WAIMAKARIRI
DISTRICT COUNCIL

ENGINEERING CODE OF PRACTICE

FINAL

April 2009

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Engineering Code of Practice

Associated Documents

WAIMAKARIRI
DISTRICT COUNCIL

ENGINEERING CODE OF PRACTICE

PART ONE

INTRODUCTION

April 2009

Part 1: Introduction

CONTENTS

Part 1: Introduction

1.1 DOCUMENT PURPOSE

The Waimakariri District Council's Engineering Code of Practice provides controls to ensure that all infrastructure created is and will remain fit for the intended life of the asset.

The purpose of this major revision is to incorporate any structural changes in the way that the Council accepts assets and to update the technical engineering aspects of the Engineering Code of Practice to current practice, including alignment with the Christchurch City *Infrastructure Design Standards* (IDS) and *Construction Standard Specifications* (CSS). The opportunity was also taken to incorporate the application of quality assurance, to ensure that Council assets are well designed and constructed.

The parts of the CoP are summarised below:

- **Part 1: Introduction** introduces the Code and the processes involved with revising the document. It also includes those definitions and abbreviations specific to the CoP.
- **Part 2: General Requirements** covers a number of regulatory details and sets out the process from design to acceptance by the Council of land developments.
- **Part 3: Quality Assurance** sets out the requirements for the application of quality assurance to the construction of all assets. Each project will require the implementation of a project quality management system, with documentation and certification presented to the Council at both the design and construction stages.
- **Part 4: Geotechnical Requirements** sets out the requirement for geotechnical input in land development and what must be considered by the geotechnical engineer. It emphasises the Council's desire to work with the landforms and preserve natural features. It also details issues to be considered under erosion, sediment and dust control.
- **Part 5: Stormwater and Land Drainage** builds on Christchurch City's *Waterways and Wetlands Drainage Guide* (WWDG), which sits behind the CoP as a supporting document. Part 5 provides more prescriptive design and compliance criteria than is found in the *WWDG* but reinforces the emphasis on water quality and ecological protection.
- **Part 6: Wastewater Drainage** incorporates an explanation of the Waimakariri District reticulation system. It provides the design and compliance criteria for wastewater systems. The requirements for private drains have been tied to the *New Zealand Building Code* and it references the two pumping station specifications.
- **Part 7: Water Supply** covers the design and compliance criteria of the water reticulation. It references the Christchurch City document *Water Supply Wells, Pumping Station and Reservoir Design Specification* for larger infrastructure.
- **Part 8: Roading** sets out both the design and compliance criteria for the road layouts e.g. road classification and the roads themselves e.g. footpaths, construction depths. It incorporates the design and construction of roads in accordance with Austroads specifications.
- **Part 9: Utilities** covers the Council's compliance requirements for telephone, electricity and gas. It excludes the utility design itself, as this must be to the network operator's requirements.
- **Part 10: Reserves, Streetscapes and Open** Spaces is based on NZS 4404, modified to suit the Waimakariri District context. It sets criteria for reserves, including layout, facilities, structures and furniture. It also applies to landscaping in legal roads.
- **Part 11: Lighting** sets the Council's requirements in an environment in which private companies can carry out street lighting design and construction. It builds on AS/NZS 1158.
- **Part 12: As-Builts** sets the Council's requirements for as-built information on completion of the development.
- **Associated Documents** are any useful documents not included in the main body of the CoP.

Part 1: Introduction

1.2 DOCUMENT COMMENTS

1.2.1 Sources

This Code was originally developed from a number of sources including existing Waimakariri District Council standards, Christchurch City Council standards and adapted procedures from other local authorities. The Code is based on the Christchurch City Council Infrastructure Design Standards, modified to suit local conditions and practices.

1.2.2 References

A list of referenced documents, definitions and abbreviation used in this Code is included in QP-C801, attached at the end of the CoP under *Associated Document*s.

Website addresses are provided where the referenced documents are available on-line. Please note that the links are correct at the time of publication; however, websites are subject to change without notice and those using the Code are expected to arrange their own access to documents referred to in this Code.

1.2.3 Performance Standards & Means of Compliance

This Code sets minimum requirements for planning and design, and provides scope for developers to propose alternative solutions. The Code supports the Council's Asset Management Plans to achieve appropriate engineering standards for utilities and other services, and is aligned with the District Plan.

These requirements are intended to protect the environment and those parties affected by a proposed development from physical failures that result from natural hazards and/or inadequate design and construction, and to achieve cost effective life-span performance of the Council's infrastructural systems.

1.2.4 Review Process

This issue of the Code has been extensively reviewed by the Council's engineering and asset management staff. The review has resulted in significant changes to the Code's layout and readability for better use as a reference and design tool. Consequently, and for practical reasons, changes are not individually highlighted. The Council will consider submissions for future review. The review process is detailed in the Engineering Code Review Process (QP-C802) attached under *Associated Documents*. Please send your comments and suggestions for amendments to the Code on the form QP-C802-AA. Registered recipients should record updates on the amendment sheet provided (QP-C802-AC).

1.2.5 Notes to Readers/Disclaimer

While this Code is believed to be correct at the time of publication, the Waimakariri District Council and those involved in the Code's preparation and publication do not accept liability for any consequences arising from its use. The Code has been designed to assist those performing development activities but should not be relied upon in isolation. Those using the Code will need to gather and consider information from other sources notwithstanding using their own skill and judgment.

Any enquiry in regard to interpretation of any matter in this Code should be referred to Council through Helen Field, Engineer, Technical Services Unit.

Part 1: Introduction

1.2.6 Distribution

A register of Document Users is maintained. Those registered will receive a CD containing the most recent electronic files as PDFs, the cost of which is $40.00 including GST. Registered users will be informed of updates to the Code of Practice webpage by email. For additional information please refer to the Engineering Code Review Process attached under *Associated Documents*.

WAIMAKARIRI
DISTRICT COUNCIL

ENGINEERING CODE OF PRACTICE

PART TWO

GENERAL REQUIREMENTS

April 2009

Part 2: General Requirements

CONTENTS

Part 2: General Requirements

TABLES

Part 2: General Requirements

2.1 INTRODUCTION

The CoP serves as a basis of compliance for projects carried out by the Council as part of its capital works programme, as well as the subdivision and development of land, where these activities are subject to the Resource Management Act 1991.

This Part of the CoP includes both those components of the design process common to all developments or not restricted to one asset type and those components particular to the subdivision of land.

The provisions of the Engineering Code of Practice must be read subject to the provisions of the *District Plan* and to any applicable statutes, regulations and bylaws.

Part 2: General Requirements

2.2 CONSENT AND COMPLIANCE ISSUES

2.2.1 Legislation

2.2.1.1 Resource Management Act (1991) and amendments (2005)

The Resource Management Act (RMA) is the principal statute under which the use and subdivision of land is controlled.

The *District Plan* is a resource management instrument with the purpose of achieving the promotion of sustainable management of natural and physical resources, which is the overarching purpose of the RMA.

The CoP serves as a technical compliance manual and, although outside the *District Plan*, its provisions are referred to and given effect through conditions of resource consent and through capital works' project briefs.

2.2.1.2 Local Government Act (2002) and amendments (2006)

The mechanism for requiring contributions under the Local Government Act, through land or cash, is set out in the *Long Term Council Community Plan* and the *Development Contributions Policy*.

2.2.1.3 Health & Safety in Employment Act (1992) and amendments (2002)

The object of the Health and Safety in Employment Act is to promote the prevention of harm to all people at work, and others in, or in the vicinity of, places of work.

The Act applies to all New Zealand workplaces and places duties on employers, the self-employed, employees, principals and others who are in a position to manage or control hazards.

The Act deals with all safety and health issues in all workplaces and during all work activity. Nothing in the CoP shall detract from the requirements of the Health & Safety in Employment Act, or vice versa.

2.2.1.4 Building Act (2004) and amendments (2005)

The Building Act 1991 provides a national focus for building control to ensure that buildings are safe and sanitary and have suitable means of escape from fire, and the Building Regulations made under the Act provide the mandatory requirements for building control in the form of the *New Zealand Building Code*.

The *Building Code* contains the objective, functional requirements and performance criteria that building works must achieve.

Where infrastructural development associated with capital works and the subdivision or development of land involves the creation of structures with associated site works, observe the requirements of the Building Act. Nothing in the CoP shall detract from the requirements of the Building Act or the *Building Code*, or vice versa.

Part 2: General Requirements

2.2.2 Resource Consents

The developer shall be responsible for obtaining any necessary resource consents from the Waimakariri District Council and Environment Canterbury (Canterbury Regional Council) before any construction work commences. Works requiring resource consents could include those outlined below, but the developer should satisfy him/herself as to the actual consents required.

- Generation of noise;
- The discharge of odours from pump stations, rising mains or pipelines;
- On-site treatment and disposal;
- Working within a waterway, or within 20 metres of a waterway
- Any other works that disrupt the surrounding environment

Resource consents for permanent works that will become the responsibility of the Council shall be sought for the maximum term possible and in the name of the Waimakariri District Council. Application shall be approved by the Council before submission to ECan.

2.2.3 Consent and Approval from the Waimakariri District Council

Works that may affect natural waterways or cause erosion, sedimentation or dust problems, and new stormwater, wastewater and water systems require approval from Council and consent from Environment Canterbury.

Approval may be by way of a permitted activity or rule in the District plan or by a discharge permit. A land-use consent and a discharge permit are generally required for subdivisions and capital works projects and when significant water quantity and quality issues need to be addressed.

For any works within a road reserve, the developer shall obtain a road opening permit from the Council. Refer also to QP-C843 *Standard Specification – Road Openings.*

Authorising officers from both Councils should be consulted prior to consent application. It is good practice for the Council and Environment Canterbury to process subdivision and water-related resource consents simultaneously and deal with land and water issues at a joint hearing pursuant to Section 102 of the RMA.

In some situations, approval is also required from the local Runanga. Within the Waimakariri District, this is Te Ngai Tuahuriri Runanga and TRONT.

2.2.4 Consent from the Canterbury Regional Council

Regional plan requirements will generally be limited to effects on the natural environment. However, territorial authorities have a responsibility to manage land and adverse effects under section 31 of the RMA.

Consent from Environment Canterbury will be required for the following types of works:

- Works within or affecting natural waterways unless the works meet any conditions that apply to the existing system;
- The discharge of stormwater unless the discharge is to an authorised existing utility stormwater drainage system and meets any conditions that apply to the existing system;
- The disposal of wastewater unless the discharge is to an authorised existing utility wastewater system and meets any conditions that apply to the existing system;
- The supply of water unless the supply point is an existing utility water supply system and meets any conditions that apply to the existing system;
- Construction of a new road (land-use)

Part 2: General Requirements

The WDC has a consent for works within natural waterways between the months of July and August. Consent from Environment Canterbury will also be required unless the waterway is man-made, such as a stormwater drain.

Other activities often associated with works which must be authorised by Environment Canterbury include:

- The diversion of natural water during construction work;
- The permanent diversion of natural water as a consequence of the development;
- Activities in the bed or on the banks of a natural waterway;
- Damming waterways;
- Temporary discharges from construction sites.
- Dust dispersal
- Build-up of sediments in a waterway
- Erosion soil from the banks and/or bed of a waterway

Other activities, where effects are considered minor, **may** be authorised as a permitted activity subject to certain conditions in the regional plan. Authorisation may also be by way of a comprehensive consent held for a large area or entire catchment.

Site-specific water permits must be obtained for new schemes.

All wastewater assets to be vested in the Waimakariri District Council shall comply with the requirements of the NRRP.

2.2.5 Information Required for a Consent Application

Provide the following information to support the concept drawings and/or Resource Consent plans, as a minimum:

- Key topographical features
- Locations of all buildings, roads, property boundaries, existing services, easements and other important structures;
- The location of any natural waterways, springs, wells, bores, water races or wetlands within the site or in close proximity to a boundary. The location in plan and level of the water's edge and shoulder of the banks must be indicated;
- The proposed proximity of works to the water's edge and/or shoulder of the banks;
- The location of existing surface drainage pathways (including secondary flowpaths) and the impact of any proposed filling or excavation on existing overland flow paths;
- Representative pre-existing and post development cross-sections through any natural waterways or wetlands, including the areas immediately adjacent to the proposed development;
- Clear identification of the extent of any existing and post-development river or coastal floodplains on or in close proximity to the site and overland flow paths within the site;
- Details of investigations such as ground water levels, profiles, infiltration testing and effects on the environment and geological or water quality assessments.
- Protected trees, other significant vegetation and other features to be protected and retained (e.g. natural landforms, ecological protection areas);
- The location of archaeological and historical features, where present. See *Te Whakatau Kaupapa* for more information.

The level datum used must be Lyttelton Mean Sea Level 1937 (MSL). Plans should be "to scale".

Part 2: General Requirements

2.2.6 Approval Process

Resource consent issues can be complex and the consent process long. Seek the advice of the Council at the earliest stage of planning for works.

The works shall be constructed to comply with the approved plans. 'As built' plans and documentation shall be prepared and certified by the developer's representative.

The Council will issue an Engineering Release Certificate or a Certificate in terms of Section 224(c) of the Resource Management Act 1991 upon Council approval and prior to the commencement of the activity's end use.

The following shall be completed prior to the issue of Engineering Release Certificate or 224(c) Certificate:

- Earthworks and bulk of topsoiling exclusive of road reserves;
- Full road construction including footpaths;
- Street names, and traffic signs;
- Stormwater, sanitary sewer and water reticulation: inspected tested and arrangements in place for hook-up. Note that all valve and hydrant boxes must be in place and clearly identified;
- Installation of energy, street lighting, communications and gas reticulation where applicable;
- As-Built drawings approved by Council.

The Council will audit compliance with resource consent conditions by both site inspections and checking of associated documentation to the extent necessary to ensure the work is completed in accordance with the approved plans and specifications and to the Council's standards.

2.2.7 Exercising Consents

Discharge consents, water use consents, land-use consents, and temporary consents required during construction must be applied for by, and exercised in the name of, the developer.

This includes any consents for works to be transferred to the Council upon completion.

Any application involving consents intended to be transferred to the Council should be discussed with the Council first. The Council must approve these prior to application as it will not accept the transfer of a consent unless it has previously approved the conditions of that consent.

Part 2: General Requirements

2.3 ENGINEERING PLAN APPROVAL

The Council's asset managers prefer that, before a proposed activity associated with a resource consent is commenced, engineering plans that adequately specify the works and materials are prepared and approved by the Council and any other relevant network utility operator. The required consents shall be obtained before construction can commence.

2.3.1 Documentation

The following documents and calculations shall be required for approval, where appropriate:

- **Stormwater Catchment Plan and calculations:** Showing catchments and drainage reticulation design, secondary flow paths, minimum floor levels for lots adjacent to flowpaths.
- **Sanitary sewer catchment plan and calculations:** if trunk or primary reticulation is proposed or if requested by Council.
- **Existing drains:** Where an existing private reticulation is proposed to be included as a Council asset the condition of the reticulation may require verification. Verification can be in the form of closed circuit television video inspection and/or pressure test.
- **Road pavement design calculations**.
- **Structural calculations**.
- **Geotechnical stability calculations**.
- **Test results:** to support Roading, Structural or Geotechnical calculations
- **Construction management plan:** outlining methods of dust, noise control etc.
- **Health and safety plan:** required for any work in Council Land. Must identify any potential hazards and proposed measures of dealing with them.
- Any work intended to be undertaken on third party property must be clearly identified on the plan, e.g. where material is borrowed or stockpiled.
- Where open cut excavation is proposed on existing roads this work must be identified on the plans. A Road Opening Permit shall be obtained from the Waimakariri District Council.
- Plans & Specifications.
- Any other resource consents required for the execution of the development.

2.3.2 Drawings

The following drawings shall be required for approval, where appropriate:

- **Locality plan:** Showing location of work in relation to existing roads and features to enable the site to be easily located.
- **Staged development plan:** Where development is planned in stages then each stage shall be accompanied by a plan showing how that particular stage relates to the development as a whole and also to other stages. The physical execution of the works to be staged shall align with that staging detailed in the resource consent application.

Part 2: General Requirements

- **General Roading Works Plan:**
  - Plans showing horizontal alignment, kerbs, benchmark positions, setting out data, co-ordinates etc.
  - Detailed plans with contours of intersections, cul-de-sac heads, parking bays.
  - Long-section showing, at maximum 20 m chainage intervals existing ground levels, proposed final levels, cuts and fills, grades, vertical curve details, horizontal curves and services.
  - Cross sections and typical cross sections.
- **Drainage, Sewerage and Water Reticulation:**
  - Separate plans showing the reticulation in relation to lot boundaries.
  - Long sections of each drainage line with existing and final ground levels at minimum 20 m intervals, pipe sizes lengths and grades, manhole cover levels, invert levels and depths.
  - Any existing services shall be shown on cross sections and accurately located in the field by potholing or other buried service location techniques.
- **Energy (Electrical) reticulation:** Plan showing all structures, such as power poles, and any underground lines laid outside the approved location (see SD 600-245A/B/C)
- **Street lighting layout**
- **Communications reticulation layout:** Plan showing all structures, such as telecommunications cabinets, and any underground lines laid outside the approved location (see SD 600-245A/B/C)
- **Gas reticulation layout:** (if applicable)
- **Earthworks and Sediment Control Plan:** Separate plan showing final contours, areas of cutting and filling together with depths relative to original ground level. Also include a copy of any plan submitted to ECan as part of any other resource consent requirement.
- **Topographical survey plan:** Showing and identifying existing features, spot levels on permanent features, invert levels, pipe and manhole materials, flow directions. The survey must be oriented by reference to legal survey pegs and not merely boundary fences or buildings.
- **Detail drawings:** Standard and other Detail drawings showing details of kerbs and/or channels, pram crossings, paving and underchannel drains, stormwater inlet and outlet structure details, manholes, junctions, ramped risers, sumps, pipe bedding.
- **Structural drawings** (if applicable).
- **Ducting Plan** showing ducts for communications, energy, traffic-lights, water connections etc.
- **Road signs and markings plan** including street names.
- **Pump station details** (if applicable).
- **Landscape Planting Plan**.
- **Works to Reserve areas**.

2.3.3 Submission of Application for Engineering Plan Approval

Upon works completion the certificate of design compliance that states that all works have been designed in accordance with the appropriate standards and sound engineering practice should accompany the application.

Part 2: General Requirements

The Supervising Engineer/Surveyor shall submit a programme of inspection that should demonstrate an adequate level of inspection will be undertaken.

2.3.4 Engineering Plan Approval

The Council will check the Engineering Plans and Specifications for compliance with this Engineering Code of Practice. The Council's approval of complying documents will be given in writing.

If alterations are required the plans and documents will be returned with the request that updated plans are amended. Minor amendments required will be endorsed on all copies of the plans.

Where the resource consent application includes a proposal plan for the proposed activity and a resource consent is granted that is conditional on works being completed in accordance with the approved plans then the Council will return a set of stamped approved plans and specifications to the developer.

At all times during construction a copy of the stamped approved plans shall be kept on site, together with a copy of the Resource Consent.

The works shall be constructed to comply with the approved plans. 'As built' plans and documentation shall be prepared and certified by the developer's representative.

Part 2: General Requirements

2.4 EXPANDING ON DISTRICT PLAN REQUIREMENTS

2.4.1 Fees

The Council has a set scale of fees covering most types of subdivision application. Applications are not accepted without the fee being paid. For those types of application not covered by the scale of fees, a deposit is required. The balance of the full cost of processing the application is payable after the release of the Section 224(c) certificate.

2.4.2 Pre-Application Meeting

Developers and designers of “greenfield” subdivisions that will result in substantial infrastructural assts being vested in the Council, or smaller complex subdivisions on the hills, are strongly advised to request a pre-application meeting at which issues and options can be discussed with the Council.

Submit a concept plan before this meeting.

2.4.3 Future Development

Where further development, upstream of or adjacent to the area under consideration, is provided for in the *District Plan*, the Council may require infrastructure or additional capacity to be constructed to the upper limits of the development.

Make allowance for these requirements where specified by the Council in the consent conditions or project brief.

2.4.4 Environmental Considerations

The Council has a number of policies designed to protect and enhance the District’s natural environment. It also encourages parties to retain and enhance the natural environment in tandem with development works. When carrying out a design, evaluate its overall impact on the environment for both the construction and operational phases, consistent with legislation and the *District Plan*.

Wherever possible, avoid environmentally significant areas. Some examples of these areas include:

- Stands of native vegetation, bushland, habitats of threatened native species.
- Waterways and floodways.
- Wetlands, swamps, estuaries, sand dunes, foreshore areas.
- Heritage item precincts and protected trees.
- Maori relics and significant indigenous sites.
- Landfill sites and contaminated land.
- Areas of aggressive ground conditions, e.g. acid sulphate soil, aggressive groundwater.

Wherever it is not possible to avoid environmentally sensitive areas, consider the following environmental issues during the design:

- The environmental impact of the construction;
- The use of alternative excavation technology such as tunnelling, boring, directional drilling and micro-tunnelling;
- The type and size of construction equipment;
- Issues raised in CoP Part 4: *Geotechnical Requirements*.

Part 2: General Requirements

In some situations, the Council may specify that an environmental impact assessment must be completed during the investigative stage.

Ensure that the appropriate resource consents are obtained for work in the vicinity of protected trees and that the work is carried out in accordance with the Council's requirements.

2.4.5 Road Name Signs

When the development contains new roads, private ways or access lots that require signage, the developer is responsible for erecting the nameplates where this is a consent condition. The developer is also responsible for moving existing signage, where the new work affects its installation.

Part 2: General Requirements

2.5 REQUIREMENTS FOR DESIGN AND CONSTRUCTION

2.5.1 Investigation and Design

All investigation, calculations, design, supervision and certification of the works, as outlined in the CoP, must be carried out by or under the control of persons who:

- Are experienced in the respective fields;
- Have appropriate professional indemnity insurance.

The provisions of the CoP do not reduce the responsibility of those professionals to exercise their judgement and devise appropriate solutions for the particular circumstances of each development or project.

2.5.2 Construction

All works carried out in any development must be done by persons who:

- Have the appropriate experience in the relevant areas;
- Have the appropriate equipment;
- Are approved for that type of work e.g. authorised drainlayers, authorised water supply installers, Site Traffic Management Supervisors. Refer to http://www.ccc.govt.nz/doingbusiness/approvedcontractors/ for details;
- Meet the requirements of the Health and Safety in Employment Act.

All construction must comply with the requirements of the CCC *Construction Standard Specifications* (CSS).

Erect Notice Boards, complying with Standard Drawings 600-250 and CCC *CSS: Part 1*, at all construction sites. Where work is being carried out on behalf of other parties e.g. land development or subdivision, include the developer's name in place of the Waimakariri District Council name and logo on the signs.

2.5.3 Quality Assurance

All quality aspects of the investigation, design and construction must comply with CoP Part 3: *Quality Assurance* over the lifetime of the project. If any or all of the certificates or other documents referred to in Part 3 are not supplied, the Council may refuse to accept the work and refuse to issue the certification of the work pursuant to Section 224(c) of the RMA.

2.6 SURVEY REQUIREMENTS

2.6.1 Level Datum

The level datum used in the Waimakariri District must be Lyttelton Mean Sea Level 1937 (MSL). Where a Waimakariri District Council benchmark is not available within 1.0 kilometre of the site, use a LINZ level mark. State both the source of the levels (the benchmark) and the datum used on the engineering drawings.

2.6.2 Benchmarks

Establish a permanent benchmark where required by the Council as a condition of subdivision consent or as part of a project brief for capital works. As a general rule, a permanent bench mark will be required when, in the case of a subdivision, there is an extension to the Council's sewer, water, stormwater or roading network resulting in a distance of more than 650 m from an existing permanent bench mark.

Benchmarks must be accurate to ±5 mm.

Obtain a stainless steel washer with the unique benchmark number from the Council. Fix it by Ramset nail to a kerb, drainage structure or to other substantial concrete structure within the legal road or council reserve.

Provide the following documentation:

- A finder diagram showing the reduced level to three decimal places e.g. 13.225 m, complying with the Standard Draughting Layout requirements in QP-C811-AA (attached as Appendix A);
- Certification from a Licensed Cadastral Surveyor (a template certificate is provided in QP-C811-AC, attached as Appendix C);
- The methodology used e.g. differential levelling, GPS.

2.7 DRAWINGS

Engineering drawings must be legible, clear, readable and complete. They must clearly illustrate the proposal and enable both assessment of compliance with the CoP and accurate construction. Produce drawings on ISO-A series format. Follow the draughting requirements in Appendix A and detailed in AS 1100.101: 1992 and AS 1100.401:1984. The *United States National CAD Standard* is also an acceptable standard.

Engineering drawings generally include the following:

- A locality diagram giving the overall layout and location of the works;
- Detailed drawings, longitudinal sections, cross sections and diagrams of the proposed developments and/or works;
- Special details where the standard drawings are not sufficient;
- Benchmarks at a maximum spacing of 650 m;
- A north point, preferably pointing above the horizontal (i.e. in the top 180 degrees);
- Standard sheet notes, referring particularly to the CCC *CSS*;
- Set out information;
- A service legend, where services are shown on the drawing;
- A planting key or clearly labelled planting, where it is shown on the drawing.

If the project is large, provide a separate landscape drawing. On smaller projects, landscaping details may be shown on the engineering drawings. In both cases, show landscape planting areas on the roading construction drawings, by shading or patterning.

2.7.1 Content of Drawings

Show the following information on the drawings:

- The extent of the works showing existing and proposed roads, and the relationship of the works with adjacent works, services and/or property, including adjacent property levels;
- Proposed and existing property boundaries and street numbers
- Significant existing vegetation to be removed and any special or protected trees, and any areas of heritage significance that may be affected by the works;
- The extent of earthworks, including earthworks on proposed reserves, existing and proposed contours, areas of cut and fill, batter slopes, proposed stockpiles, subsoil drainage, erosion and sediment control measures both temporary and permanent;
- Details and location of existing and proposed stormwater primary and secondary flowpaths;
- The design of proposed roads (and their connections with existing roads), including plans, longitudinal and cross sections, horizontal and vertical geometry and levels, typical cross sections, details of proposed pavement and surfacings, kerbing, berms, footpaths, cycleways, tree planting, road marking and signage and all other proposed street furniture;
- Details and location of existing water, wastewater and stormwater mains and service connections, valves, hydrants, manholes, sumps, bends, tees, thrust blocks, meters and backflow devices;
- The horizontal and vertical alignment and location, including invert levels, physical grades, lengths, sizes, materials, types, minimum cover, cut to invert, position relative to other services of all proposed water, wastewater and stormwater mains and service connections, valves, hydrants, manholes, sumps, bends, tees, thrust blocks, meters and backflow devices, and services that may be reconnected or plugged;

Part 2: General Requirements

- Details and location of mechanically restrained portions of pipelines, pipeline bridges, pumping stations, reservoirs, intake and outlet structures, headwalls, swales, basins, ponds and the location of surface obstructions, hazards, or other features that may be affected by the works;
- In respect of water mains - chlorination points, pressure reducing valves with upstream and downstream design pressures;
- The street lighting layout showing the location and type of each light, proposed and existing significant road features (e.g. kerbs, property boundaries, planting and traffic management features) and property addresses;
- Details and location of existing and proposed telecommunications, electricity and gas supply, including proposed underground and above-ground junction boxes, transformers and similar equipment;
- The bedding and backfill depths, design compactions and trench restoration details for all underground services;
- Details of proposed landscaping of roads and allotments, and details of proposed reserve development including earthworks, landscaping features, landscaping structures, tree planting, irrigation, hard and soft surface treatment, park furniture and playground equipment. Include details of the ongoing maintenance requirements where appropriate.

This information may be expanded in the relevant part.

2.7.2 Form of Drawings

Provide all drawings in paper and/or electronic form. Normally hardcopy drawings should be supplied as full size prints to allow ‘as-built’ drawings to be prepared prior to filing.

All drawings must be legible at A3 size. Prepare electronic drawings in one of the following formats: DWG, DXF or DGN (V8), suitable for later addition of as-built information and inclusion in the Council’s asset map base. Drawings can be supplied as PDFs able to be converted to TIFs. In particular, electronic transfer of drawings may be required.

The co-ordinate system may be New Zealand Transverse Mercator Projection (NZTMP) or New Zealand Map Grid (NZMG).

Only metric units are to be used. Principally these are millimetres (mm), meters (m), litres/sec (L/s), and cubic meters/day (m^3/day). All levels are to be to 2 decimal places.

Plans shall be completed to the appropriate scales. Standard scales are 1:50, 1:100, 1:200, 1:250, 1:500, 1:750, 1:1000 and 1:1500. Map symbols to be those required by AS/NZS 1100. All text and symbols must be legible at A3 size. Format dates as day/month/year.

2.8 ACCEPTANCE OF DESIGN

This section applies to works carried out under subdivision consent.

2.8.1 Documents to Be Submitted For Engineering Acceptance

The Council will require a design report to be submitted. CoP Part 3 clause 3.2.1 – *Design Report* sets out in detail what is required in a design report.

Submit the design records, incorporating drawings, calculations, specifications, material specifications where not detailed elsewhere, graphical representations and calculations of infrastructure where requested, with the design report. This information should enable the process to be followed easily and should allow for replication of the results.

Include the geotechnical engineer's report on the suitability of the land for subdivision and/or development, including any site investigations.

Each separate Part of the CoP sets out those aspects particular to that Part which must be covered by the design or design report, where relevant.

2.8.2 Cost Benefit or Life-Cycle Costing

Where considered appropriate by the Council, carry out a cost benefit or life cycle costing of a proposal. This will typically be for larger or unique projects.

Life cycle costing may be used to consider options within a proposal or a proposal as a whole. In undertaking life cycle costing, consider the initial costs borne by the developer or the Council and the maintenance and replacement costs borne by the future owners and/or the Council. Maintain a reasonable balance between these short-term and long-term costs.

Assets designed to minimise capital cost at the expense of overall lifecycle shall not be accepted.

2.8.3 Engineering Acceptance

When it is satisfied that the design and design report meets the requirements of the CoP, the Council shall notify the designer that the design and design report has been accepted and endorse the quality plans, engineering drawings, specifications and other documents accordingly. For the purpose of this acceptance, the Council may require amendments to any quality plans, engineering drawings, specifications and/or other documentation and further reports submitted. In considering the design and design report and giving its acceptance, the Council shall act without undue delay.

Work must not commence on site unless and until:

- A resource consent for the work has commenced, except when no such consent is required;
- The Council has given engineering acceptance;
- Any other consent required has been granted e.g. NZ Railways Corporation, Department of Conservation, landowner.

2.9 APPROVAL OF CONSTRUCTION

2.9.1 Commencement of Works

The Developer shall not commence any engineering works without prior approval from the Council of the Engineering Plans, Resource Consent issue (where applicable) and all other necessary Consents are obtained. For substantial developments a pre-construction meeting is normally held on site between the developer and the Council's representative.

Prior to physical works commencing the developer shall ensure that all pre-construction conditions have been met. The Council will audit these where applicable.

The Developer's Representative shall provide the Council with such information as reasonably requested. The Council requires 5 working days notice of intention to commence work. A minimum of 2 working days notice shall be given for pre-construction or final inspections. 24 hours notice is required for other inspections.

No work shall occur on any legal road until the Council has approved the traffic management plan for the works.

2.9.2 Notification of Hold or Witness Points

Hold or witness points form part of the Contract Quality Plan required for each development. The developer or contractor must notify the Council at all 'hold' or 'witness' points and such other times as the Council may determine, for Council's information and to enable audits or witnessing to be carried out.

Give the Council at least one working days notice and adequate access for audits or tests. Audits will be carried out within one working day of notification if possible. The Council will inform the developer of any problems encountered with these audits so they can be addressed at an early stage.

2.9.3 Testing

Any work required to be tested by the contractor or developer in the presence of the Council must be pre-tested and proved satisfactory before test witnessing by the Council is requested.

The developer shall provide the Council a minimum of two working days notice that a test inspection is required.

In the event of an unsatisfactory test then subsequent re-tests and/or re-inspection may result in additional charges against the developer.

The Council does not normally test materials or products. Plan and specification approval is not evidence that the Council has approved the material or product. The Council may require verification that a material or product is tested for conformance, quality or adequacy.

Part 2: General Requirements

2.10 CONSTRUCTION

2.10.1 Supervision and Setting Out

The developer shall engage a practising Registered Civil Engineer or Registered Surveyor prior to commencement of any works who shall supervise all engineering works and setting out.

Within five working days of the date of any site inspection or visit, the Supervising Engineer/Surveyor shall forward to the Council copies of all Site Inspection notes.

All work on any legal road shall be carried out in accordance with the traffic management plan approved by Council.

2.10.2 Maintenance of Standards

It is the developer's responsibility both directly and through its appointed representative to ensure that all physical construction work, whether carried out directly or by contractors or sub-contractors, is at all times in accordance with the approved engineering plans.

2.10.3 Departure from Approved Plans

Any departure from the requirements of the approved plans that may be necessary to meet particular circumstances shall be referred to the Council for approval.

2.10.4 Conditions Auditing

The Council will audit compliance with the conditions of consent. Auditing will involve both site inspections and checking of associated documentation to the extent necessary to ensure the work is completed in accordance with the approved plans and specifications, and to the Council's standards. The Council will undertake auditing inspections and checking of resource consent conditions as part of the Council's fixed fees for subdivision resource consents or otherwise a fee based on the officer's concerned current hourly charge out rates together with current vehicle running costs/kilometre.

The developer shall notify the Council that audit inspections are required giving at least one working day notice. The minimum level of inspection will be as outlined in Table 2.1.

Table 2.1 Minimum Inspections Required

Type of Works	Situations Where Inspections Required
Roading	Following shaping of roading and footpath subgrade prior to placement of sub-base material.
	Following metalling up, prior to pouring of kerb and channel.
	Following compaction of base course prior to final surfacing. This surface is to be tested with a Benkelman Beam, or other approved method, and the results submitted to Council for approval.
Trenching/Road Opening	Prior to backfilling of service trenches
Services	Testing of water, sewer and stormwater mains and laterals
	Disinfection of water mains
Water	Following completion of required works
Sewer	Following completion of required works
Stormwater/Land Drainage	Following completion of required works
Footpaths	Prior to pouring concrete
Vehicle crossings / Entrances / Rights-of-Way	On completion of excavation to subgrade
	Following compaction of base course prior to final surfacing

Where additional inspections are required because of faulty workmanship or work not being ready contrary to the receipt of a notification, such inspections will be carried out for an additional fee, for the additional hours required and distance travelled.

2.10.5 Emergency

Should a situation arise whereby the safety of the public, public or private property or the operation of any public facility is endangered, the Council may instruct the developer to stop work or to carry out such remedial measures required to remove the danger. Any work so ordered shall be at the expense of the Developer.

2.10.6 Fencing

The developer shall erect temporary fencing, in accordance with their approved Health and Safety plan. This fencing must protect the general public, particularly children, from all danger areas including dams and ponds. Danger signs approved by the Council shall be erected that warn persons of the danger.

2.10.7 Sewerage, Stormwater and Water Supply Connections

The Council will perform or directly supervise all connections to the Council's water supply and drainage reticulation network. All such connections require a Council Permit and Council certification.

Part 2: General Requirements

2.11 COMPLETION OF LAND DEVELOPMENT WORKS

2.11.1 Completion Documentation

Upon completion of all subdivisional developments, provide completion documentation in accordance with Part 3: *Quality Assurance* and Part 12: *As-Builts*. Additionally, provide evidence that reticulation and plant to be taken over by network utility operators has been installed to their standards and will be taken over, operated and maintained by the network utility operator concerned.

Completion documentation includes, as a minimum:

- The geotechnical reports, certificates and as-built drawings required by CoP Part 4: *Geotechnical Requirements*;
- Completion documentation required by CoP Part 11: *Lighting*;
- As-built drawings of all infrastructure, where required by the subdivision consent or contract, showing the information required by each Part;
- As-built data in RAMM format for all roads;
- Project and contract records , e.g. inspection and test plans, non-conformance reports;
- Completion certificates as per CoP Part 3: *Quality Assurance*;
- Other documentation required by the Council including, but not limited to, operation and maintenance manuals and warranties for stormwater treatment facilities and new facilities involving electrical or mechanical plant; asset valuations for all infrastructure to be taken over by the Council;
- Evidence of a complying post construction safety audit for works on or becoming legal road.

When all the conditions of approval that are imposed on a resource consent for subdivision have been met, the Council will issue a Section 224(c) Compliance Certificate or Practical Completion Certificate to that effect.

2.11.2 Approval of Uncompleted Work

Where in the opinion of the Council it is appropriate, the Council may approve uncompleted work, subject to satisfactory bonds being arranged.

2.11.3 Defects Liability

For contracted works, the defects liability period for all works must be 12 months from the issue of the Practical Completion Certificate. Of the total retentions held back during the course of the contract, half shall be released with the issue of the Practical Completion Certificate, and the remainder held until the end of the defects liability period.

For work completed under a 224 certificate, the developer shall maintain the works until they are formally taken over by the Council or to a date specified in a bond for completion of uncompleted works. A bond equal to 5% of the construction works shall be lodged with Council for the defects liability period.

The developer must also remedy defective works, as defined in NZS 3910, over this period. Establish and maintain landscaping, in accordance with CCC *CSS: Part 7*, over this period or until the landscape establishment bond is released. Maintenance shall include appropriate and regular mowing of grass and watering of all plants and trees together with the replacement of any perished specimens.

Part 2: General Requirements

The Council, upon request from the developer or contractor, will issue formal notification that the maintenance period has expired, the works are satisfactory and that the bond or retentions will be released. This notification will be followed by the release of the maintenance bond or remaining retentions. This notification will not be released until maintenance matters and defects have been remedied.

2.11.4 Defects

Council's receipt and acceptance of 'As Built' plans does not absolve the Developer of any responsibility for accuracy. In the event of any inaccuracy being discovered on the 'as built' plan the Council will verify the correct information with the consultant and require the consultant to provide corrected as-built plans.

After agreement with the developer, the Council will accept new reticulation that connects to Council's infrastructure. The Council will then operate and maintain that reticulation. However, the developer remains financially responsible for any hidden defects and defects bonded for and covered by the Practical Completion Certificate.

Part 2: General Requirements

2.12 BONDS

2.12.1 Uncompleted Works Bonds

Generally, bonds shall not be permitted for minor uncompleted works; however, this type of bond may be permitted at the discretion of the Council.

Bonds must be secured by an appropriate guarantee or must be in cash and lodged with the Council. Where necessary bonds must be executed and registered.

The amount of the bond shall be the estimated value of the uncompleted work plus a margin to cover additional costs estimated to be incurred by the Council in the event of default.

An uncompleted works bond template is available in QP-C811-AD (attached as Appendix D).

2.12.2 Maintenance Bonds

Bonds to cover maintenance of completed works are recognised as an acceptable procedure and will be permitted at the discretion of the Council, except that acceptance of a bond for maintenance shall not be unreasonably withheld.

Bonds must be secured by an appropriate guarantee or must be in cash and lodged with the Council. Where necessary bonds must be executed and registered.

The amount of the bond shall be the estimated value of the maintenance plus a margin to cover additional costs estimated to be incurred by the Council in the event of default.

A maintenance bond template is available in QP-C811-AE (attached as Appendix E).

2.13 ASSOCIATED DOCUMENTS

Appendix A	Standard Draughting Layout & Format Requirements (QP-C811-AA)
Appendix B	Draughting Checklist (QP-C811-AB)
Appendix C	Benchmark Certificate (QP-C811-AC)
Appendix D	Uncompleted Works Bond Form (QP-C811-AD)
Appendix E	Maintenance Bond Form (QP-C811-AE)

Standard Draughting Requirements

Provide drawings to a minimum standard that comply with AS/NZS 1100.101:1992 and AS/NZS 1100.401:1984. Electronic drawings complying with the *United States National CAD Standard,* used in conjunction with AS/NZS 1100, are also acceptable. Electronic drawings shall be provided in DXF or DWG format.

The scale for drawings is generally 1:200 but other accepted engineering scales may be used to suit the level of details on the drawings. Scales progress in multiples of 10 e.g. 1:1, 1:2, 1:5 as detailed in Table 5.1, AS/NZS 1100.101. All drawings shall be submitted in no larger than A1 original format.

Ensure that electronic drawings are arranged in layers, in addition to the layout and formatting requirements below. Layers shall be labelled appropriately where possible.

1. DRAWING BASE DATA (EXISTING TOPOGRAPHY)

Draw existing features in a lighter line thickness e.g. 0.18 mm or 0.25 mm. Draw standard draughting symbols un-shaded for existing features.

2. DRAWING PROPOSED WORK

Draw proposed work in a heavier line thickness e.g. 0.35 mm and thicker. Use the same line type, to enable clear differentiation between existing features and proposed work. Draw standard draughting symbols filled in for proposed features.

3. LABELLING

Draw text such that it is legible on an A3 sheet.

Do not clutter the drawing sheet with detail and leave a margin between the drawing text and lines and the page edge border.

Differentiate between existing features and proposed features by using different formatting:

- Normal format for existing features and bold format for proposed features;
- 0.25 mm pen weight minimum for existing features or 0.35 mm minimum pen weight for proposed features;
- Clear labelling to identify existing and proposed features.

Use the abbreviations in Table 1.

Table 1: Feature Abbreviations

Feature	Abbreviation
Asphaltic concrete	AC
Edge of seal	EOS
Top of Kerb	TOK
Tangent point	TP
Curve tangent point	CTP

Ensure notes do not go through other notes and that leaders do not cross.

Ensure dimensions or text are clear of all lines (e.g., dimension lines, boundaries, etc)

Ensure all vertical text or dimensions are read by viewing from the right of the drawing sheet. No text or dimensions shall appear upside down when read with the sheet in its correct orientation.

Standard Draughting Requirements

Place road names above the north road boundary but not through section boundary lines. Show spot levels on the legal boundary and at least 3 m inside the abutting private property.

Use standard cells for trees, lights, service covers and boxes. Typical symbols are shown in the example drawings in section 14 of this appendix. Typical abbreviations are shown in Table 1, Table 3, Table 4 and Table 9.

Standard symbols for features on pipelines shall be orientated to the centreline of the pipeline.

4. SETOUT DATA

Label setout data clearly and concisely. Mark tangent points with a line that goes through the kerb only. Label TPs and CTPs in a Pegging Box only and place the pegging box (e.g., Table 2) as close to the pegs they represent as possible. Drawings may be more understandable if a separate drawing for construction setout is provided.

Table 2: Pegging Box Example

Peg	Peg Level	Kerb Level	Cut or Fill	Kerb Offset (front or behind)
1TP	13.290	13.280	C0.010	1.5 m F
2	13.305	13.285	C0.020	1.5 m F
3	13.330	13.295	C0.035	1.5 m F
4	13.345	13.300	C0.045	1.5 m F
5TP	13.345	13.310	C0.035	1.5 m F

Show join or match lines, referencing the relevant adjoining sheet.

5. UNDERGROUND SERVICES

Distinguish services by using different line types and colours. Ensure that services may be easily identified when printed in black and white. Table 2.2.1b of AS/NZS 1100.401 may be used as a guideline for labelling services. Provide a legend where necessary.

Label all of the following items:

- High voltage cables and all fibre optic cables.
- Utility structures or boxes.
- Water meters (these include the backflow preventers installed as part of the connection on each side).

Table 3: Service Abbreviations and Symbols

Service Type	Symbol	Abbreviation
Fire Hydrant		FH
Sluice Valve		SV
Stop Valve		Stop Valve
Scour Valve	Scour	Scour
Single Air Valve	SAV	AV
Double Air Valve	DAV	DAV
Gate Valve	GV	GV
Flow Meter		FM

Service Type	Symbol	Abbreviation
Pressure reducing valve		PRV
Reflux/Non-return valve		NRV
Manhole		MH
Power box (above ground)		PB
Power pole		PP

Note: Label telecommunications boxes, manholes and pillars to suit the development.

Make sure symbols are sized appropriately for the scale of the drawing.

6. PIPEWORK

Label all stormwater and sewer pipes with nominal pipe diameter and flow direction, using similar terminology to that used by the manufacturer to code or classify the pipe, e.g., label a 225 mm diameter stormwater pipe as Ø225 RCRRJ Class X stormwater or DN225 PVC-U stormwater. Show sewer laterals. Also include the year of installation.

In addition, for major pipes 750 mm and above, show the outside diameter of the pipe and show the location of manholes, as the manhole lid may not be on the pipe centreline. Show the actual shape of special manholes.

Label all sumps and manholes with the structure identifier, e.g., MH with a unique letter and sump abbreviation with a unique number. Structures that are not affected by the work do not require a unique letter or number. Start at one end of the project and number or letter continuously through. Where an existing sump is being modified, draw the proposed sump over it. Label any structures that are being altered in height.

Table 4: Drainage Structure Abbreviations

Drainage Structure	Abbreviation
Single Sump	SS
Double Sump	DS
Triple Sump	TS
House Drain Sump	HDS
Hillside Sump	HS
Corner Sump	CS
Manhole	MH
Inspection Chamber	IC
Flush Tank	FT
Flush Manhole	FM
Air Gap Separator	AGS

7. LANDSCAPE

Show existing trees, including those to be removed and retained, as well as proposed trees, using the symbols in Figure 1. Label any heritage or protected trees. Distinguish existing vegetation from proposed vegetation. Show the full canopy of existing trees that will be retained.

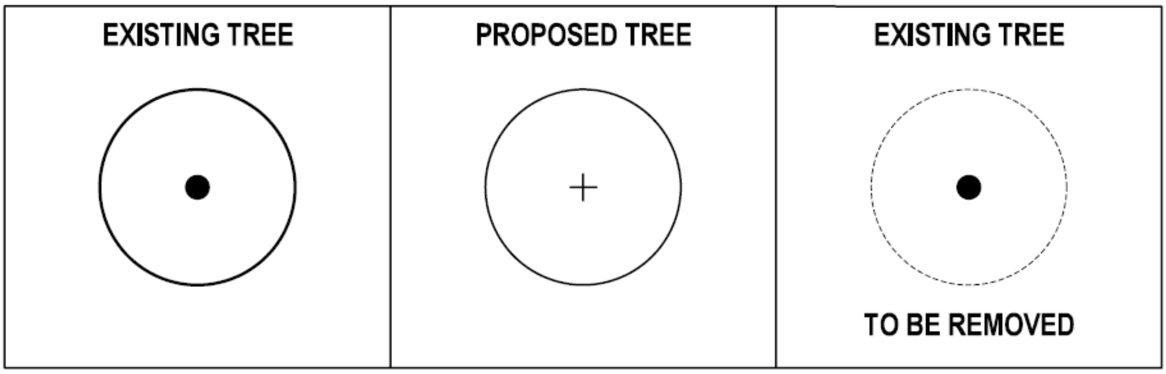


Figure 1: Landscape draughting symbols

Cross reference all other related drawings, including irrigation or lighting. Show underground services and street light locations on planting drawings.

All planting drawings must have a plant list. The plant list must include the following:

- Botanical name;
- Common name;
- Container size and/or height of plant at time of planting;
- The quantity of that type used.

The plant list can also include any abbreviations used, planting centres (plant spacings) and any special maintenance requirements to retain the initial concept, i.e., hedge heights, park furniture treatments. Where there is a separate plant list for trees only, cross reference any other plant lists/drawings.

8. STREETLIGHTING

Where streetlighting will be altered, label all affected poles as detailed in Table 5. Label poles to be removed with "R". Number each affected streetlight with the related number from the lighting schedule on the drawing. Label existing poles that will not be affected as "E". Show the lighting wattage of all proposed and remaining lights.

Table 5: Lighting Symbols

Symbol	Use	Numbering system
Pxxx	Every pole upon which work is to be carried out. Existing poles shall have construction material and manufacturer's pole code shown on the drawing	Prefix to be followed with unique identifier either Network Operator's pole number or sequential number for project.
Lxxx	Any alteration to lighting. Provide separate codes for replacement, new and differing light, lamp, pole or arm details	Prefix to be followed with unique identifier.
Rxxx	Any lighting equipment to be removed that is not covered by an "L" reference	Prefix to be followed with unique identifier.

Standard Draughting Requirements

9. TITLE BLOCKS

The title block must include the following information:

- A project title, including street address;
- A unique number or identifier, preferably the consent or project number;
- The designer's name, signature and contact details;
- The draughtsperson's name;
- The drawing checker's name;
- The design reviewer's name and signature;
- The stage of work e.g. for acceptance, accepted engineering drawings, construction, as-built;
- The date of preparation and of acceptance;
- The scale or scales used;
- A graphic scale;
- The datum and origin;
- The original sheet size;
- A drawing title, e.g., Long section;
- Sheet numbers, including the number in the set;
- An amendment box, including brief description of amendment and sign off by designer.

10. LONG-SECTIONS

Draw horizontal scales generally to match the plan. Appropriately exaggerated vertical scales may be used to improve clarity.

Show concrete surround on the pipe long-section. Label structures and vertical curves. Use thicker line weights for proposed work.

11. CROSS-SECTIONS

Label levels with identifiers, e.g., K12.400. Use thicker line weights for proposed work.

Provide a minimum of one fully detailed typical cross-section per sheet.

Show construction depth outlines for roads, paths, grass berms and landscape planting. Label legal boundaries vertically.

12. ROAD MARKING DRAWING

Use different line types to distinguish between specific road markings.

The road marking drawing must show:

- The existing markings to be removed (i.e., sandblasted);
- The new road markings to be installed;
- How the proposed markings mate into the existing markings at the project's extents.

Show roadmarking on a drawing base that is essentially 'as-built' in terms of features such as kerbs and paths. Indicate the type of marker, generally by using standard symbols and descriptions and providing a legend.

Note: Specify numbers, spacings and colours for reflective pavement markers and kerb top markers.

13. LOCALITY DIAGRAM

Show the road boundaries and street names. Show the limit of the development. Draw the locality diagram true to the map orientation or at the same orientation as the engineering drawing.

Draughting Checklist

DRAWING – (LAYOUT)	
Street names and waterways correctly spelt and orientated with correct text size.	
Running distances are shown at top of drawing - at right angles to drawing.	
Join lines (if any) are shown and labelled.	
North point (should be correctly orientated i.e. not pointing down), service legend and standard notes (bottom right hand corner of sheet) shown. Drawing to be labelled with scale.	
Leader arrows from notes should not cross one another.	
Existing notes and proposed notes do not overlap one another, or the boundary and section lines.	
Title block filled out correctly, including sheet numbers.	
Any amendment to drawing to be indexed in amendments box as a letter (not number) with small description and date.	
Any details or sections to be labelled correctly.	
Related drawings cross referenced.	
Locality diagram labelled and orientated correctly	
Proposed notes are standard in wording. Benchmark referenced.	

DRAWING – (EXISTING FEATURES)	
Existing kerb and channel correctly labelled.	
All existing manholes, sumps, fences, grass berms, footpaths, driveways and landscape features are labelled.	
Boundaries shown – existing and proposed, including easements.	
Property levels or contours are shown over development, at boundary and 3m outside development.	
All buildings to be hatched and labelled (e.g. DAIRY).	
House numbers shown at correct orientation.	
All existing reticulation pipes are correctly labelled with flow direction shown.	
All existing utilities are correctly labelled.	
Existing vegetation, including that to be removed, is clearly shown, in both canopy size and position.	

DRAWING – (PROPOSED FEATURES)	
Proposed kerb and channel correctly labelled.	
Proposed kerb and flat channel has fender line shown.	
All radii on proposed kerb and channel shown.	
TP's, CTP's on proposed kerb face have 'tick' shown.	
Proposed cutdowns are shown and labelled (particularly at intersections and adjacent to pedestrian islands). Does not apply to standard driveways.	
Proposed pipes to be installed or removed correctly labelled.	
Proposed property/spot levels and contours are 'proposed' weight.	
All proposed paths/paving/other hard surfaces are shaded and labelled correctly.	
Correct Peg box attached.	
Manholes being altered or installed have an allocated letter.	
Extent of filling, finished levels shown.	
If landscape planting is shown on drawing there must be a landscape planting key.	
If there is a separate landscape planting drawing, planting to be patterned and labelled on roading drawing; cross referenced to the landscape planting drawing.	

Draughting Checklist

LANDSCAPE DRAWING (additional to layout)	
Proposed features/structures labelled, including furniture/bins/signs/fountains/fencing.	
Proposed playground equipment/softfall areas/sports fields/recreational hard surfaces labelled.	
Proposed vegetation/plant symbols clearly labelled and/or listed in plant list.	
Plant list has correctly spelled botanical names, common names, sizes and quantities.	

LONG SECTION (additional to layout)	
Proposed kerbs, crowns, edge of seals to be labelled. No existing kerbs, edge of seals are shown (when required, small sections may be shown for clarity).	
Pipe size, class, protection shown, vented manholes labelled.	
Longitudinal section to have title below section.	
Sump numbers/MH letters correspond to the drawing.	
Running distances from easily located point on engineering drawing.	
All required grades shown and labelled.	
Existing and proposed levels shown, including cuts and fills.	
Property boundaries, road intersections, crossing services shown.	
Datum. Shown to 3 decimal places.	

ROAD MARKING DRAWING (additional to layout)	
RPM'S and KTM's use the symbols and are correctly labelled.	
Correct line types are used for 100 mm WHITE, NO STOPPING, CONTINUITY etc.	
Correct line weights used for 'ex lines to be removed'; 'ex lines to remain' and 'proposed markings'.	

CROSS SECTIONS (additional to layout)	
Every cross section sheet to have at least one typical cross section showing construction in full and labelled correctly with standard notes.	
The word chainage should not appear. Cross sections labelled with chainage value only (i.e. 20.00 m) to be centred under cross section.	
Proposed kerb and fender, quarter points, crown, interpath channel, and invert of swales to have levels shown.	
Sump numbers/MH letters correspond to the drawing.	
Proposed pipes, manholes, sumps and any services which could be disturbed to be shown.	
North, south or west and east boundaries to be labelled as such.	
Proposed trees and other plantings are shown in relation to underground services, paths and carriageways.	
Datum text to be positioned at left hand side of cross section on datum line.	

DESIGN CHECK BY: ______________________ **DATE:** ______________

Benchmark Certificate

ISSUED BY: ____
(Surveyor)

TO: ____
(Developer)

TO BE SUPPLIED TO: ____
(Territorial authority)

IN RESPECT OF: ____
(Description of benchmark)

AT: ____

____
(Address)

I, ______________________ a Licensed Cadastral / Registered Professional Surveyor
(Surveyor) (delete one)

hereby certify that the benchmark shown on finder diagram ______________________
has been installed in accordance with the requirements of the Infrastructure Design Standard and good survey practice, using ______________________ methodology.

______________________ Date: ______________________
(Signature of Surveyor)

______________________ ______________________
(Surveyor) (Address)

Uncompleted Works Bond

SCHEDULE

SUBDIVISION REFERENCE: ______________________________

THE OWNER: ______________________________

ADDRESS OF ACTIVITY: ______________________________

DATE FOR COMPLETION: ______________________________

DESCRIPTION OF WORK: ______________________________

____

BOND VALUE: ____________________ GL Code ____________________

THE OWNER described below for himself, his successors and assigns, hereby confirms and ratifies that the conditions set out below are the conditions upon which he has lodged the said sum and hereby covenants to complete the works listed in the schedule by the date specified therein.

____________________	____________________	____________________
Owner	Signature	Date

THE WAIMAKARIRI DISTRICT COUNCIL hereby acknowledges:

(a) Receipt of the cash refundable bond (Receipt No. ______________)

(b) That such sum is to be held by it as a cash refundable bond for uncompleted subdivisional works on the conditions set out below.

____________________	____________________	____________________
Council's Representative	Signature	Date

CONDITIONS

1. If the owner completes all the work listed in the Schedule below to the satisfaction of the Council by the date specified, the sum shall be refunded to the Owner in full.
2. If the Owner does not complete all the said work by the said date the Council, on the Owner's behalf, may carry out or cause to be carried out the said work or such parts as shall not be completed and may apply the said sum towards the cost of so doing. Any surplus after completion by the Council shall be refunded to the Owner.
3. The Council shall not however, be obliged to carry out all or any of the said work and if it chooses to do so the carrying out of such work shall be without prejudice to the Council's exercise of any other rights remedies or powers which it may have against the Owner.
4. Bond monies will be refunded once Council costs attending to the outstanding works and confirming compliance have been recovered. An invoice will be raised in due course for these costs.
5. Bond monies are non-interest bearing.

Maintenance Bond

SCHEDULE

SUBDIVISION REFERENCE: ______________________________

THE OWNER: ______________________________

ADDRESS OF ACTIVITY: ______________________________

DATE FOR COMPLETION: ______________________________

DESCRIPTION OF WORK: ______________________________

____

BOND VALUE: ____________________ GL Code ____________________

THE OWNER described below for himself, his successors and assigns, hereby confirms and ratifies that the conditions set out below are the conditions upon which he has lodged the said sum and hereby covenants to complete the works listed in the schedule by the date specified therein.

____________________	____________________	____________________
Owner	Signature	Date

THE WAIMAKARIRI DISTRICT COUNCIL hereby acknowledges:

(a) Receipt of the cash refundable bond (Receipt No. _____________)

(b) That such sum is to be held by it as a cash refundable bond for uncompleted subdivisional works on the conditions set out below.

____________________	____________________	____________________
Council's Representative	Signature	Date

CONDITIONS

1. If the owner completes all the work listed in the Schedule below to the satisfaction of the Council by the date specified, the sum shall be refunded to the Owner in full.
2. If the Owner does not complete all the said work by the said date the Council, on the Owner's behalf, may carry out or cause to be carried out the said work or such parts as shall not be completed and may apply the said sum towards the cost of so doing. Any surplus after completion by the Council shall be refunded to the Owner.
3. The Council shall not however, be obliged to carry out all or any of the said work and if it chooses to do so the carrying out of such work shall be without prejudice to the Council's exercise of any other rights remedies or powers which it may have against the Owner.
4. Bond monies will be refunded once Council costs attending to the outstanding works and confirming compliance have been recovered. An invoice will be raised in due course for these costs.
5. Bond monies are non-interest bearing.

WAIMAKARIRI
DISTRICT COUNCIL

ENGINEERING CODE OF PRACTICE

PART THREE

QUALITY ASSURANCE

Updated 7/7/2020

Part 3: Quality Assurance

CONTENTS

Part 3: Quality Assurance

FIGURES

TABLES

Part 3: Quality Assurance

3.1 INTRODUCTION

Waimakariri District Council (WDC) aims to achieve well-designed and constructed assets for its ratepayers. Building and maintaining assets, regardless of whether they are created through the subdivision and development of land or the capital works process, is a partnership of developers, designers and contractors. Where quality principles are applied to both design and construction, real benefits result.

Waimakariri District Council therefore requires the application of quality assurance for all physical works that result in assets being transferred to the Council. Any designer, contractor or supplier wishing to tender for capital works or any developer exercising a resource consent must implement this part of the CoP.

Where the assets will be vested through subdivision, constructing assets in accordance with a Project Quality System will be a condition of subdivision consent. The developer must demonstrate compliance by providing and applying the project quality system, to substantiate the release of the subdivision compliance certificate, known as the 224(c) certificate. Similarly a contractor engaging in capital works is required to provide and apply a Contract Quality Plan during the contract period, which provides the supporting structure for the quality system and allows the issue of a Practical Completion Certificate.

This Part provides a framework for a quality management system. It is based on the system developed by Christchurch City Council, which has been benchmarked against best national practice. The quality management system must ensure that all quality assurance issues relevant to a subdivisional land development or a capital works project are effectively defined, managed and communicated to ensure that all quality requirements are achieved.

Part 3: Quality Assurance

3.2 PROJECT QUALITY SYSTEM

The project quality system consists of a document trail comprising:

- The Design Report, as described in clause 3.2.1;
- Records of all materials used, testing undertaken and inspections carried out.

These documents support the certificate trail, which establishes compliance with the Project Quality System. The certificate trail includes:

- The Producer's Statement – Design (QP-C812-AC, attached as Appendix C) which completes the Design Report documentation;
- The Producer's Statement – Construction (QP-C812-AD, attached as Appendix D);
- The 224(c) Certificate or Practical Completion Certificate.

The issue of the 224(c) Certificate or Practical Completion Certificate is therefore dependent on the application of the Project Quality System and the provision of its related documentation.

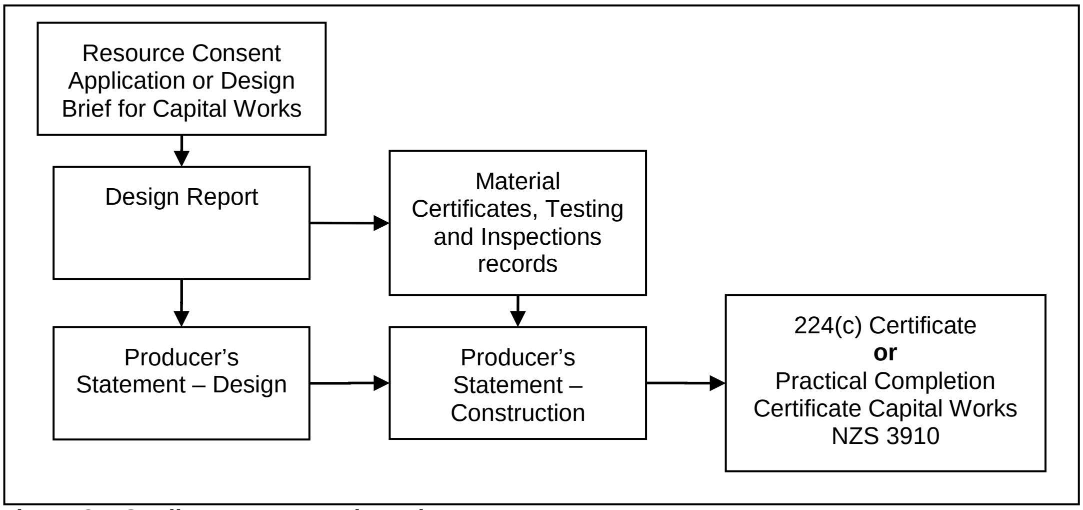


Figure 3.1 Quality Assurance Flow Diagram

Provide details of how all the identified requirements were or will be planned, controlled (managed), checked or inspected for compliance and the results recorded. Include provision for document control, including review and approval of the quality systems.

3.2.1 Design Report

A Design Report is a document summarising the design of a project in compliance with the requirements of the CoP and the resource consent or project brief.

Submit a Design Report where required as a condition of consent in respect to a subdivisional land development or where specified in the project brief. A Producer's Statement (Design) shall be submitted to the Council along with the Design Report, confirming that the design has been completed to the requirements of the CoP and appropriate WDC and NZS standards. Engineering acceptance is subject to presentation of this report.

The Design Report shall include details of the design and demonstrate that the design complies with the CoP, the conditions of subdivision and all relevant standards. It shall also provide WDC with a complete record of the design so that this can be referred to for future engineering design and subdivisions relating to this subdivision/development as assets.

All models, calculations, specifications and plans shall be appended to the Design Report. The report shall cover assumptions made, design standards, statements on deviations from standards, and options considered. It shall also cover the planned methodologies for construction quality assurance and site auditing, including testing, inspections, and certificates for materials confirming compliance with standards.

Any subsequent amendments to the design, plans and specifications shall be submitted to Council for approval.

3.2.2 Documentation

The following documentation may be required before the approval for works may be processed:

- Stormwater catchment plan and calculations showing catchments and drainage reticulation design, secondary flow paths, minimum floor levels for lots adjacent to flowpaths.
- Wastewater catchment plan and calculations if trunk or primary reticulation is proposed or if requested by Council.
- Existing drains: Where an existing private reticulation is proposed to be included as a Council asset the condition of the reticulation may require verification. Verification can be in the form of closed circuit television video inspection and/or pressure test.
- Road pavement design calculations.
- Structural calculations.
- Geotechnical stability calculations.
- Test results to support Roading, Structural or Geotechnical calculations
- Construction management plan outlining methods of dust, noise control etc.
- Health and safety plan: required for any work in Council Land. Must identify any potential hazards and proposed measures of dealing with them.
- A copy of the Earthworks and Silt Control plan and also of any submitted to Environment Canterbury as part of any other resource consent requirement.
- Any work intended to be undertaken on third party property must be clearly identified on the plan, e.g. where material is borrowed or stockpiled.
- Where open cut excavation is proposed on existing roads this work must be identified on the plans. A Road Opening Permit shall be obtained from the WDC.
- Plans & Specifications.
- Any other resource consents required for the execution of the development.

3.2.3 Drawing and Plans

It is the developer’s responsibility both directly and through its appointed representative to ensure that all physical construction work, whether carried out directly or by contractors or sub-contractors, is at all times in accordance with the approved engineering plans. Any departure from the requirements of the approved plans that may be necessary to meet particular circumstances shall be referred to the Council for approval.

Upon completion of construction work, and prior to the acceptance tests, copies of ‘As-Built’ plans and data recording information about the completed works shall be provided to WDC, as specified below and in CoP Part 12: *As-Builts*. Separate plans shall be required for wastewater, stormwater and water supply services. In addition to the plans, a practicing registered civil engineer or registered surveyor shall provide certification stating that the As-Built plans are a true and accurate record of all services.

Part 3: Quality Assurance

The following drawings shall be submitted to the Council where available and appropriate:

- Locality plan: showing location of work in relation to existing roads and features to enable the site to be easily located;
- Staged development plan: where development is planned in stages then each stage shall be accompanied by a plan showing how that particular stage relates to the development as a whole and also to other stages. The physical execution of the works to be staged shall align with that staging detailed in the resource consent application;
- Site plans: showing horizontal alignment, kerbs, benchmark positions, setting out data, co-ordinates etc;
- General roading works plan (including the following):
    - Detailed plans with contours of intersections, cul-de-sac heads, parking bays
    - Long-section showing, at maximum 20m chainage intervals existing ground levels, proposed final levels, cuts and fills, grades, vertical curve details, horizontal curves and services
    - Cross sections and typical cross sections
- Drainage, sewerage and water reticulation (including the following):
    - Separate plans showing the reticulation in relation to lot boundaries
    - Long sections of each drainage line with existing and final ground levels at minimum 20m intervals, pipe sizes lengths and grades, manhole cover levels, invert levels and depths
    - Any existing services shall be shown on cross sections and accurately located in the field by potholing or other buried service location techniques shall be highlighted
- Energy (electrical) reticulation
- Street lighting layout
- Communications reticulation layout
- Gas reticulation layout (if applicable)
- Earthworks and silt control plan: separate plan showing final contours, areas of cutting and filling together with depths relative to original ground level
- Topographical survey plan: showing and identifying existing features, spot levels on permanent features, invert levels, pipe and manhole materials, flow directions. The survey must be oriented by reference to legal survey pegs and not merely boundary fences or buildings
- Detail drawings: standard and other detail drawings showing details of kerbs and/or channels, pram crossings, paving and underchannel drains, stormwater inlet and outlet structure details, manholes, junctions, ramped risers, sumps, pipe bedding
- Structural drawings (if applicable)
- Ducting plan: showing ducts for communications, energy, traffic-lights, water connections etc
- Road signs and markings plan, including street names
- Pump station details (if applicable)
- Landscape planting plan
- Works to reserve areas
- As-built plans: as required in CoP Part 12: *As-Builts*

Any departure from the requirements of the approved plans that may be necessary to meet particular circumstances shall be referred to the Council for approval.

Responsibility for providing the plans and associated data shall lie with the developer in the case of land development, or with the contractor in the case of works constructed for the Council under contract to the Council.

3.2.4 Submission of Application for Engineering Plan Approval

Upon works completion the certificate of design compliance that states that all works have been designed in accordance with the appropriate standards and sound engineering practice should accompany the application.

The Supervising Engineer/Surveyor shall submit a programme of inspection that should demonstrate an adequate level of inspection will be undertaken.

The Council will check the Engineering Plans and Specifications for compliance with this Engineering Code of Practice. The Council's approval of complying documents will be given in writing.

If alterations are required the plans and documents will be returned with the request that updated plans are amended. Minor amendments required will be endorsed on all copies of the plans.

Where the resource consent application includes a proposal plan for the proposed activity and a resource consent is granted that is conditional on works being completed in accordance with the approved plans then the Council will return a set of stamped approved plans and specifications to the developer.

At all times during construction a copy of the stamped approved plans shall be kept on site, together with a copy of the Resource Consent.

Part 3: Quality Assurance

3.3 MANAGEMENT RESPONSIBILITY

3.3.1 Developer's Representative

The Developer should appoint a single Developer's Representative who shall be responsible for submitting information required for consent application, preparing and submitting engineering plans, liaison with council, monitoring/supervising construction, certifying the 'as-built' information and the works. The Developer's Representative shall be a Chartered Professional Engineer or Registered Professional Surveyor.

The Earthworks and Land Stability investigation and completion reports shall be prepared by a Chartered Professional Engineer experienced in geotechnical engineering.

The Developer's Representative should be available for a site meeting as required. The Council will provide two (2) working days notice for any meeting it instigates except in the case of emergencies in which case an immediate response may be required.

Engineering plans and specifications must adequately specify the works and materials. Approved engineering plans are one of several requirements to be met before construction may commence.

3.3.2 Material Supply

Check materials purchased for the project that are significant in terms of achieving the contract quality requirements. Confirm compliance with the specified requirements prior to incorporation in the project. Note the verification of compliance either on the relevant checksheet or some other appropriate record.

Checking for compliance should preferably be done on receipt of the materials. The "verification" referred to can be recorded when completing the relevant checksheet. Attach any supporting documentation to the checksheet, such as delivery dockets or supplier certificates of compliance, which provide evidence of the type, grade, and class etc of material used.

Keep records of material tests that are traceable to defined sections of the work e.g. 7-day and 28-day concrete crushing strength test results, basecourse sand equivalent tests ex-supplier.

3.4 SAFETY AND ENVIRONMENTAL MANAGEMENT

3.4.1 Health & Safety

A health and safety programme is mandatory for all contract quality plans submitted as part of a capital works project. It is not a Council requirement of subdivision consents.

Operate a formal health and safety programme, which complies with the statutory requirements of the Health and Safety in Employment Act 1992 and any subsequent revisions and associated regulations. To the extent practical and permissible by law, health and safety policies and procedures should be integrated into the engineer's and contractor's quality system.

The developer shall erect temporary fencing, in accordance with their approved Health and Safety plan. This fencing must protect the general public, particularly children, from all danger areas including dams and ponds. Danger signs approved by the Council shall be erected that warn persons of the danger.

Should a situation arise whereby the safety of the public, public or private property or the operation of any public facility is endangered, the Council may instruct the developer to stop work or to carry out such remedial measures required to remove the danger. Any work so ordered shall be at the expense of the developer.

3.4.2 Environmental Management

Environmental management is an integral part of project management and therefore will be most efficiently operated within the framework of the project's quality system.

Design the environmental management programme in full compliance with the Resource Management Act. Specific activities that may require resource management consents include:

- Management of stockpile material.
- Management of disposal areas.
- The use of chemical sprays and fertiliser.
- Noise and dust nuisance.
- Prevention of fuel and oil spills including the actions taken if an oil spill occurs.
- Control of silt, contaminants and stormwater runoff.
- The alteration of, or taking water from, waterways.
- Work around protected trees.
- Redirection of groundwater.

This is by no means an exhaustive list. Consider (if not contractually required to) developing a formal Environmental Effects Register. Also identify these matters in an assessment of environmental effects, for applications for subdivision consent.

Operate a formal environmental management programme that complies with the statutory requirements of the Resource Management Act 1991, any subsequent revisions and associated Regulations and any other specific requirements set out in any applicable resource consent. To the extent practical and permissible by law, integrate the programme into the quality system.

The Contract Quality Plan must identify all compliance issues relating to the Resource Management Act 1991, including any conditions contained within the project related resource consents.

3.5 CONTROL AND INSPECTION OF THE WORK

The developer shall ensure that the quality requirements of the consent, CoP, design and relevant standards are complied with.

- Check, inspect and test the work and verify that it conforms to the specified requirements;
- Record the results as documentary evidence of compliance.

3.5.1 Checking, Inspection, Testing and Recording

The documentation requirements associated with checking, inspection, testing and recording need not be complex. The checksheets are useful in that they provide a breakdown of the checks that should be performed and, when completed, serve as a record. They should be developed for each work activity and should contain the quality requirements as reminders.

The construction checksheet should:

- Provide a checklist of the items to be inspected;
- Include the acceptance criteria;
- Identify the personnel responsible for doing the inspection;
- Contain space for recording that compliance of the individual items has been attained;
- Contain reference to further records generated by non-conformances;
- Provide for "signing-off" at the bottom of the sheet after a fully complying "final inspection".

An audit or inspection and test schedule should provide a full listing of all audits, inspections and tests of materials and completed works. It should clearly indicate ‘hold’ or ‘witness’ points and include signing off by the contractor, the engineer and the Council where required.

Check, inspect and test to verify compliance during design and construction and on final completion. Specify the methods, specification references, frequency, timing and responsibilities for checking, inspection and testing in the Design Report. Wherever possible, measure compliance against quantified acceptance criteria based on the CoP and/or specification requirements. Document the results and retain as part of the quality records.

3.5.2 Inspection

The developer and his/her advisors are responsible for providing Council with a Certificate of Construction.

These certifications must be provided for all engineering works associated with subdivision and land development, in accordance with this document and the District Plan. The Certification must be prepared by a chartered professional engineer or surveyor.

Commencement of stages shall not proceed until after the Engineer's inspections and approval of the previous stage. Engineer's inspections are as follows:

- After setting out and prior to commencement of work;
- Inspections of excavated material;
- Any unexpected subsoil conditions and obstructions;
- Base of trench to be inspected;
- Bedding prior to commencement of subgrade filling;
- Subgrade layer completion;
- Sub-basecourse layer completion;
- Basecourse layer completion;

Part 3: Quality Assurance

- Temporary surfacing;
- Preparation for application of final surfacing;
- Completion of final surfacing;
- Completed pipelines, drainage structures, anchor blocks prior to backfilling;
- Witnessing sterilisation of water mains in accordance with Section 6 of the Waimakariri District Council Hygiene Code of Practice for Work on Public Water Supplies;
- Inspection of finished lid levels on surface boxes, markings and reinstatement etc;
- For gravity lines, the lines are to be flooded, flushed and inspected by the Engineer with a CCTV and a copy of the CCTV provided to Council on a DVD along with an inspection record to NZ pipe inspection standard.

Council shall also be advised a minimum of 24 hours prior to the inspections required by this clause, so that they may also carry out inspections.

A summary of the Quality Assurance records obtained throughout the works will also be submitted when applying for Subdivision Compliance or Code Compliance. This will take the form of a report prepared by an appropriately qualified professional. The report will summarise the Quality Assurance Records and Standards achieved in all aspects of the project.

In addition, if Council is not satisfied with the standard of information provided, any or all Quality Assurance records must be provided to Council with 24 hours upon receiving a written request to do so by Council.

3.6 PIPE RETICULATION – GENERAL

Refer also to CoP Part 5 *Stormwater and Land Drainage*, Part 6 *Wastewater* and Part 7 *Water Supply*. The relevant requirements of those Parts shall be met.

3.6.1 Materials

Manufacturers of any pipes and fittings intended for use in the Waimakariri distribution system must have a certified quality management system in place that complies with AS/NZS ISO 9001:2000. This system must apply to all aspects of the manufacturing processes, including product handling, administration and stock control.

The Council requires the right to verify that any and all contracted and subcontracted products conform to the specified requirements. Full product identification and traceability is required. Protection of the quality of the pipe and fittings includes transportation and off-loading at the delivery point. Full quality records, as per the manufacturer's Quality Assurance manual, must be available on request for evaluation by the Council and be kept for a minimum period of 10 years.

The Council reserves the right to require full details of the manufacturer's means for demonstrating compliance. Irrespective of the means of demonstrating compliance and the supplier's and manufacturer's quality assurance systems, responsibility remains with the developer to ensure the installation of products that conform with the requirements of the CoP and the appropriate standards. The Council may arrange for independent testing to be carried out on randomly selected samples or assembled joints.

Positive verification inspections or testing results obtained by the Council shall not limit the supplier's responsibility to provide an acceptable product, nor shall it preclude subsequent claims made under warranty due to manufacturing defects, faulty design, formulation, or processing.

3.6.2 Tolerances

Horizontal tolerances shall be as follows:

- Manholes and other drainage structures shall be within 150 mm of the position indicated on the plan.
- Pipelines shall be within 100 mm of the position indicated on the plan.
- Pipelines shall not extend into the internal wall of drainage structures more than 10 mm for pipes not entering at invert level
- For the pipeline entering and exiting the manhole at invert level the maximum tolerances are as shown in Table 3.1:

Table 3.1 Horizontal tolerances for pipeline/manhole joins

Pipe Diameter	Maximum Distance from Internal Manhole Wall
D < 675 mm	50 mm
D < 1050 mm	150 mm
D ≥ 1050 mm	250 mm

Vertical Tolerances shall be as follows:

- Sump shall be within 5 mm of the sump frame in the correct location.
- Manhole invert levels are to be within 5 mm of the design level.
- Pipelines are to be laid to grade such that no pipe shall be more than 15 mm out of grade and adjoining pipes shall not vary in error by more than 5 mm from the adjacent pipe.
- Manhole cover levels shall be within 15 mm to adjacent surface for grass surfaces and 5 mm for concrete and seal surfaces.

3.6.3 General Testing

Before new reticulation is connected to the existing public system it shall be inspected and tested by the developer in the presence of the Council's representative. All testing shall be carried out as required in this document. All costs and arrangements shall be borne by the developer. The developer shall provide the Council a minimum of two working days notice that a test inspection is required.

The Council does not normally test materials or products. Plan and specification approval is not evidence that the Council has approved the material or product. The Council may require verification that a material or product is tested for conformance, quality or adequacy.

The developer shall supply all necessary testing apparatus. The developer shall also provide all appropriate Health and Safety equipment including gas monitors, harnesses, etc.

3.6.4 Acceptance Testing

Acceptance testing shall not be commenced before:

- The developer's representative shall have certified and supplied the Council with 'As Built' drawings of the work to be tested
- The Contractor's written testing methodology and all equipment, including backflow prevention equipment (if needed), pressure test rig, makeup volume measurement, etc) have been approved
- Suitable means for filling and flushing are in place
- The pipeline to be tested has been completed and backfilled, and is in conformity with the specification
- Any permanent or temporary concrete thrust blocks have been poured and have attained sufficient compressive strength to resist test thrusts
- End caps (that allow for filling and bleeding of air) and any temporary anchors are in place and are adequately braced to resist test thrusts
- Air has been purged from the pipeline
- Air valves are installed and their isolating valves are open
- For potable water mains, sterilisation shall have been completed in accordance with Section 6 of the Waimakariri District Council Hygiene Code of Practice for Work on Public Water Supplies;
- Arrangements have been made for the safe disposal of water flushed from the pipeline, including any consent to discharge if necessary
- Suitably qualified personnel are on site to carry out and oversee the testing
- Appropriate and approved record sheets are available for recording all aspects of the testing procedure

3.6.5 Personnel Qualifications

The testing of all pipelines shall be carried out and supervised by acceptably qualified or accredited personnel.

Qualified or accredited personnel shall show competence and knowledge of the relevant testing methods and procedures, and:

- Hold appropriate qualifications issued by a registered training organisation; or
- Have attended a relevant training course, and received accreditation relating to the work being undertaken.

Refer to Section 7 – Water Supply, and the Waimakariri District Council Hygiene Code of Practice for Work on Public Water Supplies for Water Supply specific qualifications.

3.6.6 Filling the Pipeline

The Contractor shall be responsible for arranging for a suitable supply of clean water for testing (i.e. water containing no sediment or floating material). Waimakariri District Council will make water available for filling pipes (subject to any prevailing water restrictions) at no cost to the Contractor for testing using one of the two methods outlined below:

- From a dedicated fire hydrant to fill a water tanker. Refer to Council's 'Tanker Filling Points' on the Council's website for permit process and approved locations. The Contractor shall be responsible for all costs associated with transporting the water to the pipe section under test. Refer also Section 4.8 of the Waimakariri District Council Hygiene Code of Practice for Work on Public Water Supplies for tanker requirements, if pipe being tested is a potable water main, or;
- From an available hydrant close to the worksite, in accordance with Section 5.1 and 6 of the Waimakariri District Council Hygiene Code of Practice for Work on Public Water Supplies. Specific Council approval shall be obtained to use a hydrant for this method.

Water may be drawn from the reticulation at a maximum rate of 10 litres per second, in accordance with the following conditions:

- Preferably fill from the low end and ensure that air valves and venting points are open and operating to optimise air removal
- Making sure that the filling or flushing operations do not cause an unacceptable pressure drop in the reticulated water supply. Should the Contractor's filling operations cause a disruption to any water supply by exceeding the approved rate of flow, permission to take water will be withdrawn and an alternative water source found at the Contractor's expense.
- Repairing any leaks or making good any defects that are revealed
- Allowing the pipeline to "soak" for a period of at least 4 hours at a pressure of 20±10 metres head to allow the temperature to stabilise and any time dependent movement to take place

3.6.7 Test Lengths

Pipeline tests shall be split into three separate sections:

Lengths of shorter sections of pipe shall be tested during construction: The length of these test sections will be influenced by a number of factors:

- The availability of water,

- The Contractor's confidence in the pipe installation and
- The level of acceptable risk related to location of possible leaks.

Test lengths should not normally exceed 1,000 metres in length; however permission to test longer lengths will be given favourable consideration. The test shall be to the system test pressure.

Pipelines shall be tested before and after connection at each end: These tests may only be possible on completion of work done under separate contracts. The Contractor shall allow for a return to the site once works have been completed to finish testing requirements. This test shall be undertaken at the connection into the pump station, and shall be to the system test pressure.

The entire length of pipeline shall be tested, once completed: The Contractor shall allow in his timetable and pricing for a return to site once the STP upgrade works have been completed to finish the testing requirements. This test shall be at the pumpstation working pressure (i.e. less than the system test pressure). Its purpose is to ensure there are no pipeline leaks.

The Contractor shall leave in position any flanges and blanking off materials required to complete testing of the pipeline.

3.6.8 Manholes – Rainfall Simulation Test

All manholes shall be subjected to the Manhole Rainfall Simulation Test and passed where required by the Engineer.

A moat 300 mm below the riser-lid joint shall be dug around each manhole. The moat and lid will then be flooded to just below the top of cast iron frame, and the water level maintained for 10 minutes.

The manhole will be deemed to have failed upon water intrusion at the time of test, or at any time prior to the end of the maintenance period.

3.6.9 Joints – Coating Of Joints (Concrete Lined Steel Pipes Only)

After initial pressure testing, the exposed exterior metal at the joint shall be thoroughly cleaned, dried and then coated with a continuous coating of "Denso" paste (or equivalent approved by the Engineer) at the rate of 500 grams to every 2.5 square metres. After the application of "Denso" paste the joint shall be wrapped with 100 mm wide "Denso" tape so that the tape laps the coal-tar coating of the pipe by 25 mm and so that laps in the "Denso" tape itself are at least 25 mm wide.

3.6.10 Failure of Test

In the event of an unsatisfactory test result, the source of failure shall be determined and repaired at the developer's expense and the system retested. Even if testing procedures produce a satisfactory result, any visible leaks that are discovered shall be rectified and re-tested.

Failure to allow adequate "soak" time or if there is a significant amount of entrapped air in the pipeline may result in an inconclusive test or a marginal failure. In such a case, the test period may be extended for a further one to two hours, as may be agreed between the Contractor and the Engineer.

If a PE pipeline test fails, the pipeline must be rested at a pressure of no more than 20m head for a period of at least 4 hours before repeating the test procedure. In the event of a dispute over test results, testing by an approved volumetric reference method will be allowed.

3.6.11 Reporting

A complete record of all details of the test shall be made. This record shall include the following:

- Full details of the pipeline tested (including details of pipe material, diameter and pressure class, pressure rating, manufacturers identification, jointing system, pipeline profile showing changes in pipe material or pressure class as well as the location of valves and fittings, and the exact extent of test sections)
- Failure of any thrust block, pipe, fitting or other component
- Any visible leakage detected and repaired
- A detailed record of the pressure in the pipeline at appropriate time intervals. This may be from a pressure data-logger or by manually recording times and pressure readings at appropriate intervals
- Whether the pipeline passed or failed the test
- The signatures of the representatives of the Contractor and Engineer who witnessed the test.

3.7 PIPE TESTING – GRAVITY

Before being approved all non-pressure wastewater pipelines shall have passed the air test outlined below, and any other tests required by WDC.

Gravity pipe air tests shall only be permitted when approved by the Engineer and all equipment used for air testing shall be subject to acceptance by the Engineer.

The section of pipe to be air tested should be flushed and cleaned to clear the pipe and wet the internal surface. The line shall be isolated with suitable plugs and one plug should have an inlet valve for connection to a source of air under pressure. Connect the air hose to the inlet tap and a portable air control source.

The air equipment should consist of necessary valves and pressure gauges to control the rate at which air flows into the test section and to enable monitoring of the air pressure within the test section. Also the testing apparatus should be equipped with a pressure relief device to prevent the possibility of loading the test section with the full capacity of the compressor.

3.7.1 Low-Pressure Air Test

This method should not be used for test lengths greater than 250m or where DN > 450mm. Where larger pipes are used, the designer shall be required to submit a specific testing methodology which may involve a different type of test.

The procedure for low-pressure air testing of large diameter pipelines is potentially hazardous because of the very large forces to be resisted by temporary plugs or bulkheads and the serious consequences of accidental bulkhead blowout. It is recommended that a relief valve with a 50kPa maximum setting be installed on all pressurising equipment.

For the testing process and conditions of acceptance, see NZS 2566.2:2002, Appendix N2.

3.7.2 Infiltration Testing

In addition to the air test, upon completion of any section of the work, the line shall be tested for infiltration if required by the Engineer.

For the testing process and conditions of acceptance, see NZS 2566.2:2002, Appendix N5.

3.8 PIPE TESTING – PRESSURE

No test will be carried out on pressure pipelines until the whole of the layout and workmanship conforms to requirements. The test section shall then be pumped up to the pressure specified below by means of a force pump; the pump delivery being connected to any convenient and approved tapping on the main.

The pipeline may be tested as a whole or, if necessary, subdivided into test sections that satisfy the following requirements:

- The maximum allowable pressure on the lowest rated component in the test section is not exceeded
- A pressure of at least the pipeline's maximum designed operating pressure (including an allowance for pressure surges) is achieved at the highest point of each test section
- Sufficient suitable water is available for the test and there are appropriate arrangements in place for the disposal of the test water
- The elevation difference between the lowest and highest parts of the test section is minimised.

The pipeline shall be filled at an approved rate, in accordance with the following conditions:

- Preferably fill from the low end and ensure that air valves and venting points are open and operating
- A polyurethane foam swab may be run along with the filling water to assist with debris and air removal
- Where the test water is derived from a potable water supply, the filling or flushing operations shall not cause an unacceptable pressure drop in the reticulation.

Pressure testing shall not take place until thrust blocks have cured sufficiently to resist forces generated by the test pressures. Where possible and practical, fittings and bolted flanges shall be left exposed during the test.

The System Test Pressure (STP) shall be set so that the pipeline is subjected to a pressure that is in excess of the maximum pressure that will be encountered during the pipeline's operational lifetime. Unless otherwise required by the Council, the STP shall be equal to the rating pressure of the lowest rated pipe or component installed.

The pressure shall be monitored at the lowest part of the pipeline, or if that is not possible at some other convenient point, and the test pressure adjusted to achieve the system test pressure at the lowest part of the section under test. Pressurising of the pipeline above the "soak" pressure shall not begin until the Engineer is on site to witness the test.

3.8.1 Constant Pressure (Water Loss) Method – Pipes with DN ≤ 150mm

This test is acceptable for all pipelines with a nominal diameter of 150mm or less. The test pressure shall be set to the pipe rated pressure.

For the testing process and conditions of acceptance, see NZS 2566.2:2002, Appendix M8.

3.8.2 Constant Pressure (Water Loss) Method – PVC, ductile iron and steel

This test is acceptable for PVC, DI and steel pipelines. It shall be used for water mains with a diameter of 200mm diameter or greater, and for all wastewater rising mains. The Contractor shall include the method and means of measuring the make-up water volume in the test methodology provided before testing commences.

For the testing process and conditions of acceptance, see NZS 2566.2:2002, Appendix M4.

3.8.3 Pressure Rebound Method – PE

Polyethylene pipelines require a different testing procedure to account for the visco-elastic behaviour of PE.

Note that the evaluation of this test requires the volume of entrapped air to be minimised. Failure to achieve adequate venting of the pipe may result in inconclusive test results and significant delays. The results of the main test can only be judged if the remaining volume of air in the test section is sufficiently low. This test may not be suitable for critical pipes or pipes with a nominal diameter greater than 315mm.

For the testing process and conditions of acceptance, see NZS 2566.2:2002, Appendix M7.

3.8.4 Constant Pressure Test (Water Loss Method) – PE pipes

This test is acceptable for PE pipelines, and should be used in place of the Pressure Rebound Method (see clause 3.8.3) for critical pipes or pipes with a diameter greater then 315mm. The Contractor shall include the method and means of measuring the make-up water volume in the test methodology provided before testing commences.

For the testing process and conditions of acceptance, see NZS 2566.2:2002, Appendix M5.

3.8.5 Pressure Gauge Requirements

The pressure gauge to be used shall be accurate and readable to within 5kPa. The pressure range of the gauge shall be such that the test pressure falls within the range 50 - 90% of the full-scale range of the gauge.

The main gauge shall have been calibrated within the last 6 months and shall have a minimum dial diameter of 100mm (preferably 150mm) or be a digital gauge. A “test” pressure gauge (either digital or analogue) with an accuracy of better than ±0.5% of full scale and pressure range as above is preferred for the main gauge.

For testing on wastewater rising mains and on water mains of 200mm diameter and greater, the Contractor shall arrange for a waterworks data-logger and calibrated pressure transducer with a maximum pressure range 20 bar to be connected to the test section of pipeline throughout the duration of the test, from initial filling to the final release of the pressure. Failure to deliver a full electronic record of the test may result in a re-test being necessary. The Contractor shall be responsible for ensuring that the pressure gauge and data-logger register the pressure within 5% of each other.

The Contractor shall submit details of the proposed test rig including the gauge, data-logger etc to the Engineer for approval, prior to commencing the test.

Inadequate equipment shall not be permitted.

3.8.6 Additional or Failed Pressure Tests

The cost for the Engineer to attend pressure tests that fail shall be deducted from any payment due to the Contractor. The amount to be deducted shall be the greater of $400 plus GST or the actual costs for the Engineer’s time, transport and on-costs resulting from witnessing the failed test/s.

If the Contractor elects to use more than the scheduled (or agreed) number of pressure tests, the cost to the Contractor for each additional test shall be as described above.

3.8.7 Completion of the Test

After testing, release the test pressure slowly and if necessary, open air valves and drain points to drain the line.

3.9 PUMP STATIONS

Refer also to CoP Part 5 *Stormwater and Land Drainage*, Part 6 *Wastewater* and Part 7 *Water Supply*. The relevant requirements of those sections shall be met.

Testing and commissioning shall be thorough and rigorous. The pump station shall be operated beyond the range it will experience in operation and throughout its life.

3.9.1 Testing

The Contractor shall give two days notice in writing to WDC of the date after which the workers are ready to carry out any tests required.

All test instruments and other testing facilities shall be provided by the Contractor within his tender price. Should the Engineer have any doubt as to the accuracy of a measuring device, he reserves the right to instruct the Contractor to have the instrument recalibrated at no extra cost. Nevertheless, if the recalibration was in fact not necessary, the cost shall be borne by the Principal.

All testing shall be carried out in strict accordance with NZCEP 11:1993.

A thorough test schedule shall be prepared and copies of all test results, as required by NZCEP 11:1993 and AS/NZS 3017:2001, shall be appended to the Certificate of Compliance (COC) and shall be executed by an independent registered Electrical Inspector.

3.9.2 Commissioning

As a follow on from testing, the Contractor shall allow for a full re-commissioning of the switchboard, associated existing pumps, soft starters, control, alarms, and measurement/ instrumentation and telemetry systems and commissioning of the new pump, filter and extract fan. Included with this requirement is the re-commissioning of the standby generator on the new switchboard and interconnections. Full operational checks and pump running shall be carried out on the Standby Power generator supply.

A fully scheduled pre-commissioning and commissioning program shall be submitted to WDC. This shall include, but not necessarily be limited to, defining all activities to be undertaken after the testing is completed. Such pre-commissioning checks and commissioning shall allow for co-ordination with the WDC operational staff and their input. Commissioning in this regard is the confirming of operational safety and reliability only after all non-livened tests have been completed.

Full written records of all operational set points, readings of all dials, instrument digital displays for the whole range of operational equipment, alarm indications etc, shall be taken at the time, on site, and presented in a tabulated and written/typed form to WDC.

The relevant Asset Manager or a representative shall be present for the pump station commissioning. Following commissioning two copies of the pump station manual and keys shall be submitted to the relevant Asset Manager.

Commissioning shall include the following items, which shall be fully documented and submitted to WDC for insertion on the pump station file:

- Ensuring all electrical circuits are operating as expected
- Calibration by operating hydrants during a low flow period
- Simulate cavitation cut-out for each pump separately
- Check manual override operates
- Check a minimum of three flow and pressures readings to ensure compliance with pump operating curve
- Check pumps supply adequate flow/pressure to meet level of service in highest point of zone
- Check minimum run time
- Simulate flows to ensure that the pumps station control schematic is met.
- Confirm that water hammer does not occur and that the check valves operate quietly
- Forced water hammer test

3.10 WATER QUALITY TESTING

Refer also to CoP Part 7: *Water Supply*. The relevant requirements of that Part shall be met.

All proposed water supplies shall be sampled and tested to ensure the health and well-being of consumers. Sampling and testing of the proposed water supply for both bacteriological and chemical quality shall be carried out in accordance with "*Drinking Water Standards for New Zealand 2005*" by a laboratory that is IANZ registered or independently accredited by a recognised authority approved by the Council.

Samples from the water source shall be taken either by:

- The laboratory carrying out the analysis, or
- Other agencies approved by the Waimakariri District Council.

Refer also to QP-C816-AC Chemical Quality of Potable Water.

3.11 ROAD TESTING

The relevant requirements of CoP Part 8: *Roading* shall be met. Refer also to CCC *CSS Part 6 – Roads*.

Subgrade and pavement testing shall accord with the appropriate tests and sample rates from NZS 4402: 1986/1988 and the methods given below:

- Benkelman Beam test;
- Clegg Hammer Impact Value test;
- Density & Voids (Nuclear Densometer) test;
- CBR (Scalar Penetrometer) test Victoria County Roads method;
- Undrained Shear Strength test;
- Any other approved method, as agreed with the Council.

The Council may approve other standards and alternative test methods.

The developer shall provide the Council with 48hrs minimum notification of any proposed test, and 24hrs minimum notification that a pre-seal inspection is required. A sealed surface that has not been approved by inspection will not be approved. The developer shall submit for approval the binder composition and application rate prior to chipsealing.

The developer shall supply sufficient information to confirm all other performance criteria have been achieved. Laboratory results shall be forwarded to the Council as soon as they become available.

The developer shall be responsible for remedial works required to any failed section.

The finished surface shall not hold water at Practical Completion, during the defects liability period and at the issue of the Defects Liability Certificate. Channels with a design gradient of 1 in 500 or steeper shall not pond water.

3.11.1 Level Tolerances

Level tolerances shall be as follows:

- Sealed surfaces shall be reasonably smooth and even, having no ridges or depressions, shall finish flush with but in no case more than 3mm above the adjacent surface and no area shall hold water.
- Unsealed surfaces shall be within ±15mm of the surrounding ground
- Grassed surface shall be within ±15mm of surrounding ground.
- Kerb & channel shall be within ±5mm of design level and location

The gap under a 3m straight-edge placed longitudinally shall not exceed 5mm with a cumulative total of all visible gaps of not more than 20mm and the gap under a 1m straight-edge placed transversely shall not exceed 5mm with a cumulative total of all visible gaps of not more than 10mm, except where design or material considerations dictate otherwise.

The finished carriageway shape shall be consistently convex across the constructed width, unless otherwise specified. All tie-ins to existing carriageways or concrete kerbs shall be flush.

The line of the kerb shall be straight between tangent points and shall sweep around curves without kinks, flats, or angles in a smooth arc.

The difference in level between adjacent paving blocks shall not exceed 2mm. The joint widths shall be between 2mm and 5mm with an average over the entire pavement of 3mm.

