6.11.2 Key criterion for equipment selection

The key criterion for University equipment selections include, but is not limited to equipment which is:

- Fully compliant with current revisions of all local regulations, standards and energy performance requirements
- Locally sourced and supported
- Favoured by the University or as a minimum is proven on other local Auckland sites
- Energy efficient and to industry best practice
- Robust and unlikely to require major maintenance, overhaul or component replacement during its economic life cycle.

6.11.3 Equipment manufacture

The University has favourable preference to equipment manufacture types which are common throughout the University as this provides benefit of performance and maintenance familiarity, together with carrying of spare parts. However, the University has no objection to alternative or new equipment manufacture types being offered on any of its projects should the offered equipment have performance and/or cost advantages which can be clearly demonstrated.

6.11.4 Noise and vibration

Hydraulic services shall be designed and constructed to ensure that all necessary precautions and measures are made to the installed plant and equipment to minimise the effects of noise and vibration transmission.

Acoustic requirements shall be project specific in accordance with the project Acoustic Engineer's requirements. In the absence of an Acoustic Engineer, required noise levels shall comply with the NZ Building Code and the requirements AS/NZS 2107.

6.11.5 Specific equipment guidelines and requirements

The following table is a list of equipment manufacture types which are currently favourable to the University, and some University site specific design guidelines for University selected equipment. The table is not comprehensive and should not be considered as all-inclusive.

All equipment must be supplied, installed and commissioned in accordance with NZ Building Code requirements and the instructions of the manufacturer:

Table 8: Hydraulic equipment requirements - DHW and DCW services

Equipment type	Manufacture types currently favoured by the University	Site specific remarks / Design guidelines
Backflow preventers	Wilkins	• Must be fully accessible and complete with isolation valves on both sides. • Must be installed above ground. In-ground is not accepted. • For incomer BFP, provide secure enclosure with University padlockable access door / gate. • Provide drainage sufficiently sized for full discharge flow.
Boiling water units (Potable boiling water; above bench)	Rheem laser Coopers boil and brew	• FM preference over under-bench units. • Provide local hard wired power isolation. • Provide local water isolation.
Boiling water units (Potable boiling water; under bench)	Zenith hydrotap	• Provide local hard wired power isolation. • Provide local water isolation. • Ensure adequate ventilation provisions within cabinetry. • Shall be programmable types for energy efficient use. Programing must be completed as part of installation and commissioning.
Combination potable chilled & boiling water units; under bench	Zenith hydrotap Billi Quadra	• FM preference is that combination units are avoided. • Any potable CHW provisions are a departmental choice. The ongoing maintenance costs of such combination units are to be borne by the users. • Provide local hard-wired power isolation. • Provide local water isolation. • Ensure adequate ventilation provisions within cabinetry. • Shall be programmable types for energy efficient use. Programing must be completed as part of installation and commissioning.

Equipment type	Manufacture types currently favoured by the University	Site specific remarks / Design guidelines

Domestic heating water plant – gas fired	Wall hung continuous flow hot water units:
	• Rinnai Infinity
	• Rheem Compak, Multipak & Tankpak
	
	Condensing boilers:
	• Rendamax
	• Raypak (Rheem)
		• DHW heating plant must be separate from space heating plant.
		• Boilers shall come complete with on-board boiler management control system.
		• Provide high level interface for BMS status monitoring and alarming.
		• Must be installed with:
		  • Water temperature gauges
		  • Pressure read gauges
		  • Gas pressure read gauges.
		• Condensing type boilers favourable for energy recovery.
		• Floor mounted boilers must be installed on concrete plinths.

