
CHRISTCHURCH CITY COUNCIL

CONSTRUCTION STANDARD SPECIFICATION

PART 4 – WATER SUPPLY

CSS: PART 4 2019

TABLE OF CONTENTS

1.0 FOREWORD.....	1
2.0 RELATED DOCUMENTS	1
3.0 APPROVAL OF MATERIALS, OPERATORS/CONTRACTORS, LABORATORIES AND WORKMANSHIP	2
3.1 Authorised Water Supply Installer	3
3.2 Materials	3
4.0 PREVENTION OF CONTAMINATION OF CHRISTCHURCH’S DRINKING WATER SUPPLY	4
4.1 Hygiene Certificate	4
4.2 Measurement of Works and Basis of Payment	5
5.0 HAZARD IDENTIFICATION.....	5
5.1 Electrical Earthing of Metallic Water Pipes	5
5.2 Asbestos Cement Pipe.....	5
6.0 INTERFERENCE WITH WATER SUPPLY NETWORK.....	5
7.0 NOTIFICATIONS.....	5
7.1 Start Work Pamphlet	5
7.2 ‘Water Shutdown’ Notification	5
7.3 Shutdown Timing	6
7.4 Contractor’s Representative	6
7.5 Consumer Complaints	6
7.6 Measurement of Work and Basis of Payment.....	7
8.0 CRITICAL CONSUMERS	7
8.1 Measurement of Work and Basis of Payment.....	7
9.0 EXCAVATION.....	7
9.1 Length of Open Trench	7
9.2 Trench Width.....	8
9.3 Keeping the Excavation Free of Water	8
9.4 Cover Over Pipes	8
9.5 Clearance to Existing Services	9
9.6 Extra Excavation Around Services	9
9.7 Geotextiles.....	9
9.8 Measurement of Work and Basis of Payment.....	9
9.8.1 Excavation	9
9.8.2 Trench Support	9

9.8.3	Extra Excavation Around Services.....	10
9.8.4	Unsuitable Foundations.....	10
9.8.5	Geotextiles.....	10
10.0	JOINTING.....	10
10.1	Jointing of PVC-U Pipe.....	10
10.2	Thermoplastic Jointing of Polyethylene Pipe by Electrofusion Welding.....	10
10.2.1	Methodology.....	11
10.2.2	Quality Assurance Records.....	11
10.2.3	Operator Qualifications.....	11
10.2.4	Equipment.....	11
10.2.5	Pipe Preparation.....	12
10.2.6	Welding.....	13
10.2.7	Pipeline Recovery after Pulling in/Cooling of Heated Pipe.....	13
10.3	Site Butt Fusion Jointing of Polyethylene Pipe and Fittings.....	14
10.3.1	Methodology.....	14
10.3.2	Quality Assurance Records.....	15
10.3.3	Operator Qualifications.....	15
10.3.4	Equipment.....	16
10.3.5	Pipe Preparation.....	16
10.3.6	Welding.....	17
10.3.7	Bead Profile.....	17
10.3.8	Joint Failure during Handling and Installation.....	18
10.4	Measurement of Works and Basis of Payment.....	18
11.0	PIPE INSTALLATION.....	18
11.1	Handling.....	18
11.2	Cleanliness.....	19
11.3	Leaks.....	19
11.4	Pipe Installation by Trenching.....	19
11.4.1	Hillside definition.....	19
11.4.2	Bedding.....	19
11.4.3	Bedding Material.....	19
11.4.4	Bedding Requirement.....	19
11.4.5	Watermain Location.....	19
11.4.6	Submains.....	20
11.5	Water Stops.....	20
11.6	Pipe Protection.....	20
11.7	Polyethylene Pipe Installation by Trenchless Technology.....	20
11.7.1	Polyethylene Pipe Installation by Slip Lining.....	20
11.7.2	Polyethylene Pipe Installation by Directional Drilling.....	21
11.8	Access Pits.....	21
11.9	Measurement of Works and Basis of Payment.....	22
11.9.1	Pipe Installation by Open Trenching.....	22
11.9.2	Pipe Installation by Pipe bursting.....	22
11.9.3	Pipe Installation by Slip Lining.....	22
11.9.4	Pipe Installation by Directional Drilling.....	23
11.9.5	Water Stops.....	23
11.9.6	Pipe Protection.....	23
12.0	FITTINGS.....	23
12.1	Fasteners.....	23
12.2	Valves, Fire Hydrants and Surface Boxes.....	24
12.2.1	Valves.....	24
12.2.2	Fire Hydrants.....	24
12.2.3	Surface Boxes.....	24

12.2.4	Roadmarking	24
12.2.5	Measurement of Works and Basis of Payment	25
12.3	Tees, Crosses, Bends, Reducers	25
12.3.1	Measurement of Works and Basis of Payment	25
12.4	Surface Boxes Installed or Adjusted Separately from Watermain Works.	25
12.4.1	Measurement of Works and Basis of Payment	25
12.5	Thrust Blocks	26
12.5.1	Location.....	26
12.5.2	Site Constructed Thrust Blocks.....	26
12.5.3	Precast Thrust Blocks.....	26
12.5.4	Measurement of Works and Basis of Payment	26
12.6	Anchor Blocks.....	27
12.6.1	Location.....	27
12.6.2	Measurement of Works and Basis of Payment	27
12.7	Removal of Redundant Fittings.....	27
12.7.1	Measurement of Works and Basis of Payment	28
13.0	BACKFILLING.....	28
13.1	Materials.	28
13.2	Treatment of Under-runners.....	28
13.3	Quality Assurance.....	28
13.4	Measurement of Works and Basis of Payment	29
13.4.1	Backfill.....	29
13.4.2	Treatment of Under-runners	29
13.4.3	Filling to Unsuitable Foundations.....	29
14.0	CONNECTING INTO EXISTING SYSTEM	29
14.1	Measurement of Works and Basis of Payment	30
15.0	STERILISATION OF NEW MAIN.....	30
15.1	Chlorinating Point	30
15.1.1	Temporary Fitting	30
15.1.2	Permanent Fitting.....	30
15.2	Sterilising	30
15.3	Bacteriological Testing	31
15.4	Measurement of Works and Basis of Payment	31
16.0	CONSUMER CONNECTION.....	31
16.1	Connection Position	31
16.2	Changing Consumer Connections to New Pipework.....	31
16.3	Fittings for Consumer Connections	32
16.3.1	Removal of Existing Stopcocks	32
16.3.2	Installation of Stopcock.....	32
16.3.3	Reuse of Water Meters.....	32
16.3.4	Water Meters over 20mm Diameter.....	33
16.3.5	Reuse of Water Meter Boxes	33
16.3.6	Installation of Water Meter Boxes	33
16.3.7	Multiple Meters.....	33
16.3.8	Backfill and Final Surfacing	33
16.4	Flushing of Reconnection	33
16.5	Measurement of Works and Basis of Payment	34
17.0	PERFORMANCE TESTING.....	34
17.1	Equipment.....	34
17.2	Polyethylene Pipe Weld Tests.....	34

17.2.1	Pre-construction Joint Testing - Electrofusion	34
17.2.2	Pre-construction Joint Testing – Electrofusion Saddles.....	35
17.2.3	Pre-construction Joint Testing – Butt Fusion.....	36
17.2.4	Joint Testing During Construction – Electrofusion and Electrofusion Saddles.....	36
17.2.5	Joint Testing During Construction – Butt Fusion.....	37
17.3	Pressure Testing.....	38
17.3.1	PVC, Ductile Iron, Glass Reinforced Plastic Pipe.....	38
17.3.2	Polyethylene Pipe (100mm to 315mm diameter).....	38
17.3.3	Polyethylene Pipe (over 315mm diameter).....	38
17.3.4	Polyethylene Pipe (less than 100mm diameter)	38
17.4	Measurement of Works and Basis of Payment	38
17.4.1	Polyethylene Pipe Weld Test.....	38
18.0	FINAL SURFACING	39
18.1	Measurement of Works and Basis of Payment	39
19.0	LOCATION MARKING OF FIRE HYDRANTS AND SLUICE VALVES	39
19.1	Roadmarking	39
19.2	Fire Hydrants.....	39
19.3	Sluice Valves	40
19.4	Gate Valves	40
19.5	Paints and Markers	40
19.6	Removal of Redundant Markings	40
19.7	Measurement of Works and Basis of Payment	41
20.0	AS-BUILT RECORDS.....	41

COPYRIGHT © CHRISTCHURCH CITY COUNCIL, 2019

The information contained in this document (other than information or images that have been credited to a third party) may be reproduced subject to inclusion of acknowledgement of the source, and provided that no commercial usage or sale of the material occurs. Reproduction for commercial usage or sale requires prior written permission from Christchurch City Council. Copyright in information or images that have been credited to a third party remains that of the credited person or company. Reproduction of any credited image will require the permission of that third party. Contact details may be sought from Christchurch City Council.

APPENDICES

- 1 Water Meter Exchange Record Sheet
- 2 Pipe Butt Weld Record Log Sheet
- 3 Pipe Electrofusion Weld Record Log Sheet
- 4 Compliance Requirements Checksheet
- 5 PE Weld Testing Information Requirements
- 6 Hygiene Certificate

STANDARD DETAILS

Connections	SD 401	50mm Diameter Connection to Main
	SD 402	50mm Diameter Submain Supply off Fire Hydrant
	SD 403/1	Typical Layout for Consumer Connection
	SD 403/2	Typical Layout for Restricted Connection
	SD 421	Water Supply Backflow Preventer RPZ
Roadmarking	SD 404	Hydrant and Sluice Valve Markings
Concrete Products	SD 405	Precast Hydrant and Valve Frames
	SD 406	Precast Thrust Blocks
Pipelaying	SD 410	Pipe Bedding Haunching and Surround
	SD 411	Thrust and Anchor Blocks
	SD 412	Hydrant and Valve Covers
Iron Work Details	SD 420	Water Supply Spindle Cap

1.0 FOREWORD

This Specification forms Part 4 of the Christchurch City Council Civil Engineering Construction Standard Specification (abbreviated as CSS). All parts of the CSS should be read in conjunction with each other and the Infrastructure Design Standards (abbreviated as IDS).

The full Specification includes the most recently published versions of the following Parts:

- CSS: Part 1 - General
- CSS: Part 2 - Earthworks
- CSS: Part 3 - Utility Drainage
- CSS: Part 4 - Water Supply
- CSS: Part 5 - Lights
- CSS: Part 6 - Roads
- CSS: Part 7 - Landscapes

Part 4 of the Standard Specification includes those Standard Details (SD) relating to this part only. The Standard Details (SD) are not to scale and all units are in millimetres (mm) unless otherwise shown. All rights reserved on Standard Details.

2.0 RELATED DOCUMENTS

The latest versions of the following documents shall be read and form part of this standard specification, together with revisions, replacements and amendments up to the date of calling tenders. The requirements of this specification supersede the requirements of any related documents listed or referred to within this specification, except acts of parliament. Where this document is referred to in a contract, the requirements of that contract supersede the requirements of this specification.

Christchurch City Council Infrastructure Design Standards 2018

<https://www.ccc.govt.nz/consents-and-licences/construction-requirements/infrastructure-design-standards/download-the-ids/>

AS/NZS 2032: 2006	Installation of PVC pipe systems
AS/NZS 2033: 2008	Installation of polyethylene pipe systems
AS/NZS 2566.2: 2002	Buried flexible pipelines - Installation
AS/NZS 4158:2003	Thermal-bonded polymeric coatings on valves and fittings for water industry purposes
AS/NZS 4087:2011	Metallic flanges for waterworks purposes
AS/NZS ISO 9001: 2008	Quality management systems – Requirements
ISO 13953: 2001	Polyethylene (PE) Pipe and Fittings – Determination of the tensile strength of test pieces from a butt-fused joint

ISO 13954:1997	Peel decohesion test for polyethylene (PE) electrofusion assemblies of nominal outside diameter greater than or equal to 90 mm
ISO 13956: 2010	Decohesion test of polyethylene (PE) saddle fusion joints - Evaluation of ductility of fusion joint interface by tear test
ISO 21751: 2011	Plastic pipes and fittings – Decohesion test of electrofusion assemblies – Strip-bend test
National Code for Utility Operators’ Access to Transport Corridors	http://www.nzuag.org.nz/national-code/CodeNov11.pdf
Christchurch City Council Schedule of Local and Special Conditions to the National Code of Practice for Utility Operator’s Access to Transport Corridors 2013	
Christchurch City Council Authorised Water Supply Installer Specification	http://www.ccc.govt.nz/consents-and-licences/construction-requirements/approved-contractors/authorised-water-supply-installers/
Plastic Industry Pipe Association of Australia (PIPA) POP001 Industry Guidelines for Electrofusion Jointing of PE Pipe and Fittings for Pressure Applications	Version 7.0 http://pipa.com.au/images/pdf/POP001.pdf
Plastic Industry Pipe Association of Australia (PIPA) POP003 Industry Guidelines for Butt Fusion Jointing of PE Pipes and Fittings - Recommended Parameters	Version 6.0 http://pipa.com.au/images/pdf/POP003.pdf
Worksafe Good Practice Guideline Excavation Safety	http://construction.worksafe.govt.nz/guides/excavation-safety/
Worksafe Guidelines for the Management and Removal of Asbestos Revised January 1999	http://www.business.govt.nz/worksafe/information-guidance/all-guidance-items/new-zealand-guidelines-for-the-management-and-removal-of-asbestos-3rd-edition

3.0 APPROVAL OF MATERIALS, OPERATORS/CONTRACTORS, LABORATORIES AND WORKMANSHIP

‘Approved’ in this document means:

- A material listed on the Approved Materials List, with a current Certificate Status and an Approval Status permitting that use;
- A Council-approved contractor authorised to do that specific work and listed on the relevant register;
- approved by the Engineer.