3.11.2 NAASRA Testing

The finished surface shall give a smooth ride with average and maximum NAASRA roughness counts as specified in Table 3.2

Table 3.2 NAASRA Roughness Counts

Surfacing	Average (mm/km)	Maximum (mm/km)
All new asphaltic concrete and open graded porous asphalt surfaces	55	75
Asphaltic concrete and open graded porous asphalt overlays and shape corrections	65	90
Chipseal through streets with 10,000-20,000+ vehicles per day (RAMM Pavement Use T6 and T7)	60	80
Chipseal through streets with 2,000-9,999 vehicles per day (RAMM Pavement Use T4 and T5)	65	85
Chipseal through streets, culs-de-sac and rights of way with 0-1,999 vehicles per day (RAMM Pavement Use T1-T3)	70	90

The developer shall undertake NAASRA testing on the carriageway where specified. The average and maximum readings shall exclude values affected by intersecting streets, platforms and road humps. The Defects Liability Certificate will not be issued until a complying NAASRA test is received.

3.11.3 Benkelman Beam Testing

Benkelman Beam testing is specified in the TNZ T/1 document, which sets out equipment and test method requirements. Acceptable results shall be as specified in Table 3.3.

Table 3.3 Benkelman Beam – Acceptable Values

Traffic Loadings (heavy vehicles/day)	95% of readings (mm)	Maximum (mm)
>500	<1.2	1.5
100-499	<1.6	2.0
<99	<2.0	2.5

Beam testing shall commence with a test 5m **beyond** the extent of work, then at 15m intervals for projects greater than 100m in length, or 10m intervals for projects less than 100m. In each case the final reading shall also be beyond the end of the work. The readings beyond the work should not form part of the calculation, as they are required for asset research purposes only.

No more than 5% of the tests may exceed the maximum design deflection for that category. No single result shall exceed the maximum by more than 50% for that category.

3.11.4 Clegg Hammer Testing

Compaction may be measured by Clegg hammer or other approved impact device. These devices shall be calibrated at 12-month intervals. At no point on the finished surface shall the Clegg Impact Value (CIV) be less that that specified in Table 3.4, and the testing shall be carried out at a minimum rate of 1 test per 1000m^2 for subbase, and 1 test per 200m^3 for metalcourse.

Table 3.4 Clegg Hammer – Acceptable Values

Material	Minimum CIV
Subgrade	10
Metalcourse – Footpath & Residential Vehicle Crossings	25
Metalcourse – Commercial Vehicle Crossing & Carriageway	35

3.11.5 Nuclear Densometer Testing

The density of metalcourse under kerb & channel shall be measured by Nuclear Densometer. NZS4402 sets out equipment and test method requirements. .

Individual readings with the nuclear densometer in the backscatter mode shall be at completely random locations and at not greater than 10m longitudinal intervals for shoulder work, or not greater than 5m intervals for trenching work. Testing shall be carried out at a minimum rate of 1 test per 2000m^2 for subgrade, and 1 test per 100m^3 for metalcourse

Table 3.5 Nuclear Densometer – Acceptable Values

Material	Minimum Voids	Average Voids	Maximum Voids
Subgrade	12%	-	18%
Metalcourse	-	≤ 8%	10%

Moisture content test shall be as per NZS 4402 within 2% of Optimum Moisture Content

No more than 5% of the tests may exceed the maximum or minimum voids percentage for that category. No single result shall exceed the maximum or minimum by more than 50% for that category.

3.11.6 Scale Penetrometer

CBR results shall be equal to or greater than 7. Testing shall be carried out at a minimum frequency of 1 test per 2000m^2.

To convert penetrometer readings to CBR values, when confirming pavement designs, use Figure 5.2 “Correlation of Dynamic Cone Penetration and CBR” from Austroads Pavement Design 2004.

For irregular unsuitable foundation areas up to 50m^2 the developer shall remove the unsuitable material to meet the design requirements. The Council shall be advised as soon as practicable and provided with the following information: area and depth excavated and marked on the plan; CBR and description of the unsuitable material; CBR and description of material at base of unsuitable material excavation.

3.11.7 Undrained Shear Strength

Undrained shear strength shall be measured by hand-held vane. Testing shall be in accordance with BS 1377:1990, as adopted by TELARC, or with NZS 4402.

The average result shall be at least 150kPa, and the minimum for any single test shall be 80kPa.

The testing shall be done at a minimum frequency of 1 test be 2000m^2.

3.11.8 Core Testing

Where asphaltic concrete is laid on carriageways, core samples shall be a fair representation of the paved area. All core results shall be returned to the Council. Core samples shall be 100mm in diameter.

Where required, the developer shall take core samples from the kerb. The cores shall be greater than 90mm in diameter and shall be tested for compressive strength by an approved laboratory. The cores shall be clearly marked to identify the contract site and core location. The coring and testing shall be in accordance with NZS 3109 “Concrete construction”.

For machine laid kerb and channel each core shall be assumed to represent the truckload of concrete for that pour.

3.11.9 Chipseal Texture (Sand Circle) Test

Finished first-coat surfaces shall be of uniform texture and appearance and shall meet the sand circle test limits specified below at the end of the defects liability period. Tests to TNZ T/3 shall be carried out at the frequency of not less than one per 30m lane length with a minimum of three sand circles to be carried out on any treated area.

Table 3.6 Sand Circle Testing – Acceptable Values

Surface Type (chip grade)	Sand Circle Maximum Diameter
3 (8.5-10)	150
4	160
5	170
6	185
4/6	165
3/5	165

3.11.10 Slurry Sealing

Prior to commencing the works, a test section at least 20m long and 2m wide shall be placed at the developer’s cost away from the site and using the proposed materials.

The slurry seal shall be placed and rolled in accordance with CCC *CSS Part 6*, and shall be checked for laid depth, consistency and break time. An approved laboratory shall carry out tests to determine the asphalt content and aggregate gradation. If the observations and tests indicate that the slurry seal test section does not conform to the specification, the necessary adjustments shall be made and additional test sections shall be constructed for conformance to the specification.

The Contractor shall supply recently achieved wet track abrasion and loaded wheel abrasion loss tests carried out in accordance with ASTM D3910 ‘*Standard practices for design, testing and construction of slurry seal*’ for the proposed slurry mixes at least one week prior to commencing the contract works.

The Contractor shall test a minimum of one sample of slurry seal each day that slurry is laid. The sample shall be taken from the discharge chute and tested to determine asphalt cement content, moisture content and aggregate grading. Testing shall be by an approved laboratory and the results shall be submitted to the Engineer the next working day.

The cured slurry shall have a homogeneous appearance, with no efflorescence, scars, streaks or uneven joints and shall adhere firmly to the surface. The final compacted depth of Type I slurry shall be 3.5mm +1mm, -0mm. The final compacted depth of Type II slurry shall be 5.5mm ±1mm.

Abrasion or loss of the slurry surface due to the effects of normal use and environmental conditions shall not reveal more than 0.5m^2 of the underlying surface of the area being slurried within the defects liability period.

3.12 UTILITIES TESTING

Inspection and testing shall be carried out on all new reticulation and switchgear in the presence of a representative of the utility service provider prior to its connection to existing utility, in accordance with the requirements of that provider.

The developer shall provide evidence to the Council that the supply and reticulation meets the requirements of the utility service provider and of the Electricity Act 1992.

The developer shall ensure that all tests are documented, identifying the tested equipment and the personnel involved. Test sheets shall be transmitted to the utility service provider for approval and copied to the Council.

The developer shall arrange for the utility service provider to forward certification to the Council. Certification shall verify that:

- The reticulation meets the requirements of this Code.
- Reticulation is physically available to the main body of each lot within the completed development.
- The utility service provider/s have received and approved satisfactory As-Built drawings from the developer.

3.13 NON-CONFORMANCE & QUALITY IMPROVEMENT

3.13.1 Conditions Auditing

The Council will audit compliance with the conditions of consent. Auditing will involve both site inspections and checking of associated documentation to the extent necessary to ensure the work is completed in accordance with the approved plans and specifications, and to the Council's standards. The Council will undertake auditing inspections and checking of resource consent conditions as part of the Council's fixed fees for subdivision resource consents or otherwise a fee based on the officer's concerned current hourly charge out rates together with current vehicle running costs/kilometre.

The developer shall notify the Council that audit inspections are required giving at least one working day notice. The minimum level of inspection will be as given in Table 3.7.

Table 3.7 Inspection Requirements

Type of Works	Level of Inspection
Roading	Following shaping of roading and footpath subgrade prior to placement of sub-base material
	Following metalling up, prior to pouring of kerb and channel
	Following compaction of base course prior to final surfacing. This surface is to be tested with a Benkelman Beam, or other approved method, and the results submitted to Council for approval
Trenching/Road Opening	Prior to backfilling of service trenches
Services	Testing of water, sewer and stormwater mains and laterals
	Disinfection of water mains
Water	Following completion of required works
Sewer	Following completion of required works
Stormwater/Land Drainage	Following completion of required works
Footpaths	Prior to pouring concrete
Vehicle crossings / Entrances / Rights of Way	On completion of excavation to subgrade
	Following compaction of base course prior to final surfacing

Where additional inspections are required because of faulty workmanship or work not being ready contrary to the receipt of a notification, such inspections will be carried out for an additional fee, for the additional hours required and distance travelled.

3.13.2 Control of Non-conforming Work

It is inevitable that, even with excellent practices and controls, some degree of defective workmanship or material will occur. When it does, it is important that it is properly handled to ensure that the defects are rectified in the appropriate way.

A non-conformance should be considered an opportunity for improvement, rather than to apportion blame. By adopting this philosophy, identifying a non-conformance provides an opportunity to learn from the mistake and (more importantly) prevent it happening again.

Part 3: Quality Assurance

Note that there is a clear differentiation between what should be considered a "routine construction issue" or a "routine design step" and a non-conformance. Ensure this is understood by and communicated to all staff. A construction issue, such as soft sub-soils, is often identified (and reasonably expected) during a project and does not therefore necessitate the raising of a Non-Conformance Report, unless procedures have not been followed. The inability to achieve the minimum grade on a sewer design is a non-conformance and must be reported, as is the inability to achieve a passing Benkelman Beam test or infiltration test.

A non-conformance exists, and therefore a report should be raised, in all instances where a defect in the work or design occurs that indicates that the required standard or key achievement criteria prescribed in the Design Report, Contract Quality Plan or Engineer's Report has not been met, e.g. failure to achieve compaction results, pre-seal inspection etc. For this process to be successful it must be handled in a positive and constructive manner, without unnecessary recrimination.

Any non-conforming work that is subject to follow-on work by other parties must be clearly denoted as such to alert the other parties to its non-conforming status.

The designer must have a procedure to ensure that design work that does not conform to the specified requirements is either:

- Redesigned to meet the specified requirements; or
- Accepted by concession from the Council.

Record all non-conforming work on the relevant design record and/or the relevant design checksheet.

The contractor/engineer must have a procedure to ensure that construction work that does not conform to the specified requirements is either:

- Reworked to meet the specified requirements;
- Accepted with or without repair by concession from the Council;
- Regraded for alternative use;
- Rejected and replaced.

Record all non-conforming work on the relevant construction checksheet.

If the construction non-conformance is significant in that it either:

- Results in the need for written concession;
- Results in delay or interference to the work or to other parties;
- Indicates that the fault has occurred due to the use of incorrect work practices and/or failure of materials and could have been prevented;
- Occurs sufficiently frequently as to indicate a problem in training or procedures,
- Produce a Non-Conformance Report (NCR) and send to the Council.

The report and supporting documentation must clearly indicate the action to be taken to rectify the fault, the timeframe and responsibilities. It must be authorised by the engineer.

In cases involving concessions, the engineer and the Council must approve the proposed rectification (the corrective action) of the non-conforming work in writing and prior to implementation.

3.13.3 Defects

Council's receipt and acceptance of 'As Built' plans does not absolve the Developer of any responsibility for accuracy. In the event of any service connection not being located where shown on the 'as built' plan the Council will verify the 'as built' information with the consultant and give the consultant 48 hours to rectify the situation. If no action has been taken within 48 hours the Council will arrange for another connection to be installed and charge the consultant accordingly.

After prior agreement, the Council will accept new reticulation that connects to Council's infrastructure. The Council will then operate and maintain that reticulation. However, the developer remains financially responsible for any hidden defects and defects bonded for and covered by the Construction Completion Certificate.

3.13.4 Maintenance

The developer shall be responsible for maintenance of any services or infrastructure to be adopted by the Council a period of six months following the date of issue of the Engineering Release Certificate. A bond equal to 5% of the construction works shall be lodged with Council for the same period.

Maintenance shall include appropriate and regular mowing of grass and watering of all plants and trees together with the replacement of any perished specimens.

The Council, upon request from the developer, will issue formal notification that the maintenance period has expired, the works are satisfactory and that the bond will be released. This notification will be followed by the release of the maintenance bond. This notification will not be released until maintenance matters and defects have been remedied.

3.13.5 Completion

Prior to the issue of the 224(c) Certificate or Engineering Release Certificate as appropriate, the developer shall:

- Provide As-Built information to the Council's for approval and certification.
- Provide their consultant's completion certificate to the Council.
- Have made arrangements for fee payments to the Council's satisfaction.

3.14 ASSOCIATED DOCUMENTS

Appendix A	Design Report Template (QP-C812-AA)
Appendix B	Contract Quality Plan Template (QP-C812-AB)
Appendix C	Producer's Statement – Design (QP-C812-AC)
Appendix D	Producer's Statement – Construction (QP-C812-AD)
Appendix E	Non-Conformance Report Template (QP-C812-AE)
Appendix F	Engineer's Checklist (QP-C812-AF)
Appendix G	Construction Checklist – Pipe Construction (QP-C812-AG)
Appendix H	Construction Checklist – Basecourse Stringing (QP-C812-AH)

Design Report (Template)

____
(contract name/subdivision name)

____
(contract /subdivision consent number)

Copy No: ________ of ________

Version: ________________

Date of Issue: ________________

Contents

Appendices

A Producer Statement – Design
B Non-Conformance Report

Design Report (Template)

1 PROJECT PERSONNEL

Principal designer:

Name: ______________________________

Address: ______________________________

____

Contact Ph (Mobile): ______________ Contact Ph (A/H): ______________

Telephone: ______________ Fax: ______________

Developer:

Name: ______________________________

Address: ______________________________

____

Contact Ph (Mobile): ______________ Contact Ph (A/H): ______________

Telephone: ______________ Fax: ______________

______________ ______________

Sub-consultant:

Name: ______________________________

Address: ______________________________

____

Contact Ph (Mobile): ______________ Contact Ph (A/H): ______________

Telephone: ______________ Fax: ______________

Design Review:

Name: ______________________________

Address: ______________________________

____

Contact Ph (Mobile): ______________ Contact Ph (A/H): ______________

Telephone: ______________ Fax: ______________

Design Report (Template)

2 FULL DESCRIPTION OF WORK

This section contains a full description of the work included in the Design Report. It should include a description of:

- The existing pre-development site;
- The proposed development;
- The extent of the assets to be constructed;
- All key design and quality requirements, from Council and the developer;
- Evidence of consultation, if applicable;
- The constraints, parameters, assumptions and raw data on which the design is based;
- Data manipulation methods e.g. computer software, methodology.

3 DESIGN MANAGEMENT

The following key personnel have been involved in this design:

Name	Position Title

Key responsibilities and authorities are as follows:

a) Designed the work: ______________________________
(Title)

b) Carried out the internal design review: ______________________________
(Title)

c) Performed the internal quality audits: ______________________________
(Title)

d) Prepared and amended this report: ______________________________
(Title)

e) Approved this report: ______________________________
(Title)

4 SUB-CONSULTANTS

Sub-consultants undertook the following design activities:

Activity	Name of Sub-consultant

Design Report (Template)

Sub-consultants were selected in accordance with company policies and procedures, and were provided with copies of the relevant project briefs and/or resource consents requirements and/or drawings prior to commencement of the work.

Sub-consultants were subject to monitoring and their work was subject to periodic internal audit.

5 QUALITY CONTROL & INSPECTION

Procedures and design checksheets were used to control the design and verify compliance with the quality requirements. The following documents were used for this design:

Identifier Title

____

____

____

____

The documents can be made available for the Council's review, if requested.

Exceptional aspects of this project to be covered by the Contract Quality Plan include:

____

____

6 ENVIRONMENTAL MANAGEMENT

The following Resource Consents, relevant to the design, have been obtained:

____

____

In accordance with the resource consent/s, environmental controls relating to this particular design will be outlined in the Contract Quality Plan.

7 CONCESSIONS

If, during the process of design, work is identified which does not conform to the specified requirements and will require a concession from Council, submit a Non-conformance Report as part of the Design Report. The concession proposed will be discussed and must be approved by the Council prior to execution.

8 DESIGN REVIEW & CHECK

Undertake internal design reviews, to verify the design outlined and/or referenced in this Design Report, in accordance with "Reviewing the work of another engineer". Include written documentation of this review, by checksheet, calculations carried out by hand or another method to check design calculations, or document here.

Undertake a peer review, to verify the compliance and effectiveness of the design, in accordance with "Reviewing the work of another engineer". Document the review here or include as an Appendix. This review shall be specific only to those aspects of the works in which the reviewer is competent i.e. more than one reviewer may be required where the development incorporates specialized disciplines.

Record, report and action the review findings.

Design Report (Template)

9 DESIGN RECORDS

The following design records were produced for this design and are appended where noted:

____

____

(e.g. engineering drawings, specifications, calculations, material specifications where not detailed elsewhere, photos etc.)

The following completed checksheets are appended.

Checksheet No.	Title

10 DESIGN REPORT APPROVALS

This Design Report has been:

Prepared by: (Designer)	____________________ (Name/Sign/Date)
Approved by: (Principal designer)	____________________ (Name/Sign/Date)
Reviewed by: (Peer Reviewer)	____________________ (Name/Sign/Date)

Design Report (Template)

CONTRACT/JOB: ______________________ DATE: ______________________

DRAIN LOCATION: ____

Task	Acceptance Criteria/Test Frequency	Task/Completion Signature/Comment
1. Drawings and specifications checked for requirements		
2. Pipe material		
• Type class • Diameter		
3. Filter material		
• Specification • Grading		
4. Trench		
• Alignment check • Grade (normal min 1:100) • Width • Depth		
5. Bedding		
• Min depth 75mm • Sockets not bearing	Yes/No	
6. Pipe laying		
• Sockets uphill • Joints clean, invert flush • Joints as detailed • Rings required • Isolated from surface water		
7. Backfill material		
• Specification • Grading		
7. Backfill placement		
• Layer depth • Compaction		
8. Connections		
• As per design • Location		

Arising NCR: ____

All tasks defined above have been satisfactorily completed to the standards required:

Contractor: ______________________________________ (Sign/Date)

Contract Quality Plan (Template)

____
(contract name/subdivision name)

____
(contract /subdivision consent number)

Copy No: __________ of __________

Version: ____________________

Date of Issue: ____________________

CONTENTS:

APPENDICES: (attach these as applicable)

A Construction Programme
B Inspection & Test Schedule
C Site Safety Plan
D Traffic Management Plan(s)
E Erosion and Sediment Control Plan
F Non-Conformance Report
G Producer's Statement – Construction

Contract Quality Plan (Template)

1 CONTRACT PERSONNEL

Contractor:

Name: ______________________________

Address: ______________________________

Contact Ph (Mobile): ______________ Contact Ph (A/H): ______________

Telephone: ______________ Fax: ______________

Developer:

Name: ______________________________

Address: ______________________________

Contact Ph (Mobile): ______________ Contact Ph (A/H): ______________

Telephone: ______________ Fax: ______________

Project Manager:

Name: ______________________________

Address: ______________________________

Contact Ph (Mobile): ______________ Contact Ph (A/H): ______________

Telephone: ______________ Fax: ______________

Engineer:

Name: ______________________________

Address: ______________________________

Contact Ph (Mobile): ______________ Contact Ph (A/H): ______________

Telephone: ______________ Fax: ______________

Contract Quality Plan (Template)

2 DOCUMENT CONTROL

This Contract Quality Plan (CQP) has a controlled distribution as follows:

Copy No	Issued To	Date	Version No
1	<Contract Manager>		
2	<Site Supervisor>		
3	<All Subcontractors>		
4	<Other>		
5	<Engineer (for review and acceptance)>		
6	Council (for review and acceptance)		

This CQP will be subject to periodic review during the course of the contract. All holders of controlled copies listed above will be issued with updates to this document as and when they occur.

3 CONTRACT MANAGEMENT

The following key personnel have been assigned to this contract:

Name	Title

<or insert your organisation chart here>

Key responsibilities and authorities are as follows:

a) Overall responsibility for the management of the contract and principal contact with the developer and the engineer:

____ (Title)

b) Authorised to address and resolve issues of dispute relating to compliance with the quality requirements of the contract and this quality plan and rectification of non-conforming work:

____ (Title)

Contract Quality Plan (Template)

c) Responsible for the day to day on-site supervision, control and inspection of the works and communicate on such matters with the developer or engineer, and authorised to receive, on behalf of the contractor, any instructions from the developer or engineer (refer NZS 3910:2003 Clause 5.2.1):

______________________________ (Title)

d) Responsible for on-site Traffic Control activities:

______________________________ (Title)

e) Responsible for compliance with the requirements of the Resource Management Act (Environmental Management):

______________________________ (Title)

f) Preparation and amendment of this quality plan:

______________________________ (Title)

g) Approval of this quality plan:

______________________________ (Title)

4 SUB-CONTRACTORS

Sub-contractors will undertake the following work activities:

Activity	Name of Sub-contractor

All Sub-contractors are required to operate in accordance with this Contract Quality Plan.

5 QUALITY CONTROL AND INSPECTION

Procedures, construction checksheets and inspection and test schedules will be used to control the work and verify compliance with the quality requirements. The following procedures will be adopted for this contract or will be prepared in advance and be made available on site:

Identifier	Title

Contract Quality Plan (Template)

These can be made available for the Council's review, if requested.

Compliance checksheets are appended to the various parts of the CSS, which may provide initial guidance on what to consider when compiling construction checksheets.

An example of an inspection and test schedule is contained in Appendix XI. The schedule should indicate the frequency, timing, type of both inspection and/or tests required to be performed on the materials and at certain stages of construction. This schedule would be signed off as the specified activities are completed, and once completed would then serve as a Contract Record (refer clause 3.5.2 – Material supply).

In addition to the inspection and test schedule, the following are identified as key 'Hold' and 'Witness' points, requiring inspection and approval by the engineer and/or the Council prior to further construction. They will be documented on the relevant construction checksheet.

Hold or Witness Point	Inspection / Approval Required by

'Hold' or 'witness' points include, as a minimum:

- Site establishment;
- Commencement of works;
- Formwork or foundations prior to pouring concrete;
- Prepared earthworks and subsoil drainage prior to filling;
- Completed earthworks and prepared subgrade prior to topsoil or metalcourses;
- Drainage and water reticulation prior to backfilling;
- Utility reticulation prior to backfilling;
- Water and drainage reticulation during testing;
- Sterilisation of watermain;
- Finished subbase before the placement of basecourse;
- Finished basecourse before the commencement of surfacing or paving;
- Finished surface prior to roadmarking;
- Landscape areas formed and plants on site prior to planting;
- Construction safety audit;
- Practical Completion inspection;
- Defects Liability inspection for planting;
- Defects Liability inspection for roading etc.

Contract Quality Plan (Template)

6 ENVIRONMENTAL CONTROL

The following Resource Consents, relevant to the works undertaken and/or materials used in this contract, have been received:

____

____

These have been reviewed and appropriate controls have been put in place to manage and/or mitigate the risk.

In accordance with contract requirements, <if applicable> environmental controls relating to this particular contract and/or the work being undertaken are outlined <delete as applicable> further in the attached documentation/in the site-specific Erosion and Sediment Control Plan appended. The compliance and effectiveness of management controls will be subject to periodic review.

7 NON-CONFORMANCE

If, during the process of inspection, work is identified which does not conform to the specified site requirements, a Non-Conformance Report will be prepared by the person at 3 b). The rectification proposed will be discussed and agreed with the engineer and will be stated on the NCR.

A pro-forma Non-Conformance Report is attached.

8 CONTRACT RECORDS

The following records will be produced for this contract:

____

____

(e.g. site meeting minutes, construction checksheets, photos, inspection and test schedules, test results, construction programmes, completion documentation, as-built plans)

9 CONTRACT QUALITY PLAN APPROVALS

This Contract Quality Plan has been:

Prepared by: ______________________________
(Name/Sign/Date)

Approved by: ______________________________
(Engineer)
(Name/Sign/Date)

Approved by: ______________________________
(Contractor)
(Name/Sign/Date)

Producer Statement – Design

ISSUED BY: ______________________________ *(Suitably qualified design professional)*

ON BEHALF OF: ______________________________ *(Company)*

TO: ______________________________ *(Owner)*

TO BE SUPPLIED TO: **WAIMAKARIRI DISTRICT COUNCIL** *(Territorial Authority)*

IN RESPECT OF: ______________________________

(Description of land development/subdivision work)

AT: ______________________________

____

(Address)

______________________________ has been engaged by ______________________________

(Designer) *(Owner)*

to provide ______________________________ services
in respect of the land development and/or subdivision work described above.

I am a Chartered Professional Engineer / Registered Professional Surveyor, and have the qualifications and experience relevant to this project as set out herein. I have designed the subject works and confirm that the design is to current good engineering practice, and that it satisfies all subdivision consent and other relevant resource consent conditions, all WDC Engineering Code of Practice requirements and applicable codes and standards.

I / my practice holds professional indemnity insurance in the sum of: $ ______________________________

Minimum amount of insurance shall be commensurate with the current amounts recommended by IPENZ, ACENZ, TNZ, INGENIUM.)

Please note the following special considerations:

____

____

______________________________ Date: ______________________________

(Signature of designer)

______________________________ Member: CSNA NZIS ACENZ IPENZ

(Professional qualifications – CPEng or RPSurv)

Producer Statement – Construction

ISSUED BY: ______________________________ *(Suitably qualified professional)*

ON BEHALF OF: ______________________________ *(Company)*

TO: ______________________________ *(Developer)*

TO BE SUPPLIED TO: **WAIMAKARIRI DISTRICT COUNCIL** *(Territorial Authority)*

IN RESPECT OF: ______________________________

(Description of land development/subdivision work)

AT: ______________________________

____

(Address)

______________________________ has been engaged by ______________________________

(Consultant) *(Developer)*

to provide construction supervision, observation, review and certification services in respect of the above work which is described in the specification and shown on the drawings numbered:

____

(Insert reference to all drawings, including dates of later amendments and itemised schedule of quantities)

approved by **Waimakariri District Council** on: ______________________________ *(Date)*

I am aware of the details of the **Waimakariri District Council** consent and conditions of consent to the works and the approved specifications and drawings.

As an independent professional I, or personnel under my control, have carried out supervision and periodic reviews of the land development work appropriate to the nature of the work and in my professional opinion, based upon reasonable enquiry, these reviews and the works have been completed in accordance with the above consent, using materials and methods fit for purpose and sound engineering practice.

______________________________ Date: ______________________________

(Signature)

______________________________ Member: CSNA NZIS ACENZ IPENZ

(Professional qualifications – CPEng or RPSurv)

Non-Conformance Report (Template)

Contract Name/No: ______________________ NCR Ref No: ____________________

1.0 NON-CONFORMING WORK DETAILS:

(provide precise location, detailed description and sketches as appropriate)

Company responsible for NC ______________________________________

Contractor ______________________________________ (sign/date)

2.0 PROPOSED CORRECTIVE ACTION

(provide details with sketches)

3.0 APPROVALS:

3.1 The corrective action is accepted/ not accepted/ accepted subject to attached conditions.

Engineer ______________________________________ (sign/date)

Council ______________________________________ (sign/date)

3.2 The corrective action has been completed.

Certified: ______________________________________ (sign/date)

Reviewed: ______________________________________ (sign/date)

Approved: ______________________________________ (sign/date)

Engineer's Checklist

CONTRACTOR ______________________ DATE ______________

PROJECT DESCRIPTION ______________________________

The following should be documented:

	Requirement Met? Yes	No
1. Project Description:		
• Brief description of the scope of the work or services		
• Summary of major activities and types of work		
• Specialist tasks or procedures are documented and reference to safe work procedures and training documented		
• Areas of project requiring special consideration are documented and procedural requirements are referenced: e.g. presence of public, traffic management, notifiable work, restricted work		
2. Contractor's Health and Safety Structure and System:		
• Names and positions of personnel with specific health and safety responsibilities are documented		
• Position and name of the senior person who will liaise with the Engineer on health and safety issues is documented		
• Name and position of the on-site supervisor is documented		
3. Contractor's Induction and Safety Training		
• Outline of the contractor's induction procedures for employees and subcontractors		
• Register of personnel completing the induction programme		
• Details of employee health and safety training relevant to the project.		
• Copies of relevant certificates attached e.g. Code of Practice for Temporary Traffic Control, Cable Location, Confined Spaces		
• Register of persons holding authorisations, permits, competency certificates, licenses etc required for the project		
4. Safe Work Practices and Procedures		
• List of company safe work procedures relevant to the project		
• Copies of safe work procedures, permits or notifiable work notices		
• Details of project operations subject to work permits		
• Work permit procedure documented		
• Distribution list of people (including subcontractors) issued with safe work procedures		
5. Noise		
• Control measures and standards are documented with clear procedures on how to achieve the control		
6. Hazard Management		
• All hazards (existing and potential) associated with the project are documented on the hazard register form		
• The hierarchy of controls has been considered (i.e. eliminate, isolate or minimise)		
• Control measures are documented with clear procedures on how to achieve the control		
• Evidence of employee and subcontractor training on control measures is included		

Engineer's Checklist

Requirement Met? Yes No

7. Workplace Health and Safety Inspections

	Yes	No
• Inspection team documented		
• Frequency and type of inspection defined		
• Checklists to be used are included		
• Procedure for actioning inspection findings included		
• Hazard reporting procedures documented and form included		
• Specific areas targeted for inspections documented		

8. Emergency Procedures

	Yes	No
• Overall emergency plan and structure for the project		
• Register of emergency equipment and locations		
• Register of current qualified first aiders		
• Arrangements/coordination with other worksite occupants in event of emergency		

9. Accident Reporting, Recording and Investigation

	Yes	No
• Details of accident recording, reporting and investigation system and procedures		
• Details of how accidents will be notified to OSH and Engineer		
• Details of how accident statistics are to be compiled (major projects)		

10. Health and Safety Performance Monitoring (Major Projects)

	Yes	No
• Details of how health and safety performance statistics associated with the project are reviewed		
• Details of how monthly health and safety performance reports will be compiled for review by Engineer		
• Nature of health and safety performance information presented to employees on a regular basis		
• Outline of auditing programme to evaluate the effectiveness of the Health and Safety Management Plan		

11. Health and Safety Management Plan Review

This Health and Safety Management Plan has been:

Reviewed by: ______________________________ (Name/Position/Sign)

Approved by: ______________________________ (Sign/Date)

Contractor notified: ______________________________ (Date)

Reviewed by: ______________________________ (Council - Name/Position/Sign)

Construction Checklist – Pipe Construction

CONTRACT/JOB: ________________________ DATE: ________________________

DRAIN LOCATION: ____

Task	Acceptance Criteria/Test Frequency	Task/Completion Signature/Comment
1. Drawings and specifications checked for requirements		
2. Pipe material • Type class • Diameter		
3. Filter material • Specification • Grading		
4. Trench • Alignment check • Grade (normal min 1:100) • Width • Depth		
5. Bedding • Min depth 75mm • Sockets not bearing		
6. Pipe laying • Sockets uphill • Joints clean, invert flush • Joints as detailed • Rings required • Isolated from surface water		
7. Backfill material • Specification • Grading		
8. Backfill placement • Layer depth • Compaction		
9. Connections • As per design • Location		

Arising NCR: ____

All tasks defined above have been satisfactorily completed to the standards required:

Contractor: ____ (Sign/Date)

Construction Checklist – Basecourse Stringing

CONTRACT/JOB: ______________________________ DATE: ______________________________

ROAD LOCATION: ____

Refer to diagram on back of this sheet for measuring diagram

	L	C	R
Required Dip			

Ch.	L	C	R	Ch.	L	C	R

WAIMAKARIRI
DISTRICT COUNCIL

ENGINEERING CODE OF PRACTICE

PART FOUR

GEOTECHNICAL REQUIREMENTS (EARTHWORKS AND LAND STABILITY)

April 2009

Part 4: Geotechnical Requirements

CONTENTS

Part 4: Geotechnical Requirements

Part 4: Geotechnical Requirements

4.1 INTRODUCTION

This part of the Engineering Code of Practice draws attention to the need for the assessment of land stability and the design and control of earthworks. Such assessment ensures a suitable platform for the construction of buildings, roads and other structures, as well as the minimisation or mitigation of any adverse environmental effects arising from such works.

This is not a geotechnical standard but sets out some, though not necessarily all, of the matters to be considered in planning and constructing a land development project.

4.2 CONSENT AND COMPLIANCE ISSUES

The consent and compliance information set out in Part 2: *General Requirements* applies to all works within the Waimakariri District, with the addition of the clauses below.

4.2.1 Legislation

The Resource Management Act (RMA) 1991 and amendments is the principal statute that controls land development, including earthmoving and land-use aspects.

NZS 4431:1989 applies to the construction of earthfills for residential development, including residential roading. It does not, however, deal with historical fill that has not been undertaken in accordance with any Standard and it does not cover natural slopes, banks and batters.

There is no Standard for earthfill for other than residential developments. Clause 4.7.3 - Compaction standards for fill material sets out the requirements in these situations.

4.2.2 Statute and District Requirements

Where there is a requirement for an assessment of land stability, to meet the provisions of the Resource Management Act and the Building Act, this is the responsibility of the geotechnical engineer. The Council relies on that assessment when granting the resource consent. The geotechnical engineer determines the methods used and investigations undertaken.

Special requirements apply when the land is subject to erosion, avulsion, alluvium, falling debris, subsidence, inundation or slippage. In such situations, refer to section 106 of the Resource Management Act and, for subsequent building work, section 74 of the Building Act.

Specific Council requirements include:

- No earthworks permission for work within Waimakariri District unless it complies with the provisions of the District Plan.
- No earthworks beginning on a subdivision that has been granted resource consent prior to final engineering acceptance, unless written permission from the Council is given, detailing conditions that must be adhered to.

Part 4: Geotechnical Requirements

4.3 QUALITY ASSURANCE REQUIREMENTS AND RECORDS

Provide quality assurance records that comply with the requirements in Part 3: Quality Assurance, during design and throughout construction.

4.3.1 Requirement for a Geotechnical Engineer

Engage a geotechnical engineer (or suitably experienced civil engineer) to provide geotechnical expertise where the following issues exist:

- The lack of, and limitations of, relevant Standards.
- The assessment of land stability requires specialist expertise.
- The construction of earthworks associated with any development requires initial planning and design, to ensure that banks and batters remain stable and that fill material is placed in such a way that it can support the future loads imposed on it.
- The assessment of ground for building foundations, roads, etc. requires specialist expertise e.g. weak ground may require special design.
- The wide range of soil types, physical conditions and environmental factors existing in different areas make it impossible to lay down precise requirements for land stability assessment or earthworks.
- The preliminary evaluation raises doubt about the stability, or suitability, of the ground for the proposed development.
- Other geotechnical hazards are identified.
- The Council requires geotechnical expertise to assess the project.

The geotechnical engineer will carry out the following functions:

- Undertake a site inspection and any preliminary site evaluation required, including investigations of sub-surface conditions and identifying geotechnical hazards affecting the land before the detailed planning of any development. These matters must be included in any assessment of environmental effects (AEE) associated with any consent application;
- Before work commences, be involved in the design or review the drawings and specifications defining any earthworks or other construction work, and submit a written report to the Council on the foundation and stability aspects of the project with the application for engineering acceptance;
- Set earthwork requirements, where no standard for earthworks is applicable to the project, to conform to the CoP and to subdivision or resource consent conditions (if any) that apply to the proposed development;
- Before work commences, and during construction, determine the extent of further geotechnical engineering services required (including investigation and geological work);
- Before and during construction, determine the methods and frequency of construction control tests to be carried out, determine the reliability of the testing, and evaluate the significance of the test results and field inspection reports in assessing the quality of the finished work;
- During construction, undertake regular inspections consistent with the extent of geotechnical issues associated with the project;
- On completion, submit a written report to the Council attesting to the compliance of the earthworks with the specifications and the suitability of the development for its proposed use. If NZS 4431 is applicable, the reporting requirements of that Standard must be used as a minimum requirement.

Where a development proposal has been submitted without geotechnical input and where, in the opinion of the Council, such input is required, the Council may direct that such advice is obtained before proceeding further with the proposal.

4.3.2 Design Report

Detail the key achievement criteria in the Design Report for the geotechnical aspects of the engineering design.

Provide the following design records to support the engineering drawings and Design Report, as a minimum:

- The site inspection and evaluation;
- The foundation and stability aspects of the project;
- The extent of further geotechnical engineering services required (including investigation and geological work);
- The methods and frequency of construction control tests to be carried out.

4.3.3 Construction Records

Provide the information detailed in CoP Part 3: *Quality Assurance* and the CCC *Construction Standard Specifications (CSS)*, including where applicable:

- Material specification compliance test results;
- Subgrade test results and corresponding recalculations of metalcourse depths;
- Compaction test results;

4.3.4 Post-Construction Records

Provide the information detailed in CoP Part 3: *Quality Assurance*, Part 12: *As-Builts*, and the CCC *CSS*, including where applicable:

- Design report
- Completion certificates;
- Producer statements – design, construction, construction review
- Completion report, including all test results
- As-built plans and records

4.3.5 Geotechnical Completion Report

For all developments where a geotechnical engineer is engaged, the geotechnical engineer must submit a Geotechnical Completion Report, accompanied by a statement of professional opinion as set out in QP-C813-AA (attached as Appendix A).

The report must identify any specific design requirements that necessitate the building design to deviate from NZS 3604 and NZS 4229. Describe the extent of inspection, the results of testing and include all geotechnical reports prepared for the development.

The professional opinion must indicate the degree of compliance of the development with the design or standards set by the geotechnical engineer.

Part 4: Geotechnical Requirements

The developer shall test areas of natural ground on planned subdivisions or developments that are not proposed to be filled or excavated, for soil strength and type. Wherever building sites on natural ground have soil strengths less than 100 kPa, or exhibit other specific characteristics that may require specific foundation design, note them in the report, along with any recommendations for strengthened or piled foundations for residential buildings.

Include documentation on both the testing of the soils for compaction and for soil strength and type, clearly showing the areas to which the tests relate. Include areas where compaction met the required Standards, any areas requiring re-testing and areas which did not meet the Standards.

For simple developments where there are no earthworks, the Geotechnical Completion Report will consist of the Geotechnical Assessment Report. For large or more complex developments where there may have been several stages of geotechnical reporting, include all relevant geotechnical information in the Geotechnical Completion Report.

4.3.6 Acceptance Criteria

All basecourse, topsoil and other integral components must be tested before acceptance and/or comply with *CSS*.

Part 4: Geotechnical Requirements

4.4 PRELIMINARY SITE EVALUATION

Consider the total surroundings of the site, without being influenced by details of land tenure, territorial or other boundary considerations.

In simple cases, a visual appraisal may be sufficient. In other cases, depending on the nature of the project, its locality, the scale of development proposed and individual site characteristics, consider the following matters before preparing a proposal for development.

4.4.1 Drainage

Identify the existing natural drainage pattern of any area, and locate any natural springs or seepage. Wherever any natural surface or subsurface drainage paths may be interfered with or altered by earthworks, assess the wider implications e.g. the impact on springs in nearby waterways. Sealing areas to preserve these drainage paths may be preferable to providing alternative drainage paths. Consider also the stormwater needs of the site and sedimentation control during development.

4.4.2 Slope Stability

Some natural slopes exist in a state of only marginal stability and relatively minor works such as trenching, excavation for streets or building platforms, removal of scrub and vegetation, or the erection of buildings, can lead to failure. Look for signs of instability, such as cracked or hummocky surfaces, crescent-shaped depressions, crooked fences, trees or power poles leaning uphill or downhill, uneven surfaces, dispersive soils, swamps or wet ground in elevated positions, plants such as rushes growing down a slope and water seeping from the ground.

4.4.3 Rock Fail Potential

In some circumstances, a potential hazard from rock fall within or beyond the site boundaries may exist. Assess the risk for any proposed development on such sites. Provide:

- Details of source areas of rock fall hazard;
- A full geological description of potential sources of rock;
- Likely rock sizes.

4.4.4 Foundation Stability

Study the general topography of the site and its surroundings for indications of areas that have previously been built up; either as a result of natural ground movement or by the deliberate placing of fill material. Unless such fill has been placed and compacted under proper control, long-term differential settlement could occur, potentially causing damage to superimposed structures, roads, services or other structures.

4.4.5 Unsuitable Historical Fill

Council records may (or may not) indicate that a site has been filled with unsuitable, uncontrolled or contaminated material. Discuss any remediation proposals for such fillings with the Council at an early stage of the investigation.

4.4.6 Contaminated Site

Sites known to be, or subsequently found to be, contaminated as a result of previous activities may require the services of a specialist environmental scientist for a site evaluation. Ascertain, at an early stage, the extent of any contamination and the remediation needed to meet the required standards.

Part 4: Geotechnical Requirements

4.4.7 Local Conditions

Consider the range of soil types which exist within the Waimakariri District e.g. expansive soils, volcanic soils, dispersive soils, soft alluvial sediments and compressible soils. Also consider the liquefaction of saturated non-cohesive soils. The Council and Canterbury Regional Council (Environment Canterbury) may have information on the soil types of particular areas.

4.4.8 Peer Review

If the risk to the land is assessed as being medium to very high, obtain a peer review of the geotechnical assessment for the proposed development before development. An independent geotechnical engineer must carry this out. *The Role of Peer Review* provides guidance on this process.

The Resource Consent Application must make reference to, and give an evaluation of, these matters.

Part 4: Geotechnical Requirements

4.5 GROUND INVESTIGATIONS

Field-testing shall be undertaken to determine the existing site conditions, subgrade strength, other soil characteristics, ground stability and any other foundation conditions that may exist at the proposed site.

Field testing should include, but not be limited to, the following:

- Benkelman beam tests to determine subgrade or existing pavement strength
- Scala penetrometer subgrade testing to 1m minimum depth below finished subgrade level
- Soil profile logs
- Hand auger tests to 2m minimum depth below finished subgrade level
- Additional tests as required assessing, for example, slope stability and ground water
- Densometer testing

Sufficient borings, probings or open cuts shall be carried out to:

- Classify the soil strata by field and visual methods;
- Evaluate the likely extent and variation in depths of the principal soil types;
- Establish the natural long-term seasonal groundwater levels.

An indication of the seasonal variation in groundwater levels shall be obtained from a review of historical data held by the Council or Canterbury Regional Council, or by an extended period of monitoring. At least one year's readings may be required wherever groundwater levels are critical, or could have a long-term effect on the development.

4.5.1 Soil Data

Obtain soil data for areas that are intended to:

- Form in-situ bases for fills.
- Yield material for construction of fills.
- Be exposed as permanent batters.
- Remain as permanent slopes or cut areas.

Special consideration of erosion potential is required wherever excavation and filling is made in loess soils, because of their highly dispersive properties.

For consistency in the reporting of soils to the Council, use the Soil Description Method in QP-C813-AB (attached as Appendix B) and the *Field Description of Soil and Rock*.

4.5.2 Further Investigation

The soil information thus obtained forms the basis for:

- Further sampling and testing which may be required on representative soil types.
- Relating subsequent soil test properties to relevant strata over the site.
- Assessment of, or calculations for, slope stability.
- Assessment of, or calculations for, foundations suitable for the finished site.
- Assessment of, or calculations for, road pavements.

Determine the test data that is appropriate for different areas.

Part 4: Geotechnical Requirements

4.5.3 Stability Criteria

When making an assessment of the stability of slopes and earthfills, use accepted criteria and analysis methods. Stability criteria applicable to land development in New Zealand are published or recommended by the New Zealand Geotechnical Society. Refer to *Geotechnical Issues in Land Development*.

4.5.4 Special Soil Types

Wherever special soil types are known to exist in a locality or are identified, advise on appropriate measures for incorporation of these soils into a development.

Special soil types include, but are not limited to:

- Soils with high shrinkage and expansion.
- Compressible soils.
- Volcanic soils.
- Soils subject to liquefaction.
- Soils prone to dispersion (e.g. loess).
- Marine or estuarine soils.

Contact the Council for hazard maps and information on special soil types in the locality if unfamiliar with the area.

Part 4: Geotechnical Requirements

4.6 PLANNING AND DESIGN

4.6.1 Balancing Landform Choices

The final choice of landform is dependent on many factors, which may be specific to the development. These include the:

- Relationship with surrounding landscapes.
- Natural drainage patterns.
- Size of the development.
- Proposed and existing roading patterns.
- Preservation of natural features.
- Enhancement of natural features where compromised by fragmentation or reduction due to the development.
- Stability of the land.
- Function and purpose of the development.
- Potential for flooding, erosion and other natural events.

The order of importance of these factors will vary from project to project.

The final choice of landform must represent the most desirable compromise between the development requirements, the preservation of natural features including the existing soil profile, and the natural quality of the landscape. Preservation aspects include retaining natural watercourses, and excluding any development from natural gullies (refer to the *District Plan*).

4.6.2 Reducing Waste

When designing the development, consider ways in which waste can be reduced.

- Design to reduce waste during construction e.g. minimise earthworks, reuse excavated material elsewhere.
- Use materials with a high recycled content e.g. recycled concrete subbase. Proposed recycled materials will need approval from the Council to ensure that environmental contamination does not occur.

See the Resource Efficiency in the Building and Related Industries (REBRI) website for guidelines on incorporating waste reduction in your project (www.rebri.org.nz/).

4.6.3 Existing Landforms

Study the general nature and shape of the ground and take particular note of:

- The geological nature and distribution of soils and rock.
- Existing and proposed drainage conditions and the likely effects on groundwater.
- The previous history of ground movements in similar soils in the area.
- Where earthworks are involved, the performance of comparable cuts and fills (if any) in adjacent areas.
- Air photography and other sources of information that should be reviewed and incorporated into any slope stability assessment.

4.6.4 Suitability

The choice of a suitable landform is dependent on many factors that may be specific to a particular site. Avoid unnecessary earthworks, aim to protect original soils and drainage patterns and to minimise disturbance, compaction, earthworks and importation of topsoil, although earthworks may be justified in the following circumstances:

- To minimise the risk of property damage through ground movement in the form of rock fall, slips, subsidence, creep, erosion or settlement.
- To minimise the risk of property damage through flooding, or surface water run-off.
- To lessen tunnel gully erosion within hillside developments.
- To develop a more desirable roading pattern with improved accessibility to and within the site, and to create a better sense of orientation and identity for the area as a whole.
- To increase the efficiency of overall land use, including the quality of individual sites and amenity areas around buildings, the economics of providing engineering services and the standard of roading and on-site vehicular access.
- To create, where needed, suitably graded areas for playing fields and other community facilities.
- To enhance the general environmental character of the area by softening the landscape or by artificially creating or emphasizing landforms of visual significance, particularly on flat sites or on areas devoid of landscape features.

Note that some hillside developments require soil conservation measures such as plantings and revegetation of areas liable to tunnel gully erosion, sheet erosion, slips and existing stream bank/bed erosion. Refer to the *Soil Conservation Guidelines for the Port Hills* for guidance on erosion prone areas and measures to prevent or control erosion. Refer to CoP Part 10 clause 10.5.2.4 – *Revegetation, Restoration and Connection of Habitats* for an explanation of revegetation.

4.6.5 Seismic Considerations

Consider the seismic effects on earthfills, slopes and liquefiable ground, and take these into account in the design and construction of any development.

4.6.6 Rockfall Hazard Mitigation

Determine possible protection and/or remedial measures to mitigate the assessed risk for any proposed development. Provide results by analysis of bounce height and velocity for typical annual events and 100 year events for the likely rock sizes as assessed in clause 4.4.3 – Rock Fail Potential.

Mitigation could include:

- Catch fences or other forms of protective barriers;
- Benching, bunding, excavation or filling;
- Planting of vegetation.

Part 4: Geotechnical Requirements

Determine the rock energy in kilojoules and demonstrate how the protective barrier will arrest them. Protective barriers must:

- Have a 50 year design life;
- Be accessible for inspection, rock removal and repair;
- Not be compromised where gates or accessways are included;
- Be designed by suitably experienced designers;
- Be and remain effective over their design life.

State the growth time until vegetation is an effective barrier and the vegetation's life expectancy.

Ensure the design addresses erosion potential and any impact on natural surface flow.

4.6.7 Peat

Ensure the geotechnical design in peat areas will achieve the infrastructure design life required by all other parts of the CoP. Preserve the flow of groundwater through the peat at pre-development levels.

Part 4: Geotechnical Requirements

4.7 CONSTRUCTION

4.7.1 Underrunners and Springs

In hill catchments, underrunners are often encountered. Intercept these and bring them to the surface, with a free outfall into the stormwater system wherever possible. If possible, locate the source and redirect or eliminate the underrunner.

4.7.2 Control Testing

A testing laboratory, or a competent person under the control of the geotechnical engineer, must carry out the construction control testing. The testing laboratory must have recognised registration or quality assurance qualifications.

4.7.3 Compaction Standards for Fill Material

The standard of compaction and method of determination is as set out in NZS 4431, except where NZS 4431 is not applicable. For example, industrial and commercial developments often have specialised requirements for fill materials and compaction.

Set the fill and compaction standards, procedures and methods of determination for the development in these cases. Use NZS 4431 as a basis where appropriate.

4.8 EROSION, SEDIMENT AND DUST CONTROL

4.8.1 Minimisation of Effects

Design and construct earthworks to minimise soil erosion and sediment discharge. Where necessary, make permanent provision to control erosion and sediment discharge from the area of the earthworks.

At the planning and design phase, consider the generation of dust during and after the earthworks operation. If necessary, incorporate specific measures to control dust.

Requirements for erosion, sediment and dust control will be set in the resource consent conditions for the project. Refer to these conditions and take into account in the early stages of planning a project. Refer also to the requirements of CCC *CSS: Part 1*.

4.8.2 Site–specific Erosion and Sediment Control Plan Requirements

For all developments where erosion could result in contaminants in sediments entering the groundwater, surface waters or the Council's stormwater system, provide a site-specific Erosion and Sediment Control Plan (ESCP) to the Council at least one week before any works on site. Note that, even where the Council has accepted an ESCP, the developer remains entirely responsible for all adverse effects associated with the site development.

Develop the ESCP to eliminate or reduce the following issues:

- Ecological damage to waterways;
- Channel infilling;
- Disturbed or uncompacted surfaces and potential sediment yield;
- Contaminated runoff.

The ESCP must include the following assessment factors:

- A description of the pre-development surface water runoff regime;
- The development area (hectares);
- The catchment area passing through the site (hectares) marked on drawing;
- A plan of the development area, identifying discharge points to waterways or pipelines;
- Calculated flow rates, and velocities through from the site (dry weather, two-year flood and typical water levels);
- A site plan showing the proposed earthwork strategy;
- The earthworks engineering drawings;
- A statement on how the exposed soil surface will be minimised;
- A statement (with sketches as appropriate) on how sediment runoff will be trapped and disposed of;
- A statement on potential tracking of soils on and off site by machinery;
- A statement on other contaminants and how they will be controlled;
- A statement on how ground water will be treated and discharged (if required).

The ESCP must comply with the following standards:

- ECan *Erosion and sediment control guidelines*
- ECan *Erosion and sediment control guidelines for small sites*;
- ARC90: *Erosion and sediment control: guidelines for land disturbing activities in the Auckland Region*.

4.8.3 Protection Measures

Take the following protection measures, unless incompatible with Canterbury Regional Council resource consent conditions:

- Construct stabilised construction entrances and detail proposed remedial works to mitigate contaminants moving off site e.g. mud on streets or silt in existing sumps in streets.
- Construct sediment traps and retention ponds where necessary. These should be cleaned out, as required, to ensure that adequate sediment storage is maintained.
- Use temporary barriers, or silt fences using silt control geotextiles, to reduce flow velocities and to trap sediment.
- Leave sections of natural ground unstripped to act as grass (or other vegetation) filters for run-off from adjacent areas.
- Construct temporary drains at the top and toe of steep slopes to intercept surface run-off and to lead drainage away to a stable watercourse or piped stormwater system.
- Slope benches in batter faces back and grade (both longitudinally and transversely), to reduce spillage of stormwater over the batter wherever surface water could cause erosion of batters, or internal instability through infiltration into the soil.
- Prevent surface water from discharging over batter faces by constructing open interceptor drains in permanent materials formed to intercept surface run-off and discharge via stable channels or pipes, preferably into stable watercourses or piped stormwater systems.
- Grade the surfaces of fills and cuts to prevent ponding.
- Shape and compact the upper surface of intermediate fills with rubber-tyred or smooth-wheeled plant when rain is impending or when the site is to be left unattended, to minimise water infiltration.
- Topsoil and grass the completed battered surfaces of fills to reduce run-off velocities.
- Re-topsoil and grass (or hydroseed) all earthwork areas as soon as possible after completion of the earthworks and drainage works.
- Use planting, environmental matting, hydroseeding, drainage channels or similar measures at an early stage in the earthworks construction phase as a permanent control of erosion and sediment discharge.
- To control dust or encourage early vegetation growth, water the site frequently during construction.
- Establish the permanent surface at an early stage of the construction phase.

Possible treatment methods are provided in the CCC *Stormwater treatment devices: design guideline manual*.

Ensure a satisfactory grass strike is obtained on all completed earthworks surfaces as soon as practicable. The intention is to provide early vegetative cover, particularly before the onset of winter, to minimise erosion and sedimentation. Suitable irrigation methods may be required to assist grass growth in the summer months.

Part 4: Geotechnical Requirements

Prevent water from stormwater systems flowing into a fill or into natural ground near the toe or sides of a fill. Do not construct stormwater or wastewater soakage systems in a fill, which could impair the fill's stability. Take into account the effect of utility services laid within the fill.

4.9 AS-BUILT INFORMATION

Prepare as-built records, which comply with CoP Part 12: *As-Builts*. Present the as-built drawings in conjunction with the Geotechnical Completion Report and tabulated results.

Part 4: Geotechnical Requirements

4.10 ASSOCIATED DOCUMENTS

Appendix A	Statement of Professional Opinion on the Suitability of Land for Building Construction (QP-C813-AA)
Appendix B	WDC Soil Description Method (QP-C813-AB)
Appendix C	WDC Soil Log (QP-C813-AC)

Statement of Professional Opinion on the Suitability of Land for Building Construction

ISSUED BY: ____
(Engineer)

OF: ____
(Name and address of firm)

TO: ____
(Developer)

TO BE SUPPLIED TO: ____
(Territorial Authority)

IN RESPECT OF: ____
(Description of infrastructure/land development)

AT: ____

____
(Address)

I hereby confirm that:

1. I am a suitably qualified and experienced geotechnical engineer and was retained by the developer as the geotechnical engineer on the above development.

2. The extent of my inspections during construction, and the results of all tests carried out are as described in my Geotechnical Assessment Report, dated ________________

3. In my professional opinion, not to be construed as a guarantee, I consider that *(delete as appropriate)*:

(a) The earthfills shown on the attached Plan No________________ have been placed in compliance with the requirements of the ________________ Council and my specification.

(b) The completed works give due regard to land slope and foundation stability considerations.

(c) The original ground not affected by filling is suitable for the erection thereon of buildings designed according to NZS 3604 provided that:

(i) ____

(ii) ____

(d) The filled ground is suitable for the erection thereon of buildings designed according to NZS 3604 provided that:

(i) ____

(ii) ____

(e) The original ground not affected by filling and the filled ground are suitable for the construction of a development/subdivision and are not subject to erosion, subsidence or slippage in accordance with the provisions of Section 106 of the Resource Management Act 1991 provided that:

(i) ____

(ii) ____

NOTE: The sub-clauses in Clause 3 may be deleted or added to as appropriate.

Statement of Professional Opinion on the Suitability of Land for Building Construction

4. This professional opinion is furnished to the territorial authority and the developer for their purposes alone, on the express condition that it will not be relied upon by any other person and does not remove the necessity for the normal inspection of foundation conditions at the time of erection of any building.

5. This certificate shall be read in conjunction with my geotechnical report referred to in Clause 2 above, and shall not be copied or reproduced except in conjunction with the full geotechnical completion report.

6. I / My practice holds professional indemnity insurance in the sum of $ ___________________ (Minimum amount of insurance shall be commensurate with the current amounts recommended by IPENZ, ACENZ, TNZ, INGENIUM.)

______________________________________ Date: ___________________________________

(Signature of engineer)

Qualifications and experience

____

____

Soil Description Methods

As:

Moisture		Strength		Colour		Soil Type		Grading		Organics
	+		+		+				+	

1. MOISTURE

Moisture		Description
1	Dry	Cohesive soils usually hard or powdery Granular soils run freely through hands
2	Moist	Some moisture present – usually darkens the colour
3	Wet	Strong squeezing in the hand will drive some water out
4	Saturated	Squeezing will drive water out

2. STRENGTH

Cohesive Soil Consistency		Characteristic
1	Very soft	Exudes between figures
2	Soft	Easily moulded by fingers
3	Stiff	Impossible to mould with fingers, but will change shape with heel pressure
4	Very stiff	As for stiff, but considerable heel pressure is required
5	Hard	Brittle, very tough
Non-Cohesive Soil Density		**Characteristic**
6	Very loose	Very easy to excavate by hand
7	Loose	Easy to excavate by hand
8	Medium dense	Between loose and dense
9	Very dense	Very difficult to excavate by hand
0	Cemented	Particles bound together

3. COLOUR

Adjective1	Adjective2	Main Colour
1. Light	1. Pinkish	1. Pink
2. Dark	2. Reddish	2. Red
	3. Yellowish	3. Yellow
	4. Brownish	4. Brown
	5. Olive	5. Olive
	6. Greenish	6. Green
	7. Bluish	7. Blue
	8. Greyish	8. White
		9. Grey
		0. Black

Soil Description Methods

4. SOIL TYPE

Lesser Fraction	
20-50% volume	
Soil Type Term	
1. Coarse	gravelly
2. Medium	gravelly
3. Fine	gravelly
4. Coarse	sandy
5. Medium	sandy
6. Fine	sandy
7. Silty	
8. Clayey	
9. Peaty	

Dominant Fraction			
> 50% volume			
Soil Type term		Particle size (mm)	Graphic Symbol
0. Boulders		>200	
1. Coarse*	gravel	60-200	
2. Medium	gravel	20-60	
3. Fine	gravel	2-20	
4. Coarse	sand	0.6-2.0	
5. Medium	sand	0.2-0.6	
6. Fine	sand	0.06-0.2	
7. Silt		0.002-0.06	
8. Clay		<0.002	
9. Peat		N/A	

Minor Fraction	
< 20% volume	
With some	
0. Boulders	
1. Coarse	gravel
2. Medium	gravel
3. Fine	gravel
4. Coarse	sand
5. Medium	sand
6. Fine	sand
7. Silt	
8. Clay	
9. Peat	

* also referred to as cobbles

5. SAND/GRAVEL GRADING

1. well graded
2. poorly graded

6. ORGANIC CONTENT

Adjective	Organic Type
1. Trace	1. Fibrous
2. Little	2. Wood pieces
3. Some	3. Root fibres
4. And	4. Vegetation

Soil Log

WAIMAKARIRI DISTRICT COUNCIL			
Project:		Project No:	Bore ID:
Client:			
Bore Depth:	GL:	Recorded by:	Date:
Location:	WT Depth:		

Elevation	Depth	Lithology	Material Description	Soil Code											Scala Penetrometer (mm/blow)											Depth
	0			1	2	3	4	5	6	7	8	9	10	11	0	10	20	30	40	50	60	70	80	90	100	0
	0.1																									0.1
	0.2																									0.2
	0.3																									0.3
	0.4																									0.4
	0.5																									0.5
	0.6																									0.6
	0.7																									0.7
	0.8																									0.8
	0.9																									0.9
	1																									1
	1.1																									1.1
	1.2																									1.2
	1.3																									1.3
	1.4																									1.4
	1.5																									1.5
	1.6																									1.6
	1.7																									1.7
	1.8																									1.8
	1.9																									1.9
	2																									2
	2.1																									2.1
	2.2																									2.2
	2.3																									2.3
	2.4																									2.4
	2.5																									2.5
	2.6																									2.6
	2.7																									2.7
	2.8																									2.8
	2.9																									2.9
	3			Moisture	Strength		Colour			Soil Type		Grading	Organics													3
														Safe bearing kPa->		250	155	110	80	68	57	50	44	39	36	

Locality Diagram		

WAIMAKARIRI
DISTRICT COUNCIL

ENGINEERING CODE OF PRACTICE

PART FIVE

STORMWATER & LAND DRAINAGE

25 February 2025

Part 5: Stormwater & Land Drainage

CONTENTS

Part 5: Stormwater & Land Drainage

TABLES

Part 5: Stormwater & Land Drainage

5.1 INTRODUCTION

This Part of the CoP covers the design and construction requirements of stormwater and land drainage works for land development and subdivision, including capital works projects.

This Part is not intended to be a detailed design guide or to replace the need for stormwater engineering expertise in some areas of the design process. The standards included in this Part are one way of achieving the desired outcomes and performance criteria of the network components described below.

5.1.1 Philosophy

The Waimakariri District Council is taking a values-based approach to management of the natural and physical resources that make up the District's system of waterways, wetlands and drainage. This includes not only the natural waterway system but also the built network. By understanding the natural processes operating in land and water we are much more able to bring to life values that are important to the community while addressing drainage issues associated with individual developments. Values that have been specifically identified are ecology, landscape, recreation, heritage, culture and drainage.

The emphasis on each value at a particular site will be dependent on the objectives of the project. The process toward understanding these values, how they can be reflected and enhanced in new developments, and an appreciation of ongoing management requirements, is outlined in the CCC *Waterways, Wetlands and Drainage Guide* (*WWDG) Part A*.

5.1.2 Objectives

The stormwater drainage system serves four purposes:

- The conveyance of storm surface run-off with minimal flood damage;
- Control of water quality (surface and groundwater);
- Protection of bio-diversity and ecological function;
- Groundwater control and protection.

The objective of a stormwater drainage system is to balance these four aspects; to the extent that agreed levels of service are maintained and any adverse effects on the environment are minimised. To satisfy the latter, remedial or mitigation works will often need to be incorporated within the stormwater drainage system (see *WWDG Part B* section 2.2). Potential adverse effects include flood damage, surface and channel erosion and sedimentation, water pollution, loss of bio-diversity and damage to aquatic ecosystems.

Opportunities exist for the stormwater drainage design to integrate with the natural drainage system. Grassed swales, natural or artificial waterways, ponds and wetlands, for example, may in certain circumstances be not only part of the stormwater drainage system, but a required solution (depending on urban priorities) especially if a low impact on receiving waters downstream is critical.

Well designed and maintained alternative systems that replicate the pre-development hydrological regime can not only mitigate adverse environmental effects but also enhance amenity and ecological values.

Part 5: Stormwater & Land Drainage

5.2 CONSENT AND COMPLIANCE ISSUES

The consent and compliance information set out in Part 2: *General Requirements* applies to all works within the Waimakariri District, with the addition of the clauses below.

5.2.1 Legislation

The following Acts and amendments are the principal statues governing stormwater and land drainage:

- Local Government Act (2002) (LGA)
- Resource Management Act (1991) (RMA)
- Land Drainage Act (1908)

5.2.2 District Council Requirements

Requirements in the *Stormwater Bylaw* must be met (see also *WWDG Part B* chapter 17).

5.2.3 Consent Application – Information Required

In addition to the information required to support the concept drawings and/or Resource Consent plans in CoP Part 2: *General Requirements*, the following data shall also be provided:

- Catchment boundaries by defined surface levels (where the location of the catchment boundary is uncertain, the developer must define the boundary by survey);
- Identification of any natural or artificially created basins.

Part 5: Stormwater & Land Drainage

5.3 QUALITY ASSURANCE REQUIREMENTS AND RECORDS

Provide quality assurance records that comply with the requirements in CoP Part 3: *Quality Assurance* and the CCC *Construction Standard Specifications* (CSS), during design and throughout construction.

5.3.1 The Designer

The designer of all stormwater reticulation systems that are to be taken over by Waimakariri District Council and the person undertaking the catchment analysis must be suitably experienced. The qualifications and experience of the designer may be requested by the Council for approval prior to commencement of the design.

The design reviewer must have at least equivalent experience to the designer.

5.3.2 System Review

When the pipe selection and layout have been completed, perform a system review to ensure that the design complies with both the parameters specified by the Council and detailed in the CoP. The documentation of this review must include a full hydraulic system analysis. Compliance records must cover at least the following requirements:

- Pipe and fittings materials are suitable for the particular application and environment;
- Pipe and fittings materials are approved by Council;
- Pipe class is suitable for the pipeline application (including operating temperature, surge and fatigue where applicable);
- Layout and alignment meets the Council's requirements;
- Capacity is provided for future adjacent development;
- Hydraulic analysis details are provided;
- All assumptions are stated.

5.3.3 Engineering Design Approval

Provide the following information to support the engineering drawings and Design Report, as a minimum:

- Details and calculations that demonstrate that minimum standards of protection required by clause 5.5.2 will be maintained;
- Detailed calculations and drawings where applying to build within a flood plain, which determine the floodplain boundaries and levels relative to building floor levels (see *WWDG Part B* chapter 20 and the Building Act);
- Details and calculations that clearly indicate any impact on adjacent areas or catchments that the proposed works may have;
- Estimates of catchment imperviousness and the basis for its derivation;
- Summaries of hydrological and hydraulic modelling as required by the *WWDG* (see *WWDG Part B* chapters 21 and 22), including design parameters and assumptions;
- All assumptions used as a basis for calculations, including pipe friction factors;
- Draft versions of operations and maintenance manuals for any water quantity or quality control structures (refer also to clause 5.3.7);
- Landscape and planting drawings complying with QP-C811-AA *Standard Draughting Layout and Format Requirements* (attached to CoP Part 2 as Appendix A);
- System review documentation as detailed in clause 5.3.2;
- All options considered and the reason for choosing the submitted design.

Design checklists, to aid this process, are available in *WWDG Part B* sections 6.10 and 19.2.

Part 5: Stormwater & Land Drainage

Provide the following additional information for detention basins and swales:
- The design return period;
- The design rate of discharge at each discharge point;
- The design water level;
- The design volume, where there is a storage function;
- The volume of the basin or swale below surrounding ground level.

5.3.4 Construction Records

Provide the information detailed in CoP Part 3: *Quality Assurance* and the CCC *CSS*, including where applicable:
- All performance test results;
- Material specification compliance test results;
- Compaction test results;
- Subgrade test results;
- Infiltration test results.

5.3.5 Post-Construction Records

Provide the information detailed in CoP Part 3: *Quality Assurance*, Part 12: *As-Builts*, and the CCC *CSS*, including where applicable:
- Design report;
- Completion certificates;
- Producer statements – design, construction, construction review;
- Commissioning report, including all test results;
- Operations & maintenance manuals, where applicable;
- As-built plans and records.

5.3.6 Approved Materials

Where a material or product is proposed that is not approved in the district, prior to approval, the Council may require assurance that demonstrates the durability of that material. Where there is no current standard, the manufacturer will be required to supply copies of their Quality Assurance procedures and producer statements to support their performance and composition claims for the products concerned.

5.3.7 Operations and Maintenance Manual

Provide an Operations and Maintenance Manual in accordance with *WWDG* Part B clause 19.2 for any water quantity and/or quality control structures or formed features such as ponds. The manual must describe the design objectives of the structure, describe all the major features, identify all the relevant references to the *WWDG* and identify key design criteria (including any conditions attached to the relevant resource or other consents).

A separate section must explain operations such as the recommended means of sediment removal and disposal, and identify on-going management and maintenance requirements such as landscape establishment, vegetation control and nuisance control. CoP Part 10 section 10.6 – *Establishment & Maintenance* expands on these requirements.

5.3.8 Acceptance Criteria

All pipelines, pump stations and other integral components must be tested before acceptance, and must have been inspected and signed off by the Council. Testing shall be carried out in accordance with CCC *CSS: Part 3* clause 14.

Part 5: Stormwater & Land Drainage

5.4 GENERAL DESIGN PRINCIPLES

Stormwater drainage is the total system protecting people, land, infrastructure and improvements against flooding. It consists of a primary drainage system of pipes and waterways and detention areas and a secondary system consisting of open channels, controlled flood plains, natural ponding areas and flow paths. These are utilised in conjunction with the setting of building levels to ensure that buildings remain free of inundation up to the minimum protection standards set out in clause 5.5.2 and the Building Act.

The primary system must cater for the more frequent rainfall events and the secondary system must cater for higher intensity rainfall events and occasions when there are blockages in the primary drainage system. Table 5.1 sets out the minimum level of service requirements for the District. Where required, the developer shall provide new treatment and disposal facilities, and upgrade the existing facilities. Treatment and disposal systems in Business zoned area shall be specifically designed.

The designer shall have an appreciation of the local catchment, both upstream and downstream, and limit or mitigate any adverse effects imposed by the development, including effects on surface water and groundwater

To maintain water quality, it is desirable to avoid mixing stormwater and spring water if at all possible. The reticulation and disposal system should receive minimal influence from wastewater and groundwater.

5.4.1 Design Considerations

Consider the following aspects and include in the design, where appropriate:

- Size (or sizes) of the surface water drainage pipework throughout the proposed reticulation system;
- Selection of appropriate pipeline material type(s) and class;
- Mains layout and alignment including: route selection, topographical and environmental aspects, easements, foundation aspects, clearances and shared trenching requirements, provision for future system expansion;
- Hydraulic adequacy including acceptable flow velocities and other requirements where applicable to satisfy *WWDG Part B* chapter 22;
- Property service connection locations and sizes;
- Seismic design – all structures must be designed with adequate flexibility and special provisions to minimise risk of damage during earthquake. Provide specially designed flexible joints at all junctions between rigid structures (e.g. reservoirs, pump stations, bridges, buildings, manholes) and natural or artificially formed ground;
- Geotechnical investigations – take into account any geotechnical requirements determined under CoP Part 4: *Geotechnical Requirements*.

5.4.2 Integrated Stormwater Systems to Manage Quality and Quantity

Integrated stormwater systems are both the optimum and preferred method of stormwater treatment. When these systems are being considered, discuss their use with the Council at an early stage (Refer to *WWDG Part B* chapters 5 to 12 for more information on this topic).

Part 5: Stormwater & Land Drainage

Well-designed and well-maintained integrated systems, which replicate the pre-development hydrological regime, can not only mitigate adverse environmental effects, but also enhance local amenity, water quality and ecological values. These systems are designed in accordance with the waterway's six values of ecology, landscape, recreation, heritage, culture and drainage (refer *WWDG Part 1* Table 1.1).

- Ecology - Includes ecological processes and inter-relationships between plants, birds, fish and insects.
- Landscape - The special character of sites, aesthetic quality, and sense of place to people and communities.
- Recreation - Active and passive recreation, play and facilities associated with recreational activities.
- Heritage - Sites and activities of both human (e.g. structures) and natural (e.g. landforms) significance.
- Culture - The values of Maori and Pakeha, as well as wider community aspirations and involvement.
- Drainage - Groundwater and surface water inter-relationships, flows, flooding and stormwater.

The Council may approve existing or proposed areas of vegetation that are protected by way of an agreement, such as conservation covenant or Queen Elizabeth II Trust Covenant.

Matters that the Council will assess when considering approval shall include:

- Vegetation type, cover and location with respect to the stormwater system;
- Duration and purpose of the agreement (as defined above);
- Planned or potential earthworks or vegetation removal.

5.4.3 Catchment Management Planning

Carry out stormwater planning on a coordinated and comprehensive catchment-wide basis. Consider catchment-wide issues at the concept design stage and comply with the catchment management plan, if one exists.

The implications of future development upstream of the site, and the cumulative effects of land development on water quality and flooding downstream, are important considerations. The larger the scale of the development the more significant the catchment management planning issues are likely to be.

Discuss any catchment management planning issues with the Council at an early stage (see also *WWDG Part B* chapters 2, 5, 7 to 12 and 20).

5.4.4 Effects of Land Use on Receiving Waters

Impervious surfaces and piped stormwater drainage systems associated with urban development have a major effect on catchment hydrology. Faster run-off of polluted storm flows, reduction in stream and groundwater base flows and accelerated channel erosion and depositions alter the hydrology and adversely affect the quality of receiving waters. This in turn reduces the diversity of the aquatic biological community.

The effects of rural development on receiving waters are generally less significant where riparian margins are protected. However, any reduction in riparian vegetation which increases sediment loads and nutrient concentrations is likely to reduce aquatic biodiversity.

Consult with Environment Canterbury (ECan) and Waimakariri District Council at an early stage to identify likely adverse effects of land use on receiving waters (see also *WWDG Part B* chapter 2).

Part 5: Stormwater & Land Drainage

5.4.5 Catchments and Off-Site Effects

All stormwater systems must provide for the collection and controlled disposal of surface water from within the land being developed, together with any existing run-off from upstream catchments. In designing downstream facilities, consider the upstream catchment to be fully developed, including both the existing zoning and any catchment management plans.

For all land development works (including projects involving changes in land use or coverage), include an evaluation of stormwater run-off changes on upstream and downstream properties. This evaluation will generally be required at the resource consent stage.

Development must not increase the depth or duration of off-site flooding in any storm event up to the design event, unless any increase is negligible and can be shown to have no detrimental effects.

Investigate downstream impacts including changes in flow peaks and patterns, flood water levels, contamination levels, erosion or silting effects, and effects on the existing stormwater drainage system. Where such impacts are considered detrimental, mitigation measures (e.g. peak flow attenuation, velocity control, contamination reduction facilities) on or around the development site, or the upgrading of downstream stormwater disposal systems at the developer's expense, will be required.

5.4.6 Stormwater Pumping

Permanent stormwater pumping will only be permitted under exceptional circumstances. Refer to *WWDG Part B* section 13.6, taking into account the following additional requirements:

- Pumping systems shall be specifically designed using a multi-pump system to best balance the need for regular pump operation against the relative infrequency of major storm events. Design philosophy and technical details shall be discussed with the Council before detailed design is commenced;
- All pumps within a station shall be of the same or similar capacity. An additional installed pump shall act as standby;
- All electrical equipment shall be designed for a maximum of 15 starts per hour. Depending on the consequences of flooding during a pump station power outage, the Council may require that an on-site emergency power source or hook-up be provided;
- Valving of pumps shall be such that maintenance can be undertaken on the standby pump and check valve without interfering with the operation of the duty pump. Flanged or welded fittings shall be provided throughout, with a proprietary dismantling joint or similar in the system to facilitate dismantling;
- Stormwater pump stations shall incorporate control, monitoring, alarm and telemetry communication systems to Council standards at the time of the design. Any station on private land must have all weather access for light 5 to 7 tonne trucks.

5.4.7 Flood Risk

Flood Risk Assessment shall take account of the characteristics of the total catchment. A search shall also be undertaken to find any relevant historical information on flooding. This could include reviewing records held by relevant bodies, discussions with the local inhabitants or appropriate field investigations.

The assessment shall address the following:

- The proximity and nature of any river, stream or watercourse and associated flood plains;
- The capacity of culverts or watercourses downstream of the site and likelihood of upstream ponding resulting from under capacity or from blockage by debris or slips;
- The upstream culvert and watercourse conditions and the location of the secondary flow path for floodwater in the event of blockage or under capacity.

Flood design shall take into account the overall site conditions, details of the drainage system and the probable impediments to free flow (both upstream and downstream) when determining the expected runoff and design flood levels.

5.4.8 Reducing Waste

When designing the development, consider ways in which waste can be reduced.

- Plan to reduce waste during site clearance e.g. minimise earthworks, reuse excavated material elsewhere.
- Design to reduce waste during construction, e.g. prescribe waste reduction as a condition of contract.
- Select materials and products that reduce waste by selecting materials with minimal installation wastage rates.
- Use materials with a high recycled content e.g. recycled concrete subbase.

See the Resource Efficiency in the Building and Related Industries (REBRI) website for guidelines on incorporating waste reduction in your project www.rebri.org.nz/.

5.4.9 Alternative Technologies

The Council will consider alternative technologies on a case-by-case basis. Examples of such technologies are gross pollutant traps and bio-filters.

Part 5: Stormwater & Land Drainage

5.5 DESIGN PARAMETERS

5.5.1 Design Lifetime

All stormwater reticulation systems are to be designed to last for an asset life of at least 100 years with appropriate maintenance. Design the systems accordingly, to minimise lifecycle costs for the whole period. Assets designed to minimise capital cost at the expense of overall lifecycle cost will not be accepted.

5.5.2 Minimum Protection Standards for New Developments

Design all new surface water and land drainage systems to cope with design storms in accordance with Table 5.1 and *WWDG Part B* chapters 20, 21 and 22. It is noted that Table 5.1 takes precedence over the *WWDG* where there are discrepancies.

Table 5.1 Design Storm AEP for System or Infrastructure

System or Infrastructure	AEP
Primary reticulation system	10%
Secondary system, including overland flowpaths	1%
Culvert (Refer also NZTA Bridge Manual Clause 2.3 for heading up and maximum levels below road surface).	10%
Bridge (Refer also NZTA Bridge Manual Appendix A3 for minimum clearance above water level).	1%

Post-development peak flows for all intensity events shall be less than pre-development flows, The way in which this is demonstrated shall include consideration of a range of design events (5-year, 10-year, 50-year and 100-year ARI) and durations (10 minute through to 72 hour), and for this to include consideration of off-site effects, as outlined under Section 5.4.5. As a minimum stormwater management area (SMAs) shall be sized to manage flows from the 10-year and 100-year ARI events, however the impact of other events, as outlined above, shall also be considered.

The minimum floor level must be as specified in the *District Plan Chapter 27: Natural Hazards* where those plans apply, otherwise as specified in the Building Code E1/AS1 subject to the limitations of that document. Where neither document is applicable, specific flooding design shall be required to demonstrate compliance with the Building Code.

Note:

- The Building Code requires that the floor height must be above the 2% AEP (annual exceedance probability) flood level, plus a set freeboard depending on the building site. Freeboard is the provision for flood level design estimate imprecision, construction tolerances and natural phenomena (e.g. waves, debris, aggradations, channel transition and bend effects) not explicitly included in the calculations.
- Discuss commercial and industrial developments with special circumstances with the Council.
- In circumstances where ponding water on roads will exceed 100 mm a greater freeboard may be required.
- It is the responsibility of the developer to identify the 2% AEP level and ensure the accuracy of that information.

Discuss protection standards in tidal areas with ECan and the Council at an early stage. Storm surge and tsunami hazards, climate change, the *District Plan* requirements, and sea level rise must be considered, and a precautionary design approach is recommended.

Part 5: Stormwater & Land Drainage

5.5.3 Surface Water Run-off

Surface water hydrology shall be in accordance with *WWDG Part B* chapter 21, with the adjustments stated below. Drainage system hydraulics shall be in accordance with *WWDG Part B* chapters 20 and 22. Disposal to soakage chambers shall be in accordance with *WWDG Part B* chapter 6.

Estimation of the peak flow rate and volumes shall be in accordance with *WWDG Part B* chapters 21, 22.

The rainfall intensity tables for use in runoff calculations are provided in QP-C814-AA (attached as Appendix A). These have been taken from HIRDS V4 Scenario RCP 8.5 (2081-2100). For areas not covered by the tables, interpolate between the nearest points given. If required, more precise data may be obtained by using HIRDS V4 Scenario RCP 8.5 (2081-2100) or by requesting the data from WDC.

To be conservative, the rainfall estimates should be increased further for hill catchments.

The runoff coefficient (C value) used shall be taken from either Table 5.2 or Table 5.3, whichever is the greater, rather than the values given in *WWDG*.

Table 5.2 Runoff Coefficients for Specific Designs

Surface Type	C Value
Fully roofed and/or sealed developments	0.90
Asphalt, concrete, and other paved surfaces	0.85
Bare impearmeable clay with no interception channels or runoff control	0.70
Bare uncultivated soil of medium soakage	0.60
Unsealed roads, yards and similar surfaces	0.50
Heavy clay soil types – pasture and scrub cover Parks, playgrounds, reserves, gardens, lawns, etc.– predominantly grassed areas	0.30
Heavy clay soil types – bush cover Parks, playgrounds and reserves – predominantly bush	0.25
High soakage gravel and sandy types – pasture and scrub cover	0.20
Slope of Ground	**Correction**
0-5%	-0.05
5-10%	0
10-20%	+0.05
Steeper than 20%	+0.10

The C values in Table 5.2 shall be adjusted by the slope corrections as appropriate. The initial values given assume an average slope of 5-10%.

Table 5.3 Runoff Coefficient by Zone

Land Use	Zones	C Value
Industrial, commercial, CBD, town house developments	Bus1, Bus2, Bus3, Bus4	0.80
Residential	Res1, Res2, Res3, Res6, Res6A	0.65
Rural, Rural-residential	Res4A, Res4B, Res5, Rural 4B, Rural Pegasus	See Table 5.2

Impervious area estimations shall be based on proposed land use activity. Impervious area is defined as all potential buildings, houses, driveways, sheds, patios, carparks and other impervious or semi-pervious areas. Where alternative porous pavements or other methods that encourage groundwater infiltration are used then appropriate allowances may be made. Historical evidence would need to be submitted that verifies the performance of these alternatives.

Part 5: Stormwater & Land Drainage

A recognised alternative runoff estimation method supported by good hydrological information may be presented for consideration.

5.5.4 Determination of Water Surface Profiles

Design stormwater drainage systems in accordance with *WWDG Part B* sections 14.6 and 22.10, by calculating or computer modelling backwater profiles from the specified outfall water level set by the Council as stated in clause 5.9.9 – Outfall water levels On steep gradients, both inlet control and hydraulic grade line analysis must be used, and the more severe relevant condition adopted for design purposes. For pipe networks at manholes and other nodes, water levels computed at design flow must not exceed finished ground level while allowing existing and future connections to function satisfactorily.

An example of stormwater system analysis including a backwater calculation is provided in *WWDG Part B* Appendix 5.

Stormwater pipelines generally operate in a surcharged condition at full design flow. Pipe diameters chosen on the basis of pipe flow graphs, such as *WWDG Part B* Appendix 9 (which uses pipeline gradient rather than hydraulic gradient), are likely to be conservative in parts affected by free outfall conditions.

5.5.5 Secondary Flowpaths

Shape lots generally so that they fall towards roadways, which may be used as secondary flow paths. The use of strategic or arterial roads for this purpose shall not be approved. Ponding or secondary flow on roads must not exceed 100 mm at the crown, and velocities must be sub-critical other than where it is unavoidable on hillsides. On hillsides, convey secondary flows safely and as directly as possible into permanent open waterways.

Surface flows on carriageways shall be controlled in order to enable safe and comfortable vehicle and pedestrian access across and along road reserves.

Where secondary flow paths cannot, with good design, be kept on roads, they should be kept on public land such as accessways, parks, and reserves. Secondary flow paths over private land are the least desirable option and will need to be protected by legal easements.

Design secondary flow paths so that erosion or land instability caused by the secondary flows will not occur. Where necessary, incorporate special measures to protect the land against such events.

Avoid shaping roads to create basins with piped outlets. Where basins are created a higher level of service for the primary system may be required.

The secondary flow path sizing and location must be supported by adequate analysis to show:

- That it is of adequate capacity to handle the full flow of events up to 1% AEP, assuming the primary system is not functioning (this may be relaxed at the Council’s discretion); and
- That it discharges to a location that does not detrimentally affect others and can safely dissipate via a controlled disposal system as the storm peak passes.

Consider the secondary flow path under conditions of total inlet blockage at critical culverts and other critical structures.

5.6 PIPELINE DESIGN

5.6.1 Pipe Flow

Determine pipe diameters, flows and gradients from *WWDG Part B* Appendix 11.

For pipes not flowing full, use Manning's equation adopting 'n' values from *WWDG Part B* Table 22-1. Determine part full pipe flow relationships from *WWDG Part B* Appendix 9.

The primary piped system shall be designed to cater for the peak design flow, without surcharge, based on the "Colebrook-White" equation. The pipe roughness coefficient shall be:

- For pipes up to and including 300 mm diameter – Ks = 1.50 (n = 0.013).
- For larger pipe diameters – Ks = 0.60 (n = 0.012).

Refer to *WWDG Part B* chapter 22 for guidance on energy loss through structures.

5.6.2 Pipeline Connections

Make pipeline connections in accordance with CCC *CSS: Part 3*.

Design the stormwater drainage system as a separate system (i.e. with no inter-connections whatsoever with the wastewater system).

Submain and lateral lines may be saddled directly onto larger pipelines, if and only if the main line is greater than twice the diameter of the branching line, and provided that a manhole or other surface opening is supplied on the branching line within 50 m of the main line. If this is not possible, then a manhole shall be installed.

5.6.3 Minimum Pipe Sizes

The minimum pipe diameter is 225 mm diameter.

5.6.4 Material Selection

Select stormwater pipe materials in accordance with this document. Other materials shall be considered on a case-by-case basis.

The following pipe materials currently available in New Zealand are acceptable for gravity stormwater lines:

- Polyvinyl Chloride: PVC-U
- Reinforced Concrete with Rubber Ring Joint (RCRRJ)

The following pipe materials currently available in New Zealand are acceptable for pressure stormwater lines:

- Polyvinyl Chloride: PVC-U and PVC-O
- RCRRJ;
- Polyethylene: PE 100B and PE 80B;
- Ductile iron (DI);
- Concrete-lined steel.

Part 5: Stormwater & Land Drainage

Each material has specific design and installation issues, as identified in the manufacturers' design manuals, specifications and other literature. Consider these issues, as listed below, when specifying materials.

- Polyvinyl Chloride: PVC-U, PVC-O
  - UV degradation after more than 2 years exposure.
  - Depth of scratching, gouging and impact damage limited to 10% of the wall thickness.
  - Proper bedding and installation required.
  - Possible permeation by contaminants.
- Polyethylene: PE80B, PE100
  - Sophisticated equipment and highly skilled workers required.
  - Depth of scratching, gouging and impact damage limited to 10% of the wall thickness.
  - UV degradation (Blue pipe).
  - Bedding support required to prevent excessive deformation.
  - Pulling forces for PE are not to exceed the manufacturer's recommendations.
  - Vulnerable to permeation by contaminants (e.g. hydrocarbons).
- RCRRJ and Concrete-lined Steel
  - Internal lining and external coatings must be undamaged or fully restored after repairs or fabrication work.
- Ductile Iron
  - Internal lining and external coatings must be undamaged or fully restored after repairs or fabrication work.
  - Potential problems with stray electric currents and bimetallic corrosion.

The effect of fatigue on the pipe is important for all pressure lines subject to cyclic pressure changes.

All fittings shall have a rating at least equal to or greater than the pipe rating. Pressure pipe fittings may not have a rating less than PN12.

The highest class determined for any point on a line is required for the entire section, manhole to manhole.

5.6.5 Minimum Cover

Pipelines must have pipe protection complying with CoP Part 6 clause 6.6.8 – *Pipe Protection & Cover*, where the minimum cover specified in CCC *CSS: Part 3* is not available.

5.6.6 Gradients and Acceptable Flow Velocities

Refer to *WWDG Part B* clause 14.2.4.

5.6.7 Steep Gradients

Where gradients are steeper than 1:3 over lengths greater than 3.0 metres or where velocities are higher than 4.0 m/s, and when flows are continuous or frequent, specify wear-resistant pipes such as ABS, or PVC-U pressure pipe with a minimum class of SN12. This requirement may extend past the termination of the steep grade. Sacrificial layers can be used in special concrete pipes, or in in-situ structures.

Avoid lateral junctions on these sections of pipeline. If PVC-M pipes are used and junctions can not be avoided, specify factory-moulded fittings. Take care to provide adequate anchorage for the pipes.

5.6.8 Scour

Hilly areas, and areas adjacent to them, may have large variations in groundwater levels. These variations can cause sufficient water movement within the trench for bedding scour to develop. Allow for scour in flat areas where pipe gradients are steeper than 1:10 and immediately below hill areas. Refer to *CSS: Part 3* clause 8.6 for details of requirements. Fill any under-runner voids encountered during the work with either 'foam concrete' or 'stiff flowable mix' as defined in CCC *CSS: Part 1*. This treatment must be carried out under the direction of the engineer.

Haunching and backfill materials for areas prone to scour include lime-stabilised loess (40 kg/m^3), lime stabilised SAP20 (40 kg/m^3), lime stabilised SAP40 (40 kg/m^3), 'firm mix' as defined in CCC *CSS: Part 1* or concrete haunching (if bedrock is encountered).

Confirm the suitability of loess for backfill. Loess can only be used in areas outside carriageways and where there is adequate control of moisture content and mixing on site. Use lime stabilised SAP40 for backfilling all carriageways, and lime stabilised SAP20 in all areas outside carriageways where loess is not suitable.

Specify water stops on all pipelines with gradients steeper than 1:3, where the pipe is concrete haunched. Where 'firm mix' is used for haunching, water stops are not required. *WWDG Part B* clause 14.2.3 details the design criteria, and construction must comply with SD 600-347.

5.6.9 Inlet and Outlet Structures

Design inlets and outlets in accordance with *WWDG Part B* sections 14.6 and 14.7. Install safety grills where pipe diameter is greater than 525 mm. Install debris grills where blockage is a potential problem. Provide for operational requirements.

Consider the effects of inlet and tailwater controls when designing culverts, as set out in *WWDG Part B* section 22.9.

Take backflow effects into account in design. Consider outlet design and water level conditions in the design of discharges to existing stormwater systems and waterways and incorporate backflow prevention if necessary.

Where pipes discharge onto land or into a waterway outlet, design structures to dissipate energy and minimise erosion or land instability. Ensure velocities are non-scouring at the point of discharge. Acceptable outlet velocities will depend on soil conditions, but should not exceed:

- 0.5m/s where the substrate is cohesive; or
- Velocities given in *WWDG Part B* section 22.7 Table 22-5.

5.6.10 Manholes

Provide manholes in accordance with *WWDG Part B* section 14.4 and CCC *CSS: Part 3*. Consult the Council before embarking on any part of the system design where the velocity is such that the flow will not progress smoothly through the manhole into the discharge pipe.

No feature should impede flow through a manhole. If circumstances necessitate such a feature, widen the cross section of the manhole to counteract any potential head loss. The design must be accepted by the Council.

Check the effects of turbulence or hydraulic grade on pressure within manholes. Manhole depths must prevent the lifting of manhole lids and tops.

Part 5: Stormwater & Land Drainage

Manholes shall normally be provided on all drainage pipelines as follows:

- At each change of direction, pipe size or gradient;
- At each branching line or intersection;
- At the end of all terminal lines other than those with headwalls;
- At a spacing of not more than 90 m for pipes of diameter 1500 mm or less;
- At a spacing of not more than 150 m for pipes of diameter in excess of 1500 mm, with the approval of the Drainage Asset Manager.

Access chambers or sumps may be used in place of manholes where appropriate.

5.6.11 Sumps

Sumps shall be generally constructed to accord with *WWDG Part B* section 14.5 and with the standard drawings. Sump grate bars shall be aligned with the direction of flow.

Sumps shall be installed at every intersection and dip , and located such that channel flows do not exceed the limits stated:

- 55 L/s for a single sump
- 90 L/s for a double sump

Maximum sump spacing shall be as described for manholes in clause 5.6.10. In addition to the requirements above, note that intersection sumps are generally located on the kerb-line tangent point.

Sumps shall be sited so that they do not impede accessways or kerb crossings due to any ponding that may occur in rainfall events less than 10% AEP.

Design consideration shall also be given to the effect of stormwater flows from and along the road surface, for example flow around corners and at intersections.

Terrain with a slope of greater than 10% is considered hilly. In this situation sump efficiency and effectiveness decreases and the Council will require specific design to be submitted for approval.

Connections to sumps shall be made in accordance with SD 600-341A/B/C. Minimum 225 mm diameter pipes shall be used to connect a sump to any adjacent manhole in the primary stormwater reticulation system. Direct saddle connections from any sump outlet pipe to an adjacent stormwater system may be approved provided the adjacent system uses 600 mm diameter pipes or larger, and an existing manhole is not conveniently located. The diameter of the connecting pipe shall be less than half the diameter of the pipe used by the adjacent system.

During road works or construction a suitable means of preventing debris entering the stormwater system must be used. Any gravel or debris entering sumps or the stormwater system shall be removed or flushed from the system prior to acceptance by the Council.

Sump filters may be used, provided that a specific design and a maintenance plan are submitted to the Council. Written approval from the Council shall be required to proceed.

5.6.12 Subsoil Drains

Design subsoil drains, which are installed to control groundwater levels, in accordance with *WWDG Part B* clause 5.3.1.

Refer to manufacturer’s literature for information on pipe materials, filter fabrics, bedding and filter design.

Part 5: Stormwater & Land Drainage

5.6.13 Pipelines in Permeable Ground

Where a buried pipeline is likely to encounter an underground source of water, ensure that the groundwater in the water bearing layers will not be diverted to a new exit point through the backfill. Specify backfill material with the same permeability as the surrounding ground and detail water migration barriers at any change of ground permeability.

5.6.14 Concrete Waterstops

WWDG Part B clause 14.2.3 details the design criteria to consider before installing concrete waterstops, additional to those relating to permeable ground. Space waterstops as detailed in *WWDG Part B* Table 14.2. Specify waterstops constructed to comply with SD 600-347.

Also specify waterstops on all pipelines with gradients steeper than 1:3 where the pipe is concrete haunched. Where 'firm mix' is used for haunching water stops are not required.

Part 5: Stormwater & Land Drainage

5.7 WATERWAY DESIGN

Design waterways in accordance with *WWDG Part B* chapters 7 to 13 inclusive.

Where a natural waterway, open stream, or formed drainage channel is incorporated in a land drainage system, then it shall:

- Accommodate the design freeboard including the required factor of safety;
- Be designed to prevent scour effects resulting from a 2% AEP storm.

Provide access along at least one side of any waterway for maintenance, taking into account the “reach” of cleaning machinery. Vegetate berms and banks and lay at slopes that are stable, maintainable, and not prone to scour in flood flows.

Buildings and other structures are to be subject to a 10m offset from a waterway, and any proposed reduction will require approval by the Drainage Asset Manager.

Maintain fish passage, unless otherwise authorised by the Council or ECan. Refer to *WWDG Part B* section 2.2 and clause 13.2.5

5.7.1 Constructed waterways

Design constructed waterways to meet the aesthetic and amenity criteria of the Council (see *WWDG Part B* chapters 7 to 9, 11 and 12). These waterways must form part of a surface water management system.

Public constructed waterways will be maintained by the Council.

5.7.2 Natural waterways

Restore and enhance the natural features and amenity values of highly modified natural waterways wherever possible.

Avoid the piping or filling-in of natural waterways. A resource consent from the Council and ECan will be required for this activity.

Provide for drainage, landscape, ecology heritage, recreation and cultural values when enhancing these waterways. Refer to *WWDG Part A* for an understanding of the principles underpinning these values and *WWDG Part B* Chapters 7 to 9, 11 and 12 for information about specific criteria. For information about riparian planting refer also to the *Streamside Planting Guide*.

Create Local Purpose (Esplanade) Reserves around significant natural waterways.

5.7.3 Fencing

The *Stormwater and Land Drainage Bylaw* requires consent for the erection of a fence across a waterway. Fences must not significantly impede flood flows up to the minimum protection standards (Refer *WWDG Part B* section 13.9).

5.8 DISPOSAL AND TREATMENT DESIGN

5.8.1 Approved outfall

The outfall for a development must be either the public stormwater drainage system or an approved alternative stormwater disposal system, subject to the following conditions:

- Development in areas zoned Residential 1 or 2 shall discharge either directly or indirectly to a reticulated system, through an approved soakage or detention system as appropriate;
- Development in areas zoned Residential 4A or 4B, but not in a rural drainage area, shall discharge to a public drain, a natural drainage system or to ground, where the subsoil strata permits;
- In rural drainage areas, all lots shall be provided with access to a common or public drain. This may require passage via a reticulation system that includes a private drain across third party property, in which case easements and rights of way shall be required. In all cases, the existing drainage system and use rights shall be retained. Where practicable and approved, disposal may be via soakage to ground.
- A suitable headwall and dissipating structure must be constructed at the outlet to ensure no erosion occurs in the immediate vicinity of the waterway;
- No obstruction which will impede the natural flow may be placed in the channel;
- The discharge must be authorised by ECan.