Domestic heating water plant – electric	Hot water cylinders: • Rheem Heat pump	• Install on purpose-built bases complete with safe bunding trays and local drainage. • Safety relief drains shall visibly terminate at open tundishes. • Heat pump options will be considered where energy recovery from AC plant can be beneficial.
Domestic hot water UV sterilisers	Davies Steriflo	• Shall be externally insulated. • Shall have visual sight glass. • Lamps must be withdrawable without removal or disruption of the unit housing. • Shall be BMS monitored for lamp failure indication and alarming.
Pumps – Domestic hot water circulators	Grundfos Lowara Wilo	• Must be rated at applicable water temperature. • Installed so not exposed to weather. • Provide isolation valves on both sides of pump. • Provide local plugged power isolation. • Shall have stainless steel, or bronzed impellors. • Shall be BMS controllable for energy management and alarming. • Duty/standby not required on DHW circulation.
Pumps – Mains booster	Lowara Hydrovar	• Variable flow – constant pressure via on board VSD and controls. • Duty/standby sized for 50% redundancy. • Provide individual isolation to each pump. • Provide BMS capable pressure gauges. • Installed on plinths.
Water storage tanks (hot water)		• Provide temperature read gauges. • Shall be isolatable. • Where hot water tanks are installed in covered areas, but are still exposed to outside elements, tanks shall have external jackets installed for better thermal efficiency. • Shall have cleaning access provisions. • Shall have drainage outlets suitably sized and accessible to ensure tanks are readily drainable. • Shall be bunded to a volume of 110%. • Ceramic lined tanks shall not be accepted.

6.11.6 Valves

Valves shall be of a high commercial standard, suitably rated for the temperature and pressure for the intended service and fluid to be reticulated.

Valves must be installed in easily accessible locations to facilitate correct, safe, and complete system operating purposes. Valve installation must facilitate separation of pipework and valve assemblies without requiring cutting or other modification of the pipework installation.

Valve materials shall be de-zincification resistant brass and/or stainless steel.

Valves installed exposed to weather shall be of materials suitably protected and rated for external conditions.

All valves shall be installed in fully accessible locations.

6.11.7 Valve design guidelines

Brass valves shall be lead-free in construction.

These valve design guidelines shall be followed:

Table 9: Hydraulic valve requirements

Type	Size	Requirements
Isolating (IV)	All	• Must be provided to all equipment, tanks, meters, control valves, check valves, strainers, header connections, risers, and on-floor riser branches to ensure equipment and groups of equipment can be effectively isolated without causing system disruption. • Shall be used in 'closed' or 'fully open' positions only. • All existing isolation valves within existing buildings should not be assumed to be in good working order. Similarly, all existing isolation valves which appear to be in poor condition, or greater than 20 years old, should be replaced with new as part of the project works where replacement opportunity arises.
	50mm and below	• Ball type (preferred). • Brass body, chromed ball, stainless steel handles.
	65mm and above	• Lugged butterfly type or ball type. • Stainless steel shaft.

Backflow prevention	All	• Shall be installed wherever any item of equipment may be affected by reverse flow or backflow, e.g.:
		  • Contamination protection of potable water supplies
		  • Protection and prevention of potential system flow reversal during shutdown.

Non-return		• Pump protection. • Boiler protection for multiple boiler installations. • Prevention of flow under gravity. • Prevention of flooding.
	50mm and below	• Spring type. • Swing type. • Check valves must be installed with sufficient clearance / separation from pumps to avoid oscillation of valve check.

Type	Size	Requirements
	65mm and above	• Wafer type (80mm and above). • Flap type. • Silent type (65mm and above). • Check valves must be installed with sufficient clearance / separation from pumps to avoid oscillation of valve check.
Thermo-blending valves		• JRGUMAT are FM favoured supply. • Must be sized and installed in accordance with manufacturer's instructions. • Must be installed with non-return valves to avoid unwanted circulation to the blending valve.
Thermostatic control valves / tempering valves		• Shall be installed in areas of childcare facilities. • Shall be installed in accessible toilet facilities
Automatic balancing / flow regulating valves		• Tour and Anderson are FM favoured supply. • Install isolation valves either side of valve.
Urinal flushing valves		• Zurn or Cobra are FM favoured supply. • Ensure flowrate is compatible with flowrate / capacity of urinal basin. • Ensure sufficient riser pressure for application.
WC flushing valves		• Zurn or Cobra are FM favoured supply. • Must be installed in fully accessible locations. • Minimum delivery pipe size of 25mm.
Pressure relief (expansion) valves		• Pressure relief valves which, for this document, also includes safety relief valves, must be installed to prevent over pressure of any installed equipment • Pressure relief valve discharges must be piped to open tundishes
Pressure reducing valves		• Shall have isolation provisions.
Hose taps		• Shall be provided on all roofs and within all mechanical services plant rooms. • Shall be provided in coordinated locations and quantities for building wash and irrigation requirements. • Shall have square keyed shaft (i.e. no handles). • Shall incorporate vacuum breakers.
Motorised control valves		• Refer to *Section 7 Building Management System (BMS)* of the University's PS Design Standards and Guidelines.