Schedules of approved materials and contractors can be found on the Christchurch City Council web page at:

<http://www.ccc.govt.nz/consents-and-licences/construction-requirements/approved-materials-list>

<http://www.ccc.govt.nz/consents-and-licences/construction-requirements/approved-contractors>

Selected materials are specified in CSS: Part 1 - General.

Approved testing laboratories are IANZ accredited to carry out the particular test being requested.

3.1 Authorised Water Supply Installer

Each work site shall have an Authorised Water Supply Installer working full time whenever water related infrastructure is being installed, including the placement of bedding and backfill up to subgrade level. This person shall carry out all works in accordance with the 'Conditions for Approval as an Authorised Water Supply Installer'. The individual's approval shall be removed where they contravene the requirements. Details of the Authorised Water Supply Installer shall be provided in the Contract Quality Plan, as detailed in IDS, clause 3.3 – Project Quality System.

This person is permitted to control Council water main and submain contracts, fire service connections, new subdivision reticulation works and their connection to the existing system and the connection of new pump stations and reservoirs to the existing system. Reactive maintenance work on the existing system, temporary connections to the system via fire hydrants and new metered water connections are specifically excluded from this agreement.

Details regarding Authorised Water Supply Installers are available at www.ccc.govt.nz/consents-and-licences/construction-requirements/approved-contractors/

3.2 Materials

Refer to IDS, clause 7.12 – Materials for Council's requirements regarding material specifications.

The Contractor shall supply the pipe details, where not recorded on or where different from the plan. Materials supplied shall be approved materials as stated above. Refer to IDS clause 12.4 – As-Built Records for those details required with the as-built records.

This information shall be provided through the Contract Quality Plan at Practical Completion, to facilitate the compilation of accurate as-built records of assets installed under these works.

All fittings shall have a pressure rating at least equivalent to the rating of the adjacent pipe. All pipe lengths shall be supplied and stored on site with end caps fitted.

All pipe diameters are nominal internal, unless specifically stated otherwise.

4.0 PREVENTION OF CONTAMINATION OF CHRISTCHURCH'S DRINKING WATER SUPPLY

All work shall comply with the Council's 'Conditions for Approval as an Authorised Water Supply Installer, Schedule D – Techniques & procedures for preventing contamination of Christchurch's potable water supply system'.

Schedule D specifies the following:

- The chain of cleanliness for equipment and fittings prior to use on all works.
- Worker hygiene and the steps necessary to minimise the potential for workers to be a source of contamination.
- Sterilisation procedure prior to the commissioning or re-commissioning of plant.
- Water testing required to establish compliance with Drinking Water Standards of New Zealand (DWSNZ), prior to plant commissioning or re-commissioning.
- Procedures to be followed when contamination of the system has occurred.
- The submitting of a Hygiene Certificate, prior to application for a Certificate of Practical Completion.

The objective of this clause is to:

- comply with the regulatory requirements.
- afford a high level of confidence that when work is carried out on the water supply system, the water supply network is not put at unnecessary risk of contamination.

The Ministry of Health is notified immediately if a water sample taken from the public water supply is found to contravene the Maximum Acceptable Values (MAVs) of the DWSNZ. Contamination could impact severely in the health of consumers, particularly the elderly, infants and people with immune deficiencies.

Where contamination is found, the Council is required to immediately isolate and remove the source of the contamination. Where this contamination is caused by work carried out by a Contractor, this Contractor shall incur the costs of remedial work.

These requirements also apply to work carried out in subdivisions.

4.1 Hygiene Certificate

Before a Certificate of Practical Completion is issued, the Authorised Installer shall complete, sign and return to the Council, as part of the as built documentation required under the Contract Quality Plan, a Hygiene Certificate confirming that during the period of these works the authorised installer and all people directly involved with the work have adhered to and complied with the provisions of the Authorised Water Installer's Specification.

A Hygiene Certificate template is attached in Appendix 6.

4.2 Measurement of Works and Basis of Payment

All costs involved in the prevention of contamination of Christchurch's water supply shall be borne by the Contractor.

5.0 HAZARD IDENTIFICATION

The Contractor's Health & Safety Plan must include the means for dealing with all hazards likely to be encountered on the site.

5.1 Electrical Earthing of Metallic Water Pipes

Prior to 1961 it was common practice for metal water supply pipes to be used as the electrical earth for private premises. A change in electrical supply regulation and the use of plastic water supply pipes means that most premises no longer have their electrical earth in this manner. However, a number are still earthed this way and the Contractor shall be aware that cutting and separating metal water pipes may cause a voltage difference (electric shock) and a bonding strap should be used at all times.

5.2 Asbestos Cement Pipe

Worksafe guidelines for asbestos should be followed when dealing with damaged asbestos cement pipes due to the risk of asbestosis and related diseases. Refer to CSS: Part 1 clause 20.1 – Asbestos.

6.0 INTERFERENCE WITH WATER SUPPLY NETWORK

The Contractor shall not operate valves or fire hydrants or otherwise interfere with the Water Supply Network without the Engineer's permission.

This is important as headworks operating procedures exist that need to be followed.

7.0 NOTIFICATIONS

7.1 Start Work Pamphlet

The Contractor shall deliver the Start Work Pamphlet to each property affected by the contract works at least 36 hours before work commences.

7.2 'Water Shutdown' Notification

The Contractor shall notify each affected consumer prior to turning off the water supply. The Contractor must obtain approval from the Engineer before shutting off consumers' supplies.

The Engineer will supply to the Contractor a pro-forma letter, which advises the consumer of work taking place. This letter must be delivered by the Contractor to each affected property prior to 10.00am not less than one and not more than two working days prior to any work commencing that affects those properties (Saturday and Sunday are not counted as working days).

Where it is possible to turn off the water to an individual property without affecting other properties, the Contractor must verbally notify the property owner immediately before the water is turned off. Where this is not possible the letter must give specified times for the shut-off and the Contractor must adhere to these times.

7.3 Shutdown Timing

Any water shut-offs to consumers must be limited to the minimum possible time and carried out without any meal or tea breaks. All consumers, whenever possible, shall be notified of intended shutdowns and of the expected duration.

Water shutdowns shall be arranged between the hours of 9.00 am and 3.00 pm except by prior agreement with the Engineer. Where a daytime water shutdown will disrupt business activities, the Engineer may require the Contractor to re-issue the shutdown notifications for and arrange a night-time shutdown. Shutdowns shall only be granted when the Contractor has all the plant, equipment, labour and materials necessary for the task on site.

7.4 Contractor's Representative

The Contractor shall supply to the Engineer the name, address and a 24-hour contact telephone of the Contractor's Representative. Details of the Contractor's Representative shall be provided in the Contract Quality Plan, as detailed in IDS, clause 3.3 – Project Quality System.

The name of this representative shall be supplied before any work is carried out on the contract. This representative must be authorised by the Contractor to act on their behalf and to expeditiously investigate any consumer complaints and repair all such reported downstream plumbing faults.

7.5 Consumer Complaints

The Engineer will assume that any plumbing problems within private premises reported in the three days subsequent to pipe installation work are the responsibility of the Contractor. Should the Contractor's Representative, on investigation, dispute the liability of the Contractor for the fault in the consumer's system, the representative should advise the consumer to engage a tradesperson of his/her own choice to carry out repairs, pay the account and forward it, together with a request for reimbursement (giving reasons for his/her belief that it is the Council's responsibility), to the Engineer within 28 days. The Council will compensate the Contractor for all reasonable costs incurred in investigating consumer complaints that are found not to be their responsibility.

The Engineer shall arbitrate on the liabilities involved and approve Council reimbursement to the consumer. Corresponding deductions will be made from contract payments if the Engineer determines that the consumer's complaint related to a fault that was the Contractor's responsibility.

The Engineer reserves the right to make arrangements to have consumer faults repaired expeditiously. The Contractor shall be responsible for any repair costs associated with the work undertaken. In particular, neither the failure of the shift control officer to contact the Contractor's Representative nor the passing of a period in excess of three days before the complaint is received exonerates the Contractor from the costs of repairs attributed to work undertaken by the Contractor.

7.6 Measurement of Work and Basis of Payment

Payment for the delivery of the start work pamphlet and shutdown letter by the Contractor shall be included in the rate for pipe installation.

8.0 CRITICAL CONSUMERS

The Contractor shall liaise, particularly with critical consumers, regarding the timing and duration of water shutdowns. These may include dialysis patients and healthcare facilities.

8.1 Measurement of Work and Basis of Payment

Where necessary, arrangements for temporary supply may be ordered. This work shall be paid as a variation.

9.0 EXCAVATION

Where trenching is needed, all trenching work shall adhere to the Worksafe Good Practice Guideline Excavation Safety. The bottom of the trench shall be flat and conform approximately to grade. At joints a depression shall be cut with ample dimension to allow joints to be made and thoroughly inspected.

Excavations in legal roads shall be carried out in accordance with CSS: Part 1 clause 31.0 - Excavation.

Refer to the Council webpage 'Working on the Legal Road' <http://www.ccc.govt.nz/transport/working-on-the-legal-road/> for further information.

Council's Trench Support Best Practice Guideline is available at <https://www.ccc.govt.nz/consents-and-licences/construction-requirements/approved-contractors/authorised-drainlayers/best-practice-guidelines>. Also refer to the Worksafe Good Practice Guideline Excavation Safety.

9.1 Length of Open Trench

The Contractor shall not have more than 50 metres of carriageway trench or footpath trench in a commercial area, or 100 metres elsewhere, open in the legal road at any time. When offsite, this open trench shall be reduced to a maximum length of not more than 10 metres.

9.2 Trench Width

The nominal width of trenches for diameters up to and including 150mm shall be 200mm wider than the nominal size of the pipe. Trenches for pipe diameters over 150mm shall be 300mm wider than the nominal size of the pipe. For pipes 63mm and below, where a trench digger may be used, its digging width shall be a minimum of 150mm.

9.3 Keeping the Excavation Free of Water

Subsoil water must be kept down below the bedding.

Should the Contractor fail to take adequate steps to keep the subsoil water down the Engineer shall require other methods to be adopted.

The Contractor shall be responsible for making good any lifting of the pipes due to the flooding of the trench.

9.4 Cover Over Pipes

When laying watermains 100mm and above, the top of the pipe shall have not less than 750mm cover at all times, unless approved by the Engineer.

When laying watermains smaller than 100mm, the following minimum pipe covers shall apply:

Metal pipes in carriageways or where likely to be crossed by vehicles

Metal pipes elsewhere

Plastic or other than metal pipes in carriageways or where likely to be crossed by vehicles

Plastic or other than metal pipes elsewhere

The cover over the main shall be increased where necessary to ensure the correct installation of valves and other fittings. The maximum cover shall not exceed 1.1m for watermains 100mm and above and 700mm for watermains smaller than 100mm, unless approved by the Engineer. Similarly depths may require adjustment where crossing other services.

9.5 Clearance to Existing Services

New services shall comply with the following clearances (from Table 1 and Table 2 – Utility Clearances of IDS: Part 9 - Utilities), unless approved otherwise by the Engineer.