All primary piped reticulation outlets that discharge into a natural waterway, swale, pond, or open drain, and are also subject to tidal effects or backflow, shall be fitted with an approved flap valve.

All primary piped reticulation outlets in Residential or Business Zone areas and using pipes greater then 600 mm in diameter, or if otherwise required by the Drainage Asset Manager, shall have an approved safety grill that is secured to prevent unauthorised access.

5.8.2 Discharge to ground

The Council encourages discharging to ground where soil conditions are suitable for soakage. Note that soakage cannot be relied on to reduce the capacity required by the system (refer to *WWDG Part B* section 6.5). The stormwater system should be designed to handle the full stormwater discharge at the required level of service, with the assumption that the soakage is not functioning. Offset of reticulation capacity may be allowed at the Council's discretion.

A geotechnical investigation shall be carried out when considering the use of soakage in a development.

A discharge consent may be required from ECan for discharge to soakage.

All roadside soakpits shall comply with the requirements of this Code. Example designs are shown in SD 600-330A/B and 600-390. Soakpits for roading purposes shall be marked using one blue post of a type to be approved by the Council.

Silt traps and standard sump and gratings may be installed upstream to protect soakpits from excess sediment entering the soakpit system.

Soakpit design will take into account any effects of the location and inflow source. Pre-treatment shall be designed and installed where needed to prevent silting up and other problems. The systems shall be designed and located for ease of maintenance and replacement as required.

Discharge to ground on private property is acceptable, but in urban areas the soakpit must be protected by a consent notice requiring the property owner to maintain and protect the system. This does not apply for rural developments.

5.8.3 Stormwater Tanks

Stormwater tanks on private properties can regulate stormwater discharge from connected impervious areas such as roofs, hardstand areas and driveways. The Council may recommend or require a stormwater tank when:

- The public stormwater system downstream has no capacity for a new connection and it is uneconomic to upgrade it;
- Direct discharge to a hill gully or slope is likely to cause erosion.

Tanks are unlikely to be approved if an economic alternative system is available.

The Council may approve a request from a private property owner to install a stormwater tank for water conservation or other reasons.

Refer to the CCC leaflet *Stormwater Tanks on Private Properties* for further guidance, including installation guidelines.

5.8.4 Treatment

Design for discharge quality in accordance with *WWDG Part B* chapter 6 and ARC TP10. The designer may propose alternative design elements with supporting evidence from recognised authorities.

All stormwater that outfalls from a development to a centralised system shall be treated prior to entry to the Council's stormwater system. Discharge quality shall not breach the ECan Pollution and Sediment Control guideline, and shall also comply with the specific conditions of the discharge consent. Note that ECan currently has a minimum threshold of 30 lots.

The Council may consider alternative methods that provide adequate treatment of discharge. The developer is encouraged to explore ground infiltration and non-structural methods of water quality protection. Such methods include reduction of impervious area, providing sheet flow through vegetated buffer strips, bio-retention and maximising vegetation cover. Use of the above suggestions may reduce the size of stormwater treatment facilities required.

5.9 NETWORK LAYOUT DESIGN

5.9.1 Topographical Considerations

In steep terrain, the location of pipes is governed by topography. Gravity pipelines operating against natural fall create a need for deep excavations, which can be very expensive. They can also create basins with piped outlets.

The pipe layout must conform to natural fall as far as possible. Where basins are created, provision of a fail-safe outlet and a higher level of service for the primary system may be required.

5.9.2 Location of Open Waterways

Open drainage systems shall generally be located within a drainage reserve, easement or road reserve. Using drainage easements or road reserves in Residential or Business zones is subject to approval by the Drainage Asset Manager.

5.9.3 Location and Alignment of Stormwater Pipelines

Locate stormwater pipeline mains within the legal road (but not under the crown of the carriageway) or within other public land. Allow for access for construction or future maintenance.

Position pipes as follows:

- Within the road formation (refer *WWDG Part B* clause 14.2.1);
- Within public land with the approval the Council;
- Within drainage reserves;

Pipes should not be placed within private property where other options are available. If this is unavoidable, the pipe shall be placed adjacent to and, if possible, parallel to boundaries, with a minimum offset to the pipe centreline of one metre. Clause 5.9.12 – *Easements* shall apply.

Make crossings of roads, railway lines, creeks, drains and underground services at right angles, as far as practicable.

Allow for possible future building plans when locating proposed pipes and avoid maintenance structures within the property. This may include specifying physical protection of the pipe within or adjacent to the normal building areas or any engineering features (existing or likely) on the site e.g. retaining walls.

Specific design and approval from the Council is required for the use of curved pipelines.

Note that pipes with diameter 450 mm or less, within the road reserve, shall be located under the kerb & channel (where present). Pipes with diameter 525 mm or greater shall be located in the carriageway. See also SD 600-245A/B/C.

5.9.4 Service Lateral Connections

In Residential or Business Zone areas, all primary piped reticulation inlets shall be via either a service connection, a sump or an approved grated entry structure. Those fitted with a grate shall offer a maximum bar spacing of 150 mm. The approach slope of any fitted inlet grill shall be at a slope of no more than 30 degrees above the horizontal.

Connections of laterals to mains must be in accordance with CCC *CSS: Part 3*.

Part 5: Stormwater & Land Drainage

The connection of individual lots and developments to the public system must meet the following requirements:

- Connection must be by gravity flow via laterals to mains or waterways, or to a roadside kerb or swale or rain tanks, or (in certain situations) on site detention tanks;
- Provide all new urban lots with individual service laterals;
- Each connection must be capable of serving the entire building area of the lot (unless approval is obtained from the Council to do otherwise);
- Provide stormwater connections at such depth at the boundary of urban lots that a drain is able to be extended from the connection to the farthest point on the lot, at grades and cover complying with the Building Act 2004;
- The minimum diameter of connections must be:
  - 100 mm for residential or commercial lots.
  - 150 mm for industrial lots.
  - 150 mm for connections serving three or more dwellings or premises (unless otherwise approved by the Council);
- Where the public system is outside the lot to be served, extend a connection pipeline a minimum of 0.6 m into the main area of the lot;
- The connection shall be positioned so as not to compromise the lot's available building area. Generally this position will be on the road frontage, clear of street trees and vehicle crossings, approximately 0.6 m from a side boundary and within 0.6 m of the final ground surface;
- Connection to features such as vegetated swales, soakpits, or soakage basins is acceptable provided the system is authorised by ECan and adverse effects and potential nuisances are addressed;
- Seal all connections to pipelines or manholes by removable caps at the upstream end until such time as they are required.

Where a design for a residential lot requires a 150 mm diameter service connection pipe or larger:

- Connection to a kerb or roadside drain outfall shall require two 100 mm diameter pipes.
- The 100 mm diameter pipes shall outfall from an approved sump located inside or adjacent to the roadside boundary.
- Where outfall is to kerb and channel, two kerb adapter connections shall be used and be located not less than 300 mm and not more than 500 mm between centres.

Service connections shall, wherever possible, be laid at right angles to the main reticulation system, and shall be of a type as detailed in Table 5.4.

Table 5.4 Service Connection Type

Zone	Reticulation	Connection Type
All Residential except 4A and 4B	Kerb and channel	PVC-U Kerb adapter
	Piped main available	Direct saddle connection to main, or to ground soakage where soil conditions are suitable (overflow pipe to kerb & channel may be required)
Residential 4A or Residential 4B	With Reticulated drainage system	To provide retention, drains, natural waterways or ground soakage where soil conditions are suitable.
	Without reticulated drainage system	To natural waterway or ground soakage where soil conditions are suitable.

Where the reticulation is laid deeper than 3 metres below ground level, service connections should not be via direct connection to the reticulation. In this situation, connections shall be made via a manhole, sump or similar structure.

Footpaths and kerbs shall be sawcut at the position of the service connection to allow controlled cracking.

5.9.5 Location and Design of Basins

Ponding basins are being used throughout the district as stormwater treatment and detention devices to improve water quality and to mitigate increased stormwater flows. These structures are important landscape features in public open space. Carefully consider their location, design, construction, and ongoing maintenance requirements, including full vehicle access, during the early stages of planning.

Ponding basins must be constructed on land vested in the Council. If the land is not to be vested immediately, the area must be protected by an easement, a bond, and an agreement for the land to be vested at a later date.

From a landscape perspective, these types of basins are highly designed and managed in order to protect their primary functions (e.g. stormwater storage capacity, soil infiltration). Design solutions should build on the features of the local landscape, features associated with the proposed development and the wider planning context. As the Council will generally take on the responsibility for these structures, it needs to have input into the design of these structures from the outset.

Co-locate basins with public open space having a similar appearance and maintenance approach (i.e. road reserves and recreation reserves with a garden approach to maintenance). Basins should not be located in areas that are being managed primarily for their ecological values (such as esplanade reserves). The management approach for ecological areas aims to support natural processes through encouraging natural regeneration with limited maintenance that focuses predominantly on managing for weed species.

Design and construct swales and basins so that they replicate natural landforms. Where possible, create organic, undulating landforms with meandering inverts and mid-slope terraces. Avoid slopes that have a gradient steeper than one-in-four. Round off all tops and toes of slopes to blend imperceptibly with adjoining landforms. For safety reasons, ensure open sightlines from surrounding public and private land. Provide sufficient areas of land to achieve this land shaping and to enable public access, as well as to provide for stormwater capacity.

The flow characteristics of natural open stream systems shall be based on their likely long-term state, particularly in terms of density of vegetation. The flow characteristics shall also consider peak flood conditions such as surcharge and blockage.

Refer to *WWDG Part B*, Chapter 6 for more information on the design of stormwater treatment systems.

5.9.6 Location and Design of Swales

Use swales for temporary water storage or retention, as this provides attenuation of stormwater peaks and may also reduce the downstream flood peak. Normally this design consists of shaped grass berms, with no permeability built into the construction materials.

Primary treatment is achieved by a detailed design that uses suitable permeable material to allow soakage to subsoil levels. Volumes undergoing primary treatment through infiltration can be increased through longer resident times in permeable swales. Provide opportunities for sediment to settle out in swales through slower velocities, longer resident times and dense grass cover, as these all slow overland flows.

Design longitudinal gradients steeper than 1 in 70 unless:

- There is an effective subsoil drainage system either under or in the swale invert or;
- The invert contains gravel mulch, a narrow concrete invert or landscape planting.

Part 5: Stormwater & Land Drainage

Planting material installed in the swale should not include bark, similar organic mulch or other loose easily transported material.

Take into account repeated use of vehicles or heavy ride-on mowers, which will substantially reduce the permeability of swales that have been constructed for primary treatment. See also clause 5.9.5 and CoP Part 10: *Reserves, Streetscape & Open Spaces* for guidance on design.

5.9.7 Bridges and Culverts

Refer to the *Bridge Manual* and *WWDG Part B* chapter 13 for waterway design at bridges and culverts.

The minimum design storm AEP for systems or structures shall be as shown in Table 5.1.

5.9.8 Protection of road subgrade

The potential risk of carriageway damage from a saturated sub-base is a design issue. Early discussion with the Council is needed when the maximum level of detained water in any ponding area is greater than 200 mm below any carriageway or right of way within a horizontal distance of 80 metres. Provide evidence that the road subgrade will not be compromised. Special pavement or pond design may be necessary.

5.9.9 Outfall water levels

Where possible, the Council will provide the start water level at the point of connection to the public stormwater system or at some point downstream where design water levels are known, as a subdivision consent parameter. If this information is not known to the Council, the applicant's engineer shall determine this figure.

When a tributary drain or a waterway flows into a much larger drain or a much larger waterway, the peak flows generally do not coincide. Check both the situation where the tributary has reached peak flow but the receiving waterway has not and where the receiving waterway is at peak flow but the tributary has passed it. Take the worst case as the design case (refer to *WWDG Part B* clause 22.5.2).

5.9.10 Clearances from Other Services or Structures

CoP Part 9 clause 9.5.4 – *Typical Services Layout and Clearances* summarises clearances for utility services. Confirm these clearances with the network utility operators, before deciding on any utility layout or trench detail.

Locate pipes that are adjacent to existing buildings and structures clear of the "zone of influence" of the building foundations. If this is not possible, undertake a specific design covering the following:

- Protection of the pipeline;
- Long term maintenance access for the pipeline;
- Protection of the existing structure or building.

Specify the protection on the engineering drawings.

5.9.11 Building over Pipelines

The Council prefers not to have public stormwater mains under buildings because of the potential difficulties with maintenance, replacement and repairs. In some situations it is permitted to construct buildings over the stormwater mains, however, this would be considered on a case by case basis.

Approval may be given provided:

- There is no reasonable alternative for the property owner; and
- The existing pipeline is not greater than 225 mm diameter; and
- The length under the building is minimised; and
- The Council is advised and approves each individual proposal, in writing, prior to obtaining a building consent; and
- One of the following solutions is used:
    - The length of pipe under the building is replaced with an equivalent diameter PVC main laid inside a carrier pipe of the next appropriate larger size or as specified to facilitate future size upgrading. Manholes are to be placed on each side of and clear of the building, with no lateral connections permitted between these points. The foundations of any building must be designed and constructed so that no additional load is placed on the pipe. All backfill must be thoroughly compacted and certified by an appropriately competent person; **or**
    - There is still access for repairs or replacement without disturbing the building, e.g. high open foundations on poles or cantilevered with a minimum of 2 metres vertical clearance from ground level and 1.5 metres vertical clearance from the centreline of the main.

Where the pipeline is covered by an easement, the property owner shall:

- Where there is no subdivision planned, request a waiver letter from the Council seeking permission to encroach upon the easement; **or**
- Where a subdivision is planned, adjust the easement document to record the encroachment and pay associated costs.

5.9.12 Easements

Provide easements for public pipelines, subsoil drains and waterways through private property or where private pipelines serving one lot cross another lot.

For a pipeline, the minimum width of a drainage reserve or easement shall be 3 m or twice the depth from ground level to the buried pipe, whichever is greater. The easement shall be centred on the pipe.

For a waterway, the minimum width of a drainage reserve or easement shall be annual bank full width plus 10 metres on one side of the drain from the top of bank and along the full length of the drain.

The easement may also provide for public right of way or other legal access.

Where it is on one side of the drain only, the reserve shall be continuous on that side from one road/public legal corridor to the next upstream or downstream road/public legal corridor.

5.10 MATERIALS

The Council has an asset service life requirement of 100 years. Pipes and fittings must have a minimum required design life of 100 years and a minimum warranty period of 50 years. All products must be fit for their respective purpose and comply in all respects with the Council's current specification for the supply of that material and the standards referenced.

Where a material or product is proposed that is not approved in the district the Council may require assurance that demonstrates the durability of that material prior to approval. Where there is no current standard, the manufacturer will be required to supply copies of their Quality Assurance procedures and producer statements to support their performance and composition claims for the products concerned.

5.10.1 Bedding, Haunching and Backfill

Bedding and haunching materials must comply with CCC *CSS: Part 3* and the pipe manufacturer's specifications.

Specify backfill materials individually. The material used must be capable of achieving the backfill compaction requirements set out in CCC *CSS: Part 1*.

5.10.2 Corrosion Prevention

Contaminated sites and areas with the potential for corrosion may produce a reduction in expected life and should be specifically designed for. The developer will be required to submit for approval their proposed list of materials such that the Council can determine material suitability.

Potential problems may include:

- Mildly corrosive soils
- Higher than normal operating pressures
- Potential for liquefaction

Corrosion can be caused by hydrogen sulphide, aggressive groundwater, saltwater attack, carbon dioxide or oxygen rich environments. **Before** specifying concrete pipes within potentially corrosive areas, test the groundwater to check whether concrete piping is appropriate. Regard groundwater as aggressive to ordinary Portland cement if any of the criteria in Table 5.5 are met.

Table 5.5 Criteria for Aggressive Groundwater

Options	Measure	Condition
1)	Calcium carbonate alkalinity	$CaCO_3 > 35$ ppm
	Aggressive carbon dioxide	$CO_2 > 90$ ppm
2)	Calcium carbonate alkalinity	$CaCO_3 < 35$ ppm
	Aggressive carbon dioxide	$CO_2 > 40$ ppm
3)	Acidity	pH < 6
4)	Sulphate	$SO_4 > 1,000$ mg/L

Design to minimise corrosion through:

- Selecting materials which will resist corrosion;
- Designing in an allowance for corrosion over the 100-year life-cycle of the asset;
- Providing protective coatings, such as polyethylene film or coal tar epoxy;
- Increasing cover to reinforcing;
- Laying concrete pipes in concrete haunching (see SD 600-344A Type C or H).

Bolts and fittings must be hot dip galvanised and incorporate zinc anodic protection. Do **not** use stainless steel where it may fail as a result of crevice corrosion in the presence of sulphides and chlorides.

5.11 INSTALLATION

5.11.1 Authorised Installers

Only Waimakariri District Council Authorised Drainlayers are permitted to install pipework that will be vested into the Council and any pipework that is located within legal roads. A full list of authorised drainlayers and conditions of approval may be obtained on request from the Council.

Registered drainlayers who have tendered for a Council contract as a contractor or sub-contractor shall be evaluated on their ability to complete the works, and accepted or rejected accordingly.

Construction of the stormwater system must not start until acceptance in writing has been given by the Council.

Wherever works are installed within existing legal roads, a Road Opening Notice (RON) must be obtained for that work. The work must comply with requirements as set out in the Council standard specification QP-C843 for this type of work.

No work may start until the RON has been approved in writing by the Council.

5.11.2 Connection to the Public System

Only Council approved contractors may make connections to the Council utility system. Connection of any part of the works into the Council system shall only be made with prior approval of Council in writing.

5.11.3 Handling

Both the developer and the contractor are responsible for ensuring the appropriate handling, storage, transportation and installation of pipes and fittings to avoid damage and to preserve their dimensions and physical properties. The total exposed storage period from the date of manufacture to the date of installation for all PVC pipe must not exceed 12 months. Store fittings under cover at all times.

5.11.4 Approved Plans

The contractor shall work from the most up-to-date, Council-authorised plans.

5.11.5 Confined Spaces

Contractors shall work within the Council's *Guidelines for Entering and Working Within Confined Spaces* (QP-C606). Contractors that do not hold the relevant qualifications shall not work within confined spaces. The Council Water Unit may be engaged at the Contractor's expense.

5.12 TESTING & COMMISSIONING

Testing of all pipelines, manholes and other structures must be carried out as specified in CoP Part 3: *Quality Assurance* in the presence of the Council Representative.

Any particular network facility (e.g. pumping station or other complex item) shall have a specific testing and commissioning procedure prepared and submitted to the Council for approval. It shall then be tested & commissioned in accordance with this approved procedure.

5.13 AS-BUILT INFORMATION

Provide as-built information which complies with CoP Part 12: *As-Builts* and this Part.

Rainfall Intensity Tables

This data has been generated from HIRDS V4 software, Scenario RCP 8.5 (2081-2100). For areas not covered by the tables, interpolate between the nearest points given. If required, more precise data may be obtained by using HIRDS V4 Scenario RCP 8.5 (2081-2100) or by requesting the data from WDC. To be conservative, values should be increased for hill catchments.

Rainfall Intensities (mm/hr) for 20% AEP Event (HIRDS V4 Scenario RCP 8.5 (2081-2100))

Location	Northing	Easting	Duration									
			10m	20m	30m	1h	2h	6h	12h	24h	48h	72h
Ashley Gorge	5775086	2447402	63.2	41.5	33.2	23.1	16.3	9.28	6.39	4.27	2.76	2.1
Ashley Township	5770187	2477408	49.5	33.7	27.3	19.5	14	8.02	5.5	3.64	2.31	1.73
Cust	5766018	2459305	56.3	37.1	29.7	20.8	14.7	8.4	5.79	3.88	2.51	1.91
Kaiapoi	5758066	2482037	38.6	27.4	22.7	16.8	12.4	7.35	5.11	3.41	2.18	1.63
Lees Valley	5785117	2444245	51.3	36.5	30.3	22.2	16.2	9.5	6.55	4.34	2.76	2.07
Loburn	5772950	2470718	50.9	35.1	28.7	20.7	15	8.7	6	3.99	2.54	1.91
Mandeville / Ohoka	5758585	2472200	49.5	33.6	27.2	19.3	13.8	7.81	5.32	3.5	2.21	1.65
Okuku	5773640	2463277	49.6	34.9	28.8	21	15.3	8.86	6.05	3.96	2.47	1.82
Oxford	5767328	2444164	60.8	40.3	32.2	22.5	15.7	8.77	5.91	3.85	2.42	1.8
Pines/Kairaki	5758567	2485933	38.5	28.2	23.7	17.5	12.8	7.38	5.03	3.29	2.08	1.55
Rangiora	5766688	2476775	51.2	34.8	28.2	20	14.3	8.12	5.53	3.62	2.28	1.7
Sefton	5773365	2483100	46.6	32	26.1	18.7	13.5	7.8	5.36	3.55	2.26	1.69
Tuahiwi	5763950	2480958	45	31.1	25.5	18.4	13.3	7.65	5.24	3.45	2.18	1.62
View Hill	5767298	2433696	56.3	37.4	30	21.1	15	8.59	5.92	3.96	2.56	1.94
Waikuku Beach	5768888	2486675	43.3	30.2	24.8	18	13.1	7.64	5.27	3.49	2.21	1.65
West Eyreton	5761881	2458060	55.1	36.4	29.2	20.4	14.4	8.15	5.58	3.7	2.37	1.78
Woodend	5765047	2482873	43.8	30.7	25.2	18.4	13.3	7.72	5.28	3.46	2.17	1.61

Rainfall Intensity Tables

Rainfall Intensities (mm/hr) for 2% AEP Event (HIRDS V4 Scenario RCP 8.5 (2081-2100))

Location	Northing	Easting	Duration									
			10m	20m	30m	1h	2h	6h	12h	24h	48h	72h
Ashley Gorge	5775086	2447402	124	80.3	63.5	43.6	30.2	16.8	11.4	7.47	4.76	3.58
Ashley Township	5770187	2477408	97.7	65.3	52.5	36.8	25.9	14.5	9.76	6.34	3.97	2.93
Cust	5766018	2459305	112	72.5	57.4	39.4	27.4	15.2	10.3	6.76	4.31	3.23
Kaiapoi	5758066	2482037	77.1	53.6	44	31.8	22.9	13.2	9	5.88	3.68	2.71
Lees Valley	5785117	2444245	99.3	69.6	57.2	41.3	29.7	17	11.5	7.49	4.7	3.49
Loburn	5772950	2470718	100	67.9	54.9	39	27.7	15.7	10.7	6.96	4.38	3.24
Mandeville / Ohoka	5758585	2472200	98.8	65.8	52.7	36.7	25.6	14.1	9.42	6.06	3.77	2.78
Okuku	5773640	2463277	97.8	67.7	55.3	39.6	28.3	16	10.7	6.86	4.21	3.07
Oxford	5767328	2444164	119	77.8	61.7	42.4	29.3	16	10.6	6.82	4.23	3.11
Pines/Kairaki	5758567	2485933	77.2	55.5	46	33.4	23.9	13.4	8.91	5.71	3.53	2.6
Rangiora	5766688	2476775	101	67.4	54.1	37.9	26.5	14.7	9.85	6.34	3.93	2.89
Sefton	5773365	2483100	92	62.1	50.1	35.4	25	14.1	9.53	6.19	3.88	2.87
Tuahiwi	5763950	2480958	89.2	60.5	49	34.7	24.6	13.8	9.29	5.99	3.72	2.73
View Hill	5767298	2433696	111	72.3	57.5	39.8	27.8	15.6	10.6	6.94	4.42	3.31
Waikuku Beach	5768888	2486675	85.9	58.8	47.8	34.2	24.4	13.9	9.37	6.08	3.79	2.8
West Eyreton	5761881	2458060	110	71.3	56.5	38.7	26.8	14.8	9.91	6.44	4.05	3.02
Woodend	5765047	2482873	86.6	59.6	48.6	34.8	24.8	14	9.42	6.07	3.74	2.74

WAIMAKARIRI DISTRICT COUNCIL

ENGINEERING CODE OF PRACTICE

PART SIX

WASTEWATER

November 2013

Part 6: Wastewater

CONTENTS

Part 6: Wastewater

Part 6: Wastewater

TABLES

CHARTS

EQUATIONS

Part 6: Wastewater

6.1 INTRODUCTION

This Part of the CoP provides guidelines and standards as a basis for designing wastewater reticulation, treatment and disposal systems that not only function well but are also appropriate and safe environments.

This Part is not intended to be a detailed design guide or to replace the need for wastewater engineering expertise in some areas of the design process. The standards included in this Part are one way of achieving the desired outcomes and performance criteria of the network components described below.

6.1.1 Description of the Wastewater System

The Council's wastewater system comprises a number of discrete urban and rural schemes.

At present there are fifteen wastewater schemes in the Waimakariri District, where wastewater disposal is managed by the Council. These range from the small septic tank systems at Ohoka Meadows and Swannanoa to the large urban reticulated schemes of Kaiapoi and Rangiora.

Table 6.1 List of WDC schemes

Scheme	Zone	Type	Treatment & Disposal
Fernside	Rural-residential	STEP system, pumped to WWTP	**Fernside WWTP** Discharge to ground via recirculating sand contactor filter system
Kaiapoi	Urban	Gravity reticulation with pumpstations	**Kaiapoi WWTP** Discharge to ocean outfall via oxidation ponds and infiltration wetland
Loburn Lea	Rural-residential	Gravity reticulation	**Loburn Lea WWTP** Discharge to ground via recirculating sand contactor filter system
Mandeville	Rural-residential	STEP system, pumped to WWTP	**Mandeville WWTP** Discharge to ground via sand filter system
Ohoka Meadows	Rural-residential	STEP system, pumped to WWTP	**Ohoka Meadows WWTP** Discharge to ground via recirculating sand contactor filter system
Oxford	Urban	Gravity reticulation with pumpstations	**Oxford WWTP** Discharge to ground (centre pivot irrigator) via aerated activated sludge system
Pines Kairaki	Urban	Gravity reticulation with pumpstations	**via Kaiapoi WWTP**
Rangiora	Urban	Gravity reticulation with pumpstations	**Rangiora WWTP** Discharges to ocean outfall via Rangiora oxidation ponds and Kaiapoi wetland
Swannanoa	Rural-residential	STEP system, pumped to WWTP	**Swannanoa WWTP** Discharge to ground via sand filter system
Tuahiwi	Rural-residential	STEP system, pumped to WWTP	**via Woodend WWTP**
Waikuku Beach	Urban	Gravity reticulation with pumpstations	**via Woodend WWTP**
Woodend	Urban	Gravity reticulation with pumpstations	**Woodend WWTP** Discharge to ocean outfall via oxidation ponds and infiltration wetland
Woodend Beach	Urban	Gravity reticulation	**via Woodend WWTP**
Pegasus	Urban	Gravity reticulation	**via Woodend WWTP**
Mapleham	Rural-residential	STEP system, pumped to WWTP	**via Woodend WWTP**

6.1.2 New Developments

Gravity reticulation, with a minimum amount of pumping is the preferred method of wastewater reticulation for new developments.

Standard plans and specifications for submersible pumping stations are available from the Council.

In areas where gravity reticulation systems are not practicable due to flat grades or long distances, alternative systems (such as common pressure main systems, including small privately operated and municipal treatment & disposal systems) may be accepted, subject to the Council's approval. Typically, each lot must have an individual wastewater pump connected to the common pressure main system.

Biofilter design is included in this Part of the CoP. Biofilters are required at the terminal of all pressure mains likely to generate hydrogen sulphide.

6.2 CONSENT AND COMPLIANCE ISSUES

The consent and compliance information set out in Part 2: *General Requirements* applies to all works within the Waimakariri District, with the addition of the clauses below.

6.2.1 Legislation

The Resource Management Act (RMA) 1991 and amendments is the principal statute that controls land development, including wastewater aspects.

6.2.2 Approval Process

Refer to Part 2: *General Requirements*, Section 2.2.6 for information regarding the standard approval process.

6.2.3 District Council Requirements

The Council is currently preparing a Wastewater Bylaw. When the Bylaw is adopted it will define the Council's requirements and protection for wastewater drainage work. Requirements in the *Wastewater Bylaw* must be met by any application made after the bylaw is adopted.

Pump stations are defined as structures under the Building Act, and building consents may be required.

6.2.4 Consent Application – Information Required

In addition to the information required to support the concept drawings and/or Resource Consent plans in CoP Part 2: *General Requirements*, the following data shall also be provided:

- General layout and alignment of reticulation through to the laterals;
- Connection points to the existing reticulation;
- Pipe diameters of mains;
- Identification of redundancy and networking within the system;
- Confirmation that there is sufficient capacity and that the scheme is cost-neutral.

6.3 QUALITY ASSURANCE REQUIREMENTS AND RECORDS

Provide quality assurance records that comply with the requirements in Part 3: Quality Assurance, during design and throughout construction.

6.3.1 The Designer

The designer of all wastewater systems that are to be taken over by Waimakariri District Council must be suitably experienced in the design of wastewater systems. The qualifications and experience of the designer may be requested by the Council for approval prior to commencement of the design. The design reviewer must have at least equivalent experience to the designer.

6.3.2 System Review

When the pipe selection and layout have been completed, perform a system review to ensure that the design complies with the parameters specified by the Council and detailed in the CoP. The documentation of this review must include a full hydraulic system analysis. Compliance records must cover at least the following requirements:

- Pipe and fittings materials are suitable for the particular application and environment;
- Pipe and fittings materials are approved by the Council;
- Pipe class is suitable for the pipeline application (including structural strength, operating temperature, surge and fatigue where applicable);
- Layout and alignment meets the Council's requirements;
- Maximum operating pressure will not be exceeded anywhere in pressurised systems;
- Capacity is provided for future adjacent development;
- Self-flushing volumes are achieved at least once per day to all sewers and rising mains.

6.3.3 Engineering Design Approval

Provide the following information to support the engineering drawings and Design Report, as a minimum:

- Proposed status of mains (public or private);
- Detailed offsets, alignments and grades of designed pipelines;
- Detailed plans of the proposed wet well, pumping and treatment systems, storage and reticulation layout, if applicable.
- All assumptions used as a basis for calculations, including pipe friction factors;
- Design checklists or process records;
- Design flow rates;
- System review documentation as detailed in 6.3.2;
- Trenchless technology details, where appropriate;
- Calculations carried out for the surge analysis of pressure pipes where appropriate;
- Summaries of hydraulic modelling, including design parameters and assumptions;
- All options considered and the reason for choosing the submitted design.

6.3.4 Construction Records

Provide the information detailed in CoP Part 3: *Quality Assurance* and the CCC *Construction Standard Specifications* (CSS), including where applicable:

- All performance test results;
- Material specification compliance test results;
- Site photographs;
- Pressure test results;
- Commissioning results.

Part 6: Wastewater

The developer must provide the Council with a certificate for each pipeline tested including the date, time and pressure of the test. The details of the pipes, including manufacturer, diameter, type, class, date of manufacture, serial numbers, jointing and contractor who laid the pipe, must be included on the certificate, where applicable.

6.3.5 Post-Construction Records

Provide the information detailed in CoP Part 3: *Quality Assurance*, Part 12: *As-Builts*, and the CCC *CSS*, including where applicable:

- Design report;
- Completion certificates;
- Producer statement – design review;
- Producer statements – construction, construction review;
- Commissioning report, including all test results;
- Operations & maintenance manuals, where applicable;
- As-built plans and records;
- Guarantees and warranties.

6.3.6 Code of Compliance

Where a building consent is required for a structure or structures, the developer shall apply for and obtain a Code of Compliance Certificate for that structure prior to the issue of the 224 certificate by the Council.

6.3.7 Operations and Maintenance Manual

Provide an Operations and Maintenance Manual for any wastewater quantity and/or quality control facilities such as pump stations, treatment facilities and odour control units. The manual must include:

- A description of the facility and its purpose;
- Design criteria;
- A description of major features;
- Normal operational procedures and constraints (e.g. resource consent conditions);
- Emergency operational procedures (where relevant);
- A copy of any resource consents relating to the facility;
- A maintenance schedule for all items requiring periodic maintenance including landscaping;
- A schedule of suppliers and contact details for key components;
- A copy of manufacturers' operating & maintenance instructions for key items;
- A copy of the as-built drawings and commissioning report for the facility.

The manual shall be contained in clearly marked A4 ring binders, divided into sections with clearly marked dividers. Drawings and other bulky information may be appended in separate folders. One copy shall be provided to the Council for review. Once the manual has been approved by Council, a final copy shall be provided to site and two printed and bound copies, plus electronic copies in Word (*.doc) and PDF (*.pdf) format, shall be provided to Council. CoP Part 10 clause 10.6 – *Establishment & Maintenance* expands on these requirements.

6.3.8 Acceptance Criteria

All pipelines, pump stations, and other integral components must be tested, certified and inspected as appropriate before acceptance by the Council. Perform testing in accordance with CoP Part 3: *Quality Assurance*.

Part 6: Wastewater

6.4 GENERAL DESIGN PRINCIPLES

6.4.1 Design Considerations

Consider the:

- Options to minimise pumping and maximise gravity conveyance of wastewater;
- Hydraulic adequacy of the system;
- Ability of the network to minimise and control odours;
- Structural strength of components to resist applied loads;
- Health & Safety requirements, particularly for access to confined spaces;
- Environmental requirements;
- Impact of the works on the environment and community;
- “Fit-for-purpose” service life of the system;
- Best way to minimise the “whole-of-life” cost;
- Resistance of each component to internal and external corrosion or degradation;
- Installation requirements expressed in CCC CSS: Part 4;
- Potential to use trenchless installation methods in sensitive areas (refer Section 6.14)
- Capacity and ability to service future extensions and development;
- Risks of overflows and their likely locations during extreme events;
- Risk of odour problems;
- Ease of maintenance.

6.4.2 Future System Expansion

Design the network with sufficient capacity to cater for all existing and predicted development within the area to be served. Make allowance for areas of subdivided or un-subdivided land capable of future development, as specified by the Council in section 6.5.

6.4.3 Reducing Waste

When designing the development, consider ways in which waste can be reduced.

- Plan to reduce waste during demolition e.g. minimise earthworks, reuse excavated material elsewhere;
- Design to reduce waste during construction, e.g. prescribe waste reduction as a condition of contract;
- Select materials and products that reduce waste by selecting materials with minimum installation wastage rates;
- Use materials with a high recycled content e.g. recycled concrete subbase.

See the Resource Efficiency in the Building and Related Industries (REBRI) website for guidelines on incorporating waste reduction in your project www.rebri.org.nz/.

6.4.4 Alternative Technology

The Council will consider alternative technologies on a case-by-case basis. Examples of such technologies are vacuum wastewater collection systems and Septic Tank Effluent Pumping (STEP) systems.

6.5 DESIGN PARAMETERS

6.5.1 Design Life

All buried wastewater conveyance systems are expected to have a useful asset life of at least 100 years with appropriate maintenance, and must be designed accordingly to minimise life cycle costs for the whole period. Assets designed to minimise capital cost at the expense of overall lifecycle cost will not be accepted.

The developer is advised that certain locations within the District have water and ground conditions that may be detrimental to the durability of some materials and fittings. Upon receipt of the developer's application, the Council may set specific location requirements for such materials and fittings, based on experience and historical performance.

6.5.2 Design Flows

Wastewater flows vary with the time of day, the weather and the extent and type of development within the catchment. Design systems to carry maximum flows without surcharging.

Design pipelines with sufficient capacity to cater for all existing and predicted development within the area to be serviced. Make allowance for all areas of subdivided or unsubdivided land that are capable of future development. When calculating the unit average wastewater flow, the net area used includes roads but excludes reserves.

The minimum diameter of public sewer pipelines in residential zones is 150 mm. The minimum diameter of pipelines in commercial and industrial zones is 225 mm.

6.5.3 Nomenclature

The following terms and abbreviations are used in this section:

- PF_{DWF} – Peaking Factor (Dry Weather Flow)
- PF_{WWF} – Peaking Factor (Wet Weather Flow)
- ADWF – Average Dry Weather Flow
- PDWF – Peak Dry Weather Flow
- PWWF – Peak Wet Weather Flow
- D_{pop} – Population Density
- Q_{Res} – Residential Flow Rate
- Dwell – No. of dwellings

6.5.4 Peaking Factor (Dry Weather Flow)

Use a peaking factor (PF_{DWF}) of 2.5 for wastewater reticulation design.

6.5.5 Peaking Factor (Wet Weather Flow)

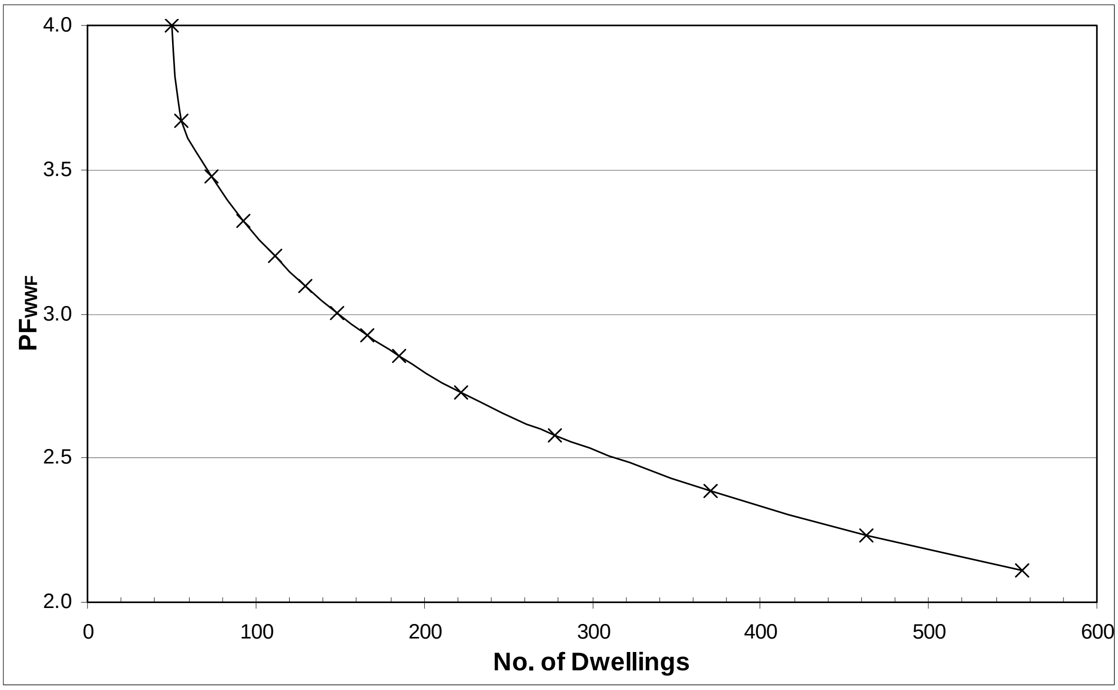
Apply PF_{WWF} to the peak wastewater flow to allow for infiltration and storm inflow in conventional gravity wastewater reticulation systems. Infiltration is the entry of subsurface water into the pipeline through cracks and leaks in the pipeline. Inflow is the direct entry of surface water to the pipeline from low gully traps, downpipe discharges, illegal stormwater connections, and vented manholes positioned in low areas.

The method of calculating the peaking factor (wet weather flow) varies according to the number of dwellings.

- Where Dwellings ≤ 50, set PF_{WWF} to 4
- Where 50 < Dwellings ≤ 550, use Chart 6.1.
- Where Dwellings > 550, use Equation 6.1.

Part 6: Wastewater

Chart 6.1 WDC Wet Weather Peaking Factor (50 ≤ Dwell ≤ 550)



Equation 6.1 Wet Weather Peaking Factor (Dwell >550)

PF_{WWF} = 2.1181 – 0.00006 * Dwell

where Dwell = Potential number of dwellings to be constructed in the development

6.5.6 Average Residential Flows

Residential flows are derived from a wastewater use (Q_{Res}) of 250 litres per person per day. At an assumed residential population density (D_{pop}) of 2.7 people per dwelling, the unit average wastewater flow is given by Equation 6.2 below. The Peak Dry Weather and Wet Weather Flows are calculated by Equation 6.3 and Equation 6.4.

Note that these are the minimum design figures to be adopted; if there are any case-specific reasons why these figures could be higher (e.g. a higher occupancy level) then appropriately higher figures should be used.

Equation 6.2 Average Dry Weather Flow (ADWF)

ADWF = D_{pop} x Q_{Res} x Dwell
= 2.7 x 250 x Dwell
= 675 [L/day/dwell] x Dwell
= 0.0078 [L/s/dwell] x Dwell

where ADWF = Average Dry Weather Flow [L/s]
D_{pop} = Population density [p/dwell]
Q_{Res} = Estimated water use per person [L/p/day]
Dwell = Potential number of dwellings to be constructed [dwell]

Equation 6.3 Peak Dry Weather Flow

PDWF = ADWF x PF_{DWF}
= (0.0078 x Dwell) x 2.5
= 0.0195 [L/s/dwell] x Dwell

where PWDF = Peak Dry Weather Flow, including inflow and infiltration [L/s]
ADWF = Average Dry Weather Flow [L/s] (Equation 6.2)
PF_{DWF} = Dry Weather Peaking Factor (Clause 6.5.4)

Equation 6.4 Peak Wet Weather Flow

PWWF = PDWF x PF_{WWF}
= (0.0195 x Dwell) x PF_{WWF}

where PWWF = Peak Wet Weather Flow, maximum flow expected in a system [L/s]
PWDF = Peak Dry Weather Flow [L/s] (Equation 6.3)
PF_{DWF} = Dry Weather Peaking Factor, (Clause 6.5.4)
PF_{WWF} = Wet Weather Peaking Factor, (Clause 6.5.5)

6.5.7 Average Commercial and Industrial Flows

For known industries, base design flows on available water supply and known peak flows.

Ensure that the design flow allows for potential wet industries, using Table 6.2. When assessing whether a wet industry can be reasonably accommodated in an area that is reticulated but not fully developed, leave sufficient flow capacity in the pipeline to serve remaining developing areas at a unit ADWF of 0.15 L/s/ha (provided that no other wet industries are being planned).

If actual flow use figures are unavailable, use the values in the table below:

Table 6.2 Commercial and industrial wastewater flow values

Land use	ADWF (L/s/ha)	PDWF (L/s/ha)	PWWF (L/s/ha)
Central Business District	0.4	1.0	2.0
Commercial	0.2	0.5	1.0
Dry Industrial	0.2	0.5	1.0
Wet Industrial	0.3	0.75	1.5

6.5.8 Maximum Flows for New Developments

Calculate the maximum flow for new developments using Equation 6.4. The number of dwellings used shall be the maximum possible, considering any reasonable future subdivision.

6.5.9 Total Design Flows for Existing Developments

Base the design of major renewal and relief sewers serving older catchments on actual catchment data.

6.6 GRAVITY SEWER DESIGN

The wastewater system shall be designed with sufficient depth not to interfere with other utilities and any future driveway construction.

Refer to Table 6.4 for the pipe cover requirements. Any design involving a cover less than the minimum specified shall be required to demonstrate that compliance is impractical, supported with full calculations.

WDC will approve the final layout. Construction shall not start until this approval has been granted in writing from the Council. All diameters referred to in this section are nominal internal diameters, unless otherwise noted.

6.6.1 Hydraulic Design

Base the hydraulic design of wastewater pipelines on the Manning's 'n' or Colebrook White equations. Use a pipe roughness coefficient k_s in the design of 1.5 mm for pipelines 300 mm and smaller, and 0.6 mm for pipelines 375 mm and larger. This allows for long-term grit deposits, slime growth etc.

Size pipelines to cater for future flows from the upstream catchment, when fully developed.

6.6.2 Flows

Design wastewater pipelines on a uniform flow basis, without surcharging, so that at times of normal flow (non-peak) there is a uniform airspace for ventilation.

6.6.3 Minimum Pipe Sizes

Gravity pipelines maintained by the Council must have a minimum diameter of 150 mm for residential and 225 mm for industrial or commercial applications. Nominal pipe diameters shall be limited to the following standard sizes: 150 mm, 225 mm, 300 mm, 375 mm and 450 mm internal diameter. Any larger pipe sizes shall be subject to specific approval.

6.6.4 Private Drains

The minimum size of private sewer drains must be 100 mm nominal internal diameter. For major industrial users, determine the size of the lateral using the maximum flow requirements and the available grade.

6.6.5 Pipeline Materials

The following pipe materials currently available in New Zealand are acceptable for gravity wastewater sewers:

- Polyvinyl Chloride: PVC-U;
- Polyethylene (black only): PE100, PE80B, PE80C;
- Reinforced Concrete Rubber Ring Jointed (DN375 and larger only);
- Ceramic (Hepworth or equivalent).

Select wastewater rising main materials in accordance with the pipe selection chart in Appendix B. Interpretation of this flow chart shall be at the discretion of the Council. No new materials may be installed without the Council's prior written approval.

The following pipe materials are acceptable for wastewater rising mains:

- Polyvinyl Chloride: PVC-U and PVC-O;
- Polyethylene (black only): PE 100B and PE 80B;
- Ductile iron (DI);
- Concrete Lined Steel.

Pipes with nominal internal diameters of 100, 150, 225, 300, 375, 450, 525, 600 and 675 mm are readily available and are the sizes approved for use in the Waimakariri District.

Each material has specific design and installation issues, as identified in the manufacturers' design manuals, specifications and other literature. Consider these issues, as listed below, when specifying materials.

- Polyvinyl Chloride: PVC-U
    - UV degradation after more than 2 years' exposure during storage and/or outdoor installation conditions;
    - Depth of scratching, gouging and impact damage limited to 10% of the wall thickness;
    - Careful handling, bedding and installation required to avoid ovality and dips;
    - Can be adversely affected by certain waste chemical characteristics and/or high temperatures.
- Polyethylene: PE80B/C, PE100
    - Sophisticated equipment and highly skilled workers required where fusion-welded joints are required;
    - PE80C not suitable for rising mains;
    - Pipes must be fully restrained at all ends;
    - Depth of scratching, gouging and impact damage limited to 10% of the wall thickness;
    - UV degradation;
    - Good bedding support and careful installation required to prevent excessive deformation.
    - Pulling forces for PE during trenchless installation are not to exceed the manufacturer's recommendations.
    - Can be adversely affected by certain waste chemical characteristics and/or high temperatures.
- Reinforced Concrete Rubber Ring Jointed (RCRRJ) (gravity sewers only)
    - Less suitable for earthquake and/or ground movement situations;
    - Rings may be attacked by certain wastewater types.
    - Concrete pipes 375 mm ID and larger may be used only with approval from the Council and may require an internal sacrificial layer up to 25 mm thick. This layer should not be taken into account in strength calculations. Using additives that promote chemical resistance may be an alternative.
- Ductile Iron (rising mains only)
    - Internal lining and external coatings must be undamaged or fully restored after repairs or fabrication work;
    - Polyethylene bag wrap corrosion protection system must be properly applied;
    - May require special concrete lining composition where H_2S is likely.
    - Potential problems with stray electric currents and bimetallic corrosion.
- Concrete-lined Steel (rising mains only)
    - Internal lining and external coatings must be fully restored after repairs or fabrication work and during jointing;
    - May require special concrete lining composition where H_2S is likely.
- Ceramic (gravity sewers only)
    - Pipes are easily damaged during handling;
    - Can be less familiar to contractors and thus more difficult to lay well.

Gravity sewers may not have nominal stiffness ratings of less than SN6 (6 kN/m^2) for flexible pipes, or be less than Class 2 (for RC pipes). Pipe classes on gravity sewers shall not vary between manholes.

Pipes carrying trade waste shall be designed in ceramic or PE materials. If there are circumstances where neither of these is suitable, alternatives such as GRP or similar may be acceptable with the specific approval of Council.

6.6.6 Gravity Sewers Immediately Downstream of Pressure Mains

PVC, PE or ceramic pipes shall be used in this situation. Concrete pipes must not be used for the first 90 metres from the discharge point of a pressure main because of the risk of attack from hydrogen sulphide.

Do not specify concrete pipes where it is likely that, in the future, a pressure main will discharge to the top end of a gravity system.

Where a new pressure main will discharge to an existing concrete pipe gravity system, use measures that will reduce the level of dissolved sulphides and remove hydrogen sulphides. These measures could include any one, or a combination, of:

- Laying a length of new gravity main to which the pressure main discharges;
- Lining the first length(s) of the existing concrete gravity mains;
- Installing a biofilter.

6.6.7 Minimum Gradients

Design sewer pipes at the steepest grade available, with a minimum velocity of 0.65 m/s, to minimise deposition and transit time of wastewater, while making provision for upstream users. If 0.65 m/s cannot be achieved, due to insufficient grade being available, detail an alternative solution in the Design Report for Council consideration.

The first 25 properties shall be connected to a gravity sewer main that is installed at a minimum gradient of 1:160. The only exceptions to this requirement shall be where the Council agrees that the gravity main will be extended in the future to supply future properties.

As a general philosophy, the Council aims to keep the gradient of sewer mains, other than those serving the first 25 lots, at 1:200 or steeper. However, flatter grades will be permitted where it can be demonstrated that there will be a benefit to the Council in doing so. Table 6.3 sets out the minimum grades for pipes in the District.

Standard A sets the preferred gradient for the stated diameters. All design shall comply with this standard as far as practicable.

Pipes laid to Standard B can only be installed with the specific approval of the Sewer Asset Manager, and may be approved only where:

- There is a section of main above the flat section laid at a minimum grade of 1:160 with at least 25 houses connected; and
- It can be demonstrated that one or both of the following situations applies:
    - It would eliminate the need for a pump station; or
    - It would reduce the maximum sewer depth to less than 4.0 metres, which would make future renewals less difficult.

Where sewer mains are to be extended to service future developments, the need to install the section of 1:160 main with 25 houses may be exchanged for the installation of an appropriately sized flush tank at the top of the main line.

Pipes laid to Standard C can only be installed with the specific approval of the Sewer Asset Manager, and may be approved only where:

- An appropriately sized flush tank is installed at the top of the line to facilitate easy and frequent cleaning of the line; and
- There is a section of main above the flat section laid at a minimum grade of 1:160 with at least 25 houses connected; and
- It can be demonstrated that one or both of the following situations applied:
    - It would eliminate the need for a pump station; or
    - It would reduce the maximum sewer depth to less than 4.0 metres, which would make future renewals less difficult.

Table 6.3 Minimum Gradients

Nominal Pipe Diameter (mm)	Standard		
	A	B	C
150	200	250	300
225	300	350	400
300	400	450	500

For pipe sizes larger than 300 mm, discuss the design with the Sewer Asset Manager.

Sewer mains installed at grades flatter than 1:200 will require careful attention to installation and quality control to ensure the grades are achieved and no low points are present.

It is not acceptable to increase pipe diameter beyond the required size to achieve a flatter grade.

6.6.8 Pipe Protection and Cover

For standard compacted metalcourse trench backfill, Table 6.4 gives the minimum cover to wastewater reticulation from finished ground level in different locations. The pipeline should be designed such that these dimensions are generally achievable. This requirement is intended to provide a minimum depth-to-invert that enables a lateral to service any building site on an allotment.

Table 6.4 Minimum cover above the crown of sewer pipes

Location	Minimum Cover (mm)
Private property at boundary	1000
Carriageways, driveways, road reserve and parking areas	1200
Berms and footpaths	900
Public land – reserves and parks	750
Lateral at kerb – measured from kerb fender	800

Note that pipe depth at the boundary of a private property must be sufficient to adequately service the entire lot at an appropriate grade, potentially increasing the minimum cover required for this situation.

Where the minimum cover specified in Table 6.4 is not available, specify pipe protection to SD 600-342. Variations from Table 6.4 will only be permitted where no other alternative is available, and will require written approval from the Council.

For lightly trafficked areas such as footpaths, residential driveways, and under kerbs and channels (except commercial crossings) specify a plain concrete surround. For areas subject to normal or heavy traffic, specify a reinforced concrete surround. In both cases, pipe protection must comply with SD 600-342. Allow sufficient cover for road surfacing above the protection.

Pipelines with cover exceeding 4.0 metres in depth require specific structural design.

6.6.9 Joints

Gravity mains shall be connected with flexible joints, such as rubber-ring or z-joints. Solvent-cement joints are not acceptable on Council assets.

6.6.10 Manholes

Manholes shall be positioned on roadways or where there is vehicle access, clear of ponding, flooding, and overland flow paths.

Manholes shall be located at each change of direction, grade or pipe size, and at the end of all terminal pipelines greater than 50 m long, and locations approved by Council.

The table below specifies the range of maximum spacings.

Table 6.5 Spacing for manhole covers

Diameter in mm	Maximum spacing (m)
150 – 225	90
300 – 900	120
1050 – 1500	150

Vented manholes are designed to serve as intakes for fresh air, which passes through the sewers and laterals to the main vents on individual houses, disposing of corrosive and foul air in a way that causes minimal offence. However, occasional temperature inversions cause the air to flow in reverse, therefore inlet vents should also be located so that any foul air coming from them causes minimal offence to neighbouring properties.

Use vented manholes on each alternate manhole and place them where there is minimal turbulence, to avoid undue odours. Avoid situations such as angles, junctions, and pressure main outlets.

To avoid surface water entry and the associated flooding of pipelines, site vented manholes away from areas where ponding of stormwater is likely to occur, including secondary flow paths. Likewise, avoid road intersections because gravel and grit entry is greater at these locations.

Special consideration must be given to large trunk sewers (larger than 450 mm ID) as these may be inadequately vented by house connections. To ensure that air movement adequately serves all parts of a sewer, it may be necessary to use special air inlets, special vent stacks and/or a forced draught with designed circulation, possibly in conjunction with odour control (Refer to clause 6.11 – *Odour Control Design*). Note that siphons cut off all airflow, unless special air ducting is incorporated.

Pre-cast concrete manholes with integral flanged bases shall generally be used in the Waimakariri District. Manholes manufactured from other materials, such as PE, may be accepted but shall require specific approval from the Council. Cast in-situ manholes may be used only in special circumstances with specific approval from Council.

Manholes must comply with SD 600-302A/B, 600-303A/B, or with other Council approved designs. Provide yield joints between manholes and pipes in accordance with SD 600-341A/B/C. Manholes shall be constructed from the longest available risers relative to the depth of the manhole, in order to reduce the number of joints

A specific design is required for larger pipes, especially where changes of direction are involved. The design must incorporate a standard manhole opening and be able to withstand a heavy traffic loading (HN-HO-72).

Design of manholes shall include an assessment of flotation and settlement potential. The factor of safety against flotation should be at least 1.2 excluding skin friction in the completed condition, with an empty manhole and water table at ground surface. Counter increased forces resulting from greater depths and spans by thicker walls and/or floors, and/or larger base flanges. Detail the calculations in the design report.

Design small structures to withstand a wheel load of 70 kN, taking into account an impact factor. The impact factor reduces linearly with depth of fill, from 1.30 for zero fill to 1.00 for one metre of fill.

Unreinforced vertical concrete panels, provided for future connections in manholes or other underground structures, which are subject to soil and traffic loading should be specifically designed. Alternatively, in the case of a square panel, ensure that the length of the side does not exceed seven times the panel thickness.

Design structures to withstand all loads, including hydrostatic and earth pressure and traffic, in accordance with the TNZ *Bridge Manual*. Design structures exposed to traffic for HN-HO-72 loading.

Consider the foundation conditions as part of the design. If there is a possibility of soft ground, carry out ground investigations and a full foundation design.

Drop manholes are a potential source of blockages and odour-causing turbulence. Lay pipelines as steeply as possible to avoid any need for a drop, noting the material requirements outlined in clause 6.13. This may require an additional manhole to be installed.

Where drop inlets are unavoidable, specific design is required for the approval of Council.

The minimum fall in the invert of angled wastewater manholes is set out in the table below.

Table 6.6 Minimum fall in manhole

Angle of deviation	Minimum fall (mm)
60° - 90°	20
30° - 60°	10
0° - 30°	5

Half-round former pipes shall be used in the invert to construct the manhole benching.

When there is an increase in the pipe size at a wastewater manhole, the pipes should be aligned soffit to soffit.

6.6.11 Flush Tanks

Flush tanks are required at the upstream end of wastewater lines wherever pipe gradients preclude self-cleaning (Refer to clause 6.6). They may also be required in staged developments or for larger pipes as a temporary measure, when initial flows are substantially lower than design flows.

Avoid the use of flush tanks by grading the upper manhole lengths of sewer at 1:160. In general, 25 dwellings connected to the 1:160 graded section of pipe are sufficient to generate a self-cleaning flow, provided the downstream grade is not flatter than 1:300. Temporary flushing may be required in some areas until sufficient dwellings are completed.

Construction of flush tanks must comply with SD 600-311A/B. The location of the flush tank is to be determined in conjunction with other utilities.

Air gap separators on the water supply connection point are required at all flush tanks and must be located in accordance with SD 600-313. The air gap separator shall have an isolation valve fitted inside a toby box between the separator and water supply point.

Part 6: Wastewater

A flush tank feeding into a 150 mm pipeline shall have a minimum usable storage capacity of 3 m^3. Flush tanks for pipes of larger diameter shall be subject to specific design and approval from the Council. The factor of safety against flotation should be at least 1.2, excluding skin friction, in the completed condition with an empty chamber and water table at ground surface.

Flush manholes do not have sufficient capacity for normal flushing, so restrict their use to temporary dead ends, alterations because of roadworks, and other similar situations.

6.6.12 Inverted Siphons on Wastewater Lines

Inverted siphons are generally not acceptable on Council wastewater pipelines. Where there are no other practical options, a specific design and Council approval shall be required.

6.6.13 Laterals

Design the lateral grade and invert level to serve the lot adequately. If there could be conflict with other services, it may be necessary to lower the lateral.

Each front lot must be provided with a separate lateral connection to the wastewater main.

For infill developments, the Council may consider sharing an existing lateral where, in the Council's view, providing a new connection to the main is impractical or inefficient. Prior to approving such connections, the developer will be required to provide evidence (including CCTV camera survey) that the lateral is in good condition and has adequate grade. If approved by the Council, the common lateral shall comply with the requirements of clause 6.7.3.

Easements must be created where legally possible (parent block and subdivided properties)

Pumped lots are not counted when setting the required grade, but the maximum number of lots (pumped and un-pumped) on a common main is always five.

If the lateral is over 50 m long an accessible inspection chamber is required at the junction of the last two laterals.

Lay laterals at least 1.0 m clear from property side boundaries, to terminate at least 1.0 m inside the net site area of the lot and within 1.0 m of the final ground level. Where possible, the connection point of a lateral to each lot shall be located such that the available building area is maximised, and on the low side of the proposed site.

Where ground contour and available pipe grade prevents a service connection depth of 1m at the boundary, then the allotment shall be identified on the subdivision proposal plan. That allotment's title should include a notice stating the extent of restricted service, together with the allotment area available for a building site and the floor level that can be adequately serviced, or note that a pumping system is required.

On sewer renewal work, when a lateral is identified for renewal and runs close to trees, either reroute the lateral around the tree by repositioning the junction on the main, or use pipe bursting or similar techniques to relay the lateral in its present position. Specify jointing in accordance with CCC *CSS: Part 3* clause 11.1.

Haunch laterals laid as part of a development in accordance with this Part of the CoP. All materials used must be Council-approved.

Where manholes are conveniently located, lateral connections shall outfall to those manholes.

If manhole connections cannot be used, then manufactured junctions, London junctions, or Fernco or Flex-seal fittings are required. Saddle connections are not permitted on PVC or PE mains.

Where the depth to soffit of the main sewer is more than 2.0 metres, risers may be used, subject to the requirements of other services and land levels. All other junctions must be side junctions. Do not lay junctions on pipelines deeper than 4.0 metres.

Form all junctions with a Y or riser junction so that the side flow enters the main at 45°, to reduce deposition of solids. Gravity connections shall be provided for all new subdivision lots.

Gradients are subject to BIA Regulations, but the minimum gradient for a 100 mm diameter pipe in roads is 1:60. Do not install inverted siphons on any lateral.

For allotments where further development potential exists, junctions at the terminal ends of lines may be replaced by the inclusion of a rodding eye approved by Council. This replacement will be subject to approval by the Council, and in lieu of junctions.

The end of each lateral shall be marked by a 50x50 timber stake (H3 or equivalent treated post) embedded at least 600 mm in the ground and extending 600 mm above ground level with the top painted red. The measurement to the invert of the pipe shall be clearly marked on the peg.

All new or additional lateral connections to the existing sewer main shall be carried out by WDC authorised contractors at the cost of the applicant(s). The applicant(s) shall obtain prior approval of the Council for the connection.

6.6.14 Gully Traps

The minimum level for a gully trap is calculated as shown below in Equation 6.5:

Equation 6.5 Minimum level for gully trap

$$L = S + R + C$$

where L = minimum gully trap level

S = soffit level of main

R = rise on gradient to furthermost likely head of drain (m)

C = minimum cover over lateral as set in BIA regulations (m)

Gully traps must be at least 1.0 metre above the soffit level of the sewer main, and at least 200 mm above the crown of the road.

6.6.15 Temporary Ends

Extend wastewater sewer mains to the upstream boundary of new developments, to allow for connection of any future upstream catchments. This may require temporary flush tanks to be installed.

6.6.16 Restraint

Where polyethylene pipes are used for gravity sewers, they shall be fully restrained against movement from thermal effects. Typically, this will require each end to have a puddle flange which is cast into concrete at the manhole.

6.7 NETWORK LAYOUT DESIGN

6.7.1 Location and Alignment

Lay gravity pipelines in straight lines and at a constant gradient between access points such as manholes and inspection chambers.

Locate gravity wastewater pipes in the centre of the road in general; with a minimum vertical cover of 1.2 metres to the crown of the pipe. This makes the sewer equidistant from the properties it serves and, being at a relatively high point on the road surface; vented manholes are less subject to surface floodwater entry.

In curved roads, straight lengths of wastewater pipelines must clear kerbs by two metres and manholes should be on the centreline in all cases.

Lay rising mains in straight lines and at a constant gradient between air valves and scour valves. Locate rising mains generally in the grass berm, for convenient positioning of air valves and scour valves, clear of any street trees. The final alignment shall require the specific approval of the Council.

The Council will generally not accept ownership of drains in private property unless there is no other practicable alternative. Where public drains do occur in private property then an easement-in-gross is required in favour of the Council. The easement shall be 3 m wide, and the pipe shall be at the centre of the easement. The easement shall confer rights for access, conveyance and maintenance.

6.7.2 Clearances

CoP Part 9: *Utilities* summarises clearances for utility services. Confirm these clearances with the network utility operators before deciding on any utility layout or trench detail. Maintain the clearances unless the utility operator grants approval otherwise.

6.7.3 Common Drains

A common drain is a wastewater pipeline through privately owned land, shared by more than one property and not vested in the Council. A sewer main installed in private property as part of a development and that serves only that development will be a private common drain.

Each lot shall have a single connection to the common drain. Each future lot will require a new connection.

Table 6.7 specifies the requirements for new common laterals.

Table 6.7 Requirements for existing common laterals (addition to existing subdivision)

No. of Lots	1	2	3	4	5	6+
Ownership of Pipe	Private Lateral	Common Lateral	Common Lateral	Common Lateral	Common Lateral	Public Main
Status of Corridor	-	-	Easement	Easement	Easement in corridor of right-of-way	Easement-in-gross
Minimum Grade	1:120	1:100	1:100	1:80	1:60	1:160
Access to Pipe	-	-	-	Access points at < 50 m intervals and at bends	Access points at < 50 m intervals and at bends	Manholes at terminal points and changes of direction & grade.
Condition	-	Good	Good	Excellent	Excellent	-
Diameter	100	100	100	100	100	150

Notes: - Minimum Grade: Applies to the number of properties connected to any given section of pipeline
- Access to Pipe: Where depth to invert is greater than 1.5 m, manholes shall be used in place of access chambers
- Condition: Shall be as scored from CCTV inspection using the NZ Pipe Inspection Manual 3rd Edition

The following conditions apply:

- Each dwelling shall have only one discharge point into a common drain;
- Each discharge shall include an accessible junction, e.g. inspection point or chamber;
- An easement shall be created over common laterals where legally able to do so.

6.7.4 Building over Pipelines

No building shall be built over a public rising main or closer than 1.5 metres from the centre of any rising main. Subject to WDC approval, a building developer may divert the public rising main (including any valves and fittings) in accordance with Council standards, and at their own expense.

The Council prefers not to have public gravity wastewater mains under buildings because of the potential difficulties with maintenance, replacement and repairs. In some situations it is permitted to construct buildings over the wastewater mains, however, this will be considered on a case-by-case basis. The approval of the Sewer Asset Manager must be in writing for each case.

Approval may be given provided:

- There is no reasonable alternative for the property owner; and
- The existing sewer is not greater than 225 mm diameter; and
- The length under the building is minimised; and
- That the sewer main has a CCTV inspection before and after any work is done; and
- The Council is advised and approves each individual proposal, in writing, prior to obtaining a building consent; and
- One of the following solutions is used:
  - The length of pipe under the building is replaced with an equivalent diameter PVC main laid inside a carrier pipe of the next appropriate larger size or as specified to facilitate future renewal or upsizing. Manholes are to be placed on each side of the building, with enough clear space to be accessible by a truck-mounted water blaster. No lateral connections permitted along the length of pipe between these manholes. The foundations of any building must be designed and constructed so that no additional load is placed on the sewer. All backfill must be thoroughly compacted and certified by an appropriately competent person; or
  - There is still access for repairs or replacement without disturbing the building, e.g. high open foundations on poles or cantilevered with a minimum of 2 metres vertical clearance from ground level and 1.5 metres horizontal clearance from the centreline of the sewer main.

Where the pipeline is covered by an easement, the property owner shall:

- Where there is no subdivision planned, request a waiver letter from the WDC seeking permission to encroach upon the easement; or
- Where a subdivision is planned, adjust the easement document to record the encroachment and pay associated costs.

6.8 PUMPING STATIONS

Where a proposed development cannot be adequately serviced by a gravity system, a public wastewater pump station will be considered, provided it is located and designed to service the area of land beyond the reach of the existing gravity system with the potential for further development. Note that this shall also include land outside the current development.

Pump stations shall be located to provide the utility service provider unobstructed and perpetual access from a road reserve without the requirement for key or card access.

The design of a wastewater pump station will vary depending on the size, criticality and location. The Council has a number of typical pump station designs, and these are available on request to assist with the design of new pump stations.

6.8.1 Conditions for the Council taking over Pumping Stations

The Council will generally take ownership of wastewater pumping stations, providing the following conditions are met.

1. That the pump station is designed and constructed to the standards in this document or as approved by the Sewer Asset Manager. Engineering drawings of the proposed pump station shall be submitted for approval prior to the commencement of construction. As a minimum, the pump station shall incorporate the following:

- Duty & Standby pumps (same size);
- Concrete or GRP pump chamber including a Flygt TOP base;
- Concrete valve chambers, housing isolation and non-return valves;
- Canal gate valve on the upstream manhole;
- Pedestal type Flygt pumps;
- Multitrode level control system;
- A Datran eXcel SCADA RTU connected and configured to Council's Telemetry System complete with the following I/O (where appropriate):
  - Low level alarm
  - High level alarm
  - Battery backed emergency high level alarm (separate multitrode or float switch, set 1000mm below the overflow point or 200mm above the normal high level, whichever is lower)
  - Pump 1 Run
  - Pump 1 Fault
  - Pump 1 Seal Fault
  - Pump 1 VSD Speed
  - Pump 2 Run
  - Pump 2 Fault
  - Pump 2 Seal Fault
  - Pump 2 VSD Speed
  - Wet Well Level
  - Generator Run
  - Generator Fault
  - Odour Filter Run
  - Odour Filter Fault
  - Mains Power Fail
  - Instantaneous Flow L\s
  - Accumulated flow pulse m^3

- A Magmaster electromagnetic flow meter installed on the rising main;
- Emergency Storage of 8 hours at Average Dry Weather flow (including reticulation storage as described below)
- Terminal connection for the WDC portable generator;
- Electrical controls approved by Council's electrical subcontractor;
- Access and sealed parking area for a sucker truck, utility vehicle, and generator;
- Potable water supply & appropriate backflow prevention device (RP03 BSP, complete with frost protection);
- All workmanship shall be to best trade practice;
- Strategic pump stations may require permanent generators and/or a control building. The Council will advise which pump stations are considered strategic. Factors the Council will consider in determining whether a pump station is strategic include:
    - Proximity to nearest available portable generator;
    - Reliability of power supply;
    - Available storage at ADWF;
    - Size and capacity of electrical controls (≤ 7.5 W pumps);
    - Remoteness;
    - Requirement for odour control unit
    - Environmental conditions (e.g. coastal area).

2. The pump station shall be situated on a separate title, land to be vested in the Council;

3. A summary of calculations shall be submitted to Council with the following information:

- Peak and average daily inflows;
- Pump duty point with one pump running;
- Pump duty point with two pumps running;
- Demonstration of a maximum of 10 pump starts per hour.

4. Certified as-built information of the completed sewer pump station shall be provided, including drawings, specifications, and Operations & Maintenance manuals for all reticulation, civil, mechanical and electrical works, and the lowest overflow point (e.g. gully trap, manhole, or pump station) shall be clearly marked on the plans. This information is to be provided to and approved by the Sewer Asset Manager before s224c certification will be issued.

5. The pump station and associated rising main shall be fully commissioned in the presence of a Council representative. The commissioning shall include the following minimum checks and measurements:

- Each pump running;
- Level controls;
- Alarms and telemetry are working and set correctly, including the acknowledgement of alarms;
- Motor currents;
- Pump pressures when running and under closed valve conditions and surge simulation;
- Flow rate of each pump operating individually;
- Flow rate of both pumps operating simultaneously;
- Flow monitor check and calibration;
- Odour control running and alarms checked;
- Generator run with all equipment checked to ensure that it will work as designed. Where a generator is not installed, then a WDC portable genset will be used instead. The contractor shall pay all costs associated with the equipment check;
- All valves shall be opened fully and closed;
- Pressure gauges working and calibrated;
- A full commissioning report of the above shall be forwarded to the Council by the developer.

6. The pump station shall be designed and tested to achieve a preferred velocity in the rising main of 0.8-1.2 m/s, with an absolute minimum velocity of 0.6 m/s and a maximum velocity of 1.5 m/s.
7. A maintenance check shall be undertaken immediately prior to Council taking ownership of the pump station. All defects shall be made good by the developer prior to Council taking ownership.

Council will take ownership when all of the above conditions have been met and each pump has operated satisfactorily for a minimum of 10 minutes per day over a 30 day period. The developer shall contact Council 24 hours prior to the 30 day testing period to ensure that all telemetry and monitoring equipment is operating satisfactorily. The testing period shall not commence until after the pump station has been commissioned in the presence of a Council representative (ref condition 5.).

The 30 day testing period shall be managed by Council's Water Unit but costs shall be borne by the Developer. The testing period shall incorporate weekly site inspections and response to any alarms or faults. Responses shall be invoiced on a time and disbursements basis.

The 8 hours' storage at average daily dry weather flow may incorporate storage in the pump station, manholes, and reticulation. The storage must be provided with a minimum of 500 mm freeboard to the lowest ground level on the proposed building sites, or 200 mm freeboard to the lowest manhole lid or pump station lid, whichever provides the least storage. The average daily dry weather flow shall be calculated as outlined in Section 6.4 above. Calculations shall be submitted showing how the emergency storage volume has been derived.

6.9 RISING MAIN DESIGN

Rising mains shall be designed to fully account for the characteristics of the system in question including pump characteristics, surge, flow regimes and fatigue. The design shall minimise the time wastewater spends in a rising main, to avoid septicity and odour problems, and maintain self-cleansing velocities. Both these objectives can be achieved by minimising the length and diameter of the pipe. The pipeline will also need to withstand normal operating pressures, including short duration surge pressures from normal cycling and special events (such as power failure).

The general requirements of CoP Part 7 – *Water Supply* regarding water supply pressure mains shall also apply to wastewater rising mains.

6.9.1 Maximum Operating Pressure

Design the components of a pressure pipeline to withstand a maximum operating pressure that is greater than all of the following:

- 400 kPa (note that this is not the minimum pipeline pressure class);
- 1.5 x (static head + friction head);
- Pump shut off head;
- Positive or negative surge pressures.

Ensure that external loads on the pipeline are included in all load cases, especially when pressure testing large diameter pipes. Provide a factor of safety of at least 2 against buckling under negative or external pressures. All fittings shall have a pressure rating equal to or greater than the pressure rating of the associated pipeline, or PN12, whichever is the greater.

For plastic pipes, fatigue effects may require a higher nominal pressure rating, which must be the greatest of the following:

- The maximum calculated operating pressure; or
- The minimum pressure rating in the table below; or
- The equivalent operating pressure based on a surge & fatigue analysis.

To calculate the equivalent operating pressure (P_{eo}) use the methodology described in CoP Part 7 Appendix C – *Design for Surge and Fatigue*.

Table 6.8 Minimum Pressure Rating for Rising Mains

Material type	Pressure rating (kPa)
PVC-U	1200
PVC-O	1000
PE 80B	1000
PE 100	1000
DI	3500

6.9.2 Pressure Surges

Pressure surges can arise from a number of different operations, e.g. the sudden starting or stopping of a pump or closure of a non-return valve. Surges can be critical in pumping systems, especially in large diameter mains and high static head systems.

The designer shall submit the design for rising mains, including levels and layout, with the engineering drawings. Submit a detailed hydraulic surge and fatigue analysis report, including all assumptions and all calculations.

When choosing the pipe class for rising mains, ensure that the effect of surge and fatigue from the projected number of cycles over a 100-year lifecycle is taken into account. For details on surge and fatigue see Part 7 Appendix C.

Consider soft closing, non-return valves for installations in high head situations as well as variable speed controls.

Allow for issues such as operation and maintenance and consider failure of any mechanical surge protection measures and protection from damage during these situations.

6.9.3 Minimum Pipe Sizes

Pressure pipelines maintained by the Council must have a minimum nominal diameter of 50 mm. PVC pipe diameters shall be limited to the following standard sizes: 50 mm, 100 mm, 150 mm, 200 mm, and 300 mm nominal bore (internal diameter). Any larger pipe sizes, or alternative PE pipe sizes, shall be subject to specific approval.

6.9.4 Velocity

Pressure mains shall have a preferred velocity of 0.8-1.2 m/s, with an absolute minimum velocity of 0.6 m/s, and a maximum velocity of 1.5 m/s. The velocity shall be confirmed in the Design Report.

6.9.5 Gradients

The profile of rising mains shall be designed to minimise the number of high and low points, which require the installation of air and sluice valves respectively. However, the final profile will be a balance between the minimum depth of main and number of valves.

Where possible, rising mains shall be graded continually upwards from the pumping station to termination. Design to keep the pipe full and prevent sudden discharges of foul air at pump start. Avoid creating summits since they trap air, reducing capacity, and allow the build up of sulphides, which convert to droplets of sulphuric acid and may cause pipe corrosion.

If a summit is unavoidable, provide automatic air release valves. Design the air valves specifically for wastewater operation. Mount air valves vertically above the pipeline to which the air valve is connected. Fit an isolating gate valve between the air valve and the vented pipeline and mount the valves in a concrete valve chamber. The chamber must be large enough to allow easy access for maintenance staff to operate the isolating valves or remove all valves from the chamber.

At low points, provide drain valves and chambers such that the contents of the entire main can flow into the chamber and the contents be collected by a sucker truck. Alternatively, it may be possible to drain directly to a nearby sewer (subject to specific Council approval).

6.9.6 Cover over Pipes

The minimum cover over the top of the pipe to finished ground level shall be:

- 600 mm in berm, footpath or behind carriageway or kerb & channel;
- 750 mm under carriageways or areas where the Council proposes carriageways.

Where the minimum required cover is not available, specific design is required.

6.9.7 Joints

Joints between fittings and pipes on rising mains shall be made using the following methods (where appropriate):

- Socket & spigot (except for PE pipes) only where the socket is designed specifically for the spigot outside dimension);
- Gibault (except for PE pipes) where the gibault is either of the multi-fit type or specifically designed for the outside diameters of the items to be joined. Gibaults may not be used where the step difference exceeds 10 mm;
- Flange-socket or flange-gibault adaptors (except for PE pipes);
- Butt-fusion welding (PE pipes DN160 and larger only) by a specialist contractor only;
- Mechanical couplers (full restraint type – PE pipes only);
- Welding (concrete lined steel only);
- Threaded connections to BSP (generally only for pressure tappings or similar)

Electrofusion and solvent-cement joints are not permitted without specific approval by Council.

6.9.8 Flanges

All valves and fittings shall be flanged to either AS2129 Table D/E or AS4087 Class 16. It is the developer's responsibility to ensure that all mating flanges are compatible. Note that this also applies to items such as flow meters and check valves, and that alternative flange standards (such as ANSI or DIN) will not be accepted. If higher pressure ratings are required, these will be subject to specific Council approval.

6.9.9 Sluice Valves

Attach sluice valves to flanged fittings rather than plain-ended fittings.

The force required to open or shut a manually operated valve, using a standard valve key, with pressure on one side of the valve only, must not exceed 15 kg on the extremity of the key. Specify geared operation, motorised valves or a valve bypass arrangement, to reduce pressure across the valve, if the allowable force cannot be met.

6.9.10 Scour Valves

Scours are required on the low point of all rising mains. Generally, valves should be the same size as the main, but no greater than 150 mm in size. Install scour valves at the lowest point between isolating valves, and discharge to an approved chamber.

6.9.11 Air Valves

Air can accumulate at high points when it is drawn into the system. It is preferred to have no high points in wastewater rising mains wherever possible, and thus little or no requirement for air valves. If this cannot be avoided, mains should be laid evenly to grade between peaks to ensure all possible locations of potential air pockets are well known. Investigate the need for air valves at all high points, particularly those more than 2 m higher than the lower end of the section of main, or if the main has a steep downward slope on the downstream side.

Air may also come out of solution in the wastewater due to a reduction in pressure, such as when wastewater is pumped uphill. Air valves may be required to allow continuous air removal at these locations.

The number and location of air valves required is governed by the configuration of the reticulation, in terms of both the change in elevation and the slope of the mains. Install air valves in a secure enclosure, with an isolating valve to permit servicing or replacement without needing to shut down the rising main. Air valves shall be specifically designed for use on wastewater, and attention paid to venting, odour and noise control.

6.9.12 Non-Return Valves

Non-return valves are required on all private laterals and at pump stations. HDL or SOCLA ball-check valves shall be used.

6.9.13 Thrust Blocks on Mains

Design thrust blocks for all fittings and valves, to withstand the maximum operating pressure and test pressure.

Where required, thrust blocks shall be constructed so as to be clear of pipe joints and fittings.

Cast in-situ concrete thrust blocks shall be provided at all points where an unbalanced thrust occurs. Anchors and thrust blocks shall be appropriately designed and installed clear from connections and fittings. Concrete shall:

- Be a minimum of 20 MPa at 28 days;
- Surround not more than 180 degrees or 50% of the fitting or pipe barrel;
- Be insulated from the reticulation using an appropriate flexible membrane.

The precast thrust block detailed in SD 600-405 may be used if all of the following criteria are met:

- It must have a minimum surface area of 0.18 m^2 in contact with an undisturbed trench wall;
- The fitting or valve is up to and including 150 mm diameter;
- The maximum operating pressure is up to and including 700 kPa;
- The trench ground conditions can sustain a safe bearing capacity greater than 150 kPa, as established by testing.

Design and detail thrust blocks individually for any of the following situations:

- The fitting or valve is over 150 mm diameter;
- The maximum operating pressure is greater than 700 kPa;
- The ground bearing capacity is less than 150 kPa.

Also detail anchorage for in-line valves on pipelines that are not capable of resisting end bearing loads.

6.9.14 Restrained Joint Wastewater Mains

Restrained joint wastewater main systems may be used in place of thrust and anchor blocks to prevent the separation of elastomeric seal-jointed pipelines.

Restrained joint systems include welded steel joints, flanged pipes and fittings and commercial mechanical restrained joint systems. Specify details of commercial restrained joint systems on the engineering drawings, including the:

- Length of restrained pipeline and adjacent fittings required to ensure the transfer of thrust forces to the ground strata;
- Requirement for placing suitably worded marking tape in the trench over the pipeline to define the limits of the restrained joint system;
- Requirement for details of the commercial restrained jointing systems to be shown on the as-built drawings, including the location of restrained portions of pipelines.

6.10 WASTEWATER TREATMENT & DISPOSAL

Where new treatment facilities are required, these shall be designed, constructed and tested to demonstrate compliance with the Resource Consent conditions. The approval process will depend on a number of factors including:

- The size of scheme;
- The complexity of treatment process;
- The quality of the treated effluent;
- The sensitivity of the receiving environment; and
- Whether the scheme shall be vested in the Council.

Contact the Council to discuss the approval process when details of the treatment and disposal systems are known. Each new treatment facility requires approval on a case-by-case basis.

6.10.1 Private Septic Tanks and On-Site Wastewater Treatment Systems

In rural residential areas, where ground conditions and terrain are suitable, wastewater disposal may be provided by on-site septic tanks or wastewater treatment systems.

The *Natural Resources Regional Plan (NRRP)* contains policies and rules relating to the discharge of wastewater effluent.

If compliance with the *NRRP* rules is not achieved, a resource consent is required from Canterbury Regional Council (Environment Canterbury). Contact Canterbury Regional Council for information on their requirements.

In all instances, obtain a Building Consent and a Landuse Consent from the WDC to install, modify or renew an on-site wastewater treatment and distribution system.

6.11 ODOUR CONTROL DESIGN

A biofilter is a device used to treat odours arising from the wastewater system.

The usual form of biofilter used in sewerage systems is a media bed, through which the odorous gas is passed. The principal odour component of sewage is H_2S (hydrogen sulphide) and the biofilter operation makes use of the ability of naturally occurring bacteria to convert the H_2S to acid and elemental sulphur.

The biofilter media is commonly bark nuggets but can be a variety of materials, which possess a high surface area and resistance to breakdown and in which the bacteria can thrive.

Typically, the situations where odours cause nuisance are where the wastewater is more than eight hours old, held in anaerobic conditions in rising mains and where there is high turbulence that encourages H_2S to come out of solution.

Consider the following factors in the design of a biofilter: site, airflow rate, location of air extraction point, air velocities, filter media depth, filter media, air distribution, textile filter fabric, underdrain, irrigation.

6.11.1 Biofilter Site

Locate the biofilter at a minimum distance of 100 m from houses or retail type commercial development. Biofilters can be very effective but total odour control at all times cannot be guaranteed.

Consider the prevailing wind directions at all sites. The worst conditions are warm and very light winds.

Where the site must be very close to houses, businesses or sensitive environmental areas, consider an activated carbon filter installation. Balance the constraints of the location against the higher running costs for high H_2S removal using a carbon filter.

6.11.2 Bark Bed Type

Generally, for odour control on an existing sewer well away from a nearby pressure main discharge, use an airflow rate equal to the sewer pipeline’s normal air space at a velocity of 1.0 m/s. For turbulent situations, particularly when deliberately induced to reduce dissolved sulphide levels, consider the length and size of the pipeline from which it is desired to extract the gas.

Consider whether excessive moisture in the sewer could be controlled by increased forced ventilation. Corrosion rates are more rapid in condensing atmospheres and ventilation can help dry the air.

For gravity sewers at pressure mains discharges, extract the gas at the first manhole downstream of the discharge point, to collect as much H_2S coming out of solution in the sewer as possible.

Air velocity through the filter media governs the bed area. The required detention time (determining the average velocity in the bed) is dependent on the following factors:

- Depth of the media;
- Concentration of H_2S gas;
- Degree of the nuisance odour risk to the nearby population.

For a conservative design, use a velocity of 5 m/hour (calculated using the air flow rate divided by total bed area). Note that the actual velocities within the bed are much higher, due to the relatively low void ratio.

For air flows greater than 0.2 m^3/s and/or average H_2S concentrations greater than 5 ppm measured at those air flow rates, use velocities up to 10 m/hour to reduce the bed installation costs but consider the increased risk of odour in the immediate vicinity.

To minimise gas short circuits within the bed and to provide the maximum detention time, use 1.0 m depth of filter media and, where the site allows, slope the sides at 45°. Vertical sides can allow gas to escape if any media shrinkage occurs.

Use premium medium grade bark mulch as specified in CCC *CSS: Part 1*.

Ensure even air distribution in the biofilter bed. For example, in a rectangular bed feed air from the centre of a bed of crushed metal (CCC GC 14-10) to a uniform layout of perforated (drilled PVC or subsoil drain) pipes at 1.5 m centres.

Do not place textile filter fabric above the air distribution granular fill.

In most locations an underdrain in the biofilter is necessary, to collect acidic leachate and drain it out to the sewer. Include an impermeable membrane at the base of the air distribution system.

The efficient operation of biofilters relies on keeping the media moist. This aspect is very important and **irrigation controlled by a moisture sensor and timer is required on all biofilters**.

The natural bacteria in the media may not be sufficient to control odour on start-up, therefore airflow rates should start low and be increased gradually as the bacteria colonies develop. Confirm the development of the colonies during this process through testing whether odour can be detected.

6.11.3 Activated Carbon Filter Type

Proprietary Activated Carbon Filters shall be designed to meet the following requirements:

- Design life of 25 years;
- Constructed from non-corrosive materials;
- Vandal-proof;
- Meet the District Plan maximum noise control of 45 dBA at the property boundary at all times;
- SCADA monitoring of running and fault conditions;
- Comprehensive design report that includes the following:
  - Contaminant removal rates;
  - Life cycle costs;
  - Operational and maintenance costs
- Comprehensive Operating & Maintenance manual (including manufacturer's contact details for all equipment.

6.11.4 Monitoring

Biofilter operation should be monitored on a regular programme. The programme can be very simple - from smell inquiries of nearby residents for installations with low H_2S concentrations to comprehensive airflow and gas concentration measurements for critical installations.

Regular inspection of the mechanical equipment is essential.

6.12 ALTERNATIVE CONVEYANCE SYSTEMS

6.12.1 Septic Tank Effluent Pump (STEP) Systems

Where a proposed development cannot be adequately or cost-effectively serviced by a gravity system, a STEP system may be considered. The design of the STEP system must give due consideration to servicing beyond the immediate area.

A STEP system may be appropriate if:

- The development has a low population density;
- Lot areas are between 0.5 and 1.0 hectares;
- It would avoid the need for a pump station;
- There is a high groundwater table.

A specific design shall be provided to Council for approval, prepared by an appropriately qualified or experienced professional. This shall include plans for operation and maintenance, and ongoing costs.

The system as a whole, and discharge points in particular, shall be designed with the following considerations:

- Odour control;
- Aeration;
- Minimising septicity, H_2S generation and corrosion;
- Low maintenance;
- Minimal disruption in case of emergencies;
- Any other potential hazards

The following parameters shall be incorporated in the design:

- K = 0.3 mm
- The design flow rate shall be calculated as outlined in section 6.4, with an estimated wastewater use of 1000 L/property/day;
- Main pipes shall have an internal diameter of 50, 65, 75, 90, 100, 125, or 150 mm. PE80B may be used for all sizes, while PVC or PE100 may be used for pipes with a diameter of 100 mm or greater;
- Private laterals shall be 50 mm NB diameter, including a non-return valve and isolation valve housed in a toby box at the road boundary;
- Maximum total head shall be 16 m;

All tee-intersections on the mains shall incorporate an isolation valve and emergency discharge point.

STEP systems shall not be used for commercial or industrial systems.

The on-site treatment system shall be designed to achieve the following minimum effluent quality:

- BOD ≤ 30 g/m^3;
- Suspended solids ≤ 10 g/m^3;
- Total Nitrogen ≤ 10 g/m^3.

The on-site treatment system is required to have the following components, as a minimum:

- Multi-chamber septic tank;
- Suitable biological outlet filter (refer SD 600-355);
- Non-return and isolating valves at the pump station;
- High level alarm (audible & visual).

Tanks shall be sealed watertight, sized and constructed in accordance with AS/NZS 1546:2008. If existing septic tanks are to be incorporated into the system, the tanks shall be tested for compliance with the appropriate standard and upgraded or replaced if not adequate. The tanks must be large enough to provide 24 hours of emergency storage capacity above the high level alarm. This may include septic tank freeboard capacity, if effluent will remain below ground and below the lowest gully trap.

Provisions for ventilation shall be provided for all pump tanks with the vent opening located above the 100-year flood elevation.

An isolation valve shall be installed at each point of supply.

Pumps shall be appropriately sized for the system and designed for frequent cycling. The recommended pump to design the system around is the Lowara GLM-55-WDC, with a minimum 0.3 L/s flow rate. All pumps in a single STEP system shall be the same model and size. The pump shall be easy to access and remove from site, to facilitate installation and maintenance.

The property owner shall be responsible for the safe and adequate operation, maintenance and liability of the septic tanks, pumps and laterals, unless the Council approves otherwise.

6.12.2 Common (Private) Pressure Main Systems

A common drain is a wastewater pipeline through privately owned land, shared by more than one property and not vested in the Council.

Common pressure main systems are subject to Council approval and will only be considered if a normal gravity system is not practicable. For private common systems in public land, a license to occupy is required.

Size the pressure main to achieve a pipe-flushing velocity at the ultimate design flows. In larger systems it is normal to vary the pipe size along the length of the pipeline, according to the number of connected pumps.

The diameter of the common pressure main at the point of connection must be larger than the diameter of the lateral connecting the pipe from each pump to the common pressure main.

Design of common pressure main systems should take account of the average retention times. Retention times of up to six hours will not normally cause odour at the discharge point; however, if the average retention time is over eight hours odour is likely to occur. If retention times are expected to exceed this, then it may be necessary to install a biofilter where these systems discharge to the gravity system to avoid odour and hydrogen sulphide problems.

6.13 MATERIALS

The Council is currently in the process of developing an approved materials specification. The following brief outline is provided as guidance, specific details are available from the Council on request.

All products must be fit for their respective purpose and comply in all respects with the Council's current specification for the supply of that material and the standards referenced.

Where a material or product is proposed that is not approved or previously used in the district, the Council may require assurance that demonstrates the durability of that material prior to approval. Where there is no current standard, the manufacturer will be required to supply copies of their Quality Assurance procedures and producer statements to support their performance and composition claims for the products concerned. This must be approved in writing by the Council before work commences.

6.13.1 Pipelines

All pipe materials must comply with their respective current NZS or AS/NZS standard.

PVC-M pipe will not be accepted.

6.13.2 Reticulation Fittings

Nylon coated ductile iron fittings complying with AS/NZS 2280 shall be generally used. Where socketed fittings are used, these shall be specifically designed for Series 1 or Series 2 pipe as appropriate (i.e. fittings that use adaptor rings are not permitted). Fabricated fittings shall not be used without specific Council approval.

6.13.3 Sluice Valves

Sluice valves used for scour or isolation purposes shall be resilient-seat and clockwise-opening, with non-rising spindles. They shall be of nylon coated ductile iron construction suitable for buried service, and comply with AS/NZS 2638. Sluice valves shall have dual shaft seals and be of the removable bonnet type (i.e. unitary construction valves are not permitted).

6.13.4 Small Diameter Valves & Fittings

Small diameter (i.e. threaded) valves and fittings shall be constructed of either bronze or 316 stainless steel and be suitable for wastewater applications. Buried valves shall be of the metal gate type, with conventional (anti-clockwise) opening and installed such that the operating wheel can be operated from the surface by hand.

Ball valves shall not be installed where there is potential for freezing. Female threaded connections on polymer fittings must have a stainless steel reinforcing ring or similar to prevent splitting.

6.13.5 Air Valves

Air valves shall be dual-acting air valves, incorporating a kinetic air valve (large orifice) and a dynamic air valve (small orifice) in a single unit. They shall be specifically designed for wastewater application and provided with an isolating valve. The nominal size of the large orifice of air valves must be 50 mm.

6.13.6 Haunching, Bedding and Backfill

A geotechnical investigation shall be carried out as part of the design. If there is a possibility of soft ground that was not identified initially, further ground investigations may be required.

Design haunching, bedding and backfill for the specific installation location. The material used must be capable of achieving the backfill compaction requirements set out in CCC *CSS: Part 1*. Specify haunching and bedding for pipes to comply with CCC *CSS: Part 3* clauses 8.5 and 8.6. Earth loads on deep pipelines can significantly increase when pipes are not laid in narrow trenches. Increase the strength of pipelines by concrete haunching, as detailed in SD 600-344A/B.

All mains installed by trenching shall be thoroughly bedded, haunched and surrounded in accordance with AS/NZS 2032:2006 and AS/NZS 2566.2:2002. Refer also CoP Part 8: *Roading* Appendix B – *Road Openings* (QP-C843) for trenching in the road. Other forms of installation utilising trenchless technology may be used subject to Council approval.

Use Type M and P (aggregate) haunching, as detailed in SD 600-344A/B, where there are no special scour, aggressive groundwater or bedding problems. Unless otherwise stated, the following shall be used:

- AP20 bedding and surround for pipes less than 1500 mm diameter;
- AP40 for pipes greater than greater than 1500 mm diameter;
- AP65 for all drainage structure foundations, including manholes, anchor blocks and any other structures.

However, where there is a danger of the surrounding soils or backfill migrating into the haunching or foundation metal, protect the haunching and foundation metals with an approved geotextile.

Replacing highly compressible soils (such as peat) with imported granular fill material can cause settlement of both the pipeline and trench surface, because of the substantial increase in weight of the imported material.

Haunching and backfill in these areas may need to be wrapped in filter cloth to stop the sides of the trench pushing out into the softer ground. Wherever the ground bearing strength is less than 50 kPa, design structural support for the pipe and any structures.

Consider using a soft beam under the pipe haunching for support or using a flexible foundation raft. Retain joint flexibility. Difficult bedding conditions may warrant the use of piling, in which case smaller pipes may require some form of reinforced concrete strengthening to take bending between piles.

6.13.7 Corrosion Prevention

The developer will be required to submit for approval their proposed list of materials such that the Council can determine material suitability.

Potential problems may include:

- Mildly corrosive soils;
- Septicity & H_2S generation;
- Potential for liquefaction and/or earth movement

Corrosion can be caused by hydrogen sulphide, aggressive groundwater, saltwater attack, carbon dioxide or oxygen rich environments. **Before** specifying concrete pipes within potentially corrosive areas, test the groundwater to check whether concrete piping is appropriate. Regard groundwater as aggressive to ordinary Portland cement if any of the criteria in Table 6.9 are met.

Table 6.9 Criteria for Aggressive Groundwater

Options	Measure	Condition
1)	Calcium carbonate alkalinity	$CaCO_3$ > 35 ppm
	Aggressive carbon dioxide	CO_2 > 90 ppm
2)	Calcium carbonate alkalinity	$CaCO_3$ < 35 ppm
	Aggressive carbon dioxide	CO_2 > 40 ppm
3)	Acidity	pH < 6
4)	Sulphate	SO_4 > 1,000 mg/L

Design to minimise corrosion through:

- Selecting materials which will resist corrosion, such as PE manholes in place of concrete;
- Designing in an allowance for corrosion over the 100-year life-cycle of the asset;
- Providing protective coatings, such as polyethylene film or coal tar epoxy;
- Increasing cover to reinforcing;
- Laying concrete pipes in concrete haunching (see SD 600-344A/B Type C or H).

Bolts and fittings must be hot dip galvanised and incorporate zinc anodic protection. Do **not** use stainless steel where it may fail as a result of crevice corrosion in the presence of sulphides and chlorides.

6.13.8 Surface Boxes and Markers

All valves shall be provided with an approved surface box and a vertical section of 150 mm minimum diameter PVC-U pipe from the valve bonnet to 50mm below the finished surface. The pipe shall be installed so as not to transfer surface load to the reticulation main (refer also SD 600-406).

Surface boxes shall finish flush with the final ground surface. Valve boxes shall be painted white.

Permanent marker posts or plates shall be installed for all valves DN100 and larger. The marker shall identify the size of the valve, and the distance to the valve (to 0.1 m accuracy). The post shall have a permanently formed ‘LV’ (for line valves) or ‘SV’ (for scour valves).

Riser spindles will be required on valves that are greater than 750 mm deep to the valve dolly.

6.14 TRENCHLESS PIPE INSTALLATION

When working in high volume roads, public areas, adjacent to trees, or through private property, consider using trenchless pipe installation technologies. Factors that need to be considered when making this decision include minimising disruption and environmental damage, social costs, design life of the proposed method, and the economic impact of the work.