6.11.8 Fixtures

Selection and use of water efficient fixtures is a requirement of the University's on-going commitment to pursuing environmental excellence.

All fixtures, tap ware and appliances shall be to a high commercial standard and shall be rated to the NZ Water Efficiency Labelling Scheme (WELS).

All fixtures and fittings shall be fixed generally in accordance with the manufacturer's requirements and recommendations. WC pans, urinals, and WHBs shall be mechanically fixed to the building structure. Any silicone sealants used shall be anti-fungal type and of a type suitable for the application and the lifetime of the installation.

All individual fixtures shall be installed with isolation provisions to enable their isolation and disconnection without causing disruption to adjacent and/or downstream fixtures.

All fixtures shall be easy to clean, replaceable with no hidden or blind fixings, and of reputable and supported manufacture which are not at risk of obsolescence.

This table shows a list of fixture target WELS ratings together with University site specific remarks.

Note: The table is not comprehensive and should not be considered as all-inclusive.

Table 10: Hydraulic fixture target WELS ratings

Fixture type	Minimum accepted WELS rating	Remarks
WCs (cistern, pan & seat)	3 Stars	• WCs shall be 3/6L dual flush.
Urinals	5 Stars	• Consideration shall be taken for installation of waterless urinals where the project allows • Ensure urinal flushing valve flowrate matches urinal basin flushing rate/capacity. • Electronically operated via occupancy detectors. • Favoured supply is AquaSaver
Amenity tap ware	6 Stars	• Manually operated single lever mixers preferred.
Showers	3 Stars	•
Cleaners sinks	4 Stars	• Shall be installed with hose tap provisions.
Hose taps		• Shall be installed with vacuum breakers. • Shall be keyed type where external to buildings.

6.12 Sanitary drainage

6.12.1 General

The guidelines within this section are in relation to the University's private sanitary drainage system provisions.

6.12.2 Codes and Standards

Sanitary drainage design must be in accordance with the requirements of the NZ Building Code Clause G13/AS1.

All sanitary drainage installations and materials must be in accordance with the NZ Building Code Clause G13, relevant standards and local regulatory requirements.

6.12.3 Pipework and materials

Sanitary drainage pipework materials are tabled within *6.8 Pipework* Materials of this document.

Sanitary drainage shall be designed and installed to maximum allowable practicable gradients, and shall take the most direct route i.e. using the least number of bends. Any sanitary drains found to be holding water in any location will be remedied by the Contractor at no extra cost to the University.

Inspection openings (and clean-out ports) shall be provided at every change in direction and generally at intervals not exceeding 6m. Inspection openings shall be proprietary fittings and shall not rely upon sections of the installed pipework requiring removal to facilitate inspection or cleaning access.

Waste traps shall be located as close as practically possible to the fixture or appliance they serve. Waste traps shall be universal 'P' or 'S' traps designed and installed to meet the performance of NZ Building Code Clause G13/AS1 and NZS 7652.

Provisions shall be made for system expansion in all installations. The provisions described within section 8 of NZS 7643 shall be incorporated for uPVC pipes.

Sanitary drainage installed in noise sensitive areas, or where specified by the Acoustic Engineer, shall be acoustically insulated with proprietary acoustic treatment.

Fire stopping provisions approved by a fire protection specialist shall be fitted to all pipework passing through fire separations.

With the exception of any underground drainage, no horizontal sanitary drainage shall be cast within concrete slabs.

6.12.4 Venting

Sanitary drainage shall be vented in accordance with the requirements of NZ Building Code Clause G13/AS1.

Vent terminations shall be proprietary cowls with vermin proofing.