Utility pairing	Clearance (mm)	
	Parallel	Crossin g
Water – pressure sewer	1000 110Ø 600 ≤110Ø	100
Water – gravity sewer	1000	100
Water - high voltage power	1000	150
Water – s/w, phone, gas	450	100
Water - low voltage power	300	100
Water submains – sewer, s/w, gas, phone, low voltage power	300	100
Water submains – pressure sewer	450	100
Water submains – high voltage power	300	150

The Contractor shall notify the Engineer if this clearance will be reduced at any time by the work. Wherever existing pressurised sewer mains cross over watermains the Contractor must notify the Engineer.

9.6 Extra Excavation Around Services

Extra excavation shall not apply until the cover of the pipe being laid exceeds 1.0m from the ground surface.

9.7 Geotextiles

Geotextiles shall fully wrap flexible pipe haunching and raft foundations, in accordance with the manufacturer's specification, where specified.

9.8 Measurement of Work and Basis of Payment

9.8.1 Excavation

Excavation shall include sawcutting, excavating to the required depth and nominal width, keeping the excavation free of water, trench support where necessary, removal and suitable disposal of excavated material from site, and all costs incidental to the work. Well pointing is not included in keeping the excavation free of water.

Excavation shall be included in the rate for the relevant scheduled item.

9.8.2 Trench Support

Trench support will only be paid where the Engineer orders its permanent installation. Trench support is measured per m² on the face area of the

trench supported, to the nearest square metre, and includes all materials and any work involved in permanent installation.

9.8.3 Extra Excavation Around Services

Extra Excavation will be paid per m³ solid volume of excavation ordered, to the nearest 0.1 m³, with the quantities being fixed by the depth, width and length of the required excavation.

This rate shall include all items necessary to carry out this work as stated under the scope of excavation above e.g. pumping, trench support.

9.8.4 Unsuitable Foundations

Unsuitable foundations will be paid per m³ solid volume of excavation ordered, to the nearest 0.1 m³, with the quantities being fixed by the depth, width and length of the required excavation.

This rate shall include all items necessary to carry out this work as stated under the scope of excavation above e.g. pumping, trench support.

9.8.5 Geotextiles

Geotextiles surrounds, cover over haunching materials and raft foundations shall be included in the rate for the relevant scheduled item. This rate shall include supply, installation, lacing or fixing and testing. No extra payment shall be made for laps or returns. Soft ground geotextiles shall be paid per square metre of geotextile laid. Raft foundations include geogrid, geotextile and GC64-40.

10.0 JOINTING

No jointing shall be permitted under water unless expressly approved.

10.1 Jointing of PVC-U Pipe

Jointing shall be carried out in accordance with AS/NZS 2032 “Installation of PVC pipe systems”, the manufacturer’s instructions and to the Engineer’s satisfaction. Solvent weld joints are not permitted.

10.2 Thermoplastic Jointing of Polyethylene Pipe by Electrofusion Welding

Jointing shall be carried out by approved welders in accordance with AS/NZS 2033 “Installation of polyethylene pipe systems”, the approved methodology and the pipe manufacturer’s instructions. Jointing shall not be carried out until the Engineer has received passing results of pre-construction pipe tests carried out in accordance with clause 17.2 – Polyethylene Pipe Weld Tests.

Water laterals and fire services do not require the provision of weld test results where comprising less than 5 joints in the length from the main to the legal boundary. These laterals shall undergo a visual inspection of all joints whilst under the adjacent network reticulation pressure. Photographic records of all

stages of the weld preparation and completion shall be provided with the as-built records.

Electrofusion couplings are not an acceptable jointing method for sections of PE pipeline that will be pulled into place.

10.2.1 Methodology

The Contractor shall submit a detailed jointing methodology through the Contract Quality Plan.

Individual methodologies shall be submitted for each diameter range and material being jointed. The jointing method contained in POP001 "Industry Guidelines for Electrofusion Jointing of PE Pipes and Fittings for Pressure Applications" should form the basis of the methodology.

10.2.2 Quality Assurance Records

The Contractor shall prepare a site welding log sheet template and submit this through the Contract Quality Plan. The log sheet shall be used to provide a detailed record of all joints carried out. As a minimum, the site welding log sheet shall provide the specified and actual fusion and cooling times, ambient conditions and the actual temperature of the pipe and coupler prior to jointing, corresponding to each weld number and certification number. The log shall also clearly identify the location of each joint unless the pipe is installed by trenchless methods.

The completed welding log shall be submitted to the Engineer as an as-built record.

A sample electrofusion welding log sheet is attached in CSS: Part 3 – Utility Drainage Appendix 5.

10.2.3 Operator Qualifications

Electrofusion jointing shall only be carried out by approved welders who have been named in the Contract Quality Plan. Approved welders shall hold the applicable registration on the Council Approved PE Welders Register for the pipe diameter range being welded.

A copy of the operator's registration shall be submitted through the Contract Quality Plan.

Diameter ranges are up to and including 250mm and over 280mm.

10.2.4 Equipment

Electrofusion jointing shall be carried out using automatic machinery designed for the pipe size. Manually operated welding machines are not acceptable. The machine shall not be changed without the Engineer's approval.

Two clamps supported on a frame shall ensure the alignment of the components and mating of the component ends. Re-rounding clamps of the appropriate size shall be used where necessary.

All equipment shall be well maintained and kept in a clean condition at all times. The equipment shall be serviced and calibrated regularly. The frequency at which this is carried out will be different for individual items of equipment and will also depend on usage, but should be at least once every 12 months. Guidance should be sought from the equipment manufacturer and a scheme of calibration and servicing implemented.

Particular attention shall be given to the control box, the generator and the peeling tools. The sharpness of the cutter head tools shall be monitored regularly and appropriate maintenance work carried out whenever the jointing surfaces show visible signs of ridges or grooves. If they have aluminium facer plates, use a cleaner that will remove aluminium oxide.

Suitable protection against inclement weather shall be provided, to prevent water, dirt and dust contamination and differential cooling of the pipes and couplings. Adequate working space shall be provided around the pipe in the trench to allow peeling and installation of equipment.

10.2.5 Pipe Preparation

The spigot end of the component shall be cut square and all rough edges and swarf shall be removed from the pipe ends.

The maximum 'out of roundness' of the pipe shall be 1.5% of the internal diameter. The maximum allowable gap between butted ends within an electrofusion fitting shall comply with the fitting manufacturer's requirements.

The pipe diameter and wall thickness shall be measured for compliance using the appropriate tools. Sections of the pipe experiencing pipe end reversion shall be removed.

After cleaning pipe ends shall be peeled to 0.3mm depth and for a distance equal to half the length of the coupling plus 20mm to remove dirt and oxidation. This should be peeled to a smooth profile using a sharp rotational peeler. The exposed ends of the pipe strings shall be covered until cooling is complete, to prevent any air flow which may heat or cool the pipe. Covers on fittings shall be retained until immediately before welding.

All jointing surfaces shall be clean, dry and free of all contamination before being assembled. Iso-propyl alcohol complying with the manufacturer's concentration requirements and a lint-free disposable

wipe shall be used to remove any oil or grease films. Mark witness marks with a non-contaminating marker.

The pipe and coupler shall have a minimum allowable temperature of 5°C prior to jointing. Where this cannot be achieved naturally, the Contractor shall submit a methodology for heating the pipe and coupling through the Contract Quality Plan.

10.2.6 Welding

Each electrofusion joint shall be identified with the operator's registration number and date welded, applied in a legible and durable form. Individual joint details shall be recorded on the log sheet (refer appendices for an electrofusion log sheet example).

The manufacturer's recommended Standard Fusion Times (SFT) shall be entered into the control box using the appropriate methods required by the type and model of control box.

- *For automated systems, the resistor lead shall be connected to the resistor terminal pin of the coupling.*
- *For bar code systems, the light pen shall be wiped across the code panel to enter the fusion times.*
- *For magnetic card systems, the card shall be placed into the control unit reader to enter the fusion times.*

The pipe and fittings shall be pre-heated to manufacturer's requirements if required.

The pipes shall be restrained in position during welding at the centreline height of the coupling, to prevent movement and the application of stress during the fusion process. The pipes shall be horizontal either side of the clamps to prevent both pulling away from the coupling joint and the entry of water or dirt into the pipe, which may contaminate the weld zone.

The welded joint shall be kept immobile for the full cooling times, before removing clamps or moving the joint assembly. No attempts shall be made to accelerate the rate of cooling.

10.2.7 Pipeline Recovery after Pulling in/Cooling of Heated Pipe

The polyethylene pipeline shall be allowed to recover from the effects of thermal expansion and installation stretching. The pipeline shall not be restrained by rigid connections until the pipeline temperature reaches ground or service temperature. Where the pipeline is installed by trenchless methods, a minimum period of 24 hours shall be allowed after installation before connecting the pipe to any rigid connections including previously installed pipelines, bends and valves.

10.3 Site Butt Fusion Jointing of Polyethylene Pipe and Fittings

Jointing shall be carried out by approved contractors in accordance with AS/NZS 2033 “Installation of polyethylene pipe systems”, the approved methodology and the manufacturer’s instructions. Jointing shall not be carried out until the Engineer has received passing results of pre-construction pipe tests carried out in accordance with clause 17.2 – Polyethylene Pipe Weld Tests.

Unless the manufacturer gives explicit permission and provides details of specific welding procedures, butt fusion jointing shall only be used to join pipes and fittings that are:

- *composed of similar materials (PE 80 shall be welded to PE 80, PE 100 shall be welded to PE 100);*
- *the same nominal diameter;*
- *the same wall thickness measured by Pressure Number (PN) or Standard Dimension Ratio (SDR).*

The Contractor shall plan the jointing, installation and tensile testing to minimise the number of electrofusion couplers used.

Water laterals and fire services do not require the provision of weld test results where comprising less than 5 joints in the length from the main to the legal boundary. These laterals shall undergo a visual inspection of all joints whilst under the adjacent network reticulation pressure. Photographic records of all stages of the weld preparation and completion shall be provided with the as-built records.

10.3.1 Methodology

The Contractor shall submit a detailed jointing methodology through the Contract Quality Plan. Individual methodologies shall be submitted for each diameter range and pipe material type being jointed.

The methodology shall detail the parameters, as listed in clause 10.3.2 – Quality Assurance Records, which are necessary to meet the requirements of this specification. It shall also reference the procedures applied to achieve consistent and high quality joints. This methodology shall include (but not necessarily be limited to) the following information:

- the make and model of the butt fusion jointing machine;
- the cylinder area;
- the weld method to be used (e.g. single phase or dual phase);
- the name and qualifications of the approved operator;
- details of the pressure gauge, including the make, dial diameter, pressure range, smallest graduation value and the date of last calibration;
- specific parameters for each nominal pipe diameter, wall thickness and pipe material type to be jointed;

The weld parameters contained in the latest version of POP003 "Industry Guidelines for Butt Fusion Jointing of PE Pipes and Fittings - Recommended Parameters" should form the basis of the methodology.

CSS: Part 3 – Utility Drainage Appendix 2 provides general requirements for site butt fusion jointing.

10.3.2 Quality Assurance Records

The Contractor shall prepare a site jointing log sheet template and submit this through the Contract Quality Plan. The log sheet shall be used to provide a detailed record of all joints carried out. As a minimum, the site jointing log sheet shall provide the following details:

- *Pipeline name/description*
- *Joint location, accurate enough to locate the joint within one pipe length, unless the pipe is pulled into place.*
- *Weld date and time*
- *Operator name and ID number*
- *Pipe nominal diameter*
- *Pipe SDR or PN*
- *Pipe material (PE 80, PE 100)*
- *Pipe manufacturer's name and pipe identification*
- *Wall thickness (t, nearest 1 mm)*
- *Cooled bead height & width (mm)*
- *Confirmation that the weld parameters have been met (as below).*
 - Pipe annular area (A, mm²)*
 - Hydraulic cylinder area (a, mm²)*
 - Heater plate temperature (°C)*
 - Bead-up pressure (P1, kPa)*
 - Bead-up time (T1, seconds)*
 - Heat soak pressure (P2, kPa) (= drag pressure only)*
 - Heat soak time (T2, seconds)*
 - Change-over time (T3, seconds)*
 - Time to achieve welding pressure (T4, seconds)*
 - Welding and cooling pressure (P3, kPa)*
 - Cooling time (T5, seconds)*

The results shall be presented in tabular form, along with the printouts from the fusion jointing machine.

The completed welding log shall be submitted to the Engineer as an as-built record.

10.3.3 Operator Qualifications

Butt fusion jointing shall only be carried out by approved welders who have been named in the Contract Quality Plan. Approved welders shall hold the applicable registration on the Council Approved PE Welders Register, for the pipe diameter range being welded.

Diameter ranges are up to and including 250mm and over 280mm.

A copy of the operator's registration shall be submitted through the Contract Quality Plan.