Thorough surveys and site investigations, which minimise the risk of encountering unforeseen problems during the work, are essential for the success of trenchless construction. Ensure that the method used complies with the pipe manufacturer's specifications.

Options available include the following:

- Pipe bursting;
- On-line replacement;
- Caseless microtunnelling;
- Pipe relining;
- Directional drilling and Guided boring;
- Slip lining.

The Council may approve other technologies on a case-by-case basis as they are considered or developed. When proposing a new trenchless technology, submit a full specification to the Council that covers the design and installation process.

6.14.1 Pipe Bursting

Pipe bursting is suitable only for replacing sewers that are constructed of brittle pipe material, such as unreinforced concrete and vitrified clay. Generally, this method is not suitable for replacing reinforced concrete pipes.

Obtain accurate information about the original construction material and the condition of the existing pipeline, including whether there have been any localised repairs, and whether sections of the pipeline have been surrounded or haunched in concrete. Take special care when the existing pipe has been concrete haunched, as this will tend to raise the invert level of the new pipeline and cause operational problems. Shallow pipes or firm foundations can also disturb the ground above the burst pipe.

Replace the entire pipe from manhole to manhole. The number and frequency of lateral connections may influence the economic viability of this technique.

6.14.2 Cured-In-Place Pipe Relining

Cured-in-place pipe (CIPP) lining systems are preferable for renovating gravity sewers. Before undertaking CIPP, check the structural integrity of the host pipe and ensure that the hydraulic capacity is sufficient for projected future peak flows.

The CIPP liner must produce a durable, close fit with a smooth internal surface. The liners must be resistant to all chemicals normally found in sewers in the catchment area. The manufacturer must submit guarantees to this effect to the Council.

The design of the CIPP liner, including the required wall thickness under different loading conditions, must comply with the manufacturer's recommendations and specifications. Submit a liner specification to the Council that addresses the design procedure and installation methodology. Follow the layout of the WIS 4-34-04.

As the host pipe is blocked during the insertion and curing operations, adequate flow diversion is essential for this method. Repair any structural problems at the junctions by open dig prior to CIPP installation.

The opening of connections must be carried out remotely from within the lined sewer. For this purpose, prepare accurate location records by detailed surveys prior to CIPP installation. Additional grouting of junctions may be required after opening.

6.14.3 Directional Drilling and Guided Boring

Restrict sewer installation using guided boring or directional drilling to instances where their construction tolerances are acceptable.

Take into account the space requirements for the following:

- Drill pits, including working space;
- Drill rigs, including access paths for drill rigs;
- Drill angle (the drill rig may need to be placed some distance away from the sewer starting point, depending on the angle);
- Placement of an appropriate length of the joined sewer on the ground for pulling through the preformed hole;
- Erosion and sediment control.

Surface-launched drilling machines require larger construction and manoeuvring spaces compared to pit-launched drilling machines. Consult specialist contractors before selecting this technique.

An adequate survey and/or investigation during the design phase are important to the success of this technique. Investigate the separation from existing services carefully.

6.14.4 Slip Lining

It is essential to carefully consider the effect that the work will have on the system operation **before** using a slip-lining technique, especially in relation to finished invert levels and capacity.

Carefully inspect and prepare the host pipe prior to the installation of the new pipe. Use a sizing pig at the investigation stage, to confirm clearances.

Replace the entire pipe from manhole to manhole. Reconnect lateral connections to the new sewer as set out in CCC *CSS: Part 3*, clause 7.3. The number and frequency of lateral connections may influence the economical viability of this technique.

Carry out grouting of any annulus after installing the new pipeline and gain approval for the technique to be used **before** the pipe is installed. Ensure that grouting doesn't cause buckling or flotation of the internal pipe.

6.15 INSTALLATION

6.15.1 Authorised Installers

Only Waimakariri District Council Authorised Drainlayers are permitted to install pipework that will be vested into the Council and any pipework that is located within legal roads. A full list of authorised drainlayers and conditions of approval may be obtained on request from the Council.

Construction of the wastewater system must not start until acceptance in writing has been given by the Council.

Wherever works are installed within existing legal roads, a Road Opening Notice (RON) must be obtained for that work. The work must comply with requirements as set out in the Council standard specification QP-C843 for this type of work.

No work may start until the RON has been approved in writing by the Council.

6.15.2 Handling

The engineer, developer and contractor are responsible for ensuring the appropriate handling, storage, transportation and installation of pipes and fittings to avoid damage and to preserve their dimensions and physical properties. The total exposed storage period from the date of manufacture to the date of installation for all PVC pipe must not exceed 12 months. Store fittings under cover at all times.

6.15.3 Approved Plans

The contractor shall work from the most up-to-date, Council-authorised plans.

6.15.4 Confined Spaces

Contractors shall work within the Council's *Guidelines for Entering and Working within Confined Spaces* (QP-C606). Contractors that do not hold the relevant qualifications shall not work within confined spaces.

6.16 TESTING & COMMISSIONING

6.16.1 Testing

Testing of all pipelines, manholes and other structures must be carried out as specified in CoP Part 3: *Quality Assurance* in the presence of Council staff.

Pumping stations shall be tested & commissioned as required in Section 6.8.1.

6.16.2 Connecting into existing system

Only Council approved contractors may make connections to the Council utility system. Connection of any part of the works into the Council system shall only be made with prior approval of Council in writing.

New pipe work must not be connected to the Council reticulation until after the mains have passed a pressure test.

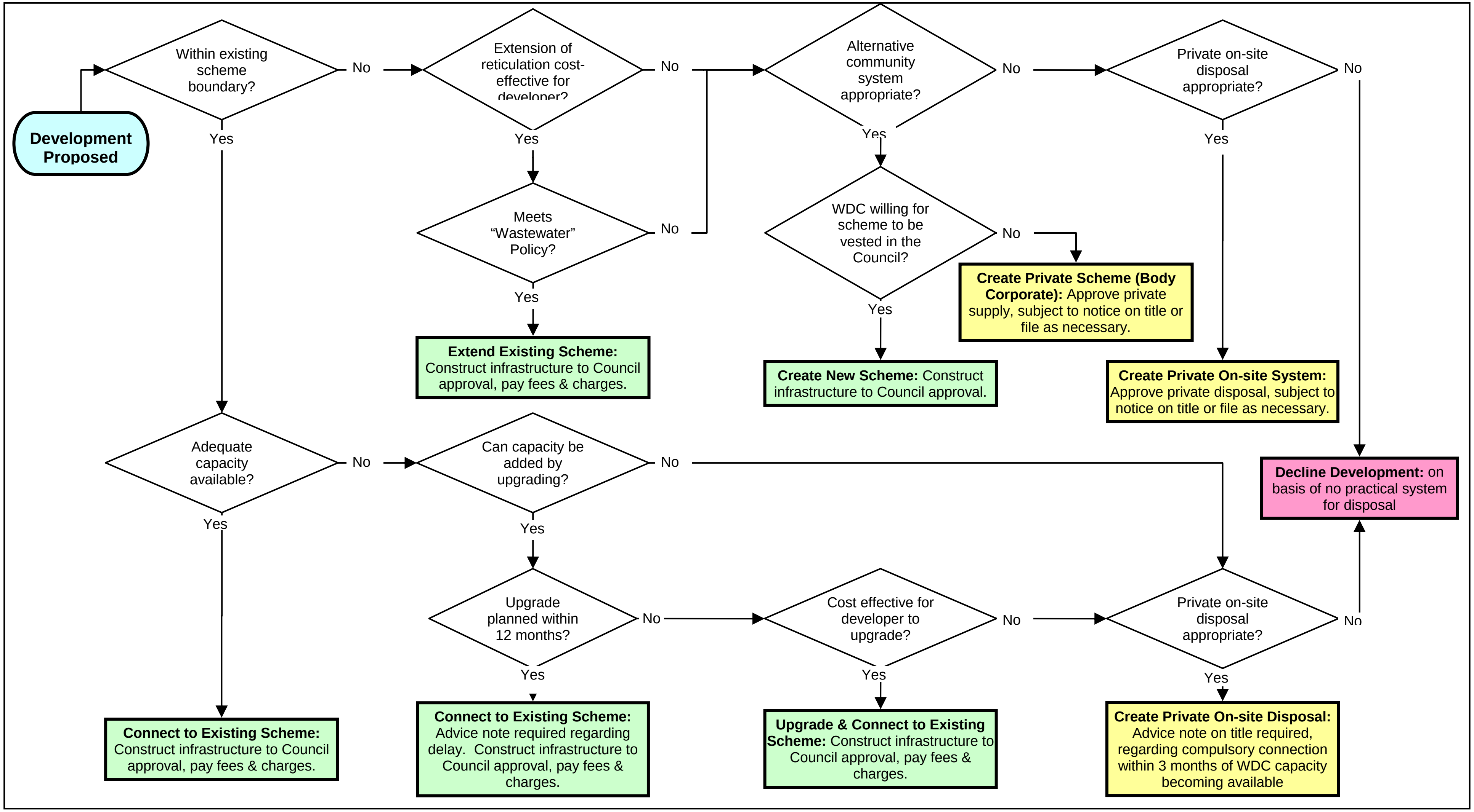
6.17 AS-BUILT INFORMATION

Present as-built information which complies with CoP Part 12: *As-Builts* and this Part.

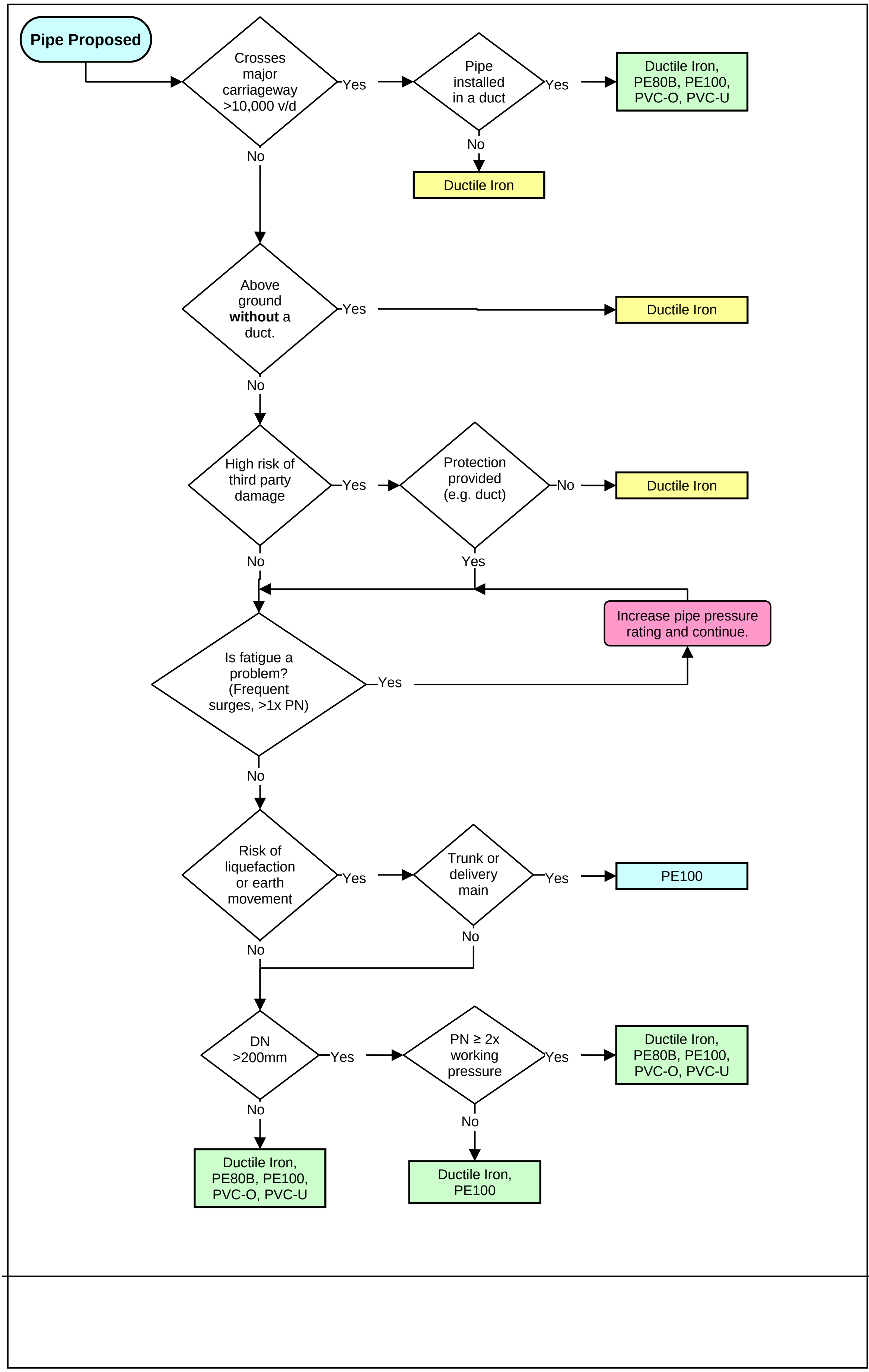
6.18 ASSOCIATED DOCUMENTS

Appendix A	Wastewater Disposal System Selection (QP-C815-AA)
Appendix B	Pipe Materials Selection (Wastewater – Pressure) (QP-C815-AB)

Wastewater Disposal Scheme Methodology



Pipe Material Selection (Wastewater Rising Mains)



WAIMAKARIRI DISTRICT COUNCIL

ENGINEERING CODE OF PRACTICE

PART SEVEN

WATER SUPPLY

Updated July 2020

Part 7: Water Supply

CONTENTS

Part 7: Water Supply

Part 7: Water Supply

TABLES

FIGURES

EQUATIONS

Part 7: Water Supply

7.1 INTRODUCTION

This Part includes:

- The assessment of required infrastructure
- Technical design requirements
- Material requirements

This Part is not intended to be a detailed design guide or to replace the need for water engineering expertise in some areas of the design process. The standards included in this Part are one way of achieving the desired outcomes and performance criteria of the network components described below.

7.1.1 Description of the Water Supply System

The Waimakariri District water supply system is essentially a collection of discrete urban and rural schemes.

At present there are seventeen active water supply schemes in the Waimakariri District. These range from the small rural communities at West Eyreton and Garrymere to the large urban schemes of Kaiapoi and Rangiora.

The water schemes can be divided into three types, each affecting the amount and nature of water supply available to consumers.

- Urban schemes are set up in urban areas, and provide a full-flow water supply. There are six such urban schemes active in the District.
- Restricted schemes are generally used in rural areas. Supply is limited by a restrictor unit and each connection is required to have a tank (and usually a pump if an elevated tank site is not available) to supply the property. There are six restricted schemes in the District.
- Semi-restricted schemes are designed to provide an on-demand water supply, but at a limited flowrate, and at present are only in place in Garrymere and Ohoka, and a small number of properties on Poyntzs Road. Each connection on these schemes is restricted to a peak flow of 13 L/min, or about 19 m^3/d.

Table 7.1 List of WDC schemes

Scheme	Zone	Type	Typical Connection Size for Restricted Schemes
Cust	Urban	On-demand	NA
Kaiapoi	Urban	On-demand	NA
Oxford Urban	Urban	On-demand	NA
Rangiora	Urban	On-demand	NA
Waikuku Beach	Urban	On-demand	NA
Woodend-Pegasus	Urban	On-demand	NA
Mandeville-Fernside	Rural	Restricted	2 m^3/d
Oxford 1	Rural	Restricted	Various
Oxford 2	Rural	Restricted	Various
Poyntzs Road	Rural	Restricted	13 L/min
Summerhill	Rural	Restricted	2 m^3/d
West Eyreton	Rural	Restricted	4 m^3/d
Garrymere	Rural	Semi-restricted	13 L/min
Ohoka	Rural	Semi-restricted	13 L/min

All of the schemes have some form of monitoring attached.

Please note the following points:

- All on-demand and semi-restricted schemes have some properties with restricted connections;
- No new semi-restricted connections or schemes will be approved. All new connections attached to these schemes will be fully restricted.

7.1.2 Ashley Rural Water Supply System

Although this scheme is reticulated within the Waimakariri District boundaries, it is owned, administered and maintained by the Hurunui District Council (HDC), and all enquiries regarding the scheme should be directed to HDC.

7.1.3 Effects of Development on the Water Supply Network

Groundwater and surface water resources are restricted by water quantity and quality. Any new development or extension to an existing scheme can have an effect on the available water supply. Consult with the Council before drawing up concept plans for additional water use.

System extensions, upgrading headworks and any other specific works required to provide water for a new development will be assessed and funded in accordance with the Council's *Water Supply Extension Policy* and *Development Contributions Policy*.

Part 7: Water Supply

7.2 CONSENT AND COMPLIANCE ISSUES

The consent and compliance information set out in Part 2: *General Requirements* applies to all works within the Waimakariri District, with the addition of the clauses below.

7.2.1 Legislation

The following Acts and amendments are the principal statutes governing water supply:

- Local Government Act (2002) (LGA)
- Health (Drinking Water) Amendment Act (2007)
- Resource Management Act (1991) (RMA)

7.2.2 Approval Process

New water supply systems require approval from the Council and consent(s) from Environment Canterbury. Extensions to existing water supply systems require approval from the Council only.

For new water supplies, specific approval is required from the Council before it will agree to take ownership of the asset. In making this decision, the Council will consider the following as a minimum:

- Compliance with this document;
- Reliability of supply, including redundancy, back-ups and fail-safe devices;
- Economic sustainability, including the type and size of scheme, and rates affordability;
- Water quality and compliance with the Drinking Water Standards;
- Implications of Resource Consent conditions for Council in the long-term;
- Proposed level of service and consistency with other schemes.

Where the developer proposes to drill a new well (bore) to provide a secure potable water supply then the developer shall:

- Obtain all required resource consents for the abstraction of water from Environment Canterbury;
- Submit to the Council for approval a copy of all such Resource Consents. Note that the developer is advised to consult with Council over proposed consent conditions prior to finalising of any consent.

The Council may agree to the establishment of a private water supply. In doing so, it will consider the following as a minimum:

- Ownership and management arrangements;
- Ability to comply with the relevant legislation, in particular the Health (Drinking Water) Amendment Act 2007;
- Feasibility of proposed source, location, headworks and treatment;
- Reliability of supply, including redundancy, back-ups and fail-safe devices;
- Economic sustainability, including the type and size of scheme, and rates affordability;
- Water quality and compliance with the NZ Drinking Water Standards;
- Proposed level of service.

7.2.3 District Council Requirements

The Council *Water Supplies Bylaw* defines the Council's requirements and protection for supply systems.

Part 7: Water Supply

All works on the water supply system shall adhere to the requirements of the Waimakariri District Council Hygiene Code of Practice for Work on Public Water Supplies. This is available on Council's website.

All works shall comply with the Council's Backflow Prevention Policy.

7.2.4 Source of Supply

Where a subdivision creates a new dwelling lot then the developer shall enable a safe and secure potable supply by provision of one of the following:

- An individual, safe and potable water supply to each dwelling lot (safe, in this context, includes a bore head that meets the MoH requirements for a 'secure' borehead and may include a bore that is sourced from a confined aquifer and/or a treatment system);
- A Council owned, operated and maintained community water supply, (refer to clauses 7.5.2 and 7.5.3). In this event the proposed supply shall be subject to Council approval prior to being vested in the Council;
- An existing Private water supply scheme operated and maintained by the community. This type of scheme will be shared and shall be protected by adequate agreements (refer to clause 7.5.4).

Refer to QP-C816-AA (attached as Appendix A) to assist in identifying the appropriate supply methodology.

Where a development is proposed in the Residential or Business Zone then the development shall connect to that supply and pay the associated Development Contribution/s per new connection/lot/unit.

7.2.5 Consent Application – Information Required

In addition to the information required to support the concept drawings and/or Resource Consent plans in CoP Part 2: *General Requirements*, the following data shall also be provided:

- General layout and alignment of reticulation showing locations of pipes, valves, hydrants and service connections;
- Connection points to the existing reticulation;
- Nominal diameters of principal mains;
- Redundancy and networking within the system;
- Confirmation that the connection to the Council scheme complies with the Council's water supply extension policy. This requires a separate application to the Council's Utilities Department.

For new water supplies the following information is required in addition to the above:

- Details of the source, headworks and treatment, including water quality, quantity, capacity, sustainability, reliability and risks;
- Assessment of ongoing operation and maintenance requirements including cost.

7.3 QUALITY ASSURANCE REQUIREMENTS AND RECORDS

Provide quality assurance records that comply with the requirements in CoP Part 3: *Quality Assurance*, during design and throughout construction.

7.3.1 The Designer

The designer of all water supply systems that are to be taken over by Waimakariri District Council must be suitably experienced. The qualifications and experience of the designer may be requested by the Council for approval prior to commencement of the design.

The design reviewer must have at least equivalent experience to the designer.

7.3.2 System Review

When the pipe selection and layout have been completed, perform a system review, to ensure that the design complies with both the parameters specified by the Council and detailed in the CoP. The documentation of this review must include a full hydraulic system analysis. Compliance records must cover at least the following requirements:

- Minimum residual pressure can be maintained at all property connections;
- Maximum operating pressure will not be exceeded anywhere in the system;
- Pipe class is suitable for the pipeline application (including operating temperature, surge and fatigue);
- Pipe and fittings materials are suitable for the particular application and environment;
- Pipe and fittings materials are approved by the Council;
- Minimal likelihood of water quality problems or water stagnation;
- Valve spacing and positioning allows isolation of required areas and extension to future stage(s) or areas without shutdowns of existing consumers;
- Mains layout and alignment meets the Council's requirements;
- Fire fighting requirements are met;
- Control valves, where required, are positioned to provide the required control of system;
- Watermains are extended to the subdivision boundary where subsequent development may occur;
- Connections, to existing or future subdivisions, form a cohesive network and provide security of supply;
- Capacity provided for future adjacent development;
- System shall be easy and logical to access, maintain and operate.

7.3.3 Engineering Design Approval

Provide the following information to support the engineering drawings and Design Report, as a minimum:

- Detailed offsets, alignments and grades of designed pipelines;
- Detailed plans of the proposed supply headworks, pumping and treatment system, storage and reticulation layout, as applicable'
- All assumptions used as a basis for calculations, including pipe friction factors;
- Design checklists or process records;
- Design flow rates;
- System review documentation as detailed in clause 7.3.2;
- Trenchless technology details, where appropriate;
- Calculations carried out for the surge analysis of pressure pipes, where appropriate;
- Summaries of hydraulic modelling including design parameters and assumptions;
- All options considered and the reason for choosing the submitted design.

7.3.4 Construction Records

Provide the information detailed in CoP Part 3: *Quality Assurance* and the CCC *Construction Standard Specifications* (CSS), including where applicable:

- All performance test results;
- Material specification compliance test results;
- Compaction test results;
- Subgrade test results;
- Site photographs;
- Pressure test results;
- Disinfection records.

The developer must provide the Council with a certificate for each pipeline tested, including the date, time and pressure of the test. The details of the pipes, including manufacturer, diameter, type, class, date of manufacture, serial number, jointing and contractor who laid the pipe, must be included on the certificate.

7.3.5 Hygiene Records

Provide documentation of procedure used to manage the hygiene of water supply installations as detailed in the Waimakariri District Council Hygiene Code of Practice for Work on Public Water Supplies, to demonstrate that the hygiene of the work undertaken has been adequately managed. This shall include, where applicable:

- Audits of work practices;
- Reporting of Gastrointestinal Illnesses;
- Qualifications of Water Supply Installers;
- Pipeline sterilisation results.

7.3.6 Post-Construction Records

Provide the information detailed in CoP Part 3: *Quality Assurance*, Part 12: *As-Builts*, and the CCC *CSS*, including:

- Design report;
- Completion certificates;
- Certificate of compliance with the NZ Drinking Water Standards 2005 (Revised 2008);
- Producer statements – design, construction, construction review;
- Commissioning report, including all test results;
- Water quality test results;
- Operations & maintenance manuals, where applicable;
- Schedule of Costs;
- As-built plans and records.

7.3.7 Operations and Maintenance Manual

Provide an Operations and Maintenance Manual to the approval of the Council, for any water quantity and/or quality control facilities. The manual must include:

- A description of the facility and its purpose;
- Design criteria;
- A description of major features;
- Normal operational procedures and constraints (e.g. resource consent conditions);
- Emergency operational procedures (where relevant);
- A copy of any resource consents relating to the facility;
- A maintenance schedule for all items requiring periodic maintenance including landscaping;
- A schedule of suppliers and contact details for key components;
- A copy of Manufacturers' operating & maintenance instructions for key items;
- A copy of the as-built drawings and commissioning report for the facility.

The manual shall be contained in clearly marked A4 ring binders, divided into sections with clearly marked dividers. Drawings and other bulky information may be appended in separate folders. One copy shall be provided to the Council for review. Once the manual has been approved by Council, a final copy shall be provided to site and two printed and bound copies, plus electronic copies in Word (*.doc) and PDF (*.pdf) format, shall be provided to Council. CoP Part 10 section 10.6 – *Establishment & Maintenance* expands on these requirements.

7.3.8 Acceptance Criteria

All pipelines, pumping stations, and other integral components must be tested, certified and inspected as appropriate before acceptance by the Council. Perform testing in accordance with CoP Part 3: *Quality Assurance*. For pumping stations and other structures, the developer shall submit a specific methodology for testing and commissioning, which shall not be deviated from unless approved by the Council.

7.4 GENERAL DESIGN PRINCIPLES

7.4.1 Design Considerations

Consider the:

- Hydraulic capacity of the system;
- Ability of the water system to maintain acceptable water quality, including consideration of materials and their disinfection demand, and prevention of back flow and stagnation;
- Structural strength of water system components to resist applied loads;
- Pipeline's ability to withstand both internal and external forces, taking into account any temperature variations;
- Requirements of the Fire Service Code of Practice;
- Health & Safety requirements;
- Environmental requirements;
- Impact of the works on the environment and community;
- "Fit-for-purpose" service life of the system;
- Best way to minimise the "whole-of-life" cost;
- Resistance of each component to internal and external corrosion or degradation;
- Installation requirements expressed in CCC *CSS: Part 4*;
- Capacity and ability to service future extensions and development;
- Networking, redundancy and security of supply;
- Ease of maintenance and operation.

In urban areas, also consider the Council's minimum levels of service, detailed in section 7.5 and in the Council's *Water Supply Activity Management Plan*. Design all parts of the water supply system that are in contact with drinking water using components and materials that comply with AS/NZS 4020:2002. Select the pipe material to ensure a minimal impact on water quality within the system.

7.4.2 Future System Expansion

Design water mains with sufficient capacity to cater for all existing and predicted development within the area to be served. Make allowance for areas of subdivided or un-subdivided land capable of future development, as specified by the Council in section 7.5.

7.4.3 Contaminated Sites

Avoid contaminated sites wherever possible. If a contaminated site cannot be avoided, provide details about the following issues with the engineering drawings:

- Compliance with statutory requirements;
- Options for decontaminating the area;
- Selection of wrapped ductile iron watermains, wrapped galvanised rider mains and jointing techniques to maintain the water quality (in accordance with the pipe selection chart in QP-C816-AB, attached as Appendix B);
- Safety of construction and maintenance personnel;
- Any special pipeline maintenance considerations.

7.4.4 Reducing Waste

When designing the development, consider ways in which waste can be reduced:

- Plan to reduce waste during demolition e.g. minimise earthworks, reuse excavated material elsewhere;
- Design to reduce waste during construction, e.g. prescribe waste reduction as a condition of contract;
- Select materials and products that reduce waste by selecting materials with minimum installation wastage rates;
- Use materials with a high recycled content e.g. recycled concrete subbase.

See the Resource Efficiency in the Building and Related Industries (REBRI) website for guidelines on incorporating waste reduction in your project www.rebri.org.nz/.

7.4.5 Alternative Technology

The Council will consider alternative technologies on a case-by-case basis. Examples of such technologies are desalination plants and wastewater recycling.

7.5 DESIGN PARAMETERS

In developments where adequate system pressure and coverage from hydrants already exists, the Council will advise the point of supply and the minimum pipe size for the supply pipe. The developer is responsible for the full cost of the supply pipe from the point of supply to the individual connection points.

When the developer is providing water reticulation for vesting in the Council, the Council will provide the following parameters, after receipt of the application plan:

- Point of supply;
- Mains size at the point of supply;
- Supply type (e.g. on-demand or restricted);
- Additional development to be allowed for in the design;
- Static pressure at point of supply;
- Residual pressure at point of supply during peak system demand in the network;
- Residual fire pressure during fire demand at point of supply;
- Fire risk classification at point of supply;
- The minimum residual pressure at house site at peak system demand;
- Networking requirements;
- Other requirements (e.g. minimum mains size).

The on-demand, restricted and semi-restricted water supply areas are listed in Section 7.1.1

Where a development is proposed in the areas noted above and adjacent to the reticulation then the development shall be connected to that supply and pay the associated development contributions, provided the development meets the criteria in the Water Supply Extension Policy. Connection will be subject to specific Council approval.

7.5.1 Supply Type

The following can be used to guide decisions on connection types for new connections or new developments. Ultimately the connection type able to be provided shall be at the discretion of Council.

On-demand connections can be provided in the following circumstances:

- Main scheme type is on-demand, adequate pressure and capacity can be provided by the scheme, the zoning is either Residential 1, Residential 2, Residential 3, Business 1 or Business 2, and the land parcel being serviced is less than 4,000 m^2.

Restricted connections shall be provided where the above criteria for an on-demand connection cannot be met, but where there is adequate pressure and capacity available for a restricted connection.

7.5.2 Design Life

All water supply distribution systems are expected to last for an asset life of at least 100 years with appropriate maintenance, and must be designed accordingly to minimise life cycle costs for the whole period. Assets designed to minimise capital cost at the expense of overall lifecycle cost will not be accepted.

The developer is advised that certain locations within the District have water and ground conditions that may be detrimental to the durability of some reticulation materials and fittings. Upon receipt of the developer’s application, the Council may set specific location requirements for such materials and fittings, based on experience and historical performance.

7.5.3 Design for Water Supply Schemes – On-Demand

Develop residential and business zones to comply with the definitions in the *District Plan*. Provide the design flow rates, for developments other than standard living zones (e.g. multi-unit developments or older persons' housing), with the engineering drawings.

The developer shall use the following table for design purposes:

Table 7.2 Flow Information

Type of Development	Peak Hourly Flow
Residential	0.10 L/s/dwelling
Business and Commercial	1.00 L/s/ha

For business and commercial developments, actual figures should be used where available. Specific design will be required for wet industries and high-density developments.

The developer shall design the water supply system to satisfy the following criteria:

- Fire flow plus 50% of the peak hourly flow with a minimum residual pressure of 100 kPa at hydrants and for Residential Zone allotment lateral connections;
- Peak hourly domestic flow with a minimum residual pressure of 300 kPa and minimum flow of 20 L/min at the point of supply;
- Peak hourly domestic flow with a minimum residual pressure of 250 kPa and minimum flow of 15 L/min at the house site;
- Minimum domestic flow case with a maximum static pressure of 850 kPa at the lowest elevation in the supply area;
- Appropriate working, emergency and fire-fighting storage (refer to Table 7.8).

Note that the minimum **combined** flow from any two hydrants shall be 25 L/s, and the maximum flow assumed from any single hydrant shall be 30 L/s;

The developer shall, for multi-lot developments that will connect to the Council's supply, obtain approval from the Council in regard to the design, layout and operation of the proposed system.

These requirements may be varied by the Council to suit specific usage or geographic conditions. Reasons for significant changes to the average figures will be outlined in the design parameters for the development, when applicable.

7.5.4 Design for Water Supply Schemes – Restricted

Restricted rural water supplies include the installation of a Council owned and maintained restrictor at each point of supply that restricts flow to each customer.

The developer shall provide:

- A minimum of 2.0 cubic metres per day (1.4 litres per minute) to each dwelling lot. This may be increased for certain schemes (see Table 7.1);
- An approved restrictor at the roadside boundary of each lot that limits the flow at the point of supply to that set for the scheme, and evenly distributes the flow over a 24 hour period;
- On-site potable water storage on each dwelling lot equivalent to either 24 hours supply or the minimum permitted volume (4.0 m^3 for rural properties, 20 m^3 for rural-residential properties), whichever is greater;
- Storage tanks that are fit and adequate for the intended use, have an appropriate fire-hose connection, and that comply with appropriate New Zealand standards;
- Air-gap separation backflow prevention at the storage tank inlet in accordance with G12/AS1 of the Building Code;
- No connection upstream of the point of supply (restrictor unit).

7.5.5 Design for Water Supply Schemes – Private

A private water supply is one that is not owned by the Council. The establishment of a private scheme still requires approval by the Council. Any water supplier is required to comply with the relevant legislation, in particular the Health (Drinking Water) Amendment Act (2007).

The Council may approve the construction of a shared rural water supply that the developer intends to be private, provided the supply meets the requirements of this document.

For private supplies clause 7.5.3 applies, with the following exceptions:

- The scheme shall be jointly owned by the landowners connected to the supply.
- A legal agreement shall be registered on the certificate of title for the equitable sharing of the ownership and the actual costs of operating and maintaining the water supply scheme.
- Clause 7.8.5 – *Site & Access*, regarding ownership of headworks' land & facilities and accessways, will not apply.
- The ownership of the headworks' land & facilities and accessways shall be held in joint ownership and included in the legal agreement required above.
- The results of bacteriological and annual chemical tests shall be forwarded to the Waimakariri District Council, at least annually or when requested. All sampling and testing shall be in accordance with clause 7.3.5. Copies of the results will be held on the Council's property file.
- There is no requirement for the installation of a SCADA system.

Note that it is appropriate for developers to keep themselves advised of proposed legislative changes with regard to private shared water supplies.

7.5.6 Fire Service Requirements

The water supply reticulation must comply with SNZ PAS 4509:2008 *New Zealand Fire Service – Firefighting Water Supplies Code of Practice*. In particular, the reticulation must meet the requirements for fire fighting flows, residual fire pressure and the spacing of hydrants, together with any additional requirements, including storage where applicable.

The reticulation must be designed to provide fire-fighting capacity within and adjacent to all urban areas, whether or not these areas are gazetted fire districts.

7.5.7 Fire-Prevention Services

Many industrial and commercial sites require the installation of additional fire-protection means where the fire risk exceeds the service level provided by the reticulation network. These fire-protection works must be designed to meet the requirements of the *New Zealand Building Code*.

Note that the available pressure and flow from the reticulated network is likely to reduce in the future, due to demand growth and pressure management. This may result in future compliance problems for the property owner/user unless a suitably conservative design approach is taken.

7.6 PIPELINE DESIGN

Any development shall not cause adverse effects to existing consumers (e.g. cause pressure and/or flow to drop below the target level of service).

7.6.1 Maximum Design Pressure (Head)

Calculate the maximum design pressure for the mains as follows:

Equation 7.1 Maximum design pressure

$$H_{max} = H_s + S$$

where H_S = Static pressure (m)

S = Surge allowance (m)

Use the calculated maximum design pressure when:

- Selecting pipe materials and classes;
- Selecting pipe fitting types and ratings;
- Designing thrust and anchor blocks;
- Specifying the test pressure.

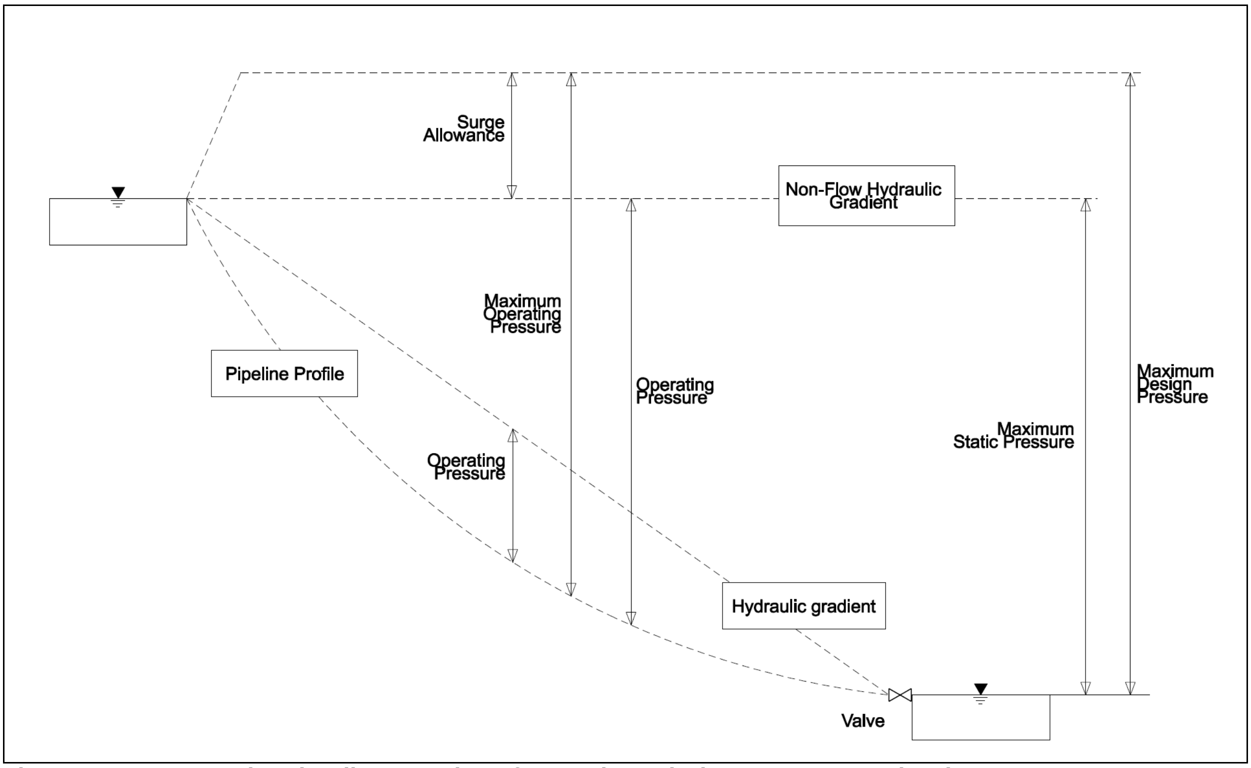


Figure 7.1 Conceptual Hydraulic Operation of a Gravity Main (CCC IDS Part 7 Fig. 1)

Where the main supplies directly to the reticulation system, the proposed maximum design pressure must comply with the maximum operating pressure normally supplied in that zone. Alternatively, if supply is required to a small area adjacent to the trunk main, the supply pressure may be reduced using a pressure reducing valve before its transition to a reticulation main.

The developer shall note that most reticulation within the urban schemes operates between 300 kPa and 500 kPa working pressure and refer to NZS 4404:2004 Table 2 for design purposes. See also SD 600-412.

7.6.2 Pipeline Material Selection

Select watermain materials in accordance with the pipe selection chart in Appendix B, and with the WDC Materials Specification. Interpretation of this flow chart shall be at the discretion of the Council.

Each material has specific design and installation issues, as identified in the manufacturers' design manuals, specifications and other literature. Consider these issues, as listed below, when specifying materials.

- Polyvinyl Chloride: PVC-U, PVC-O
  - Test pressures not to exceed 1.25 times the rated pressure of the lowest rated component but to be at least 1.25 times the maximum operating pressure;
  - UV degradation after more than 2 years' storage or installation in outdoor conditions;
  - Depth of scratching, gouging and impact damage limited to 10% of the wall thickness;
  - Careful handling, bedding and installation required;
  - Possible permeation by some contaminants (e.g. hydrocarbons).
- Polyethylene: PE80B, PE100
  - Sophisticated equipment and highly skilled workers required where welded joints are required;
  - Depth of scratching, gouging and impact damage limited to 10% of the wall thickness;
  - UV degradation (Blue pipe is not suitable for outdoor installation);
  - Bedding support required to prevent excessive deformation;
  - Pulling forces for PE during trenchless installation are not to exceed the manufacturer's recommendations;
  - Vulnerable to permeation by some contaminants (e.g. hydrocarbons).
- Ductile Iron
  - Internal lining and external coatings must be undamaged or fully restored after repairs or fabrication work;
  - Polyethylene bag wrap corrosion protection system must be properly applied;
  - Potential for water quality effects where very low velocities are likely for extended periods of time;
  - Potential problems with stray electric currents and bimetallic corrosion.
- Concrete-lined Steel
  - Internal lining and external coatings must be fully restored after repairs or fabrication work and during jointing;
  - Potential for water quality effects where very low velocities are likely for extended periods of time

Rider mains must be of polyethylene pipe of resin type PE100 or PE80B, with a minimum pressure rating of PN12.5. Contaminated sites will require careful material selection. Refer to clause 7.4.3 – *Contaminated Sites*.

7.6.3 Standard Pipe Sizes

All pipe diameters referred to in this section are nominal internal diameters unless otherwise noted.

Acceptable standard main sizes are 100, 150, 200, 300, 375, 450 and 600 mm nominal diameter. Other sizes may be considered where there is a particular long-term benefit to Council.

7.6.4 Minimum Pressure Rating

The minimum nominal pressure rating for pipelines is 1200 kPa (PN12). Check the Council's minimum requirements, using the flow chart in Appendix B, before specifying the required pressure rating.

The minimum nominal pressure rating for valves, fittings and hydrants is 1600 kPa (PN16).

7.6.5 Losses

When determining the residual pressure at each site, take into account the minimum residual pressure to be available at the point of supply, as specified in the design parameters for the development, and, for residential developments, also consider any friction losses through the supply pipe at peak flow rate.

Assume all private service pipes are not more than 20 mm internal diameter, unless a statement specifying the service pipe internal diameter is registered on the Property File relating to that allotment.

For all developments, design losses through meter(s) and the rider main must be such that the design flow rate downstream of any point allows for theses losses and complies with clauses 7.5.1 or 7.5.3 as appropriate.

Assume service connections to individual allotments to be 15 mm nominal internal diameter, unless consent has been given for a larger service connection size. Determine mains losses using flow rates in accordance with clauses 7.5.1 or 7.5.3 as appropriate.

7.6.6 Pipe Hydraulic Losses

Take differences in elevation across the subdivision or development into account.

Calculate pipe friction losses using the Darcy-Weisbach/Colebrook-White formulae, and the friction factors given in Table 7.3. Manufacturers' published friction factors/charts shall not to be used as they do not account for pipe aging and are usually over-optimistic.

Table 7.3 Friction factors (NZS 4404, Table 6.1)

Pipe material	k_S (mm)
PVC-U, PVC-O, PE	0.15
Ductile Iron	0.6

Most water supplies in the Waimakariri District must be pumped, so hydraulic gradients shall be less than 0.01 m/m (other than for fire fighting purposes). The Council may approve exceptions to this rule in isolated cases where the pressure is independent of pumping rates.

7.6.7 Surge and Fatigue Re-rating of Plastic Pipes

Plastic pipes are susceptible to damage from cyclic loads. Although plastic pipes may be permitted in zones affected by pressure variations (e.g. pump zones, in locations downstream of pressure reducing valves, and in high surge areas), it is essential that the pipe class be checked for long-term performance under surge & fatigue loadings in accordance with the criteria set out in QP-C841 *Design for Surge & Fatigue* (attached as Appendix D).

7.6.8 Sloping Terrain

Give special consideration to the design and installation of pipelines in any land prone to slips or instability, or with a gradient steeper than 1:10.

7.6.9 Joints

Joints between fittings and pipes shall be made using the following methods (where appropriate):

- Socket & spigot (except for PE pipes) only where the socket is designed specifically for the spigot outside dimension);
- Gibault (except for PE pipes) where the gibault is either of the multi-fit type or specifically designed for the outside diameters of the items to be joined. Gibaults may not be used where the step difference exceeds 10 mm;
- Flange-socket or flange-gibault adaptors (except for PE pipes);
- Butt-fusion welding (PE pipes DN160 and larger only) by a specialist contractor only;
- Mechanical couplers (full restraint type – PE pipes only);
- Welding (concrete lined steel only);
- Threaded connections to BSP (small fittings <DN50 and connections only).

Electrofusion and solvent-cement joints are not permitted without specific approval by Council.

When specifying the connection details, consider the:

- Pipe materials, especially capacity for galvanic and other corrosion;
- Relative depth of mains;
- Standard fittings;
- Pipe restraint and anchorage;
- Limitations on shutting down major mains to enable connections;
- Existing cathodic protection systems.

Design anchorage for valves unless they are fully restrained by the pipe and fittings used.

Where the branch connection at the trunk main will have less than 1.5 m cover, obtain the correct cover on the proposed reticulation main by utilising joint deflection of the reticulation pipes downstream of the valve that is attached to the branch connection.

Design connections, from the end of an existing main, to address any differing requirements for the pipes being connected, particularly restraint, spigot/socket joint limitations and corrosion protection. Use standard fittings and pipework to connect to non-metallic mains. Confirm all sluice valves near the connection are restrained.

Any alterations or connections to the existing reticulation system shall be done at the developer's expense.

7.6.10 Flanges

All valves and fittings shall be flanged to either AS2129 Table D/E or AS4087 Class 16, using raised-face flanges. It is the developer's responsibility to ensure that all mating flanges are compatible. Note that this also applies to items such as flow meters, check valves and pressure-reducing valves, and that alternative flange standards (such as ANSI or DIN) will not be accepted. If higher pressure ratings are required, these will be subject to specific Council approval.

7.6.11 Backfill and Bedding

Design bedding and backfill for the specific installation location. The materials used must be capable of achieving the backfill compaction requirements set out in CCC *CSS: Part 1*. Specify bedding for pipes to comply with CCC *CSS: Part 3* clause 8.5 and 8.6. Earth loads on deep pipelines can significantly increase when pipes are not laid in narrow trenches.

7.6.12 Specific Structural Design

Design pipelines being installed at depths greater than detailed in CCC *CSS: Part 4* to resist structural failure. The design must comply with AS/NZS 2566.1 including Supplement 1. Show details of the final design requirements on the engineering drawings.

Any ground that has a bearing capacity less than 50 kPa is unsatisfactory for watermain construction. In such cases, engage a geotechnical specialist to investigate the site and to design and supervise the construction of an appropriate support or foundation remediation system for the watermain.

Wherever it is necessary to fill an area before laying a watermain across it, or to build an embankment in which to lay the watermain, seek advice from a geotechnical specialist to ensure that the weight of the fill will not cause failure or leakage of the pipe joints after the main is laid.

7.7 NETWORK LAYOUT DESIGN

Lay watermains in public roadways unless there is no practicable alternative. Public watermains across private property, other than right-of-ways, shall generally not be accepted. Remove any existing reticulation between new lots.

The developer shall include approved metallic detection tape in all pipe trench-lines that are:

- Not laid in accordance with SD 600-245A/B/C *Location of Underground Services*;
- At road crossings and intersections.

Metallic detection tape shall be continued to the nearest accessible point (e.g. valves and hydrants) and the end left such that it may be reached from the surface cover box.

The developer shall submit to the Council for approval any proposed reticulation not laid in accordance with SD 600-245A/B/C.

7.7.1 Mains Layout

Consider the following factors when deciding on the general layout of the mains:

- The need for mains to be replaced due to their physical condition and/or inadequate capacity or whether new mains are required to provide additional capacity;
- Providing easy access to the main for repairs and maintenance;
- Whether system security, disinfectant residual maintenance and mains cleaning meet operational requirements;
- The location of valves for shut off areas and zone boundaries;
- Topographical and environmental considerations;
- Avoidance of dead ends;
- Providing dual or alternate feeds to minimise customer disruptions.

Generally, the connection of reticulation to trunk mains is not permitted, as these mains may be shut down for servicing over extended periods, disrupting supply to reticulation where alternate feeds have not been provided.

7.7.2 Duplicate Mains

Provide duplicate mains to provide redundancy as per Table 7.4 below. Duplicate mains shall be of the same nominal diameter and separated such that a single event is unlikely to affect both (e.g. on separate sides of a road).

Table 7.4 Duplicate mains

Situation	Duplicate main
Parallel to large distribution/trunk mains that are not available for service connections	Required
Industrial/commercial areas	May be required
Arterial and dual carriageway streets	May be required

7.7.3 Ridermains (Sub-main)

Ridermain (sub-main) reticulation is required in all urban areas. Ridermain reticulation typically includes service connections and excludes fire hydrants.

Part 7: Water Supply

The developer shall provide ridermain reticulation that:

- Supplies service laterals to allotments on each side of each road;
- Is generally laid out in accordance with SD 600-245A/B/C;
- Is generally laid under berm and not under footpaths;
- Is generally laid behind the kerb or road shoulder;
- Excludes fire hydrants;
- Allows for the rider main to continue completely around the head of any cul-de-sacs.

For developments within Residential Zones, ridermains shall generally be 50 mm internal diameter (DN63) PN12.5 PE80B. Where there is insufficient room for installation of long lengths of PE pipe, DN50PN12 PVC-U pipe will be accepted. The maximum number of connections on a ridermain shall be in accordance with Table 7.5:

Table 7.5 Maximum Service Connections of Ridermain

Pressure	Type of Supply	
	One-End Supply	Two-End Supply
Low: P ≤ 400 kPa	5	15
Medium: 400 kPa < P ≤ 600 kPa	10	25
High: P > 600 kPa	15	30

Ridermains shall be extended around intersections and laid such that corner properties can be serviced from either street (refer Figure 7.2). Install rider mains approximately 600 mm from boundaries, to serve all allotments.

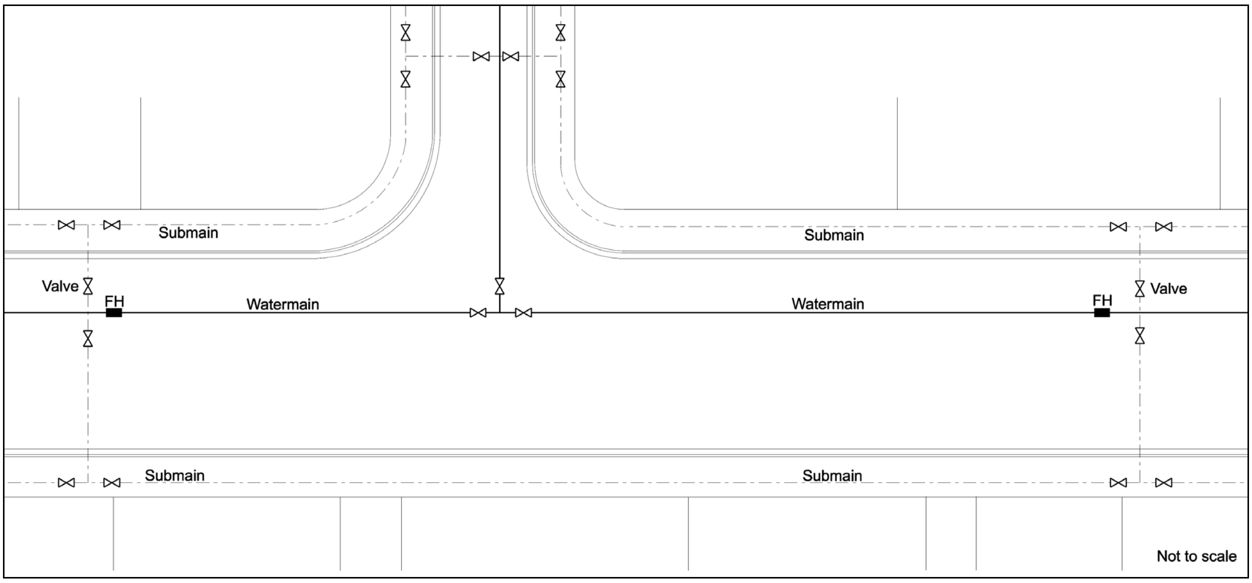


Figure 7.2 Ridermain layout

Ridermains must be served from crossovers, usually located at fire hydrants. The method of connection shall be a tapping saddle off the main. All crossovers must be DN63 PN12.5 PE80B, regardless of the pipe size.

Locate 50 mm sluice valves next to the ridermain on the crossover. Wherever a crossover serves both directions and more than ten properties each way, locate valves on the rider main on either side of the crossover.

Ridermains and valve layout shall allow for flushing through the nearest hydrant. Where this is not possible an approved flushing point shall be provided. The preferred ridermain layout on straight roads is to lay connections between the rider and the water main adjacent to every second hydrant.

Council requires that water supply reticulation in private property remains with the owner/s of the allotments and that the point/s of supply are located at the roadside boundary by either separate connections, or otherwise multi-valve manifold connections. Refer also SD 600-412.

7.7.4 Valves

Reticulation shall include valves to enable each section of the main to be isolated. Only the Council, as the utility service provider, is authorised to close water supply reticulation valves.

Sluice valves are required next to the branch of any tee junction. Other valves must also be provided to ensure that turning off a maximum of five valves can isolate the network in any area. The maximum five-valve shut off must not isolate more than 50 properties.

Locate sluice valves at street intersections and also along the line of the main as required. Consider the following when deciding on the location of sluice valves:

- The operational needs of the system so that continuity of supply is maximised;
- Operation and maintenance requirements;
- The safety of maintenance personnel.

Keep the number of valves to a minimum, without compromising the ability to easily identify and isolate a section of the network.

Attach sluice valves to flanged fittings at junctions rather than plain-ended fittings.

The force required to open or shut a manually operated valve, using a standard valve key, with pressure on one side of the valve only, must not exceed 15 kg on the extremity of the key. Specify geared operation, motorised valves or a valve bypass arrangement, to reduce pressure across the valve, if the allowable force cannot be met.

Valves shall be located in accordance with Table 7.6 below.

Table 7.6 Reticulation Valve Locations

Type of Main	Valve Location
Trunk, Booster and Principal mains 100 mm and larger in diameter.	Shut-off valves shall be provided at each junction and generally not more than 500 m apart. Larger spacings shall be permitted for the delivery mains, with the approval of the Council. Subject to having a suitable discharge location, sluice valves may be required at the system's lowest elevation.
Rider mains not in road carriageway.	Shut-off valves shall be provided at each junction and generally to provide shut off isolation for not more than 10 lots.
Service connections	Toby valves shall be provided on each service connection, and generally located 300 mm off the property boundary.

7.7.5 Scour Valves

Scour valves are required to be installed at the following locations:

- On mains of 300 mm diameter and larger;
- On mains of less than 300 mm diameter where there are no fire hydrants;
- At the lowest point between isolating valves, and shall discharge to an approved outfall, (refer to CoP Part 5: *Stormwater* for outfall requirements);
- At the end of all dead-end mains where there are no fire hydrants.

Scour valves shall be resilient-seat and clockwise-opening, with non-rising spindles. They shall be one nominal size smaller than the pipe; for example, the valve shall be 100 mm diameter when installed on a 150 mm pipe. Note that this applies to 50 mm mains and larger. The valves shall discharge to an approved outlet or accessible concrete chamber.

7.7.6 Air Valves

Air can accumulate at high points when it is drawn into the system at reservoirs and pumps. Mains should be laid evenly to grade between peaks to ensure all possible locations of potential air pockets are known. Investigate the need for air valves at all high points, particularly those more than 2.0 m higher than the lower end of the section of watermain, or if the main has a steep downward slope on the downstream side. When used for vacuum relief, size air valves to prevent a negative pressure greater than -50 kPa developing.

Air may also come out of solution in the water due to a reduction in pressure, such as when water in a main is pumped uphill or at pressure reducing valves. Air valves may be required to allow continuous air removal at these locations.

The number and location of air valves required is governed by the configuration of the distribution network, in terms of both the change in elevation and the slope of the watermains. Install air valves in a secure enclosure with an isolating valve to permit servicing or replacement without needing to shut down the main.

Air valves are not normally required on reticulation mains in residential areas, as the service connections usually eliminate air during operation. Where the need is primarily for admission and exhaust of air during dewatering and filling operations, a high-point hydrant usually adequately serves reticulation networks.

On hillsides, locate a fire hydrant adjacent to and downhill from any sluice valve where the main descends from that location to release air.

DN300 and DN375 reticulation mains, with only a few service connections, may require dual-acting air valves, to automatically remove accumulated air that may otherwise cause operational problems in the water system.

7.7.7 Fire Hydrants

The developer shall provide fire hydrants to principal mains for the purposes of fire-fighting, air release, charging and system maintenance.

Hydrants shall be located within 1.5 m of the end of a capped reticulation pipeline.

In addition to hydrants required for maintenance purposes, they shall be located to comply with NZS 4404: 2004 *Code of Practice for Urban Land Subdivision* and the following:

- 135 m maximum spacing in Residential Zone
- 90 m maximum spacing in Business Zone
- 20 m maximum distance from the end of a no-exit street – measured from the road boundary.
- Site and reticulation specific air release requirements.

7.7.8 Additional Hydrants and Scour Valves for Maintenance Activities

Hydrants, additional to those required by the *Fire Service Code of Practice*, may be needed to facilitate maintenance activities, such as flushing the watermains. Ensure that there are approved and adequate drainage facilities to cope with the contents of the watermain from dewatering and flushing operations. These shall be marked as specified in section 7.7.7.

Where automatic dual-acting air valves are not installed at high points on the watermains, install a hydrant to release air during charging, to allow air to enter the main when dewatering and for manual release of any build up of air as required.

Provide hydrants at low points on mains to drain the pipeline when scours are not installed. As a general rule, place a hydrant or scour at the lowest point of elevation where the volume of water unable to be drained exceeds 15 m^3. This normally applies to mains DN200 or greater.

7.7.9 Pressure Reducing Valves and Check Valves

Pressure reducing valves (PRVs) are preferred over break pressure tanks, and must be sized for minimum and maximum demand. PRV installations shall include the following:

- A concrete chamber located in a berm or other non-carriageway area;
- Positive drainage from the chamber;
- Secure covers either protected from traffic loads or rated for them;
- Isolation valves on the main PRV to enable servicing;
- Adequate restraint of pipes and valves to cope with the forces generated under all conditions;
- Flexible joints such that pipework in the chamber can be readily disassembled;
- A bypass PRV or small diameter pipe to provide service during maintenance
- A pressure relief valve where the maximum downstream pressure in the event of PRV failure exceeds 1,000 kPa. This shall discharge to a kerb or other visible location that will not cause a flooding nuisance;
- A flow meter to register flow into the zone;
- 100 mm diameter pressure gauges with isolating cocks mounted on the chamber wall to register the upstream and downstream pressures
- Manual overrides on the valve pilot gear to permit the valve to be forced fully open or fully closed.

The PRV must be designed to provide peak flows (including fire flows) as well as minimum night flows. Where minimum flows are likely to result in excessive seat wear, a bypass PRV must be provided to meet normal daily flows.

Check valves shall also be installed in a chamber with isolating valves. Check valves 100mm and larger shall have either a bypass arrangement or a manual open feature so that flow can be reversed if required. Check valves shall be of the resilient flap type and able to be serviced from a removable top cover.

7.7.10 Thrust Blocks on Mains

Install thrust blocks for all fittings and valves, to withstand the maximum operating pressure and test pressure.

Where required, thrust blocks shall be constructed so as to be clear of pipe joints and fittings.

Cast in-situ concrete thrust blocks shall be provided at all points where an unbalanced thrust occurs. Anchors and thrust blocks shall be appropriately designed and installed clear of connections and fittings. Concrete shall:

- Be a minimum of 20 MPa at 28 days.
- Surround not more than 180 degrees or 50% of the reticulation.
- Be insulated from the reticulation using an appropriate membrane.

The precast thrust block detailed in SD 600-405 may be used if all of the following criteria are met:

- It must have a minimum surface area of 0.18 m^2 in contact with an undisturbed trench wall;
- The fitting or valve is up to and including 150 mm diameter;
- The maximum operating pressure is up to and including 700 kPa;
- The trench ground conditions can sustain a safe bearing capacity greater than 150 kPa, as established by testing.

Design and detail thrust blocks individually for any of the following situations:

- The fitting or valve is over 150 mm diameter;
- The maximum operating pressure is greater than 700 kPa;
- The ground bearing capacity is less than 150 kPa.

Also detail anchorage for in-line valves on pipelines that are not capable of resisting end loads.

7.7.11 Restrained Joint Watermains

Restrained joint watermain systems can be used in place of thrust and anchor blocks to prevent the separation of elastomeric seal-jointed pipelines.

Restrained joint systems include welded steel joints, flanged pipes and fittings and commercial mechanical restrained joint systems. Specify details of commercial restrained joint systems on the engineering drawings, including the:

- Length of restrained pipeline and adjacent fittings required to ensure the transfer of thrust forces to the ground strata;
- Requirement for placing suitably worded marking tape in the trench over the pipeline to define the limits of the restrained joint system;
- Requirement for details of the commercial restrained jointing systems to be shown on the as-built drawings, including the location of restrained portions of pipelines.

7.7.12 Provision for Disinfection

The fittings and reticulation layout must provide for disinfection of new mains to be achieved as per Section 6 of the Waimakariri District Council Hygiene Code of Practice for Work on Public Water Supplies.

7.7.13 Backflow

Design and equip drinking water supply systems to prevent backflow and/or back-siphoning. This shall be in accordance with Council's Backflow Prevention Policy.

Locate air valves and scours to avoid water entering the system during operation.

7.7.14 Service Connections – On-Demand

For design purposes, assume a 15 mm connection and meter manifold unless Council consent has been granted for other sizes.

Individual connections shall not be installed until applied for by the consumer.

The developer shall provide:

- Service connections;
    - To the boundary of each dwelling allotment at the time of subdivision development;
    - For any lot that is accessed by a right of way, extended 1.0 metre minimum into the main body of the lot, excluding leg-in access.

- Backflow prevention at the point of supply complete with at least a low-hazard, non-testable device, and a higher specification device where the Council specifically requires this;
- A flow meter where specifically required by the Council. The flow meter will be required to meet the standards specified by the Council.

Where the development includes traffic or pedestrian islands that will be landscaped, then the developer shall provide a 100 mm duct from the nearest main to the islands that shall terminate clear of other underground services and vehicle crossings.

Refer to SD 600-412 and NZS 4404:1981 *Code of Practice for Urban Land Subdivision*.

7.7.15 Service Connections – Restricted

In rural areas where long rights-of-way exist, the Council will consider the installation of a public main within the right-of-way with individual connections where all the following criteria are met:

- The length of the main is greater than 500 m;
- There are four or more connections on the main;
- The water main will be vested in the Council;
- A 3 m wide easement-in-gross in favour of the Council is provided over the main, stipulating that no locked gates shall be constructed along the pipe main.

7.7.16 Clearances to Other Services or Obstructions

The designer shall be familiar with the required clearances from existing and proposed overhead and underground utilities. All underground and surface obstructions, or utility assets that may be hazardous, shall be identified on the engineering drawings.

Table 7.7 Water Main Clearances

Service Type 1	Service Type 2	Clearance (mm)	
		Crossing	Parallel
Water mains DN ≤ 200	Water Mains > DN 375	500	600
	Water Mains ≤ DN 375	150	300
	Stormwater mains	150	300
	Wastewater pipes	500	1000
	Kerbs	150 (where possible)	150
Water mains DN ≤ 200	Water Mains > DN 375	500	600
	Water Mains ≤ DN 375	150	600
	Stormwater mains	150	600
	Wastewater pipes	500	1000
	Kerbs	150 (where possible)	600

Note that a vertical (crossing) clearance shall always be applied to wastewater mains, in addition to the horizontal clearance required where the pipes are parallel. The water main shall always be located above the wastewater pipe.

Refer to CoP Part 9 clause 9.5.4 – *Typical Services Layout and Clearances* for clearances for utility services.

When using a trenchless technology installation method, apply the clearances required for watermains laid in an open trench. Refer to NZS 4404:2004 for more information.

Services must cross as close as possible to 90° (right angles).

7.7.17 Reticulation in Legal Road

Evaluate and incorporate the following design considerations when locating reticulation in legal roads:

- Situate the water main 1.5 m off the road crown, as shown in SD 600-245C;
- Consider the balance between initial capital cost versus ongoing operational and maintenance costs, for factors such as access and soil type;
- Special cover requirements when renewing or laying new pipes in streets with a high crown and dish channels (refer to clause 7.10.6 – *Cover Over Pipes*);
- Allow for known future utility services and road widening.

The preferred position of surface boxes is in line with either side of property entranceways, to avoid interference with parked vehicles. Surface boxes must be located clear of feature paving such as cobblestones, and within roundabouts where possible.

7.7.18 Water Mains in Easements

Water mains may be located within a registered easement-in-gross only with the specific approval of the Council. Easements must extend a minimum of 1.5 m each side of the centreline of the water main (i.e. 3 m wide easement). The easement registration must provide the Council with rights of occupation, conveyance and access and ensure suitable conditions for water main replacement, upgrade, operation and maintenance. All WDC easements shall be easements-in-gross.

Typical situations where the Council may approve mains in easements include those where there is a need for a link main to provide continuity of supply or where fire protection is required for multiple properties within a private right-of-way.

An easement over private property for a water main is not the preferred option and is generally only used as a temporary solution to landlocked developments, pending the future provision of a permanent supply within a legal road. Easements may be located over private property, public reserves, crown reserves, other government-owned land, private roads or access ways in both conventional and community title subdivisions.

7.7.19 Termination Points and Hydrants at the End of Mains

Avoid dead end mains in order to prevent poor water quality. Where a dead end main of 50 mm diameter is unavoidable, a flushing valve shall be installed at the termination point. Refer to SD 600-404. Consider alternative configurations such as a continuous network, link mains and use of rider mains to service properties off the end of mains.

A hydrant must be placed within 1.5 m of the end of all permanent and temporary sections of dead end mains greater than or equal to DN100. Apart from the fire fighting function, this also allows the section of dead end main to be flushed regularly to ensure acceptable ongoing water quality. This is particularly important in new subdivisions, where only a small number of properties may be connected initially.

7.7.20 Temporary Ends of Watermains

Lay watermains to within 1.0 m of a subdivision boundary, where it is intended that the road will extend into other land at some future time.

In new development areas, construct mains to terminate approximately 2.0 m beyond finished road works, with a hydrant within 1.5 m of the temporary end, as detailed in clause 7.7.19. The hydrant must be suitably anchored, to ensure that future works do not cause disruption to finished installations.

Part 7: Water Supply

7.7.21 Temporary Works

The Council may, at its discretion, approve a delay in providing the total infrastructure requirements for large developments that will be developed over a period of several years. Such approval is conditional on the provision of a temporary infrastructure of sufficient capacity for the immediate development and may require a bond to ensure construction of the remaining infrastructure when necessary.

7.7.22 Reticulation on Private Property

Supply pipes in private property and mutually owned rights-of-way are considered to be privately owned and must be protected by easements in favour of the dominant tenants. The developer shall state the intended water supply proposal for the development on the subdivision consent application.

For multiple-unit developments, individual water connections shall be provided at the boundary. For large, Body Corporate establishments, the Council may approve a single metered connection. In rural areas where long rights-of-way exist, the Council will consider the installation of a public main with individual connections (refer to section 7.7.15).

7.7.23 Multiple Meters at the Boundary

Locate all the meters at the legal road boundary as shown in Figure 7.3. This layout can be used for fee simple, cross lease or unit title developments.

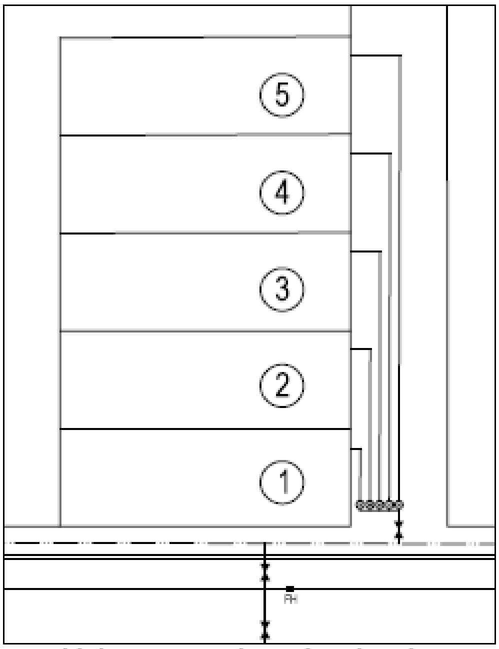


Figure 7.3 Multiple meters at boundary (NTS)

7.7.24 Single Connection to Body Corporate

Where a development requires the creation of a Body Corporate (e.g. a Unit Title subdivision) a single meter can supply all the dwelling units as shown in Figure 7.4.

This layout requires only one Council meter, however the developer must install additional sub-meters within the private land. These sub-meters will be private and will not be maintained by the Council.

Part 7: Water Supply

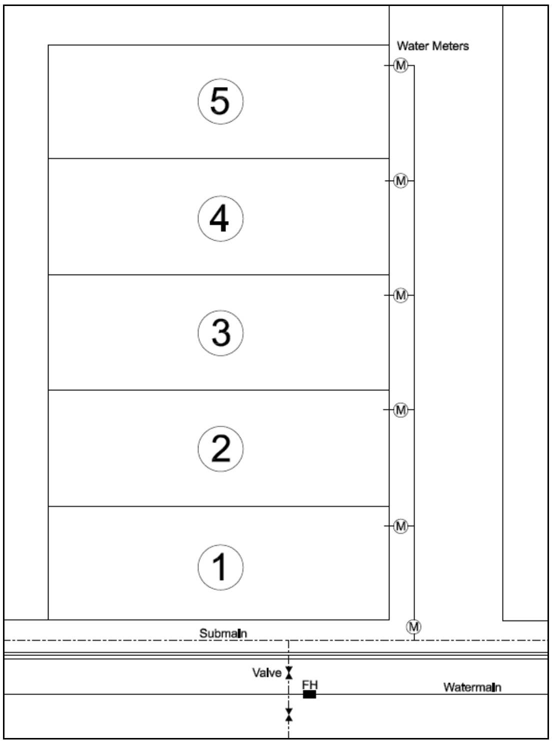


Figure 7.4 Single connection at Body Corporate boundary (NTS)

Any water supply charges will be invoiced by the Council against the Body Corporate. The rules of the Body Corporate shall nominate the Unit to which the water charges are applied. The rules shall also allow for the equitable distribution of these charges between all Units on the basis of volumetric use, if the Council implements water charges by this method.

The Body Corporate documents shall be supplied to the Council for approval as part of the application for the Section 224c certificate, including the identity of the nominated Unit.

7.8 HEADWORKS & PUMPING STATION DESIGN

Any requirement for headworks (i.e. any combination of a pumping station, treatment plant, supply well and storage reservoirs) will become apparent during the preliminary reticulation design. The Council will take into account the long-term cost-effectiveness (i.e. total life-cycle costs) of the facility before accepting any infrastructure to be vested in the Council. Design and construct any such infrastructure to accord with the *Water Supply Wells, Pumping Station and Reservoir Design Specification*. Design pumping stations that supply residential zones to provide the flow requirements set in section 7.5 unless otherwise specified.

Obtain requirements for pumping stations from the Council prior to design.

7.8.1 Water Supply Wells

Wells shall have sufficient year round capacity to supply the maximum daily flow for the scheme, with a maximum of 20 hours' pumping per day. Water pumped from the well to the storage tanks shall be by an adequate and durable submersible pump.

The following information shall be submitted to the Council for approval:

- The well log/strata data;
- Depth of the well;
- Water levels (static and operating);
- Materials' classification;
- Water bearing strata type and depth;
- Well screen type, dimensions and position(s);
- The results of a step draw down test up to the maximum yield of the well, which shall then be continued for a minimum of 48 hours, and the recovery time taken to the initial static water level;
- Defined well plume or catchment area;
- Independent or comparative comment on well capacity, future performance, and the likely extent of the abstraction plume.

A resource consent shall be obtained to extract water from a supply well. The resource consent application shall consider and address any effects on other parties.

All water supplies with 400 or more connected properties shall have two supply wells, each capable of meeting the peak daily demand.

All water supplies shall be installed complete with a magflow meter on the outlet and a water level sensor capable of sensing the full range from static water level to maximum drawdown. The magflow meter and level sensor shall be connected to the Council's DATRAN system.

7.8.2 Water Treatment

Where new treatment facilities are required, these shall be designed, constructed and tested to demonstrate compliance with the MoH *Drinking Water Standards* 2005 (Revised 2008), or any subsequent revisions. The approval process will depend on a number of factors including:

- The quality of source water;
- The size of scheme;
- The complexity of treatment process; and
- Whether the scheme shall be vested in the Council.

Contact the Council to discuss the approval process when details of the source and treatment are known.

7.8.3 Pumping Station Buildings

Where the developer requests that the pumping station be vested in the Council then the pumping station building shall:

- Be constructed from durable products, such as concrete block or masonry construction on a reinforced concrete slab floor, with Coloursteel roofing;
- Consist of two separate compartments, one to house pumps, pressure system and electrical controls and the other for treatment equipment and chemical storage. The compartments shall be isolated from one another by sealed wall(s) or door(s) and separately vented;
- Provide a chemical treatment storage and equipment compartment that shall be fully insulated on all walls, floor and ceiling;
- Have a containment foundation with the floor graded to a discharge point with an outlet to a holding tank with a minimum storage of the volume of liquid chemical contained plus 25%, or 1000 litres, whichever is the greater;
- Have thermostatically controlled ventilation;
- Have a building consent and Code Compliance certificate;
- Include 15 mm faucets capable of withstanding flame sterilisation for both raw and treated water and identified by appropriate signage;
- Include a stainless steel hand-basin complete with associated fittings and drainage to the public sewer (where available) or to the holding tank in the pumping compartment;
- Include an external sign showing the name of the station and any hazards;
- Include Council approved three-phase wiring and plug installation to enable reticulated power supply isolation and connection of portable emergency power generation equipment;
- Be keyed to Council’s standard water supply key for all locks (including padlocks).

7.8.4 Pumping Station Pumps

Where the supply is not gravity fed, the developer shall provide a minimum of two reticulation mains pressure pumps for each pumping station.

Each pump shall have sufficient capacity to provide the required peak instantaneous flow for the total area reticulated while maintaining the design residual mains pressure (duty and stand-by).

All pumps shall be:

- Models approved by the Waimakariri District Council prior to installation;
- Fitted with flanged pipe fittings;
- Wired with IP66 plug connections;
- Installed with sufficient valving to allow simple isolation from the reticulation system;
- Fitted with an automatic start (upon reticulated power supply failure) emergency backup diesel generator where the pumps supply on-demand reticulation.

Where pumps are providing flow directly into the reticulation, they shall be controlled with PDL variable speed drives (VSD).

7.8.5 Site & Access

Where the developer requests that the pumping station be vested in the Council then the pumping station site shall include:

- Site and accessways are vested in the Council;
- A sealed all-weather accessway to each wellhead, pump house building and headworks storage site;
- Chain-link fencing around all headworks components, with a minimum height of 2 m, barbed wire top, complete with a 4.2 m wide lockable gate;

7.8.6 Electrical Control Panel

Where the developer requests the Council to adopt a water supply pumping station then the electrical control panel shall be installed in the pump house and shall include the following components:

- Separate steel cabinets powder coated complete with relevant New Zealand Standard approved boards for power meters and fuses;
- Hour meter for each pump (including the well submersible pump/s);
- Start counter for each pump;
- Ammeter for each pump;
- Duty selector switch;
- A manual/off/auto switch for each pump;
- Automatic start of standby pump(s);
- Phase failure relay in control circuit with a delay reset;
- Motor overload protection, thermistor on surface pumps and electronic on submersible pumps;
- Low well cut-out on well pump;
- Time delay between pump starts to meet manufacturers requirements;
- Alarms and panel indication for low well, low storage, high storage, no flow and pump fault.
- Pressure gauges;
- Engraved labels;
- Numbered wiring;
- Full "As Built" drawings and documentation;
- Floatless level controls for level controls and alarms;
- Well and storage level measument equipment connected to SCADA;
- Flow measurement equipment on bores and reticulation pumps with connection to SCADA for instantaneous and totalised flows;
- SCADA RTU unit complete with transmitting equipment;
- Connection and changeover switch for standby generator (where permanent generator is not required);
- Manuals for all components with comprehensive operating instructions.

7.8.7 Reservoir Design

Reservoirs are required to provide:

- Working storage (calculated from a volume balance across the peak demand period);
- Fire fighting storage (calculated from SNZ PAS 4509:2003);
- Emergency storage (sufficient to maintain supply for a period of time as specified in Table 7.8).

Table 7.8 Storage Capacity Requirements

Source of Supply	Emergency Storage Required (Time at ADF)
Single surface-water or non-artesian groundwater source	24 hours
Multiple surface-water or non-artesian groundwater sources	12 hours
Single or multiple artesian groundwater sources	6 hours

The size of the reservoir shall be given by the working volume, plus the emergency or fire fighting storage (whichever is larger), plus the unused volume (for example, volume between the base of reservoir and the outlet).

7.8.8 Headworks Supply Storage for On-Demand and Semi-Restricted Supplies

All on-demand and semi-restricted supplies shall have storage provided at each headworks.

Generally, the developer shall provide a volume equivalent to the working storage plus the greater of either the fire fighting storage **or** the emergency storage. However, where multiple artesian sources or multiple sources with backup power supply are provided, a risk assessment may be carried out to demonstrate that a reduced emergency storage volume is appropriate. The methodology and the outcome shall require the specific approval of the Council.

Each tank shall have a sealed and locked secure inspection cover.

Pipework & fittings shall be installed that:

- Allows all tanks to be individually isolated for maintenance;
- Ensures balanced flow through all tanks;
- Provides protection from freezing;
- Provides stock protection.

A level sensor must be installed in all reservoirs and be connected to the Council's SCADA system.

7.8.9 Headworks Supply Storage for Restricted Supplies

All restricted supplies' headworks shall incorporate a minimum of two storage tanks with a minimum capacity of 30 m^3 each. These tanks should be the same size where possible.

Each tank shall have a sealed and locked secure inspection cover.

Pipework & fittings shall be installed that:

- Allows all tanks to be individually isolated for maintenance;
- Ensures balanced flow through all tanks;
- Provides protection from freezing;
- Provides stock protection.

A level sensor must be installed in all separate reservoirs and be connected to the Council's SCADA system.

7.9 MATERIALS

The Council is currently in the process of developing an approved materials specification. The following brief outline is provided as guidance, specific details are available from the Council on request.

All products must be fit for their respective purpose and comply in all respects with the Council's current specification for the supply of that material and the standards referenced. The manufacturer's requirements shall be complied with during construction.

Where a material or product is proposed that is not approved in the district, the Council may require assurance that demonstrates the durability of that material prior to approval. Where there is no current standard, the manufacturer will be required to supply copies of their Quality Assurance procedures and producer statements to support their performance and composition claims for the products concerned.

7.9.1 Material Selection

All materials must comply with their respective current NZS or AS/NZS standards.

The following pipe materials currently available in New Zealand are acceptable for distribution mains:

- PVC-U and PVC-O;
- Polyethylene - PE 100 and PE 80B;
- Ductile iron;
- Concrete-lined steel.

PVC-M pipe will not be accepted.

These pipes, with nominal internal diameters of 100, 150, 200 and 300 mm, are readily available and are the sizes commonly used in the Waimakariri District.

All PVC pipes used in the Waimakariri public supplies must have a minimum pressure rating (PN) of not less than 12 bar or PN12 (1200 kPa).

7.9.2 Bedding and Backfill

Bedding material shall be suitable for the pipeline material in question and shall comply with CCC CSS: Part 3 clauses 8.5 and 8.6.

7.9.3 Reticulation Fittings

Nylon coated ductile iron fittings complying with AS/NZS 2280 shall be generally used. Where socketed fittings are used, these shall be specifically designed for Series 1 or Series 2 pipe as appropriate (i.e. fittings that use adaptor rings are not permitted). Fabricated fittings shall not be used without specific Council approval.

7.9.4 Sluice Valves

Sluice valves used for scour or isolation purposes shall be resilient-seat and clockwise-opening, with non-rising spindles. They shall be of nylon coated ductile iron construction suitable for buried service and comply with AS/NZS 2638. Sluice valves shall have dual shaft seals and be of the removable bonnet type (i.e. unitary construction valves are not permitted).

7.9.5 Hydrants

Hydrants shall be clockwise closing, screw down, medium pattern with a screwed outlet and comply with NZS/BS 750: 1984 Specification for Underground Fire Hydrants and Surface Box Frames and Covers. The stem gland shall have PTFE packing or "0" ring seals and the sealing cup washer shall be made of Polyurethane.

7.9.6 Small Diameter Valves & Fittings

Small diameter (i.e. threaded) valves and fittings (including service manifolds) shall be constructed of either dezincification–resistant brass, bronze or stainless steel. Buried valves shall be of the metal gate type, with conventional (anti-clockwise) opening and installed such that the operating wheel can be operated from the surface by hand.

Ball valves shall not be installed where there is potential for freezing. Water sample taps shall be of metallic construction and mounted securely with the operating handle removed in a position that allows convenient sterilising of the tap (by flame or by disinfectant solution).

Female threaded connections on polymer fittings must have a stainless steel reinforcing ring or similar to prevent splitting.

7.9.7 Air Valves

Air valves shall be dual-acting air valves, incorporating a kinetic air valve (large orifice) and a dynamic air valve (small orifice) in a single unit. The nominal size of the large orifice of air valves must be DN50, for installation on mains less than or equal to DN300.

7.9.8 Service Connections – On-Demand

Service connection fittings shall be in accordance with the material specification, but generally shall include:

- DN20 OD (15 mm internal diameter) blue PE80B pipe;
- Manifold in accordance with Standard Drawing 600-414A.
- A marker groove cut into the adjacent kerb & channel, painted blue.

7.9.9 Service Connections – Restricted

Service connections shall be in accordance with all relevant approved New Zealand Standards, but generally shall include:

- DN25 (20 mm internal diameter) blue PE80B pipe;
- Manifold in accordance with Standard Drawing 600-414B.
- The installation of an appropriately sized restrictors (typically 2,000 L/d);
- A white plastic marker post attached to the boundary or fence, adjacent to the connection.

7.9.10 Surface Boxes and Markers

All valves shall be provided with an approved surface box in accordance with 7.9.10 and a vertical section of 150 mm minimum diameter PVC-U pipe from the valve bonnet to 50 mm below the finished surface. The pipe shall be installed so as not to transfer surface load to the reticulation main (refer also SD 600-406).

Table 7.9 Surface Box Requirements

Situation	Surface Box
Line valve, scour valve, air valve or hydrant	Cast iron or ductile iron valve box, marked "FH", "AV" or "V" as appropriate and capable of carrying Class 1 vehicle load.

Rider mains in berm or footpath	UV-resistant, high-impact, high-density polyethylene (Draper Enterprises Type D), complete with blue lid marked “V”.
Service connections – On-Demand	Refer to Standard Drawing 600-414A.
Service connections – Restricted	Refer to Standard Drawing 600-414B.

Surface boxes shall finish flush with the final ground surface. Valve boxes shall be painted blue. Hydrant boxes shall be painted yellow.

Hydrant posts or plates shall be installed as required by PAS SNZ 4509.

Permanent marker posts or plates shall be installed for all valves larger than DN100. The marker shall identify the size of the valve, and the distance to the valve (to 0.1 m accuracy).

White and yellow paint shall accord with the requirements of TNZ *Manual of Road Markings* Part 2. Blue paint type will be subject to specific Council approval.

7.10 INSTALLATION

7.10.1 Authorised Installers

Water Reticulation Workers shall adhere to the requirements of Section 3 of the Waimakariri District Council Hygiene Code of Practice for Work on Public Water Supplies. This sets out minimum qualification requirements for workers installing, repairing or testing new water mains either for Council or to be vested in Council.

Construction of the water supply system must not start until acceptance in writing has been given by the Council.

Wherever works are installed within existing legal roads, a Carriageway Access Request (CAR) must be obtained for that work. The work must comply with requirements as set out in the Council standard specification QP-C843 for this type of work.

No work may start until the CAR has been approved in writing by the Council.

7.10.2 Handling

Both the developer and the contractor are responsible for ensuring the appropriate handling, storage, transportation and installation of pipes and fittings to avoid damage and to preserve their dimensions and physical properties. The total exposed storage period from the date of manufacture to the date of installation for all PVC and Blue PE pipe must not exceed 12 months. Store fittings under cover at all times.

Refer also to Section 4.2 of the Waimakariri District Council Hygiene Code of Practice for Work on Public Water Supplies for requirements for managing hygiene of water supply pipes during storage.

7.10.3 Proposed Method of Installation

There are a number of methods of installing underground services. These include open trenching, directional drilling, pipe bursting or slip lining. Factors that may influence the selection of installation method include ground conditions, disruption to traffic, need to work around trees, topographical and environmental aspects, site safety and the availability of ducts or redundant services, e.g. old gas mains or their offsets.

Wherever the intention is to lay a number of utilities with a rider main in a common trench, pay particular attention to obtaining the required minimum cover and clearances for each utility in the trench cross-section. Mains must always be laid in a separate trench. The required clearance between services is presented in CoP Part 9, Table 9.2 *Utility Clearances*.

7.10.4 Bedding and Backfill

Reticulation pipework shall include pipe trench bedding using a selected granular material in accordance with the manufacturer's recommendations.

Under no circumstances is the trench base or excavated material to be used as pipe bedding.

The developer shall ensure that the manufacturers' recommendations for pipe storage, handling, protection, and laying techniques are complied with.

The developer shall prevent the entry of clay, bedding, stormwater runoff and other foreign material into the pipeline during construction. End caps shall be used wherever practicable during the construction phase.

All fittings and anchors shall be left exposed for inspection by the Council during the course of the acceptance test.

7.10.5 Trenchless Technology

Trenchless technology may be adopted for alignments passing through:

- Environmentally sensitive areas;
- Built-up or congested areas;
- Arterial and strategic roads;
- Areas not suitable for trenching (e.g. railway and main road crossings);
- Difficult hill crossings;
- Private land;
- Under sealed roads or accessways.

Open trenching through all roads shall be avoided where possible. Excavation by methods such as directional-boring, thrust-boring, micro-tunnelling, and pipe-jacking may be used in order to lessen the impact of the works on pavements and trees.

Submit the following, with the engineering drawings:

- How the required clearances from other services and obstructions will be achieved;
- The location of access pits and exit points;
- The depth at which the pipeline is to be laid and the tolerance on this, to ensure minimum cover is maintained;
- How pipe support and ground compaction will be addressed.

The Council may also request process details.

Where the developer proposes trenchless installation in road, railway or drainage reserve then this shall be submitted to the Council for approval. Note that additional approvals may also be required from the New Zealand Transport Agency and/or Ontrack for works in state highways and rail reserves, respectively. Carrier pipes may also be required in such situations.

7.10.6 Cover Over Pipes

The minimum cover to all mains from finished ground level shall be:

- 600 mm in berm, footpath or behind carriageway or kerb & channel;
- 750 mm under carriageways or areas where the Council proposes carriageways
- 1000 mm in all areas for strategic water mains such as delivery mains.

Where the minimum required cover is not available, specific design is required.

Special design considerations apply to the installation of pipes in streets with high crown and/or dish channels. These roads are likely to get reconstructed in future years, which usually results in a lower crown, hence pipes must be installed at greater depths so that the 750 mm cover is maintained after road reconstruction. To estimate future road levels, take spot levels along the property boundaries, which will most likely be the future crown level. Deduct 125 mm from that level to get the future kerb level. Install water mains with 750 mm cover over those future levels.

7.10.7 Working around Structures

Watermains that are located close to structures, such as foundations for brick walls and buildings, must be clear of the “zone of influence” of the structure’s foundations, to ensure that the stability of the structure is maintained and that excessive loads are not imposed on the watermain. Refer to the table below for guidance on minimum clearances from structures.

Table 7.10 Minimum clearance from structures

Nominal Pipe Diameter (mm)	Clearance to Wall or Building (mm)
<100	300
100-150	1000
200-300	1500
375	2000

Watermains that are constructed from metallic materials must not be located within 30 m, measured horizontally, of overhead electricity transmission towers having a voltage 66 kV or higher, especially if cathodic protection will be provided. Galvanic anodes for cathodic protection should be located away from the transmission lines or approximately midway between the transmission towers.

Deviate pipelines around obstructions by deflection at the pipe joints and with bends. If plastic pipes are used, the pipes may be cold bent, with minimum radii not less than 50 nominal diameters (PE pipes) or 300 diameters (PVC-U pipes), or as recommended by the manufacturer, whichever is the greater. The deflection angle permitted at a flexible joint must comply with the manufacturer's recommendation. Provide a detailed design, showing the route of the watermain around the obstructions.

7.10.8 Crossings

Wherever watermains cross under roads, railway lines, waterways, drainage reserves or underground services, make the crossing, as far as practicable, at right angles to the centreline of the road, railway lines, etc. Design and locate the main to minimise maintenance and crossing restoration work. Make all crossings of natural waterways below the invert level of the waterway.

Refer to section 7.10.6 regarding the minimum cover required over the pipe. Wherever pipelines are located under major infrastructure assets, carriageways, intersections or waterways, determine whether the pipeline may require mechanical protection or increased cover, or if different pipeline materials are needed for the crossing.

7.10.9 Above-ground Watermains

Include the design of pipeline supports and loading protection with the design of above ground watermains. Address any exposure conditions such as corrosion protection, potential for vandalism, UV protection and temperature re-rating.

7.10.10 Works within Road Reserve

For any works within a road reserve, the developer shall obtain a road opening permit from the Council. Refer also to WDC *Standard Specification – Road Openings* (QP-C843, attached to CoP Part 8: *Roading* as Appendix B).

For any temporary works within a road reserve, the developer shall meet the Council's requirements for temporary traffic management, which may include the submission of a traffic management plan to the Council for approval and prior to commencing work.

7.10.11 Valve Installation

All buried valves shall be installed with cast iron surface boxes such that the top of the spindle or handle is within 750 mm of the surface. Spindle extensions shall be provided where required.

Standard Drawing 600-406-C shall be referred to.

7.10.12 Hydrant Installation

Hydrants shall be:

- Mounted on Council approved hydrant tees, with risers if necessary, such that the top of the valve spindle is between 100 and 250 mm from the finished surface level;
- Identified with an H (75 mm high) cut into the top surface of the kerb (typically using a grinding wheel) and a 300 mm length of kerb painted yellow at that point.
- Marked in accordance with NZS 4501:1972, and include an approved blue coloured Raised Reflectorised Pavement Marker (RRPM) cemented to the carriageway surface by an approved adhesive. The RRPM shall be located adjacent to the centre of the base of the triangle.
- Provided with a surface box of a type approved by the Council. The box lid shall be painted using a yellow paint to be approved by the Council.
- Yellow circular clearance marking (in accordance with MOTSAM Section 4.07.03), shall be provided around fire hydrants that may be obstructed by park vehicles (as set out in SNZ 4509:2008 Appendix L3.1(c)).

Hydrants shall be raised on approved precast concrete sections from the level of the hydrant base flange and installed not to transfer loads to the reticulation. Construction shall accord with the requirements of NZS/BS 750: 1984 *Specification for Underground Fire Hydrants and Surface Box Frames and Covers* (refer also CoP Part 8 Roading 8.11.9 – *Road Markings*).

Standard Drawing 600-406-C shall be referred to.

7.11 TESTING & COMMISSIONING

7.11.1 Testing and Inspection

Mains shall be pressure tested, and sterilised prior to connection to the existing system. The developer shall obtain prior approval from the Council for the location of waste disinfection water.

Pressure Testing

After bedding and haunching, but prior to final backfilling, the developer shall make available for inspection:

- Each section of reticulation main.
- All fittings, anchors and thrust blocks.
- The reticulation for testing in the presence of the Council's representative. The pressure test may be undertaken simultaneously with the visual inspection.

Testing shall:

- Include visual inspection by the Council.
- Use water to the test pressure requirements approved by the Council.
- Successfully withstand a pressure test performed using the appropriate method set out in section CoP Part 3 section 3.8 – *Pipe Testing – Pressure.*

The developer shall supply all necessary test equipment and apparatus.

Sterilisation

Sterilisation of new water mains shall be carried out in accordance with Section 6 of the Waimakariri District Council Hygiene Code of Practice for Work on Public Water Supplies.

7.11.2 Connecting into Existing System

Prior to connecting into the Council water supply system, the applicant shall complete an 'Application for Approval to Connect to Council Water Infrastructure' (QS-U550-AC).

As part of this application, the application shall set out:

- Evidence that chlorination and pressure testing have been witnessed and acceptable results obtained.
- Methodology for connecting into the existing pipework.
- Qualifications of staff to be undertaking the cut-in.
- Details of affected customers to be notified.
- List of key parts to be used.
- Plan for flushing and commissioning the pipework following the cut-in.

A Council Water Unit staff member shall be present to oversee the connection, or they shall be engaged to undertake the connection.

7.12 AS-BUILT INFORMATION

Present as-built information which complies with CoP Part 12: *As-Builts* and this Part.