The installation of air admittance valves as an alternative to vent pipework can be accepted where a vent pipework solution cannot be achieved. Air admittance valves must be installed in fully accessible locations, and in accordance with the manufacturer's instructions.

6.12.5 Underground drainage

All underground drainage shall be laid in trenches which have been excavated in a safe manner and with the correct fall and clearances. Drains shall be bedded on washed and screened sand, so the pipework is completely supported. Bedding materials shall be clean and durable and free of any dirt and impurities.

Materials and methodology for the backfilling of trenches shall be approved prior by the consultant and, where relevant, the territorial authority and FM. Backfilling should commence as soon as practically possible to the completion of the drain laying, **after** the inspection and testing in the presence of the aforementioned personnel.

Backfilling shall be carefully and safely carried out to ensure sufficient compaction and support of pipework.

6.12.6 Floor wastes

Floor waste gullies shall be provided in these areas:

- All mechanical services and hydraulic services plantrooms
- Sprinkler valve rooms
- Amenity blocks typically served by five or more sanitary fixtures
- Men's amenities, which include trough urinals
- Shower spaces
- Laboratories, as defined in *Section 12 Chemical and Biological Laboratories*.

For kitchen and laundry areas, overflows at point-of-use within fixtures is preferred as appropriate and practicable.

Floor waste gullies shall be designed and installed in accordance with the performance requirements of NZ Building Code Clause G13/AS1.

Floor waste grates shall be chrome plate on brass, removable and set to finish lower than the surrounding finished floor level. Sufficient directional fall in the surrounding finished floor level must be set to ensure floor surface water drains sufficiently to the floor waste gully collection point.

The means of charging the water seal of a floor waste gully shall preferably be by adjacent fixtures or floor washing hose taps. Mechanical trap priming devices shall only be provided where this cannot be accommodated. Where mechanical trap priming devices are required, backflow prevention of mechanical trap priming devices shall be preferably provided by air gap as opposed to backflow prevention devices.

6.13 Stormwater Drainage

Introduction

The guidelines within this section are in relation to private University stormwater drainage system provisions.

6.13.1 General

Roof construction and roof stormwater collection provisions shall be in accordance with NZ Building Code Clause E2/ VM1 & AS1/AS2/AS3. Design guidelines in relation to roof construction and roof stormwater collection provisions are not covered within these guidelines. The general exception being internal roof gutters as these are least preferred over external gutters by FM. Proprietary Syphonic Stormwater drainage systems are the preferred solution, particularly in new construction.

Where stormwater internal gutters must be provided as part of the design solution, they shall be:

- Minimum 450mm wide
- Fully supported the entire length of the gutter
- Capable of withstanding human traffic
- Sized for 1:100 year storm with 100% overflow.

Stormwater drainage design must be in accordance with the requirements of the NZ Building Code Clause E1/AS1.

All stormwater drainage installations and materials must be in accordance with the NZ Building Code Clause E1, relevant standards and local regulatory requirements.

BRANZ recommends designing to a 1:100 year storm but calls for Rain Fall Intensity (RFI) of 200 mm/hr. Typically, based on NIWA figures, Auckland sits around 150-160mm/hr for a 1:100 year storm.

Overflow discharges shall be directly onto grounds wherever practicable, to avoid unwanted surface flooding, and to ensure visibility.

6.13.2 Pipework and materials

Downpipes, gutters, roofing, fastenings and all adjoining components shall be of similar or compatible materials to prevent risk of galvanic corrosion.

Accepted stormwater drainage pipework materials are tabled within *6.12.3 Pipework and materials*.

Stormwater drainage shall be designed and installed to maximum allowable and practicable gradients and shall take the most direct route, i.e. using the least number of bends. Any stormwater drains found to be holding water in any location will be remedied by the contractor at no extra cost to the University.

Stormwater drainage maintenance access provisions shall be provided to the minimum requirements as described within NZ Building Code Clause E1, section 3.7.

Stormwater drainage installed in noise sensitive areas or where specified by the Acoustic Engineer, shall be acoustically insulated with proprietary acoustic treatment.