10.3.4 Equipment

The welder shall have previous experience on the nominated welding machine. The machine shall not be changed without the Engineer's approval.

The machine shall have either automatic logging facilities incorporated or be retrofitted with suitable logging facilities.

All equipment, but particularly the electrically heated plate, shall be well maintained and kept in a clean condition at all times. The equipment shall be serviced and calibrated as recommended by the manufacturer. The pressure gauge shall be graduated to be reliably readable to 10 kPa or less and calibrated at least within the last six months.

The heater plate shall be undamaged and temperature controlled to be between 205°C and 235°C over both sides of the whole plate. A portable surface probe pyrometer capable of measuring the plate surface temperature to $\pm 1^\circ\text{C}$ shall be used to confirm this.

The sharpness of the planer or facing tool shall be monitored regularly and appropriate maintenance work carried out whenever the jointing surfaces show visible signs of ridges or grooves.

Suitable protection against inclement weather shall be provided, to prevent differential cooling of the pipes and dirt, dust or water contamination e.g. a tent.

Ancillary equipment shall include:

- *the clamping device with one fixed and one movable clamp, supported on a rigid frame.*
- *pipe support rollers or skids.*
- *pipe end plugs or caps.*
- *the weld bead measuring gauge.*
- *iso-propyl alcohol and lint-free disposable wipes.*
- *a clean ground sheet or baseboard.*

10.3.5 Pipe Preparation

The Contractor shall follow the approved welding methodology.

The pipe and fittings shall have a minimum allowable temperature of 5°C prior to jointing. Where this cannot be achieved naturally, the

Contractor shall submit a methodology for heating the pipe and fittings through the Contract Quality Plan.

All jointing surfaces, including the heater plate, shall be clean, dry and free of all contamination.

The proposed joint interface shall not show any misalignment of more than 1mm for pipe diameters between 90mm and 315mm and of 2mm for pipe diameters between 355mm and 630mm. The maximum allowable diametric mismatch ("step" in the pipe OD at any proposed butt fusion joint) is 10% of the measured wall thickness.

End gaps between faces to be welded shall not exceed the following values:

<i>Pipe Diameter DN (mm)</i>	<i>Minimum Gap (mm)</i>
<i>Up to 225</i>	<i>0.3</i>
<i>280 to 450</i>	<i>0.5</i>
<i>500 to 630</i>	<i>0.6</i>
<i>710 to 900</i>	<i>0.7</i>
<i>1000 and above</i>	<i>1.0</i>

10.3.6 Welding

Each butt fusion joint shall be identified with the operator's registration number and date welded, applied in a legible and durable form. Individual joint details shall be recorded on the log sheet, (refer appendices for a log sheet example).

The welded joint shall be kept immobile for the full cooling times, before removing clamps or moving the joint assembly. No attempts shall be made to accelerate the rate of cooling.

10.3.7 Bead Profile

The bead faces shall be smooth and free from pitting bubbles. If pipes are any colour other than black, there shall be no discolouration of the weld bead material.

The joint beads shall be rounded and uniformly sized around the entire pipe circumference. In general, the "V-groove" between the beads should not be deeper than half the bead height above the pipe wall. However, provided that each half of the final bead is of a similar size and shape and tensile testing shows that the strength and failure mode meet the requirements of this specification, the overall width and height of the bead should not be a critical factor in the assessment of a butt fusion joint.

Guidelines from POP 003 for the joint bead width are:

<i>Minimum Wall Thickness (mm)</i>	<i>Width of Bead (mm)</i>
11	9-12
13	10-14
16	11-15
18	12-16
19	12-18
22	13-18
24	14-19
28	15-20
30	16-22

Neither internal nor external beads shall be removed, unless specified.

10.3.8 Joint Failure during Handling and Installation

If a joint fails during handling and installation, the Contractor shall inform the Engineer immediately. The Contractor shall provide the Engineer with the failed joint identification number and details of proposed actions to determine if the failed joint is an isolated incident or if it is a symptom of a more widespread problem, through the provision of a Non-Conformance Report.

No further pipe installation shall take place until the corrective action is accepted.

10.4 Measurement of Works and Basis of Payment

Jointing shall be included in the pipe installation rate.

11.0 PIPE INSTALLATION

11.1 Handling

All pipes shall be transported, haunched and installed in accordance with the manufacturer's instructions. Polyethylene pipe shall be installed in accordance with AS/NZS 2033 "Installation of polyethylene pipe systems"

Polyethylene pipe shall be installed with curving radii greater than 100 x OD of the pipe where the pipe may be tapped on the bend or radii greater than 75 x OD otherwise and the pinching or squashing of polyethylene pipe to facilitate the installation of fittings is not permitted.

PVC-U pipe shall be installed in accordance with AS/NZS 2032 "Installation of PVC pipe systems", except where amended in this specification.

11.2 Cleanliness

Internal pipe walls shall at all times during the Contract be kept clean and free of all dirt, rubbish, water, etc.

If pipes are delivered plugged or capped, they shall remain plugged or capped as long as practical.

11.3 Leaks

The Contractor shall repair all leaks detected up to the end of the defects liability period.

11.4 Pipe Installation by Trenching

11.4.1 Hillside definition

Hillside is defined as any location where either the pipe gradient or surface slope directly uphill or downhill is steeper than 1 in 20 and any location adjacent to hilly areas.

11.4.2 Bedding

Bedding is haunching and surround constructed of imported material placed to the full width of the trench up and around the pipe to the top of the surround.

All metal bedding shall be hand compacted around the pipework without causing unequal loading or damage of any sort. At least 90% of the maximum dry density (MDD) shall be achieved at any point on any bedding. Bedding constructed of M/4: AP20 shall be compacted to the greater of the manufacturer's requirements or a minimum dry density of 2,050kg/m³ at any point.

Nuclear densometer use shall comply with CSS: Part 1 clause 32.5.1 – Compaction Tests. The dry density shall be determined in accordance with NZS 4402.4.1.3 “New Zealand vibrating hammer compaction test”.

11.4.3 Bedding Material

The pipe shall be bedded with NZTA M/4:AP20, unless otherwise specified.

11.4.4 Bedding Requirement

Haunching and surround shall be in accordance with SD 410 and the manufacturer's specifications.

11.4.5 Watermain Location

The pipe shall be installed within 50mm of the specified horizontal offset on straight lines or within 200mm on continuous curves.

11.4.6 Submains

63mm and smaller diameter submains shall be installed at an offset of 150mm ± 50mm from the boundary unless otherwise specified.

The submain pipework shall be connected into existing pipework as specified.

11.5 Water Stops

Water stops shall be constructed where specified in accordance with SD 347 or as specified.

11.6 Pipe Protection

Where cover over flexible pipes is less than the minimum stated in clause 9.4 – Cover Over Pipes, provide a non-conformance report as detailed in IDS, clause 3.7 – Non-conformance and quality improvement. A concrete protection slab shall be constructed in accordance with SD 342 Type E.

When reinstating a concrete protection slab, the slab shall extend onto undisturbed ground each side of the trench.

11.7 Polyethylene Pipe Installation by Trenchless Technology

Pipe installation by trenchless technology may be by pipe bursting, sliplining or directional drilling.

Gouging or notching of the pipe shall not exceed 10% of the pipe wall thickness for pressure pipe.

The load applied to the pipe during pulling shall not exceed the specified allowable load.

Where gouging or notching exceeds the above limits or if buckling of the pipe occurs that length of pipe shall be removed and a new section welded in at the nearest joins.

The Contractor shall overpull an extra metre of pipe for each continuous 200m length of pulled pipe. The excess pipe length shall be supplied to the Engineer for a visual inspection.

11.7.1 Polyethylene Pipe Installation by Slip Lining

The host pipe shall be cleaned to provide a clear pipe diameter that passes the new polyethylene pipe without gouging or notching the pipe.

Disposal of the cleanings shall be carried out in accordance with CSS: Part 1 - General.

The Contractor shall not detrimentally affect the host pipe when cleaning it. The most effective method of cleaning steel pipes in Christchurch is through physical scraping.

Prior to any attempt to pull in the new polyethylene pipe a plug, no less than the diameter of the new pipe, shall be passed through the host pipe to ensure there is sufficient clearance.

11.7.2 Polyethylene Pipe Installation by Directional Drilling

The constructed pipe alignment shall not vary more than 100mm horizontally from the design alignment and the tolerance on the vertical alignment shall not exceed the specified amount.

Cover to pipes of 100mm diameter or greater shall not be less than 750mm, unless approved by the Engineer. Cover to pipes smaller than 100mm in carriageways or where likely to be crossed by vehicles shall be 600mm and elsewhere cover shall be 450mm.

The following shall be the maximum allowable depths to top of pipe:

<i>Submains (<100 mm ID)</i>	<i>700 mm</i>
<i>Crossovers (<100 mm ID)</i>	<i>700 mm</i>
<i>Mains (≥ 100 mm ID)</i>	<i>1100 mm</i>

Clearances to services shall be as set out in clause 9.5 – Clearance to Existing Services. The Contractor shall be liable for damages to any underground services.

All liquid waste shall be disposed of in accordance with CSS: Part 1 - General.

The Contractor shall accurately monitor the position of the drilling head to achieve the above requirements. Provide the design depth and drilling tolerances before commencing work.

11.8 Access Pits

<i>Pit Depth</i>	<i>Minimum pit length for pipe diameter</i>			
	<i>110mm</i>	<i>160mm</i>	<i>200mm</i>	<i>250mm</i>
<i>0.6</i>	<i>3.0</i>	<i>3.6</i>	<i>4.2</i>	<i>4.6</i>
<i>0.8</i>	<i>3.4</i>	<i>4.2</i>	<i>4.8</i>	<i>5.2</i>
<i>1.2</i>	<i>4.2</i>	<i>5.0</i>	<i>5.8</i>	<i>6.4</i>
<i>1.6</i>	<i>4.8</i>	<i>5.8</i>	<i>6.6</i>	<i>7.4</i>
<i>2.0</i>	<i>5.2</i>	<i>6.4</i>	<i>7.2</i>	<i>8.2</i>
<i>2.4</i>	<i>5.6</i>	<i>7.0</i>	<i>8.0</i>	<i>8.8</i>
<i>2.8</i>	<i>6.0</i>	<i>7.4</i>	<i>8.4</i>	<i>9.6</i>
<i>3.2</i>	<i>6.2</i>	<i>7.8</i>	<i>9.0</i>	<i>10.0</i>
<i>3.6</i>	<i>6.6</i>	<i>8.2</i>	<i>9.4</i>	<i>10.6</i>

Assumptions:

- a) New pipe is parallel with the road at the start of the pit and parallel (and in line) with the old pipe at the end of the pit. If this does not apply, calculate the minimum pit length from (b).
- b) Table is based on a PE pipe bend radius minimum of 35 times pipe OD.

Pipes shall be haunched through any pits in accordance with clause 11.4 – Pipe Installation by Trenching.

11.9 Measurement of Works and Basis of Payment

Pipe installation shall include shutting off and turning on the water supply during the works.

11.9.1 Pipe Installation by Open Trenching

Payment for pipe installation shall be per lineal metre, to the nearest metre, based on the pipe length installed, including the distance over bends, tees, crosses, thrust blocks etc.

Pipe installation includes excavation as detailed in clause 9.0 - Excavation, installation of all pipework, jointing, installation of in-line fittings and thrust blocks, bedding, backfill and testing. Final surfacing is scheduled separately.

11.9.2 Pipe Installation by Pipe bursting

Payment for pipe installation shall be per lineal metre, to the nearest metre, based on the pipe length installed, including pits and welds. Pipe installation shall include the location of services, pipe bursting, pulling the pipe, haunching and backfilling in pits, provision of samples and testing as detailed in clause 17.0 – Performance Testing.

Where additional pipe is pulled to provide a sample for visual inspection of notching and gouging, the Contractor will be paid for one metre only.

11.9.3 Pipe Installation by Slip Lining

Payment for pipe installation shall be per lineal metre, to the nearest metre, based on the pipe length installed, including pits and welds. Pipe installation shall include cleaning the host pipe and checking for clearances, pulling the pipe, haunching and backfilling in pits, provision of samples and testing as detailed in clause 17.0 – Performance Testing.

Special anchor blocks are separately scheduled and shall include all materials and labour.

Where additional pipe is pulled to provide a sample for visual inspection of notching and gouging, the Contractor will be paid for one metre only.

11.9.4 Pipe Installation by Directional Drilling

Payment for pipe installation shall be per lineal metre, to the nearest metre, based on the pipe length installed including pits and welds. Pipe installation shall include determining the alignment, drilling, haunching and backfilling in pits, provision of samples and testing as detailed in clause 17.0 – Performance Testing.