7.13 ASSOCIATED DOCUMENTS

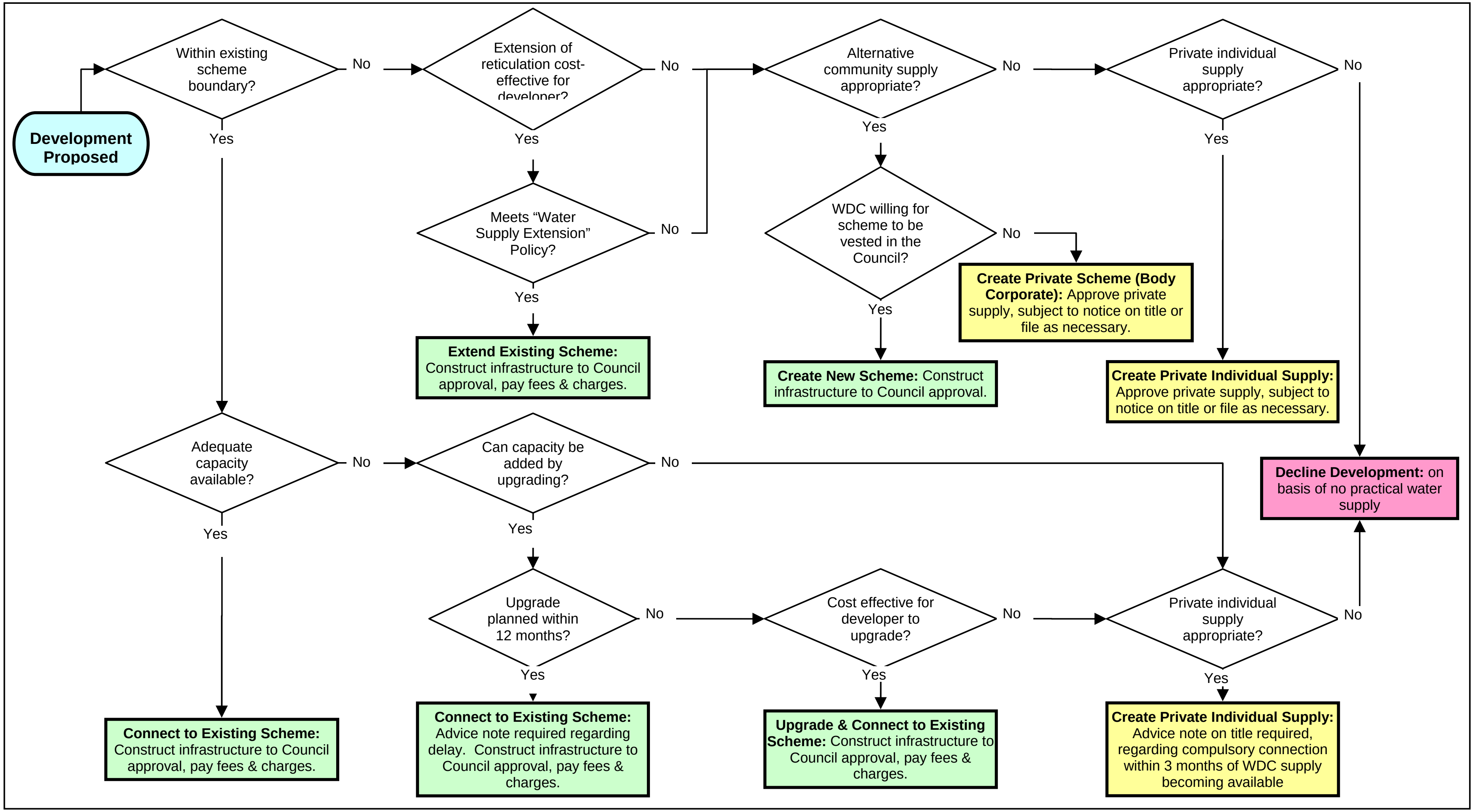
Appendix A Water Supply System Selection Flowchart (QP-C816-AA)

Appendix B Pipe Materials Selection (Water Supply – Pressure) (QP-C816-AB)

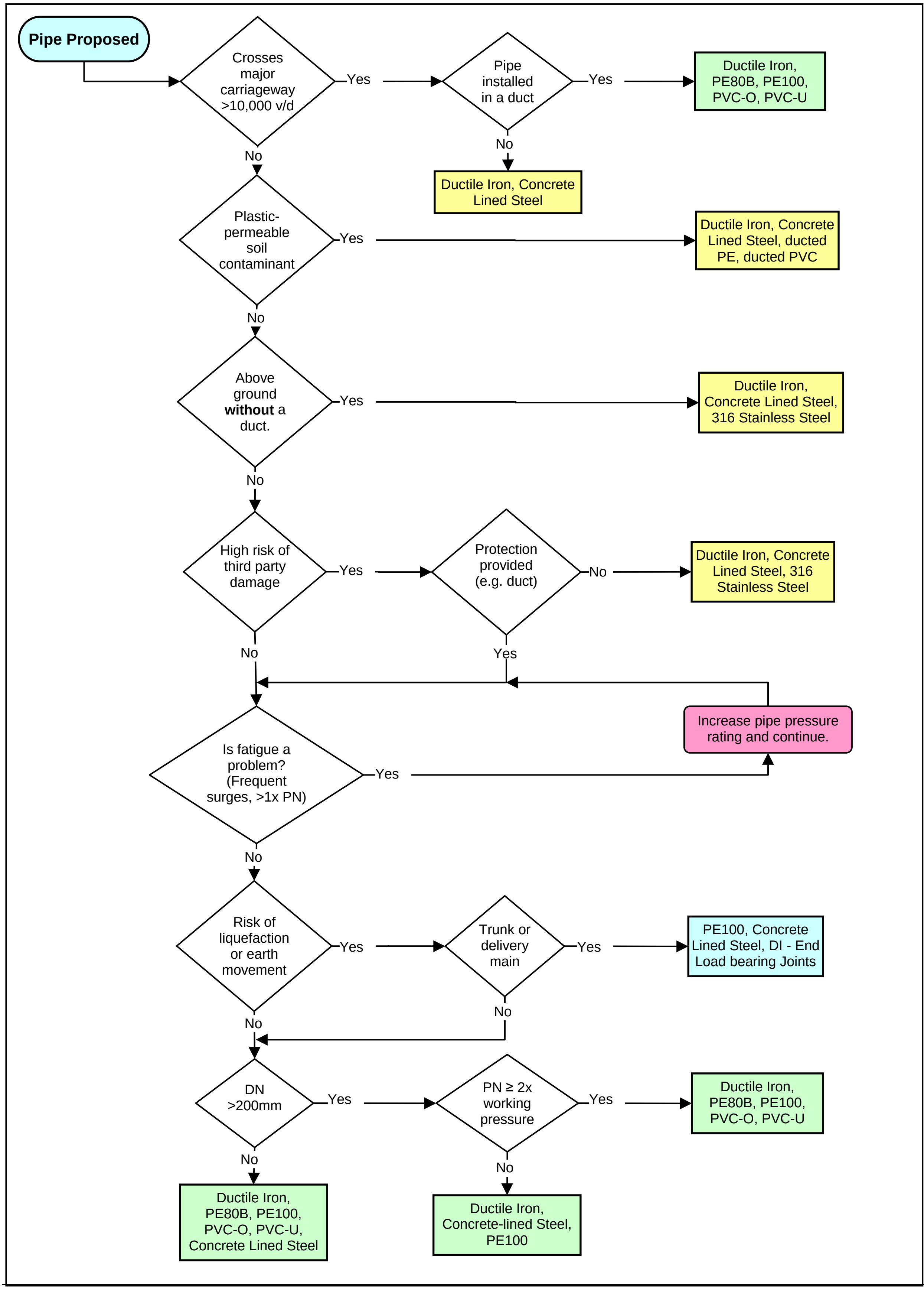
Appendix C Water Quality Testing (QP-C816-AC)

Appendix D Designing for Surge and Fatigue (QP-C841)

Water Supply Selection Methodology



Pipe Material Selection (Water – Pressure)



Chemical Quality of Potable Water

1. INTRODUCTION

Sampling and testing of the proposed water supply for both bacteriological and chemical quality shall be carried out in accordance with "Drinking Water Standards for New Zealand 2005 (Revised 2008)" by a laboratory that is IANZ registered or independently accredited by a recognised authority approved by the Council.

Samples from the water source shall be taken either by:

- The laboratory carrying out the analysis, or
- Waimakariri District Council staff, or
- Other agencies approved by the Waimakariri District Council.

2. CONTAMINANT LIMITS

The following tables are adapted from the New Zealand Drinking Water Standards 2005 (Revised 2008) (DWSNZ), and identify the maximum acceptable limits for potential contaminants. Where a contaminant is not shown here, refer to the DWSNZ. Note that where World Health Organisation Guideline values are based on 60 kg bodyweight, the DWSNZ uses 70 kg bodyweight. See the datasheets for calculations (WHO 2004).

DWSNZ Table 2.1 Maximum acceptable values (MAV) for microbial determinands

Micro-organism	MAV	Remarks
Escherichia coli (E. coli)	1 in 100mL of sample	Indicator organism
Viruses	-	No value has been set due to lack of reliable evidence
Total pathogenic protozoa	1 (oo)cyst per 100L	

NOTE: These are maximum acceptable values for regulatory purposes. They do not represent a dose/response relationship that can be used as the basis for determining acceptable concentrations of pathogens in drinking water.

DWSNZ Table 2.2 Maximum acceptable values (MAV) for inorganic determinands

Name	MAV	Remarks
Antimony	0.02	
Arsenic	0.01	For excess lifetime skin cancer risk of 6 x 10^{-4}. Provisional (analytical difficulties).
Barium	0.7	
Beryllium	0.004	Provisional (WHO has no guideline value but the DWSNZ has developed its own).
Boron	1.4	WHO guideline Provisional MAV is 0.5 mg/L
Bromate	0.01	For excess lifetime cancer risk of 7 x 10^{-5}. PMAV
Cadmium	0.004	
Chlorate	0.8	Provisional. Disinfection must never be compromised. Disinfection by-product (chlorine dioxide)
Chlorine	5	Free available chlorine expressed in mg/L as Cl_2. Concentrations of the substance at or below the health-based guideline value may affect the water's appearance, taste or odour. Disinfection must never be compromised
Chlorite	0.8	Expressed in mg/L as ClO_2. Provisional. Disinfection must never be compromised. DBP (chlorine dioxide)
Chromium	0.05	Provisional. Total. Limited information on health effects

Chemical Quality of Potable Water

Name	MAV	Remarks
Copper	2	Concentrations of the substance at or below the health-based guideline value may affect the water's appearance, taste or odour
Cyanide	0.08	Total cyanides
Cyanogen Chloride	0.08	Expressed in mg/L as CN. Total. Disinfection by-product (chloramination)
Fluoride	1.5	For oral health reasons the Ministry of Health recommends that the fluoride content for drinking-water in New Zealand be in the range of 0.7–1.0 mg/L.
Lead	0.01	
Lithium	1	Provisional (WHO has no guideline value but the DWSNZ has developed its own).
Manganese	0.4	Concentrations of the substance at or below the health-based guideline value may affect the water's appearance, taste or odour
Mercury	0.002	Total
Molybdenum	0.07	
Monochloramine	3	Disinfection by-product (chlorination)
Nickel	0.02	Provisional
Nitrate (short-term)	50	The sum of the ratio of the concentrations of nitrate and nitrite to each of their respective MAVs should not exceed one. The short-term exposure MAVs for nitrate and nitrite have been established to protect against methaemoglobinaemia in bottle-fed infants.
Nitrite (short-term)	3	
Nitrite (long-term)	0.2	Provisional (WHO has no guideline value but the DWSNZ has developed its own).
Selenium	0.01	
Silver	0.1	Provisional
Uranium	0.02	Provisional

DWSNZ Table A2.1 Guideline values (GVs) for aesthetic determinands

Name	GV	Units	Comments
pH	7.0-8.5		Should be between 7.0 and 8.0. Most waters with a low pH have a high plumbosolvency. Waters with a high pH have a soapy taste and feel. Prefer pH <8 for effective disinfection with chlorine.
Chloride	250	mg/L	Taste, corrosion
Sulphate	250	mg/L	Taste threshold
Iron	0.2	mg/L	Staining of laundry and sanitary ware
Turbidity	2.5	NTU	Appearance. For effective terminal disinfection, median turbidity <1 NTU, single sample <5 NTU. Note that this does not apply to source/treatment requirements and lower limits are required to comply with DWSNZ.
Conductivity	75	mS/m	Measured at 20°C
Absorbence	0.05		270nm, 1 cm cell
Colour	10	TSU	From absorbence 270nm
Total Hardness (as $CaCO_3$)	200	mg/L	High hardness causes scale deposition, scum formation. Low hardness (<100) may be more corrosive.
	100-300	mg/L	Taste threshold.

Chemical Quality of Potable Water

1. INTRODUCTION

Sampling and testing of the proposed water supply for both bacteriological and chemical quality shall be carried out in accordance with "Drinking Water Standards for New Zealand 2005 (Revised 2008)" by a laboratory that is IANZ registered or independently accredited by a recognised authority approved by the Council.

Samples from the water source shall be taken either by:

- The laboratory carrying out the analysis, or
- Waimakariri District Council staff, or
- Other agencies approved by the Waimakariri District Council.

2. CONTAMINANT LIMITS

The following tables are adapted from the New Zealand Drinking Water Standards 2005 (Revised 2008) (DWSNZ), and identify the maximum acceptable limits for potential contaminants. Where a contaminant is not shown here, refer to the DWSNZ. Note that where World Health Organisation Guideline values are based on 60 kg bodyweight, the DWSNZ uses 70 kg bodyweight. See the datasheets for calculations (WHO 2004).

DWSNZ Table 2.1 Maximum acceptable values (MAV) for microbial determinands

Micro-organism	MAV	Remarks
Escherichia coli (E. coli)	1 in 100mL of sample	Indicator organism
Viruses	-	No value has been set due to lack of reliable evidence
Total pathogenic protozoa	1 (oo)cyst per 100L	

NOTE: These are maximum acceptable values for regulatory purposes. They do not represent a dose/response relationship that can be used as the basis for determining acceptable concentrations of pathogens in drinking water.

DWSNZ Table 2.2 Maximum acceptable values (MAV) for inorganic determinands

Name	MAV	Remarks
Antimony	0.02	
Arsenic	0.01	For excess lifetime skin cancer risk of 6×10^{-4}. Provisional (analytical difficulties).
Barium	0.7	
Beryllium	0.004	Provisional (WHO has no guideline value but the DWSNZ has developed its own).
Boron	1.4	WHO guideline Provisional MAV is 0.5 mg/L
Bromate	0.01	For excess lifetime cancer risk of 7×10^{-5}. PMAV
Cadmium	0.004	
Chlorate	0.8	Provisional. Disinfection must never be compromised. Disinfection by-product (chlorine dioxide)
Chlorine	5	Free available chlorine expressed in mg/L as Cl_2. Concentrations of the substance at or below the health-based guideline value may affect the water's appearance, taste or odour. Disinfection must never be compromised
Chlorite	0.8	Expressed in mg/L as ClO_2. Provisional. Disinfection must never be compromised. DBP (chlorine dioxide)
Chromium	0.05	Provisional. Total. Limited information on health effects

Chemical Quality of Potable Water

Name	MAV	Remarks
Copper	2	Concentrations of the substance at or below the health-based guideline value may affect the water's appearance, taste or odour
Cyanide	0.08	Total cyanides
Cyanogen Chloride	0.08	Expressed in mg/L as CN. Total. Disinfection by-product (chloramination)
Fluoride	1.5	For oral health reasons the Ministry of Health recommends that the fluoride content for drinking-water in New Zealand be in the range of 0.7–1.0 mg/L.
Lead	0.01	
Lithium	1	Provisional (WHO has no guideline value but the DWSNZ has developed its own).
Manganese	0.4	Concentrations of the substance at or below the health-based guideline value may affect the water's appearance, taste or odour
Mercury	0.002	Total
Molybdenum	0.07	
Monochloramine	3	Disinfection by-product (chlorination)
Nickel	0.02	Provisional
Nitrate (short-term)	50	The sum of the ratio of the concentrations of nitrate and nitrite to each of their respective MAVs should not exceed one. The short-term exposure MAVs for nitrate and nitrite have been established to protect against methaemoglobinaemia in bottle-fed infants.
Nitrite (short-term)	3	
Nitrite (long-term)	0.2	Provisional (WHO has no guideline value but the DWSNZ has developed its own).
Selenium	0.01	
Silver	0.1	Provisional
Uranium	0.02	Provisional

DWSNZ Table A2.1 Guideline values (GVs) for aesthetic determinands

Name	GV	Units	Comments
pH	7.0-8.5		Should be between 7.0 and 8.0. Most waters with a low pH have a high plumbosolvency. Waters with a high pH have a soapy taste and feel. Prefer pH <8 for effective disinfection with chlorine.
Chloride	250	mg/L	Taste, corrosion
Sulphate	250	mg/L	Taste threshold
Iron	0.2	mg/L	Staining of laundry and sanitary ware
Turbidity	2.5	NTU	Appearance. For effective terminal disinfection, median turbidity <1 NTU, single sample <5 NTU. Note that this does not apply to source/treatment requirements and lower limits are required to comply with DWSNZ.
Conductivity	75	mS/m	Measured at 20°C
Absorbence	0.05		270nm, 1 cm cell
Colour	10	TSU	From absorbence 270nm
Total Hardness (as $CaCO_3$)	200	mg/L	High hardness causes scale deposition, scum formation. Low hardness (<100) may be more corrosive.
	100-300	mg/L	Taste threshold.

Designing for Surge & Fatigue

CONTENTS

TABLES

FIGURES

EQUATIONS

Designing for Surge & Fatigue

1. INTRODUCTION

All pipelines are subjected to pressure variations during their lifetimes. Some of these pipelines, e.g. rising mains, will experience significant and regular pressure surges, while others may be subjected only to minor diurnal pressure variations.

Rapid pressure fluctuations and surges generally result from events such as pump start-up and shutdown, or rapid closing or opening of valves, including "slamming" of air valves as can happen during venting of bulk air from pipelines.

For the purposes of the CoP, a pressure surge is defined as a rapid, short-term pressure variation. Surges are characterised by rapid, high-pressure rise rates, with minimal time spent at the peak pressure. Surge events usually consist of a number of diminishing pressure waves that cease within a few minutes.

The frequency and magnitude of the pressure transients affects the choice of pipe pressure class. Ensure that the following aspects are considered when designing for surges and fatigue:

- That the maximum and minimum pressures are within acceptable limits for the pipe and fittings for all surge events (including infrequent events such as power failure, emergency shut-down, rapid closure of fire hydrants);
- Consider the potential for fatigue and select the pipe pressure class accordingly, to allow for frequent repetitive pressure variations;
- The pipe and the quality of installation and their influence on the fatigue resistance of the pipe.

The following sections provide a methodology for dealing with surge and fatigue, so that pipes are adequately designed to provide the 100 year design life that is required.

The PIPA Guidelines may also be used, specifically the following:

- POP010A – Polyethylene Pressure Pipes Design for Dynamic Stresses
- POP101 – PVC Pressure Pipes Design for Dynamic Stresses

These may be found at http://www.pipa.com.au/Guidelines.html.

2. PRESSURE SURGE EVENTS

A surge analysis is required to check whether damaging pressure surges (or surges that could cause customer complaint) could occur in a system. The level of detail of the surge analysis should be appropriate to the pipeline. For example, a reticulation pipeline may require only consideration of rapid closure of fire hydrants and conservative selection of pipe pressure rating.

Pipelines that may be subjected to more severe surge effects e.g. rising mains, areas close to control valves (reservoir inlet valves and pressure reducing valves) and where specified by the Council, require a more detailed level of analysis, or the selection of pipe materials that are highly resistant to surge and fatigue issues.

The source(s) of significant pressure surges in a water system should be identified and included in any surge analysis. Mitigating measures may be needed to minimise any surges generated, and any surge control devices must be designed accordingly. As a minimum, such a surge analysis should consider:

- Identified causative scenarios (e.g. power failure, pump trip, component failure, air valve operation, rapid closure of valves);
- The highest pressure along the pipeline;
- The lowest pressure along the pipeline;
- Vacuum and air relief requirements along the pipeline under all conditions.

Note that non-slam air valves may be required on plastic pipelines, to minimise the risk of severe surges being generated by the movement of trapped air, and to minimise the potential for instantaneous “slamming” shut of a conventional air valve.

If, during the design phase, it is found that the minimum pressure in the mains could fall below atmospheric pressure during pressure surge events or drain down, mitigating measures must be designed to eliminate or minimise these effects. If negative pressures are a possibility, buckling of the pipe must be considered and a safety factor of at least 2.0 applied.

3. FATIGUE

Consideration of the effect of fatigue is particularly relevant to plastic pipes that are subjected to a large number of pressure cycles. Fatigue considerations can generally be ignored for ferrous pipe materials, e.g. ductile iron and concrete-lined steel. The important factors are the magnitude and frequency of the pressure fluctuations.

For fatigue loading situations, the maximum pressure reached in the pressure cycle must not exceed the nominal pressure rating of the pipe.

Fatigue does not need to be considered if the number of pressure cycles during the pipe's designed lifetime does not exceed the values below

Table 1 Critical number of surges in pipe lifetime

Pipe Material	Critical Number of Cycles in Lifetime
PVC-U, PVC-O	100,000
PE 80B, PE 100	300,000

The procedure for fatigue design is:

- confirm the design lifetime of pipeline (The pipeline design life must be taken as 100 years unless specified otherwise by the Council);
- estimate the likely number of pressure cycles during design life;
- calculate the range of pressure surges;
- calculate the fatigue load factor;
- determine the equivalent operating pressure;
- select the pipe PN rating.

Designing for Surge & Fatigue

4. NUMBER OF PRESSURE CYCLES

Calculate the expected number of cycles during the pipe's lifetime, based on realistic estimates of the number of pressure cycles per day or per hour. If the primary pressure variation is followed by a smaller number of pressure fluctuations on each cycle, as shown in Figure 1, the calculated number of cycles should be doubled.

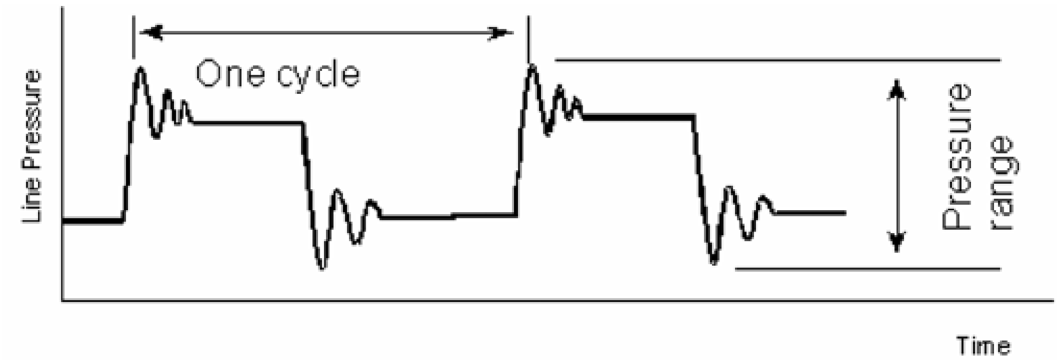


Figure 1 Pressure cycle and pressure range (from POP101 Figure 1)

The table below shows the number of pressure cycles over 100 years for various numbers of cycles per day and hour.

Table 2 Pressure cycles in 100 years for various numbers per hour and per day

Cycles Per Hour	Cycles Per Day	Total Number of Cycles in 100 Years
0.04	1	36,000
0.5	12	440,000
1	24	880,000
10	240	8,800,000
60	1440	52,500,000
120	2880	105,000,000

5. RANGE OF PRESSURE SURGES

Calculate the pressure range of the regular pressure variations by surge analysis. Figure 1 shows a typical cyclic pressure pattern. Where pumps are controlled by variable speed drives, select a pressure cycle that is most representative of the expected pipeline operation over its design life.

The effects of infrequent or accidental conditions, e.g. power or surge protection device failures may be ignored, provided the peak surge pressure does not exceed the values derived from Table 19.

Note that the pressure range will vary along the pipeline. Economies may be possible on some pipelines by dividing the pipeline into sections and evaluating the fatigue design for each, subject to the approval of the Council.

Designing for Surge & Fatigue

6. FATIGUE LOAD FACTOR

The fatigue load factors for plastic pipes are as shown below in Table 3 and Table 4

Table 3 Fatigue Load Factors for PE80B and PE100 (from POP010A Table 1)

Total Cycles	Cycles per day for 100 year life	PE80B	PE100
36,500	1	1.00	1.00
100,000	3	1.00	1.00
300,000	8	1.00	1.00
500,000	14	0.95	0.95
1,000,000	27	0.88	0.88
5,000,000	137	0.74	0.74
10,000,000	274	0.68	0.68
50,000,000	1370	0.57	0.57

Table 4 Fatigue Load Factors for PVC (from POP101 Table 1)

Total Cycles	Cycles per day for 100 year life	PVC-U	PVC-M	PVC-O
26,400	1	1.00	1.00	1.00
100,000	3	1.00	0.67	0.75
200,000	5.5	0.81	0.54	0.66
500,000	14	0.62	0.41	0.56
1,000,000	27	0.50	0.33	0.49
2,500,000	82	0.38	0.25	0.41
5,000,000	137	0.38	0.25	0.41
10,000,000	274	0.38	0.25	0.41

7. EQUIVALENT OPERATING PRESSURE

Calculate this using the following equation:

Equation 1 Equivalent operating pressure

$$P_{eo} = \frac{\Delta P}{FLF}$$

where:	P_{eo}	= Equivalent operating pressure (bar)
	ΔP	= Cyclic pressure range (bar) (refer Figure 5)
	FLF	= Fatigue Load Factor (refer Figure 6)

8. PIPE PRESSURE RATING

The specified pipe pressure rating (PN) must exceed both the equivalent operating pressure, P_{eo} and the maximum operating pressure for the system.

WAIMAKARIRI
DISTRICT COUNCIL

ENGINEERING CODE OF PRACTICE

PART EIGHT

ROADING

April 2009

Part 8: Roading

CONTENTS

Part 8: Roading

Part 8: Roading

TABLES

FIGURES

Part 8: Roading

8.1 INTRODUCTION

This Part of the CoP provides guidelines and standards as a basis for designing streets, and other access linkages, that not only function well but are also appropriate and safe environments.

This Part is not intended to be a detailed design guide or to replace the need for traffic and pavement engineering expertise in some areas of the design process. The standards included in this Part are one way of achieving the desired outcomes and performance criteria of the network components described below.

8.1.1 Philosophy

Access to, and within, areas to be developed includes more than the road network constructed to provide formal access to properties. It also includes public transport access and purpose-built green linkages that provide for pedestrians and cyclists to use areas such as reserves and waterways.

These linkages need to reflect desire lines, within and outside the area, and make the area attractive so that people are encouraged to walk or cycle rather than use their car where practicable, particularly for shorter local trips. When this can be achieved, it results in energy savings and creates a safer and more pleasant neighbourhood.

Urban streets can serve a wide range of functions, whilst providing valuable and unique areas of community space (see Figure 8.1). Use the design process to challenge the assumption that motor vehicles have "automatic" priority (particularly on local roads) and consider all the demands and functions of the street space, in order to achieve a better balance for all those who use it.

This Council supports the "Living Streets" concept developed by the Christchurch City Council (CCC). Information about creating Living Streets is available on the CCC website.

Roads through rural communities tend to serve both low-speed and high-speed traffic. Pedestrians, cyclists, horse riders and moving stock should be allowed for in the design, as well as motor vehicles. Where vehicles are rare, the tendency to consider the road as open space increases. Combined with higher speed limits, this means that providing good sight-lines and clear zones become even more important. Rural roads often have a lower level-of-service requirement than urban streets, but this should not be allowed to reduce safety.

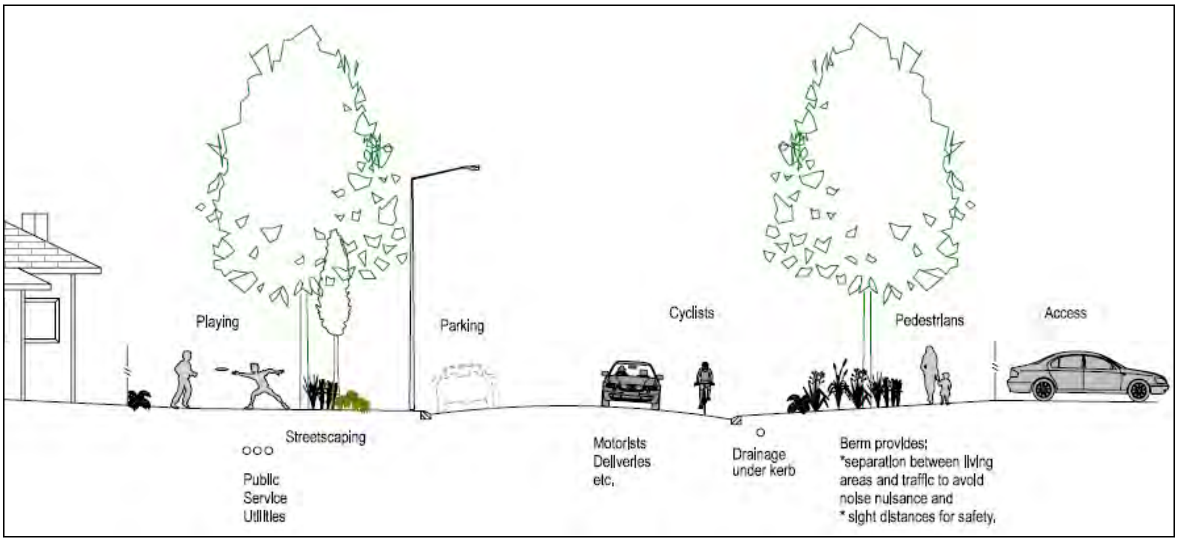


Figure 8.1 Street Functions

Part 8: Roading

The Council encourages innovative design, for access and roading, which satisfies the following objectives:

- Safe – the layout must be safe for pedestrians, cyclists, public transport and motorists;
- Secure – the design of the roads and other linkages must not compromise the personal security of the users;
- Energy efficient – the layout should minimise the number and length of vehicle trips and promote alternatives to motor vehicle use;
- Linked – the layout of a development should be extended on a hierarchical network basis for all modes. In particular, good traffic permeability is important in a development. It should promote walking and cycling, particularly for short trips to local facilities, and should provide direct access to public transport routes. Linkages to existing areas of development must also be provided.
- Suitable traffic speeds – the road design must encourage traffic speeds that are appropriate for the road classification and context;
- Comprehensible – the road layout must be easy to read and follow, for both residents and visitors;
- Enhances environment – the road design should incorporate carriageway and residential stormwater quality improvements or design features as part of the grass berm design e.g. encouraging sheet flow over grass berms, swales protected from traffic use;
- Attractive – the design of the street landscaping and other features can add significantly to the amenity, environment and character of the area.

In addition, the different purposes of roads in the hierarchy should be appropriately considered. Generally, access onto roads with higher classifications should be limited.

Where the above objectives may be achieved through other mechanisms, the Council may reconsider applying the specific requirements of this part of the CoP to a development.

Be familiar with the following documents when considering the design of the development:

- ECan *Regional Land Transport Strategy*
- WDC *Parking Bylaw*
- WDC *Walking and Cycling Strategy*
- WDC *Road Safety Strategy*
- NZS 4121:2001 *Design for Access and Mobility: Buildings and Associated Facilities*
- AS/NZS 1158 *Lighting for roads and public spaces – series*

8.2 CONSENT AND COMPLIANCE ISSUES

The consent and compliance information set out in Part 2: *General Requirements* applies to all works within the Waimakariri District, with the addition of the clauses below.

8.2.1 Legislation

The Land Transport Act 1998 and amendments is the principal statute that controls roads and highways.

All traffic control devices, as defined in the Land Transport Act, on roads and rights of way, must comply with the:

- Land Transport Management Act (2003)
- Land Transport Act (1998);
- Traffic Regulations (1976);
- Land Transport NZ *Traffic Control Devices Rule*;

8.2.2 District Council Requirements

Requirements in all bylaws relating to traffic and roadworks must be met. New roads require approval from the District Council, which is generally granted as part of the standard subdivision consent.

8.3 QUALITY ASSURANCE REQUIREMENTS AND RECORDS

Provide quality assurance records that comply with the requirements in CoP Part 3: *Quality Assurance*, during design and throughout construction.

8.3.1 The Designer

The designer of all road networks that are to be taken over by Waimakariri District Council must be suitably experienced.

The design reviewer must have at least equivalent experience to the designer.

8.3.2 Design Report

Provide the following information as a minimum, to support the engineering drawings and Design Report:

- A clear description of the purpose of the work;
- Transport infrastructure and services issues (e.g. vehicle, cycle, public transport, pedestrian);
- Traffic-loading, traffic modelling and volume data and projections used and calculations;
- Geometric data;
- Geotechnical data, including subgrade information and CBR's;
- Pavement design methodologies used and corresponding metalcourse calculations;
- Surface treatments;
- Road drainage control and edge treatment;
- Hydraulic data (e.g. road level, flood level);
- Slope retention;
- Utility services conflicts and programmed work issues;
- Preliminary traffic safety audits;
- Streetscape and amenity features;
- All assumptions used as a basis for calculations;
- Details of investigations such as ground water levels, profiles, infiltration testing and effects on the environment and geological or water quality assessments.
- All options considered and the reason for choosing the submitted design;

8.3.3 Safety Audit

A safety audit of the design for all roading, pedestrian and cycle facilities should be undertaken by an independent qualified road safety auditor, and submitted as part of the design. Safety auditors should be totally independent of the project team and must be appointed separately from the professional services contract for the project development. The safety audit provides a check that the proposed design is safe and complies with all of the legal requirements for road marking, lighting and signage.

A safety audit of the constructed asset must also be undertaken by a qualified road safety auditor and submitted as part of the As-Built record.

Carry out safety audits in accordance with the Land Transport New Zealand Guideline *Road Safety Audit Procedures for Projects*. Use the Austroads *Guide to Traffic Engineering Practice, Part 4: Treatment of Crash Locations,* for safe design practices.

8.3.4 Construction Records

Provide the information detailed in CoP Part 3: *Quality Assurance* and the CCC *Construction Standard Specifications (CSS)*, including where applicable:

- Material specification compliance test results;
- Subgrade test results and corresponding recalculations of metalcourse depths;
- Compaction test results;
- Benkelman Beam test results;
- Surface profile test results i.e. NAASRA/International Roughness Index;
- Surface texture test results;
- Concrete or asphalt core test results;

8.3.5 Post-Construction Records

Provide the information detailed in CoP Part 3: *Quality Assurance*, CoP Part 12: *As-Builts*, and CCC *CSS Parts 1-7*, including where applicable:

- Design report
- Completion certificates;
- Producer statements – design, construction, construction review
- Post-construction safety audit;
- Commissioning report, including all test results
- As-built plans and records

8.3.6 Approved Materials

All materials shall comply with the appropriate standards and with manufacturer's requirements.

8.4 ROAD CLASSIFICATION

The road network is the system of interconnected road links that provides for the movement needs of people and goods, property access and servicing needs. It is usually arranged and operated in a manner to recognise and best serve the varying demands expected of different elements (usually using a hierarchical classification system). Developments must provide road networks internally to achieve these purposes, and connect appropriately to the existing network.

The length and arrangement of these roads within the development, and connections to the existing network, determine the amount of traffic each element is likely to carry and the role it plays in providing for property access or longer journeys.

The traffic volume, surrounding land uses and the function of each link, determines its classification, and therefore its geometric characteristics and preferred speed regime. The classification of existing roads within the District is listed in the *District Plan*, plans 135-137.

Be aware of any local area traffic management schemes or neighbourhood improvement plans which may incorporate street requirements for the area.

8.4.1 Strategic Roads

Strategic roads are generally present, former or proposed State Highway roads serving as the main traffic routes into, through and out of the District. They are constructed and managed to minimise their local access function

These roads must be designed in conjunction with the appropriate roading authority. Discuss access to the existing road network with the Council and Transit New Zealand (if a State Highway will be affected) at the consent stage. Use the TNZ *Planning Policy Manual* for the design of any works on or adjacent to a state highway.

8.4.2 Arterial Roads

Arterial roads cater primarily for traffic movement feeding onto the strategic roads. They are constructed and managed to minimise their local access function.

These roads must be designed in conjunction with the appropriate roading authority. Discuss access to the existing road network with the Council and Transit New Zealand at the consent stage, if a State Highway will be affected. Use the TNZ *Planning Policy Manual* for the design of any works on or adjacent to a state highway.

8.4.3 Collector Roads

Collector roads are generally the preferred route for travel within the District, between areas of population and principal activities. The function of collector roads is to provide the link between the local roads and the strategic/arterial roads.

In the urban area, collector roads usually have predominantly residential frontage and will often contain the bus routes within the neighbourhood. A speed environment of up to 50 km/h is expected.

8.4.4 Local Roads

The primary purpose of local roads is to provide access to properties and other local streets. Their design should encourage a low speed environment of 30-40 km/h, and provide a safe environment for pedestrians and cyclists. These roads are likely to be close to areas of demand such as shops and schools.

Local roads should not generally connect to strategic or arterial roads, except in exceptional circumstances and with the Council's approval.

8.4.5 Traffic Volumes

Identify the likely volumes of traffic that will be generated by a development, using the following average household trip generation rates:

Table 8.1 Household trip generation rates

Areas	Trips/Household/Day
Urban areas	10
Rural areas	8

If surveyed data is available for areas with similar characteristics, use this in preference to the values above, due to the variation in generation rates throughout the District.

Where not specified by the Council, use the expected traffic volume to decide on the appropriate classification of roads within the development area, according to the recommended daily flows as outlined in the *District Plan*.

8.5 SPEED ENVIRONMENT

The speed environment of roads can have a huge impact on the actual and perceived safety of the facilities; therefore it is important to design for the appropriate speed of the roads involved. Determine the speed environment for the road classification based on the Land Transport Rule *Setting Speed Limits*.

This should be done first as it is the primary design control. All other factors relate to and can reinforce the design speed e.g. road alignment, width, intersection location and treatment, landscaping. Ensure that the speed environment is consistent along the road section.

Traffic management devices should not be installed where the speed environment does not require alteration. Use the flow chart in Figure 8.2 for determining alternative design options.

Traffic speed for lower speed environments may be controlled, so that it is conducive to a mixed use street environment and function, through a variety of means:

- Roadway width – a narrow roadway may provide space for only one vehicle at a time. Parked vehicles reduce the available space for moving vehicles so that there may only be a single usable lane. If cyclists use the road, their presence may control the traffic speed and the design requirements of the road.
- Landscaping – appropriately designed on-street landscaping can visually narrow the road. It can also be used with changes to the kerb alignment to physically narrow the roadway.
- Corners – the use and spacing of tight corners to maintain short lengths of straight road makes it difficult to gain speed.
- Intersection spacing – short lengths of road between intersections make it difficult to reach high speeds.
- Intersection design – tight kerb radii force motorists to slow down when entering an intersection. This can be combined with an intersection treatment (e.g. change in road width or surfacing) to indicate a change in the speed environment to drivers.
- Traffic calming – localised road narrowing, changes in road texture, changes in the road alignment (both horizontal and vertical) can all be used to reduce speeds on local roads and to create safe crossing points for pedestrians and cyclists.
- Rural thresholds – localised narrowing of the road through kerbs, road markings, signage and/or roadside planting can provide a signal to drivers that they are entering a residential area with lower speed limits.

Find standards for the design of higher speed environments, such as are appropriate on various classified and rural roads, in the *Austroads* series and TNZ manuals.

Part 8: Roading

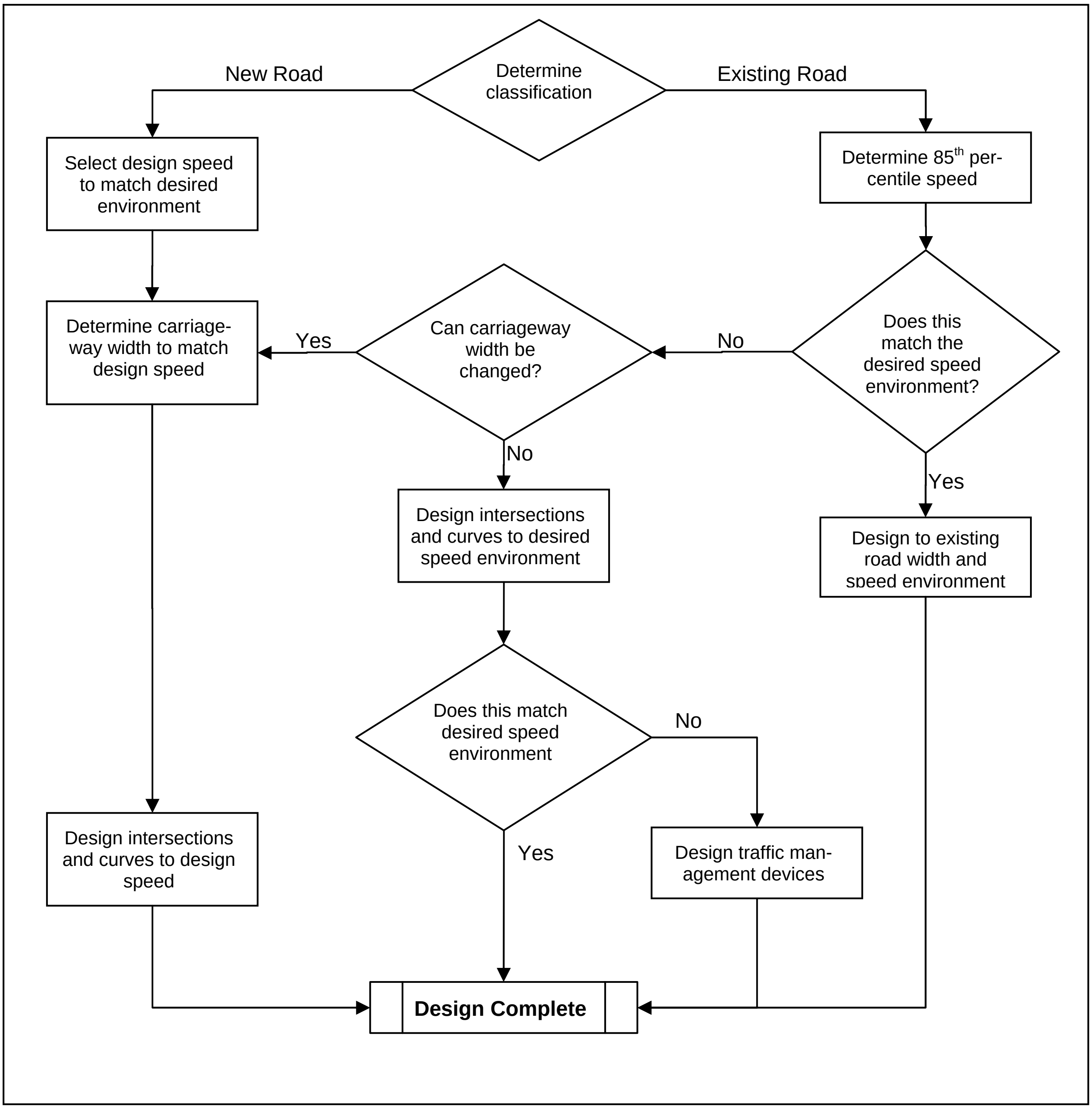


Figure 8.2 Application of traffic management

8.6 ROAD DESIGN

Areas that require particular attention during road design are:

- Speed environment;
- Intersection design and spacing;
- Pavement design;
- Connections and intersections with the existing transport network;
- Bus movement requirements and bus stop locations and facilities;
- Pedestrian and cycle facilities;
- Parking requirements;
- Road crossings for pedestrians;
- The connection of off-road facilities to roads and property access;
- Lighting;
- Road surfacing.

Consider life cycle costs and benefits for all new road elements. When choosing materials in particular, consider the replacement and maintenance cost whilst ensuring levels of service are met.

8.6.1 Access to Existing Roads

Discuss access to the existing road network with the Council, and also Transit New Zealand, if a State Highway is to be affected.

The safety and efficiency of the existing roads must be protected, when considering connections or accesses from the development.

8.6.2 Culs-de-sac / Hammerheads / No-Exit streets

Culs-de-sac can provide pleasant residential environments with little traffic and a sense of community. However, if they are used to excess they can lead to:

- A loss of comprehensibility;
- Inadequate linkage with existing roads;
- No opportunity to link with future roads;
- Inefficient layout of roads and other linkages;
- The discouragement of walking, cycling and public transport use;
- Poor public passenger transport route structures and accessibility;
- The loss of emergency vehicle access, in some situations.

Therefore a balanced approach to their use is required.

The length of culs-de-sac should be no longer than 150 m.

Where possible, provide walking and/or cycling linkages at the end of culs-de-sac to parks, reserves or other roads. When designing large cul-de-sac heads, consider incorporating islands or other measures to break up large expanses of seal. Surface all turning heads and hammerheads with asphaltic concrete.

Cul-de-sac heads that conform to NZS 4404:2004 (Clause 3.3.9) are acceptable.

8.6.3 Parking

Provide parking on all roads, with improved facilities in business areas. Widths for parking lanes vary from 2.5 m minimum to 3.0 m for high turnover areas. The off-street parking requirements for various activities are listed in the *District Plan*. Refer also to the WDC *Parking Bylaw.*

Wherever on-street parking in residential areas is provided in bays, rather than as part of the carriageway, it should be at the minimum rate of one space per three residential units and evenly distributed along the street. Construct all parking bays to the same standard as the adjacent road pavement and with a minimum width of 2.5 m for parallel parking.

When parking bays are located in front of properties, consider the possible location of the property access, which may need restriction by a Consent Notice.

Marking is required for all angle parking and where parking restrictions are in place. There will also be other circumstances where roadmarking of parking is advisable e.g. outside schools and on arterial or strategic roads.

8.7 GEOMETRIC DESIGN

8.7.1 Design Speed

Roads classified as higher than a local road are typically designed to a higher speed than local roads. Austroads *Urban Road Design* states that major urban roads should be designed for an operating speed 10 km/h above the legal speed limit. The desired speed environment or target speed for local urban roads may determine the design speed. Refer to Austroads *Part 10: Local Area Traffic Management* clause 4.3.

Austroads *Rural Road Design* states that rural roads should be designed for the 85th percentile operating speed.

The *Speed Limits Bylaw* sets out the speed limits for the listed roads.

8.7.2 Horizontal Alignment

Design the elements of the road network for the appropriate design speed.

Design intersections to meet the tracking curve requirements in the Land Transport NZ *On Road Tracking Curves for Heavy Vehicles* (RTS 18). Pedestrian crossing distances must be minimised at local road intersections.

A design vehicle shall be used of selected dimensions and turning characteristics representative of the 90th percentile vehicle (i.e. the vehicle for which only 10% of vehicles in its category have more critical dimensions).

Table 8.2 Vehicle Types Road Classification

Road Classification	Vehicle Type	Minimum Turning Radius (m)
Strategic and Arterial	B Train	12.5
Collector & Urban Collector	Semi trailer HCV	12.5
Local & Cul-de-sac	Single unit HCV	10.0

Avoid reverse curves where possible. If they are necessary, balance and separate them by a sufficient length of straight road to allow for a satisfactory rate of superelevation reversal (where the design speed is greater than 50 km/h).

Curves in the same direction in close proximity must be compounded. Avoid “broken back” effects.

Where horizontal curves of less than 60 m radius are necessary for topographical or other reasons, extra widening of between 0.5 and 1.5 m may be required, according to the width of carriageway available to moving traffic, the radius of the curve and the classification of the street. Austroads *Urban Road Design* Table 8.7 provides further information to calculate this extra widening.

Generally, horizontal curves shall conform to either Austroads *Urban Road Design* or *Rural Road Design*, as appropriate.

8.7.3 Vertical Alignment

Gradient lengths must be as long as possible, with vertical curves provided in compliance with Austroads *Urban Road Design* or *Rural Road Design*, where necessary.

Gradients at any point on the kerb line should comply with the following:

- No steeper than 1:6; and
- No shallower than 1:500, and
- No shallower than 1:300 on the outside kerb line of any curve.

Kerb grades less than 1:500 may be acceptable in conjunction with underchannel piping or frequent stormwater outfalls.

Wherever the change of gradient exceeds 1%, join the change with appropriate vertical curves of not less than 30 m for through roads and 20 m in culs-de-sac.

Design the crown line at intersections to ensure a smooth ride on the main road. Normally, this means running the crown of the minor road into the nearside edge of the main road lane line or quarter point.

8.7.4 Crossfalls

Normal carriageway crossfalls should be 3% for urban roads, and formed as per Austroads guidelines.

Some variation from this requirement may be necessary in cases where a differential level between kerb lines is adopted and/or the crown is offset from the centreline.

Design turning circles to avoid an excessive differential between the crown and edge of seal. Minimum crossfall must be 2% for asphaltic concrete and 2.5% for chipseal. Wherever an off-centre cul-de-sac head is used offset the road crown to create symmetrical crossfall conditions.

Generally, crossfall should not exceed 6%, when measured from the carriageway edge to the crown.

Transitions from sealed to unsealed roads shall be constructed so that the crossfall on the metal road is never less than 1^{V}: 20^{H} (5%). The transition from the sealed crossfall to metal crossfall shall be taken up in a 20 m transition section of only the sealed carriageway.

8.7.5 Superelevation

Normally superelevation is not applied to urban roads. For speed limits over 50 km/h, specific design of superelevation will be required. Where superelevation is required, it shall be applied in accordance with Austroads guidelines.

8.7.6 Cross-section Design

Provide carriageway and legal road widths that comply with Table 8.3. Design these widths as part of an optimal road cross-section, to achieve the following objectives:

- Minimise the capital costs of construction by not exceeding the desirable widths for high cost elements like carriageway, cycleway and footpath;
- Minimise the ongoing maintenance costs by designing and constructing elements to achieve their design life;
- Provide all the specified roadway elements;
- Reinforce the speed environment through appropriate lane and carriageway widths;
- Provide an attractive streetscape, adding to the amenity and character of the area;
- Facilitate a safe, efficient and effective drainage system by ensuring that the new works do not detrimentally affect the existing drainage pattern or road users;
- Provide a safe layout for all users.

When proposing narrower widths or where all elements may not be provided, carefully consider the reasons and balance them against the above objectives. Detail the non-conformances, including the process of trading off these objectives to arrive at the non-complying design widths, as part of the Design Report.

Table 8.3 Road Design Attributes by Zone (from Table 30.1, District Plan)

Road Type	Strategic		Arterial		Collector/Urban Collector		Local		Cul-de-sac	
Zone	Rural	Res & Bus	Rural	Res & Bus	Rural	Res & Bus	Rural	Res & Bus	Rural	Res & Bus
Min. width of road (m)		30	20	20	20	20	20	16	20	16
Min. lane width (m)	3.5	3.5	3.7	3.3	3.5	3.3	3	3	3	3
No. of lanes	2	2	2	2	2	2	2	2	2	2
Parking lanes width (m)	-	2.5	-	2.5	-	2.5	-	2	-	2
Min. no. of parking lanes	-	2	-	2	-	2	-	1	-	1
Min. sealed shoulders width (m)	1.5	-	0.75	-	-	-	-	-	-	-
Min. footpath width (m)	-	1.5	-	1.5	-	1.5	-	1.5	-	1.5
Min. no. of footpaths	-	2	-	2	-	2	-	Res = 1 Bus 1 = 1 Bus 2 = 2 Bus 3 = 0	-	2
No. of Cycleways	2	2	2	2	2	2	-	-	-	-

8.7.7 Rural Road Shoulders

Shoulders on rural roads shall be in accordance with Table 8.5. Make an allowance for off-road parking areas on roads with 1.0 m shoulders.

Table 8.4 Shoulder Width

Design Traffic Volume (AADT)	Formed Widths (m)	Sealed widths (m)
Single lane road <150vpd	2.0	0.5
<500	1.5	0.5
500-1000	1.5	0.5
>1000	2.0	1.0
>3000	2.0 – 2.5	1.5

Sealing of the shoulder varies from 0.5 – 1.5 m, depending on traffic volumes and site conditions. Mark edgelines to prevent shoulders being incorporated in the traffic lane. On local rural roads, the shoulder widths may be determined by the width required to provide cycle facilities.

8.7.8 Medians

The *District Plan* sets out requirements for the installation of medians.

Determining median widths is typically dictated by the function of the median and intersection details. Austroads *Urban Road Design* clause 12.6 provides guidance on median functions, types and widths.

Flush medians may be used for roads in urban areas that have speed restrictions of 70 km/h or less. Flush median uses include provision for right turning traffic to leave through lanes to queue and also for pedestrian refuge points. Splitter islands shall be provided where required by the Council.

8.7.9 Hill-side Construction

Where the road is or will be constructed on a slope, this can affect the ability to provide all the required elements of a streetscape and therefore impact on the achievable widths for some or all of those elements. Consider batter stability and property access, in addition to issues detailed in clause 8.7.6 – *Cross-section Design*.

Options available for hillside construction:

- Design narrower legal road widths. Wider widths may be impractical as it may be impossible to utilise more than a certain width due to crossfall restrictions. Property access may also be compromised if wide roads require high cuts or retaining walls.
- Use localised widening to construct passing or parking bays or to accommodate heavy vehicles.
- Provide a lesser standard of elements; through restricted parking, constructing only one footpath or combining elements e.g. shared cycle paths and footpaths.
- Construct retaining walls.
- Locate pedestrian and cycle facilities separately from the carriageway.

8.8 INTERSECTION DESIGN

The potential for crashes to occur at intersections is higher than other areas of the road network, due to the number of conflicting vehicle, cycle and pedestrian movements. Proper design of intersections can reduce the number of conflicts, while providing for a range of turning movements.

Consider traffic safety issues due to the location of existing above-ground structures e.g. poles or trees, at the time of design.

Use the following standards and guidelines for the design and operation of intersections and driveways:

- Austroads *Guide to Traffic Engineering, Part 5: Intersections at Grade*
- Land Transport NZ *Guidelines for the Implementation of Traffic Controls at Cross Roads*, RTS 1
- Christchurch City Council, *CSS: Parts 1-7*
- Waimakariri District Council Standard Drawings 600-260A/B through to 600-263A/B

8.8.1 Comprehensibility

Comprehensibility of the network improves the ease with which people can negotiate their way through and around an area.

Generally, the geometry of any road intersection should be designed so that the major route is the through road and has traffic priority. Wherever the roads are of equal classification or one classification different, a roundabout may be used. This can also limit vehicle speeds. Wherever a local road intersects with a higher classified road, a perimeter threshold treatment may be appropriate to reinforce traffic priority and assist with comprehending the layout.

Improve comprehension by designing each classification of road to reflect its function, through consistency of appearance, width and geometric design of the road; e.g. the main arterial roads may have a central median. Reduce confusion by minimising the use of culs-de-sac and, in particular, culs-de-sac accessing other culs-de-sac. See clause 8.6.2 above.

8.8.2 Intersection Types and Controls

To support the safety and efficiency of the road network, roads should preferably only intersect if they are classified the same or are one level different in status. If it is unavoidable that roads two classification levels or more apart must intersect, then the Council may consider movement controls such as left in/out only or entry only.

Within new residential areas, appropriate intersection types include:

- Priority, roundabout or signal controlled T or Y-intersections (3-way), depending on the balance of traffic flows and classification of the approach roads. All approach legs to Y junctions should be separated by 120 degrees and T junctions by 90, 90 and 180 degrees.
- Roundabouts shall be considered for use in four-way intersections at grade, due to the high crash risk. Local roads should not intersect with the main road network as cross roads and should only form cross junctions with themselves where necessary. Where unavoidable and a reasonable volume of traffic across the busier road is anticipated, offset the quieter roads as a left – right stagger, to minimise the risk of crashes.

Wherever traffic from the planned roading network for a development will access a collector, arterial or strategic road, the intersection may require roundabout or traffic signal control or have certain movements restricted. Consult with the Council before submitting engineering drawings, to ensure that the intersection conforms to the Council's requirements.

8.8.3 Unsignalised Urban Intersection Spacing

Locate intersections sufficiently far apart to separate their traffic movements and provide drivers with sufficient lead-time for decision making. The minimum spacing requirements must in accordance with the District Plan. Discuss spacings for major intersections with the Council before engineering drawings are submitted.

8.8.4 Sight Distances

Adequate sight distances at an intersection must be provided as sight distance is fundamental to safe intersection design. When designing intersections and/or small radius curves use Austroads *Guide to Traffic Engineering, Part 5: Intersections at Grade*, which provides guidance on the minimum sight distance requirements.

8.8.5 Traffic Control Signage

When signs are used within the road corridor, they must comply with the following standards and guidelines:

- TNZ & Land Transport NZ *Manual of Traffic Signs and Markings Part 1*
- Land Transport NZ *Guidelines for Street Name Signs*, RTS 2
- Land Transport NZ *Road Signs and Markings for Railway Level Crossings*, RTS 10
- NZS 8603:2005 *Design and application of outdoor recreation symbols*
- RSMA *Compliance Standard for Traffic Signs*
- Christchurch City Council, *CSS: Parts 1-7*
- Land Transport Rule *Setting of Speed Limits* 2003
- Waimakariri District Council *Parking Bylaw* (2007)
- Waimakariri District Council *Guidelines for Street Name Blades*

Ensure that reconstruction projects include the relocation of the street name sign, if the works make its old position inappropriate.

Regulatory signage, as detailed in MOTSAM shall be provided in all the circumstances described in that manual. All roads shall have other signage appropriate to their hierarchical classification.

The following shall be indicated by appropriate signage:

- Bridges: Bridge End Markers shall be located at bridge ends and not behind a kerb
- Culverts: Culvert ends within the road reserve and not behind kerbs shall be indicated by the use of Bridge End Markers. These shall be located at the ends of the culvert or no further than 2 m from the edge of the carriageway
- Curves with a design speed 15 km/h or more below the legally permitted speed: as required by MOTSAM.

8.8.6 Traffic Signals

If the road controlling authority decides that traffic signals are necessary to provide safe and efficient access to the area, use the guidelines in the Austroads *Guide to Traffic Engineering Practice, Part 7: Traffic Signals* for the design and operation of the traffic signals. The location and design of each installation must conform to the requirements and approvals set by the Council, to enable coordination of the traffic signals.

8.8.7 Roundabouts

Roundabouts provide control at intersections with 3 or more intersecting roads in a variety of circumstances e.g. they can control speeds or improve traffic flows. Their location must be agreed with the Council at the consent stage.

Consider these issues in the design: the classification of the intersecting roads; the vehicle types expected to use the intersection; the speed environment; the distribution of turning traffic; pedestrian and cyclist safety; landscaping; heavy vehicle access requirements.

Roundabouts at the intersection of local roads can be used to control speeds, and may be designed with semi-mountable aprons for effective traffic calming. The semi-mountable apron slows cars (it must be high enough to discourage drivers from over-running it), whilst providing for the larger turning requirements of vehicles such as rubbish trucks and emergency vehicles. Discuss the geometric design of such roundabouts with the Council.

Use the following standards and guidelines for the design and operation of roundabouts:

- Austroads *Guide to Traffic Engineering, Part 6: Roundabouts*
- Austroads *Guide to Traffic Engineering, Part 13: Pedestrians*
- Austroads *Guide to Traffic Engineering, Part 14: Bicycles*
- Christchurch City Council, *CSS: Parts 1-7*

Refer to CoP Part 10 clause 10.4.3.5 – *Protection of Sightlines*.

8.9 PAVEMENT DESIGN

8.9.1 Pavement and Surface Treatment Design

Design roads to preferably be flexible pavements, with a 50-year life, using the general principles of the current New Zealand Supplement of the Austroads *Pavement Design Manual.* Projected traffic growth volumes shall be calculated based on the existing traffic volumes, available from the Waimakariri District Council, and using an agreed rate of growth.

All roading and private access rights of way must comply with the Benkelman Beam criteria shown in Table 8.5. See CCC *CSS: Part 6* for more detail on analysing test results.

Table 8.5 Benkelman Beam criteria

Traffic Loadings (heavy vehicles/day)	95% of readings (mm)	Maximum (mm)
>500	<1.2	1.5
100-499	<1.6	2.0
<99	<2.0	2.5

The pavement design must detail the:

- Geotechnical requirements – test the sub-grade and establish a CBR. Soaked CBR's shall be used unless it can be shown that the subgrade shall always be in an unsaturated condition. Establish a correlation between the local soils and the test methods used;
- Structural design – design pavements to meet the (modified) life-cycle requirements of the *New Zealand Infrastructure Asset Valuation and Depreciation Guidelines*. The pavement designs are, however, restricted to a 50-year life for the basecourse layer.

Other considerations in the design may include, but should not be restricted to:

- Type of edge restraints – in most urban environments a concrete edge restraint or kerb and channel must be provided. In other areas, provide road shoulders, as defined in clause 8.7.7 – Rural Road Shoulders, to prevent edge break.
- Semi-rigid and rigid pavements – semi-rigid and rigid pavements (e.g. those that require structural layers of asphaltic concrete, cement or bitumen stabilised metalcourses, concrete roads and similar) require specific design.
- The local sub-grade – many sites have sub-grades where the CBR values are so low that the pavement design requires a sacrificial layer of aggregate, sand or the use of geotextiles.
- The subsurface drainage – the Council recognises that the lack of subsurface drainage outfalls often results in the inability to avoid a "bath-tub" design where the pavement materials will, at times, become saturated. However, the acceptance criteria set in Table 8.5 still apply.
- The local water table – basecourse layers must be above the water table during a 1 in 10-year flood event.
- Cover to underground services – maintain adequate cover to utilities when the project proposes lowering the road level or crown.

8.9.2 Reducing Waste

When designing the development, consider ways in which waste can be reduced.

- Plan to reduce waste during demolition e.g. minimise earthworks, reuse excavated material elsewhere.
- Design to reduce waste during construction e.g. prescribe waste reduction as a condition of contract.
- Select materials and products that reduce waste by selecting materials with minimum installation wastage rates.
- Use materials with a high recycled content e.g. recycled concrete subbase, foamed bitumen. Proposed recycled materials will need approval from the Council to ensure that environmental contamination does not occur.

See the Resource Efficiency in the Building and Related Industries (REBRI) website for guidelines on incorporating waste reduction in your project www.rebri.org.nz.

8.9.3 Pavement Materials

The design and construction of the road must comply with the following criteria:

- Materials – see the CCC *CSS* for details of approved pavement materials, gradings, etc. Any proposed variations from these materials, such as the use of cement-stabilised metalcourses or concrete roads, will require specific design;
- The extent of work – pavement materials must extend at the same thickness beyond the edge control devices, such as kerb and channel or the concrete edge restraints, as detailed in CCC *CSS: Part 6*.

8.9.4 Surfacing

All surfacings must meet site-specific traffic loading requirements, including skid resistance requirements as defined in TNZ T/10 *Skid Resistance Investigation and Treatment Selection*.

The selection of surfacing material is critical. Consider the benefit, performance and life-cycle costs of the material, particularly for pavers as these surfaces have higher maintenance costs i.e. select pavers for traffic management purposes, not just aesthetic reasons. Pavers shall be accepted subject to specific approval, and not permitted in large surface areas.

All newly constructed road surfaces must comply with the NAASRA roughness counts in Table 8.6. See CCC *CSS: Part 6* for more detail on analysing test results.

Table 8.6 NAASRA roughness criteria

Surfacing	Average (mm/km)	Maximum (mm/km)
All new asphaltic concrete and open graded porous asphalt surfaces	55	75
Asphaltic concrete and open graded porous asphalt overlays and shape corrections	65	90
Chipseal through streets with 10,000-20,000+ vehicles per day (RAMM Pavement Use T6 and T7)	60	80
Chipseal through streets with 2,000-9,999 vehicles per day (RAMM Pavement Use T4 and T5)	65	85
Chipseal through streets, culs-de-sac and rights of way with 0-1,999 vehicles per day (RAMM Pavement Use T1-T3)	70	90

All surfacing materials must meet the appropriate CCC *CSS* requirements.

Part 8: Roading

The general minimum surfacing requirement is a two-coat (wet lock) chipseal – grade 4 and grade 6. At the head of a cul-de-sac, the minimum surfacing requirement is a 30 mm layer of paver-laid AC10 laid over a Grade 5 chipseal.

Skid resistance on any new road that intersects with an existing road must match or exceed that of the existing road though the intersection area. Skid resistance can be improved through grooving in asphaltic concrete.

Part 8: Roading

8.10 DRAINAGE DESIGN

8.10.1 Road Drainage Control

All road runoff must be contained in the legal road or within land over which drainage easements have been created in favour of Council.

Guidance and standards for the work can be found in:

- CoP Part 5: *Stormwater and Land Drainage*
- Environment Canterbury, *NRRP*
- Catchment Management Plans for the development area
- Christchurch City Council, *CSS: Parts 1-7*

8.10.2 Primary Stormwater System

On-street treatment of stormwater is a required part of the design. Design for the removal of contaminants throughout the stormwater system, but particularly before the stormwater enters existing open water-bodies.

Collect surface water in kerbs and channels or within grassed swales, depending upon the requirements of that particular water catchment area, as detailed in the resource consent or project brief.

All pipework downstream from sumps contained within the carriageway must have a minimum internal diameter of 225 mm. Sump spacing must not exceed 90 m, for maintenance purposes.

The level of service requirements for stormwater systems are set out in CoP Part 5, Table 5.1.

8.10.3 Secondary Flowpaths

Strategic and arterial road carriageways shall not be used as a secondary flow path. Collector, local and cul-de-sac road carriageways may be used as a secondary flow path, where necessary.

8.10.4 Subsoil Drainage

In areas of high groundwater, install subsoil drainage to protect the carriageway subgrade and/or metalcourse.

The subsoil drainage pipework must be drilled PVC or other approved perforated pipe, installed with the appropriate filler material in accordance with the manufacturer's specifications, and must flow to an acceptable outlet.

8.10.5 Drainage Patterns

The existing drainage pattern may provide a constraint on possible design solutions. Ensure that the upstream catchment, including existing channels, can drain through the new works without ponding and that property outfalls, either at the kerb or at the boundary, are not raised above inlet levels. Thoroughly investigate the catchment around the project area, to determine accurate falls, transition levels and the most effective outfall.

8.11 TRAFFIC MANAGEMENT DEVICES

Initiatives to enhance road safety are built around the three E's – engineering, education and enforcement. Engineering the environment to 'solve' a problem may not always be the most efficient solution but is likely to be the most expensive. Consider education or enforcement as well as engineering in the design process.

Design a road at the outset for its environment and function, as it is difficult to retrospectively alter the speed environment. Analyse the existing speed environment, including the 85th percentile speeds, for assessment against the design operating speed and comparison to the constructed speed environment.

The installation of traffic management devices (TMD) is most appropriate to local residential streets where:

- The posted speed limit < 85th percentile operating speed < posted speed limit + 20 km/h;
- Peak hour traffic volumes exceed 60 vehicles (equivalent to approximately 600 vehicles/ day);
- The length of the road segment under consideration > 250 m;
- The road has a documented crash history of the type that could be corrected by the devices considered for implementation;
- There are significant pedestrian safety issues.

Install TMD in classified or rural roads:

- At the transition from the open road to a lower speed limit;
- To enhance pedestrian safety;
- To reduce conflict points.

Use the following standards and guidelines for the design and operation of traffic management devices:

- Austroads *Guide to Traffic Engineering, Part 10: Local Area Traffic Management*
- TNZ & Land Transport NZ *Manual Of Traffic Sign and Markings Part 2*
- Christchurch City Council, *CSS: Parts 1-7*
- Land Transport NZ *Guidelines for Urban-Rural Thresholds, RTS 15*
- AS/NZS 1158 *Set Lighting for roads and public spaces - series*

8.11.1 Device Selection

When designing traffic management, be clear about the objective of the measure's installation and the strategy or strategies that the device should achieve. Make the differentiation clear between "neighbourhood improvement" type works and traffic management works, to ensure the measures don't have unexpected effects. Wherever possible, make the objective measurable, to allow an assessment of its effectiveness.

Both the street environment and traffic control must be in tune with each other, and compatible with the desired character of the street. Select traffic management devices which reinforce the road function, through inhibiting inappropriate behaviour or through changing the user's perception of the environment. Where alternative devices support the same objectives, consider the degree of effectiveness required and the likely environmental effects.

Factors such as traffic noise and air pollution can have significant impacts both locally and remotely. When selecting the device, consider other environmental effects e.g. noise from deceleration and acceleration, increases in travel distances or traffic volumes on arterial roads.

Part 8: Roading

The four main types of measure are listed in the table below, with an indication of the objectives to which they are most applicable and of their degree of effectiveness (by number of ticks) or negative impact (by cross). The environmental effects are also indicated, including the effects on neighbouring residents.

Table 8.7 Measures and Objectives

Measure		Reduce speeds	Reduce traffic volume	Increase pedestrian safety	Reduce crash risk	Environmental effects
Vertical Deflection Devices	Raised mid-block tables	√	√√	√	√√	XX
	Pedestrian platforms	√√	√√	√√√	√√	X
	Road humps	√√√	√√	√	√√	XX
	Road cushions	√√	√√	√	√√	X
	Raised intersection platforms	√√	√√	√	√√	XX
	Perimeter threshold treatments with hump	√√	√√	√	√√	XX
Horizontal Deflection Devices	Lane narrowings / kerb extensions	√		√√√	√	
	Splitter islands	√		√√√	√X	
	Slow points – one-lane	√√√	√√√	√	X	
	Slow points – two-lane	√	√			
	Blister (wide) islands	√	√	√		
	Driveway links	√√√√	√√√√	√√√√	X	√√
	Mid-block flush median treatment	√		√√	√√√	
	Mid-block raised median treatment	√		√√√	√√√	
	Roundabouts	√√√		√	√	XX
Diversion Devices	Full road closure		√√√√√	√√√√√	√√√√√	XX√√
	Half road closure	√√√	√√√	√√√	√√√	X√√
	Diagonal road closure	√√	√√√√	√√√√	√√√√	X√
	Modified T intersection	√√	√√		X√	
	Left in/Left out islands		√√√	√√√	√√√	X√
Signage, Road marking and Other treatments	Speed limit signs	√		√	√	
	Prohibited traffic movement signs		√√√√	√√	√√√√	X√√
	One-way signs	X	√√√	√√√	√√√	X
	Stop signs/ Give way signs	√	√	√	√	
	Pedestrian crossings	√		√√√	√	X√
	Perimeter threshold treatments			√		√√
	Rural threshold	√				√√
	Tactile surface treatments	√				XX√√
	Bicycle facilities				√√	√√
	Bus only treatments		√			√√√
	Shared zones	√√√	√√√	√√√	√√√	√√√

Refer to Austroads *Guide to Traffic Engineering, Part 10: Local Area Traffic Management* and Land Transport NZ *Pedestrian network planning and facilities design guide* for an in-depth examination of these devices, their application, advantages and disadvantages.

8.11.2 Design Considerations

Overuse of devices will reduce their effectiveness globally, as will the passage of time reduce it locally, as drivers become familiar with them. Regardless of this, ensure a degree of consistency in the use of traffic management devices:

- Use similar devices in similar ways.
- Design devices so that drivers can recognise and react to them appropriately both in approach speed and alignment.
- Provide roadmarking, signage and lighting to support the device’s purpose.
- Ensure sight distances comply with clause 8.8.4 – Sight Distances and Austroads *Guide to Traffic Engineering, Part 5: Intersections at Grade*.
- When designing the device layout, first consider where in the street the device is best placed to achieve the objectives.
- Design longitudinal vertical gradients under 3% at intersections where traffic management devices will be installed.

Install devices with operating speeds that are within 20 km/h of the speed environment. Appendix A, Figure A2, in Austroads *Guide to Traffic Engineering, Part 10: Local Area Traffic Management*, has a range of indicative operating speeds for various devices. Space devices with a high degree of restraint, like road humps, 80 -120 m apart.

Design devices to remove any confusion with pedestrian crossings. Surface footpaths and traffic devices in different colours, to help define their limits. Use tactile surface treatments where there is no level difference between the footpath and the road.

Use landscaping to clarify pedestrian routes and to enhance the effectiveness and safety of the devices. Where devices are used as pedestrian or cycle refugees, ensure that landscaping does not obstruct sightlines.

Select lane widths carefully. Generally only either a vehicle or bicycle can use a 3.0 m lane. Both cars and bicycles can use wide kerbside lanes (3.7 m or over) at the same time, which are best for roads over 60 km/h or where devices must cater for buses or heavy vehicles. Avoid intermediate widths as these can create squeeze points for cyclists.

8.11.3 Vertical Deflection Devices

Design raised tables and platforms to be 75 – 100 mm above the road surface, with flat platforms between 2 – 6 m long. The design height of the table or platform should be related to the type of transition from the ramp to the platform or road surface. Rounded transitions are smoother to travel over than sharp transitions so may require a greater height increase. Also examine the longitudinal profile of the adjacent centreline to ensure that it doesn’t amplify or nullify the vertical deflection experienced by the vehicle.

Install road humps constructed in accordance with Standard Drawing 600-231.

Consider the types of traffic which will negotiate these devices. Where buses and heavy vehicles will regularly negotiate devices, specify flatter ramps (1 in 20) and longer platforms (6 m). Cyclists also prefer longer ramps (1 in 15) but these do not reduce speed as effectively as short ramps (1 in 12).

8.11.4 Horizontal Deflection Devices

Design bicycle lanes to bypass horizontal deflection devices where demand warrants it. If cycles use the traffic lane, eliminate squeeze points in, before and after devices.

Assume operating speeds of 10-20 km/h for slow points and design them with deflection angles between 10 to 30 degrees. Where bicycle usage is not significant, design lane widths between 2.8 and 3.0 m. Detail blister islands at least 2 m wide and 3 m long.

Roundabouts are also horizontal deflection devices and are discussed in clause 8.8.7.

8.11.5 Diversion Devices

Construct pathways through diversion devices for bicycles and pedestrians and ensure that the devices can cater for the permitted users.

Carefully consider the use of full road closures and design them to minimise disruption. Design half road closures to make prohibited manoeuvres difficult. Provide turning facilities for both forms of road closure. Maintain two-way movement through diagonal closures for all users.

Design modified 'T' intersections with mountable kerbs, and reinforce changed priorities where appropriate. Combine left in/left out islands with central median islands to improve efficiency.

8.11.6 Signage, Road Marking and Other Treatments

Reinforce the effectiveness of signage by combining it with other devices. Install zebra crossings or signalised pedestrian crossings only where there is a warrant for it, as defined in Trafinz *Guide to Pedestrian Crossing Facilities*.

8.11.7 Thresholds

Design perimeter thresholds which are at least 5 m long and entirely flush with the road. Provide for the turning movements of commercial vehicles and buses.

Install rural thresholds only where there is more than 20 km/h between the posted speed limits on each side of the threshold site and where there are no existing constraints which reduce the speed environment. Vertical design elements are an essential component of rural thresholds and include evergreen planting, signs, lights and their poles. Utilise horizontal design elements like planting, medians and lane narrowing. Refer to *Guidelines for Urban-Rural Thresholds* for widths in differing traffic conditions.

8.11.8 Traffic Control Devices

Ensure that all the traffic control devices are visible. Signs or raised studs, which comply with CCC *CSS: Part 6*, or supplementary lighting, may be required. For lighting, refer to CoP Part 11: *Lighting*.

8.11.9 Road Markings

Where road markings are required, use the following standards and guidelines:

- TNZ & Land Transport NZ *Manual Of Traffic Signs and Markings Part 2*
- Land Transport NZ *Guidelines for Flush Medians*, RTS 4
- Land Transport NZ *Guidelines for Safe Kerbline Protection*, RTS 8
- Land Transport NZ *Guidelines for Rural Road Marking and Delineation*, RTS 5
- NZ Supplement to Austroads *Guide to Traffic Engineering Practice, Part 14: Bicycles*
- Christchurch City Council *CSS: Parts 1-7*

Install centrelines on rural roads with an AADT over 250 or where a road with an AADT over 100 has frequent or substandard horizontal or vertical curves. Install centrelines on classified urban roads carrying substantial volumes of non-local traffic.

Install lane lines wherever there is more than one lane in the same direction. Replace centrelines and lane lines with raised pavement markers on roads with a fine textured surface.

Install edge lines on rural roads with an AADT over 750 or where a road with an AADT over 250 has frequent or substandard horizontal or vertical curves. Install edge lines on urban arterial roads and where the lane requires definition or may conflict with parking.

Consider the requirement for no overtaking and no stopping lines. The Council has delegated the approval of no stopping line installations to the Community boards. This is separate from and additional to engineering acceptance.

8.12 STREETSCAPE

The streetscape elements include paths, grassed berms, trees, shrub beds, streetlights, structures and hard landscaping. These can provide various benefits including:

- A network of safe, pleasant, comfortable, convenient and efficient paths.
- Positive guidance for pedestrians and/or cyclists.
- Seats, lighting, litter bins (where required) and other facilities.
- Enhancement of the street environment by the inclusion of grassed areas, specimen street trees and plant beds, built structures e.g. fences, low walls, art works.
- Attractive 'rain gardens' with safe overflow provision, which can provide a water quality and air quality improvement component for air and water borne vehicle pollutants.

Note that maintenance costs are an important consideration when designing streetscapes, and street gardens in particular should be designed with an eye towards minimising future maintenance.

Discourage vehicle access to berms, footpaths and swales by using landscape elements (e.g. kerbing, bollards, planting or fences).

Widening and redeveloping existing roads should take into account the current streetscape. Innovative and interesting designs may be considered, such as meandering footpaths and street trees set between parking spaces. Refer also to CoP Part 10: *Reserves, Streetscape and Open Spaces*.

The following documents should also form the basis of the design:

- Christchurch City Council *CSS: Parts 1-7*
- Transit New Zealand *Guidelines for Planting for Road Safety*

Refer to Standard Drawings 600-245A/B/C for roadside layout examples.

8.12.1 Crossfalls and Gradients

Grass areas and plant beds located on roadsides or median islands must have crossfalls under 6% unless agreed by the Council.

8.12.2 Grassed Berms

Berms shall comply with the CCC *CSS Parts 6 and 7*. Where the width from the legal boundary to the kerb or road edge exceeds 2.5 m in residential areas, install a berm. Allow sufficient space for any planting (e.g. trees) between the footpath or property boundary and the kerb.

Typical berm cross sections, showing minimum berm widths, are shown in Standard Drawings 600-245A/B/C. The smallest area of berm permitted is 2 m^2, the minimum width is 0.7 m, and areas or widths smaller than this must be formed and sealed as footpath.

Where adjoining pavement surfaces meet, forming a point in the grassed area with an angle of less than 60 degrees, square or round off the point to be no narrower than 0.7m.

8.12.3 Batters

Where the formed batter is not required to cater for foot traffic, grassed batters are permitted, to a maximum of 1 in 4. These must be mowable, as defined in Cop Part 10 clause 10.5.2.6 – G*rass Maintenance*.

The top edge of every fill, and the toe of every cut, must have a crossfall of 3% and extend at least 500 mm beyond the outside edge of the footpath. If there is no footpath, measure this dimension from the back of the kerb or the outside edge of the trafficable shoulder as applicable.

8.12.4 Slope Stabilisation

Generally, slopes should match any existing stable slope. Flatter slopes that are integrated into the natural landscape are preferred.

Retain all new cut faces or stabilise with vegetation. Slopes steeper than 1 in 2 will need to be retained unless otherwise agreed by the Council. Locate stabilised faces or retaining structures that support private assets or property outside of the legal road. Structures supporting the road must be located in the road reserve.

Some of these structures may require building consent, which the developer must obtain.

8.12.5 Utilities

Show any existing utilities and services on the drawings.

Both existing and proposed underground and above-ground utility services can impact on the design through conflicts with the proposed carriageway elements. The cost of relocating existing utilities is significant and may therefore not be a viable option. Existing roads are often reconstructed at a lower finished level but restrictions on lowering carriageways, and the corresponding kerb, due to the presence of utilities can lead to property and upstream drainage problems.

To ensure there is no conflict with the road geometrics or between any utilities and proposed street features or planting, become familiar with the required clearances from both existing and proposed above-ground and underground utilities. Refer to CoP Part 9 clause 9.5.4 – *Typical Services Layout and Clearances* and to Standard Drawings 600-245A/B/C for guidance and standards for the work. Any conflicts should be resolved during the design process.

Pothole existing underground services to confirm both their location and depth. When utilities constraint the design, there are a range of solutions available:

- Consider moving the carriageway alignment. This can allow either underground utilities to be positioned towards the centreline or underground utilities and poles to be positioned outside of the carriageway or footpath.
- Design element widths to achieve the same result as moving the carriageway alignment.
- Provide a lesser standard of elements, through restricting parking or constructing only one footpath.

8.12.6 On-Street Planting

Plant beds are generally used to soften the street environment and to provide visual guidance to pedestrians, cyclists and drivers. Landscaping is also an important component of traffic management devices but must be carefully designed to enhance the safety and effectiveness of these devices. The location of streetlights, sight line visibility and hazard criteria are critical when designing the on-street planting.

Refer to CoP Part 10: *Reserves, Streetscapes and Open Spaces* before designing plant beds or street trees.

8.12.7 Street Furniture

Landscaping structures such as planter boxes, seats, bins, sculptures, memorials and entrance structures on legal roads must be constructed in long-life materials (20-year minimum). Refer to CoP Part 10 clause 10.5.4 – *Reserve Facilities, Structures and Furniture* for further information.

In low speed environments, locate continuous structures like low walls at least 450 mm behind the kerb, with a maximum height of 700 mm if adjoining the footpath. In high speed environments, the clear zone rules apply.

Locate street furniture so that it does not obstruct the sight lines of intersections, pedestrian crossings or signs.

Some of these structures may require building consent, which the developer must obtain.

8.12.8 Rural Mailboxes

In rural areas, mailboxes may be allowed on the road reserve. They shall be designed and placed so as not to endanger the motoring public. Consideration shall be given to frangibility of the base and to location. Refer to Table 8.8 Clear zone widths. See also the WDC Policy *Rural Mailboxes* (yet to be completed).

8.12.9 Site Access

Wherever access to property is required across a swale, the crossing design must be specific for the affected site(s). The designs shown in CCC *CSS: Part 6* are acceptable design solutions.

Use the following standards and guidelines for the design and operation of intersections, kerb crossings, cut-downs and driveways:

- Austroads *Guide to Traffic Engineering, Part 5: Intersections at Grade*
- LTNZ *Guidelines for the Implementation of Traffic Controls at Cross Roads*, RTS 1
- Christchurch City Council, *CSS: Parts 1-7*
- Waimakariri District Council *District Plan*
- Waimakariri District Council *Vehicle Crossing Bylaw*

8.12.10 Clear Zones

The clear zone is the width from the edge of the traffic lane in which an errant vehicle can recover. To provide this zone, locate new hazards e.g. above ground utilities, street furniture and trees, streetlights, at a distance from the edge of the traffic lane greater than the widths in Table 8.8. Remove or treat existing roadside hazards within this distance.

Table 8.8 Clear zone widths

One way AADT	50 km/h	70 km/h	100 km/h
1000	3.0m[1]	3.4 m	6.0 m
>5000	3.0m[1]	5.4 m	9.0 m

Where the above setbacks are not achievable, discuss alternative options with the Council early in the design process.

In an urban, 50 km/h speed zone, street trees and other structures placed behind kerb & channel shall be deemed to be outside the clear zone. In other areas, street trees planted within clear zones shall have frangible trunks, defined as less than 100 mm diameter.

Some on-street structures in urban areas cannot feasibly be relocated and should be protected but formal barriers may not be the best option. Alternatives to barriers that could be considered in low speed urban areas include frangible planting and bollards.

When providing a barrier to a hazard within the clear zone, include the barrier deflection when determining the offset between the edgeline and the structure.

Austroads *Urban Road Design* and *Rural Road Design* provide details on clear zones, hazards and safety barriers.

8.13 SERVICES LANES, PRIVATE WAYS AND ACCESS LOTS

Access to a site (or sites) that will be provided by a private way must comply with the legal requirements of the *District Plan*.

Private roads may be constructed to lesser standards than this Code, but shall still require the provision of a secondary flowpath for stormwater, as detailed in CoP Part 5 clause 5.5.5 – *Secondary Flow Paths*. Where a private road is proposed at the time of subdivision the Council will require assurance that the road can be managed and maintained on a sustainable basis and in perpetuity. Such assurance may be by way of a body corporate, or similar.

Wherever street or pedestrian accessway lighting will be installed, construct it to the same standard as that required for an equivalent construction within legal road.

Use the Council's *Refuse and Recyclable Material Collection* Policy to determine the requirement for either refuse truck access or refuse bag storage areas at the road boundary. Where there is insufficient space, clear of the footpath and within the legal road, for the short-term storage of rubbish bags and recycling bins, provide a collection point within the accessway but close to the road boundary.

As work within private ways, service lanes and accessways will not be taken over by the Council upon completion; the Council will be placing the onus of confirming both the suitability of design and construction on the developer.

The developer must provide a Design Report with the engineering drawings and a Design Certificate covering the design of these works, before any physical works commence (see CoP Part 3: *Quality Assurance*). This can be incorporated with the design and Design Report for the overall project.

On completion of the works, the developer must provide records, certifying that they have been built in accordance with the design and that the works and materials were inspected, audited and tested, to ensure compliance with the quality requirements. Include copies of documentation relating to 'key' hold or witness points e.g. Benkelman Beam results.

8.14 STREET LIGHTING

Refer to Part 11: *Lighting* for street lighting requirements.

8.15 PUBLIC TRANSPORT

8.15.1 Bus Routes

Consider the specific needs for public transport at an early stage of the design process to ensure that:

- Roads can cater for the manoeuvring requirements of public transport vehicles (including turning around or U-turns at a terminus);
- Termini of routes are identified;
- Routes are efficient and easily accessible by public transport vehicles;
- Proposed routes form a coherent new bus route or an extension to an existing route.

The provision of bus routes in new development areas must be discussed with Environment Canterbury staff.

In any urban subdivision, not less than 90% of households should be within 500 m direct distance from a bus route. Wherever there is an existing bus route which can service the area (as defined in the previous sentence), there should be easy and direct access to it for pedestrians. Wherever culs-de-sac are used to provide access to properties, the heads of these should be extended where appropriate to provide direct pedestrian linkages to bus routes.

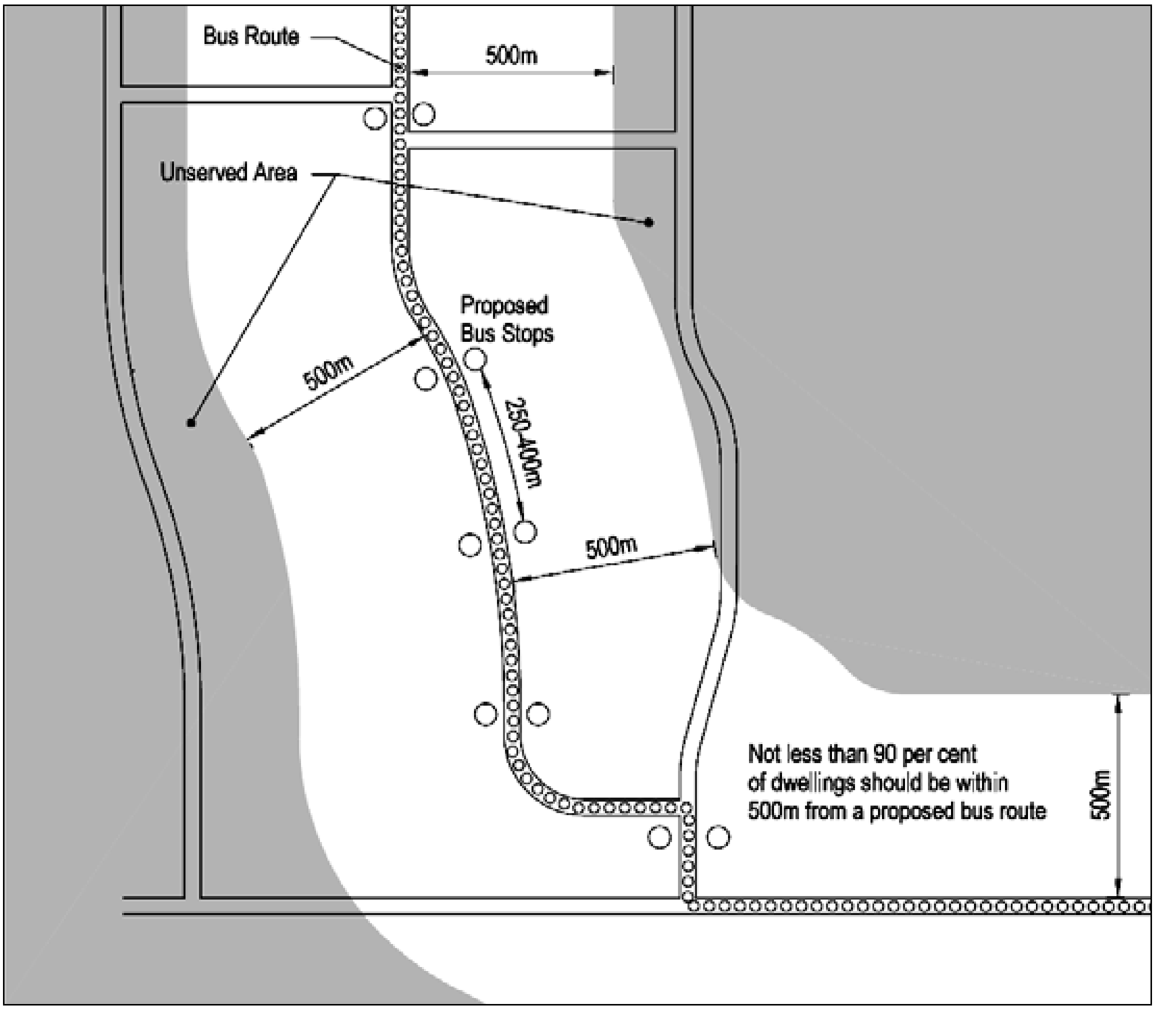


Figure 8.3 Example of bus routing

Wherever the bus route travels through a development, design the relevant roads to ensure that the bus can travel and manoeuvre along the proposed route easily, ideally without delaying other traffic.

Bus routes are generally along collector or arterial roads. The proposed route needs to be as direct as possible to reduce travel times and should avoid or minimise complicated turning manoeuvres at intersections. In particular, avoid right turns when accessing arterial roads.

Bus priority measures such as bus lanes may be required in certain locations. Consult with the Council before submitting engineering drawings to ensure that intersections conform to the Council's requirements.

8.15.2 Bus Stops/Bus Shelters

Plan and co-ordinate the bus stop locations and associated infrastructure on the street with the Council at the consent stage. Extra space may be required to site bus shelters or other required infrastructure, which can be incorporated in the engineering drawings.

Bus stops must be spaced appropriately, with inbound and outbound pairs of stops opposite each other wherever the service travels in both directions along a road.

Bus shelters shall be type E2-Narrow, located and designed in accordance with CCC SD366-07.

If the width of the roadway does not provide for roadside parking, allow for the construction of inset bus bays or bus boarders. Construction details for bus stops may be found in CCC *CSS: Part 6*.

Part 8: Roading

8.16 PEDESTRIAN & CYCLE FACILITIES

Linkages for pedestrians and cyclists must create an attractive, friendly, connected, safe and accessible environment. These linkages must ensure that people can move about the community freely in areas where there are no road linkages (e.g. at the end of culs-de-sac) and provide direct pedestrian access to bus stops. Use green linkages between culs-de-sac, through public reserves or adjacent to waterways, or other natural features.

Make provision for on-street and off-street pedestrian and cycle facilities, as required by the WDC *District Plan* or indicated in the WDC *Walking and Cycling Strategy*, to facilitate an alternative to the car for short to medium length trips. CoP Part 10: *Reserves, Streetscape and Open Spaces* and Part 11: *Lighting* provide further information on off-road facilities.

8.16.1 Pedestrian Footpaths

Footpath widths are measured from the footpath edge of the kerb or service strip. The minimum widths set out in Table 8.9 must **be clear of all obstructions** such as vegetation, light standards, traffic signs, utility furniture and bollards. See Standard Drawings 600-245A/B/C for examples. Extra widening will be required wherever such obstructions cannot be avoided. Where topography or existing features preclude providing the minimum widths, discuss options with the Council.

Table 8.9 Minimum footpath widths

Adjacent land use	Minimum width (m)	Preferred location
Residential	1.5	Adjacent to service strip
Retail/town centre	2.5	Adjacent to kerb
Industrial	1.5	Adjacent to kerb

Note that residential footpaths are normally separated from the kerb by a grass berm and from the road boundary by a service strip.

The optimum crossfall for sealed footpaths is 2.0%, with a minimum of 1.25% and a maximum of 3%. To provide access for wheelchairs and prams, steps must not be used on footpaths on public roads, unless approved by the Council.

In culs-de-sac, footpaths shall extend around the circumference/perimeter of the turning area/head and return to a point where the opposite kerb and channel/edge of seal becomes parallel. At that point the kerb and channel shall terminate with a pram crossing (refer Standard Drawing 600-275 *Turning Areas*).

Lateral changes of the footpath direction should normally be achieved using smooth continuous curves. This is particularly relevant where the path deviates around obstacles (e.g. utility boxes, poles) or adjacent berm areas (e.g. trees, shrubs or structures) or shifts laterally to join another footpath.

Wherever the footpath deviates from pedestrian desire lines and positive guidance is required, install street trees, fences or comparable barriers.

8.16.2 Road Crossings for Pedestrians

Provide pedestrian crossing facilities that comply with CCC *CSS: Part 6* at all road intersections and other locations, wherever these will provide logical and safe movement of pedestrians. Mid-block crossing facilities may be combined with kerb build-outs and pedestrian islands, to minimise the crossing distance for users.

To aid safe crossing of roads, pedestrian islands or other facilities may be required in areas where high numbers of pedestrians are expected to be crossing (e.g. local commercial areas, reserves).

Provide tactile warning pavers for vision-impaired pedestrians on public footpaths at all pedestrian crossing kerb cut-downs.

Avoid designing pedestrian crossing facilities that can be interpreted by pedestrians as official zebra crossings.

Use the following standards and guidelines for the design and operation of pedestrian crossing facilities:

- Christchurch City Council *CSS: Parts 1-7*
- Trafinz *Guide to Pedestrian Crossing Facilities*
- LTNZ *Traffic Control Devices Rule*;
- LTNZ *Guidelines for Facilities for Blind and Vision-Impaired Pedestrians,* RTS 14

8.16.3 Cycle Facilities

Consider installing cycle parking facilities near bus stops, to ease the transfer between transport modes.

Provide continuous on-street cycle lanes on all collector and arterial roads. For local urban roads, cycle facilities may be provided through wide kerbside lanes.

Design the cycle facilities and widths in general compliance with the New Zealand Supplement to Austroads *Guide to Traffic Engineering Practice, Part 14: Bicycles*. Use the *Guidelines for the Marking of Cycle Lanes on Urban Roads* to design the roadmarking and mark in accordance with CCC *CSS: Part 6*.

8.16.4 Shared Pathways

Design shared paths so that they are suitable for pedestrians, cyclists, skate-boarders, skaters, prams and people with disabilities. Motorised wheelchairs require 1.2 m clear width.

Refer to LTNZ *Pedestrian Planning and Design Guide*, Section 14.

The minimum clear width of formed paths in legal road is 2.5 m for paths shared by pedestrians and cyclists. The formed width should be widened wherever a lot of people are expected to use the facility. CoP Part 10, clause 10.5.3.2 – *Pedestrian and Cycle Paths* details requirements for paths in reserves. The Council must agree to shared paths by resolution.

The overall width of the linkage needs to be adequate for the path and appropriate landscaping. Providing wide, open and well-lit areas is extremely important to provide a secure and useable linkage. The minimum overall width preferred by WDC is 10 m

Off-street accessways:

- Shall be as short and as wide as possible.
- Shall, where possible, have clear line of sight through their length.
- All positions along a pedestrian accessway/walkway shall be visible from at least one of the serving roads.
- Shall be appropriately landscaped, including street trees where possible.
- Shall include provision for transport and disposal of stormwater flowing along the length of the accessway (and to an approved outfall).
- Shall have a minimum reserve width of 10 m.
- Shall, to prevent access by motorcycles and cars, be provided with approved traffic barriers and/or bollards at their ends. Access must still be available to maintenance vehicles.
- May be utilised as overland flow paths for the transportation of surcharge stormwater from stormwater drainage reticulation resulting from a storm event greater than that of a 20% AEP or 1-in-5-year storm.
- Shall generally have fences constructed in accordance with Standard Drawing 600-242.

Seal the path and landscape the remaining land in a manner that does not compromise the security of people using the facility. CoP Part 10: *Reserves, Streetscapes and Open Spaces* provides landscaping guidelines.

To enhance amenity, specific and/or alternative designs for both accessway paths and adjoining fencing is encouraged.

Use the following guidelines for the detailed design of off-road paths:

- Minstry of Justice *National Guidelines for CPTED in NZ*
- Austroads *Guide to Engineering Practice, Part 13: Pedestrians*
- Austroads *Guide to Traffic Engineering Practice, Part 14: Bicycles and the New Zealand Supplement*
- AS/NZS 1158 *Set Lighting for roads and public spaces – series*

8.17 BRIDGES, CULVERTS, UNDERPASSES, RETAINING WALLS & OTHER STRUCTURES

Bridges, culverts, underpasses, retaining walls, and other structures within the legal road perform a key role in ensuring continuity of access for the public. Design these items to ensure their continuous function (including during extreme events) throughout their design life. For timber bridges, this is 70 years. For steel or concrete bridges and all culverts, this is 100 years. For all other structures, this is 50 years.

All bridges and culverts on the roadway or right of way shall be designed in accordance with the TNZ *Bridge Manual*. Any structures involving waterways or surface water channels shall be designed in accordance with CoP Part 5: *Stormwater and Land Drainage*.

The design loading for bridges and culverts in the Waimakariri District shall be:

- Class I (~85% HN) for private accessways.
- HN-HNO-72 for all public roadways

Determine the width of bridges and culverts in conjunction with the site-specific current and future road requirements for carriageway widths. Take into account the land drainage requirements, as set out in CoP Part 5: *Stormwater and Land Drainage* and Chapter 13 of the CCC *WWDG*. The length of these structures is also site-specific and must make allowance for waterway requirements during extreme events. Design the wing wall and anti-scour structures to provide support and to prevent scour, as required.

Other design issues include, but are not limited to:

- Legal compliance – building and resource consents are required for bridges, culverts, retaining walls and other structures, as appropriate;
- Technical requirements – bridges and culverts must have separated footpaths, space for cyclists and suitable guard-rails/handrails. The surfacing of bridge decks must meet the site-specific traffic loading requirements including skid resistance requirements;
- Aesthetic contribution – use the design of the new structure to enhance the attractiveness of the built environment.
- Existing structures – ensure lane widths are not compromised when retrofitting existing structures to cater for future traffic needs.

Where retaining walls are required to support land or property adjacent to the road reserve, they shall not be built on the road reserve.

Where retaining walls are required to support the road, including the carriageway and ancillary roading features, such walls shall be contained entirely within the road reserve.

Safety barriers shall be provided along carriageways for all structures where the clear zones as set out in clause 8.12.10 are not available.

Bridges and culverts with waterway cross-sectional areas greater than 3 m^2 or 1 m deep (measured from the road surface to the invert) shall be fitted with handrails. Where there is a fair expectation of pedestrian access, the handrails installed shall be in compliance with the Building Act. These shall be provided for the span/crossing length.

Traffic widths shall be in accordance with Table 30.1 of the District Plan.

Specific design shall be required for culverts in urban areas and for underpasses.

8.18 AS-BUILT INFORMATION

Provide as-built information as set out in Part 12: *As-Builts*, including a safety audit of the constructed works.

8.19 ASSOCIATED DOCUMENTS

Appendix A Standard Specification – Street Name Blades (QP-C842)

Appendix B Standard Specification – Road Openings (QP-C843)

Street Name Blades

Street Name Blades

1. INTRODUCTION

Within the Waimakariri District, the requirements for street name blades shall be as specified in the *Guidelines for Street Name Signs* 1990, produced by the Land Transport Safety Authority, with the additions and alterations indicated in the WDC standard specification (this document).