Fire stopping provisions approved by a fire protection specialist shall be fitted to all pipework passing through fire separations.

With the exception of any underground drainage, no horizontal stormwater drainage shall be cast within concrete slabs.

6.13.3 Downpipes

Stormwater downpipes shall route external of buildings. Internal downpipes are generally not accepted.

Where downpipes may be subject to mechanical damage, they shall be appropriate metallic material or protected with physical barriers.

Downpipes shall incorporate expansion joints.

6.13.4 Underground drainage

All underground drainage shall be laid in trenches which have been excavated in a safe manner and with the correct fall and clearances. Drains shall be bedded on washed and screened sand and ensure the pipework is completely supported. Bedding materials shall be clean and durable and free of any dirt and impurities.

Materials and methodology for the backfilling of trenches shall be prior approved by the consultant, and where relevant the territorial authority and FM. Backfilling should commence as soon as practically possible to the completion of the drain laying, after inspections by the aforementioned personnel have been carried out.

Backfilling shall be carefully and safely carried out to ensure sufficient compaction and support of pipework.

6.14 Gas reticulation systems

Introduction

The guidelines within this section are in relation to private University natural gas reticulation system provisions.

Refer to *Section 12 Chemical and Biological Laboratories* of the University's PS Design Standards and Guidelines for gas reticulation provisions specific to laboratory applications.

6.14.1 Gas installations

Gas installations shall be in complete accordance with the requirements of NZ Building Code Clauses G11/AS1 and G10/AS1, and the requirements of AS/NZS 5601.1.

Gas installations shall only be performed by skilled and experienced tradesperson holding a current gas-fitting certificate or licence as issued under the Plumbers, Gasfitters, and Drainlayers Act 2006.

6.14.2 Safe working practices

Safe working practices associated with all forms of gas work must be followed. This includes but is not limited to working on new and existing installations, leak repairs, purging, live-tappings, and electrical earthing and bonding.

Any gas leaks or suspected gas leaks must be reported to FM immediately. Appropriate action must also be taken on site to safeguard building occupants who may be within the vicinity.

6.14.3 Connections and/or modifications

All new gas connections, and/or modifications to existing gas reticulation systems must be communicated to FM during both the design and construction phases.

Refer to *Section 3 Utilities Connections* of the University's Design Standards and Guidelines

6.14.4 Redundant pipework and appliances

All gas pipework and appliances which have been made redundant through project works must be completely removed to the nearest branch supply point. Points of connection must safely terminated – this includes the sealing off of all redundant connections via the installation of closed isolation valves, complete with screw plugs and blanking flanges as appropriate. Any future connections shall also be terminated by this method.

6.14.5 Pipework and materials

All gas pipework materials and fittings shall be sized, designed, supplied and installed in accordance with the detailed requirements of AS/NZS 5601.1.

Gas pipework shall not be reticulated within the locations including, but not limited to:

- Locations where subject to potential physical damage or abrasion
- In electrical services plantrooms and risers

- In fire control rooms
- In fire isolated stairways, exit ways, and safe paths
- In lift shafts
- In service shafts not designed for pipework concealment such as rubbish shuts, fresh air plenums etc.
- Attached to fences
- Surface mounted to partition walls.

Gas pipework shall be supported by its own dedicated pipework supports, not from other building service supports, and shall incorporate measures for appropriate thermal expansion and contraction.

Underground gas pipework shall be installed in purpose-built beds backfilled with clean, hard sand compacted along the complete length of the bed. Underground pipework shall be laid with tracer wire and identification marker tape in accordance with AS/NZS 264.1. Underground gas pipework shall be separated from any electrical or communications underground cabling in accordance with electrical regulations and the requirements of AS/NZS 5601.1. Crossovers with any building service shall be avoided. Where crossovers are required, these shall be at angles not exceeding 45° and have vertical separation, with the exception of electrical and communications services, of not less than 150mm.

6.14.6 Pressure regulation

It shall be the responsibility of the designer to verify that the existing gas supply associated with their project work is of sufficient capacity and suitable operating pressure for the application. Any new specified appliances shall similarly be verified. This must be established prior to site commencement.