Where additional pipe is pulled to provide a sample for visual inspection of notching and gouging, the Contractor will be paid for one metre only.

11.9.5 Water Stops

Payments shall be per item.

11.9.6 Pipe Protection

Concrete protection slabs are paid per lineal metre, to the nearest 0.1m, and shall include joint formers.

12.0 FITTINGS

Metal flanges shall comply with AS/NZS 4087:2011 “Metallic flanges for waterworks purposes” and have a flange pressure rating of PN16. Flanges should be raised face flanges.

Mechanical couplers shall only be used on polyethylene pipe where it is less than 125mm diameter.

Gibault joints and any other exposed metal components shall be thoroughly wrapped in place with a petrolatum impregnated two layer tape system. Mastic filler shall be applied to fill voids and create a smooth surface for tape application. Primer, filler and tapes shall be applied in strict accordance with the manufacturer’s specifications.

When installing branch saddles, the hole shall be drilled with a fine toothed hole saw after fitting and pressure testing the saddle, where appropriate. Spade bits must not be used.

12.1 Fasteners

Bolts and washers fitted to metal flanges shall comply with AS/NZS 4087. All carbon steel bolts should be no less than class 8.8 and should be hot dip galvanised. All stainless steel bolts shall be grade 316 or PERN \geq 20.

Washers shall be installed under both nuts and bolt heads. Washers shall be of the same material as the bolt and fitting. Wherever they are different, they shall be isolated from dissimilar materials by inserting nylon washers between the differing surfaces (including where metallic flanges are coated to AS/NZS 4158 “Thermal-bonded polymeric coatings on valves and fittings for water industry purposes”). Washers shall be appropriately sized for the bolt diameter and be a minimum 3mm thickness, increased to 5mm for bolts greater than M24.

Bolt torque shall be between 60-65% of proof stress for the diameter of bolt when tightened, adjusted by the manufacturer's recommended surface treatment/condition factor for the bolt thread.

12.2 Valves, Fire Hydrants and Surface Boxes

12.2.1 Valves

The spindles of all valves shall be installed perpendicular to the road surface. Square valve spindle caps complying with SD 420 shall be installed on all spindles. Sluice valve spindle caps shall not be set less than 100mm below the finished level.

The Engineer may require the Contractor to install a pipe sleeve to surround the valve spindle. The sleeve shall extend from the top of the valve up into the valve surface box. The Contractor shall be responsible for ordering the length of the sleeve and installing it so that any incidental loads placed on the valve surface box are not transferred onto the valve itself.

12.2.2 Fire Hydrants

Hydrants shall be installed in line with the main and with valve spindles vertical. The correct sized riser shall be bolted to the hydrant tee to bring the top of the hydrant spindle cap not less than 100mm and not more than 300mm below the finished level.

12.2.3 Surface Boxes

Hydrant and valve surface boxes shall be firmly bedded and accurately positioned on precast concrete frames in accordance with SD 412. The box shall protrude not more than 5mm above the surface and shall lie parallel to the plane of the finished surface. Hydrant surface boxes shall be positioned so that the long side is parallel to the main.

Precast concrete frames shall be constructed in accordance with SD 405 and CSS: Part 3 clause 12.0 - Structures.

The width of the excavation for any surface box shall be 200mm wider than the surface box's width.

Wood, bricks or in-situ poured concrete shall not be used to make small adjustments in surface level.

12.2.4 Roadmarking

When the section of main has been completed the Contractor shall mark the fire hydrants and sluice valves in accordance with clause 19.0 – Location Marking of Fire Hydrants and Sluice Valves.

12.2.5 Measurement of Works and Basis of Payment

The scheduled rate per item includes excavation and disposal of spoil, bedding, installing valves or fire hydrants, precast thrust blocks, precast concrete frames and surface boxes, backfill and roadmarking. It also includes installing sleeves to valve spindles and risers and blue markers to fire hydrants, where required. Final surfacing is scheduled separately.

12.3 Tees, Crosses, Bends, Reducers

12.3.1 Measurement of Works and Basis of Payment

The scheduled rate per item includes excavation and disposal of spoil, bedding, installing tees, crosses, bends or reducers, precast thrust blocks, and backfill. Final surfacing is scheduled separately.

12.4 Surface Boxes Installed or Adjusted Separately from Watermain Works.

Surface boxes shall be installed or adjusted in accordance with clause 12.2 – Valves, Fire Hydrants and Surface boxes or clause 16.3 – Fittings for Consumer Connections. Restoration shall be as specified below and shall be completed within 48 hours of backfilling within carriageways, Roadmarking shall be carried out in accordance with clause 19.0 – Location Marking of Fire Hydrants and Sluice Valves.

Restoration outside of existing carriageway surfaces shall comply with the construction requirements of CSS: Part 6 - Roads or Part 2 - Earthworks and Part 7 - Landscapes for that type of work.

Where the surface box shall be installed or adjusted within the carriageway after the surrounding area has been restored, restoration shall be carried out in accordance with the following requirements. These requirements shall also apply where the surface boxes being adjusted are in existing permanent surfacing within the carriageway.

Boxes shall be wrapped in plastic. 200mm width of high slump rapid hardening concrete shall be placed around the box from the compacted base level to within 50mm of the finished surface. The remaining 50mm shall be compacted AC14 or DG10 asphaltic concrete.

12.4.1 Measurement of Works and Basis of Payment

The installation or adjustment of surface boxes includes excavation and disposal of spoil, bedding, installing precast concrete frames and surface boxes, backfill, final surfacing and roadmarking. It also includes installing blue markers to fire hydrants, where required.

12.5 Thrust Blocks

12.5.1 Location

A concrete thrust block shall be located at each bend, tee, etc on all pipes over 50mm internal diameter unless specified otherwise.

Generally this shall be at all changes in direction greater than and including 11.25 degrees.

12.5.2 Site Constructed Thrust Blocks

Thrust blocks shall be constructed as designed in the locations specified and shall have a 28 day concrete strength of 17.5 MPa. The concrete must have developed adequate strength and cured for 48 hours before the main is pressure-tested.

Bolts and nuts shall be freely accessible. The pipe shall be wrapped for the length of the thrust block at the concrete interface. Wrapping shall be a compressible material and provide a 6mm installed barrier to the pipe. The wrapping shall prevent gouging of the pipe.

Thrust blocks shall be poured against natural ground. The bearing capacity of the natural or filled ground shall be checked, to ensure it complies with the design capacity, before construction. Proof of this testing shall be provided through the Inspection and Test Schedule in the Contract Quality Plan.

The contact area of the site constructed thrust block will be specified.

12.5.3 Precast Thrust Blocks

Precast thrust blocks shall be constructed in accordance with SD 406 and CSS: Part 3 clause 12.0 - Structures.

Sufficient bracing shall be installed to precast concrete thrust blocks to ensure they do not move when the pipeline is pressurised.

The bearing capacity of the natural or filled ground shall be checked, to ensure it complies with the design capacity, before installation. Proof of this testing shall be provided through the Inspection and Test Schedule in the Contract Quality Plan.

Precast concrete thrust blocks are normally sufficient for 150mm or smaller mains. Watermains 200mm diameter and greater require specific design.

12.5.4 Measurement of Works and Basis of Payment

The installation of precast thrust blocks is included in the rate for the fitting to which they apply.

Site constructed thrust blocks are separately scheduled items. These items shall include all materials and labour.

These items shall include for confirming the capacity of the ground on which the thrust block bears through site testing.

12.6 Anchor Blocks

Anchor blocks shall be constructed of 17.5 MPa concrete, to the specified dimensions and in accordance with SD 411.

The PVC pipe shall be wrapped for the length of the anchor block at the concrete interface. Wrapping shall be a compressible material and provide a 6mm installed barrier to the pipe. The anchor block shall have a drain hole.

The wrapping shall prevent gouging of the pipe under lateral movement. The drain hole shall allow minor groundwater movement.

12.6.1 Location

Gradient anchor blocks shall be positioned behind the pipe collars at the spacings stated below:

<i>Gradient</i>	<i>Spacing of anchor blocks in metres</i>
<i>1:2</i>	<i>6</i>
<i>1:3</i>	<i>6</i>
<i>1:4</i>	<i>12</i>
<i>1:5</i>	<i>18</i>
<i>1:6</i>	<i>24</i>

12.6.2 Measurement of Works and Basis of Payment

Gradient anchor blocks include excavation and disposal of spoil, the provision of all materials including pipe wrapping, construction of drain holes and backfill.

12.7 Removal of Redundant Fittings

Redundant sluice valves and fire hydrants shall be removed and returned to the Council's water reticulation maintenance contractor. The Contractor shall provide the following information to Council and tag all removed meters and sluice valves with:

- *Name of authorised installer who removed the fitting*
- *Date fitting removed*
- *Meter serial number*
- *Meter Reading*
- *Fitting okay to be reused Y/N*
- *Valve Type*
- *Date fitting delivered to maintenance contractor.*

The redundant pipe shall be plugged with concrete. Redundant roadmarking shall be removed in accordance with clause 19.0 – Location Marking of Fire Hydrants and Sluice Valves.

The Contractor shall dispose of all other removed materials.

Blank ends fitted to remove redundant infrastructure shall be installed immediately adjacent to the live main or submain.

The disturbed area shall be reconstructed in accordance with clause 13.0 - Backfilling and clause 18.0 – Final Surfacing.

12.7.1 Measurement of Works and Basis of Payment

Removal of redundant fittings includes excavation and disposal of spoil, removal of fittings, plugging of redundant pipes, return of recycled materials, and disposal of other materials, removal of redundant roadmarking, backfill and final surfacing.

13.0 BACKFILLING

Backfilling shall be in accordance with CSS: Part 1 - General.

13.1 Materials.

Backfill shall be the specified imported material, unless the Engineer approves the use of the excavated material as backfill.

13.2 Treatment of Under-runners

The Contractor shall notify the Engineer of any under-runners, erosion cavities or tunnel gullies encountered during excavation. The Engineer shall advise on under-runner treatment.

The Engineer may order the Contractor to bridge any suspect area with ductile iron pipe. Such work will be paid as a variation to the contract.

13.3 Quality Assurance

The Contractor shall provide records of compliance tests carried out on backfill as required by CSS: Part 1 – General, to comply with IDS: Part 3 - Quality Assurance.

Records of these tests shall be supplied at regular intervals, to provide confirmation of ongoing testing. Details of the proposed methods and frequency of such activities, and the reporting of these, shall be set out in the Contractor's Contract Quality Plan.

13.4 Measurement of Works and Basis of Payment

13.4.1 Backfill

Backfill includes the supply of materials, placement, compaction and testing. It also includes the provision of testing records.

Backfill to subgrade level under berms and to presealing level elsewhere shall be included in the rates for the scheduled item being backfilled (e.g. pipe installation, fire hydrant). Final surfacing is paid under a separate item, except where detailed in both clauses 15.4 and 16.5 – Measurement of Works and Basis of Payment.

13.4.2 Treatment of Under-runners

The treatment of under-runners will be paid by the solid volume filled, to the nearest m³. This rate shall include any labour and equipment.

The installation of ductile iron pipe, where ordered, will be paid by the lineal metre and shall include all labour and connections.

13.4.3 Filling to Unsuitable Foundations

Filling to unsuitable foundations shall be paid per m³ solid volume of fill placed, to the nearest m³, and shall include all work involved as stated under backfill above. Measurement of filling shall be determined from the volume of unsuitable foundations being filled.

14.0 CONNECTING INTO EXISTING SYSTEM

A Water Supply Authorised Installer shall carry out all connections to the existing Council water supply in accordance with the Authorised Water Supply Installer Specification.

The Authorised Installer shall ensure that no dirt or debris enters the existing system and that all valves, hydrants to be utilised in the connection/join-in are visible, open and in operational order.

To facilitate chlorination and pressure testing, one end of the new reticulation may be connected to the network providing:

- It is not at the lower end of a hill site
- A sluice valve is installed immediately after the cut-in tee where there is no fire hydrant nearby. This valve can be opened to charge the new main prior to commissioning.

- A temporary red dolly cap with tag and chain labelled 'Closed Under Construction' shall be placed on the valve until the main is chlorinated. The water installer shall keep a record of the location of these dolly caps.

Pressure tests and chlorination shall be completed and accepted by Council before the final connections are undertaken.

Faulty valves and hydrants shall be reported to the Engineer prior to joining in.