Street Name Blades

2. DESIGN OF STREET NAME SIGNS

2.1 Colour

The whole blade background, including any fabrication, is to be the same shade of green. Where "paint" is used its colour is to be powder-coat "BP GREEN".

Letters and numbers are to be white.

2.2 Reflectorisation

Sign lettering shall be reflectorised with High Intensity Reflective materials on local roads and at local-local intersections, and Diamond Grade Reflective materials on all other road and intersection types.

2.3 Lettering

The standard size lettering used in the Waimakariri District for street names is 100mm. At intersections with state highways 150mm lettering should be used.

Property numbers and "No Exit" supplements shall be 75mm.

2.3.1 Letter Size & Spacing

Letters and numbers are to be single-spaced. There is to be a single blank space between arrows and adjacent letters or numbers. There is to be a single blank space between the "-" in number ranges and the adjacent numbers.

The alphabet used shall be Series C 100mm as defined in the LTNZ *Manual of Traffic Signs and Markings Part 1, Appendix A1 – Standard Alphabets*.

2.3.2 Names

All names are to be fully spelt out, not abbreviated. The street type suffix to the name itself, such as "Street", "Road" etc. (i.e. the "label"), should be abbreviated and capitalised in accordance with section 4.

The name should always be capitalised except for the "ac" or "c" in "Mac" and "Mc" and other letters in similar circumstances.

Punctuation should be used only where it is part of the name, e.g. in O'Rourkes Road. It should not otherwise be used, especially for denoting the possessive, e.g. Browns Rd, not Brown's Road. Pronunciation accents, such as, à and ê, should not be used.

2.4 Sign Size & Shape

Size shall be adequate for lettering, with a clear border of background colour at least 50mm wide around the lettering; therefore the maximum width of the sign should be 200mm.

Where the sign is greater than 1200mm in length, two support posts shall be required. Where more than two lines of lettering are required, two signs shall be used.

The blade material shall be rectangular and either one piece extruded "I" section aluminium or fabricated aluminium.

2.5 "No Exit" Supplements

"No Exit" legends shall be incorporated wherever appropriate.

The words "NO EXIT" and any arrows are to be 75mm high. The legend is to be positioned on the name-blade, below the street name.

2.6 Locality Identification

Locality identifiers, such as monograms and logos, are not permitted.

2.7 Property Numbers

Property numbers are to be 75mm high, and formatted and located so as not to detract from the main messages of the sign.

Property numbers are to be on the “line” immediately below the street name. The line height is to be appropriate and suitable for the size and style of the numbers. The arrow relating to the property numbers is to be located under the appropriate arrow of the street name.

At cross-roads, the blade should display the property numbers immediately adjacent to each side of the intersection. At T-intersections, the blade should display the range of numbers in the block, in the order they appear on the street when viewed from the location of the sign.

Note that property numbers are not required in the following situations:

- Where it is a “No-Exit” street;
- Where there are no properties opening onto the street;
- Where there is a number mismatch between the sides of the road, e.g. where the intersection breaks the road between numbers 20 and 22 on the left side and numbers 31 and 33 on the right.

2.8 Directional Indication

Retroflective chevrons or arrows at either end of the legend can be used as an indicator for road users. They are recommended on low mounted signs on medians or traffic islands, and in situations where the orientation of the street name sign does not clearly convey the direction of the street to which it refers.

Retroflective chevrons are always required on roundabouts, indicating the direction of travel.

Street Name Blades

3. LOCATION OF STREET NAME SIGNS

Paragraphs in *italic* are specifications from the RTS-02, followed by WDC requirements where these are different from RTS-02.

3.1 Height

Street name signs should be mounted with their underside between 2.5m and 3.5m above ground level.

3.2 Lateral Offset

Signs should generally be mounted within 1500mm of the face of kerb or shoulder edge but at least 450mm behind the face of kerb on kerbed streets, 500mm behind the face of kerb on islands or medians, or 600mm from the shoulder edge on streets without kerbs.

3.3 Number of Signs

The number of signs at an intersection should be increased for more complex backgrounds, more important streets and wide streets.

3.4 Advance Street Name Signs at Major Intersections

Additional street name signs should be mounted on the central median or overhead in advance of intersections between two or more arterial or strategic roads.

3.5 Recommended Sign Locations and Designs

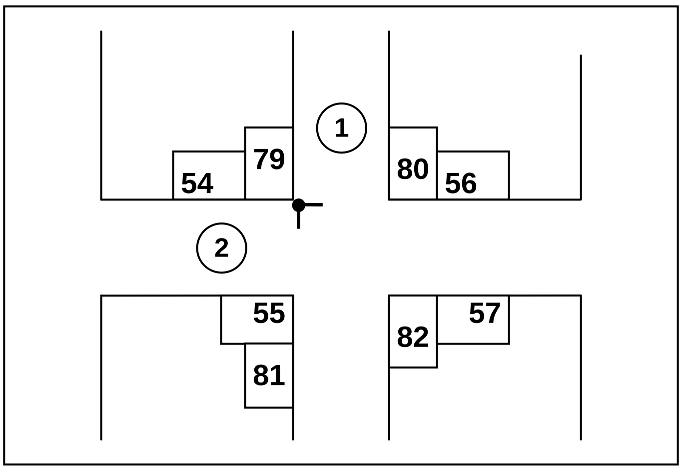
Signs must be located where they are visible over a distance appropriate to the operating speed and where possible within the area of the intersecting road reserve boundaries of the streets to which they apply.

All name blades for an intersection should be affixed to the same post, except when there is more than 1 sign post as detailed in paragraph 3.6. Each name-blade is to be double sided unless detailed otherwise.

The sign should be oriented to provide maximum visibility to the motorists on the major road. This can be achieved by placing the sign on the “traffic” side of the post.

Clauses 3.5.1, 3.5.2 and 3.5.3 show the standard sign layout for WDC roads. For complex, busy or significant roads, (for example, where the street name changes across the intersection), specific design may be required with approval from the Council. For intersections with State Highways, Transit NZ requirements apply.

3.5.1 Cross-intersections



1)

EXAMPLE St >
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2)

< MODEL St >
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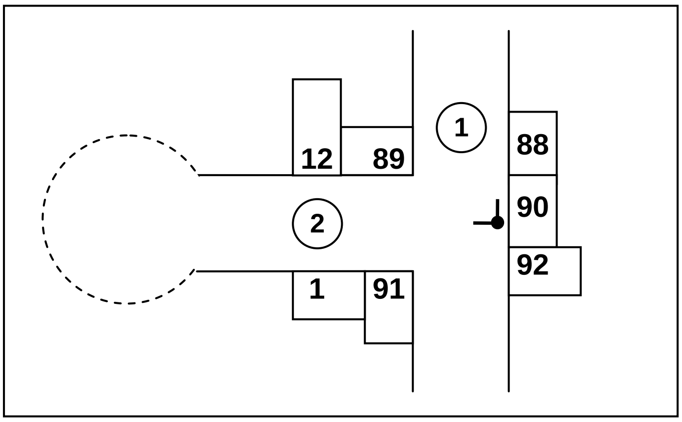
Street Name Blades

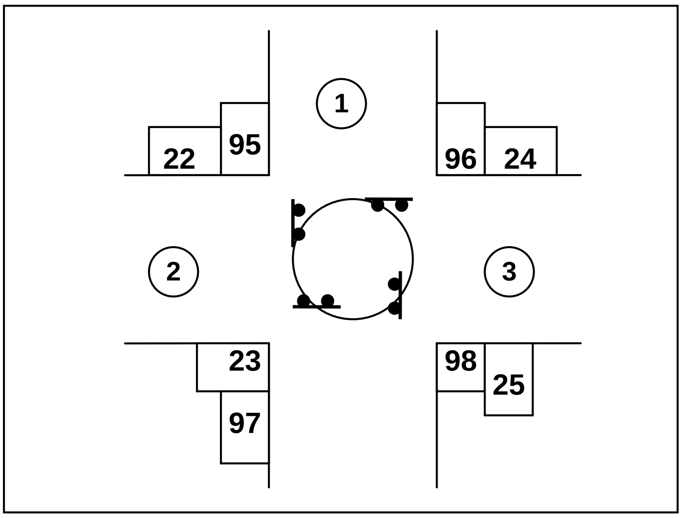
3.5.2 Tee-intersections



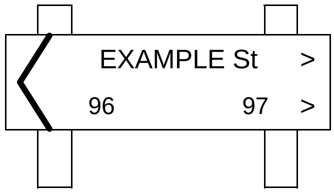
1)

2)

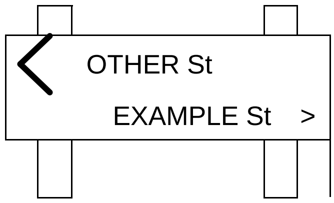
3.5.3 Roundabouts



1)



2) and 3)



A sign showing the name of each street in the centre-left of the roundabout is sufficient. Note that a retroflective chevron or large arrow shall be use to indicate the direction of travel.

3.6 Posts

Where there are existing posts in suitable locations these should be used in preference to placing new posts. “AA” posts and utility poles may be used. There shall be a maximum of four blades of any type on one post.

Where an existing post is suitable, but in a non-preferred or lowly location, and the post can be located to a more preferred location this should be done.

If the existing post is so close to the road that the sign may be hit by traffic the sign should be located on the other, or reverse, side of the post. The use of arrows on the sign will negate any confusion over the direction indicated.

Except on very busy roads (+ 10,000 vehicles / day), divided roads, where there are roundabouts or where the name of one of the roads changes at the intersection, one set of signs should be adequate.

Double Ended signs are to have at least one vertical end to allow use of standard mounting brackets.

Street Name Blades

4. STANDARD STREET LABEL ABBREVIATIONS

Name	Abbreviation	Name	Abbreviation
Anchorage	Ancg	Elbow	Elb
Arcade	Acde	End	END
Avenue	Ave	Entrance	Ent
Belt	BELT	Esplanade	Esp
Bend	BEND	Expressway	Exwy
Boulevard	Blvd	Extension	Extn
Brace	Brc	Fairway	Fawy
Brae	BRAE	Footway	Ftwy
Break	Brk	Formation	Form
Bypass	Bypa	Freeway	Frwy
Causeway	Cwy	Frontage	Frnt
Centre	Ctr	Garden(s)	Gdn(s)
Chase	CHASE	Gate	GATE
Circle	Cir	Glade	Clade
Circlet	Clt	Glen	GLEN
Circuit	Crcs	Green	Green
Close	CLOSE	Grove	Grove
Colonnade	Clde	Heights	Hts
Corner	Cnr	Highway	Hwy
Concourse	Con	Hill	HILL
Court	Court	Interchange	Int
Courtyard	Ctyd	Intersection	Intn
Cove	COVE	Junction	Jnct
Crescent	Cres	Key	KEY
Crest	CREST	Lane	Lane
Cross	CROSS	Line	Line
Crossing	Crsg	Link	Link
Dale	Dale	Loop	Loop
Distribution	Dstr	Mall	MALL
Drive	Drv	Meander	Mndr
Edge	Edge	Mews	MEWS
Motorway	Mwy	Square	Sq
Mount	Mt	Stairs	Strs

Street Name Blades

Name	Abbreviation	Name	Abbreviation
Outlook	Otlk	State Highway	SH
Parade	Pde	Steps	Stps
Park	PARK	Street	St
Parkway	Pkwy	Strip	Strp
Part	PART	Tarn	TARN
Pass	Pass	Terrace	Tce
Path	PATH	Thoroughfare	Thor
Pathway	Place	Tollway	Tlwy
Place	Pl	Top(s)	TOP(S)
Plaza	Plza	Tor	TOR
Point	Tp	Track	Trk
Port	PORT	Trail	Trl
Private Right of Way	R.o.W.	Trunkway	Tkwy
Promenade	Prom	Turn	Turn
Quad	QUAD	Vale	Vale
Quadrant	Qdrt	View	VIEW
Quay	QUAY	Villas	Vlls
Quays	Qys	Vista	VISTA
Ramble	Rmbl	Walk	Walk
Reserve	Res	Walkway	Wkwy
Rest	Rst	Way	WAY
Retreat	Rtt	Wynd	WYND
Ridge	Rdge	Yard	Yd
Rise	RISE		
River	R		
Road(s)	Rd(s)		
Roadway	Rdwy		
Rosebowl	Rsbl		
Rotary	Rty		
Route	Rte		
Row	ROW		
Rue	RUE		

Road Opening

Road Opening

1. INTRODUCTION

1.1 Standards NZ Handbook HB2002:2003 *Code of Practice for Working in the Road* provides national procedures, specifications and methods for carrying out road openings. This handbook has been adopted by the Waimakariri District Council as the basis for all openings in District roads.

1.2 NZS HB 2002:2003 has a stated objective of ensuring *"utilities are installed and maintained with minimal impact on the road environment, community, road users and other utilities*." (NZS HB2002:2003 Clause 4.6). The Code goes on to state " *Reticulation by trenchless construction is the RCA's preferred method of installation within the carriageway, except if it is impractical, unsafe, uneconomic or represents an unacceptable level of risk to other underground utilities or installations."*

1.3 The Telecommunications Act 2001, Gas Act 1992 and the Electricity Act 1992 give operators of those utilities statutory rights to use road corridors subject to any reasonable conditions that the road controlling authority may impose. Other relevant legislation includes, but is not limited to:

- Building Act 1991
- District Plan Provisions
- Health and Safety in Employment Act 1992
- Local Government Act 2002
- Resource Management Act 1991
- Transit New Zealand Act 1989

1.4 Definitions of terms used are detailed in clause 1.4 of NZS HB2002:2003.

Road Opening

2. OBTAINING A ROAD OPENING NOTICE (RON)

2.1 The Principal Provider shall lodge a RON with the Waimakariri District Council in accordance with NZS HB2002:2003 for all works involving excavation in the Council's roads.

2.2 The RON shall be applied for at least:

- Emergency work – no later than 1 working day after the work starts.
- Minor work – 3 working days before work starts.
- Major and project work – at least 15 working days before work starts.

2.3 A Road Opening Notice (RON) does not absolve the Principal Provider from:

- The responsibility of obtaining other consent/s such as those relating to the requirements of the Resource Management and Building Acts, the Council's District Plan or by Environment Canterbury prior to commencement of work.
- Obtaining service plans from other service providers.

2.4 The Road Opening Fee, established from time to time by the Council, must be paid for all road openings on lodgement of the application. The fee, and any exceptions from it, is promulgated in the Council's schedule of fees and charges.

2.5 The duties and responsibilities of the Road Controlling Authority, Principal Providers and Contractors are defined in Section 2 of NZS HB2002:2003.

3. APPENDICES

QP-C843-AA	Preliminary Notification of Road Opening – template
QP-C843-AB	Road Opening Notice
QP-C843-AC	Works Completion Notice – template
QP-C843-AD	Works Maintenance Notice – template

Preliminary notifications should be submitted for major works. This provides the Principal Provider or their consultant with the opportunity to discuss and determine with the Council mutually agreed conditions prior to lodging a Road Opening Notice (RON).

Note that the appendices at the back of NZS HB2002:2003 *Code of Practice for Working in the Road* provide a range of forms that are used for these notifications. It is from these forms that the above documents have been developed. Either the forms in this document or those in the Code may be used.

For additional information please refer to the Code of Practice for Working in the Road SNZ HB 2002:2003.

4. ASSOCIATED DOCUMENTS

SNZ HB2002:2003	*Code of Practice for Working in the Road*
QP-C492-AE	Traffic Management Plan (TMP) – template (Major and project works require a site specific TMP)
COPTTM	Code of Practice for Temporary Traffic Management – with WDC supplement.

Another useful reference is the booklet *"Guide for Safety with Underground Services"* issued in October 2002 by OSH, Department of Labour.

WAIMAKARIRI DISTRICT COUNCIL

STANDARD SPECIFICATION

Preliminary Notification of Road Opening

ROAD OPENING FEE$50.63 GST incl.
RON #:

To Roading Unit
Waimakariri District Council
Private Bag 1005
RANGIORA 7440

From ______________________ (The Principal provider or their consultant)

____

____

Date ______________________

PRELIMINARY NOTIFICATION IS PROVIDED FOR THE FOLLOWING MAJOR WORK

Where: ______________________

When: ______________________

☐ The plans ______________________ are attached

Major work situations that occur on this job are:

- ☐ A trench is to extend more that 20 m along the road
- ☐ A traffic lane needs to be closed on a Main Road
- ☐ A road needs to be closed for more than 2 minutes
- ☐ Metered parking or other restricted parking areas may be affected
- ☐ Work may affect a road structure such as a bridge, tunnel, or retaining wall
- ☐ Work needs to be done outside normal hours of work
- ☐ A variation is sought from either the requirements of this Code of Practice or any other known requirements of the WDC
- ☐ A financial contribution is sought, for example towards the reinstatement of the road surface

NOTE: When proposed work is on a State Highway Road Opening Notices/requests need to be addressed to Transit NZ.

COMMENTS (eg about the above situations and when the work is scheduled to start and finish):

____

____

____

____

Signed: ______________________ Date: ______________________

Print Name: ______________________

Contact Details: ______________________

Road Opening Notice (RON)

I (name) ____________________ as Representative for the Principal Provider (party paying for the work to be done eg utility owner, developer) as detailed below, hereby notify you, the Waimakariri District Council (RCA Road Controlling Authority) and the owners of other networks

☐ Council: Help Desk (WDC Water. Sewerage. Stormwater & Water-Race Systems) ☐ Telecommunications: ____________________

☐ Power: MainPower Network ____________ Other: ____________________

PRINCIPAL PROVIDER'S DETAILS:

Company: ____________________ Project Manger: ____________________

Phone: Day: A/H: Fax: Mobile:

of our intention to undertake the following work.

TYPE OF WORK: (tick one) ☐ Project ☐ Major ☐ Minor ☐ Emergency

DETAILS OF PROPOSED WORK (please tick all aspects)**:**

☐ Open trenching ☐ Trenchless construction ☐ Installing chamber(s) ☐ Installing pole(s)

☐ Installing cabinet/s ☐ Installing pedestal(s) ☐ Installing other structure (specify below)

☐ Removing pole/cabinet/pedestal/structure(s) (specify below)

DESCRIPTION OF WORK: ____________________

ADDRESS OF WORK (incl. street number): ____________________

Location in Road: ☐ Footpath ☐ Berm ☐ Carriageway Other: ____________

Estimated Start Date: ____________ Estimated Duration: ____________ Proposed Work Hours: ____________

Contractor Details:

Role in work to be undertaken: ☐ Principal ☐ Consultant ☐ Contractor Other: ____________

Company: ____________________ Contact person: ____________________

Postal address: ____________________

Phone - Day: A/H: Fax: Mobile:

If you seek to impose any conditions on the proposed work, please notify me at the following address:

____

ACCEPTANCE BY PRINCIPAL PROVIDER

We hereby agree on behalf of the Principal Provider to comply in full with the requirements of the Code of Practice for Working in the Road SNZ HB 2002:2003, any other reasonable conditions required by the Council and to keep this notice on site while work is in progress. This consent is valid for 3 months from date of issue.

Signature: ____________________ Date: ____________

WAIMAKARIRI DISTRICT COUNCIL APPROVAL USE ONLY

☐ Approved Contractor ☐ Route plan submitted ☐ TMP submitted ☐ Stockpiling arrangements

Special additional conditions as attached: ____________________

Signed on behalf of the Waimakariri District Council: ____________ Designation: ____________

Print Name: ____________ Date of Issue: ____________

Copy sent to Maintenance Contractor: ☐

Road Opening Notice (RON)

INFORMATION

1. "SNZ HB2002:2003 Code of Practice for Working in the Road" provides national procedures, specifications and methods for carrying out road openings. This standard has been adopted by the Waimakariri District Council as the basis for all openings in District roads. It details duties and responsibilities of the Road Controlling Authority, Principal Providers and Contractors.

2. * A Road Opening Fee of $50.60 (GST inclusive) must be paid for all road openings except:
   - Those using trenchless construction
   - Those involving the maintenance or installation of utilities in an unsealed rural berm that do not disturb an area of more than 2m x 2m or require a trench more than 0.75m wide and 6m long.

3. The Principal Provider (party paying for the work to be done eg utility owner, developer) shall lodge a RON with the Waimakariri District Council (Road Controlling Authority (RCA)) for all works[i] involving excavation. The RON shall be applied for at least:
   - Emergency work – no later than 1 working day after the work starts
   - Minor work – 3 working days before work starts
   - Major and project work – at least 15 working days before work starts

   Road Opening notifications may be made on this form or on Appendix D – Road Opening Notice in SNZ HB 2002:2003 Code of Practice for Working in the Road

4. A Road Opening Notice (RON) does not absolve the Principal Provider from:
   - The responsibility of obtaining other consent/s such as those relating to the requirements of the Resource Management and Building Acts, the Council's District Plan or by Environment Canterbury prior to commencement of work.
   - Obtaining service plans from other service providers.

5. Please refer to the Code for additional information.

---

i NZS HB2002:2003 Definitions Clause 1.4 (Works – Emergency, Minor, Major, Project)

Works Completion Notice

To Roading Unit
Waimakariri District Council
Private Bag 1005
RANGIORA 7440

From ______________________ (The Principal provider or their consultant)

____

____

Date ______________________

This is to advise that work on RON N°. ______________________

on ______________________ (Street name) *is now complete.*

Please find attached

☐ Amendments to information provided on the RON as follows:

Type of work: ☐ Project ☐ Major ☐ Minor ☐ Emergency

Details of Proposed Work

Description of work: ______________________

____

Address: ______________________

Location in road: ______________________

Estimated start date: ______________ Duration: ______________

Contractor Details

Role in work to be undertaken: ☐ Principal ☐ Consultant ☐ Contractor ☐ Other

Company Name: ______________ Contact Person: ______________

Postal Address ______________________

Phone: Day: A/H: Fax: Mobile:

☐ Copy of the compaction tests

☐ An as-built sketch or plan showing the extent and location of the work carried out

☐ A written statement confirming that the completed works fully comply with the conditions of the RON

☐ Details of work for the Waimakariri District Council to complete as follows: ______________________

Works meet required standards: Date: ______________

Accepted by Waimakariri District Council: Date: ______________ Print Name: ______________

Works comply and 12 months maintenance period commences: Date: ______________ Signature: ______________

Notice copied to ______________________ Maintenance Contractor

____

Works Maintenance Notice

To Roading Unit
Waimakariri District Council
Private Bag 1005
RANGIORA 7440

From ______________________ (The Principal provider or their consultant)

____

____

Date ______________________

This is to advise that the 12 month maintenance audit of

RON No. __________ on ______________________ (Street name)

TYPE OF WORK: ☐ Project ☐ Major ☐ Minor ☐ Emergency

has been completed and complies with the conditions of the RON.

This Audit was accomplished by:

☐ A site inspection

☐ Not inspected, but was one of a batch covered by random inspections in accordance with the Quality Plan agreed with the Waimakariri District Council.

Signed ______________________

Work meets required standards: ______________________

Signed by the principal provider:

______________________ Date: __________ Print Name: ______________________

Work meets required standards: Date of audit undertaken by the Waimakariri District Council: ______________________

Accepted by the Waimakariri District Council Date: __________ Print Name: ______________________

Works comply and 12 month warranty period commences: Date: __________ Print Name: ______________________

Notice copied to ______________________ Maintenance Contractor

____

____

WAIMAKARIRI
DISTRICT COUNCIL

ENGINEERING CODE OF PRACTICE

PART NINE

UTILITIES

April 2009

Part 9: Utilities

CONTENTS

Part 9: Utilities

TABLES

Part 9: Utilities

9.1 INTRODUCTION

This Part discusses issues that must be considered for any developer installing utilities that will not be maintained or owned by the Council. The design requirements of the utilities themselves are not covered here but can be obtained from the individual operators. To achieve good outcomes, view the web site www.nzuag.org.nz on the working road-share and the objectives agreed by the industries.

The Council should be consulted before designing large works. Designs that may cause major disruption or delays to traffic are unlikely to be approved. The costs of traffic management shall be paid by the developer.

All reticulation systems shall provide an adequate connection to each intended building site, as outlined in section 9.5. For communications systems, this shall include a data transmission rate that is approved by the relevant utility service provider.

9.1.1 Developer's Responsibility

Reticulation shall be adequately designed and provided to efficiently cater for a developments full potential. All reticulation shall meet the materials and installation requirements of the utility service provider.

For new Residential and Business Zone developments separated or annexed to existing similar Zone developments all energy and communications reticulation shall be installed underground.

For lots that are able to be built on, the developer shall provide:

- Energy and communications reticulation to the main body of each lot for Residential and Business Zone subdivisions.
- Evidence from the relevant utility service providers that a physical connection can be made available to each new lot for Rural Zone subdivisions (wireless communication systems will not be acceptable).
- High voltage electricity reticulation on all through roads, where required. This requirement will depend on the network operation and specific system configuration
- Communications reticulation on all through roads.

In Residential and Business Zones low voltage reticulation shall be provided to allow a connection to individual service pillars at the head of all rights of way and leg-in rear lots.

9.2 CONSENT AND COMPLIANCE ISSUES

The consent and compliance information set out in Part 2: *General Requirements* applies to all works within the Waimakariri District, with the addition of the clauses below.

9.2.1 Legislation

The Electricity Act 1992 and amendments is the principal statute that controls the provision of electricity. The Electricity Regulations 1997 and amendments, and the Electrical Code of Practice shall also be complied with at all times.

The Gas Act 1992 and amendments is the principal statute that controls the provision of reticulated gas. The Gas Regulations 1993 and amendments, and the Gas Code of Practice shall also be complied with at all times.

The Telecommunications Act 2001 and amendments is the principal statute that controls the provision of telephone and internet services.

9.2.2 District Council Requirements

The requirements for the provision and installation of utilities are set out in the *District Plan*.

Ensure that the appropriate resource consents are obtained for work in the vicinity of protected trees and that the work is carried out in accordance with CCC *CSS: Part 1*.

9.3 QUALITY ASSURANCE REQUIREMENTS AND RECORDS

Provide the information detailed in CoP Part 3: Quality Assurance and the *Construction Standard Specifications (CSS)*, during design and throughout construction.

9.4 NETWORK UTILITY OPERATOR REQUIREMENTS

Ensure that the design, construction and operation of any network to be adopted by a utility operator complies with their standards.

Usually, utility providers will install infrastructure in a development only where they consider it is feasible to connect to the main network reticulation.

Part 9: Utilities

9.5 UTILITY DESIGN

Where new developments occur within in a Residential and Business Zone that has existing overhead reticulation then communications and low voltage (single phase) domestic reticulation shall be underground except where that reticulation is a lateral that does not serve or cross more than one site. Refer also to the District Plan.

Dedicated lots for substations shall be created complete with appropriate easements. Substations shall be designed for a specified Maximum Demand, as agreed with the energy utility service provider. Loads should be balanced unless specified otherwise.

Transformers, lines, and wires shall not exceed a voltage of 110 kV or exceed a capacity of 100 MVA per circuit. Electrical cables shall be provided with short circuit/overload protection of appropriate capacity and rating. Transformers and switchgear must be provided with an earthing system in accordance with NZECP.

The minimum capacities shown in Table 9.1 shall be used for design purposes.

Table 9.1 Minimum Design Capacities

Development Zoning	Minimum Current Capacity (per dwelling)	ADMD (kVA per dwelling)
Residential low cost	60 Amperes Single Phase	3.0
Residential mid cost	60 Amperes Single Phase	4
Residential high cost	60 Amperes Single Phase	5
Business	100 Amperes Three Phase	N/A

Where gas is reticulated in a subdivision for the purposes of an energy supply, the above residential figures may be reduced by 0.5 kVA per dwelling.

The utility service provider will undertake overall reticulation analysis and approval.

9.5.1 Design Life

Utility reticulation systems shall be capable of serving the development potential of the land for the design life of the development or an indefinite time but not be less than 50 years.

9.5.2 Service Plans

Use the latest service plans when preparing engineering drawings. Be aware that electricity plans may not show all cables for private connections, wastewater plans may not show all laterals to individual properties and gas service plans may not show all service connections.

9.5.3 Location of Utilities

Consider the following when planning the layout of a development:

- Utility services are generally installed parallel to road or legal boundaries;
- Laterals are perpendicular to the main supply and configured to service two lots, wherever possible;
- Boundary boxes and distribution pillars are installed together on a boundary junction and clear of likely vehicle access and trees;
- Allow for maintenance access.

Part 9: Utilities

Consider the following when planning the location and design of structures and their corresponding utility lots:

- Place and design them to minimise adverse visual impact by integrating them with the design of hard and soft landscaping;
- Design to minimise the potential for damage to the structure from vandalism;
- Reduce their impact on traffic movement;
- Structures must not reduce vehicle sight distances and should not interrupt pedestrian movement;
- Ensure that they do not compromise property rights or access;
- Provide access to the structure;
- Allow for the minimum separation distance between telecommunications cabinets and power kiosks or substations.

Some structures may contribute to the environment if designed to enhance the neighbourhood character.

Consult comprehensively with the relevant network utility operators regarding the location of utilities and the spacing and final location of the structures. Refer to CoP Part 10 clause 10.5.2.3 – *Location of Utilities on Reserves* before considering locating utilities in reserves.

Point of supply to each lot/customer is deemed to be the service pillar/junction box. This shall be located at the boundary of the lot, the exact position to be determined by the utility service provider.

For lots accessed by right of way, the point of supply is deemed to be the low voltage pillar/cable pillar located at either the front or rear of the right of way depending on site-specific factors and easement arrangement.

Any point of supply and associated upstream reticulation that crosses any private property to service another property shall be protected by way of easement in favour of the utility service provider.

Service & link pillars shall comply with NZS 6300 series standards that address electrical safety. Pillars shall be installed on every second front lot boundary. This should minimise lateral reticulation within the road reserve. Pillars shall be located 100mm minimum and 400mm maximum from the boundary.

The location of services within the road reserve should generally be as shown in the Standard Drawings 600-245A/B/C. The offset of any footpath, street lighting or street trees shall be considered when siting paths and utility services. The Council will assess the proposed layout at the time engineering plans are submitted for approval.

The developer shall minimise construction of services under concrete paths.

In Residential and Business Zone, all reticulated services shall be laid underground. Where power and telecommunication cables are installed in ducts, duct colours shall meet the relevant utility services provider’s requirements.

Service-boxes and access-covers shall be flush with and parallel to the finished surface of the carriageway, berm or footpath as appropriate.

Part 9: Utilities

9.5.4 Typical Services Layout and Clearances

Minimum separation distances to other utilities shall be determined in consultation with those utility service providers.

There are specific working clearances required between different utility services. Confirm these clearances with the network utility operators before deciding on any utility layout or trench detail.

Table 9.2 Utility Clearances

Service Type 1	Service Type 2	Clearance (mm)	
		Crossing	Parallel
Electricity (Low Voltage)	Electricity – 66 or 33kV	500	1000
	Electricity – 11kV or LV	100	300
	Water – Mains	100	500
	Water – Submains	100	450
	Wastewater	100	500
	Stormwater – in right-of-way or private accessway	300	300
	Stormwater	100	500
Electricity (High Voltage)	Electricity – 66 or 33kV	500	1000
	Electricity – 11kV or LV	100	300
	Water – Mains	100	1000
	Water – Submains	100	450
	Wastewater	100	500
	Stormwater – In right-of-way or private accessway	300	300
	Stormwater	100	500
Telephone	Telephone	150	300
	Electricity – LV (neutral screened or armoured cables)	150	300
	Electricity – LV (not neutral screened or armoured cables) or High Voltage	150	450
	Electricity – High Voltage	150	450
	Water – Mains	100	450
	Water – Submain	100	450
	Wastewater	100	1000
	Stormwater – In right-of-way or private accessway	300	300
	Stormwater	100	500
Gas	Gas	150	300
	Electricity	150	300
	Telephone	150	300
	Water – Mains	100	450
	Water – Submains	100	300
	Wastewater	100	1000
	Stormwater – In right-of-way or private accessway	300	300
	Stormwater	100	500

Typically, the utilities are installed as indicated in Standard Drawings 600-245A/B/C.

Part 9: Utilities

Electricity and phone cables can be installed in a shared trench in a new development.

Gas shall be located at a convenient offset, preferably within the berm. If this is not practicable, locate it under the path or, as the final option, in the carriageway.

Substations, exchanges and other fixed utilities shall be located to optimise reticulation efficiency and facilitate access for maintenance works. They shall be located clear of other services, and not within the road reserve. Where this cannot be satisfied, Council approval is required to locate the structures in a road reserve

9.5.5 Network Reticulation

The telecommunications layout is not usually designed until the electricity layout is substantially complete - this is an economic decision as the layouts are inter-related and, in land developments, service trenches are shared wherever possible. Ensure that power is provided to telecommunication cabinets, cable television cabinets and amplifiers.

Ensure that drawings sent to the utility designer and the network utility operator show all the existing services. Ideally, these drawings should be the approved subdivision consent or engineering drawings. This reduces the likelihood of conflicts between existing and new services and increases the cost-efficiency of service provision.

Send a copy of the utility layout plans that have been accepted by each network utility operator to the Council, with the engineering drawings.

9.5.6 Above-Ground Utilities

Locate above-ground utilities within legal road to provide the clear zone required by CoP Part 8 clause 8.12.10 – *Clear Zones*. Locate street light poles in accordance with CoP Part 11 clause 11.4.10 – *Pole Setback from Road or Path*. In addition to clear zone distances within the 50km/hr speed environment, locate the utilities clear of the footpath and at least 0.7m behind the kerb

For overhead energy supply greater than 1 MVA and up to two thirds of feeder capacity, the supply shall have alternative sources connected by manual switching on the network (unless the supply is on a spur line) or otherwise a ring-main can be provided.

9.5.7 Under-Ground Utilities

The minimum cover to finished ground level shall be as noted in Table 9.3 below. Installation shall include marking tape marking that complies with NZS 4275.

Table 9.3 Minimum Cover

Utility		Cover (mm)
Communications and Gas		400
Electricity	Low Voltage	600
	High Voltage	800

For underground energy supply greater than 300 kVA and up to two thirds of feeder capacity, the supply shall be provided with a ring main unit. Manual switching shall be provided to restore supply in the event of feeder fault.

9.5.8 Energy Reticulation Layout

Service pillar positions should preferably be nested with those of other utility service providers.

A 110 mm diameter duct shall be installed along the road frontage of each lot for Business Zone developments.

Part 9: Utilities

9.5.9 Communications Reticulation Layout

Cabling shall be laid:

- To allow a connection to each service pillar/junction box.
- To the boundary of each lot.
- Along rights of way as appropriate.
- Such that minimum separation distances from other services shall be met.
- Using capacities that cater for the full potential of the development.

9.6 CONSTRUCTION

All reticulation and structures shall comply with the relevant NZ standards, acts, regulations, industry standards and utility provider's requirements for standard design criteria and approved materials.

For any works within a road reserve, the developer shall obtain a road opening permit from the Council. Refer also to *Standard Specification – Road Openings* (QP-C843) and Standard Drawings 600-243, 600-245A/B/C, 600-246, 600-347 and 600-351.

For any temporary works within a road reserve, the developer shall meet the Council's requirements for temporary traffic management, which may include the submission of a traffic management plan to the Council for approval and prior to commencing work.

9.6.1 Proposed Installation Method

There are various methods of installing underground services, including open trenching, directional drilling, pipe bursting, pipe ramming, thrusting, and sliplining. Refer to Part 6: *Wastewater* for further information.

Factors that may affect the choice include the ground conditions, disruption to traffic, presence of trees, site safety, the availability of Council blue ducts and redundant services, e.g. old gas mains or their offsets.

When the intention is to lay a number of utilities in a common trench, ensure the minimum covers and separation distances for each utility in the trench cross-section are obtained.

9.6.2 Installing New Reticulation within Legal Roads

Wherever utility services are installed along existing legal roads, obtain a Network Service Operators Road Opening Notice (RON) from the Council for that work, unless the works form part of an approved roading design. Typically, the RON is obtained after the utility reticulation layouts are confirmed.

If granted, the RON defines the Council's requirements for the restoration of the construction within the legal road and any constraints on the permitted hours of work within that road. To avoid possible conflicts, ensure that the requirements of the RON are included in any contract documentation.

9.6.3 Backfill

Bedding materials should comply with the network utility operator's requirements.

Specify backfill materials individually. The material used must be capable of achieving the backfill compaction requirements set out in *CSS: Part 1*. The RON specifies the final surfacing to the excavation. Orion has particular requirements for trench restoration on hillsides.

9.6.4 Materials

All Low Voltage (single phase) and High Voltage distribution cables shall use cables constructed to AS/NZS 4026 and/or neutral screened cables constructed to NZS 6401 as appropriate.

Streetlighting cables shall be neutral screened copper. Minimum conductor size shall be 10 mm^2. These cables can be laid alongside or integrally with low voltage cables.

Underground joints shall be adequate, permanent and of electrical industry standard, and use industry recognised materials and techniques.

Ducts shall be constructed to NZS 7649 and shall be readily identifiable by label and/or tape and/or colour.

9.7 AS-BUILT INFORMATION

The developer shall submit to the utility service provider for approval as-built drawings for the installed reticulation and utility, including street lighting.

All as-built information shall comply with CoP Path 12: *As-Builts* and this Part.

WAIMAKARIRI
DISTRICT COUNCIL

ENGINEERING CODE OF PRACTICE

PART TEN

RESERVES, LANDSCAPES & OPEN SPACES

April 2009

Part 10: Reserves, Streetscapes & Open Spaces

CONTENTS

Part 10: Reserves, Streetscapes & Open Spaces

FIGURES

Part 10: Reserves, Streetscapes & Open Spaces

10.1 INTRODUCTION

Landscape design for reserves, streetscapes and open spaces is required at all levels of the subdivision and development process, in order to promote the social, economic, environmental, and cultural wellbeing of communities, in the present and for the future. Integrate it with the engineering design to:

- Enhance the character, quality of life and environmental appeal of each development;
- Complement and improve the environmental quality of the surrounding neighbourhood;
- Provide recreation opportunities;
- Increase the region's biodiversity;
- Provide areas for social interaction.
- Contribute to the character, shape and form of the district and it's environment.

All landscape developments must seek to optimise long-term community and environmental benefits whilst minimising ongoing maintenance costs, in order to provide for the safe use and enjoyment of the public assets.

Establish the overall objectives for the landscape design, such as wildlife corridors, the provision of reserves, the connection of open spaces, access to and location of watercourses and wetlands and protection of existing valued vegetation, at the outset and incorporate them into the initial concept for the development. Ensure the subsequent engineering design and works are compatible with these objectives.

Part 10: Reserves, Streetscapes & Open Spaces

10.2 CONSENT AND COMPLIANCE ISSUES

The consent and compliance information set out in CoP Part 2: *General Requirements* applies to all works within the Waimakariri District, with the addition of the clauses below.

10.2.1 Legislation

The Resource Management Act (RMA) 1991 and amendments is the principal statute that controls land development.

10.2.2 District Council Requirements

All relevant WDC policies and specifications shall be complied with. Approval shall be required from the Parks Advisor for any new reserve or street planting assets.

The Council will audit compliance with resource consent conditions by both site inspections and checking of associated documentation to the extent necessary to ensure the work is completed in accordance with the approved plans and specifications and to the Council's standards.

10.2.3 Consent Application – Information Required

In addition to the information required to support the concept drawings and/or Resource Consent plans in CoP Part 2: *General Requirements*, the following data shall also be provided:

- Layout and details of any planned irrigation systems

Part 10: Reserves, Streetscapes & Open Spaces

10.3 QUALITY ASSURANCE REQUIREMENTS AND RECORDS

The developer shall provide the information detailed in CoP Part 3: *Quality Assurance* during design and throughout construction.

10.3.1 The Designer

The designer of all reserves and streetscapes that are to be taken over by Waimakariri District Council must be suitably experienced.

The design reviewer must have at least equivalent experience to the designer.

10.3.2 Design Records

The design report must include a design statement that:

- Shows an understanding of the inherent characteristics and values of the site (e.g. social, cultural, environmental/ecological, economic, historic, recreational), including the existing landform and vegetation;
- Outlines the design philosophy and intent;
- Demonstrates compliance with the CoP;
- Demonstrates compliance with the guidelines for safe environmental design outlined in the *CPTED* guidelines.

Provide detail of the unmodified site gained from a site visit and records which clearly demonstrate it e.g. coloured aerial photographs.

All drawings and documentation must be of sufficient detail and accuracy to ensure understanding of all aspects of the development proposal and assessment of the maintenance implications of the works.

Specifications for all proposed works or items that are not covered by the WDC Standard Specifications must provide sufficient detail that construction standards are not compromised and the Council does not inherit faulty items, features or plantings that require removal, replacement, repair or high levels of maintenance.

Wherever the developer is using a cash-in-lieu contribution to carry out works on behalf of the Council, a schedule of prices and rates with the engineering drawings is required.

10.3.3 Drawings

Drawings must show all streetscape and reserve planting and all facilities, structures and furniture that the developer proposes to install, including existing features to be retained. The location of existing and proposed underground services, irrigation systems and streetlights shall be included, and amenity beds labelled individually. The planting plan must be approved by the Council's Parks Advisor before works may begin.

Planting drawings must have a plant list. This should detail both botanical and common names, PB size at planting, quantity of individual species, staking, planting medium and other planting requirements. The source of the plants shall be recorded for revegetation projects. A clear reference system should be used to identify the location and set out of species. All planting plans containing street trees or tree planting are to show where underground services are located. Refer to Appendix A and Appendix B for tree and plant specifications.

If the development varies from the accepted engineering drawings, approval from the Council shall be obtained **before** undertaking any physical works.

10.3.4 As-Built Information and Asset Data

As-built drawings and associated reserve asset data which comply with CoP Part 12: *As-Builts* are required for all structures, services and developments on reserves. Where reserves may be geologically unstable, a geotechnical completion report, as detailed in CoP Part 4: *Geotechnical Requirements*, with the as-built drawings is required.

Part 10: Reserves, Streetscapes & Open Spaces

10.4 OVERALL SUBDIVISION LANDSCAPE DESIGN

Landscape design for reserves, streetscapes and open spaces is required at all levels of the subdivision and development process, in order to promote the social, economic, environmental, and cultural wellbeing of communities, for both the present and future.

Landscape design should be integrated with engineering design to:

- Enhance the character, quality of life and environmental appeal of each development;
- Complement and improve the environmental quality of the surrounding neighbourhood;
- Provide recreation opportunities;
- Increase the region's biodiversity;
- Provide areas for social interaction.
- Contribute to the character, shape and form of the District and surrounding environments.

The developer should work closely with the Council from the start of the subdivision process to establish overall objectives for the landscape design, such as the establishment of wildlife corridors, the provision of reserves, the connection of open spaces, the location of watercourses and wetlands and the protection of existing valued vegetation so that these can be incorporated into the initial concept for the development. The developer must ensure the subsequent engineering design and works are compatible with these objectives.

All landscape developments must seek to optimise long-term community and environmental benefits whilst minimising ongoing maintenance costs.

10.4.1 Design Criteria

The Council will use the following assessment criteria when evaluating development layouts and reserve designs:

Community – The provision of recreation assets that cater for the needs of the surrounding community, as identified by WDC Activity Management Plans and through analysis of local demographics, residential densities, and activity and leisure trends.

Accessibility – The provision of logical, safe and attractive access within the subdivision and to the surrounding community, with good linkages to reserves and community facilities.

Natural resources and habitats – The conservation and restoration of existing natural landforms, hydrological features and processes, wildlife habitats and significant vegetation.

Quality – The provision of environmental and recreational assets which function efficiently, have high aesthetic appeal, and will not cause undue nuisance to neighbouring landowners.

Safety – Any assets must provide for safe use and meet CPTED criteria.

Maintenance – The provision of durable assets whose on-going maintenance and eventual replacement will not place a disproportionate burden on Council resources.

10.4.2 Consideration of Existing Features

10.4.2.1 Existing Waterways and Wetlands

The retention and enhancement of natural waterways and wetlands is an integral part of any development. Opportunities to view should be created by establishing reserves, providing walkways and cycleways, appropriate planting, designing streetscapes, and ensuring that all boundary fencing has clear visibility from neighbouring properties.

Part 10: Reserves, Streetscapes & Open Spaces

10.4.2.2 Existing Vegetation

The Council will undertake an inspection of existing vegetation on land to be subdivided at the time of the application for subdivision consent, and may require that some trees and other existing vegetation thought to be of ecological importance or significant amenity value be protected and retained e.g. vegetation that provides a visual screen.

All notable/historic trees protected under the *District Plan* or by other legal means must be retained.

All vegetation to be retained must be protected by the subdivision or land-use consent. Existing vegetation should be shown on the engineering drawings and all tree canopies marked out to their drip lines.

All trees and vegetation must be in a safe, healthy and undamaged condition, with an expected life of at least 20 years, when accepted by the Council. Trees requiring extensive work to remove dead or twisted branches will not be accepted by the Council.

Refer to Appendix D, which details particular measures to be taken during construction to protect vegetation and other features.

A qualified arborist must undertake any arboricultural maintenance. Any trenching, excavation and filling within the drip line of the tree must have an approved methodology and be undertaken under the on-site supervision of a qualified arborist.

10.4.2.3 Historic & Cultural Features

Protect and retain culturally significant areas, historic areas (including Ecological Heritage Sites), features of importance to the community, such as monuments and memorials, objects and buildings protected under the *District Plan* or by other formal/legal means.

10.4.2.4 Natural Landforms

Protect natural landforms where appropriate and possible, as they convey the natural heritage of the site, and provide landscape features that can add to the sense of place and local identity.

10.4.2.5 Existing Soils

Protect the structural and functional integrity of the soil system by retaining the natural soil profile. Soils contain most of the life-sustaining features of the terrestrial ecosystem. These include the soil structural features such as organic and inorganic particles, nutrients, and living components (invertebrates and bacteria). These support and sustain the roots of plants that are dependent upon these components. If soils are degraded, the system’s ability to support the range of living organisms declines, compromising the wider ecosystem.

10.4.3 Landscape Planting

10.4.3.1 Benefits of Landscape Planting

Planting should be designed to make a positive contribution to the subdivision and the surrounding local area in one or more of the following ways:

Functionally

- Provide shade, shelter and privacy.
- Reduce noise and air pollution.
- Calm traffic.
- Assist drivers to recognise intersections and major entrances to subdivisions.
- Reduce glare and reflection.
- Provide relief from hard surfaces.
- Control erosion.
- Create physical barriers.
- Provide recreation and amenity value.
- Protect and restore cultural and historical resources and values.
- Protect and enhance indigenous biodiversity.
- Protect and improve water quality.

Aesthetically

- Frame views.
- Reflect the seasons.
- Emphasise landforms, soil types and landscape features.
- Structure and define spaces.
- Reduce the visual impact of roads and hard surfaces.
- Screen unsightly outlooks.
- Provide colour, form, texture and interest.

10.4.3.2 Planting Design

Trees and plantings shall be in accordance with an approved landscape plan. In small subdivisions it maybe sufficient for the developer to propose a planting scheme and submit this to the Council for approval.

All planting must be appropriate to the scale and character of the development and the local conditions.

Garden beds and specimen trees should be appropriately designed and located for the particular requirements of the street or reserve.

The proximity of houses, buildings, services, existing or future footpaths, cycleways and access ways should be considered when selecting plant species and their location.

Landscape planting is compulsory along waterways where the banks are steeper than 1:4, but is optional in other circumstances.

All planting must comply with the guidelines for safe environmental design outlined in the *CPTED* guidelines.

Allowance shall be made at the design stage for maintenance activities to be carried out without impeding traffic on the adjacent road.

10.4.3.3 Compatibility with Engineering Design

Planting plans shall be associated with engineering and earthworks drawings to ensure that the engineering works, earthworks and planting works are all compatible.

The location of specimen trees and plant beds must not compromise the efficient operation of existing infrastructural services.

Plant locations must comply with the legal overhead and underground clearance requirements of the network operators, with allowance made for the natural growth of the plants to maturity.

Trees in new subdivisions must not be planted within 2m of any sewer lateral and the effect of any services must be considered.

Trees planted in new subdivisions must have a 0.9m separation from underground services. This may limit street planting to one side of the road to gain the necessary clearance.

Planting in swales must not obscure or obstruct the access to structures or compromise the hydraulic functionality of the system over time.

10.4.3.4 Species Selection

The selection of trees, shrubs and ground cover plants must be appropriate for the conditions at the planting site, such as soil type, drainage and local climate, to ensure healthy, attractive, well-formed, mature plants. Additional selection criteria include low maintenance and longevity.

Trees and plants used in conjunction with swales must be able to tolerate both water logged soils and drought conditions.

Selection of reserve and street trees is to be in accordance with Appendix B and the WDC *Street Tree Policy*. In addition, trees should be selected and located to minimise ongoing pruning costs and other maintenance requirements, and over-reliance in any one species should be avoided.

When selecting and locating trees, allowance shall be made for each tree to grow healthily for an **expected life of 50 years** without unduly compromising services, surfaces, structures, safety or amenities, or causing unacceptable shading. Trees should be spaced sufficiently far apart to allow healthy development of mature canopies and allow sunlight to penetrate between the canopies.

Various plant species will not be permitted to be planted in Waimakariri streets or reserves due to undesirable characteristics such as their:

- Known potential to become weeds.
- Invasive root systems and potential to sucker.
- Heavy production of seeds and quick germination.
- Heavy production of pollen and/or allergenic pollen.
- Poor form and weak branch structure.
- Susceptibility to disease and pests.
- Poisonous bark, leaves, seeds or fruit.
- Heavy shading over streets (especially in winter).
- Excessive nuisance from falling leaves and debris.

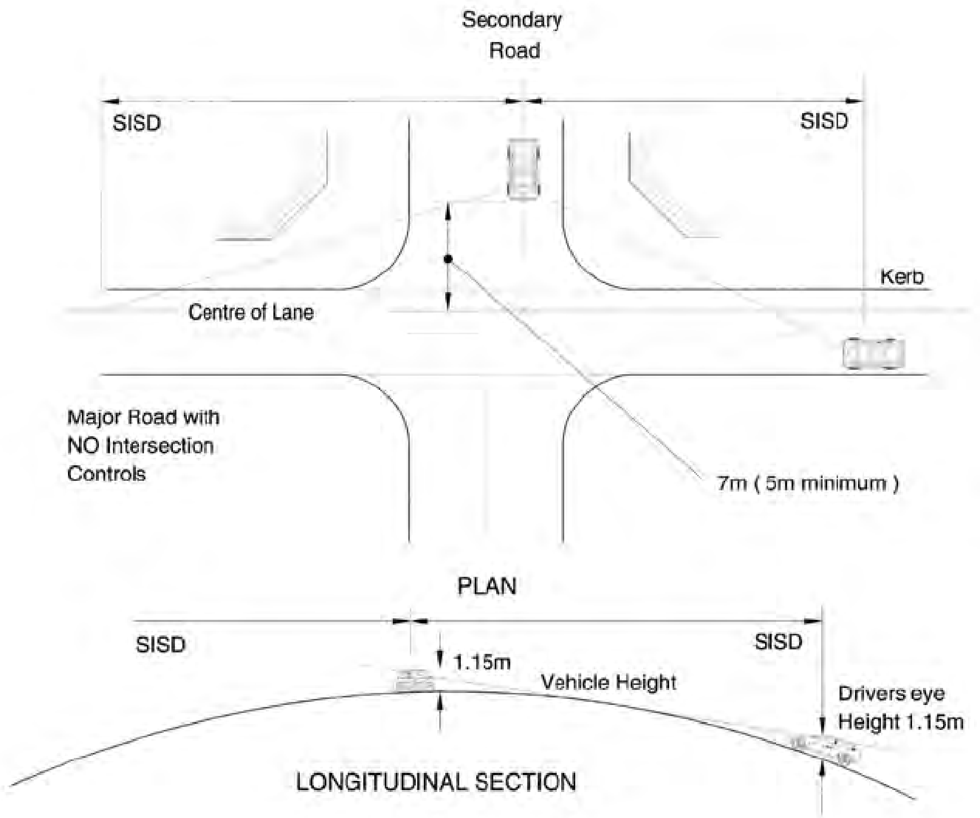
The Council's Parks Advisors will be able to advise on suitable plant and tree species.

Part 10: Reserves, Streetscapes & Open Spaces

10.4.3.5 Protection of Sightlines

All roadside vegetation on roundabouts, on traffic islands, and within traffic sight lines shown in Figure 10.1 must have either a maximum height of 0.6m or be limbed up to provide a clear trunk to a height of 2.5m. This will preserve sight lines to and from vehicles. The planting must be suitable for climbing up and easily maintained within this height.

All street-tree planting must comply with the minimum separation and sight distances shown in Figure 10.1 and Figure 10.2. These distances may need to be increased to protect sightlines, depending on the road geometry and speed environment.



Speed Value (km/h)	Safe Intersection Sight Distance (SISD) Rural	Urban
40	70	60
50	90	80
60	115	105
70	140	130
80	175	165
90	210	-
100	250	-
110	290	-
120	330	-

Notes:
1. It is desirable that plants are placed far enough back from the Intersection so that even when mature the SISD is maintained.
2. See Transit New Zealands Guidelines for Planting for Road Safety for more Details

Figure 10.1 Intersection sight distances for clear sight lines (Fig 7.2 NZS 4404)

Part 10: Reserves, Streetscapes & Open Spaces

10.4.3.6 Street Garden Design and Location

The Council will only approve new street gardens as entrance features to subdivisions and on internal roundabouts. Plant beds within streets, other than on a roundabout, will not be approved.

Roundabouts with an area less than 15.0m^2 may be planted with groundcover and have one specimen tree planted, which complies with clause 10.4.3.5 – *Protection of Sightlines*.

Shrubs and ground cover plants should be selected and spaced to achieve good form and acceptable coverage of the planted site within 2 to 3 years, but possibly with some slower growing species interspersed. Plant must be able to grow true to form without unduly compromising services, structures, safety, amenities, or causing unacceptable shading. Planting to achieve an established look in the short-term must not result in congestion that requires removal, pruning or thinning in the short to medium term. This does not apply where nursery crops are being used.

All shrubs and/or ground covers should be grouped together in mulched plant beds that are designed to minimise maintenance requirements. The edge definition may be a boundary fence, footpath, kerb, timber batten or informal trench margin. Informal trench margins are not appropriate in sandy soils.

Plants with drooping stems or leaves that might trip pedestrians should be positioned so that the leaves of the mature plants will not hang over any footpath.

Refer to Appendix A for planting and mulching specifications.

10.4.3.7 Street Tree Design and Location

The District Plan currently requires street trees to be placed within the road reserve at an average spacing of 1 tree per 20m of road length or the equivalent number of trees per section of road grouped as approved by the Council. For example, a stretch of road between two intersections of 100m length may have a group of five trees on one side near one end.

Note that the road may need to be realigned to accommodate a group of trees. There may also be additional resource consent requirements.

Street trees placed as above should be primarily centred between the two side boundaries of each residential lot.

Alternative design proposals are strongly encouraged, such as the provision of trees in a dedicated “non-services” berm on either side of a footpath; meandering footpaths; and trees placed in specialised tree planting pits within the carriageway but outside of the live lane. Variation of the boundary lines along streets can create spaces for trees to be planted in groups and can help accentuate road legibility, particularly at intersections. Strategically placed grouped plantings of trees may have more impact than individual trees placed outside each house. Consideration for reduced levels of sunlight will need to be taken into account if group planting is to take place.

Street trees shall be located where they do not affect street lighting, create dark spots or create shaded areas that could lead to icing of carriageway areas in winter or unreasonable shading on private property. Deciduous trees are preferred for street locations, however evergreen trees may be accepted by the Parks Advisor.

Street trees should be planted at a distance from the edge of the traffic lane that provides a clear zone as specified in CoP Part 8 clause 8.12.10 – *Clear zones*.

Street trees need a minimum berm width of at least 1.5m. Where the berm is less than 2.0m wide, the relationship between the final tree trunk size and the clearances required in Standard Drawings 600-245A/B/C should be carefully considered. Wherever the distance from the kerb to the legal road boundary is less than 4.5m, species growing to less than 8m high over 50 years shall be used.

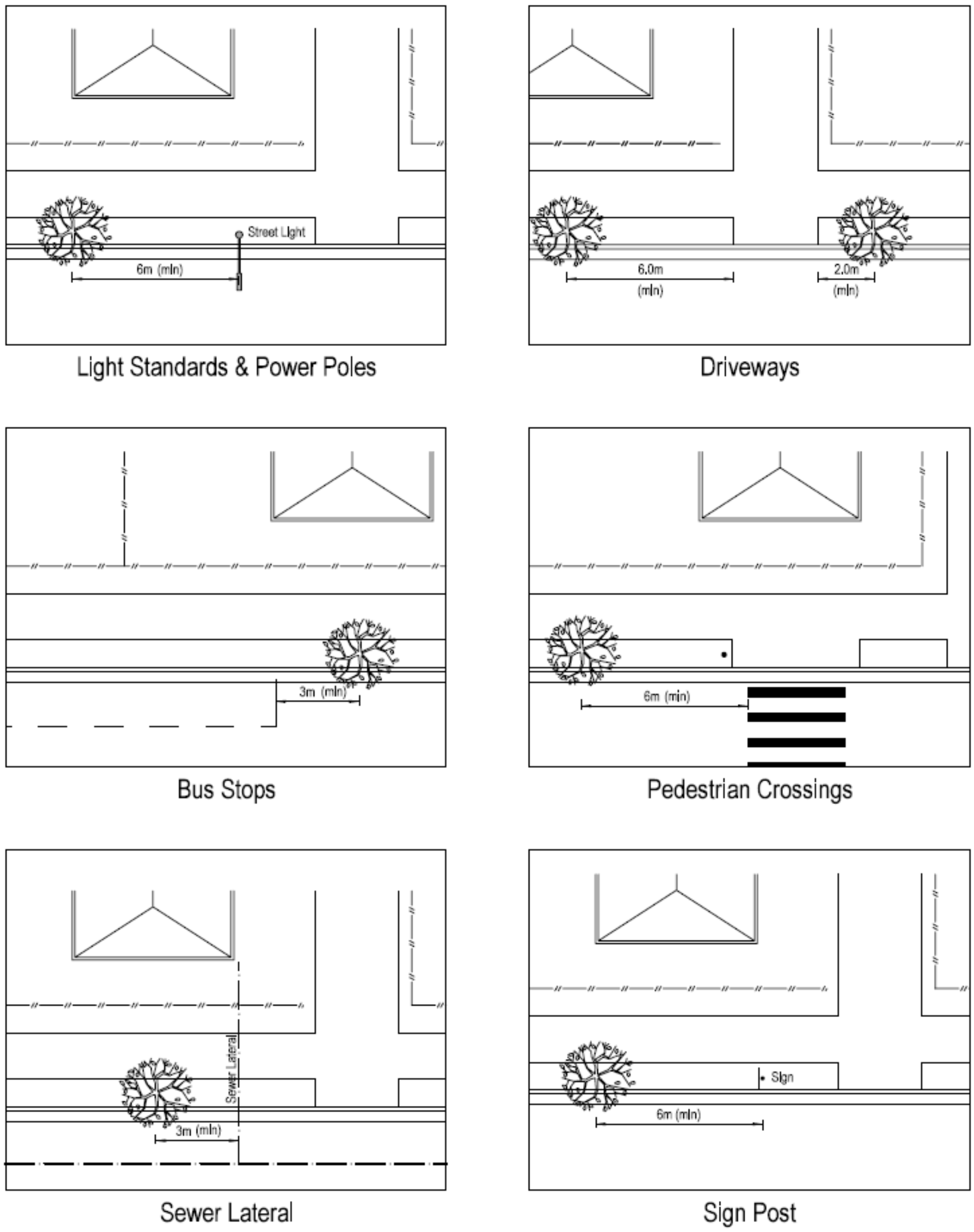


Figure 10.2 Street tree planting separation (Fig 7.1 NZS 4404)

Street trees shall be planted and any necessary root barriers installed in accordance with the *Street Tree Policy* and Appendix B.

10.4.3.8 Grassed Berms

All lawn areas must have gradients that ensure that surface water drains to a suitable area or outlet. Wherever grass lawns are flat the subsurface must have sufficient free drainage to ensure that water does not pond or settle, to maintain grass growth and health and to ensure that use of the area is not compromised. Areas that may be inundated by water regularly or for long periods are not appropriate for lawns.

Mowers must be able to access all grass berms.

The area for seeding must have adequate topsoil and fertiliser, and be free of weeds.

Refer to CoP Part 8 clause 8.12.2 – *Grassed Berms* (Roading) for details regarding berms on legal road.

10.4.4 Reducing Waste

When designing the development, the ways in which waste can be reduced should be considered, for example;

- Plan to reduce waste during demolition e.g. minimise earthworks, reuse excavated material elsewhere.
- Design to reduce waste during construction e.g. prescribe waste reduction as a condition of contract.
- Select materials and products that reduce waste by selecting materials with minimum installation wastage rates.
- Use materials with a high recycled content e.g. recycled concrete subbase.

The Resource Efficiency in the Building and Related Industries (REBRI) website has guidelines on incorporating waste reduction in projects www.rebri.org.nz/.

Part 10: Reserves, Streetscapes & Open Spaces

10.5 RESERVES

10.5.1 Reserve Planning

The Council gives priority to the equitable distribution of reserves throughout the District and within each area of urban expansion.

The developer is expected to take the community's needs and aspirations, environmental issues, existing features and vegetation on the development site into account when locating, planning and designing each reserve.

To assist with this, the developer is encouraged to engage a landscape architect and discuss reserve concepts with the Council's Parks & Recreation Manager. It is preferable for this process to begin at a pre-application meeting prior to applying for resource consent.

The requirements for each reserve area may be specific and will depend on what has generally been agreed between the Council and the developer.

Each reserve must be classified in accordance with its primary purpose e.g. recreation or local purpose (utility), and this must be recorded on the subdivision consent layout plan.

Where the terrain is suitable and space is available, the Council prefers the use of swales, soakage basins and wetlands within new developments to store, filter, and move stormwater through reserves. In most situations, the Council will agree to the vesting of these areas as local purpose (utility) reserves instead of recreation reserves.

Sufficient open space must be provided for general recreational purposes (if this is part of the reserve's primary purpose), so that land set aside for utility purposes does not limit the provision and use of open space for the community to enjoy.

A developer who wishes to contribute to the early development of recreation facilities and/or landscape features on a proposed reserve should enter into negotiations with the Council to reach agreement on:

- A landscape plan for the reserve, including planting, paving, fencing and irrigation;
- What elements of the landscape plan the developer will implement;
- The standard of finish to which completed works are carried out;
- The level of development to which completed works are carried out;
- The balance of reserve contribution owing to the Council in cash (if applicable).
- Future maintenance requirements

The reserve will be vested in the Council once the reserve is developed to the agreed level, the 224(c) certificate is signed off and the maintenance period has expired. The Council will, if necessary, carry out further landscape development as and when capital funding becomes available.

Part 10: Reserves, Streetscapes & Open Spaces

10.5.2 Reserve Design

10.5.2.1 General Considerations

The following factors shall be considered when designing reserves:

- The suitability of the site for its intended purpose;
- The extent and nature of the topsoil and subsoil, including fertility, structure, moisture-holding capacity and drainage;
- Existing and proposed levels and their relationship to the levels of the surrounding land and to the provision of underground services;
- The presence of contaminants and/or imported materials and how any adverse effects can be accommodated and/or mitigated;
- The stability of the site and how any instability can be accommodated and/or mitigated;
- Opportunities for shared use of the land for both recreational and infrastructural purposes, such as drainage easements and stormwater retention in an extreme event (20 year return period or greater), **provided the main purpose of the reserve is not unduly compromised**;
- Access through the area for pedestrians and cyclists;
- The relationship of one reserve to another within reasonable proximity, to avoid duplication.

In general all recreation reserves shall be required to have:

- Appropriate shaping and gradients to allow for mowing and stormwater control;
- Adequate drainage to provide year-round use;
- Adequate top soil;
- An even ground surface free of lumps and hollows;
- No stones, gravel or rubble at the ground surface;
- No gorse or other noxious weeds;
- A grass surface developed, watered, mown and maintained as per clauses 10.4.3.8 and 10.5.2.6, and Appendix C;
- A layout that provides a safe environment for users;
- Features that require reasonable maintenance matched to the purpose of the reserve;
- Structures that have an indefinite design life but not less than 25 years

All built assets (e.g. signs, fences, artworks, lighting, structures and furniture) must be robust, low maintenance, and safe for use by the public. The design and model of park assets shall require the approval of the Parks Advisor. The life-cycle of built assets should be considered, to reduce the frequency of renewing or replacing such assets in the future.

The aesthetics of the colours and construction materials used for built assets should be considered and approved by the Parks Advisor.

The proximity of trees to the reserve boundary shall be restricted as shown in Table 10.1.

Table 10.1 Minimum tree setoffs to reserve boundary

Type of Tree	Minimum Distance from Reserve Boundary
Small tree or shrub	4m
Specimen tree that will exceed 8m height in 50 years	6m
Specimen tree that will exceed 20m height in 50 years	20m

10.5.2.2 Design Requirements for Different Types of Reserves

Neighbourhood reserves should be designed and developed in accordance with this document and with the Councils' Neighbourhood Reserve Policy.

Good drainage and a firm turf surface are the prime requirements for providing good sports fields. Areas prone to ponding, high water tables and slow drainage are generally not suitable for use as sports fields. The slope of the turf surface must not be greater than 1 in 100.

Winter sports fields must have a minimum of 25m between the sidelines and any reserve boundary, and a minimum of 40m between the goal lines and any reserve boundary. Junior winter sports fields must have a minimum of 10m between the sidelines and any reserve boundary, and a minimum of 25m between the goal lines and any reserve boundary. Cricket blocks must have a minimum of 80m between any point on the block and any reserve boundary.

Wherever sports fields are to be provided, the developer shall supply a sewer connection as specified in the consent conditions and show this on the reserve development plan. This shall be installed over the legal boundary into the reserve and to the specified location.

10.5.2.3 Location of Utilities on Reserves

Any proposed primary utility lines and structures located on reserves must be shown accurately and to scale on the landscape drawings.

Aboveground structures, such as power kiosks and pump stations, must not be located on recreation reserves.

The Council must approve the location of any aboveground structure in an esplanade reserve or local purpose reserve.

Aboveground structures should be located on other types of reserve where they do not reduce the use of the reserve for its prime purpose or interfere with pedestrian and cycle paths.

Wherever reserves are to be provided, the developer shall supply a water connection as specified in the resource consent conditions and show this on the reserve development plan. This shall be installed over the legal boundary into the reserve and to the specified location.

10.5.2.4 Revegetation, Restoration and Connection of Habitats

Revegetation and restoration means planting native trees, shrubs and ground cover plants, based on ecological principles. It may involve infill planting in existing remnant plant associations or the re-establishment of lost associations. Such opportunities should be identified at the earliest stage in planning.

Developers should identify opportunities to use waterway corridors, recreation reserves and street trees to form "green corridors" linking existing and proposed habitats.

Revegetation and restoration planting may also be required along stream and riverbanks and in and around swales, soakage basins and wetlands. Plants used must be able to tolerate inundation and variations in the groundwater and surface water levels. Existing and future variations in micro-topography and microclimate should be taken into account.

Plants should generally be eco-sourced and endemic to the local area. Eco-sourcing means that the plants are grown from seeds which have been collected from old naturally established plants (e.g. forest remnants) that are as close as possible to the revegetation site. There are nurseries that specialise in eco-sourced plants.

Refer to Appendix A for planting guidelines.

Part 10: Reserves, Streetscapes & Open Spaces

10.5.2.5 Existing Features

Any trees or shelter belts on the site that the Council does not want to retain shall be removed by the developer, including the removal of stumps and reparation of the surface.

Trees that are to remain on site shall be pruned by a qualified arborist to international best practice, and the wood disposed of by approved means. This shall include the removal of any deadwood or crossing branches, and any end weight reduction as required to prune the tree to a high arboricultural standard.

Any redundant or demolition materials shall be removed (including fences, stockyards, and farming use items) from the site.

See Appendix D for requirements for trees in reserves.

10.5.2.6 Grass Maintenance

All reserve grassed areas and road frontages must be able to be accessed by tractor-mounted or ride-on mowers typically used by reserve maintenance staff.

Concrete collars should be laid around lighting poles, bollards (where appropriate) and vehicle barrier posts to eliminate time-consuming mowing and weed control.

All grass slopes must be no steeper than a 1 in 4 gradient. On mounds, or where there is a significant change in gradient, lawns should be designed and constructed to avoid mowers scalping the ground surface.

Grass mixes appropriate to the lawn use should be used, e.g. playing field mix in playing field areas.

Refer to clause 10.4.3.8 for other details regarding grassed areas.

10.5.3 Park and Reserve Access

10.5.3.1 Vehicle Access and Parking

Access points are required for vehicles to undertake mowing, waterway management, rubbish collection, general maintenance and for emergency vehicles (such as ambulances) at sports parks. The location and serviceability of these vehicle access points shall be considered as part of the overall design.

Vehicle access points must be large enough to allow the entry of heavy machinery to clear dangerous vegetation and blocked waterways during storm events and fire fighting equipment wherever structures or planting present a potential hazard.

Access roadways and off-street parking may be required for reserves such as sports parks, district parks, and at the starting points of tracks. The developer shall ensure adequate space for parking areas is allowed for in the design.

Refer to the WDC *District Plan* for parking requirements, design and layout.

Removable barriers shall be located and designed to prevent unauthorised vehicles from damaging the reserve. The design of barriers must be consistent with other design elements in the reserve.

The design and construction of roadways, parking areas, vehicle crossings and cut downs must comply with CoP Part 8: Roading.

Part 10: Reserves, Streetscapes & Open Spaces

10.5.3.2 Pedestrian & Cycle Paths

Pedestrian and cycle paths are an integral part of the reserve design, as they connect access points and activity areas within and across the reserve. They must be accessible, convenient and safe, in accordance with the *CPTED* guidelines.

Formed pedestrian-only paths should be between 1.5m and 2.0m wide, and paths shared by pedestrians and cyclists should be at least 2.5m wide. Path width should be increased to 3.0m wherever a lot of people are expected to use the path.

Pathways and hard surfaces shall be laid at least 1.0m away from the trunks of reserve trees, with a clear space of 2.5m between the path and the lower branches of the tree, as shown in Figure 10.3.

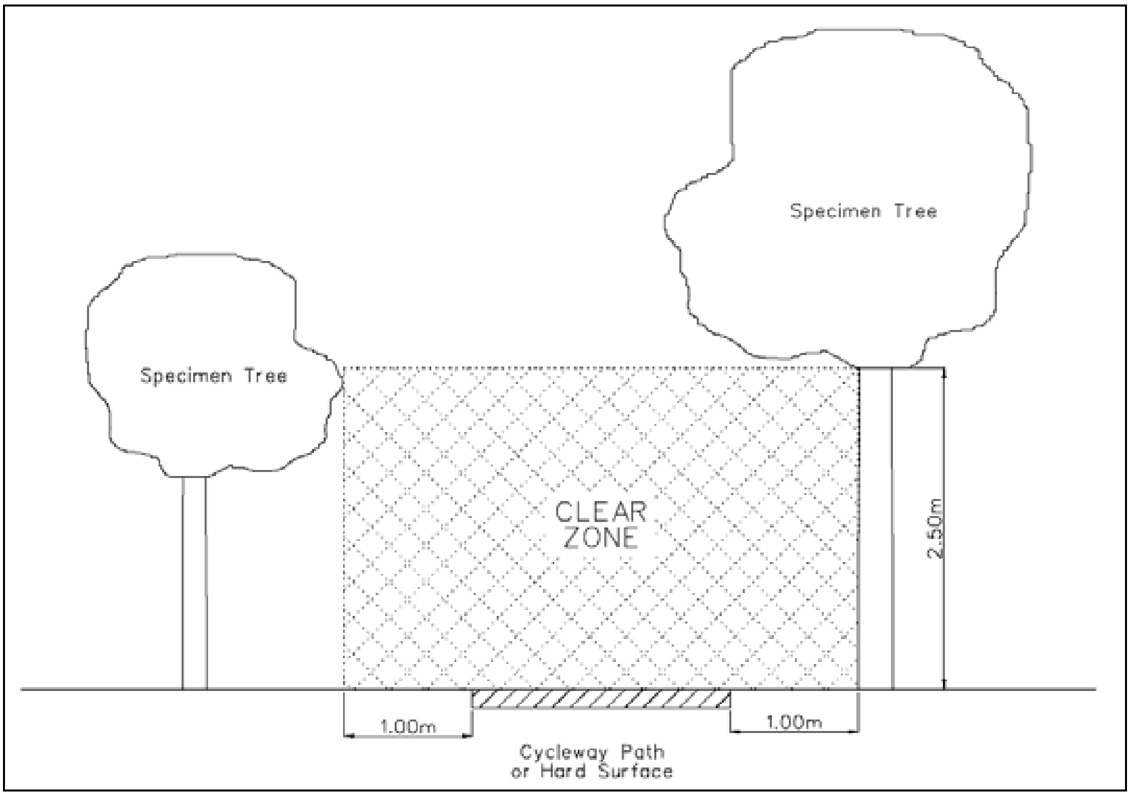


Figure 10.3 Tree offset to hard surfaces in reserves

Walking, mountain bike and multi-use tracks are also integral to the development of some reserves and the enhancement of existing networks, if new tracks can be linked to them. Design and construct walkways or other tracks to comply with NZS/AS 1657:1992 and SNZ HB 8630:2004.

In some reserves, boardwalks may be required as part of the path or walkway/track network to protect sensitive areas such as wetlands and the root zones of protected trees.

CoP Part 8 clause 8.6 –*Road Design* has further information on designing off-road linkages and CoP Part 11 has information on lighting pathways.

The design and construction of pedestrian and cycle paths must comply with CoP Part 8: *Roading.*

10.5.4 Reserve Facilities, Structures and Furniture

10.5.4.1 Playgrounds and Play Structures

The Council's objective is to provide and develop interesting playgrounds that meet the needs of the local community and, in the case of district facilities, the needs and aspirations of the greater community. Not all sites will be suitable for playgrounds.

Approval shall be obtained from the Council for any play equipment within a reserve, including the types and style of equipment. This prevents oversupply or duplication of play facilities in other nearby reserves.

It is important that any proposal integrates the formal play equipment into the entire landscape design for the reserve. The use of natural features in conjunction with formal play structures is desirable.

All play facilities must comply with:

- NZS 5828: 2004 Playground equipment and surfacing, and other applicable standards
- Reserves Activity Management Plan
- The Building Act

10.5.4.2 Recreational Hard Surfaces, Ball Courts & Skate-Boarding Facilities

Recreational hard surfaces are designed to be suitable for many different uses such as skateboarding, rollerblading or handball games.

Approval must be obtained from the Council for any recreational hard surfaces, ball courts and skate-boarding facilities within a reserve, including the types and style of equipment. This prevents oversupply or duplication of these facilities in other reserves.

Skateboarding facilities are designed and built by the Council. Items such as grind rails or small walls may be suitable within a new development but these should be discussed with the Council before incorporating them into the design.

10.5.4.3 Structures

Structures may be installed at the discretion of the Council. These include pergolas, bridges, jetties, boardwalks, barbeques, internal walls, fences and screens.

The design of structures must fulfil both functional and aesthetic requirements. They must be durable and not require a high level of maintenance.

10.5.4.4 Artworks and Sculptures

The Council will consider any requests to install sculptures or other artworks on their merits. The Council will only accept artworks that are durable and do not require a high degree of maintenance.

Any artwork must be acceptable to the majority of the public, appropriate to the character of its setting and to other structural features. Integrated or functional artworks are preferred, such as bridges, light standards and seats.

10.5.4.5 Signs

Reserve signage will be approved and generally installed by the Council following vesting of the reserve.

10.5.4.6 Seats and Picnic Tables

The design of proposed seating and tables must be consistent with the character of the reserve and locality.

The proposed seating and tables must be robust, low-maintenance and safe for use by the public. They can be constructed from materials such as timber, concrete, steel or stone, but the material is not restricted to these examples. Their design must be approved by the Council.

10.5.4.7 Drinking Fountains & Litter Bins

These items must be durable, vandal-proof and consistent with other proposed site furniture and the overall character of the reserve. The Council must approve the design and installation of these items.

10.5.4.8 Boundary Fencing

Fencing covenants are required as a condition of consent for new reserves, including drainage reserves. The developer should co-ordinate fence designs around any reserve or waterway before the subdivision is completed and sections are sold, in order to establish a consistent character.

The Council encourages the use of open frontages onto reserves, where acceptable to the residents. This concept ranges from no fence, so that private gardens merge with the reserve landscaping, to low hedges, climbers on trellis and other “green living” barriers.

Boundary fences over 1.2m high are encouraged to be at least 80% open, in order to enable clear visibility from neighbouring properties.

10.5.4.9 Lighting

The Council prefers to light only those paths and cycleways that are designated safe routes, as identified through the *CPTED* process. Although lighting can be beneficial, areas that are lit are not necessarily safe and can give an undesirable message that it is safe to use an area after dark.

The *CPTED* guidelines explain how to use lighting appropriately. Refer to CoP Part 8 clause 8.6 – *Road Design* and Part 11 clause 11.4.5 – *Category P (Cycleways and Paths in Reserves) Lighting* for more detail.

10.5.4.10 Irrigation

The Council’s long-term goal is efficient and sustainable use of the District’s water supply. The need for irrigation should be minimised by matching plant species to local site conditions.

Irrigation in streets or reserves may be approved at the expense of the developer when it is necessary to overcome difficulties with local site conditions that could prevent the reasonable growth, health and survival of lawns and amenity plantings. The Council should be contacted to discuss the type and control of the irrigation system.

After the establishment period is ended, the Council may negotiate to take over the system at no cost, otherwise the water supply may be required to be disconnected and the irrigation pipes removed.

Revegetated and restored sites are not to be watered unless extreme drought conditions prevail during establishment.

Irrigation systems should be installed in accordance with the WDC *Subdivision Irrigation & Watering Systems Policy*.

Part 10: Reserves, Streetscapes & Open Spaces

10.6 ESTABLISHMENT AND MAINTENANCE

10.6.1 Presentation at Practical Completion of Reserves and Streetscapes

At the time of Practical Completion, all reserves and street gardens must be presented in a tidy condition in accordance with the agreement negotiated with the Council. Refer to clause 10.5.1 – *Reserve Planning*.

Landscaped areas that have been developed must, as a minimum, meet the following general requirements:

- Be free of weed species, tree stumps (above and below ground) and other specified vegetation;
- Be free of surplus, unwanted construction materials, debris, waste (liquid or solid) and rubbish;
- Present an established cover of grass complying with Appendix C (lawn areas only);
- Meet the minimum standards and specifications set out in the appendices for all trees and planted areas;
- Be completed by the developer to agreed plans and standards, within the agreed timeframes and to the satisfaction of the Council.

The Council will inspect all new assets prior to the release of the 224(c) certificate to ensure that the minimum standards and specifications set out in the appendices are met.

10.6.2 Maintenance Requirements

The developer is responsible (and will be bonded) for the establishment, routine maintenance and any replacement of the planting, lawns and associated works during the maintenance period.

The length of the maintenance period is 12 months for shrubs and gardens, following the date of issue of the Council's Completion Certificate. The maintenance period for street and reserve trees shall be 24 months. The maintenance period is to demonstrate that the plants are well established, healthy and fit for purpose.

The developer shall rectify any damage to turf or surrounding areas including scalping, wheel rutting and damage caused by faulty machinery and third party contractors.

All dead, dying, diseased or damaged trees and plants (damage includes vandalism, theft and inappropriate pruning) or those trees and plants that do not conform to the Standard Specifications (included in the appendices) shall be replaced at the developer's cost, as required to maintain the original numbers, grades and species as per the approved plans. Replacement shall take place as soon as favourable planting conditions exist (i.e. winter months). Replacement trees shall be subject to a further 24 month maintenance period.

Paths, roads and all other accessways shall be kept clear of excess growth. This includes sight lines as set out in Figure 10.1 and minimum clear heights over paths and cycleways of 2.5m.

A qualified arborist must undertake formative pruning of trees at least once during the maintenance period. All pruning must comply with recognised international arboricultural best practice. At no time shall crown-lifting (removal of lower branches) exceed more than 1/3 of the total height of the tree. Trees that have been topped or are not up to a high arboricultural standard (as determined by the Parks Advisor) will not be accepted.

A qualified horticulturalist must undertake any required pruning of plants (e.g. shrubs and groundcovers) once planted. All pruning must comply with recognised horticultural practice.

Part 10: Reserves, Streetscapes & Open Spaces

The Standard Specifications included in the appendices outline the minimum establishment and maintenance standards required, and the recommended procedures to be followed, to ensure that all landscape works are at an acceptable standard prior to final inspection and release of the bond. CoP Part 2 clause 2.12 – *Bonds* elaborates on these requirements.

Contract auditing will be in accordance with the specific contract auditing specifications included in the appropriate Specification (see the appendices).

Part 10: Reserves, Streetscapes & Open Spaces

10.7 ASSOCIATED DOCUMENTS

Appendix A Standard Specification – Amenity Garden Planting & Revegetation Areas (QP-C844)

Appendix B Standard Specification – Tree Planting (QP-C845)

Appendix C Standard Specification – Grassed Areas (QP-C846)

Appendix D Standard Specification – Protection of Existing Features (QP-C847)

Appendix E Standard Drawings – 600-500, 600-501A/B, 600-245A/B/C

Amenity Garden Planting & Revegetation Areas

CONTENTS

Amenity Garden Planting & Revegetation Areas

1.0 NEW BED PREPARATION

1.1 The Contractor will spray with a suitable ground marker the outline of the garden beds to be cultivated in accordance with the landscape plan, taking into account any site variations. Any significant variations from the plan considered by the Contractor to be necessary to achieve the desired goal should be discussed with the Parks Advisor prior to implementation.

1.2 The Contractor will obtain sign off from the Parks Advisor for the shape of the garden beds prior to spraying the grass off.

1.3 A suitably qualified approved operator shall undertake spraying out of planting sites at least two weeks prior to commencement of planting.

1.4 All beds shall be rotary hoed to cultivate the existing soil and break up any large soil clods or clay pan areas.

1.5 Sufficient good quality compost is to be added to the beds to make the soil more friable, increase humus levels and promote biological activity. Compost will consist of decomposed organic matter, be pH neutral and shall not contain organic matter with a particle size greater than 10mm.

1.6 Prepared beds shall be to a cultivated depth of 200mm.

2.0 EXISTING BED PREPARATION

2.1 The Parks Advisor may require existing beds to be rotary hoed or dug by hand to cultivate the existing soil and break up any large soil clods.

2.2 Compost may be required to be added to existing beds as per 1.5.

3.0 PLANT SELECTION

3.1 All plants shall be good quality, nursery prepared stock of normal habit and true to type.

3.2 Plants should be hardened off to cope with the climatic conditions of the site and be free of pests and disease.

3.3 Plant root systems shall show no evidence of “spiralling” or being root bound.

3.4 The Parks Advisor reserves the right to reject any plants based on their quality, size or habit.

3.5 The plants to be used will be no smaller than PB3 grade for grasses, PB5 grade for flaxes and PB8 for shrubs. Wetland plants may be supplied in root trainers but must be well rooted.

4.0 PLANT SUPPLY AND CARE

4.1 The Contractor shall inspect the plants upon delivery and/or at collection time and inform the Parks Advisor within a day of this of any unacceptable defects in the plants supplied.

4.2 The Contractor will be expected to maintain the plants in good condition in the yard and not damage the plants when transporting them to the planting site or at any other time during the planting operation. Any plants damaged by the Contractor will be replaced at the Contractor’s expense.

Amenity Garden Planting & Revegetation Areas

5.0 SETTING OUT

5.1 All plants shall be set out in their locations and spaced in accordance with the supplied planting plan and any agreements reached between the Parks Advisor and Contractor in Section 1.1 of this document.

5.2 The plant species and estimated numbers required will be outlined on a planting plan provided by the Parks Advisor. The Parks Advisor shall confirm plant numbers in consultation with the Contractor after the garden beds have been marked out.

5.3 As a general principle, gardens shall be planted at a density and with the size of plant that achieves 100% coverage of soil within two years.

5.4 In revegetation areas, the plants shall be grouped informally or spaced individually to produce a natural appearance. Plant spacings must be between 1.5m and 0.75m centres, dependant on the species. In some circumstances (e.g. steep slopes or unstable ground) spacings should be reduced to less than 0.75m centres to ensure quick coverage, promote bank stability and lessen maintenance costs. The selection and placement of plants must reflect the natural succession process.

5.5 Rows of plants shall be a uniform distance apart with plants positioned alternately to those in adjacent rows.

5.6 In areas of block planting, plants shall be spaced so that when established they will completely and evenly fill the areas indicated, unless otherwise specified. The extent of the area to be filled by each species shall first be defined with plants spaced around the perimeter. The remaining plants shall then be used to fill the centre of the area in an informal manner avoiding straight lines and regular geometric patterns, unless otherwise specified.

5.7 The locations of the plants may be required to be verified with the Parks Advisor onsite, before any planting works commence. The position of some plants and/or groups of plants may be changed onsite as the planting proceeds. The Contractor shall cooperate with this requirement.

6.0 PLANTING TECHNIQUE

6.1 Planting is generally to take place between 1 April and 30 September. Planting may occur outside these times with the approval of the Parks Advisor. Wetland areas may be planted outside the recognised planting season.

6.2 Planter bags shall be removed from the root ball and the bags disposed of. Rootballs shall be saturated prior to planting and roots loosened if appropriate.

6.3 Roots shall not be exposed to the sun or wind at any time. As soon as the plant is removed from the bag, it is to be planted immediately.

6.4 Planting holes shall be 2x rootball diameter in width and 1-1.5 x rootball depth. The bottom and sides of the planting holes are to be loosened to encourage root movement into the surrounding soil. Soil removed from the planting hole shall be amended with 30% compost before planting. Fertiliser shall be applied as per Section 8.0.

6.5 Each plant shall be placed in its planting hole and the surrounding soil shall be pushed in around the root ball to firm up the plant.

6.6 The stems of the plants shall be upright and the nursery earth marks on them shall be at the same level as the existing ground level once planted.

Amenity Garden Planting & Revegetation Areas

6.7 Soil surrounding the plant shall be compacted to hold the plant firmly in place and to ensure there are no air pockets below the surface.

6.8 The finished surface shall be compact, firm and level. Any surplus planting material from the holes shall either be removed or spread evenly over the surrounding area (leaving no soil on top of the mulch layer) and taking care not to cover the surface of the newly planted rootballs with additional fill.

7.0 WATERING AND IRRIGATION

7.1 Containerised plants shall be thoroughly moistened prior to planting. If plants are dry, they shall be submerged in water for five minutes until all air bubbles stop rising and then drained before planting.

7.2 All plants shall be watered within two hours of planting, ensuring that the moisture has penetrated to the full depth of the rootball. Watering is important to settle the soil around the roots and eliminate any air pockets. If a water supply cannot be provided at the site, the Contractor will need to provide his own water supply.

7.3 The use of water crystals for amenity plantings may be undertaken as per the manufacturer's instructions and guidelines upon instruction by the Parks Advisor.

8.0 FERTILISERS

8.1 Each plant hole shall have either 'Osmocote Exact – standard' fertilizer or Nitrophoska Permanent or a similar 12 month slow release fertiliser added to the bottom of the hole prior to planting.

8.2 Fertiliser shall be applied in quantities as recommended by the manufacturer.

8.3 No fertiliser shall be applied to wetland plants.

9.0 MULCH

9.1 The planted garden beds shall be mulched with a good quality bark (such as "Budget Bark" from Taggarts, Rangiora), at an approximate settled depth of 75mm.

9.2 All bark mulch shall be free from all other matter, organic or inorganic. All mulch shall also be free from phytoxins and pathogens, and free of weed species including chip from willow, poplar or any other adventive weed species.

9.3 Mulch shall not touch the stems of the plants and a minimum circle of 50mm shall be cleared from around the stem to avoid stem rot.

9.4 Mulch shall be kept off any other adjoining surface, such as lawn or paved areas.

9.5 At no time shall any topsoil be mixed into the mulch.

9.6 Revegetation and restoration sites are not usually mulched. However, if weed suppression or moisture retention are major issues, mulch or individual weed mats may be applied. Mulch must not be placed where it is likely to be washed into the stormwater system during heavy rain.

10.0 EDGING

10.1 All planted areas shall have a maintained edge. An edge is typically comprised of a minimum vertical cut of 100mm deep on the bed perimeter, with soil pulled back into the bed from the cut to provide a smooth, rounded and defined edge and to avoid any soil spread to lawn areas.

10.2 All curved edges shall be smooth and regular. Where the edge is straight, a string line must be used in order to ensure a true straight line.

10.3 Bed edges should be flush with the surrounding surfaces such as paths and lawns.

11.0 SITE CLEAN UP AND RECTIFICATION

11.1 The planting site will be left in a clean and tidy condition at the completion of the work, with any loose stones and soil being removed from grass verges.

11.2 The Contractor shall ascertain if ground conditions are suitable before commencing the work. Any damage to the turf or surrounding areas resulting from work carried out in unsuitable conditions shall be rectified by the Contractor at the Contractor's own expense.

12.0 HEALTH AND SAFETY

12.1 The Contractor shall ensure that all requirements of the *Health & Safety in Employment Act* 1992 are complied with.

12.2 If working on the road or road verge, the Contractor shall have in place an approved Traffic Management Plan.

12.3 The Contractor shall be solely responsible for public safety within and around the site and shall provide all necessary warning devices, barricades and personnel to ensure adequate safety, protection and warning to any person or vehicle or any property within and around the site.

12.4 The Parks Advisor shall be entitled to inspect the site and all plant and equipment at any time to ensure the Contractor is complying with its obligations under section 12.0.

13.0 MAINTENANCE SPECIFICATIONS

13.1 The Contractor may be required to maintain the amenity plantings for a minimum period of 12 months after completion of works to ensure the establishment of the plantings.

13.2 All plants shall be watered to maintain healthy vigorous growth throughout the growing season.

13.3 Plants shall be kept free of pests and diseases and garden beds free of organic and inorganic litter in order to achieve their optimum performance and visual amenity.

13.4 Plantings shall be returned to a 100% weed free condition before weed growth exceeds 10% coverage of each area and 10cm in height. All weeds over 10cm in height shall be maintained by hand pulling.

13.5 Additional fertiliser is to be applied to each plant in September of each year. This fertiliser shall be in the form of a balanced 12 month slow release fertiliser.

13.6 All edging shall be maintained in a sharp, neat and vertical condition with all cuttings removed off site on the day of activity. Where the edge is to be a straight line, a string line is to be used to ensure a true straight line is maintained. All curves shall be smooth and regular.

13.7 Bark mulch is to be kept at the settled thickness specified in Section 9.1 and shall be kept from hard surfaces.

13.8 Where plants overlap hard areas, growth shall be maintained so as not to restrict use of that area. Where plants overlap grass border edges, growth shall be maintained to allow free passage for mowing machines without damage to plants.

13.9 Plants damaged, vandalised, stolen or dead shall be replaced as required to maintain numbers. Replacement planting shall take place as soon as favourable growing and planting conditions exist, which in un-irrigated beds is usually during late autumn and early winter. Plants and planting standards shall be of the same quality as specified in Section 3.0 Plant Selection and 6.0 Planting Technique.

14.0 CONTRACT AUDITING

14.1 The Council will audit compliance with the contract by both site inspections and checking of associated documentation to the extent necessary to ensure the work is completed in accordance with the approved plans and specifications and to the Council's standards.

14.2 The Contractor shall notify the Parks Advisor at least one working day prior to commencing various stages of the works. This is to enable audit inspections required by the contract to be performed.

14.3 The Parks Advisor shall send the contractor a copy of an audit carried out, with any areas of concern identified.

14.4 The minimum level of inspection shall be as follows:

- After the garden beds have been marked out and prior to the grass/area being sprayed.
- At the commencement of planting to check plant stock, plant identity, health and size, plant layout, preparation of garden beds, and planting methods used.
- On completion of the required works.
- Once during the maintenance period to ensure maintenance conditions are being adhered to.
- On completion of maintenance period.

Tree Planting

CONTENTS

Tree Planting

1.0 TREE SELECTION

1.1 Each tree shall be of nursery stock and be of good form that is true to species. Each tree will have a well developed and well shaped trunk or stem and branch placement. Plants shall be healthy, vigorous and free of disease, injury, parasites or insects and shall not be pot-bound. All root masses, except open ground trees shall retain their shape and hold together when removed from their containers.

1.2 Trees shall be a minimum of 2.5 metres above the ground level, have a trunk calliper measurement no less than 30mm at ground level, and have a container size of no less than 35 litres or pb95 at the time of planting.

1.3 Bare root stock will be accepted only in exceptional circumstances, at the discretion of the Parks Advisor.

2.0 TREE SUPPLY AND CARE

2.1 The Contractor shall inspect the trees upon delivery and/or at collection time and inform the Parks Advisor within a day of this of any unacceptable defects in the trees supplied.

2.2 Trees shall have a sturdy, clean, straight, stem. Trees shall be a minimum of 1.8 metres in height with a stem diameter that supports the tree without the need for supporting hardware attached to the main stem for support. Trees will be specified using the measurement ranges stated in Table 1. The stem diameter measurement is taken at 150 mm above the ground for trees up to 100 mm calliper size and 300mm above the ground for larger trees.

Table 1 Minimum Stem Diameter

Average Height Range (m)	Minimum Stem Diameter (mm)
1.5-1.8	15
1.8-2.5	20
2.5-3.0	30
3.0-3.6	40
3.6-4.2	60
4.2-4.8	80
4.8-5.5	100
5.5-	130

2.3 The Contractor will be expected to pick up and deliver trees to site in a good condition. The trees are to be protected during transportation, loading, unloading and planting. Any trees damaged by the Contractor will be replaced at the Contractor’s expense.

2.4 Any bare rooted trees are to have the roots protected at all times to prevent drying out. They must be in a moisture retentive material such as damp straw or Hessian.

2.5 It is the Contractor’s responsibility to ensure that trees are watered before they are transported from the nursery. Once trees leave the nursery they are the responsibility of the contractor.

Tree Planting

3.0 SETTING OUT

3.1 All trees shall be set out with their locations and spacing in accordance with the supplied landscape or planting plan and/or any agreements reached between the Parks Advisor and Contractor.

3.2 Specimen trees and large shrubs in reserves should be planted no closer than the offsets specified in CoP Part 10, Table 10.1 *Minimum tree offsets to reserve boundary*. These offsets are from boundaries with residential properties or from hard surfaces like kerbs, footpaths and cycleways. Specimen trees in lawns shall be planted as far apart as necessary to allow for full growth within a 50-year life span

3.3 Specimen trees and large shrubs in the road reserve should be planted in compliance with the offsets specified in Standard Drawings 600-245A/B/C. These offsets are from kerbs, service trenches and hard surfaces like footpaths and cycleways.

3.4 The locations of the trees shall be verified by the Parks Advisor by either an approved landscape plan or on-site meeting before any planting works commence.

3.5 The Parks Advisor may require that the position of various trees and/or groups of trees be changed onsite as the planting proceeds. The Contractor shall cooperate with this.

4.0 PLANTING TECHNIQUE

4.1 The following specifications and the specifications required by Standard Drawings 600-501A or 600-501B are to be adhered to when carrying out tree planting:

Weed free circle/mulching	400mm radius tree circle covered with 7.5cm deep bark mulch.
Tree pit	Pits shall be at least 150mm wider than the root spread each side of the tree and at least 150mm deeper. The bottom of the hole shall be forked over to an additional depth of 150mm to facilitate root penetration, air movement and free drainage. The finished surface shall be slightly convex towards the middle of the pit. The backfilled soil shall be a 50/50 mix of topsoil and compost mix.
Ties	Tree tie shall be looped around the stakes and then bound over itself repeatedly to form a tight support to the tree with giving enough room for slight movement. The tie should be of a black webbing type.
Staking posts (size)	50 x 50 mm timber stakes. If there are multiple trees to be planted, the stakes shall all be uniform in appearance to each other.
Irrigation	A 1900mm long section of perforated Novaflow pipe shall be inserted into the tree pit. The Novaflow is to run down one side of the tree pit, under the intended rootball and up the opposite side of the tree pit to be level with the ground surface. The other end is to extend above the intended mulch layer by 20mm. Both ends of the pipe should be capped. Underground irrigation systems can be used instead of manually watering.
Fertiliser	Each tree shall receive a balanced slow release fertiliser to the amended soil mix.