Where the operating pressure of the existing system exceeds the required pressure for the application, or where existing pressure regulation does not exist, pressure regulators shall be installed.

Pressure regulators shall be of a high commercial standard, and suitably rated for the application. Pressure regulators shall have built-in over-pressure protection, and be installed with upstream manual isolation valves, and downstream pressure gauges. These guidelines shall be followed for locating gas pressure regulators:

- Pressure regulators shall only be installed in locations which are:
  - Fully accessible
  - Well-ventilated
  - Above-ground.
- Pressure regulators shall not be installed in these locations:
  - Where subject to water exposure
  - Where subject to excessive temperature or potential physical damage
  - Intrinsically safe areas
  - Concealed spaces
  - Electrical rooms
  - Fire separated stairways or egress paths
  - Lift shafts or lift motor rooms.

Pressure regulators shall have engraved traffolyte labelling secured to the pressure regulator that identifies the set operating pressure of that regulator.

6.14.7 Site specific guidelines

These site specific guidelines shall be incorporated within the design and installation of University gas reticulation systems:

- Clear access within plantrooms and roof plant spaces shall be provided to the complete appliance. Clearances shall be to manufacturer's recommendations, or at least 750mm all way round, whichever is the greater.
- Provide gas detection sensors within rooms which contain gas burning appliances, e.g. plantrooms and laboratories. Sensors shall automatically alarm when gas is detected. Isolation of the supply shall be considered on a case by case basis.
- For enclosed gas plantrooms, provide emergency 'slam-shut' push buttons at each plantroom point-of-exit. Slam-shuts shall be hard wired to gas solenoid valves which, when activated, shall isolate gas being supplied into the plantroom. Gas solenoid valves shall interlock with the building fire alarm system as required by the Fire Engineer's fire safety report, and testing overrides shall be installed.
- Gas solenoid valves shall only be capable of manual reset.
- Natural ventilation provisions are preferred over mechanical ventilation provisions wherever appropriate. (Ventilation provisions in accordance with NZ Building Code Clause G4, the requirements of AS/NZS 5601.1 and specific requirements of the manufacturer).
- Provide thermal safety valves local to each gas appliance or group of appliances. Local thermal heat detectors hard wired to solenoid valves are accepted.
- BMS monitoring of gas solenoid valve status (open/close position).
- Pressure gauges shall be fitted adjacent to all pressure regulators and gas meters.
- Ensure the gas pressure can be read at all meters without requiring special equipment or access provisions.

6.14.8 Valves

Manual isolation valves shall be installed to all appliances to enable appliance isolation. Breakable connections shall be provided downstream of all appliance isolation valves to enable appliance removal without cutting or removal of sections of pipework.

Isolation valves shall be readily accessible and shall be located so they can be safely operated from the gas appliance.

Generally, quick-connect socket devices shall not be used. 'Future' connection provisions shall be via manual isolation valves complete with removable screw in caps or blanking flanges.

6.15 Irrigation systems

Introduction

This section covers the design, preparation, supply, installation and commissioning of permanent systems of drip feed irrigation and sprinklers to automatically water planting and turfed areas.

6.15.1 General

Water supply provisions shall be made to accommodate irrigation of all planting.

Irrigation supplies shall be dedicated pipework lines complete with isolation valves and check metering.

The FM Grounds and Precinct Manager shall be consulted for clarification with regard to irrigation requirements on a case-by-case basis.

6.15.2 Materials

Unless otherwise specified, pipes shall be manufactured of these materials and to these standards:

Component	Material
Pipe and fittings	**Mainline pipe**: • Polyethylene pipe, MDPE PE80 PN12.5 conforming to NZS/AS 4130. **Lateral pipes**: • Polyethylene pipe, LDPE PE PN6.5 conforming to NZS 7601. **Fittings**: • Compatible with the pipe system and shall conform to NZS/AS 4129.
Ducting	• **Under roadways** shall be 100mm uPVC pipe conforming to NZS/AS1254. • **For power supplies 100 volt and greater** shall be orange coloured 50mm or 100mm diameter uPVC pipe conforming to NZS/AS 2053.
Irrigation Nozzles	**Drippers** shall be 4 litre per hour self-compensating drippers placed to insure adequate water distribution throughout the planting area.