14.1 Measurement of Works and Basis of Payment

Connecting into the existing system includes excavation and disposal of spoil, the cutting of pipes to facilitate the joining of pipework, the sterilisation of all fittings, materials and equipment required by the Authorised Water Installer's Specification, all jointing, flushing through fire hydrants and backfill.

Connecting into the existing system shall be included in the rate for pipe installation, where not scheduled separately.

15.0 STERILISATION OF NEW MAIN

Sterilisation shall be carried out prior to any consumers being changed over from the existing pipework that is being replaced and prior to commissioning new reticulation. The Contractor shall obtain approval from the Council prior to commissioning new reticulation.

Contact Council on watertests@ccc.govt.nz.

15.1 Chlorinating Point

15.1.1 Temporary Fitting

The Contractor shall install a temporary chlorinating fitting, where specified. After sterilisation, the Contractor shall remove the temporary fittings and plug the tapping band.

15.1.2 Permanent Fitting

The Contractor shall install the temporary chlorinating fitting to the permanent tapping band and remove after sterilisation.

15.2 Sterilising

The Contractor shall arrange sterilisation of each section of new reticulation by an approved chlorinator once a passing pressure test is received. Council shall witness the confirmation of the Free Available Chlorine level (FAC) after 24 hours contact time. 24 hours' notice shall be given to Council of the chlorination.

Approved chlorinators are listed on the Council webpage <https://www.ccc.govt.nz/consents-and-licences/construction-requirements/approved-contractors/chlorination-contractors/> Sterilisation will take approximately 24 hours for each section.

Sterilisation water shall be either:

- *flushed into the sanitary sewer system when the free available chlorine is below 5g/m³,*
- *removed off site;*
- *discharged to ground in a manner approved by Council.*

15.3 Bacteriological Testing

The approved chlorinator shall take samples from each section of new sterilised reticulation for bacteriological testing.

Bacteriological testing will take approximately 72 hours for each section.

Measurement of Works and Basis of Payment

Sterilisation includes excavation and disposal of spoil, installation and removal of temporary fittings, sterilisation, disposal of chlorination water, backfill and final surfacing.

16.0 CONSUMER CONNECTION

Consumer connections shall be installed in accordance with SD 403. Where the submain is constructed from galvanised pipe, the connection shall be constructed using brass fittings to mitigate contamination of the water supply.

Where not part of a building consent, individual connections (including air gap separators) will not be installed until applied for by the consumer, using form WS1. More information is available at

<https://ccc.govt.nz/consents-and-licences/building-consents/types-of-projects/inside-and-around-your-property/connection-to-the-council-water-supply>

16.1 Connection Position

The connection shall be within 500mm of the legal boundary, in the legal road, common land or the right of way and outside of the driveway construction. Where insufficient space exists outside of the driveway construction, a heavy-duty water meter box shall be used. The connection shall be relocated at the Contractor's cost if it does not comply with these criteria.

16.2 Changing Consumer Connections to New Pipework

The Contractor shall maintain continuity of supply wherever practical. The Contractor shall take all reasonable precautions to prevent these activities from causing defects to the consumer's plumbing systems.

16.3 Fittings for Consumer Connections

Existing stopcocks, water meters, water meter boxes, etc shall be used wherever possible.

16.3.1 Removal of Existing Stopcocks

Stopcocks shall be replaced if:

- leaking water.
- constructed of plastic.
- not operating.
- backflow prevention is not functioning.

16.3.2 Installation of Stopcock

The stopcock shall be totally free of any spoil. The spindle shall be vertical and compliant with SD 403. All fittings from the stopcock to the last tail shall be fully visible within the meter box. Flushing of the connection shall be made in accordance with clause 16.4 – Flushing of Reconnection before water is turned back on to the property.

If the existing stop tap only (i.e. a previously unmetered supply) is within private property, the Contractor shall install a new stopcock and meter in the legal road, common land or right of way.

16.3.3 Reuse of Water Meters

The existing water meter shall be reinstalled onto that property's supply unless the Engineer requires its replacement.

This is vital to ensure integrity of meter records and water consumption data.

Water meters shall be replaced if:

- unreadable.
- not working.
- leaking.
- an old multi-dial type.
- giving inaccurate readings.
- likely to cause future replacement problems through its use.
- backflow prevention is not functioning.

Whenever a meter is not reused at a property, the Contractor shall record the following data on a form similar to that in the appendices 'Water Meter Exchange: Record Sheet' and forward the form to the Engineer:

- street address
- serial number of the meter being removed
- serial number of the new meter being installed
- reading of the meter being removed
- date of the meter change

16.3.4 Water Meters over 20mm Diameter

At the meter location, property supply pipes under 100mm diameter shall have a maximum of 600mm cover from the top of the pipe to the finished ground level. Property supply pipes over 100mm diameter shall have a maximum of 750mm cover from the top of the pipe to the finished ground level. Meters shall be installed so the dial is readable from directly above.

Approval shall be obtained from the Engineer prior to installing meters with covers exceeding that specified.

Care shall be taken to ensure the meter is installed correctly for the direction of flow.

16.3.5 Reuse of Water Meter Boxes

Boxes, which cannot provide access to both the water meter and stopcock together, shall be removed.

16.3.6 Installation of Water Meter Boxes

The stopcock shall operate freely in the water meter box and shall not be in contact with the box. The water meter box shall be placed flush with the surrounding surface with the longer side parallel to the legal boundary.

Where there is a likelihood of vehicles driving over boxes, heavy-duty water meter boxes shall be used and these shall be installed on precast concrete frames. Heavy duty boxes may incur additional costs to the customer or contractor.

16.3.7 Multiple Meters

Multiple meters installations (over 5 boxes in the same location) shall be housed in a single large box. The box shall be located outside trafficked areas.

Non-standard and multiple meter box design drawings and specifications must be approved by Council prior to installation.

16.3.8 Backfill and Final Surfacing

Backfill and final surfacing shall be in accordance with CSS: Part 1 - General.

16.4 Flushing of Reconnection

The Contractor shall open the front outside hose tap, if available, before the supply is reinstated to any premises. Wherever possible, the owner shall be notified prior to this work.

The hose tap shall not be closed until the supply runs clear and any debris dislodged by the reconnection work is flushed to waste.

16.5 Measurement of Works and Basis of Payment

Payment shall be per consumer's connection. The connection shall include excavation and disposal of spoil, installation of all fittings to connect the consumer's supply to the new pipework, including water meter boxes, provision of records as detailed above, flushing, backfill and final surfacing.

Locating and/or shifting the connection into the legal road and any subsequent pipework required shall also be included in the connection. Transport of new and recycled materials and disposal of unfit materials shall be included in this rate.

17.0 PERFORMANCE TESTING

The Contractor shall perform tests as detailed below on all newly installed pipework. The Engineer and Council shall be present at all site tests. 48 hours notice shall be given to the Engineer and Council of all performance testing.

17.1 Equipment

Gauges used shall have a maximum reading of no more than twice the test pressure. Gauges and meters shall be calibrated at 12-month intervals.

17.2 Polyethylene Pipe Weld Tests

Welds shall be inspected in the field and assessed in accordance with the requirements of AS/NZS 2033 "Installation of polyethylene pipe systems".

Testing shall be carried out in an approved laboratory. All weld samples submitted for testing shall be accompanied by a completed "PE Pipe Weld Sample Testing Submission Form". All welds shall include sufficient pipe length to ensure that it shows the pipe batch number. All pre-construction and during construction test results (passing and failing) shall be forwarded directly from the testing laboratory to Council via the following email address: PEWeldTestResults@ccc.govt.nz. The Contractor shall collect all the samples after testing for Electrofusion, Butt fusion and Saddles, and store them securely until the end of the defects notification period.

Additional test joints shall be made and tested if there is any change to machine, operator, pipe supplier or PE material.

17.2.1 Pre-construction Joint Testing - Electrofusion

For pipes with nominal diameters 90mm and larger and pipe wall thicknesses <50mm, joints shall first be tested in accordance with ISO 13954 "Peel decohesion test for polyethylene (PE) electrofusion assemblies of nominal outside diameter greater than or equal to 90 mm" and ISO 21751 "Plastic pipes and fittings – Decohesion test of electrofusion assemblies – Strip-bend test". For pipes with wall thicknesses of 50mm and above, joints shall be tested to ISO 21751 only.

The Contractor shall complete two joints for each differing pipe batch (and batch of fittings as applicable), using the machine and operator named in the Contract Quality Plan.

The samples shall first be tested to ISO 13954. The percentage brittle failure (non-ductile including any air voids) for any sample shall be less than or equal to 33.3% of the measured length of the fitting's winding wires within the fusion zone. The brittle fracture length (non-ductile including any air voids) shall be the sum of the brittle (non-ductile) portions between the first and last winding in the electrofusion socket.

Any sample that does not peel (fail) through the coupler fusion zone shall then be tested to ISO 21751.

Results shall include a commentary on and photos of the failure mechanism, including: peel quality, gaps and insertion into the coupler, joint alignment, melt flow into cavity. Failed joint samples shall be made available to the Engineer if requested.

The jointing log sheet shall be supplied for each test.

17.2.2 Pre-construction Joint Testing – Electrofusion Saddles

Saddle joints shall be tested in accordance with ISO 13956 "Decohesion test of polyethylene (PE) saddle fusion joints - Evaluation of ductility of fusion joint interface by tear test". Saddle joints on pipes with diameters greater than DN 250 shall only be tested to ISO 21751 "Plastic pipes and fittings – Decohesion test of electrofusion assemblies –Strip bend test".

The Contractor shall complete two joints for each differing pipe batch (and batch of fittings as applicable), using the machine and operator named in the Contract Quality Plan.

The percentage brittle failure (non-ductile including air voids) for any sample shall be less than or equal to 50% of the measured length of the fitting's winding wires within the fusion zone for the calculation of Ld (brittle length) and 25% for the calculating of Ad (brittle area). The brittle fracture length (non-ductile including any air voids) shall be the sum of the brittle (non-ductile) portions between the first and last winding in the electrofusion saddle.

Any pipe that returns a test result with no separation between the saddle and the pipe shall be retested to ISO 21751 to return the measurement for Ld.

Results shall include a commentary on and photos of the failure mechanism, including: peel quality, gaps and melt flow into cavity.

Failed joint samples shall be made available to the Engineer if requested.

17.2.3 Pre-construction Joint Testing – Butt Fusion

One joint and one section of virgin pipe, for each pipe diameter and material type supplied for the project, shall be tested in accordance with ISO 13953 “Polyethylene (PE) Pipe and Fittings – Determination of the tensile strength and failure mode of test pieces from a butt-fused joint”.

Results shall include a commentary on the failure mechanism. Failed joint samples shall be made available to the Engineer if requested.

The Contractor shall complete the joint using the machine and operator named in the Contract Quality Plan, to demonstrate that the methodology and fusion parameters proposed will produce acceptable fusion joints. The weld bead shall comply with clause 10.3.7 – Bead Profile. The relevant jointing log sheet and a graphical plot of the load versus extension shall be supplied for each test. Ductility shall be evident through the plot showing a rounded top and an extended sloping recession leg. The load-extension graph may be used by the Engineer in assessing the results of the test.

The joint must fail at a stress which is greater than 90% of the virgin pipe material and shall rupture in a ductile manner.

The cut-out joints shall be of sufficient length to make test pieces that comply with the requirements of ISO 13953. Where the nominal pipe wall thickness > 40 mm, both modified Type A and Type B specimen shall be tested. A modified Type A test piece shall be produced by machining a similar amount from each side of the test piece to reduce the wall thickness to 22 mm ±2 mm. Where the wall thickness is <40mm, standard test pieces shall be used as specified in ISO 13953.

If satisfactory tensile test results cannot be obtained and appropriate ductility of the rupture surface is not illustrated by the load-extension graph and associated photographs, the Contractor shall provide the Engineer with details of the proposed actions to determine the cause of the problem, through the provision of a Non-Conformance Report (NCR). The NCR shall include assessments of the welding parameters and cleanliness in particular, and include the methodology as defined in clause 10.3.1 - Methodology. It shall also address the ability of the welding machine to maintain parameter pressure and heater plate temperature. No further pipe installation shall take place until the corrective action is accepted.

17.2.4 Joint Testing During Construction – Electrofusion and Electrofusion Saddles

One random site constructed joint shall be tested for every 20 joints constructed for each differing pipe batch (not fitting), in accordance with

clauses 17.2.1 – Pre-construction Joint Testing – Electrofusion or clause 17.2.2 – Pre-construction Joint Testing – Electrofusion Saddles.

Where the joints constructed are between 5 and 20, one joint shall be tested. Lengths comprising less than 5 joints shall require only pre-construction testing. The Engineer shall select the joints for testing.