4.2 Planter bags shall be removed from the root ball and the bags removed from the site. Rootballs shall be saturated prior to planting and roots loosened if appropriate.

Tree Planting

4.3 Roots shall not be exposed to the sun or wind at any time. As soon as the tree is removed from the bag, it is to be planted immediately. If plants are slightly potbound the roots shall be loosened, trimmed and spread out to ensure healthy growth.

4.4 The bottom and sides of the planting holes are to be loosened to encourage root movement into the surrounding soil. Where an auger or similar method is used to excavate the tree pit, the sides of the excavation shall be scarified before planting.

4.5 Soil removed from the planting hole shall be amended with compost and fertiliser as per the table above before planting.

4.6 The tree is to be planted in the centre of the pit with the amended soil/compost mix backfilled and compacted by heeling in firmly so as to ensure that there are no air pockets below the surface.

4.7 Vertical staking (600-501B) will be adopted as the preferred method of above ground staking. Diagonal staking (600-501A) may be used in high vandalism areas but only by the approval of the Park Advisor. Tree stakes are to be firm in the ground and if multiple planting is to be carried out the stakes are all to look uniform. Tree ties are to be visually level in appearance.

4.8 The nursery earth marks on each tree's trunk shall be at the same level as the existing ground level once planted.

4.9 The finished surface shall be compact, firm and level. Any surplus planting material from the holes shall be removed from the site and the surrounding grass raked free of any residue.

4.10 All trees shall be well watered within two hours of planting to assist in the bedding in of the tree. Watering shall be of such that moisture has penetrated to the full rootball. If watering cannot be provided at the site, the Contractor will need to provide his own water supply.

4.11 Council reserves the right to ask the Contractor to install root barriers (generally in a street environment) when required. Root barriers may be installed at the time of planting on the kerb side and the footpath side of each tree or where there are other infrastructural services (including private or public buildings or other structures) likely to be affected by future growth. Each barrier shall be a minimum of 2000mm length x 600mm depth x 0.5mm thickness. The top of the barrier is to be level with the surrounding surfaces i.e. not protruding above the surface. The proposed root barrier is to have the approval of the Parks Advisor prior to installation.

5.0 MULCH

5.1 The tree circles shall be mulched with a good quality bark such as "Budget Bark" from Taggarts, Rangiora, at an approximate settled depth of 75mm.

5.2 All bark mulch shall be free from all other matter, organic or inorganic. All mulch shall also be free from phytoxins and pathogens, and free of weed species including chip from willow, poplar or any other adventive weed species.

5.3 A minimum circle of 50mm around the trunk of the tree shall be kept clear of mulch to avoid problems with trunk burn.

5.4 Mulch shall be placed in such a way that it does not run onto any other surfaces, such as grassed, paved or sealed areas.

5.5 At no time shall any topsoil be mixed into the mulch.

Tree Planting

6.0 EDGING

6.1 All tree circles shall have a maintained edge. An edge is typically comprised of a minimum vertical cut of 100mm deep on the lawn perimeter, with soils pulled back into the planting hole from the cut to provide a smooth, rounded and defined edge and to avoid any soil spread to lawn areas.

7.0 SITE CLEAN UP AND RECTIFICATION

7.1 The planting site will be left in a clean and tidy condition at the completion of the work, with any loose stones and soil being removed from grass verges.

7.2 The Contractor shall ascertain if ground conditions are suitable before commencing the work. Any damage to the turf or surrounding areas resulting from work carried out in unsuitable conditions shall be rectified by the Contractor at the Contractor's own expense.

8.0 HEALTH AND SAFETY

8.1 The Contractor shall ensure that all requirements of the Health and Safety in Employment Act 1992 are complied with.

8.2 If working on the road or road verge, the Contractor shall have in place an approved Traffic Management Plan for the work.

8.3 The Contractor shall be solely responsible for public safety within and around the site and shall provide all necessary warning devices, barricades and personnel to ensure adequate safety, protection and warning to any person or vehicle or any property within and around the site.

8.4 The Parks Advisor shall be entitled to inspect the site and all plant and equipment at any time to ensure the Contractor is complying with its obligations under section 8.0.

9.0 MAINTENANCE SPECIFICATIONS

9.1 The Contractor shall maintain the trees for a period of 24 months to ensure their successful establishment. Council will accept the trees when the trees have passed their final audit and have been jointly signed off by the Parks Advisor and Subdivisions Engineer, after the 24 month maintenance period.

9.2 The Contractor shall maintain the level of mulch around the trees during the 24 month maintenance period to the depth specified above. Mulch shall be kept off grass and hard surfaces.

9.3 During the maintenance period, trees shall be watered on a weekly cycle during the summer period (Oct-Mar) and/or as directed by the Council. Each tree should receive approximately 40 litres of water per application in order to saturate the rootball. During period of drought the trees should be watered twice a week at the same 40 litre application. Water shall be applied at low pressure from a height of less than 500mm radially to 600mm from the base of the tree. Care shall be taken to avoid the displacement of soil or mulch whist undertaking this watering. Where Novaflow pipe has been installed, water should be feed directly into the pipe instead of around the base of the tree. If an underground irrigation system is installed, the Contractor shall monitor the amount of water applied to all trees regularly to establish that water is being applied at adequate amounts for the trees and that all trees are being supplied water.

9.4 Fertiliser is to be applied to each tree in the Spring of the year following planting. This fertiliser shall be in the form of a balanced slow release fertiliser such as Nitrophoska Permanent, which has a 12 month release period.

9.5 Trees should be checked bimonthly. This must include checking ties and stakes to ensure the trees are secure and that they maintain a proper form.

9.6 Trees damaged, in poor form or dead during the maintenance period shall be replaced during the next planting season, at the Contractor's expense, as required to maintain the original numbers, grades and species, as per the approved plans. Any replaced trees will require a 24 month maintenance period commencing from when the tree is planted.

9.7 Trees shall be kept free of pests and diseases, and tree mulch circles free of weeds and inorganic litter in order to achieve their optimum performance and visual amenity.

9.8 All edging shall be maintained in a sharp, neat and vertical condition with all cuttings removed off site on the day of activity. All curves shall be smooth and regular.

10.0 CONTRACT AUDITING

10.1 The Council will audit compliance with the contract by both site inspections and checking of associated documentation to the extent necessary to ensure the work is completed in accordance with the approved plans and specifications and to the Council's standards.

10.2 The Contractor shall notify the Parks Advisor at least one working day prior to commencing various stages of the works. This is to enable audit inspections required by the contract to be performed.

10.3 The Parks Advisor shall send the Contractor a copy of an audit carried out, with any areas of concern identified.

10.4 Acceptance criteria shall be as follows.

a) Trees shall be thriving:
   - With new extension growth present
   - With less than 20% of the original foliage having dropped.
   - With less than 20% dieback of the new foliage, distributed across the entire plant.
   - With less than 5% localised dieback of individual branches.

b) Each tree shall be of good form that is true to species. Each tree will have a well developed and well shaped trunk or stem and branch structure. Plants shall be healthy, vigorous and free of disease, injury, parasites or insects.

Grassed Areas

CONTENTS

Grassed Areas

1.0 FERTILISING AND SEEDING

1.1 Grassed areas shall have adequate top soil with a minimum compacted and settled depth of 150mm. Any compacted subsoil shall be ripped, preferably during the summer period, to a depth of 30cm, with rip lines no more than 1 metre apart, then rolled before any laying of topsoil is undertaken.

1.2 Top soil shall be friable, contain organic matter suitable to support plant life and have less than 2% by weight of unwanted materials such as stones (no larger than 12mm in diameter in the top 50mm) or other inorganic material.

1.3 All grass areas are to be levelled prior to fertilising and seeding.

1.4 Grass areas are to be sown with a good quality, slow growing turf rye grass such as Arena SR4500 unless otherwise specified by the Parks Advisor.

1.5 All rye grass seed used shall have an endophyte level of greater than or equal to 80%, a purity of more than or equal to 99% and a germination final count of more than or equal to 90%.

1.6 The area for seeding shall be free of all weed species.

1.7 The seed shall be applied and cultivated to 20mm depth so that the minimum of seed is exposed. The seeded ground shall be levelled and lightly consolidated to ensure good soil/seed contact.

1.8 Areas to be newly sown for grass shall be fertilised to maintain a pH range of 6.0 to 6.5. A soil test should be carried out to determine the composition and type of fertiliser and/or lime that is to be applied. Note that a soil test may be required prior to pricing.

1.9 Two applications of fertiliser are to be carried out. The first application shall be undertaken when sowing grass seed using a suitable starter fertiliser such as di-ammonium phosphate (D.A.P.) at a rate of 25g/m^2 and second application four to six weeks after grass growth has commenced with a suitable maintenance fertiliser, such as Cropmaster 20.

1.10 For large areas of lawn, grass seed shall be undersown for better strike and reduced loss to birds at a rate of 400kg/ha.

1.11 All newly grass seeded areas are to be rolled with a Cambridge roller (or similar roller to minimise compaction) after seeding. A traditional small steel drum may be used for grass berms next to concrete edges to minimise marking of concrete surfaces.

1.12 First mowing of newly sown grass areas can be undertaken when 50% of the grass coverage has reached a height of 10cm using a rotary mower.

2.0 TURF SUPPLY AND LAYING

2.1 The turf grass mix shall be as specified by the Parks Advisor. The turf shall be sufficiently fibrous for turves to hold together when handled, but excess fibre or thatch is undesirable.

2.2 Turf should be of good quality, free of weeds and pests and of a minimum thickness of 20mm.

2.3 The Parks Advisor may request to inspect the turves prior to them being lifted.

2.4 Turf shall be delivered to the site, kept damp and installed within 36 hours of lifting.

2.5 While carrying out the work, the Contractor shall protect the existing subsoil structures and prevent excessive soil structural damage.

2.6 Turf shall be laid on topsoil that has been cultivated to a depth of 25mm to form a fine even bed.

Grassed Areas

2.7 Turf shall be handled with care and laid in a stretcher bond pattern. The turf shall be laid from planks working over turves previously laid.

2.8 Slow release fertiliser shall be applied as specified to the turf prior to watering.

2.9 The turves shall be thoroughly watered until the turf mat and top 50mm of soil is wet. After allowing a "soaking in" period, the turf should be lightly and evenly rolled so that the turf mat and the soil surface are thoroughly bonded.

2.10 Any inequalities in finished levels owing to variation in turf thickness or uneven consolidation of soil shall be adjusted by raking and/or packing fine soil under the turf, not by topdressing the turf surface.

3.0 HYDROSEEDING

3.1 The hydroseeding mulch shall be a mixture of the specified seed, wood-fibre based mulch, fertiliser and a binding agent. The percentage of wood-fibre in the hydroseeding mulch shall be no less than 75%.

3.2 The hydroseeding shall be applied to a minimum depth of 5mm. Application rates for high profile areas shall be no less than 200kg/1000m^2.

3.3 Products such as "Hydra red" or an equivalent are acceptable hydroseeding mulches.

3.4 Hydroseeding shall be applied using a suitable pumping system with mixing abilities, to prevent settling between applications.

3.5 All existing site features, such as paths and fences, shall be protected during hydroseeding application. Any overspray shall be removed promptly.

3.6 A low-pressure system shall be used to avoid surface rilling or erosion.

4.0 HEALTH AND SAFETY

4.1 The Contractor shall ensure that all requirements of the Health and Safety in Employment Act 1992 are complied with.

4.2 If working on the road verge, the Contractor shall have in place an approved Traffic Management Plan.

4.3 The Contractor shall be solely responsible for public safety within and around the site and shall provide all necessary warning devices, barricades and personnel to ensure adequate safety, protection and warning to any person or vehicle or any property within and around the site.

4.4 The Parks Advisor shall be entitled to inspect the site and all plant and equipment at any time to ensure the Contractor is complying with its obligations under Section 4.0.

Grassed Areas

5.0 MAINTENANCE SPECIFICATIONS

5.1 Grassed areas may be required to be maintained for a minimum period of 12 months after sowing to ensure dense, even turf coverage has been established.

5.2 The lawn shall be an even sward of vegetation at a uniform height with a healthy colour throughout. The lawn shall be free from hollows arising from uneven consolidation of the ground and from stones or similar debris.

5.3 The specified grasses shall be evenly distributed across the lawn and the entire ground surface covered. The grass sward shall not contain any non-specified grasses or weeds.

5.4 All grass areas, once established, shall be mown to a minimum height of 25mm and a maximum height of 50mm unless otherwise specified by the Parks Advisor.

5.5 Grass areas shall be maintained at no less than 90% weed free.

5.6 Areas where grass coverage does not exceed 95% shall be re-sown.

5.7 The contractor shall rectify any damage to turf or surrounding areas including scalping, wheel rutting and damage caused by faulty machinery and sub-contractors.

5.8 Damage caused to fixed objects is to be noted and made good at the Contractor’s cost.

5.9 Any cuttings that fly onto footpaths or surfaces other than the grassed area shall be removed prior to leaving the site. Grass clippings are to be evenly distributed over the grass area or removed.

6.0 CONTRACT AUDITING

6.1 The Council will audit compliance with the contract by both site inspections and checking of associated documentation to the extent necessary to ensure the work is completed in accordance with the approved plans and specifications and to the Council’s standards.

6.2 The Contractor shall notify the Parks Advisor at least one working day prior to commencing various stages of the works. This is to enable audit inspections required by the contract to be performed.

6.3 The Parks Advisor shall send the Contractor a copy of an audit carried out, with any areas of concern identified.

6.4 The minimum level of inspection shall be as follows:

- The Contractor shall supply certificates to the Parks Advisor verifying seed used is the mixture specified by the Parks Advisor and which give descriptions of purity, % germination and endophyte content. The seed should be no more than one year old.
- Prior to seeding to check levelling of surface and ground preparation.
- On completion of the required works after the first mow.
- Once during the maintenance period to ensure maintenance conditions are being adhered to.
- Upon notification from the Contractor that the maintenance period has ended and the assets are ready to be jointly signed off.

Protection of Existing Features

CONTENTS

Protection of Existing Features

1.0 PROTECTION OF EXISTING TREES

1.1 A temporary fence shall be erected around all existing trees that are to be retained on site. This fence shall be erected at the greater distance of one metre outside the tree's drip line or half the tree's overall height.

1.2 This fence shall be erected before any works commence and shall not be removed until all works are complete, without the approval of the Parks Advisor.

1.3 Within the fence there is to be no ground disturbance, storing or disposal of any materials.

1.4 Where it is not possible to complete the works without encroaching within this fenced area, a proposed methodology shall be submitted to the Engineer for approval.

2.0 PROTECTION OF TREE ROOTS

2.1 All roots larger than 25mm diameter shall be retained in an undamaged state and protected, unless the Parks Advisor gives permission in advance for them to be cut. No roots shall be cut if this will have a significant adverse affect on the health and stability of the tree. Where consent is given to cut roots they shall be severed cleanly with a saw or pruning shears.

2.2 All exposed roots and cut root ends shall be protected from drying and frost with damp sacking/scrim, polythene sheet or similar material if not backfilled immediately.

2.3 Wherever practicable, underground services within 10 metres of a protected tree or within 5 metres of any other tree shall be installed by trenchless methods. Otherwise, excavations within the distances set out in Table 1 below shall be carried out by hand.

Table 1 Minimum excavation distances from trees

Trunk Diameter at Ground Level	Minimum Distance from Edge of Trunk	Tree Class
0 - 100mm	1 metre	All
100 - 300mm	2 metre	All
300 - 500mm	4 metre	All
500 - 1000mm	5 metre	Protected trees
500mm and above	5 metre	Other trees
1000mm and above	10 metre	Protected trees

3.0 TREE REMOVAL/PRUNING

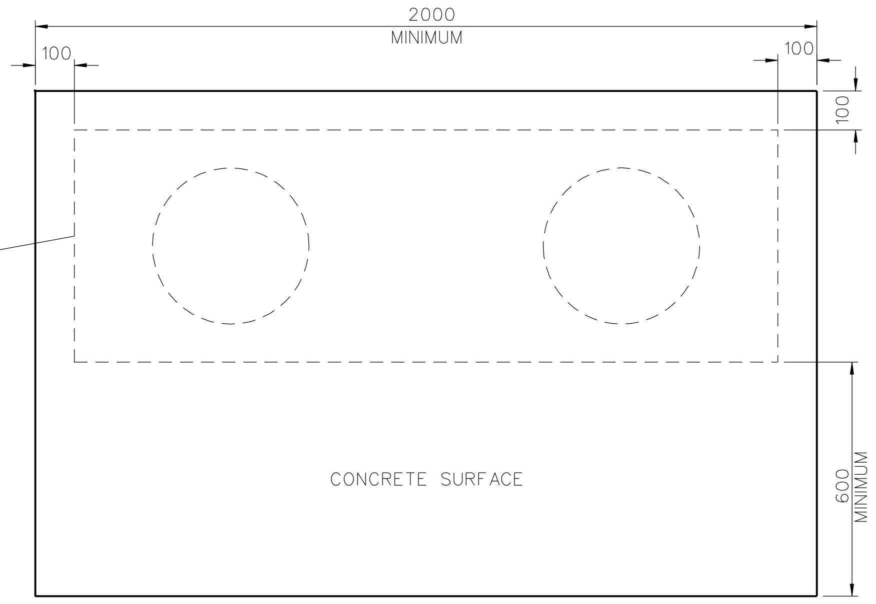
3.1 No trees shall be removed or pruned unless they have been specifically identified and marked during a joint inspection by the Engineer and the Contractor.

3.2 Trees shown on the drawings as conflicting with the works, but without an explanation of whether or not they are to be removed, must not be removed until they are identified as above. The Contractor shall notify the Engineer of trees which are not shown on the drawings, but which appear to be in conflict with the works.

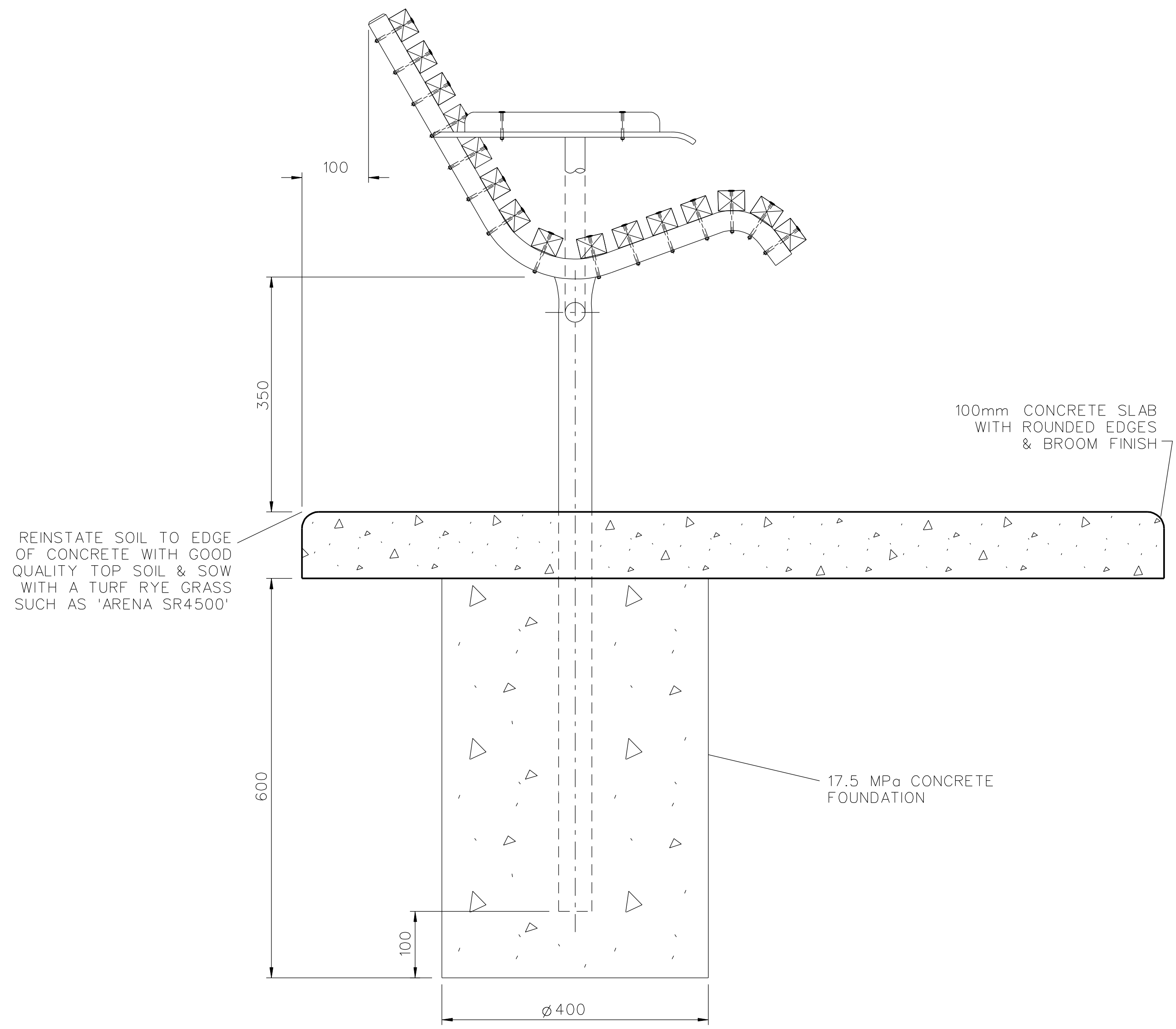
Protection of Existing Features

4.0 DAMAGE TO EXISTING FEATURES

4.1 The Contractor shall compensate the Council for any damage done to existing features, either by means of a monetary sum or by replacement of that feature. The Engineer will determine any compensation for damaged landscape planting, in consultation with the Parks Advisor.



FOUNDATION PLAN



FOUNDATION DETAIL

Based on CCC drawing SD712

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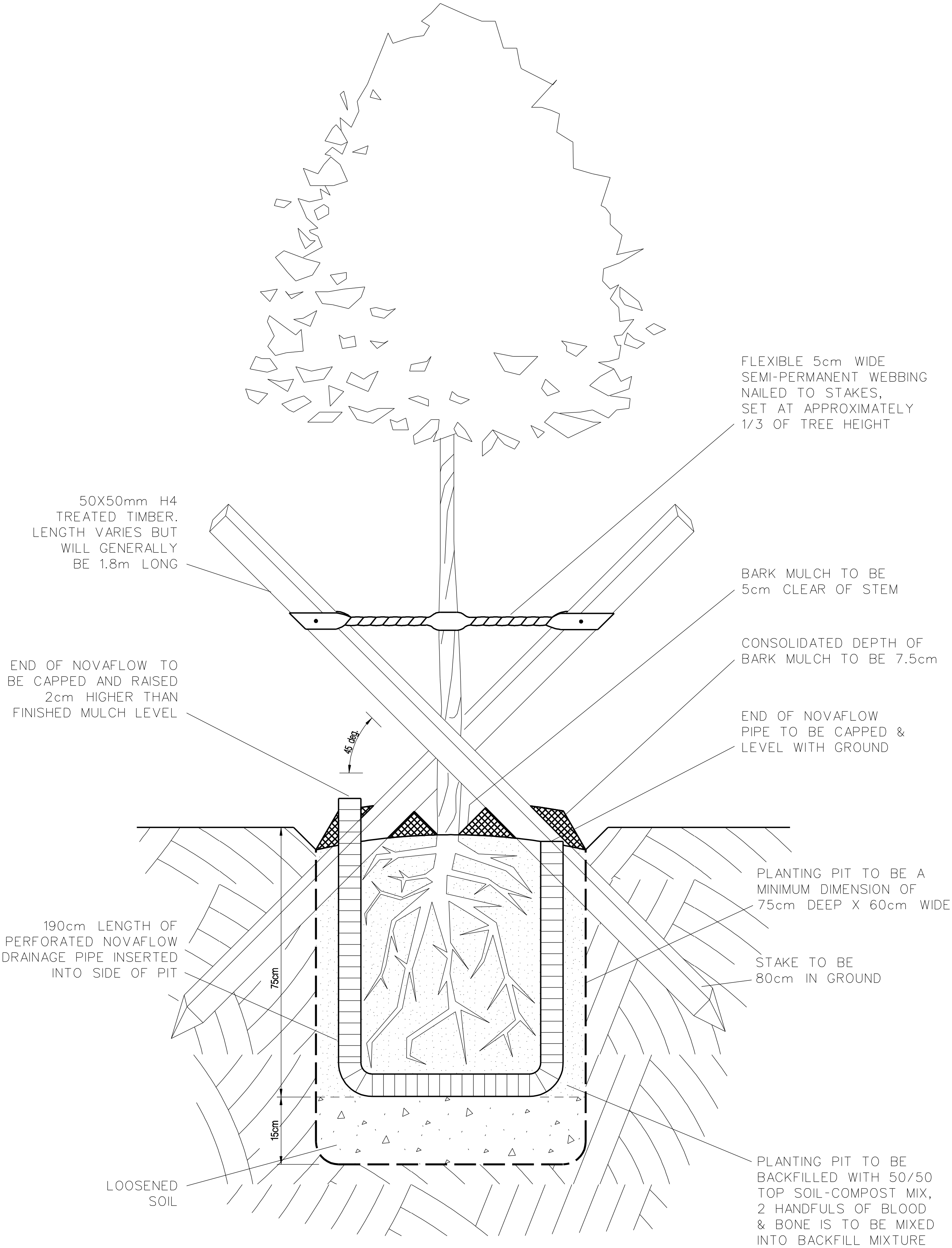
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
		STREET BENCH INSTALLATION	STANDARD DRAWINGS	500
				ISSUE B / PLAN No. 600



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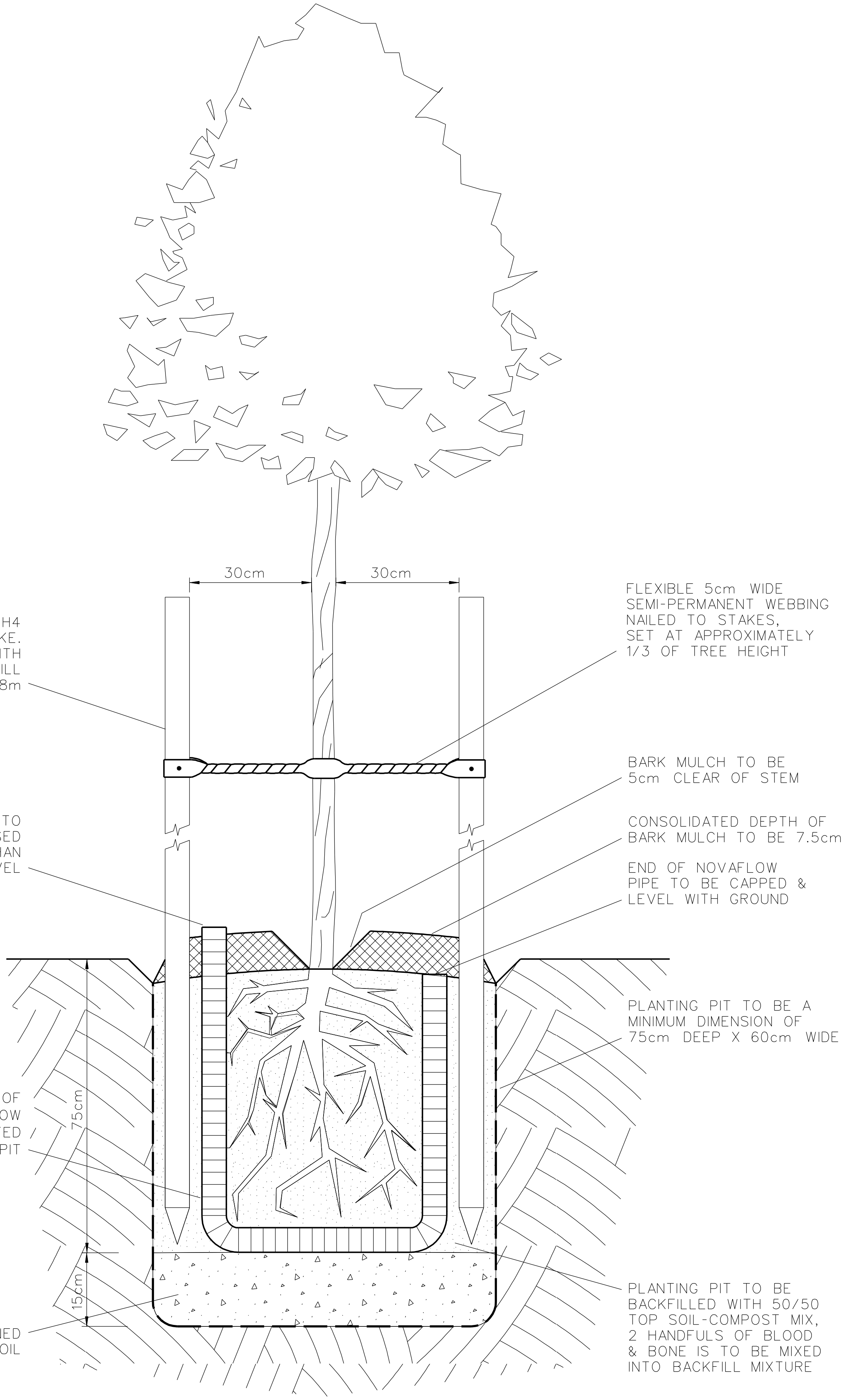
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
		DIAGONAL TREE STAKING	STANDARD DRAWINGS	501A
				ISSUE: B / PLAN No. 600



Based on CCC drawing SD702

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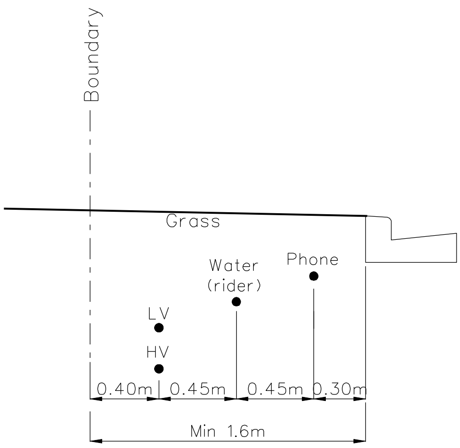
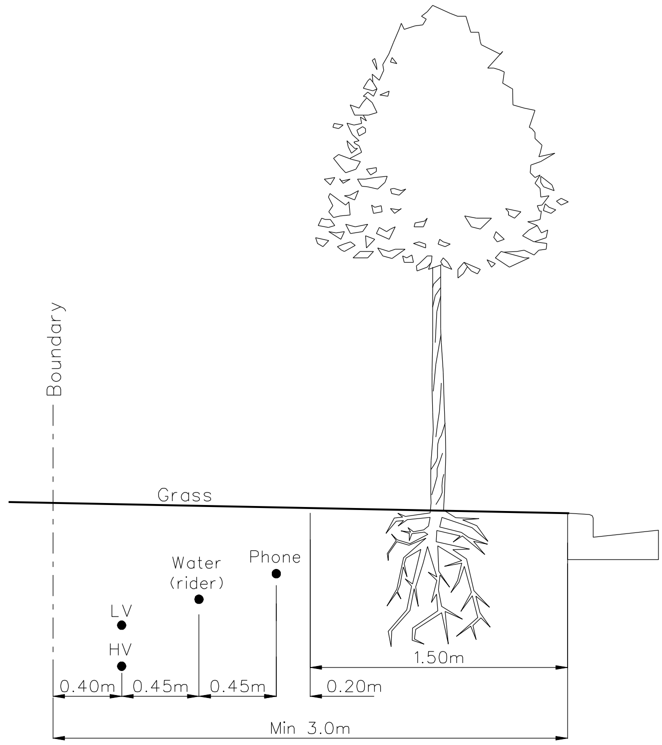
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
		VERTICAL TREE STAKING	STANDARD DRAWINGS	501B
				ISSUE: B / PLAN No. 600

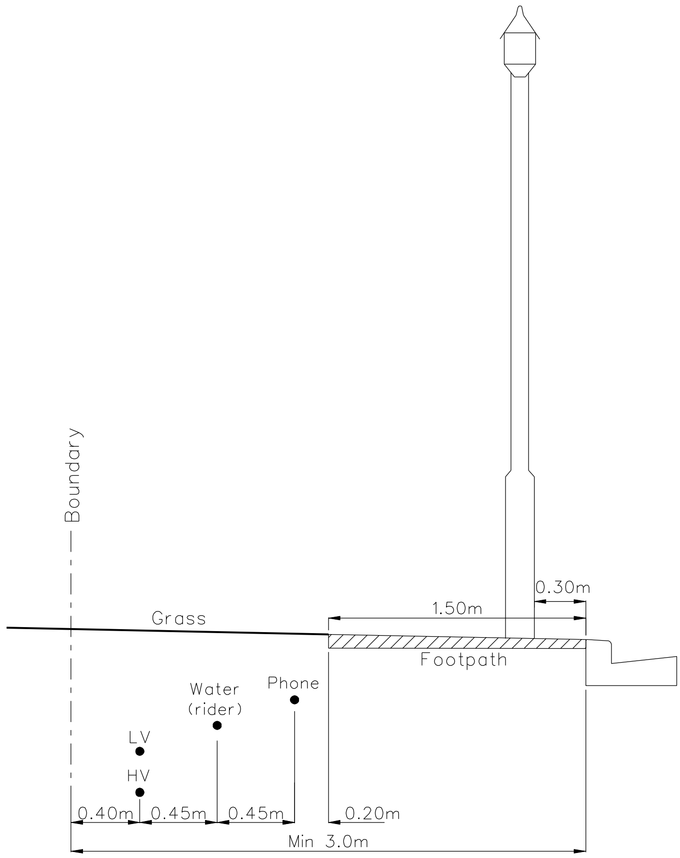
Note: The minimum width of footpath is increased to 2.0m when passing a light standard or other structure. This may overlap the services if the required width is not otherwise available. The length of the widened section shall be no more than 5m.



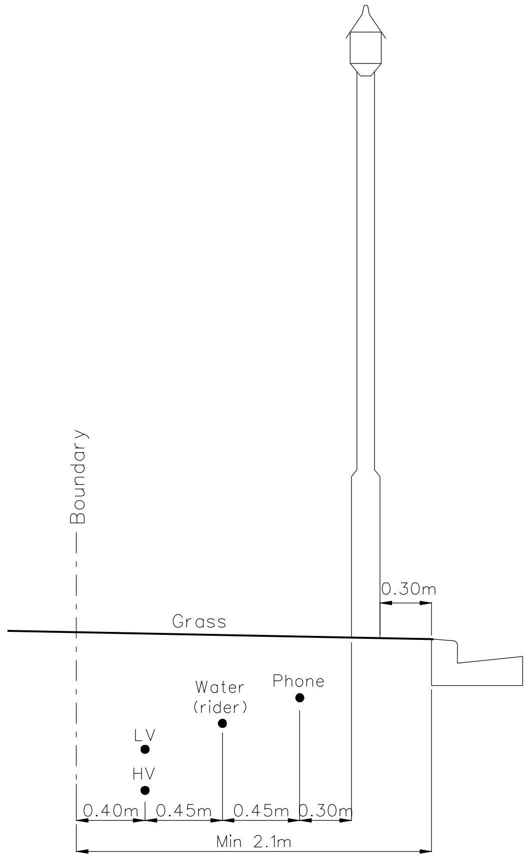
Services Only
1.6m – 2.1m wide



Services & Street Tree
3.0m – 4.5m wide



Services & Footpath
3.0m – 4.5m wide



Services & Light Standard
2.1m – 3.0m wide

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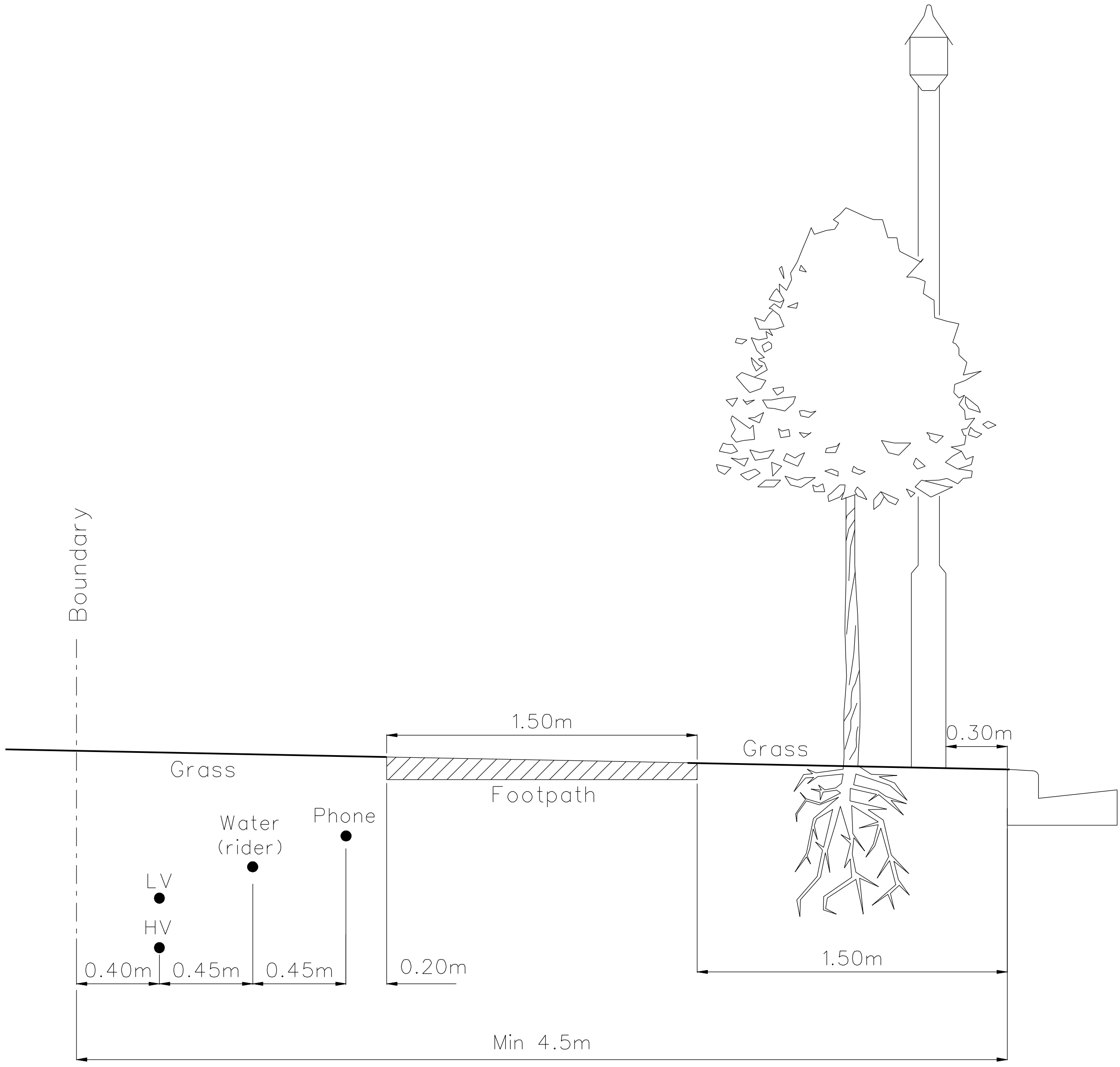
DISTRICT COUNCIL
technical services

NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
	SERVICES IN THE ROADSIDE (SHEET 1 OF 2)	STANDARD DRAWINGS	245A

ISSUE	PLAN No.
A	600



Minimum Widths for a Typical Full Width Berm
(See District Plan for required components)
Must be greater than 4.5m wide

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
		SERVICES IN THE ROADSIDE (SHEET 2 OF 2)	STANDARD DRAWINGS	245B
				ISSUE: A; PLAN No.: 600

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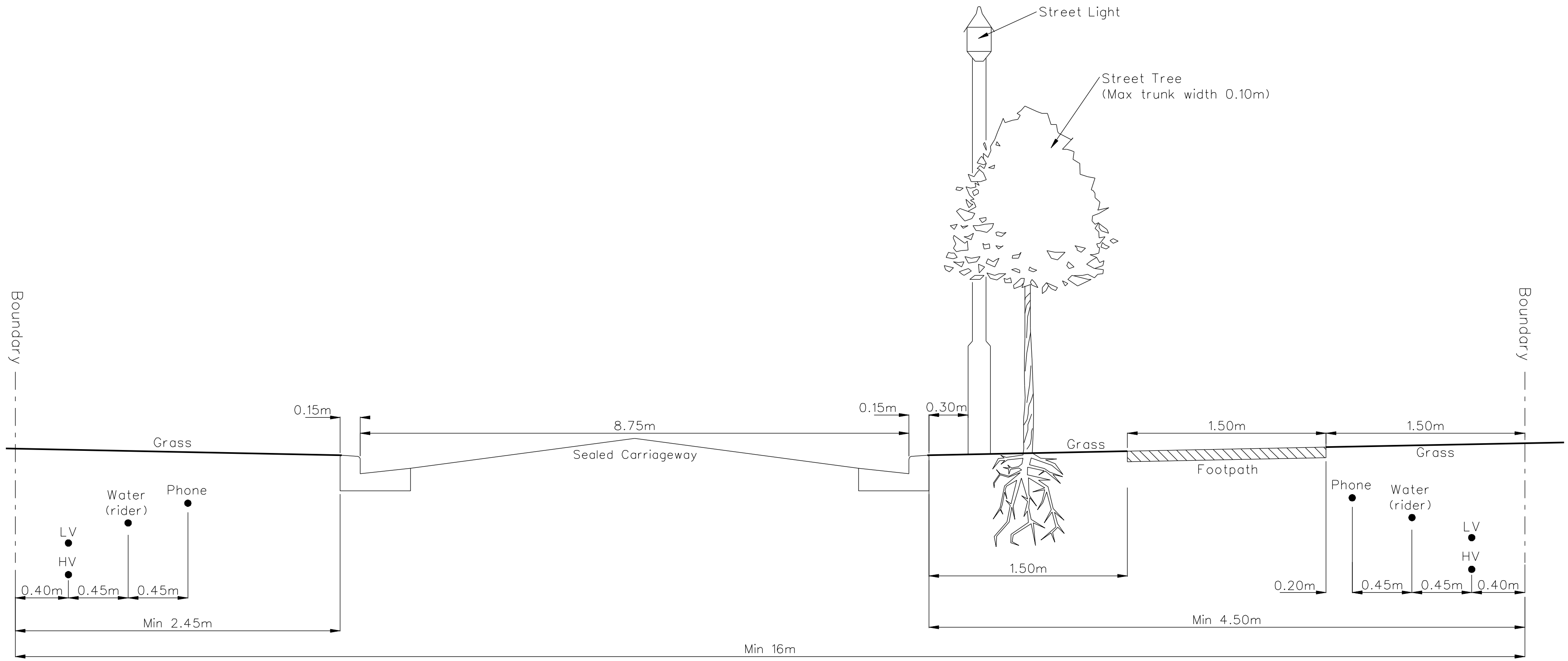
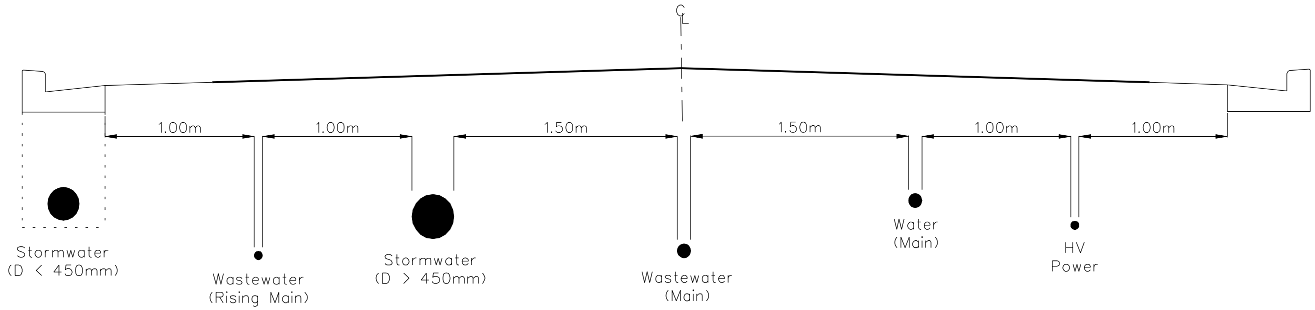


Typical Layout for Local Roads (Residential)
(All spacings given are minimum)



Minimum Spacings for Services in the Carriageway

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DISTRICT COUNCIL
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NOT TO SCALE

SHEET TITLE
MINIMUM SETOUT OF SERVICES IN ROAD RESERVE

PROJECT TITLE
STANDARD DRAWINGS

SHEET
245C

ISSUE
D

PLAN No.
600

WAIMAKARIRI
DISTRICT COUNCIL

ENGINEERING CODE OF PRACTICE

PART ELEVEN

LIGHTING

April 2009

Part 11: Lighting

CONTENTS

Part 11: Lighting

TABLES

Part 11: Lighting

11.1 INTRODUCTION

This Part explains the Council's lighting design requirements for roads, service lanes, cycleways, footpaths through reserves and other pedestrian accessways where the lighting is (or will be) managed by the Council and connected to the electricity operator's street lighting network.

It covers lighting design requirements for both privately funded developments and Council funded new installations or upgrading of existing installations.

Part 11: Lighting

11.2 CONSENT AND COMPLIANCE ISSUES

The consent and compliance information set out in Part 2: *General Requirements* applies to all works within the Waimakariri District, with the addition of the clauses below.

11.2.1 Legislation

The Electricity Act 1992 and amendments is the principal statute that controls the provision of electricity. The Electricity Regulations 1997 and amendments, and the Electrical Code of Practice shall also be complied with at all times.

11.3 QUALITY ASSURANCE REQUIREMENTS AND RECORDS

Provide quality assurance records that comply with the requirements in Part 3: Quality Assurance and the CCC *Construction Standard Specifications (CSS)*, during design and throughout construction.

11.3.1 The Designer

The designer must be suitably qualified and experienced and have an excellent track record in road lighting design. The designer must:

- Be conversant with Australian/New Zealand Standards and Practices concerning lighting design for public outdoor areas;
- Undertake the complete lighting design, including preparing estimates, tender documents and drawings, assisting with tender evaluation;
- Provide a Design Report in accordance with CoP Part 3 clause 3.3.1 – *Design Report*, including all documentation;
- Notify all adjacent residents of the proposed lighting work and pole locations before the start of the physical work;
- Ensure the lighting installation meets the requirements of the CoP and the CSS;
- Manage the lighting construction to its conclusion, including regular site supervision;
- Resolve any complaints to the satisfaction of the Council, prior to 224(c) certification;
- Sign-off the project at completion.

11.3.2 Design Records

Provide the following information as a minimum, to support the engineering drawings and Design Report, and for engineering acceptance before tendering. For “Design Build” projects, supply this information with the tender, along with a programme for implementing the design and the physical works.

- Records of any non-compliant design elements and any departures from the design spacing that have been used in the design process (e.g. AS/ NZS 1158.1.1 clause 3.4.3.4 - Conflict points at intersections) on a Nonconformance Report;
- A completed Lighting Specification Form (see QP-C820-AB, attached as Appendix B);
- The complete computer analysis information required by AS/NZS 1158;
- Intensity distribution tables (in North American IES or CIE format as requested) if required;
- The name and source of the computer programme used, and a statement of its compliance or otherwise with the requirements of AS/NZS 1158;
- Details of the design method used and the values of the light technical parameters obtained, for each of the road elements involved, compared to the limiting values given in AS/NZS 1158;
- The origin of the photometric data for the luminaires and lamps;
- Details of the road surface reflection characteristics assumed in the luminance based design calculations; Justification for the maintenance factor used in the calculations and the associated schedule of maintenance to be adopted, e.g. the luminaire cleaning and lamp replacement intervals;
- A cross-section drawing showing the proposed type of pole, arm and luminaire.

11.3.3 Engineering Drawings

Show on the engineering drawings:

- The existing and proposed electrical load of the street lighting circuits;
- The lighting design details including: lighting standard and category that the scheme has been designed to meet, mounting height, upcast, maximum spacing and any non-complying portions or exceptions;
- A lighting schedule.

Provide a schedule detailing the work required for each light, including:

- Light manufacturer, model and optic used;
- Lamp manufacturer, type and wattage;
- Outreach arm code, outreach and upcast angle;
- Pole manufacturer and type;
- Mounting height;
- Offset;
- Any other equipment or work required to ensure a complete installation.

Use the reference system and drawing symbols set out in QP-C811-AA – *Standard Draughting Layout and Format Requirements* (attached to CoP Part 2 as Appendix A) to identify the work location.

Part 11: Lighting

11.4 LIGHTING DESIGN

11.4.1 Project Brief

The Council must provide or agree to the lighting requirements for a project before any detailed design is undertaken. These lighting requirements will be specified in a project brief or, for developer-funded projects, in the Council's consent conditions.

Any resource consent requirements are considered to be part of the project brief, which will also include details about the:

- Scope and location of the project;
- Purpose and objective of the lighting scheme;
- The Council Project Manager, for Council funded projects;
- Lighting category that applies to the project;
- Specific requirements (if any), such as: a particular type of pole or luminaire, restrictions on pole locations, special features of the proposed road layout or landscaping that may influence the lighting design, traffic management devices that require supplementary lighting;
- Designation of the road or area (strategic, arterial, collector, local road, pedestrian area, accessway).

11.4.2 General Requirements

The lighting design must maximise safety and efficiency while minimising the life cycle cost and impact on the environment.

Design the lighting to blend in with adjacent street lighting, complement the neighbourhood character and, as far as is reasonably practicable, minimise the impact on the neighbouring properties and environment with regard to aesthetics, glare and spill light. Consider the crime prevention aspect of public lighting and incorporate this into the design. See the CPTED guidelines for more information.

The design must comply with all the appropriate New Zealand Standards, in particular the requirements of AS/NZS 1158. Anything not specified within this Part is specified in those standards.

Lighting on rural roads may not be required or necessary. Where lighting is required at a rural intersection, then only a full installation designed in accordance with AS/NZS 1158.1: 2005 shall be approved. The Council will not approve "Flag Lights" or isolated lights at intersections

Reticulate all 'greenfields' developments underground. In areas where the existing overhead network is for street lighting only, or where the electricity operator's network is underground, cable the power supply for the new lighting underground. The overhead network must not be extended.

The electricity operator's network usually determines whether the lighting will have an overhead or underground power supply. When lighting is being upgraded in an area where the electricity operator's network is overhead and is not part of an underground conversion project, use the electricity operator's poles to support the lights. Obtain the permission of the pole owner beforehand. This solution minimises the number of poles in that area.

This Part defines the minimum standards but it is important not to over-design and provide a standard of lighting higher than that required.

11.4.3 Category V (Traffic Route) Lighting

Category V lighting should provide a lighted environment conducive to the safe and comfortable movement of vehicular and pedestrian traffic at night and the discouragement of illegal acts. The visual requirements of the motorist predominate.

Design the lighting to accord with AS/NZS 1158.1:2005 *Road lighting - Vehicular traffic (Category V) lighting*.

QP-C820-AA (attached as Appendix A) explains how the different categories identified in AS/NZS 1158.1.1 apply to the Council's roads.

11.4.4 Category P (Local Road and Pedestrian Area) Lighting

Category P lighting should assist pedestrians to orientate themselves and detect potential hazards, and discourage fear of crime and crime against the person.

Design the lighting to accord with AS/NZS 1158.3.1:2005 *Road lighting - Pedestrian area (Category P) lighting*. The luminaires must meet the requirements for type 4 luminaires detailed in AS 1158.3.1, Table 2.5.

The minimum maintained illuminance for Category P3 must be 0.35 lux, and the horizontal illuminance uniformity U_p (that is, the ratio of maximum horizontal illuminance to average horizontal illuminance within a defined area) shall be less than or equal to 8:1.

To minimise the number of poles installed, apply the following:

Table 11.1 Minimum design spacings along local roads

Legal road width (m)	20	18	16	14	12
Minimum design spacing (m)	42	45	47	50	50

The last street light in a cul-de-sac head must be no more than 0.4 of the designed light spacing from the end of the cul-de-sac, when measured from the road boundary at the end of the cul-de-sac.

The minimum mounting heights are:

- 6.0m in residential areas.
- 7.0m in industrial areas.

11.4.5 Category P (Cycleways and Paths in Reserves) Lighting

Design the lighting to accord with AS/NZS 1158.3.1:2005 *Road lighting - Pedestrian area (Category P) lighting*. The lighting category is usually Category P3 or P4.

Luminaire types 3 or 4 can be used to control glare and the loss of waste light upwards (refer to AS/NZS 1158.3.1 Table 2.5).

The minimum mounting height is 5.5 metres and the maximum is 7.5 metres. However, if the lights are located near trees, it may be appropriate for the lights to be mounted at a lower height, to illuminate underneath the tree canopy and avoid shadowing. In this case, a minimum mounting height of 4.5 metres may be accepted.

11.4.6 Intersections

Wherever an existing Category V road intersects with a new Category V road or an existing Category V road being upgraded, apply the requirements of AS/NZS 1158.1:2005 *Road lighting - Vehicular traffic (Category V) lighting* to the intersection, even if the intersecting road is not lit to the appropriate Category V Standard.

Wherever an existing minor (Category P) road intersects with a new Category V road or an existing Category V road being upgraded, apply whichever of the following options provides the higher lighting standard:

- The requirements of AS/NZS 1158 for such intersections.
- The provision of a new light positioned in the side road near the intersection.

The minimum lamp size would normally be 100 watt high-pressure sodium light. (For an underground power installation the light shall be less than 10 metres away from the kerb line of the Category V road.)

The first light from an intersection on a Category P road must be less than 10 metres away from the through road, measured from the kerb line. Where the lighting is attached to reticulation poles, this distance can be increased to 0.4 of the designed light spacing. The design light spacing requirements for the through road continue through the intersection.

11.4.7 Traffic Management Devices

Design lighting of traffic management devices to support the purpose of the device:

- Where the device is intended to slow traffic, the lighting may need to be installed to a higher standard than normal road lighting. This will provide sufficient visibility to alert the drivers of the presence and speed constraint of the device.
- Where the device is intended to deter through traffic, the device may be identified by reflectors or by road lighting at a similar level to the normal road lighting.

Ensure all lighting is designed to AS/NZS 1158 Set *Lighting for roads and public spaces – series.*

11.4.8 Pole Locations

Ideally, lighting poles should be positioned in line with the common boundary between properties; however, these locations do not always coincide with the spacing requirements of the lighting design. If an adjacent property has not been developed (e.g. a new subdivision) and the pole cannot be positioned in line with the common boundary, locate the pole at least five metres from the boundary to allow for a future vehicle entrance.

Position poles at least one metre away from a vehicle entrance or kerb cutdown. Keep poles clear of any tree canopies in the street or in adjacent properties. Trees in a legal road or on Council land must be at least six metres away from lighting poles and more clearance may be necessary for some tree species or if the tree is protected. Consider the requirements for working near existing trees in CCC *CSS: Part 1*, when locating lighting poles.

Where possible, poles should be located close to reserves and other open spaces to provide light in these areas and improve safety.

A staggered layout is preferred for road lighting installations, when practicable and economical. Consider traffic safety when placing lighting poles, especially when they are on or near bends, intersections, threshold treatments, road humps and roundabouts.

11.4.9 Site Requirements

Poles are normally ground planted. When ground planting is not practicable, a special foundation is required. Provide a Producer Statement for this when applying for engineering acceptance.

If the road is at a different level to the area where the pole is being planted, specify pole lengths to achieve the correct mounting height, so ensuring the installed lighting complies with the design requirements. For each light type the mounting height must be uniform and consistent.

Where the longitudinal grade may exceed 1 in 6, the crossfall of a road may exceed 6% or the poles cannot be easily serviced from a cherry picker, discuss alternative pole types with the Council.

11.4.10 Pole Setback from Road or Path

For traffic safety reasons, position rigid Category V poles to comply with CoP Part 8 clause 8.12.10 – *Clear Zones*. This is generally achieved by locating the pole on the property boundary. Wherever the required setback cannot be achieved, it may be necessary to locate the pole closer to the kerb. In such instances, use frangible poles and locate the poles to comply with AS/NZS 1158.1.3:1997 Appendix B.

Rigid Category P poles in urban areas should also be positioned to comply with clause 8.15.11 where possible. Where these setbacks are not achieved, provide frangible poles, positioned to comply with Table 11.2 or discuss alternative options with the Council early in the design process.

Table 11.2 Clearance to support, traffic speed 70km/hr or less

Kerbed road	Un-kerbed road
0.7m behind kerb, increasing to 1.0m at tee intersections and on curves	3.0m from shoulder

Where installing a pole against the building line, ensure that it is installed on the legal road or on Council land, and not on private property. The Council will not accept responsibility for maintenance of any street lighting installed on private property, including right-of-ways.

11.4.11 Signs

Identify any signs that need to be altered, relocated onto lighting poles or onto their own posts. Locate these to comply with CoP clause 8.8.5 – *Traffic Control Signage*.

11.4.12 Lighting Equipment

The design lifetime of equipment is shown in Table 11.3.

Table 11.3 Expected lifetime of equipment

Component	Design life
Poles (concrete and steel)	40 years
Outreach arms	40 years
Luminaires	20 years
Lamps	20,000 hours
Painted / powdercoated surfaces	10 years

The luminaires, poles and outreach arms that are used in new installations should be compatible with adjacent lighting and, where practicable, visually match.

For efficient maintenance, the types of lighting equipment used are usually limited to those already in the lighting network.. The use of new equipment requires approval from the Council.

Part 11: Lighting

Provide information about the poles, outreach arms, luminaires and lamps used in an installation on the Lighting Specification Form (Appendix B) and the Lighting Equipment List (QP-C820-AC, attached as Appendix C).

A permanently marked, unique identification number shall be applied to every light pole or column, fitted before or during street lighting commissioning. This number shall accord with the Council's numbering system.

11.4.13 Backfill and Bedding

Specify backfill materials individually. The material used must be capable of achieving the backfill compaction requirements set out in CCC *CSS: Part 1*. Bedding materials should comply with the electricity operator's requirements. Carry out trench restoration in accordance with *CSS: Part 1*.

11.5 ELECTRICAL STANDARDS AND REQUIREMENTS

Ensure that all parts of the lighting installation conform to the following:

- All of the electricity operator's requirements for connection, supply and installation of cables, and attachment of lighting equipment to their poles;
- Mainpower *Network Connection Standards*
- The Electricity Act (1992), Electricity Regulations (1993) and approved Codes of Practice issued by the Minister.
- Part 8: *Roading*, Part 9: *Utilities* and Part 10:*Reserves, Streetscapes and Open Spaces* of the Code of Practice

Frangible and slip-base type lighting poles and columns shall be designed not to become 'live' during or after shear failure resulting from vehicle impact. In this event a mechanism shall be incorporated into the pole or column to safely break the power supply.

Part 11: Lighting

11.6 INSTALLATION AND COMMISSIONING

Carry out installation and commissioning in accordance with CCC *CSS: Part 5*.

11.7 COMPLETION PROCEDURES AND CERTIFICATION

At the completion of the physical works, check and then certify that:

- The project has met all the requirements of the project brief, the standards and specifications;
- All the documentation detailed below has been completed, is correct and has been forwarded to the Council.

At the end of the defects liability period, carry out an audit and certify that lighting poles are vertical and lights have been installed correctly and are at the correct mounting height in compliance with CCC *CSS: Part 5*.

Provide the following documentation:

- Test Certificates for each lighting standard;
- Compliance Certificate for the complete installation;
- As-built information in RAMM (SLIM) format (refer to CoP Part 12: *As-Builts*);
- Lighting Specification Form (refer to Appendix B);
- Lighting Equipment List (refer to Appendix C);
- Lighting Completion Form (refer to QP-C820-AD, attached as Appendix D);
- Contractor documentation required by the CCC *CSS*.

Update the Lighting Specification Form and Lighting Equipment List with any approved changes that have occurred.

11.8 ASSOCIATED DOCUMENTS

Appendix A Lighting Categories (QP-C820-AA)

Appendix B Lighting Specification Form (QP-C820-AB)

Appendix C Lighting Equipment List (QP-C820-AC)

Appendix D Lighting Completion Form (QP-C820-AD)

Lighting Categories

Note that this table is intended to be a guide only, and the category required will be detailed in the project brief or in the Council conditions for the project.

Many rural roads will not require lighting.

Road classification		Other criteria	Traffic volume	Lighting Category
Urban	Strategic / Arterial	Major shopping area with bright surroundings	> 20,000	V1
	Strategic / Arterial		> 15,000	V2
	Strategic / Arterial		7,000 to 15,000	V3
	Strategic / Arterial		< 7,000	V3
	Collector		> 15,000	V2
	Collector		7,000 to 15,000	V3
	Collector		3,000 to 7,000	V4
	Collector		<3,000	P3
	Local			P3
Rural	Strategic / Arterial		> 15,000	V3
	Strategic / Arterial		7,000 to 15,000	V3
	Strategic / Arterial		3,000 to 7,000	V4
	Collector		> 15,000	V3
	Collector		7,000 to 15,000	V4
	Collector		3,000 to 7,000	V4
	Local	Footpath and/or on road cycle lanes		P3
	Local			P4

Lighting Specification Form

Road lighting works at ______________________________

Plan Number ____________ Date ____________ Sheets ____________

Design Standard – AS/NZS 1158 Category: ____________

Signed ______________________ Date ____________

LIGHT TYPE A

Pole: Type ____________ ☐ Ground Planted ☐ Flange Base

Colour ____________ Offset ____________ Kerb/Boundary ____________

Arm: Type ____________ Outreach ____________ Tilt ____________

Colour ____________

Luminaire: Type ____________ Optics ____________ Mounting Height ____________

Colour ____________

Lamp: Type ____________ Watts ____________ Flux ____________

☐ Tubular ☐ Elliptical

LIGHT TYPE B

Pole: Type ____________ ☐ Ground Planted ☐ Flange Base

Colour ____________ Offset ____________ Kerb/Boundary ____________

Arm: Type ____________ Outreach ____________ Tilt ____________

Colour ____________

Luminaire: Type ____________ Optics ____________ Mounting Height ____________

Colour ____________

Lamp: Type ____________ Watts ____________ Flux ____________

☐ Tubular ☐ Elliptical

Lighting Equipment List

Lighting Project ______________________

Contractor ______________________

Signed ______________________ Date ______________________

Designer ______________________

Signed ______________________ Date ______________________

Description	Manufacturer	Model	Compliance Certificate	Country of Origin
Pole				
Arm				
Luminaire				
Lamp				
Ignitor				
Ballast				
Other				

Lighting Completion Form

To: ______________________________ (WDC Project Manager)

______________________________ (WDC Department)

Waimakariri District Council
Private Bag 1005
Rangiora 7440

From: ______________________________ (Designer's Name)

______________________________ (Designer's Address)

____

Lighting works at: ______________________________ (Location)

The above project has been completed by: ______________________________ (Contractor's Name)

All work has been carried out in accordance with the Waimakariri District Council's Engineering Code of Practice and the CCC Construction Standard Specifications and the brief/requirements for this project

All the tests were successfully completed and the lights were livened on: ______________________________ (Date)

The maintenance period commences from this date.

The following documentation is enclosed:

- ☐ Test Certificate for each Lighting Standard
- ☐ Certificate of Compliance for the complete installation
- ☐ As-Built Information
- ☐ Lighting Specification Form
- ☐ Lighting Equipment List

______________________________ (Signature)

______________________________ (Print Name)

______________________________ (Date)

WAIMAKARIRI
DISTRICT COUNCIL

ENGINEERING CODE OF PRACTICE

PART TWELVE

AS-BUILTS

April 2009

Part 12: As-Builts

CONTENTS

Part 12: As-Builts

FIGURES

TABLES

Part 12: As-Builts

12.1 INTRODUCTION

The As-Built plans shall be made available by the developer at the time of the Condition Certificate inspection, in compliance with this part of the CoP. The relevant certificates are shown below in Table 12.1. These certificates shall not be issued until the as-built plans and data has been supplied to the Council.

Table 12.1 Condition Certificates

Type	Certificate
Subdivision / Resource Consent	224(c) Compliance Certificate
Design or Construction Contract	Practical Completion Certificate

The plans shall detail all actual/legal information regarding the location of all property boundaries, pipe locations, diameters and materials used, depths and date of completion, pumps, valves and control equipment (including manufacturers and date of manufacture), and other structures including manholes (giving levels of invert and lid), kerbs, sumps, culverts and discharge points.

12.2 AS-BUILT ACCURACY

Provide all as-built locations and levels in the X, Y, Z plane detailed in Table 12.2.

Table 12.2 Level Accuracy

Feature	Tolerance
Pipe Invert (wastewater and stormwater only)	±20mm
Manhole Lid (wastewater and stormwater only)	±20mm
Reservoir RL	±20mm
Fire Hydrant Orifice	±20mm

Measure the position of all stormwater or wastewater pipe eyes and junctions from the centre of the downstream structure. Alternatively, fix the position using GPS equipment.

GPS coordinates to be provided to at 100m intervals, including changes of grade and direction for all road centrelines, pipelines, kerb-lines and supporting plant. Where permanent and or semi permanent features are used for offset dimensions GPS coordinates of these features shall also be provided. Where applicable, all Lid Level GPS coordinates and all Pipeline Invert Levels shall also be provided.

12.3 AS-BUILT RECORDS

Provide as-built plans, in the same form (e.g. scale, size) as the accepted engineering or landscape plans and to at least the same level of detail. They must show all built assets to be taken over by the Council. Provide details of the datum used, in accordance with CoP Part 2 clause 2.5.1 – *Investigation and Design.*

12.3.1 General

Where providing paper copies, mark as-built details in red on as-built plans. Clearly mark plans as “As-built” by stamping or changing the title block. Date and sign the as-built plans. Council will retain a copy of all “As-Built” drawings and Certification statements. Drawings shall be based on coordinated data from permanent control points or measurement from coordinated property boundaries.

All locations will be dimensioned and shown on the plans, including changes of grade and direction for all road centrelines, pipelines, kerb-lines and supporting plant. Where applicable, all lid level coordinates and all pipeline invert levels shall also be provided.

The consultants shall record the position and depth of the pipeline with offset dimensions to recognizable and permanent / semi-permanent site features at a distance no greater than 100m, in both horizontal directions, as per Figure 12.1. The GPS coordinates of these features shall be provided. Dimensions provided with only one horizontal direction, as shown in Figure 12.2, are not acceptable.

A1 paper “As built” copies and electronic format (CAD) data will be supplied in all cases. Hardcopy mark-ups of construction drawings are not acceptable.

Only metric units are to be used in as-built data. Principally these are millimetres (mm), meters (m), litres/sec (L/s), and cubic meters/day (m^3/day).

Original as-built plans shall be completed to the appropriate scales. Standard scales are 1:50, 1:100, 1:200, 1:250, 1:500, 1:750, 1:1000 and 1:1500. Map symbols to be those required by AS/NZS 1100. All text and symbols must be legible at A3 size.

Each Part of the CoP may have additional requirements or documentation e.g. calculations, planting lists, for that type of work, which must be supplied with the as-built plans. Check with each Part for further information.

12.3.2 Electronic Files

Electronic plan files are to be submitted in one of the following formats: DWG, DXF or DGN (V8). Format dates as day/month/year.

The co-ordinate system may be New Zealand Transverse Mercator Projection (NZTMP) or New Zealand Map Grid (NZMG). All levels are to be in terms of Lyttelton MSL 1937 and to 2 decimal places.

Part 12: As-Builts

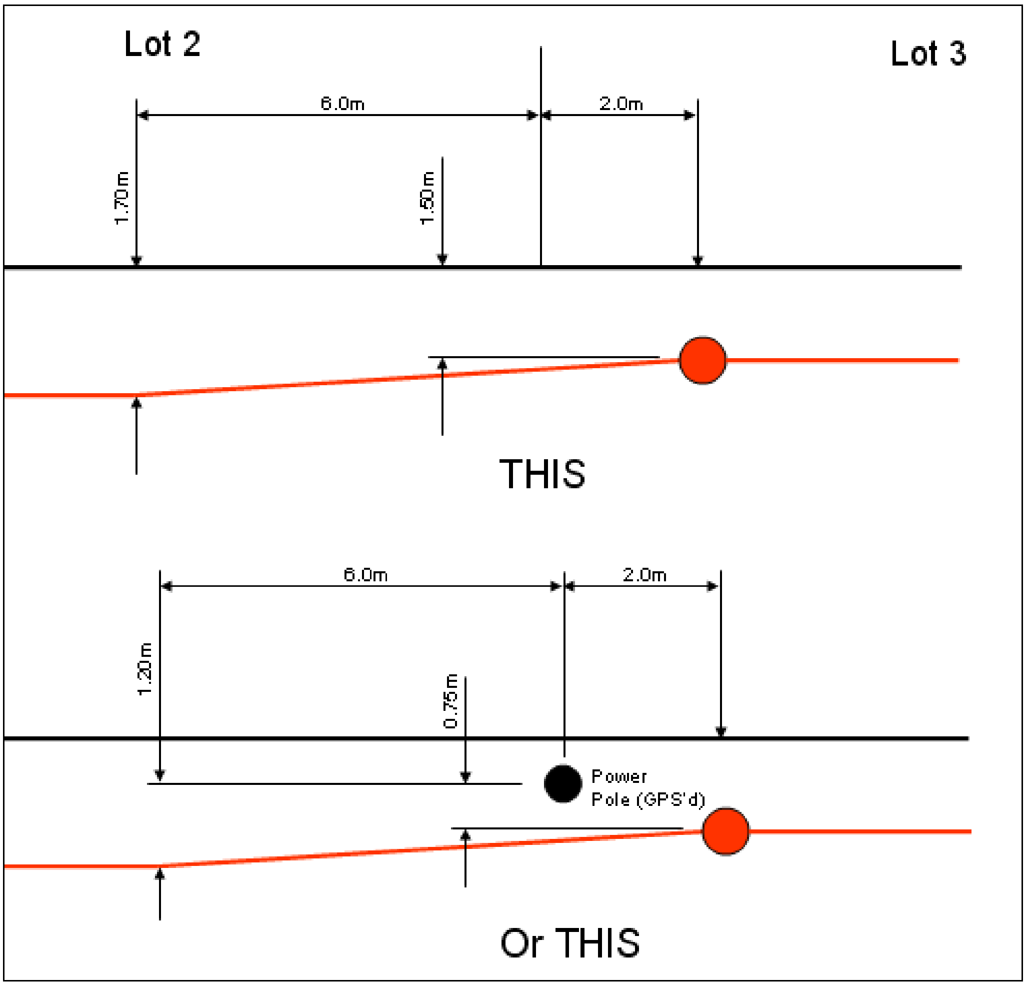

Figure 12.1 Examples of acceptable as-built drawings

Part 12: As-Builts

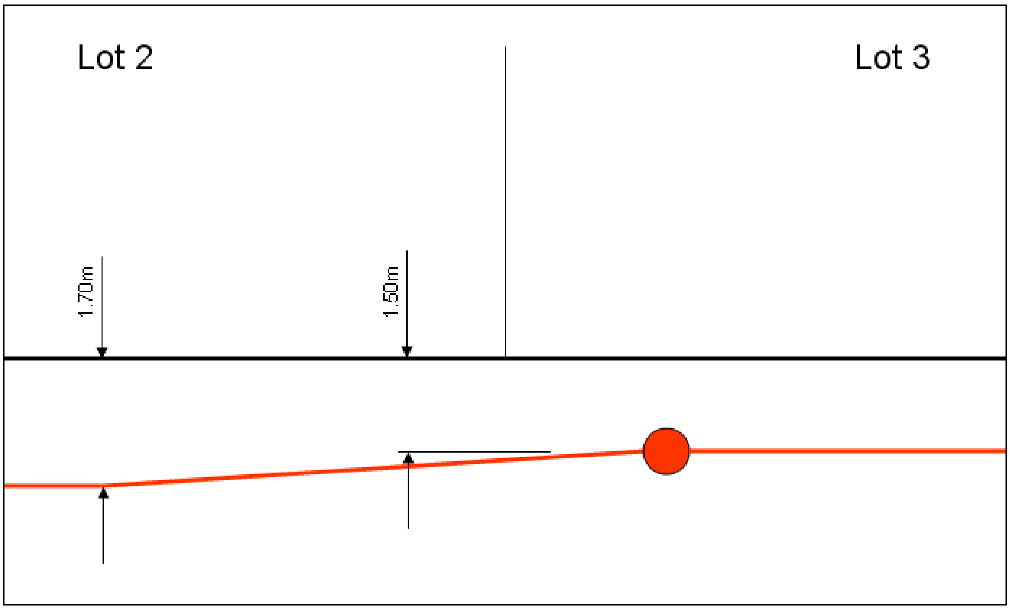

Figure 12.2 Example of unacceptable as-built drawing

12.3.3 Part 4: Geotechnical Requirements

Provide the geotechnical completion report and tabulated results, where required.

The geotechnical completion report will be used by the Council to update the Information Register, or property files for LIM or PIM data. To aid in transferring this information into the LIM system, provide the data in a tabulated form, related to lot numbers where possible. Consent Notices under Section 221 of the Resource Management Act (1991) may be required for such sites as a condition of subdivision consent such as:

- The need for an appropriately qualified specialist to carry out further geotechnical investigations as part of a building consent application.
- The specific requirements or recommendations that need to be considered.

If NZS 4431 was applicable to the development, prepare an as-built plan in accordance with that standard.

If NZS 4431 was not applicable, prepare an as-built plan as follows. It must show the extent and depth of fill in the form of lines that join all points of equal depth of fill at vertical intervals, which adequately define the fill. Alternative methods of representing the fill depths may also be acceptable. It must show areas of filling of low density, any fill areas that the geotechnical engineer considers as not complying with the CoP, and areas where the standards have been varied from the original construction specification.

The as-built plan must record the position, type and size of all subsoil drains and their outlets. It must also provide information about any underrunners and springs located.

12.3.4 Part 5: Stormwater and Land Drainage

Provide as-built plans and information for all pipes and structures to be vested in Council ownership, including the construction cost. The as-built information must conform to the asset features, materials and types listed in QP-C821-AA (attached as Appendix A) (which generally covers pipes and pipe-related assets) and QP-C821-AB (attached as Appendix B) (which generally covers open waterway-related assets). Itemise the construction cost into at least the major asset types from Appendix A and Appendix B, and to separate assets (e.g. costs of each of two basins) within the asset types.

Use the checklists provided in the appendices when compiling field pickup sheets or plans. Only one invert level is required where the inlet and outlet inverts are the same. Backfilling of service trenches must not start until as-built information has been taken.

Provide the following additional as-built information for non-pipe stormwater assets (e.g. pump station):

- Three copies of the product manual (electronically);
- Two copies of the master drawings;
- Engineering drawings, set out as stated in section 12.3.2;
- Electronic file (or hardcopy) for Building, Reticulation, Pumps, Reservoirs, Cables and Wells;
- Operations & Maintenance Manuals: Electrical, Mechanical;
- Pickup sheets;
- Diesel generator capacity details;
- Power connection ICP number;
- Digital photos of new assets;
- Grounds maintenance plans (in pdf).

12.3.5 Part 6: Wastewater Drainage

Provide as-built information conforming to the asset features, materials and types listed in QP-C821-AC (attached as Appendix C).

Use the checklists provided in the appendices when compiling field pickup sheets or plans. Only one invert level is required where the inlet and outlet inverts are the same. Backfilling of service trenches must not start until as-built information has been taken.

Provide the following additional as-built information for non-pipe wastewater assets (e.g. pump station, biofilter):

- Three copies of the product manual (electronically);
- Two copies of the master drawings;
- Engineering drawings, set out as stated in section 12.3.2;
- Electronic file (or hardcopy) for Building, Reticulation, Pumps, Reservoirs, Cables and Wells;
- Operations & Maintenance Manuals: Electrical, Mechanical;
- Pickup sheets;
- Diesel generator capacity details;
- Power connection ICP number;
- Digital photos of new assets;
- Grounds maintenance plans (in pdf).

Part 12: As-Builts

12.3.6 Part 7: Water Supply

When the installation of the mains is complete, give 24 hours notice to the Council, who will arrange the necessary measurements for the as-built plans. Backfilling of service trenches must not start until as-built information has been taken.

Provide as-built information conforming to the asset features, materials and types listed in QP-C821-AD (attached as Appendix D). Specify details of the commercial restrained joint systems on the as-built plans, including the location of restrained portions of pipelines, including joints.

Use the checklists provided in the appendices when compiling field pickup sheets or plans.

Provide the following additional as-built information for non-pipe water supply assets e.g. pump station, reservoir, new well):

- Three copies of the product manual (electronically);
- Two copies of the master drawings;
- Engineering drawing, set out as stated in section 12.3.2;
- Electronic file (or hardcopy) for Building, Reticulation, Pumps, Reservoirs, Cables and Wells;
- Operations & Maintenance Manuals: Electrical, Mechanical;
- Pickup sheets;
- Well information: well consent details, well log, water quality results (in hard copy and electronic template, available from project manager);
- Diesel generator capacity details
- Power connection ICP number;
- Digital photos of new assets;
- Grounds maintenance plans (in pdf).

12.3.7 Part 8: Roading

The Council maintains a RAMM database. To provide updated information for all new road construction and as part of the As-Builts, the subdivider shall provide the daily site records from the Sealing Contractor to the Council.

Load as-built records for the tabulated asset types, using pocket RAMM, in the Council's RAMM database.

Details of approved contractors, currently able to carry out this work, can be obtained from www.ccc.govt.nz/doingbusiness/approvedcontractors/.

Before compiling any as-built RAMM data, obtain the following information from the Council:

- Road ID;
- Road name;
- Start Displacement.

The tables below are not intended to be a complete list but provide an indication of the information required. Depending on the assets installed, additional information may be required to provide a complete description of the asset. RAMM provides existing fields to achieve this.

Part 12: As-Builts

Table 12.3 Footpath and berm RAMM data fields

Type	Inventory Data	Location incl. GPS	Property Address	Other Fields
Footpaths	Surfacing, Layer details, Materials	No	No	Position, Purpose, Side, Length, Width, Depth, Date constructed
Berms	Layer details	No	No	Type, Plant cover, Area, Side, Width, Date constructed
Structures	Construction materials, Type, Components	Yes	Yes	Digital photographs, Date constructed

Table 12.4 Carriageway RAMM data fields

Type	Inventory Data	Other Fields
Pavement and surface treatment	Length, Width, Actual layer thicknesses, Materials, Construction types, Sealed area	Sub-grade CBR values and locations, Benkelman Beam results and locations, Road roughness, Deviations from design e.g. areas of extra depth construction, Date completed, Contractor, Design life, Binder details
Kerbs and channels	Length, Type	Stormwater details e.g. underchannel pipes and pipe connections, Date completed
Sumps	Sump type, Materials	Date completed
Bridges	Length, Overall width, Area of deck	Construction type, Materials, Date completed, Number of spans
Retaining walls	Length, Overall width, Height, Face area	Construction type, Materials, Date completed
Culverts	Length, Overall width, Diameter	Construction type, Materials, Date completed
Other structures	Length, Overall width, Height, Face area	Construction type, Materials, Date completed

Note:

- Bridges are defined as having a waterway cross-sectional area of $3.4m^2$ or greater.
- Culverts are defined as having a waterway cross-sectional area smaller than $3.4m^2$, regardless of culvert shape.
- Pipes are 600mm diameter and smaller.

Table 12.5 Sign RAMM data fields

Type	Inventory Data	Location incl. GPS	Property Address	Other Fields
Signs	Class, Type, Legend (including colour, material), Framed Y/N, Substrate, Background colour/material	Yes	Yes	Dimensions, Direction, Offset from kerb, Date completed, Support type, Number of posts
Posts	Type, Shape, Material, Mount			

12.3.8 Part 10: Reserves, Streetscapes and Open Spaces

Provide plans setting out the location, size and design details of all reserves, street trees and street gardens.

Provide updated planting plans, with planting schedules amended to record actual plants installed, including source of supply. Include any amendments to structures and furniture.

Part 12: As-Builts

Provide an electronic spreadsheet giving details of all assets on reserves to be vested in Council and the associated GIS layers of these assets (where electronic drawings are provided). A data dictionary will be available on request from the Council, giving particular details required for different asset types.

The information required includes:

- Consent Number associated with asset;
- Name of adjoining main street;
- Ward name in which the park/reserve is located;
- A sequential unique ID for each new asset collected (e.g. N1, N2, N3 etc);
- Location description on-site or GPS co-ordinates (latter required only if the former is too difficult);
- Measurements (length, area, height etc – see data dictionary for details);
- Construction materials (see data dictionary for details);
- Manufacturers name;
- Date of construction/installation in park/reserve;
- Maintenance/warranty period;
- Asset Type (see data dictionary for details).

The list below gives an indication of the types of reserves assets currently owned and managed by the Council:

- Play & Sports Facilities;
- Buildings;
- Bridges & Structures (including walls & fences);
- Plantings (including grass areas);
- Trees;
- Car Parks & Drives;
- Paths & Tracks;
- Artworks & Monuments;
- Furniture;
- Park Utilities (e.g. paddling pool pumps, storage tanks, irrigation systems etc).

Collect each of the above assets recorded within the spreadsheet in GIS. Collect different asset types in different GIS layers. In GIS attribute tables, enter **only** the sequential unique ID and Consent Number captured above for each asset, to identify which GIS feature matches which entry in the spreadsheet.

Data rules around the capture of GIS data will be available on request from the Council. GIS layers must be in Geomedia format and registered to the NZMG co-ordinate system.

Where development or landscaping occurs on an existing Council park or reserve, the Council will provide where necessary a spreadsheet and accompanying GIS layers (if available) of the existing assets to update. Capture all new assets constructed or installed as part of the development as above.

12.3.9 Part 11: Lighting

Load as-built records for the streetlighting assets, using pocket RAMM, in the Council's RAMM database.

Table 12.6 Streetlight RAMM data fields

Type	Inventory Data	Location incl. GPS	Property Address	Other Fields
Streetlight	Wattage, material, surface treatment, supply, type, bulk circuit, type (bracket, light, lamp)	Yes	Yes	Height, owner, offset from kerb, date tested, date completed
Pole	Type, mount			Owner, purpose

Part 12: As-Builts

12.4 ASSOCIATED DOCUMENTS

Appendix A As-Built Data Checksheet – Stormwater (QP-C821-AA)

Appendix B As-Built Data Checksheet – Land Drainage (QP-C821-AB)

Appendix C As-Built Data Checksheet – Wastewater (QP-C821-AC)

Appendix D As-Built Data Checksheet – Water Supply (QP-C821-AD)

As-Built Data Checksheet – Stormwater

Stormwater features

Tick	Stormwater Pipe	Notes and Explanations
	Nominal Diameter	
	Material	Refer Stormwater Pipe Material list
	Pipe Type	Refer Stormwater Pipe Type list
	Installation Date	
	Upstream Invert Level	
	Downstream Invert Level	
	Eye Position	
	Junction Position	
	Stormwater Manhole	
	Position X,Y	Centre of manhole
	Installation Date	
	Lid Level	Northeast frame corner
	Manhole Type	Refer Stormwater Manhole Type list
	Stormwater Inspection Chamber	
	Position X,Y	
	Installation Date	
	Lid Level	Northeast frame corner
	Stormwater Inspection Chamber	
	Position X, Y	
	Installation Date	
	Stormwater Pipe Bend	
	Position X, Y	
	Angle	E.g. 11.25, 22.5, 45, 60, 90
	Stormwater Inlet Sump	
	Position X,Y	Centre of sump
	Installation Date	
	Sump Type	Refer Stormwater Sump Type list
	Stormwater Outlet Sump	
	Position X,Y	Centre of sump
	Installation Date	
	Sump Type	Refer Stormwater Sump Type list
	Stormwater Lateral	
	Nominal Diameter	
	Material	Refer Stormwater Pipe Material list
	Installation Date	
	Position X,Y	
	Stormwater Pumping Station	
	Position X,Y	
	Installation Date	

As-Built Data Checksheet – Stormwater

	Pump Station name	
	Pump Make(s) and Model(s)	
	Duty heads/capacities	
	Stormwater Structure	
	Position X,Y and extent	
	Installation Date	
	Structure Type	Refer Stormwater Structure Type list
	Stormwater Valve	
	Position X,Y	
	Installation Date	
	Valve Type	Refer Stormwater Valve Type list
	Stormwater Pipe Protection	
	Protection Type	Refer Stormwater Pipe Protection Type list
	Position X,Y	At each end of protection

As-Built Data Checksheet – Stormwater

Stormwater material and type lists

Stormwater Pipe Material	
ABS	Acrylonitrile Butadiene Styrene
AC	Asbestos Cement
CI	Cast Iron
CLDI	Concrete Lined Ductile Iron
CLS	Concrete Lined Steel
CONC	Concrete
EW	Earthenware
GALV	Galvanised Iron
HDPE	High Density Polyethylene
MDPE80	Medium Density Polyethylene 80
MDPE100	Medium Density Polyethylene 100
Novaflow	Novaflow
PVC	Polyvinyl Chloride
PVC-M	Modified Polyvinyl Chloride
PVC-U	Unplasticised Polyvinyl Chloride
RCRR	Reinforced Concrete Rubber Ringed
STEEL	Steel
VCP	Vertically Cast Concrete Pipe
WI	Wrought Iron
Stormwater Pipe Type	
Box Culvert	
Culvert	
Field Tile	
Gravity	
Pressure	
Stormwater Manhole Type	
Non-Standard Manhole	
Standard Manhole	
Standard Manhole-Circular	
Stormwater Sump Type	
Double	
Hillside	
Single	
Triple	
Stormwater Structure Type	
Bridge	
Energy Dissipator	
Gauging Weir Chamber	
Head Wall	

As-Built Data Checksheet – Stormwater

Inlet	
Outlet	
Pump Chamber	
Settling Tank	
Silt Trap	
Non Standard Manhole	
Valve Chamber	
Weir	
Stormwater Valve Type	
Flap Valve	
Automatic Restrictor Valve	Specify type and/or function
Automatic Shutoff Valve	Specify type and/or function
Manual Restrictor Valve	Specify type and/or function
Manual Shutoff Valve	Specify type and/or function
Stormwater Pipe Protection Type	
Concrete Beam	
Concrete Cover	
Concrete Haunch	
Concrete Surround	
PVC Sleeve	
Reinforced Concrete Surround	
Steel Cover	
Steel Surround	

NOTE: Only use this list. Brand names are not acceptable e.g. Everite. If materials are used that do not appear on this list, contact the Council

As-Built Data Checksheet – Land Drainage

Watercourse Features

Tick	Watercourse	Notes and Explanations
	Position X,Y	
	Installation Date	
	Watercourse Lining	
	Position X,Y	
	Installation Date	
	Lining Type	Refer Watercourse Lining Type list
	Top Width	
	Bottom Width	
	Depth	
	Watercourse Basin	
	Position X,Y and extent	Include contour plan
	Installation Date	
	Basin Type	Refer Watercourse Basin Type list
	Invert levels on inlet(s)	Lip of sump or pipe invert
	Invert levels on outlet(s)	Lip of sump or pipe invert
	Design volume	Design return period
	Watercourse Structure	
	Position X,Y	Position of a point marked on the as-built plan if the structure is a point feature, or start and end points if it is a linear feature e.g. retaining wall
	Installation date	
	Reference level	Level of a point marked on the as-built plan
	Watercourse Valve	
	Position X,Y	
	Installation Date	
	Valve Type	Refer Watercourse Valve Type list

NOTE: This table includes all open channels, rivers, creeks, swales, ponds, etc

Enhancement Features

Tick	Enhancement	Notes and Explanations
	Start Position X,Y	Upstream
	Finish Position X, Y	Downstream
	Installation Date	

NOTE: This includes all plantings, stabilisation of banks, etc

As-Built Data Checksheet – Land Drainage

Watercourse type lists

Watercourse Lining Type	
CON-C	Concrete Slab with Concrete Frame
CON-I	Concrete Cast In-situ
CON-P	Concrete Precast
CON-T	Concrete with Timber Posts
INVT	Concrete Invert
INVT-R	Concrete Invert with Retaining Wall
LTIMB	Low Timber Lined
ROCK	Rock Lining
ROKMTR	Mortared Rock Lining
SPRAY	Sprayed Concrete
TIMB	Timber Lined
TIMB-T	Timber Lined with Top Struts
Watercourse Basin Type	
Detention	
Infiltration	
Lake	
Pond	
Retention	
Silt Trap	
Soak Pit	
Swale	
Watercourse Valve Type	
Gate	
Flap Gate	
Tidal Gate	

As-Built Data Checksheet – Wastewater

Wastewater Features

Tick	Wastewater Pipe	Notes and Explanations
	Nominal Diameter	
	Material	Refer Wastewater Pipe Material list
	Pipe Type	Refer Wastewater Pipe Type list
	Installation Date	
	Pressure Class	
	Upstream Invert Level	
	Downstream Invert Level	
	Grade	
	Eye Position	
	Eye Type	Refer Wastewater Eye Type list
	Junction Position	
	Junction Type	Refer Wastewater Junction Type list
	Treatment Diameter	Internal diameter after reduced by treatment (lining etc.)
	Pipe shape	Circular/oval
	Wastewater Manhole	
	Position X,Y	Centre of manhole
	Installation Date	
	Material	Brick, concrete
	Lid Level	Northeast frame corner
	Manhole Type	Refer Wastewater Manhole Type list
	Wastewater Inspection Chamber	
	Position X,Y	Centre of chamber
	Installation Date	
	Lid Level	Northeast frame corner
	Wastewater Inspection Point	
	Position X,Y	
	Installation Date	
	Wastewater Pipe Bend	
	Position X,Y	
	Angle	E.g. 11.25, 22.5, 45, 60, 90
	Upstream Invert Level	
	Downstream Invert Level	
	Wastewater Flush Tank	
	Position X,Y	Of the four corners
	Position X,Y	Centre of the access lid
	Installation Date	
	Material	Brick, concrete
	Capacity	Volume of flush tank in litres

As-Built Data Checksheet – Wastewater

	Wastewater Flush Tank Water Supply Pipe	
	Position X,Y	Of pipe
	Position X,Y	Of pipe entry to flush tank
	Installation Date	
	Material	Refer Wastewater Pipe Material list
	Wastewater Air Gap Separator	
	Position X,Y	
	Installation Date	
	Diameter	
	Wastewater Lateral	
	Nominal Diameter	
	Material	Refer Wastewater Pipe Material list
	Lateral Type	Refer Wastewater Lateral Type list
	Installation Date	
	Position X,Y	
	Joint Connection	Are multiple dwellings connected to lateral: Yes/No
	Height above main	Measured in metres (e.g. 0.6m) Table 10 (cont.)
	Wastewater End Cap	
	Position X,Y	
	Wastewater Pump	
	Position X,Y	
	Pump Station Name	
	Pump Number	
	Installation Date	
	Wastewater Structure	
	Position X,Y and outline	
	Installation Date	
	Structure Type	Refer Wastewater Structure Type list
	Wastewater Valve	
	Position X,Y	
	Installation Date	
	Valve Type	Refer Wastewater Valve Type list
	Nominal Diameter	
	Wastewater Pipe Protection	
	Protection Type	Refer Wastewater Pipe Protection Type list
	Position X,Y	At each end of protection
	Wastewater Repair	
	Nominal Diameter	
	Position X,Y	At each end of repair
	Installation Date	
	Material	Refer Wastewater Repair Material list
	Repair Method	Refer Wastewater Repair Method list

As-Built Data Checksheet – Wastewater

Wastewater Material and Type Lists

Wastewater Pipe Material	
ABS	Acrylonitrile Butadiene Styrene
AC	Asbestos Cement
CERAMIC	Ceramic
CI	Cast Iron
CLDI	Concrete Lined Ductile Iron
CLS	Concrete Lined Steel
CONC	Concrete
EW	Earthenware
GALV	Galvanised Iron
HDPE	High Density Polyethylene
MDPE80	Medium Density Polyethylene 80
MDPE100	Medium Density Polyethylene 100
PVC	Polyvinyl Chloride
PVC-M	Modified Polyvinyl Chloride
PVC-U	Unplasticised Polyvinyl Chloride
RCRR	Reinforced Concrete Rubber Ringed
STEEL	Steel
VCP	Vertically Cast Concrete Pipe
WI	Wrought Iron
Wastewater Pipe Type	
Gravity	
Overflow	
Pressure	
Siphon	
Trunk	
Vent	
AGS Supply	
Wastewater Eye Type	
Dual	
Ramped	
Vertical	
Wastewater Junction Type	
Cross	
Tee	
Y	
Wastewater Manhole Type	
Flush Manhole	
Flush Manhole-Circular	
Non - Standard Manhole	

As-Built Data Checksheet – Wastewater

Standard Manhole	
Standard Manhole-Circular	
Vented Manhole	
Wastewater Lateral Type	
Gravity	
Siphon	
Pressure	
Wastewater Structure Type	
Anchor Block	
Biofilter	
Biofilter Fan Chamber	
Flume	
Gauging Weir Chamber	
Pump Chamber	
Settling Tank	
Pump House	
Non Standard Manhole	
Valve Chamber	
Truck Wash	
Wastewater Valve Type	
Air Release – one way	
Air Valve – two way	
Butterfly	
Flap	
Non-return	
Sluice	
Wastewater Pipe Protection Type	
Concrete Beam	
Concrete Cover	
Concrete Haunch	
Concrete Surround	
PVC Sleeve	
Reinforced Concrete Surround	
Steel Cover	
Steel Surround	
Wastewater Repair Material	
ABS	Acrylonitrile Butadiene Styrene
AC	Asbestos Cement
CI	Cast Iron
CONC	Concrete
DI	Ductile Iron
EW	Earthenware

As-Built Data Checksheet – Wastewater

GRP	Glass Reinforced Plastic
Polymer	
PVC	Polyvinyl Chloride
PVC-M	Modified Polyvinyl Chloride
PVC-U	Unplasticised Polyvinyl Chloride
RCRR	Reinforced Concrete Rubber Ringed
Spiral PVC	Steel
Wastewater Repair Method	
New Pipe	
Cast In-situ	
Grouted	
Patch Lining	
Lining	
Slip Liner	
RibLoc	

NOTE: Only use this list. Brand names are not acceptable e.g. Everite. If materials are used that do not appear on this list, contact the Council.

As-Built Data Checksheet – Water Supply

Water Supply Features

Tick	Water Supply Pipe	Notes and Explanations
	Nominal Diameter	
	Material	Refer Water Supply Pipe Material list
	Installation Date	
	Pressure Class	
	Position X,Y	At each end of pipe, and at all tangent points on curved sections of pipe
	Water Supply Valve	
	Position X,Y	
	Installation Date	
	Valve Type	Refer Water Supply Valve Type list
	Activation Pressure	
	Nominal Diameter	
	Special Function	Refer Water Supply Valve Special
	Function list	
	Motorised	
	Clockwise Close	Yes/No
	Water Supply Hydrant	
	Position X,Y	
	Installation Date	
	Orifice Level	
	Water Supply Pipe Fitting	
	Position X,Y	
	Bend Angle	E.g. 11.25, 22.5, 45, 60, 90
	Fitting Type	Refer Water Supply Fitting Type list
	Water Supply Meter	
	Position X,Y	
	Installation Date	
	Meter Serial Number	E.g. 05A123874
	Diameter	
	Water Supply Rural Restrictor	
	Position X,Y	
	Installation Date	
	Capacity	E.g. 1 unit, 2 units, 3 units
	Water Supply End Cap	
	Position X,Y	
	Water Supply Lateral	
	Nominal Diameter	
	Material	Refer Water Supply Pipe Material list
	Pressure Class	
	Installation Date	
	Position X,Y	

As-Built Data Checksheet – Water Supply

	Water Supply Pump	
	Diesel Backup	Yes/No
	Pump Station Name	
	Pump Function	Refer Water Supply Pump Function list
	Pump Capacity	m^3/hour
	Position X,Y	
	Pump Number	
	Installation Date	
	Water Supply Reservoir	
	Position X,Y and extent	
	Installation Date	
	Reservoir Name	
	Reservoir Number	
	Capacity	m^3
	RL	
	Water Supply Structure	
	Position X,Y and extent	
	Installation Date	
	Structure Type	Refer Water Supply Structure Type list
	Water Supply Pipe Protection	
	Protection Type	Refer Water Supply Pipe Protection Type list
	Position X,Y	At each end of protection

As-Built Data Checksheet – Water Supply

Water supply material and type lists

Water Supply Pipe Material	
ABS	Acrylonitrile Butadiene Styrene
AC	Asbestos Cement
CI	Cast Iron
CLDI	Concrete Lined Ductile Iron
CLS	Concrete Lined Steel
CONC	Concrete
EW	Earthenware
GALV	Galvanised Iron
HDPE	High Density Polyethylene
MDPE80	Medium Density Polyethylene 80
MDPE100	Medium Density Polyethylene 100
PVC-M	Modified Polyvinyl Chloride
PVC-U	Unplasticised Polyvinyl Chloride
PVC	Polyvinyl Chloride
RCRR	Reinforced Concrete Rubber Ringed
STEEL	Steel
VCP	Vertically Cast Concrete Pipe
WI	Wrought Iron
Water Supply Valve Type	
Air Release	
Backflow Prevention	
Butterfly	
Gate	
Motorised	
Non-return	
Pressure Reducing	
Pressure Relief	
Pressure Sustaining	
Sluice	
Water Supply Valve Special Function Type	
Bypass	
Fire Service	
Flushing Point	
Irrigation	
Scour	
Tap	
Water Supply Fitting Type	
Cross	
Joiner	
Reducer	

As-Built Data Checksheet – Water Supply

Tee	
Bend	
Water Supply Pump Type	
Booster	
Primary	
Standby	
Water Supply Structure Type	
Non-Standard Anchor Block (large size)	
Break Pressure Tank	
Pump House	
Manhole	
Pump Chamber	
Settling Tank	
Valve Chamber	
Well	
Water Supply Pipe Protection Type	
Concrete Beam	
Concrete Cover	
Concrete Haunch	
Concrete Surround	
PVC Sleeve	
Reinforced Concrete Surround	
Steel Cover	
Steel Surround	

Only use this list. Brand names are not acceptable e.g. Everite. If materials are used that do not appear on this list, contact the Council

WAIMAKARIRI
DISTRICT COUNCIL

ENGINEERING CODE OF PRACTICE

ASSOCIATED DOCUMENTS

April 2009

References, Glossary & Abbreviations

CONTENTS

References, Glossary & Abbreviations

1.1 INTRODUCTION

Each Part of the Engineering Code of Practice is based in part on the appropriate section of the CCC Infrastructure Design Standard, by agreement, and with the consent of Christchurch City Council.