Manual Gate Valves	**Brass valves** shall:
	• Comply with NZS/AS 2638.2
	• Be housed in HDPE surface boxes:
	  • With dark green coloured lids
	  • Sized 275mm x 440mm
	  • Labelled "Control".

Component	Material
Automatic Controller and Control Wiring	**Automatic controller** shall: • Have manual start facilities for each station • Be programmable • Have LCD programme display panel system on/off switch and fuse protected circuitry • Be housed in a vandal proof protective stainless-steel cabinet with lockable case, suitable for outside installation • Be installed at eye level and attached to the supporting structure. **Control systems** shall be: • Rainbird or equivalent • Capable of handling up to 48 stations with different irrigation needs for turf, shrubs and flower beds, special watering restrictions, dial programming, easy-to-read display, programmable master valve, 365-day calendar, rain sensor bypass, seasonal adjustment. **Electrical control units** shall be: • Capable of expanding the system by 50% at a future date • Connected to the 240-volt mains supply complete with surge protection.

Solenoid valves and wiring	**Solenoid Valves** shall:
	• Be 24V AC Hunter ICV or PGV solenoid valves
	• Be appropriately sized for the pipe sizes used and flow rates and pressures required
	• Be installed in HDPE surface boxes:
	  • With dark green coloured lids
	  • Sized 275mm x 440mm
	  • Labelled "Control".
	• Be of the normally closed design. Upon a power failure or de-energising of the solenoid coil, the valve shall close
	• Have a normal flow control stem and handle for adjusting the flow through the unit and for manual shut-off
	• Have a manual operating bleed valve to provide for manual operation of the valve without energising the solenoid coil.
	Solenoid and control wiring shall:
	• Be sized to the Automatic Controller manufacturer's specifications with due regard to the appliance and length of cable run
	• Be TPS sheathed, colour coded and taped to the underside of water supply pipework
	• Connections to solenoids shall have 500mm spare cable
	• Be joined with Gel type waterproof cable jointers.

Atmospheric sensors	**Rain sensors** shall be: • Installed to shut the irrigation system off during rain and to automatically compensate for the amount of rainfall that occurred • Attached to the building, post or bracket 2.0m above the ground and with no obstruction within 5 meters and above a line 30 degrees from the horizontal. **Atmospheric sensors** shall be proprietary units compatible with the Automatic Controller system and capable to sense rainfall in excess of 0.5mm.

Backflow preventer	**Backflow preventers** shall be:
	• Double check valve devices suitable for in-ground installation
	• Constructed in accordance with NZS/AS 2845.1
	• Housed in a pre- fabricated box:
	  • With detachable lid
	  • With internal dimensions adequate to allow for installation and servicing of the devices.

Component	Material
Pressure Controller and Water Filter	**Pressure controllers and filters** shall be: • Installed at the point of connection of the system to the supply mains • Proprietary fittings capable of regulating the pressure to the design pressure of the sprinkler nozzles (at the nozzles) • Filtered to retain particles exceeding 130 microns.

6.15.3 Design and Installation

Component	Material
Over Spray	• The irrigation system design and spray irrigation nozzles shall ensure that irrigation shall not spray over footpaths, roadways or onto buildings, walls or structures.
Power Supply	• The irrigation system shall be connected to the 240 volt power system at a location to be agreed by the engineer. • The electrical installation shall be designed and installed in accordance with Electricity Regulations 1997. • The irrigation controller power supply shall be fed directly from the mains switchboard and be provided and dedicated earth leakage switch breaker at the switchboard.
Excavation and Backfill	• All mainline and lateral pipes shall be laid in trenches. • The trench width shall be a minimum width of the pipe diameter plus 100mm. • All pipelines, mains or sprinkler lines shall be installed with a minimum cover of 500mm below finished levels. • Ducting installed beneath surfaces subjected to loading (e.g. driveways, car parks, and paving) shall be encased in sand and backfilled to subgrade level with compacted hard fill. • Trenches to be excavated in public roads shall be excavated and reinstated in accordance with the requirements of the local authority.
Ducting	• Ducts shall be no less than 500mm and no more than 700mm below finished pavement level. • Where more than one length of pipe is required for any one duct, the joints shall be solvent cemented. • Where a duct is required to change direction, it shall be achieved by natural flexing of the pipe to produce a gentle curve. No angled fittings shall be permitted. • The ends of each duct shall be adequately plugged so as to prohibit the introduction of foreign material. • Ends of ducts shall protrude a minimum of 150mm beyond any kerb, wall, or foundation. • Site measurements shall be recorded, accurately locating the ends of all ducts. Cuts shall be made on the surface of kerbs over the line of ducts.