Joints constructed	Joints tested
< 5	0*
5-20	1
>20	1 per 20 joints

Note: *Pre-construction test only

The Contractor shall instruct the approved laboratory to immediately forward all weld test results directly to the Engineer. Failure of any joint test will require the Contractor to follow the process set out in CSS: Part 3 - Drainage clause 14.5.6 - Joint Test Failures.

17.2.5 Joint Testing During Construction – Butt Fusion

A minimum of one random joint per pipeline for every 20 joints constructed shall be tested for each differing pipe batch in accordance with clause 17.2.3 – Pre-Construction Joint Testing – Butt Fusion except only Type B tests are required where the nominal pipe wall thickness is greater than or equal to 25 mm. The Engineer shall select the joints for testing.

Where the joints constructed are between 5 and 20, one joint shall be tested. Lengths comprising less than 5 joints shall require only pre-construction testing. The Engineer shall select the joints for testing.

Joints constructed	Joints tested
< 5	0*
5-20	1
>20	1 per 20 joints

Note: *Pre-construction test only

The Contractor shall instruct the approved laboratory to immediately forward all weld test results directly to the Engineer. Failure of any joint test will require the Contractor to follow the process set out in CSS: Part 3 - Drainage clause 14.5.6 - Joint Test Failures.

17.3 Pressure Testing

Pipelines shall be water tested in-situ, to the specified in-ground pressures, when fully haunched and backfilled. Complete the Pipe Pressure Test Checksheets in Appendices XV and XVI of IDS: Part 3 – Quality Assurance, as modified by the Engineer.

Polyethylene pressure tests shall only be carried out by approved testers who have been named in the Contract Quality Plan. Approved testers shall hold the applicable registration on the Council Approved PE Pipe Pressure Testers Register, as listed on the Council webpage <https://www.ccc.govt.nz/consents-and-licences/construction-requirements/approved-contractors/pe-pressure-testers/>

The test pressure shall not exceed 1.25 times the rated pressure of the lowest rated component but shall be at least 1.25 times the specified maximum operating pressure.

17.3.1 PVC, Ductile Iron, Glass Reinforced Plastic Pipe

A pressure test shall be carried out in accordance with clause 6.3.4.1 of AS/NZS 2566.2 “Buried flexible pipelines – Installation”.

17.3.2 Polyethylene Pipe (100mm to 315mm diameter)

A pressure test shall be carried out in accordance with clause 6.3.4.4 of AS/NZS 2566.2, as amended by CSS: Part 3 clause 14.3.2 – Polyethylene Pipe up to DN 315.

17.3.3 Polyethylene Pipe (over 315mm diameter)

A pressure test shall be carried out in accordance with clause 6.3.4.2 of AS/NZS 2566.2. A graphical plot of the pressure test shall be supplied to the Engineer with the test readings. Swab the pipeline to remove air before carrying out the pressure test.

17.3.4 Polyethylene Pipe (less than 100mm diameter)

A pressure test shall be carried out in accordance with Appendix M Method 8 of AS/NZS 2566.2 or as detailed in clause 17.3.2 – Polyethylene Pipe (100mm to 315mm diameter).

17.4 Measurement of Works and Basis of Payment

Testing is included in the rate for pipe installation.

17.4.1 Polyethylene Pipe Weld Test

Payment for specified sampling, testing, re-jointing and reinstatement etc of joints shall be for each complying joint. The rate for electrofusion joint testing shall include for all time related effects associated with set up, testing, approval, re-jointing etc.

If additional testing is required due to a change in machine, operator, pipe supplier or material or to prove defective work, the additional tests and any related costs shall be borne by the Contractor.

18.0 FINAL SURFACING

Final surfacing shall be carried out in accordance with CSS: Part 1 - General and the Works Access Permit (WAP) conditions, where applicable.

Apply for a Corridor Access Request (CAR) at www.beforeudig.co.nz.

18.1 Measurement of Works and Basis of Payment

Final surfacing is measured on the lineal metre of pipe installed, to the nearest metre, which shall include final surfacing to any fittings installed on the pipe.

Final surfacing from presealing level includes the supply and placing of all materials and shall also include sawcutting, bandaging where necessary and additional sealing width as detailed in CSS: Part 1 clause 33.0 – Restoration and Final Surfacing. The reinstatement of existing roadmarkings shall also be included in this rate.

Final surfacing to berms shall include the supply of topsoil, sowing and establishment of the berm in accordance with CSS: Part 2 – Earthworks and CSS: Part 7 – Landscapes.

19.0 LOCATION MARKING OF FIRE HYDRANTS AND SLUICE VALVES

19.1 Roadmarking

Permanent fire hydrant marking shall be completed within 24 hours of, but not prior to, the hydrant being commissioned. Hydrant marking shall be restored within 24 hours of final surfacing. All other roadmarking shall be completed within 48 hours of the completion of the final surfacing except where the surface is chipseal, in which case roadmarking shall be completed within 24 hours of carriageway sweeping. The carriageway shall be swept within 72 hours of the completion of chipsealing.

Where fire hydrant markings are obscured or removed, temporary markings shall be provided until the permanent markings are completed.

Paint shall be applied in accordance with the requirements of CSS: Part 6 - Roads.

Hydrant marker posts shall be removed and disposed of.

19.2 Fire Hydrants

Painting of fire hydrant surface boxes, triangles shall be in accordance with SD 404.

Fire hydrant marking shall not be performed before the hydrant or main feeding the hydrant is commissioned. Prior to commissioning fire hydrant surface boxes shall remain in black or have yellow surfaces obscured.

Fire hydrant surface boxes shall be painted yellow. A yellow triangle shall be painted on the fire hydrant side of the centreline of the carriageway, directly opposite to and pointing at the fire hydrant. A yellow circle shall be painted around a fire hydrant only when a fire hydrant will regularly have vehicles parking adjacent to it.

A bi-directional blue reflectorised raised pavement marker shall be installed adjacent to the yellow triangle within the following roads: within the four Avenues surrounding the central city; Riccarton Road; Papanui Road; Main North Road (from Papanui Road to Cranford Street); Harewood Road (from Main North Road to Breens Road).

19.3 Sluice Valves

Shut valve surface boxes shall be painted red. Anti-clockwise opening butterfly valve surface boxes shall be painted yellow. All other sluice valve surface boxes shall be painted white. Valve marking shall be in accordance with SD 404.

A white triangle shall be painted on the top of the kerb directly opposite the valve, pointing at the valve.

19.4 Gate Valves

Gate valve surface boxes shall be painted:

- *White where the gate valve is in a normally open position (e.g. submain valves)*
- *Red where the gate valve is in a normally closed position (e.g. scour valves)*

Yellow gate valve boxes shall not be used.

19.5 Paints and Markers

Only approved paints and markers shall be used.

19.6 Removal of Redundant Markings

Redundant markings shall be removed in accordance with the requirements of CSS: Part 6 - Roads.

Hydrant markings shall be removed within 24 hours of decommissioning a hydrant or the main feeding a hydrant. Removal of hydrant markings includes removal of the yellow triangle and yellow circle (if present), repainting of the fire hydrant surface box in black and removal of the blue reflectorized pavement marking where fitted. Alternatively, the entire hydrant surface box may be removed and surface restored.

19.7 Measurement of Works and Basis of Payment

Roadmarking is included in the rate for the installation or adjustment of the fitting being marked. The removal of the roadmarking associated with a fitting being removed or made redundant shall be included in the rate for the removal or disconnection of that fitting.

Where the fitting exists, roadmarking shall be paid per item.

20.0 AS-BUILT RECORDS

The Contractor shall provide Council with as-built records to the requirements set out in CSS: Part 1 clause 5.0 – Quality Assurance including those required by Clause 10.2 - Thermoplastic Jointing of PE Pipe by EF and clause 10.3 - Site Butt Fusion Jointing of Polyethylene Pipe and Fittings.

THREE WATERS AND WASTE UNIT**WATER METER EXCHANGE RECORD SHEET**

Undertaken in conjunction with job: _____

ADDRESS	METER ON	METER OFF	REASON FOR EXCHANGE
Date _____	Serial No. _____	Serial _____ No Reading _____	
Date _____	Serial No. _____	Serial _____ No Reading _____	
Date _____	Serial No. _____	Serial _____ No Reading _____	
Date _____	Serial No. _____	Serial _____ No Reading _____	
Date _____	Serial No. _____	Serial _____ No Reading _____	
Date _____	Serial No. _____	Serial _____ No Reading _____	
Date _____	Serial No. _____	Serial _____ No Reading _____	
Date _____	Serial No. _____	Serial _____ No Reading _____	
Date _____	Serial No. _____	Serial _____ No Reading _____	
Date _____	Serial No. _____	Serial _____ No Reading _____	

HPT = Heater plate temperature P1 = Initial bead pressure T1 = Bead press time
 P2 = Heat soak pressure T2 = Heat soak press time
 P3 = Welding pressure T3 = change over time
 T4 = Time to reach weld pressure
 T5 = Welding + Cooling time

BUTT PIPE WELD LOG SHEET

Project _____

Pipe/Material Details _____

Welder Name ID No _____

Weld Machine Details _____

Date	Weld No	HPT °C	P1 kPa	T1 Sec	P2 kPa	T2 Sec	T3 Sec	T4 Sec	P3 kPa	T5 Sec	Operator Signature	Comments

O = Ovality of pipe
 D = Outside diameter (using pipe tape)

TA = Ambient temperature

RF = Recommended fusion time
 RC = Recommended cooling time
 AF = Actual fusion time
 AC = Actual cooling time

ELECTROFUSION PIPE WELD LOG SHEET

Project _____

Pipe Details

_____ Details = manufacturer, PE rating, DN, wall thickness

Welder Name, ID No _____

Weld Machine Details

Date	Weld No	Fitting Details*	Location of weld	Pipe Batch	O %	D mm	RF Sec	RC Sec	AF Sec	AC Sec	TA °C	Operator Signature	Comments

*Details = manufacturer, barcode number

COMPLIANCE REQUIREMENTS CHECKSHEET – WATER SUPPLY

ITEM	CSS REF	TASK	TEST STD/ DESCRIP	COMPLIANCE REQUIREMENTS	TEST FREQ.	PASS YES/NO	TEST BY	ACTIONS
1		QUALITY ASSURANCE						
	Pt 4 3.0	Fittings and materials	www.ccc.govt.nz/business/constructiondevelopment/approvedmaterials.aspx	Materials comply				
	Pt 4 3.1	Authorised Water Installer	Auth Water Installer Spec	Authorised installer on site.				
	Pt 4 5.2	Asbestos	Inspect	Guidelines followed				
2		EXCAVATION						
	Pt 4 9.2	Trench Width	measure	<= 150mm dia 200mm wider than pipe >150mm dia 300mm wider				
	Pt 4 9.4	Trench Depth	measure	750mm cover + 100mm pipe + 100mm bedding, max 1.1m				
	Pt 2 7.4.3	Trench Depth - irrigation	measure	300mm cover + 25mm pipe + 50mm bedding				
	Pt 4 9.5	Clearance to Existing Services	measure	complies with table				
3		MECHANICAL JOINTING						
	Pt 4 10.1	Fittings and materials	AS/NZS 2032, manuf reqs	Diameters match, materials compatible and correct				
	Pt 4 10.1	Jointing	AS/NZS 2032, manuf reqs	Workspace and materials clean and dry, not using solvents				

ITEM	CSS REF	TASK	TEST STD/ DESCRIP	COMPLIANCE REQUIREMENTS	TEST FREQ.	PASS YES/NO	TEST BY	ACTIONS
	Pt 4 10.1	Joint gap setting	CCC performance reqs	Witness marks visible				
	Pt 4 10.1	Inspect completed joint	AS/NZS 2032, manuf reqs	All fittings snug and firm, no movement or leakage				
4		ELECTROFUSION WELDING						
	Pt 4 10.2	Preconstruction tests	ISO 13954, ISO 13956	Passing tests received, pipe batch, machine and welder named				
	Pt 4 10.2.1, 10.2.2	CQP documentation	POP001	Present methodology and QA record sheets through CQP				
	Pt 4 10.2.3	Welder approved	Inspect	Present copy through CQP				
	Pt 4 10.2.4	Equipment	AS/NZS 2033, manuf reqs	Appropriate clean equipment, re- rounding clamps, specified cleaners				
	Pt 4 3.0	Fittings and materials	www.ccc.govt.nz /business/constru ctiondevelopmen t/approvedmateri als.aspx	Manufacturer confirmed compatibility; witness mark location; fitting/pipe gap				
	Pt 4 10.2.5	Pipe preparation	Measure, manuf reqs, POP001	'Out of roundness' less than 1.5%, end gaps, pipe dimensions comply, pipes cleaned and protected, witness marks, pipe insertion				
	Pt 4 10.2.6	Welding	AS/NZS 2033, manuf reqs	Correct parameters, pipe position, visual inspection satisfactory, weld marked, fusion times complied with, welding records kept				