Component	Material
Water Pipe Installation	• All plastic pipe fittings to be installed shall be moulded fittings manufactured of the same material as the pipe and shall be suitable for solvent weld, slip joint, ring tight seal, or screwed connections. Saddle tees and flange fittings shall be brass. Plastic fittings are not permitted. • Connection of plastic to metal shall be made using threaded male adaptors. Joints shall be watertight and sealed with Teflon tape. • Lateral tube installed in planting beds shall be pegged at 2.0m intervals and covered by 75mm mulch. • All rubber ring spigot and socket jointed pipe affected by any bends exceeding 20 degrees from a straight line or blank cap, shall be supported against virgin ground with concrete thrust blocks of suitable proportions. • No fittings (i.e. valves, tees etc.) shall be permitted under hard landscape, seal, concrete or segmental pavers unless expressly approved by the Engineer.
Backfilling	• Backfill for trenching shall be compacted to dry density equal to the adjacent • undisturbed soil, and shall match adjacent grades without dips, sunken areas, humps, or other irregularities. Contractor shall correct any settlement of trench material. The Contractor shall ensure field drainage (where installed) is completed and backfilled to specifications prior to laying system mainline.

6.15.4 Completion

As-Built Drawings and Operation Manuals

Refer to these sections of the University's PS Design Standards and Guidelines:

- *Section 19 Asset Management Information Requirements*
- *Section 24 Project Handover Documentation.*

Guarantees and Warranties

The guarantee shall be for 2 years after the Defects Liability Period.

Warranties shall be provided for all electronic and electrical equipment.

It is expected that the following warranty periods are provided:

Product	Warranty period
Sanitary fitting: vitreous china	2 years
Sanitary fitting: stainless steel	5 years
Tapware	5 years
Plumbing reticulation systems	5 years

6.16 Electrical for Hydraulic Installations

6.16.1 General

Note: The requirements for this section are covered within *Section 8 Electrical for Mechanical and Associated Services* of the University's PS Design Standards and Guidelines

Note: All power supplies for hydraulic services plant and equipment shall be derived from mechanical services switchboards (MSSBs) and/or motor control centres (MCCs). The general exception to this guideline is localised domestic hot water and domestic cold-water systems such as electric hot water cylinders and associated re-circulating pumps and UV unit, boiling water units, and sanitary plumbing controllers.

Only electrical specialists holding a current Electrical Workers Registration Board license shall be engaged for the installation of electrical for hydraulic services (E4H).

All E4H services shall be designed, supplied and installed for full compliance with the latest revision of the Electrical (Safety) Regulations the NZ Building Code, the latest revision of AS/NZS 3000 Wiring Rules and *Section 5 Electrical* of the University's PS Design Standards and Guidelines

All metallic pipework shall be earthed.

Appendix A Feedback Form

We love hearing from you. Please take a few moments to let us know how we can improve the *Property Services Design Standards and Guidelines*.

1.	**Name:**			
2.	Contact Details: (in case we need clarification)			
Complete this section if you have found a typo / formatting error. (If possible, attach a photo of the error)				
3.	Section No:		Page No/s:	
	Description of error:			
Complete this section if you have a suggestion about content.				
4.	Section No:		Page No/s: (if applicable)	
	Suggestion/s:			
Complete this section if you have any other suggestions for improvement.				
5.	Suggestion/s:			
6.	Email your feedback to PSTechServices@auckland.ac.nz			
Thanks for your feedback!				

Appendix B Index