ITEM	CSS REF	TASK	TEST STD/ DESCRIP	COMPLIANCE REQUIREMENTS	TEST FREQ.	PASS YES/NO	TEST BY	ACTIONS
	Pt 4 17.2.4, 17.2.5	During construction tests	ISO 13954, ISO 13956	All test results received, acted on				
	Pt 4 10.2.7	Cooling period	AS/NZS 2033, manuf reqs	Pipe not moved for specified period.				
5		BUTT WELDING						
	Pt 4 10.3	Preconstruction tests	ISO 13953	Passing tests received, pipe batch, machine and welder named				
	Pt 4 10.3	Fittings and materials	https://ccc.govt.nz/consents-and-licences/construction-requirements/approved-materials-list/	Approved supplier and materials compatible and correct				
	Pt 4m 10.3.1 10.3.2	CQP documentation	POP003	Present methodology and QA records through CQP				
	Pt 4 10.3.3	Welder approved	Inspect	Present copy through CQP				
	Pt 4 10.3.4	Equipment	AS/NZS 2033, manuf reqs	Equipment clean, appropriate, plate temperature constant and as specified, re-rounding clamps, specified cleaners.				
	Pt 4 10.3.5	Pipe preparation	Measure, manuf reqs, POP003	End alignment and end gaps comply, pipes cleaned and protected, ends protected, air temperature above 4°C				
	Pt 4 10.3.6	Welding	AS/NZS 2033, manuf reqs	Welding records kept, weld marked, visual inspection satisfactory				

ITEM	CSS REF	TASK	TEST STD/ DESCRIP	COMPLIANCE REQUIREMENTS	TEST FREQ.	PASS YES/NO	TEST BY	ACTIONS
	Pt 4 17.2.5	During construction tests	ISO 13953	Passing tests received, pipe batch, machine and welder named				
6		PIPE INSTALLATION BY TRENCHING						
	Pt 4 11.4.3	Bedding material	NZTA req	To be M/4:AP20				
	Pt 4 11.4.4	Bedding depth	SD 410	To table				
	Pt 2 7.4.2 7.9.1	Bedding depth - irrigation	measure	50mm depth under and 100mm depth over pipe				
	Pt 4 11.4.2	Contractor's compaction testing	audit	Quality assurance records of haunching and bedding testing being kept				
	Pt 4 11.4.5	Watermain alignment	measure	± 50mm of design on straights or ± 200mm on curves, radii for PE pipe complies				
	Pt 4 11.4.6	Submain offset	measure	150mm from boundary ± 50mm				
7		PIPE INSTALLATION BY PULLING						
	Pt 4 11.5	Pipe pulling	AS/NZS 2033, manuf reqs	Load does not exceed that specified. Gouging, notching under 10% wall thickness for pressure pipe				
8		PIPE INSTALLATION BY DIRECTIONAL DRILLING						
	Pt 4 9.4	Vertical alignment	measure	750mm cover + 100mm pipe				
	Pt 4 9.5	Clearance to Existing Services	measure	complies with table				

ITEM	CSS REF	TASK	TEST STD/ DESCRIP	COMPLIANCE REQUIREMENTS	TEST FREQ.	PASS YES/NO	TEST BY	ACTIONS
	Pt 4 11.5.2	Horizontal alignment	measure	± 100mm of design				
	Pt 4 11.6	Access pits	measure	Exceed 3.4m length				
9		FITTING INSTALLATION						
	Pt 4 12.2.1	Valve installation	measure	Complies with SD 420				
	Pt 4 12.2.2	Fire hydrant installation	inspect	Hydrant in line with main.				
	Pt 4 12.2.2	Fire hydrant installation	measure	Spindle vertical and cap between 100mm-300mm below finished surface				
	Pt 4 12.2.3	Surface box installation	measure	Within 5mm of and parallel to finished surface, complies with SD 412				
	Pt 4 12.2.3	Surface box installation	inspect	On precast frames. Frames to SD 405.				
	Pt 4 12.5.1	Thrust block installation	inspect	Correct position				
	Pt 4 12.5.2	Thrust block installation	Measure	Specified size, confirm soil design capacity				
	Pt 4 12.5.3	Thrust block installation	SD 406	Confirm soil design capacity				
	Pt 4 12.6	Anchor installation	measure	Spacing to suit grade				
	Pt 4 12.6	Anchor installation	SD 411	Pipe wrapped				
	Pt 4 12.7	Fitting removal	inspect	Roadmarking removed, pipe plugged				
10		IRRIGATION INSTALLATION						

ITEM	CSS REF	TASK	TEST STD/ DESCRIP	COMPLIANCE REQUIREMENTS	TEST FREQ.	PASS YES/NO	TEST BY	ACTIONS
	Pt 2 7.6.3	Backflow preventer installation	Sec G12 Building Code	AS1 (3.6.3 & 4)				
	Pt 2 7.6.3	Backflow preventer installation	AS/NZS 2845.3	Commissioning test				
	Pt 2 7.6.3	Backflow preventer installation	AS/NZS 2845.3	Results forwarded to Engineer				
	Pt 2 7.6.4	Surface box installation	measure	Within 5mm of and parallel to finished surface				
	Pt 2 7.6.4	Solenoid box installation	measure	Minimum 75mm below and parallel to finished surface				
	Pt 2 7.6.5	Thrust block installation	inspect	Pipe wrapped				
	Pt 2 7.7	Wiring installation	AS/NZS 3008.1.2	Wire joints in valve boxes and water tight				
11		CONSUMER CONNECTION INSTALLATION						
	Pt 4 16.1	Position determined	measure	Within 500mm of boundary				
	Pt 4 16.1	Position determined	inspect	Outside of net area of lot and outside of driveway.				
	Pt 4 16.3.2 16.3.4	Consumer connection installation	measure	Stopcock spindle vertical				
	Pt 4 16.3.2 16.3.4	Consumer connection installation	inspect	Meter ID and dial readable				
	Pt 4 16.3.6	Water meter box installation	inspect	Stopcock clear of box, box flush with surface and parallel to boundary				

ITEM	CSS REF	TASK	TEST STD/ DESCRIP	COMPLIANCE REQUIREMENTS	TEST FREQ.	PASS YES/NO	TEST BY	ACTIONS
	Pt 4 15.0	Sterilisation and bacteriological testing	inspect	Sterilisation and testing carried out prior to any consumers changed over. Passing test results received				
12		PERFORMANCE TESTING						
	Pt 4 17.2	PE Pipe Welds	AS/NZS 2033	Satisfactory visual inspection				
	Pt 4 17.2.1	PE Pipe Preconstruction Tests - Electrofusion	ISO 13954	Joint shall pass test				
	Pt 4 17.2.2	PE Pipe Preconstruction Tests - EF Saddles	ISO 3956	Joint shall pass test				
	Pt 4 17.2.3	PE Pipe Preconstruction Tests - Butt fusion	ISO 13953	Ductile failure				
	Pt 4 17.2.4	PE Pipe Construction Tests - Electrofusion and EF Saddles	ISO 13954 ISO 3956	Joint shall pass test				
	Pt 4 17.2.5	PE Pipe Construction Tests - Butt fusion	ISO 13953	Ductile failure				
	Pt 4 17.3	Pressure Test	AS/NZS 2566.2	pressure loss within tolerances approved tester				
13		BACKFILLING						
	Pt 4 13.1	Backfill material in road	NZTA req	To be M/4:AP40				
	Pt 4 13.1	Backfill material dry density in path	NZS 4402	Standard Proctor				

ITEM	CSS REF	TASK	TEST STD/ DESCRIP	COMPLIANCE REQUIREMENTS	TEST FREQ.	PASS YES/NO	TEST BY	ACTIONS
	Pt 4 13.3	Compaction of backfill	Clegg hammer	35 in road, ROW or commercial crossing, 25 elsewhere				
	Pt 4 13.3	Compaction of backfill	MDD by ND	95% in road, ROW or commercial crossing, 90% in path, 70% elsewhere				
	Pt 2 7.9.2	Metallic detector tape installation	measure	Between 150 - 250mm below surface				
	Pt 2 7.9.3	Subgrade surface shape – irrigated lawn	measure	150mm below existing surface				
	Pt 6 6.5	Presealing surface shape - path	measure	Max 10mm gap, cumulative total gap under 25mm				
	Pt 1 28.1	Subgrade surface shape - berm	measure	75mm below existing surface				
	Pt 6 11.4	Presealing surface shape - road	measure	Max 12mm gap, cumulative total gap under 25mm in both directions				
13		FINAL SURFACING						
	Pt 1 28.1	Surface preparation	inspect	Sawcut edges in permanent surfaces, strip to fender where within 1.5m				
	Pt 1 30.1	Asphaltic concrete supply – DG 7	NZTA M/10	Complies with specification				
	Pt 1 30.2	Asphaltic concrete supply – DG 10	NZTA M/10	Complies with specification				
	Pt 6 6.6	Tackcoat application	inspect	Tackcoat adheres to complete surface				
	Pt 6 6.7	Asphaltic concrete laying		Air voids between 2.5% and 11% Mix temperature within 10° of delivery temperature				
	Pt 6 6.8	Sealed surface shape - path	measure	Max 5mm gap, cumulative total gap under 20mm for longitudinal 3m				

ITEM	CSS REF	TASK	TEST STD/ DESCRIP	COMPLIANCE REQUIREMENTS	TEST FREQ.	PASS YES/NO	TEST BY	ACTIONS
				straightedge and under 10mm for transverse 1m straightedge				
	Pt 2 9.5.3	Finished surface shape - berm	measure	+10mm, -0mm of existing level				
	Pt 6 14.4	Chipsealed surface shape - road	measure	Surface to be convex, mate-ins to be flush				
	Pt 6 17.5	AC surface shape - road	measure	Max 5mm gap, cumulative total gap under 10mm for longitudinal 3m straightedge				
	Pt 1 28.1	Surfacing	inspect	Bandage AC edges, overlap chipseal				
	Pt 4 20.0	Roadmarking	SD 404	Within 24 hrs for fire hydrants and 48 hrs for rest				
14		AS BUILTS						
	Pt 2 7.10	Provide Operations Manual		Ensure manual covers all components of irrigation system				
	Pt 4 20.0	As-built plans	present	Compliant and complete				
15		WATER QUALITY PRIOR TO COMMISSIONING						
	Pt 4 15.0	Sterilisation of water main	contact	Council sterilises main prior to connection				
	Pt 4 15.3	Bacteriological testing	contact	Sample taken by Council complies with DWSNZ				
	Pt 4 4.1	Hygiene Certificate	present	Conditions of Approval as an Authorised Water Supply Installer				

PE Pipe Weld Sample Testing Submission Form

(details to be provided to the testing laboratory for all PE weld and tapping saddle samples tested in accordance with Christchurch City Council requirements)

Customer's Company Name (entity paying for the laboratory testing)

--

Welder's Details

Welding Company:
Welder's Name:
Registration No:
Machine Number:

Project Details

Project Name:
Project Location (street name)
Type of Work (tick one): <input type="checkbox"/> Water Supply <input type="checkbox"/> Wastewater <input type="checkbox"/> Stormwater
Lead Contractor:
Engineer to Contract:

Sample Details

Sample ID (weld number as marked on sample):
Date Weld Made:
Weld Sample Purpose (tick one): <input type="checkbox"/> Pre-Construction <input type="checkbox"/> During-Construction
Weld Type (tick one): <input type="checkbox"/> Butt Weld <input type="checkbox"/> EF Weld <input type="checkbox"/> Tapping Saddle
Pipe or Fitting Size (outside diameter):

Declaration

I, _____ (customer who pays for the testing), consent to the test results being sent to Christchurch City Council at: PEWeldTestResults@ccc.govt.nz

Customer Name	Signature	Date

HYGIENE CERTIFICATE

Council Contract RMA BCN Other

_____ (contract / RMA / BCN number)

For water supply work at (location):

I, _____
(name of CCC authorised water supply installer)

of _____
(company name)

certify that during this project I have taken all practical steps to ensure that the work for this contract was carried out in accordance with CSS: Part 4, Clause 4 (Prevention of Contamination of Christchurch's Drinking Water Supply), and to the best of my knowledge these requirements have been adhered to.

Signature: _____ Date: _____