Where a conflict exists between any external document and the specific requirements outlined in the Engineering Code of Practice (CoP), the CoP takes preference (at the discretion of the Council).

The terms, and their definitions, used in this standard are consistent with those of NZS ISO 9000: 2000 and NZS 3910: 2003.

References, Glossary & Abbreviations

1.2 REFERENCED DOCUMENTS

Please note that the internet addresses provided for referenced documents were accurate at the time of issue; however, these are subject to change without notice.

1.2.1 Planning & Policy

1.2.1.1 Waimakariri District Council

- The *District Plan,* www.waimakariri.govt.nz/planning/Plan_Change/index.htm
- *Long Term Council Community Plan* (LTCCP), www.waimakariri.govt.nz/publications/ltccp/ltccp/index.htm
- Activity Management Plans
    - Stormwater
    - Water Supply, 2005
    - Wastewater
    - Parks & Recreation
- Bylaws, www.waimakariri.govt.nz/publications/bylaws/index.htm
    - *Stormwater and Land Drainage Bylaw* 2002 (DRAFT)
    - *Wastewater Bylaw* 2007
    - *Rural Water Supplies Bylaw* 1992
    - *Parking Bylaw* (2007)
    - *Speed Limit Bylaw* (2004) *and amendments 2 & 3*
    - *Vehicle Crossing Bylaw* (2007)
- Policies, www.waimakariri.govt.nz/council/policy_man.htm
    - *Oxford Sewer Individual Pumping Systems* (S-CP-5006)
    - *Sewage Disposal – Residential 4A-4B Zones* (S-CP-5005)
    - *Applications for Extension to Water Supply and Sewage Disposal* (S-CP-5610)
    - *Private Individual Water Supplies* (S-CP-5607)
    - *Water Supplies – Residential 4A-4B Zones* (S-CP-5609)
    - *Refuse and Recyclable Material Collection* (S-CP 4305)
    - *Street Trees* (QS-R900 – QS-R912)
    - *Subdivision Irrigation & Watering Systems* (S-CP 4925)
    - *Neighbourhood Reserves* (SP-C 4408)
- Strategies
    - *Road Safety,* http://www.waimakariri.govt.nz/community/road_safety/
    - *Walking and Cycling* ,www.waimakariri.govt.nz/otherways/04121300029.pdf
- Guidelines
    - *Street Name Blade Guidelines*

1.2.1.2 Christchurch City Council

- Infrastructure Design Standard (DRAFT)

References, Glossary & Abbreviations

1.2.1.3 Environment Canterbury (Canterbury Regional Council)

- *Natural Resources Regional Plan* (NRRP)
  www.ecan.govt.nz/Plans+and+Reports/NRRPNEW/
- *Transitional Regional Plan* (TRP) 1991
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1.2.1.4 Various

- Building Industry Authority (BIA) *New Zealand Building Code*
  www.dbh.govt.nz/bcl-get-a-copy-of-building-code
- Fencing Act (1978)
- IPENZ Practice Note 02 *Peer Review – Reviewing the work of another engineer*
  www.ipenz.org.nz/ipenz/forms/pdfs/PN02_Peer_Review.pdf
- Land Transport NZ *Traffic Control Devices Rule* 2004
  www.ltsa.govt.nz/rules/traffic-control-devices-2004.html
- Land Transport NZ *Setting Speed Limits Rule* 2003
- NAMS *New Zealand Infrastructure Asset Valuation and Depreciation Guidelines*
  www.nams.org.nz/Infrastructure%20Asset%20Valuation%20and%20Depreciation%20Guidelines%202006%20Edition
- Te Maire Tau, Anake Goodall, et al. *Te Whakatau Kaupapa*, Aoraki Press, 1992
- Transit New Zealand *Planning Policy Manual* (state highways)
  www.transit.govt.nz/technical/view_manual.jsp?content_type=manual&=edit&primary_key=46&action=edit
- Transit New Zealand *Quality Standard TQS2:* Second Edition, June 2005

1.2.2 Design

1.2.2.1 Christchurch City Council

- Design Specifications
  - Sewage Pumping Station
  - Private Wastewater Pumping Station
  - Water Supply Wells, Pumping Station and Reservoir
- Bush Birds, www.ccc.govt.nz/parks/publications/environmental_bush_birds.asp
- Streamside Planting Guide,
  www.ccc.govt.nz/parks/theenvironment/StreamsidePlantingGuide.pdf
- Stormwater Tanks on Private Property,
  www.ccc.govt.nz/QuickAnswers/documents/StormwaterTanksOnPrivateProperties.pdf
- Waterways, Wetlands and Drainage Guide, Ko Te Anga Whakaora mō Ngā Arawai Rēpo 2003 (WWDG), www.ccc.govt.nz/parks/TheEnvironment/waterways.asp

References, Glossary & Abbreviations

1.2.2.2 Environment Canterbury (Canterbury Regional Council)

- *Erosion and sediment control guidelines* 2007 www.ecan.govt.nz/Our+Environment/Land/ErosionAndSediment/ErosionSedimentControlGuidelines.htm
- *Erosion and sediment control guidelines for small sites* www.ecan.govt.nz/Our+Environment/Land/ErosionAndSediment/ErosionSedimentControlGuidelineSmallSites.htm

1.2.2.3 NZ Standards, http://www.standards.co.nz/

- NZS 3604:1999 *Timber framed buildings*
- NZS 3910: 2003 *Conditions of contract for building and civil engineering construction*
- NZS 4121:2001 *Design for Access and Mobility: Buildings and Associated Facilities*
- NZS 4229:1999 *Concrete masonry buildings nor requiring specific engineering design*
- NZS 4275:1995 *Methods of Test for underground Marking Tape – series*
- NZS 4404: 2004 *Land development and subdivision engineering*
- NZS 4431:1989 *Code of practice for earthfill for residential purposes*
- NZS 5828: 2004 *Playground equipment and surfacing*
- NZS 6701:1983 *Code of practice for road lighting*
- AS/NZS 1100 *Technical drawing – series*
- AS/NZS 1158 *Lighting for roads and public spaces – series*
- AS/NZS 1546.1: 1998 *On-site domestic wastewater treatment units – Septic tanks*
- AS/NZS 1547: 2000 *On-site domestic wastewater management*
- AS/NZS 2566.1:1998 *Buried flexible pipelines structural design* (including supplement 1)
- AS/NZS 2845.1:1998 *Water supply – Backflow prevention devices*
- AS/NZS 4020:2002 *Testing of products for use in contact with drinking water*
- AS/NZS 4130:2003 *Polyethylene (PE) pipes for pressure applications*
- AS/NZS 60598.12003 *Luminaries – General requirements and tests*
- NZS/AS 1657: 1992 *Fixed platforms, walkways, stairways and ladders. Design, construction and installation*
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- AS/NZS ISO 9001:2000 *Quality management systems – requirements*
- SNZ HB 8630: 2004 *Tracks and outdoor visitor structures*

1.2.2.4 Various

- Austroads, http://www.austroads.com.au/
  - *Guides to Traffic Engineering Practice* and the New Zealand Supplements
  - *Pavement Design Manual*
  - *Urban Road Design - Guide to the Geometric Design of Major Urban Roads*
  - *Rural Road Design - Guide to the Geometric Design of Rural Roads*
- Auckland Regional Council
  - *Stormwater Treatment Devices: Design Guideline Manual* (TP10), www.arc.govt.nz/plans/technical-publications/technical-publications-1-50.cfm
  - *Erosion and sediment control: Guidelines for land disturbing activities in the Auckland Region* (TP90) (1999), www.arc.govt.nz/plans/technical-publications/technical-publications-51-100.cfm

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- Building Industry Authority (BIA) *New Zealand Building Code* and Complience Documents, http://www.dbh.govt.nz/compliance-docs-get-copies
- Landcare Research Report LC0203/111 Soil Conservation Guidelines for the Port Hills (2003)
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- New Zealand Geotechnical Society *Field Description of Soil and Rock* December 2005 http://www.nzgeotechsoc.org.nz/guidelines.cfm
- New Zealand Utilities Advisory Group www.nzuag.org.nz/
- Transit New Zealand (TNZ)
  - All TNZ manuals and standards including Criteria and Guidelines
  - *Guidelines for Planting for Road Safety*
  - *Bridge Manual* (2003)
- *Geotechnical Issues in Land Development*, Proceedings of NZ Geotechnical Society Symposium, Hamilton (1996)
- Cook, D., Pickens, G.A., MacDonald, G., *The Role of Peer Review*, Report by S.A. Crawford, NZ Geomechanics News (Dec 1995)
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- New Zealand Building Code Compliance Document G13 *Foul Water*
- Water Industry Specification 4-34-04 *Specification for renovation of gravity sewers by lining with cured-in-place pipe* (WIS 4-34-04)
- Ministry of Health *Drinking Water Standards for New Zealand* 2005
- SNZ/PAS 4509:2003 New Zealand Fire Service *Fire Fighting Water Supplies Code of Practice* (Fire Service Code of Practice)
- All Land Transport New Zealand (LTSA) guidelines (including RTS series) and manuals
- Land Transport New Zealand *On Road Tracking Curves for Heavy Vehicles* (RTS 18) http://www.ltsa.govt.nz/roads/rts/rts-18/
- Trafinz *Guide to Pedestrian Crossing Facilities*, August 2001

1.2.3 Construction

1.2.3.1 Christchurch City Council

- *Civil Engineering Construction Standard Specifications Parts 1-7* 2006 (CSS), www.ccc.govt.nz/doingbusiness/css/

1.2.3.2 NZ Standards, http://www.standards.co.nz/

- NZS 6401: 1973 *Specification for PVC-Insulated Cables for Electric Power and Lighting*
- NZS 7649:1988 *Unplasticised PVC Sewer and Drain Pipe and Fittings*
- NZS 8603:2005 *Design and application of outdoor recreation symbols*
- AS/NZS 4026: 1992 *Electric Cables – For Underground Residential Distribution Systems*

References, Glossary & Abbreviations

1.2.3.3 Various

- Mainpower *Network Connection Standards* 2006
- Road Safety Manufacturers Association *Compliance Standard for Traffic Signs*
- Transit New Zealand T/10 *Skid Resistance Investigation and Treatment Selection*
- Transit New Zealand & Land Transport Safety Association *Manual of Traffic Signs and Markings*, Parts 1 & 2

References, Glossary & Abbreviations

1.3 GLOSSARY

The following definitions apply in the Engineering Code of Practice, unless inconsistent with the context. These definitions are additional to those definitions in the *District Plan*.

Abutment	An end support of a bridge or similar structure.
Access chamber	A chamber with working space at *drain* level through which the *drain* passes either as an open channel or as a pipe incorporating an *inspection point*.
Accessway	Any area of land the primary purpose of which is to provide access between the body of any allotment(s) or site(s) and any road and includes any rights of way, access lot, access leg or private road.
Alignment	The horizontal or vertical geometric form of the centreline of the carriageway.
Allotment	The meaning ascribed to it by Section 10 of the Building Act 2004.
Amenity	Amenity can be defined as those values, being natural or physical qualities and characteristics of an area, that contribute to people's appreciation of their pleasantness, aesthetic coherence, and cultural and recreational attributes. This is a subjective quality.
Annual average daily traffic	For volumes over 5000 vehicles per day, the figure shall be the count multiplied by the appropriate factor detailed in Transit New Zealand Report documentation.
Annual Exceedance Probability	A statistical term defining the probability of an event occurring annually. Expressed as a percentage and generally used in hydrology to define rainstorm intensity and frequency. This has replaced the concept of a "return period" but has a similar meaning.
Annulus	Gap between the original pipe and an inserted pipe.
Applicant	The person or body corporate applying to carry out development, which may require a Resource Consent. The code includes the Applicant as the Developer.
Arboriculture	The management of individual trees or groups of trees primarily for their amenity value.
As-Builts	Final plans and specifications that require submitting to the Council for approval. Standard scales for As-Built drawings are 1:50, 1:100, 1:200, 1:250, 1:500, 1:750, 1:1000 & 1:1500.
Applicant's Representative	A person appointed by the Applicant to act on its behalf. The Applicant's Representative may be a Consultant engaged by the Applicant. All notices and correspondence to the Applicant from the Council will be to the attention of the Applicant's Representative.
Austroads	Abbreviation for Association of Road Transport and Traffic Authorities in Australia and New Zealand (previously NAASRA).
Average Dry Weather Flow	The daily average wastewater flow from domestic, industrial and commercial sources, excluding infiltration and surface entry, as determined in clause 6.4 – Wastewater Design Flows (Wastewater Drainage)
Back pressure	A condition where the downstream pressure is greater than the supply pressure.
Backfill	The material used to refill an excavation.
Backflow	A flowing back or reversal of the normal direction of the flow that is caused by *back-pressure.* Backflow includes *back-siphonage*.
Back-siphonage	*Back-flow* caused by the supply pressure being less than atmospheric pressure.
Basecourse	The layer of material constituting the uppermost structural element of a pavement, immediately beneath the wearing course; or the graded aggregate that can be used in such a layer.
Basic boundary fence	Treated timber post and three rail fence with vertical 1.8m timber palings.
Berm	The edge of a road reserve between the kerb or surface water channel and the property boundary, exclusive of footpath.
Betterment	The increased value of land arising from improved access.

References, Glossary & Abbreviations

Booster main Booster main reticulation is connected to trunk reticulation to provide boost capacity to trunk mains.

Bridge A structure designed to carry a road or path over an obstacle by spanning it. This includes culverts with a cross-sectional area greater than or equal to 3.14 square metres.

Building consent A consent to carry out *building work* granted by a *territorial authority* under Section 49 of the Building Act; and includes all conditions to which the consent is subject.

Building The meaning ascribed to it by Sections 8 and 9 of the Building Act (2004) as follows: meaning of *building* -

(1) In the *Building* Act, unless the context otherwise requires, the term "*building*" means any temporary or permanent movable or immovable structure (including any structure intended for occupation by people, animals, machinery, or chattels); and includes any mechanical, electrical, or other systems, and any utility systems, attached to and forming part of the structure whose proper operation is necessary for compliance with the *building code*; but does not include:

- Systems owned or operated by a *network utility operator* for the purpose of reticulation of *other property*; or
- Cranes, including any cranes as defined in regulations in force under the Health and Safety in Employment Act 1992; or
- Cablecars, cableways, ski tows, and other similar stand alone machinery systems, whether or not incorporated within any other structure; or
- Any description of vessel, boat, ferry, or craft used in navigation, whether or not it has any means of propulsion, and regardless of that means; nor does it include: a barge, lighter, or other like vessel; a hovercraft or other thing deriving full or partial support in the atmosphere from the reactions of air against the surface of the water over which it operates; a submarine or other thing used in navigation while totally submerged; or
- Vehicles and motor vehicles (including vehicles and motor vehicles as defined in section 2(1) of the Transport Act 1962 and section 2(1) of the Transport (Vehicle and Driver Registration and Licensing) Act 1986, but not including vehicles and motor vehicles, whether movable or immovable, which are used exclusively for permanent or long-term residential purposes; or
- Aircraft, including any machine that can derive support in the atmosphere from the reactions of the air otherwise than by the reactions of the air against the surface of the earth; or
- Containers as defined in section 2 of the Dangerous Goods Act 1974; or
- Magazines as defined in section 2 of the Explosives Act 1957; or
- *Scaffolding* used in the course of the construction process; or
- *False work* used in the course of the construction process.

(2) For the purposes of Part IX of the Building Act, a *building consent*, a *code compliance certificate*, and a *compliance schedule* the term *building* also includes -

- Any part of a *building*; and
- Any two or more buildings that, on completion of any *building* work, are intended to be managed as one *building* with a common use and a common set of ownership arrangements.

(3) For the purposes of subsection (2) of this section, where any utility system or any part of any utility system -

- Is external to the building; and
- Is also connected to or is intended to be connected to a network under the control of a network utility operator, or some other facility which is able to provide for the successful functioning of the utility system in accordance with its intended design - that utility system or that part of the utility system shall be deemed to be part of a building.

(4) Notwithstanding the provisions of subsection (3) of this section, where a septic tank is connected to a *building* utility system the septic tank shall be deemed to form part of that *building* utility system.

References, Glossary & Abbreviations

Building work	The work for or in connection with the *construction, alteration*, demolition, or removal of a *building*; and includes *sitework*.
Canopy	The branches and foliage of a tree out to the drip line.
Capital Contributions	For a subdivision, the Council levies fees for upgrading utility services to cope with the increased demand caused by new connections to a utility service. Fees are set by the Council and apply for each new connection to each new lot created and that requires servicing (for water supply, sanitary and stormwater disposal).
Carriageway	That portion of the road devoted particularly for the movement of vehicles. It includes sealed shoulders but excludes parking areas and cycle lanes.
Catchment	A geographical unit within which surface water runoff is carried under gravity by a single drainage system to a common outlet or outlets. Also commonly referred to as a Watershed or Drainage Basin.
Cattlestop	A ground level grid crossing a carriageway to prevent stock crossing.
Causeway	A raised road across water or a floodplain.
Centre line	A line (or series of lines) painted on a road to delineate the centre.
Centreline	The line, at the centre or axis of a road or other work. It is often the line from which measurements for setting out or constructing the work can conveniently, be made.
Channel	That part of a watercourse where normal flow is contained. The channel is generally incised into the flood plain and for many of the stable stream systems in New Zealand can be defined in capacity as being just able to accommodate the annual return period flow (100% AEP) without overtopping. Also refers to an artificial conduit such as a ditch excavated to convey water.
Channel Storage	The amount of water temporarily stored in channels while *en route* to an outlet.
Channelisation	A system of islands or markings on a carriageway to direct traffic into predetermined paths, usually at an intersection or junction.
Check valve	A valve that permits flow in one direction but prevents a backflow. Also called a non-return valve or backflow preventor.
Chevron board	A chevron patterned reflective sight board that highlights an abrupt change in road direction.
Chip seal	A water proofing and wearing course consisting of a layer or layers of uniform sized chips bound to a layer of bitumen which is in turn bound to the road metalcourse layer.
Cladding	The exterior weather-resistant surface of a *building*.
Class 1 Loading	The axle loading, at particular spacing, as defined in the Heavy Motor Vehicle Regulations.
Clay (Soils)	A general term for very fine mineral soils either with or without cohesive properties with soil particles smaller than 0.002 mm
Clean Water	Any water that has no visual signs of suspended solids, e.g. that originating from stable well-vegetated or armoured surfaces.
Compact	To reduce the volume of a material by closer packing of its particles by rolling, tamping or other mechanical means.
Conduit	Any channel intended for the conveyance of water, whether open or closed.
Consultant	A technical advisor to the applicant/developer. A professional with qualifications and experience in a given discipline giving advice within that area of competence to the applicant/developer. A Consultant shall have appropriate Professional Indemnity Insurance.
Corrugations	(on a road) Closely spaced ripples running across the line of traffic, generally where braking and acceleration of vehicles occurs.
Council	Generally refers to the Waimakariri District Council. Christchurch City Council is always referred to in full or abbreviated as “CCC”. Canterbury Regional Council is always referred to as Environment Canterbury or abbreviated as “ECan”.

References, Glossary & Abbreviations

Cover	The depth of material between the surface of the ground or pavement and the top of a culvert, cable or pipe.
Crib wall	A retaining wall made of interlocking concrete or timber sections with earth or gravel fill between.
Cross connection	Any actual or potential connection between a potable water supply and a source of contamination or pollution between two or more properties.
Crossfall	The slope or camber measured at right angles to the alignment upwards to the centre or edge of a road. Usually measured in degrees or a ratio.
Crown	The highest point and finished level on the cross-section of a carriageway with two-way cross-fall.
Culvert	A culvert is a pipe or other structure that is not considered integral to a drainage reticulation system, for example where a watercourse or drain crosses under a road.
Cultivar	Proprietary seed type and or mixture.
Cut-off-drain	An interceptor drain often constructed along the top of a cutting or batter to prevent stormwater flowing where not preferred.
Cycle lane	That portion of the road devoted to the exclusive use of pedal cycles only.
Cycle route	A route (on or off roads) recommended for use by pedal cycles.
Cycleway	An off-road cycle lane.
Dam	A barrier to confine or raise water for storage, diversion, retention or detention, to create a hydraulic head, to prevent gully erosion, or to retain soil, rock or other debris.
Detention Basin	An area of land or structure purpose built for slowing or controlling stormwater runoff by storage and/or controlled outflow.
Detention Dam	A dam, constructed for the temporary storage of storm flow, which releases the stored water at controlled rates in order to reduce flooding hazard downstream of the dam.
Developer	The person or body corporate applying to carry out development that may require a Resource Consent (see also Applicant). as defined in NZS 4404: 2004
Diameter	(or bore) The nominal internal *diameter* of a pipe or duct. All pipe diameters are internal, unless specifically stated otherwise.
Direction sign	A sign placed usually at an intersection to direct traffic along a route or toward a destination.
Discharge pipe	Any pipe which is intended to convey discharge from sanitary fixtures or sanitary appliances and includes a waste pipe, combined waste pipe, branch discharge pipe and discharge stack.
District Plan	Waimakariri District Council Proposed District Plan as amended by Council decisions and publicly notified on 24 February 2001.
Divided highway	A road with physically separated carriageways for traffic travelling in opposite directions.
Drain	A pipe, or, in the case of surface water/stormwater, conduit normally laid below ground level and intended to convey *foul water* or *surface water* to an *outfall*. The definition includes including fittings and equipment.
Drainage	The removal of excess surface water or ground water from land by means of surface or subsurface drains. (As defined in NZS 4404: 2004.)
Drip line	From one outer extremity of the canopy of a tree(s) to the other outer extremity of the canopy in a 360^{o}aspect.
Drop Structure	A structure built to lower the level of an open channel abruptly from one level to a lower level without increasing the velocity of the water in the channel.
Durable	Resistant to wear and decay for not less than the intended life of the product or material.
Earthwork	Any alteration to ground by means of excavation and/or backfilling, as defined in NZS 4404: 2004.

References, Glossary & Abbreviations

Easement	The right an entity has to some use to the property of another. In the context of this Code, this refers to the right of the WDC to access and make use of a piece of property for the provision of public services (e.g. water supply, wastewater disposal). All Council easements are deemed to be "easements-in-gross".
Edge line	A line painted on a road to indicate the outer edge of the traffic lane.
Electrical installation	Any *electrical fixed appliances,* cables and other components used in the reticulation of electricity and which are intended to remain permanently attached to and form part of the *building*.
Electrical supply system	A source of energy in the form of electricity external to the *electrical installation*.
Embankment	A construction work (usually of earth or stone) which raises the ground (or formation) level above the natural surface. Similar to a causeway.
Engineer	As defined in NZS 3910: 2003.
Engineering Acceptance	The written confirmation of the Council's acceptance of the Design Report and design, including drawings, calculations, specifications.
Environment Canterbury	Usually abbreviated as "ECan", promotional name of the Canterbury Regional Council,
Erosion and Sediment Control Plan (E&SCP)	A detailed plan normally prepared by a consultant, that details the way erosion is to be minimised and treatment of sediment laden overland flow is to be undertaken.
Establishment (landscape)	As defined in *CSS: Part 7* clause 14.
Even ground surface	A ground surface that is essentially planar and usually a result of shaping from earthworks.
Filter Strip	A long, narrow vegetative planting used to retard or collect sediment for the protection of adjacent properties or receiving environments.
First Coat Seal	The initial seal placed on a prepared base course.
Floodgate	A gate on the outlet of an open channel or piped system that prevents water from downstream, whether of tidal or other origin entering back to the pipe or channel.
Flow Control	Flow Control (for stormwater) is intended to limit the amount of stormwater that leaves a site or proposed development. Design and construction for flow control will remedy or mitigate adverse effects from increased velocities, flows and flooding downstream.
Flume	An open channel for conveying water across lower level ground. Also referred to as a chute. Typically flume velocities are turbulent.
Flush Tank	An underground chamber that fills with water automatically and that is used to flush clean a gravity pipe system. These may be required at the upstream end of the system and are dependent on pipe flow and grade.
Footpath	That portion of the road reserve set aside for the use of pedestrians.
Ford	A shallow place in a water-course, stream or river where the bed may be crossed by traffic.
Foul water	The discharge from any sanitary fixture or sanitary appliance.
Foul water drainage system	*Drains,* joints and fittings normally laid underground and used specifically for the conveyance of water from the *plumbing system* to an *outfall.*
Frangible (tree)	As defined in Transit *Guidelines for Planting for Road Safety*, mature trees, not hardwoods, with a trunk diameter less than 100mm at 400mm above the ground.
Frangible (street lighting column)	As defined in TNZ M/19.
Freeboard	The height between the surface level of the flow and the level at which overtopping occurs.
Functional requirements	In relation to a building, means those functions that a building is to perform for the purposes of the Building Act.

References, Glossary & Abbreviations

Gabion	A rectangular wire mesh cage filled with rocks, used to retain embankments and riverbanks.
Gantry	A structure covering a public way providing protection from both the side and overhead.
Geotechnical Engineer	As defined in NZS 4404: 2004.
Geotexiles	A generic name for (usually) synthetic fabrics used for drainage or to improve the stability or load carrying ability of soil.
Good ground	Any soil or rock capable of permanently withstanding an ultimate bearing pressure of 300kPa (i.e. allowable bearing pressure of 100kPa with a factor of safety of 3.0), excluding: • Potentially compressible ground such as topsoil, soft soils such as clay which can be moulded easily in the fingers, and uncompacted loose gravel containing obvious voids, • Expansive soils being those that have a liquid limit of more than 50% when tested in accordance with NZS 4402 Test 2.2, and a linear shrinkage of more than 15% when tested in accordance with NZS 4402 Test 2.6, and • Any ground which could foreseeably experience movement of 25mm or greater for any reason including one or a combination of: land instability, ground creep, subsidence, seasonal swelling and shrinking, frost heave, changing ground water level, erosion, dissolution of soil in water, and effects of tree roots. • Soils (excepting those described above) tested with a dynamic cone penetrometer in accordance with NZS 4402 Methods of testing soils for civil engineering purposes Test 6.5.2, shall be acceptable as good ground for building foundations if penetration resistance is no less than: – Minimum 3 blows per 75mm at depths no greater than footing width. – Minimum 4 blows per 75mm at depths greater than the footing width. Depths shall be measured from the underside of the proposed footing.
Grade	The surface slope of a road, channel or natural ground.
Gradient	The longitudinal slope of a road or pipe or drain.
Granular material	Material with a particle size no smaller than sand.
Grease trap	A device designed to intercept grease in a *foul water* discharge.
Grit	Fine angular mineral aggregate, usually passing a 4.75 mm sieve but retained on a 1.18 mm sieve.
Ground water	Water flowing or lying under the natural surface of the ground.
Guard rail	An engineering rail erected for safety to restrain vehicles after leaving a road carriageway in an uncontrolled and unintentional direction.
Gully trap	A fitting designed to prevent foul air escaping from the drainage system and used to receive the discharge from *waste pipes.*
Handrail	A rail that provides support to, and assists with the movement of a person.
Hazard	Any unreasonable risk to people that may cause bodily injury or deterioration of health.
Hazardous	Creating an unreasonable risk to people of bodily injury or deterioration of health.
Hazardous substance	The meaning ascribed to it by the Fire Service Act 1975.
Headwaters	The source of a watercourse. The water upstream of a structure or point on a watercourse.
Hilly	Terrain is considered hilly where the slope is greater than 1v: 20h. In the District this terrain is typically found on river terraces or otherwise to the north-west and west in the foothills.
Impervious	That which does not allow the passage of moisture or infiltration of water.
Information sign	A road sign for the purpose of giving information, not being a warning or regulatory sign.
Inspection chamber	A chamber with working space at ground level through which the *drain* passes either as an open channel or as a pipe incorporating an *inspection point.*

References, Glossary & Abbreviations

Inspection point	A removable cap at *drain* level through which access may be made for cleaning and inspecting the drainage system.
Interceptor drain	A type of drain that collects and channels water in a particular direction.
Interceptor trap	A device that will separate and retain required liquids and solids from a liquid stream and which will provide a water barrier to prevent foul air or gas from entering any downstream system.
Invert	The bottom of the inside of a pipe drainage channel.
Kerb	A border of rigid material that is usually raised concrete, which is formed at the edge of a traffic lane or shoulder.
Kerb and channel	Combined kerb and sealed drainage channel.
Kerb ramp	A short ramp that either cuts through a kerb or is built up to the kerb.
Land held under the same title	This is all land appearing on an individual Certificate of Title issued by the District Land Registrar and includes a piece of land, or a *building* or part of a *building*, or both, that is: • A unit under the Unit Titles Act 1972, or • Leased under a cross-lease registered under the Land Transfer Act 1952, or • Leased under a company lease registered under the Land Transfer Act 1952
Lane line	A line other than a centre line or edge line painted on a road dividing adjacent traffic lanes.
Living Zone	As defined in the *District Plan*.
Marker post	A post placed at the edge of the road, equipped with a reflector to assist night driving that complies with MOTSAM.
Maximum operating pressure	This is specified by the Engineer and is the maximum pressure the pipeline must sustain, including surge.
Median	A raised or flush divider separating traffic.
Median barrier	A device used on multi-lane roads to keep opposing traffic in prescribed carriageways.
Mitigation	Off-setting adverse environmental effects caused by development.
Modified Rational Method	The modified rational method is an extension of the rational method for rainfalls lasting longer than the time of concentration t_c. This modified method uses concepts of the rational method to develop hydrographs for storage design rather than only flood peak discharges. The modified rational method can be used for preliminary design of detention storage for catchment sizes up to approximately 15 Ha.
Natural waterway	See Watercourse
Network utility operator	A person or organisation that: • Undertakes the distribution or transmission by pipeline of natural or manufactured gas, petroleum, or geothermal energy; or • Is an electricity operator or electrical distributor as defined by section 2(1) of the Electricity Act 1992 for the purposes of an works defined by that Act; or • Undertakes the piped distribution of *potable* water for supply; or • Is the operator of a sewerage system or a stormwater drainage system; • Is the operator of a water race or stock water race system.
Notable Plant	A plant as defined in the Proposed District Plan as amended by Council decisions Chapter 10 – Notable Plants.
Optimum moisture content	The moisture content at which a specified amount of compaction will produce a maximum density under specified conditions.
Other property	Any land or *buildings* or part thereof which are: • Not held under the same *allotment*, or • Not held under the same ownership - and includes any road.

References, Glossary & Abbreviations

Outfall	That part of the disposal system discharging or receiving *surface water* or *foul water* from the drainage system. For *foul water,* the *outfall* may include a *sewer* or a septic tank. For *surface water*, the *outfall* may include a natural water- course, kerb and channel, or soakage system.
Overland Flow	See Secondary Flow
Overland Flow Path	See Secondary Flow Path
Overpass	A grade separation where the traffic passes over an intersecting highway or railway.
Owner	In relation to any land, including any *buildings* on that land, means the *person* who is for the time being entitled to the rack rent thereof or who would be so entitled if the land were let to a tenant at a rack rent; and, for the purposes of sections 30, 33 and 43 of the Building Act, includes the: • Owner of the fee simple of the land; and • Any ***person*** who has agreed in writing, whether conditionally or unconditionally, to purchase the land or any leasehold estate or interest in the land, or to take a lease of the land, while the agreement remains in force, and **ownership** has a corresponding meaning. (As defined in NZS 4404: 2004.)
Passing bay	A widened length on a narrow bridge or road at which vehicles travelling in opposing directions can pass each other.
Passing lane	An additional lane on a road to allow one to overtake vehicles travelling in the same direction.
Pavement	The road structure that is constructed on a subgrade and supports the traffic loading.
Pavement markings	Any lines painted on the road to control traffic movement or parking.
Pedestrian crossing	A specially marked area giving right of way to pedestrians crossing the road.
Perennial Stream	A stream that maintains water in its channel throughout the year or maintains a series of discrete pools that provides habitats for the continuation of the aquatic ecosystem.
Performance criteria	In relation to a *building*, means those qualitative or quantitative criteria that the *building* is to satisfy in performing its *functional requirement*.
Person	Includes the Crown, a corporation sole, and also a body of persons, whether corporate or unincorporated.
Piping system	An assembly of pipes, pipe fittings, gaskets, bolting and pipe supports.
Plans and specifications	Means the drawings, specifications, and other documents according to which a *building work* is proposed to be constructed, altered, demolished, or removed, including proposed procedures for inspection during *construction*, *alteration,* demolition, or removal, and also including (in respect of *construction* or *alteration)*: The *intended use* of the *work*, and The design features or systems which the applicant considers will be required to be included in any *compliance schedule* issued in terms of section 44 of the Building Act; and The proposed procedures for inspection and routine maintenance for the purposes of that *compliance schedule* in respect of those design features or systems.
Pressure control valve	A pressure limiting valve, or pressure reducing valve.
Primer	In roading, the material applied to a prepared base to facilitate the binding of bitumen to the road surface.
Principal main	Principal main reticulation is typically 100 mm & 150 mm diameter and includes fire hydrants.
Private Drain	A drain that is not a public drain. A drain that is privately owned or of largely private benefit.

References, Glossary & Abbreviations

Private way	As defined by s315 of the Local Government Act 1974.
Producer statement	Any statement that is supplied by or on behalf of an applicant for a *building consent* or by or on behalf of a person who has been granted a *building consent* that certain work will be or has been carried out in accordance with certain technical specifications.
Property	Land, *buildings*, and goods; but does not include incorporeal (without material form or substance) forms of *property*.
Proposed District Plan as amended by Council decisions	The Council's district plan that is prepared under the Resource Management Act 1991. The purpose of the Resource Management Act 1991 is to promote the sustainable management of natural and physical resources.
Protected tree	A (notable) tree as listed in the Proposed District Plan Appendix 28.3.
Public Carpark	Public carparks are those in public ownership to which members of the public can be expected to have free access (almost) as of right.
Public Drain	Means a passage or channel on or over the ground for the reception and discharge of stormwater, whether the drain is continuously or intermittently flowing, that any local authority is authorised to construct, undertake, establish, manage, operate or maintain. On private property a public drain may be covered by easements in favour of the Council for the purposes of right to drain and/or right of way.
Public Place	Re *dangerous goods* – any place which is freely open to and frequented by the public, excluded is, private property where the licensee can control the access of the public to dangerous goods
Pump Station	A building housing one or more pumps for the distribution of potable or waste-water from one part of the network to another.
Qualified Arborist	A person who is in possession of a recognised arboriculture degree, diploma or certificate, and on the job experience, is familiar with the equipment and hazards involved in arboriculture operations, has demonstrated proficiency in inspecting, analysing and treating hazardous trees and has demonstrated the ability to perform the tasks involved. A Certificate shall consist of a minimum of 240 credits of learning (i.e. Level 4).
Qualified Horticulturalist	A person who is in possession of a recognised horticulture degree, diploma or certificate, and on the job experience, is familiar with the equipment, hazards and techniques involved in horticulture operations, and has demonstrated the ability to perform the tasks involved. A Certificate shall be a minimum of Level 3 i.e. the equivalent to one year full time study.
RAMM	A computer-based maintenance management system including an inventory, which assists in the management of the maintenance and rehabilitation of pavements and related features. RAMM stands for Road Assessment and Maintenance Management (System).
Rainfall Intensity	The volume of rainfall falling in a given time. Normally expressed as mm/hour.
Rated Pressure	This is specified by the manufacturer as the limit that the particular component can sustain in use.
Relevant boundary	A line from which space separation requirements are measured. It may be: • The boundary between two property titles, • The property boundary on the far side of an abutting street, railway or public place, or • A notional boundary. Note that separation requirements are related to the potential threat from the effects of a fire emanating from the exterior wall of a building. A boundary is not a relevant boundary, if lines drawn parallel to the face of the building and to the boundary, intersect at an angle of more than 80°.
Residual Pressure	Remaining pressure at a point under a particular demand.
Retaining wall	A wall constructed to resist lateral pressure from the adjoining ground or to maintain in position a mass of earth.

References, Glossary & Abbreviations

Retention Basin (Detention Basin)	An area of land or structure purpose built for the holding or delaying stormwater runoff with a controlled outflow and an engineered overflow.
Reticulation	A system of interlacing pipes, wires and other connections, constructed like a net, which feed out from a central supply to customers.
Reticulation (Fluids)	A system of pipes or drains for the conveyance of fluids.
Reticulation (Energy & Communications)	Reticulation includes all overhead and underground cables, support structures, points of supply, relays, switchgear, fittings, ducting and conduits (whether empty or used).
Return Period	The statistical interpretation of the frequency of a given intensity and duration rainstorm event. Refer AEP.
Rider main	Rider main (sub-main) reticulation is typically 50 mm diameter, includes service lateral connections and excludes fire hydrants.
Riparian	Of, inhabiting, or situated on the bank of a river.
Road	An area formed for vehicular traffic to travel on. The term “road” usually describes the area between kerbs or surface water channels and includes medians, shoulders and parking areas. Refer also the Local Government Act, Land Transport Act and Transit New Zealand. Road includes — (a) A street; and (b) A motorway; and (c) A beach; and (d) A place to which the public have access, whether as of right or not; and (e) All bridges, culverts, ferries, and fords forming part of a road or street or motorway, or a place referred to in paragraph (d): (f) All sites at which vehicles may be weighed for the purposes of the Land Transport Act or any other enactment.
Road Furniture	A general term to describe features placed on or near the road to improve safety and assist drivers. Furniture includes barriers, guard rails, lighting, parting meters, poles, posts, signs, lights, seats and rubbish bins.
Road Opening Notice	A formal application to Waimakariri District Council for the installation of a network service within legal roads.
Road reserve	A legally described area within which facilities such as roads, footpaths and associated features may be constructed and maintained for public travel.
Rodding point	A removable cap at ground level through which access may be made for cleaning and inspecting the drainage system.
Roughness	Irregularities in the longitudinal profile of a road, with wavelengths 0.1 to 15 metres and usually measured in NAASRA counts.
Roundabout	An intersection of two or more carriageways at a common level where all traffic travels around a central island, which induces weaving movements in lieu of direct crossings.
Route marker	A sign indicating by means of a number, a device, or a colour, the course of a particular route.
Running course	A thin layer of graded stone that protects the base course of an unsealed road (e.g. AP20 – Stabilised Average Particle Size 20 mm).
Rural Drainage Area	Means any area constituted for land drainage purposes in the District under Part XXIX (Land Drainage and River Clearance) of the Local Government Act 1974.
Safety sign	A particular type of sign that comprises a geometric form and a safety *colour*, together with a *safety symbol* or text (that is words, letters numbers or a combination of these) and gives a particular safety message.
Safety symbol	A graphic symbol used in a *safety sign*.

References, Glossary & Abbreviations

Sanitary appliance	An appliance that is intended to be used for *sanitation*, such as machines for washing dishes and clothes.
Sanitary fixture	Any *fixture* that is intended to be used for *sanitation*.
Scaffolding	Used in the course of the *construction* process: Any structure, framework, swinging stage, suspended *scaffolding,* or boatswain's chair, of a temporary nature, used or intended to be used for the support or protection of workers engaged in or in connection with *construction* work for the purpose of carrying out that work, or For the support materials used in connection with any such work; and include any plank, coupling, fastening, fitting or device used in connection with the *construction,* erection or use of *scaffolding*.
Second coat seal	A chip seal placed on top of a first coat sealed surface.
Secondary Flow (Overland Flow)	The path over which *surface water* will follow if the drainage system reaches design capacity and then surcharges.
Secondary Flow Path (Overland Flow Path)	The route of concentrated flow, often in the form of sheet flow. This can be designed to carry and channel secondary flow to minimise flooding hazard to buildings and infrastructure.
Sediment	Solid material, both mineral and organic, that is in suspension, being transported, or has been moved from site of origin by air, water, gravity, or ice and has come to rest on the earth's surface either above or below water.
Self Cleansing (Velocity)	In gravity pipe systems, that minimum velocity able to keep the pipe flushed from any expected solids, therefore removing the requirement to install an upstream flush-tank.
Sewage	Waste matter carried away in sewers.
Sewer	A *drain* that is under the control of, or maintained by, a *network utility operator* and used to convey sewerage or stormwater.
Sewerage	A system of sewers.
Sheet Flow	Shallow dispersed overland flow.
Shoulder	That portion of the road outside the traffic lanes and designed to provide lateral structural support to the carriageway.
Side drain	A surface drain normally constructed on the road reserve near the outer boundary to prevent water flowing onto the road, or into the pavement layers, or to take water from a surface water channel and carry it to a water course or other outfall.
Sight rail	A timber or metal rail (usually reflective or painted white) placed to highlight a change in road direction or some other hazard but not designed to act as a guard rail.
Significant Tree	A notable plant.
Siphons	A pipeline between two open channels or two water holding structures, that has all, or part of, its soffit at a lower level than that of the adjacent channels or structures.
Sitework	Work on any site, including earthworks, preparatory to or associated with the *construction, alteration*, demolition or removal of a *building* or any other work.
Slurry seal	A specialist road surface treatment consisting of a mixture of bitumen emulsion, fine aggregate and portland cement.
Soak pit	An excavation to create a void suitable for receipt of surface water run-off, enabling it to soak away (refer standard drawing 600-390 – Roadside Soakhole).
Soil fixture	A *sanitary fixture constructed* to receive solid and/or liquid excreted human waste. It includes a bedpan disposal unit, slop sink, urinal, water closet pan, bidet and water-flushed sanitary town disposal unit.

References, Glossary & Abbreviations

Specified intended life (Building)	The meaning ascribed to it by section 39 of the Building Act as follows: "*Specified intended life"* in relation to a proposed *building* or any existing *building* proposed to be altered, and which is intended to have an indefinite use but not less than 50 years, means the period of time, as stated in an application for a *building consent* or in the consent itself, for which the *building* is proposed to be used for its *intended use.*
Stabilisation (Soil)	Providing adequate measures, vegetation and/or structural that will protect exposed soil to prevent erosion.
Stabilise	To modify any natural aggregate to improve, or maintain it's load carrying capacity. (Usually by adding lime, cement or clay.)
Standard day	For the purposes of determining natural lighting, the hours between 8 am and 5 pm each day with an allowance being made for daylight saving.
Street	A road usually within an urban locality. (Has the same meaning as "road" as defined by s315 of the Local Government Act 1974.)
Sub-base	An optional layer of pavement material placed under the basecourse and above the sub-grade.
Sub-soil drain	A drain below the ground designed to collect water throughout its length and lower than ground water level in the surrounding soil.
Substructure	The piers and abutments (including wing walls) of a bridge that support the superstructure.
Subway	A structure constructed to permit the passage of pedestrians, cycles or stock beneath the road.
Sump	A chamber that is installed in a *drain* and incorporates features to intercept and retain silt, gravel and other debris prior to outfalling into piped reticulation. Elsewhere also known as a cess pit.
Superelevation	The continuous transverse slope normally given to the carriageway at horizontal curves to facilitate the safe movement of vehicles.
Superstructure	That part of a bridge structure above deck level.
Surface Runoff	Rain that runs off a surface rather than infiltrating the ground or being retained by the surface on which it falls.
Surface Water	All naturally occurring water, other than subsurface water, which results from rainfall on the site or water flowing onto the site, includes that flowing from a *drain*, stream, river, lake or sea and all that with its surface exposed to the atmosphere. (As defined in NZS 4404: 2004.)
Surface Water Channel	An open drain or ditch along the side of the road which collects water running off the road's surface, thereby, preventing ground water from entering the pavement layers.
Suspended Solids	Solids either floating or suspended in water, including colloidal solids.
Swale	An elongated depression in the land surface that can be seasonally wet, is usually vegetated, is normally without flowing water and is designed or used to convey water. Swales conduct stormwater to primary drainage channels and can provide groundwater recharge.
Territorial Authority	The meaning ascribed to it by Section 5 of the Local Government Act 2002; and includes any organisation that is authorised to permit structures pursuant to section 12(1) (b) of the Resource Management Act 1991.
Test pressure	This is the pressure the pipeline must sustain during the test.
Time Of Concentration (tc)	The time for runoff to flow from the most remote part of the drainage area/catchment to the outlet/point at which measurement is taken.
Title boundary	A boundary with *other property*. Comment: The terms "Habitable Work" and "Title Boundary" in this document replace the definition "Protected Work" used in the Dangerous Goods Regulations 1980/46, 1985/188, 1985/170.
Toe (of slope)	Where the slope stops or levels out. Bottom of the slope.

References, Glossary & Abbreviations

Traffic island	A defined area, usually raised above the surface, within a road, usually at an intersection, from which traffic is intended to be excluded, and which is used for control of vehicular movements and for pedestrian refuge.
Traffic lane	A portion of the carriageway allotted for the use of a single line of vehicles.
Traffic volume	The number of vehicles flowing in one or both directions past a particular point in a given time (for example, vehicles per hour, vehicles per day).
Trap	A chamber that is installed in a *drain* and incorporates features to intercept and retain floatable debris.
Treatment	Treatment (for stormwater) is intended to reduce the amount of suspended solids and other pollutants that is carried by stormwater off the site/proposed development. Treatment will remedy or mitigate the amount of suspended solids and pollutants entering watercourses and waterways downstream.
Trunk Main	Trunk main reticulation is defined as strategic. This reticulation conveys supply from one pump station or area to another and does not include fire hydrants.
Turning Template	A template used (in plan form) to describe the swept path of a specific vehicle when turning.
Two Coat (Chip) Seal	Two coats of hot bitumen chipseal sprayed and laid during the same designed procedure. Usually a Grade 6 chip over a Grade 4 chip or a Grade 3 chip over a Grade 5 chip.
Undercurrent	A sub-surface watercourse that may present itself as water above ground. Sometimes termed ephemeral springs undercurrent may be considered in an uncertain and random nature, not unlike a phenomenon. Historically undercurrent has demonstrated presence in only some parts of the district. Once evident undercurrent can be very difficult to control and may be present for an uncertain length of time.
Underpass	A grade separation where vehicular or pedestrian traffic passes under an intersecting highway or railway.
Urban Road/Street	Any road in a speed environment less than 70 km/h (kilometres per hour).
Utility	Utility is any service that is reticulated to provide separate consumers with a connection to that service. Services include water, sewer, stormwater, electricity, telephone & gas. (As defined in *District Plan* but excluding those utilities owned and operated by Waimakariri Council.)
Utility service provider	A utility service provider is that organisation that provides services such as gas, water, electricity, telephone, sewer and stormwater.
Vehicle crossing	Means that area of land from the carriageway up to and including the road frontage of any site or allotment used by vehicles to access the site or allotment from the carriageway
Vehicle Template	A template used (in plan form) to describe the swept path of a specific size turning vehicle. See also *Turning Template*.
Viaduct	A (long) bridge composed of a series of spans used to carry a road, usually over land.
Void-fill seal	An emulsion seal, usually consisting of grit or small chips, for filling the voids in an existing coarse textured chip seal surface.
Wastewater	As defined in NZS 4404: 2004.
Watercourse	Any pathway for concentrated overland flow, including rivers, streams and ephemeral channels.
Water hammer	Transient pressure surges can be positive and negative pressure.
Water main	A water supply pipe vested in, or is under the control, or maintained by, a *network utility operator*.
Water storage tank	A fixed and covered *water* tank generally used for reserve water storage in case of failure of the *water main*.
Water supply system	Pipes, fittings and tanks used or intended to be used in the piping of water from a *water main* or other water source to *sanitary fixtures, sanitary appliances* and fittings within a *building.*

References, Glossary & Abbreviations

Water supply tank (or cistern)	A covered *water tank* generally used for the supply to *sanitary fixtures* or to *storage water heaters*. A float control valve normally regulates the water supply to the tank.
Water Table	The upper surface of the free groundwater in a zone of saturation; locus of points in soil water at which hydraulic pressure is equal to atmospheric pressure.
Water Table Drain	A drain that parallels a carriageway to drain surface and subsurface water from the road formation (See also *Surface Water Channel*).
Water trap	A fitting designed to prevent foul air escaping from the plumbing system or *foul water drainage system* and entering a *building*.
Wearing course	The top bonded layer of an unsealed pavement. Intended to provide a waterproof skid and abrasion resistant surface. It is also the layer reshaped during grader maintenance.
Wholesome	Wholesome water is defined in the Drinking-Water Standards for New Zealand 1995.
Windrow	The long ridge of material usually formed by a grader or earth-moving machine. May also apply to loose gravel built up by traffic between/beside the wheel tracks on unsealed roads.
Wing wall	A wall extending an abutment, as in a bridge, for retaining the side slopes of earth fill.
Working day	Any day except a Saturday, a Sunday, Good Friday, Easter Monday, Christmas Day, Boxing Day, ANZAC Day, Labour Day, the Sovereign’s birthday, Waitangi Day, and any other day observed in any locality concerned as a public holiday.
Working pressure	This is the typical pressure under which the pipeline will operate.

References, Glossary & Abbreviations

1.4 ABBREVIATIONS

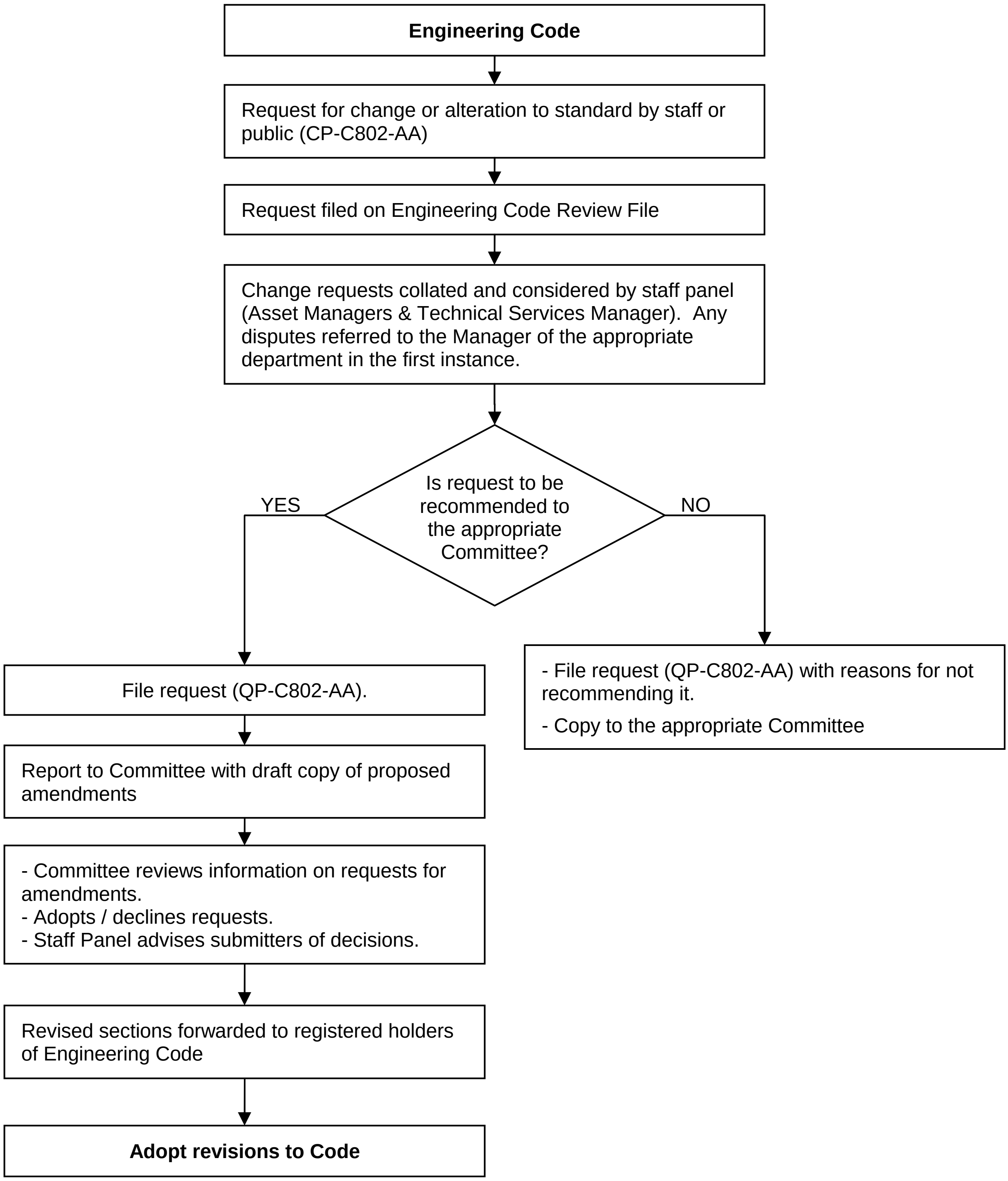
The following abbreviations apply in the Engineering Code of Practice. These abbreviations are additional to those abbreviations in NZS 4404: 2004.

AADT	Annual average daily traffic.
ADWF (l/s)	Average Dry Weather Flow
AEP	Annual Exceedance Probability.
BIA	Building Industry Authority
CoP	Waimakariri District Council Engineering Code of Practice
CPTED	Ministry of Justice National Guidelines for Crime Prevention through Environmental Design
CSS	Christchurch City Council Construction Standard Specifications
DN	Nominal Diameter
ECan	Environment Canterbury
H_2S	Hydrogen sulphide
HCV	Heavy Commercial Vehicle.
HIRDS	High Intensity Rainfall Design System in the form of software produced by NIWA
IDS	Christchurch City Council Infrastructure Design Standard
ISO	International Standards Organisation
LTCCP	Waimakariri District Council *Long-Term Council Community Plan* 2006-2016
LTSA	Land Transport Safety Authority.
MoT	Ministry of Transport.
NAASRA	National Association of Australian State Road Authorities (now Austroads)
NZS	New Zealand Standard, as published by the Standards Association of New Zealand (SANZ).
OD	Outside diameter
P/A ratio	Peak to average ratio PSF/ASF
PDWF (l/s)	Peak Dry Weather Flow
PE 80B	Polyethylene type 80B
PE 100	Polyethylene type 100
PN	Pressure nominal
PSF (l/s)	Peak wastewater flow
PVC-o	Oriented Poly Vinyl Chloride
PWWF (l/s)	Peak Wet Weather Flow is the instantaneous design total peak
RMA	Resource Management Act
RON	Road opening notification
RRPM	Raised Reflective Pavement Marker

References, Glossary & Abbreviations

RTS	Road and Traffic Standards (Published by the LTSA)
SCADA	Supervisory, Control And Data Acquisition
SN	Stiffness number
SPF	Storm peak factor
TNZ	Transit New Zealand
WDC	Waimakariri District Council
WWDG	Christchurch City Council Waterways, Wetlands and Drainage Guide

Engineering Code Review Process



QP-C802-AA	Amendment Request Form
QP-C802-AB	Order Form
QP-C802-AC	Record of Amendments Form (*Please keep a copy of this form at the front of the Code and use it to record receipt of amendments*.)
QP-C802-AD	Change of Address Form

Amendment Request Form

Submitted By: ______________________ of ______________________

______________________ **Date:** ______________

Suggested amendment to:

Volume No. ________ Part No ________ Clause No ________ Page No ________

Description of Problem:

(continue on separate page if necessary)

Suggestion for improvement:

Send this form to : Helen Field
Email: helen.field@wmk.govt.nz
Fax: (03) 313 4432,
Post: Technical Services Unit, Waimakariri District Council, Private Bag 1005, Rangiora 7440

(for office use only)

Document No. ______________________

Received by Helen Field Date: ______________

Forwarded to Dept Manager: ______________________ Date: ______________

Dept Manager Recommendation:

☐ Amend manual as requested (for simple amendments)

or

☐ I have passed this to ______________________ for review / action.

Expected date of completion : ______________ ______________

Dept Manager

Return copy to: Helen Field, Engineer, Technical Services Unit as soon as possible.

Amendments made to Document (where appropriate): ☐ **Date:** ______________

Submitter informed of outcome: ☐ **Date:** ______________

Amended pages posted to copy holders ☐ **Date:** ______________

Signed: ______________________ ______________________

(Dept Manager) (Helen Field)

Order Form

To purchase a CD of the **WDC Engineering Code of Practice**, please download this form, complete your details and email, post or fax it to the following address:

Technical Services Unit
Waimakariri District Council
Private Bag 1005
Rangiora 7440

Fax: 03 313 4432
Phone: 03 313 6136
Email: margaret.pester@wmk.govt.nz

Item	Quantity	Cost ($) (incl. GST)
CD containing PDF files		40.00
	Total Cost	

Method of payment

- ❑ Cheque (please make cheques payable to Technical Services Unit, Waimakariri District Council)
- ❑ Invoice (please provide order number below)

N.B. Credit Card payments can not be accepted.

Delivery and Manual Registration Details

Organisation:	
Contact Person:	
Email address (for contact person):	
Postal Address:	
Street Address:	
Telephone No.	
Fax No.	
Your Order No:	

Office Use Only:	*Name*	*Date*
Order Received		
Controlled Copy No. Allocated		
Document Dispatched		
Invoice Issued		

Record of Amendments Form

Issue Date	Part No.	Clause / Drawing N^o	Details of Amendment	Date Updated

Please keep a copy of this form at the front of the Code & use it to record the receipt of amendments.

Change of Address Form

To: **Technical Services Manager**

Waimakariri District Council

Private Bag 1005

RANGIORA 7440

Fax: 03 313 4432

Current Address: ____________________

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New Address: ____________________

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Signed: ____________________

Position: ____________________

Date: ____________________

List of Documents

Note that the document numbering system has been altered in the last update. The old numbers are provided here to assist identification of documents. All references to documents within the CoP shall be according to the new system.

Section	Old Document No.	Current Issue No.	Current Document No.
Cover & Table of Contents	QP-C800	3	QP-C800
References, Definitions & Abbreviations	QP-C808	3	QP-C801
Engineering Code Review Process	QP-C810	3	QP-C802
Order Form	QP-C810-AB	3	QP-C802-AB
Amendment Request Form	QP-C810-AA	4	QP-C802-AA
Record of Amendments Form	QP-C810-AC	3	QP-C802-AC
Change of Address Form	QP-C810-AD	3	QP-C802-AD
List of Documents	QP-C800	1	QP-C803
List of Standard Specifications		1	QP-C804
List of Drawings	QP-C820	6	QP-C805
Part 1: Introduction	**QP-C806**	**3**	**QP-C810**
Part 2: General Requirements	**QP-C811**	**3**	**QP-C811**
Standard Draughting Layout & Format Requirements		1	QP-C811-AA
Draughting Checklist		1	QP-C811-AB
Benchmark Certificate		1	QP-C811-AC
Uncompleted Works Bond Form		1	QP-C811-AD
Maintenance Bond Form		1	QP-C811-AE
Part 3: Quality Assurance		**1**	**QP-C812**
Design Report (Template)		1	QP-C812-AA
Contract Quality Plan (Template)		1	QP-C812-AB
Producer Statement – Design		1	QP-C812-AC
Producer Statement – Construction		1	QP-C812-AD
Non-conformance Report (Template)		1	QP-C812-AE
Engineer’s Checklist		1	QP-C812-AF
Construction Checklist – Pipe Construction		1	QP-C812-AG
Construction Checklist – Basecourse Stringing		1	QP-C812-AH
Part 4: Geotechnical Requirements	**QP-C812**	**3**	**QP-C813**
Statement of Professional Opinion on the Suitability of Land for Building Construction		1	QP-C813-AA
Soil Description Method		1	QP-C813-AB
WDC Soil Log		1	QP-C813-AC
Part 5: Stormwater & Land Drainage	**QP-C816**	**3**	**QP-C814**
Rainfall Intensity Tables		1	QP-C814-AA
Part 6: Wastewater	**QP-C815**	**3**	**QP-C815**
Wastewater Scheme Selection Flowchart		1	QP-C815-AA
Wastewater Materials Selection Flowchart		1	QP-C815-AB

List of Documents

Section	Old Document No.	Current Issue No.	Current Document No.
Part 7: Water	**QP-C814**	**3**	**QP-C816**
Water Supply System Selection Flowchart		1	QP-C816-AA
Water Materials Selection Flow Chart		1	QP-C816-AB
Chemical Quality of Potable Water	QP-C814-AA	3	QP-C816-AC
Part 8: Roading	**QP-C813**	**3**	**QP-C817**
Part 9: Utilities	**QP-C817**	**3**	**QP-C818**
Part 10: Reserves, Streetscapes & Open Spaces	**QP-C819**	**3**	**QP-C819**
Part 11: Lighting		**1**	**QP-C820**
Lighting Categories		1	QP-C820-AA
Lighting Specification Form		1	QP-C820-AB
Lighting Equipment List		1	QP-C820-AC
Lighting Completion Form		1	QP-C820-AD
Part 12: As-Builts		**1**	**QP-C821**
As-Built Data Checksheet – Stormwater		1	QP-C821-AA
As-Built Data Checksheet – Land Drainage		1	QP-C821-AB
As-Built Data Checksheet – Wastewater		1	QP-C821-AC
As-Built Data Checksheet – Water Supply		1	QP-C821-AD

List of Standard Specifications

The following documents are standard specifications produced by the Waimakariri District Council for use by developers and contractors for works within the District.

Note that the document numbering system has been altered in the last update. The old numbers are provided here to assist identification of documents. All references to documents within the CoP shall be according to the new system.

Title	Old Document No.	Current Issue No.	Current Document No.
Designing for Surge and Fatigue		1	QP-C841
Street Name Blades	QP-C813-AF	2	QP-C842
Road Openings	QP-C813-AE	3	QP-C843
Preliminary Notification of Work on the Road (Template)	QP-C813-AE-1	2	QP-C843-AA
Road Opening Notice (RON)	QP-C813-AE-2	2	QP-C843-AB
Works Completion Notice (Template)	QP-C813-AE-3	2	QP-C843-AC
Works Maintenance Notice (Template)	QP-C813-AE-4	2	QP-C843-AD
Amenity Garden Planting & Revegetation Areas		1	QP-C844
Tree Planting		1	QP-C845
Grassed Areas		1	QP-C846
Protection of Existing Features		1	QP-C847

WAIMAKARIRI
DISTRICT COUNCIL

ENGINEERING CODE OF PRACTICE

STANDARD DRAWINGS

Updated July 2020 Issue 12

April 2009

200717090277

List of Standard Drawings

Type	Title	Issue	Plan No.
Kerbs & Channels	Kerb and Flat Channel	D	600-201A
	Mountable Kerb	C	600-203A
	Mountable Kerb & Channel	D	600-203B
	Hillside Channel	C	600-204
	Kerb Only	C	600-205
	Vee Channels	D	600-206
Crossings	Typical Residential Concrete Vehicle Crossing (Flat Channel)	E	600-211A
	Typical Residential Hot Mix Vehicle Crossing (Flat Channel)	A	600-211B
	Typical Residential Hot Mix Vehicle Crossing (Dish Channel)	D	600-211C
	Typical Residential Vehicle Crossing, Zones: 3, 4 & 5	D	600-211D
	Typical Commercial Concrete Vehicle Crossing (Flat Channel)	B	600-212A
	Typical Commercial Hot Mix Vehicle Crossing (Flat Channel)	A	600-212B
	Typical Commercial Hot Mix Vehicle Crossing (Dish Channel)	C	600-212C
	Pedestrian Cutdown	E	600-213
	Typical Rural Zone Entranceway	D	600-217
	Typical Rural Zone Commercial Access	E	600-218
	Changes of Grade at Vehicle Crossing	C	600-219
	Pegasus Res6 Vehicle Crossing (With Swale)	E	600-220A
	Pegasus Res6 Vehicle Crossing (Without Swale)	E	600-220B
	Pegasus Commercial Hot Mix Vehicle Crossing (Flat Channel)	A	600-220C
	Mapleham Vehicle Crossing (With Footpath)	A	600-221A
	Mapleham Vehicle Crossing (Without Footpath)	A	600-221B
Paths	Footpaths and Berms	E	600-222
	Kerb Outlet	D	600-224
	House Drain Entry To Hillside Channel	C	600-226
	Typical Footpath Meander Detail	D	600-227
Road Humps & Islands	Road Hump Details	D	600-231
	Interlocking Concrete Block Pavement Edge Treatments	D	600-233
Miscellaneous	Local Rural Zone Road. Culvert Sight Rail. Typical Detail.	B	600-241
	Typical Wire Mesh Fence for Accessways	C	600-242
	Trenching in Public Property	B	600-243
	Standard Fabricated Light Pole	C	600-244
	Services in the Roadside (1)	A	600-245A
	Services in the Roadside (2)	A	600-245B
	Services in the Road Reserve	D	600-245C
	Trench Installation of PVC Pipes	D	600-246
	Cattle Stop – Plan & Section	B	600-248A
	Cattle Stop – Steelwork Detail	B	600-248B
	Cattle Stop – General Layout	B	600-248C
	Construction Information Sign	D	600-250

List of Standard Drawings

Type	Title	Issue	Plan No.
	Onsite Stormwater Tanks	B	600-251
	Onsite Detention Swale/Pond	A	600-252
Intersections	Standard Rural “X” & “T” Junction Notes	B	600-260A
	Standard Rural Junction Detail – Quadrant Kerb	C	600-260B
	Standard Rural “T” Junction Type A	F	600-261A
	Standard Rural “T” Junction Type A (Constrained)	F	600-261B
	Standard Rural “X” Junction Type A	F	600-261C
	Standard Rural “T” Junction Type B	F	600-262A
	Standard Rural “X” Junction Type B	F	600-262B
	Standard Rural “T” Junction Type C	F	600-263A
	Standard Rural “X” Junction Type C	F	600-263B
Typical Roading Cross Sections	Typical Cross Section – Road in Rural Zone	D	600-270
	Typical Cross Section – Residential 4A or 4B	D	600-271
	Typical Cross Section – Road & Cul-de-Sac	D	600-272
	Typical Cross Section – Rural Right of Way	D	600-273
	Typical Cross Section – Residential & Business Right of Way	D	600-274
	Turning Areas	C	600-275
Manholes	Manhole Casting – Component Details	C	600-301A
	Manhole Vent & Trafficable House Drain Sump Frames & Covers	B	600-301B
	Cast In-situ Manholes Square	C	600-302A
	Cast In-situ Manholes Square Top	C	600-302B
	Cast In-situ Manholes Square Top Reinforcement	A	600-302C
	Precast Manholes Circular	B	600-303A
	Precast Manholes Circular Top	C	600-303B
	Precast Manholes Square Base	A	600-303C
	150mm NB Diameter Drop Manholes	C	600-305
Flush Tanks	Flush Tanks	B	600-311A
	Flush Tanks	B	600-311B
	Flush Manholes	A	600-312
	Air Gap Separator	B	600-313
Sumps	Side Entry Sumps – Precast Kerb Unit	C	600-321
	Side Entry – Enlarged Sumps	C	600-322
	Hillside Sump	C	600-324
	Single Sump – Kerb & Flat Channel	D	600-325
	Single Sump – Kerb & Dish Channel	D	600-326
	Corner Sump	C	600-327
	Double Sump – Flat Channel	C	600-328
	House Drain Inspection Box and Kerb Adaptor	C	600-329
	Urban Soak Pit	C	600-330A
	Rural Soak Pit	B	600-330B

List of Standard Drawings

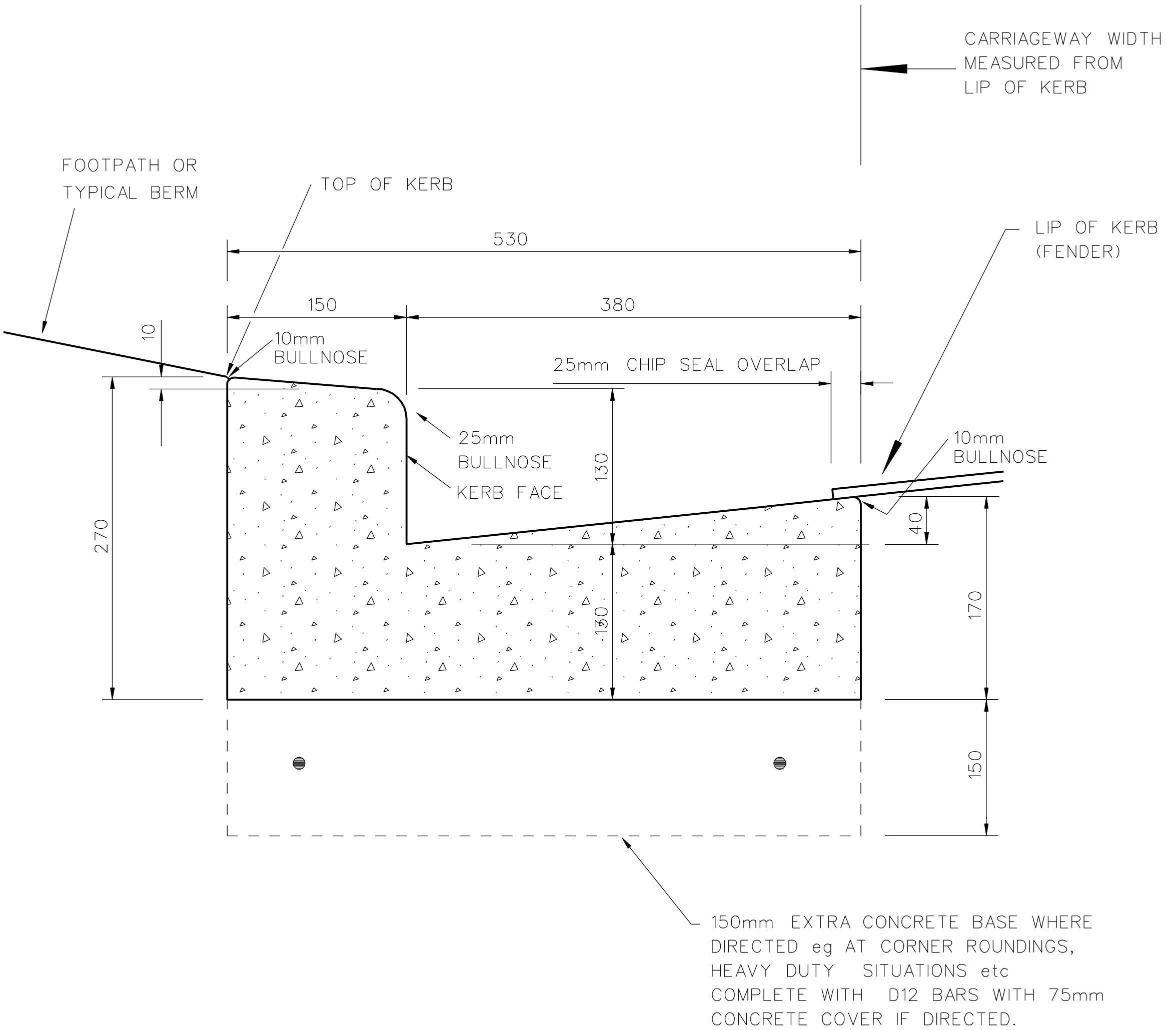
Type	Title	Issue	Plan No.
Pipe Work	Concrete Surround for Under Channel Piping 225 to 300mm Diameter	D	600-331
	Pipelaying at Manholes & Sumps - Concrete & Ceramic Pipes	A	600-341A
	Pipelaying at Manholes & Sumps - CPVC Pipes	A	600-341B
	Pipelaying at Manholes & Sumps - PE Pipes	A	600-341C
	Pipe Protection	B	600-342
	PVC Manhole Starters and Finishers	A	600-343
	Pipelaying Haunching Details - Concrete Pipes	A	600-344A
	Pipelaying Haunching Details - Flexible & Ceramic Pipes	A	600-344B
	Pressure Pipelines Thrust Blocks	B	600-346
	Water Stops	B	600-347
	Sleeving Sewer Mains	C	600-351
	Septic Tank Wet Wells on Council Reticulated Rural Schemes	E	600-352A
	Rural Zone Package Sewage Treatment Service Lateral	D	600-352B
	Land Based Treated Effluent Disposal System 1D	B	600-354A
	Land Based Treated Effluent Disposal System 2	B	600-354B
	Septic Tank on Council Reticulated STEP Schemes	H	600-355A
	Lateral Connection for Single Residential Property on Pressure Sewer Council Reticulated Schemes	B	600-355B
	Direct Connections to Existing Pipes	B	600-361
	Pipelaying Junctions off Factory Moulded & Vertical Risers	A	600-363
	PE Junctions, Swept Bends Inspections & Adaptors	A	600-364
	Standard Circular Inspection Chamber	A	600-376
	Subsoil Drains - Interceptors	A	600-377A
	Subsoil Drains - Swale	A	600-377B
	Subsoil Drain Pipes	A	600-377C
	Vacuum Column Backflow Preventer	A	600-381
	Standard Pump Line Connection to Gravity Wastewater Lateral	B	600-382
	Roadside Soakholes	F	600-390
Water Supply	Private Water Tank (Restricted Scheme)	A	600-403
	Flushing Valve Setup For Dead-Ends On 50mm Main	B	600-404
	Water Valve and Hydrant Installation	C	600-406
	High Hazard Backflow Preventer	B	600-409A
	Medium Hazard Backflow Preventer	B	600-409B
Lateral Connections	Residential Stormwater Lateral Location	B	600-410
	Residential Sewer Lateral Location (Public Land)	C	600-411A
	Residential Sewer Lateral Location (Private Land)	B	600-411B
	Residential Water Supply Lateral Location	B	600-412
	Residential Sewer Lateral Layout At Point Of Discharge	B	600-413A
	Residential Sewer Lateral Junctions.	C	600-413B
	Trade Waste Point Of Discharge	B	600-413C
	Urban Water Supply Lateral Connection	D	600-414A

List of Standard Drawings

Type	Title	Issue	Plan No.
	Rural and Rural Residential Water Supply Lateral Connection	D	600-414B
	Service Lateral Connection from Water Main	A	600-414C
Reserves	Street Bench Installation	B	600-500
	Diagonal Tree Staking	B	600-501A
	Vertical Tree Staking	B	600-501B
	Pedestrian Accessway Chicane – Surface Mounted Steel Bollards	B	600-502

NOTES

1. Concrete to comply with NZS 3109 : 1997.
2. Slump of concrete 50mm max.
3. Concrete to have a compressive strength of 20 Mpa at 28 days.
4. Kerb levels on plan given to kerb top.
5. Offsets given to kerb face.
6. Sealcoat finished 5mm above level of fender.
7. Base formation to accord with requirements of CCC Construction Standard Specification Part 6 - Roads



ELEVATION

Based on CCC drawing SD601

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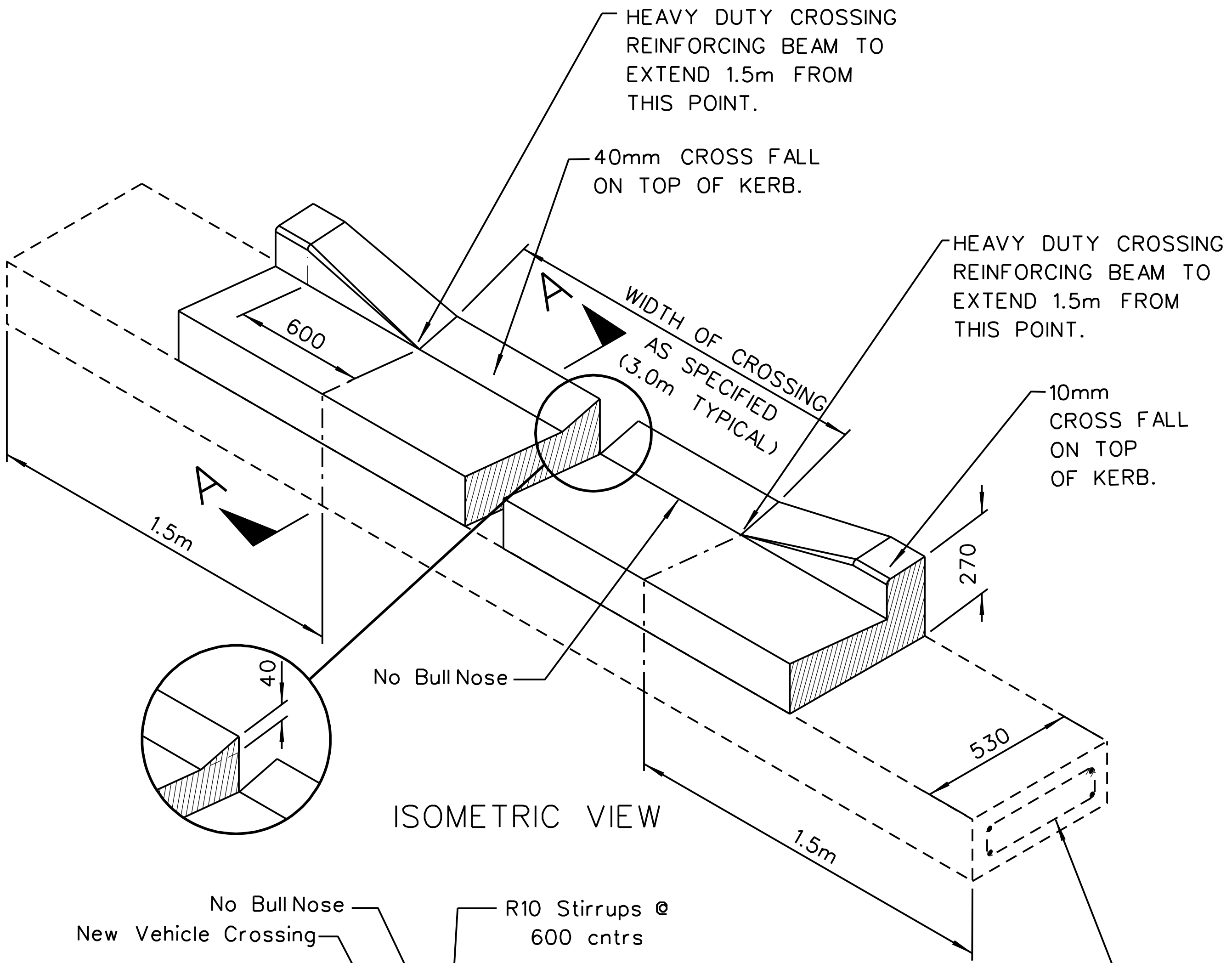
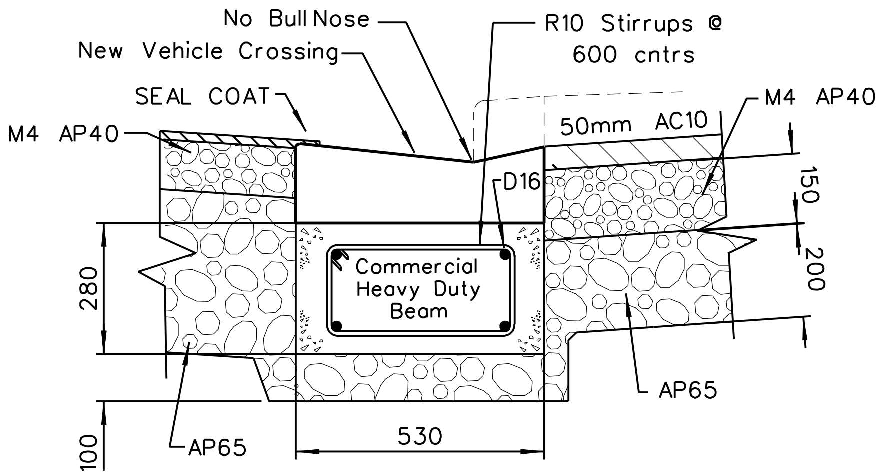
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: KERB AND FLAT CHANNEL	PROJECT TITLE: STANDARD DRAWINGS	SHEET 201A
				ISSUE D / PLAN No. 600

NOTES

1. Concrete to comply with NZS 3109 : 1997.
2. Slump of concrete 50mm max.
3. Concrete to have a compressive strength of 20 Mpa at 28 days. Kerb levels on plan given to kerb top.
4. Offsets given to kerb face.
5. Minimum compacted depth of basecourse under kerb shall be 130mm or as otherwise approved by the Council.



ISOMETRIC VIEW



CROSS SECTION A-A
(FOR COMMERCIAL CROSSING ONLY)
(REFER ALSO 600-211)

Cadastral data from LINZ's DCDB. Crown Copyright reserved.

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
		COMMERCIAL VEHICLE CROSSING REINFORCING BEAM	STANDARD DRAWINGS	201B
				ISSUE: E / PLAN No.: 600

NOTES

1 Concrete to comply with NZS 3109 : 1997.

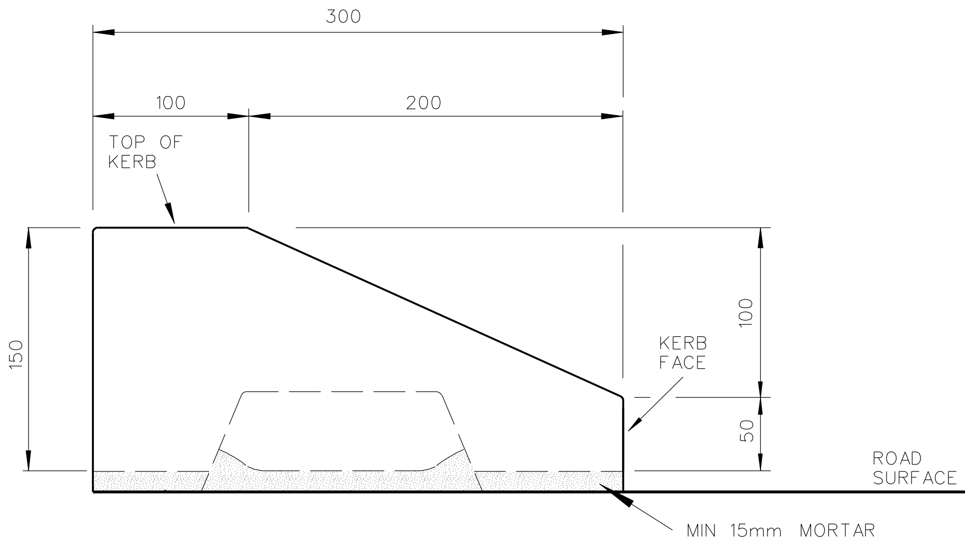
2 Slump of concrete 50mm max.

3 Concrete to have a compressive strength of 20 Mpa at 28 days.

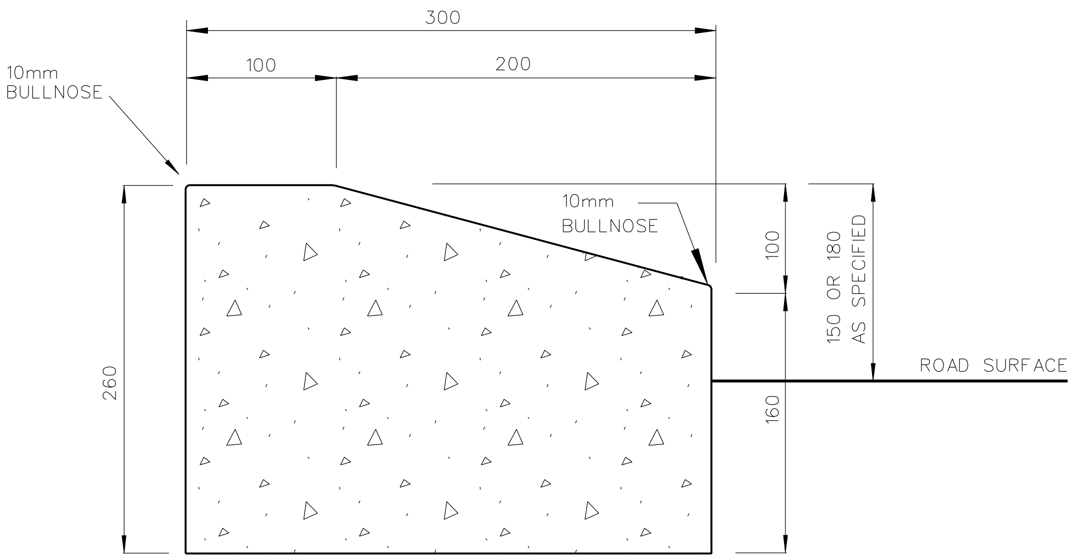
4 Kerb levels on plan given to kerb top.

5 Offsets given to kerb face.

6 Length of block 600mm



PRECAST MOUNTABLE KERB BLOCKS (TYPICAL)



IN SITU MOUNTABLE KERB

Based on CCC drawing SD603

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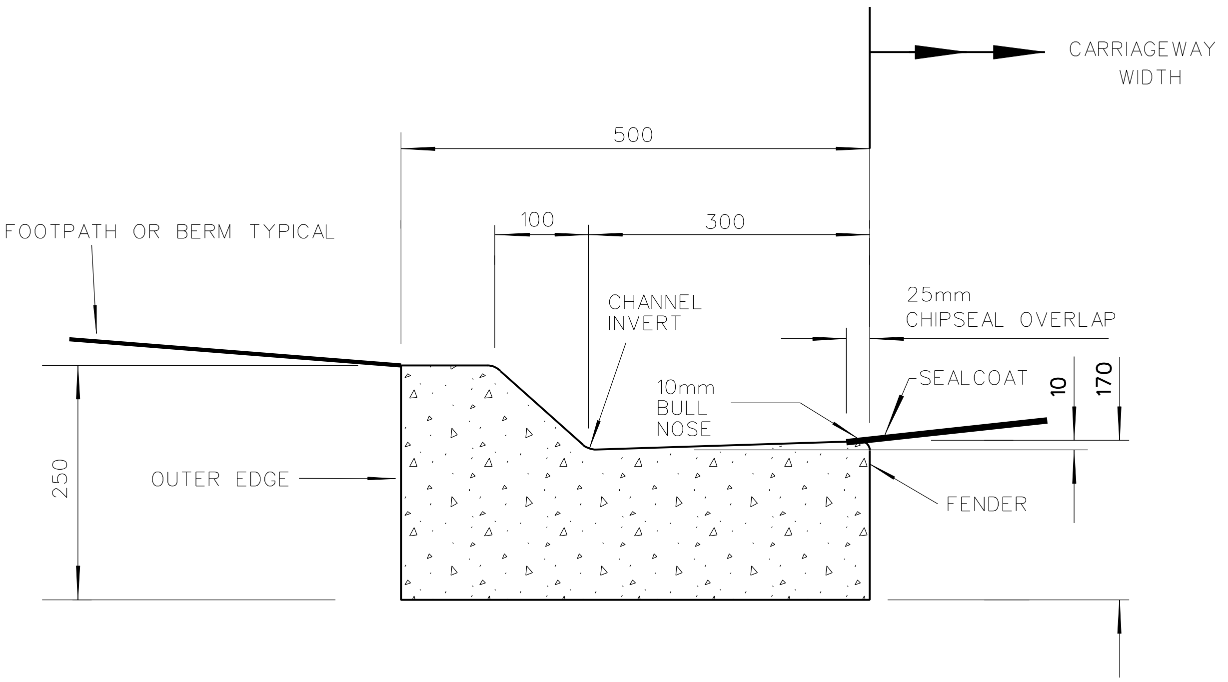
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: MOUNTABLE KERB	PROJECT TITLE: STANDARD DRAWINGS	SHEET: 203A
				ISSUE: C; PLAN No. 600

NOTES

1 Concrete to comply with NZS 3109 : 1997.
2 Slump of concrete 50mm max.
3 Concrete to have a compressive strength of 20 Mpa at 28 days.
4 Offset given to channel invert.
5 Hotmix finished 5mm above level of fender.



MOUNTABLE KERB AND CHANNEL

Based on CCC drawing SD603

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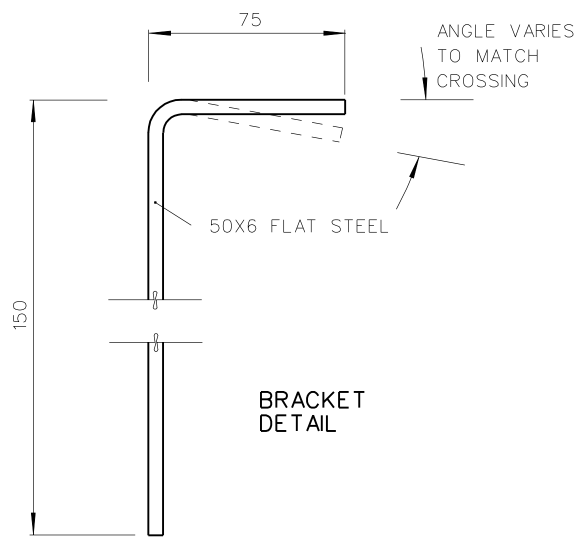
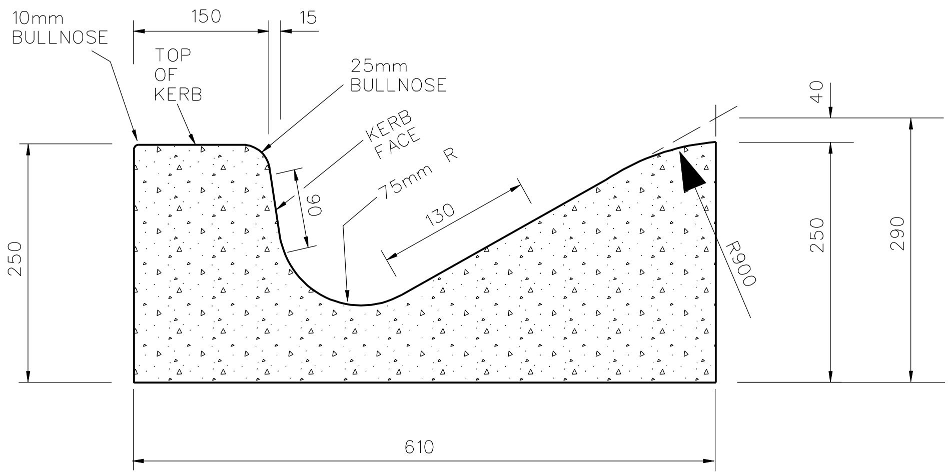
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: MOUNTABLE KERB AND CHANNEL	PROJECT TITLE: STANDARD DRAWINGS	SHEET: 203B; ISSUE: D; PLAN No.: 600

NOTES

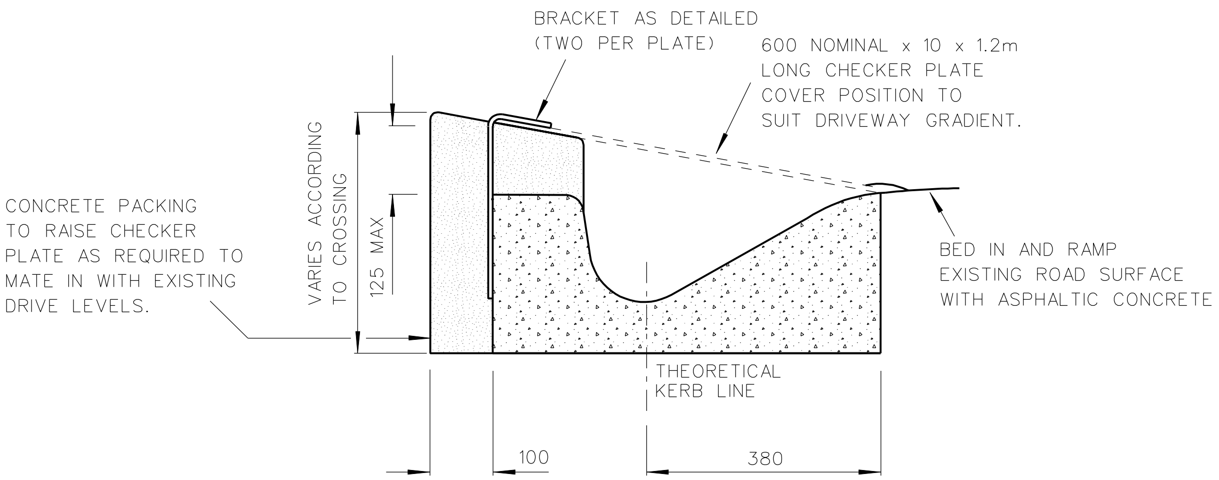
1. Concrete to comply with NZS 3109 : 1997.
2. Slump of concrete 50mm max.
3. Concrete to have a compressive strength of 20 Mpa at 28 days.
4. Kerb levels on plan given to kerb top.
5. Offsets given to kerb face.
6. Area of waterway (0.04 sq m)
7. Area of concrete (0.11 sq m)



BRACKET DETAIL



HILLSIDE CHANNEL



VEHICLE CROSSING FOR HILLSIDE CHANNEL

Based on CCC drawing SD604

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
		HILLSIDE CHANNEL	STANDARD DRAWINGS	204
				ISSUE: C / PLAN No.: 600

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NOTES

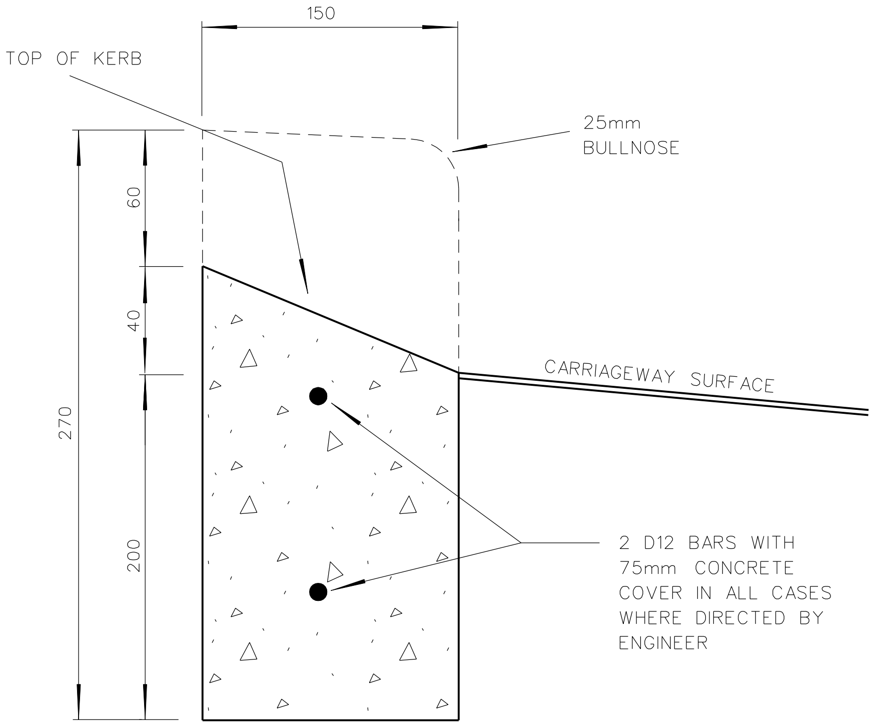
1 Concrete to comply with NZS 3109 : 1997.

2 Slump of concrete 50mm max.

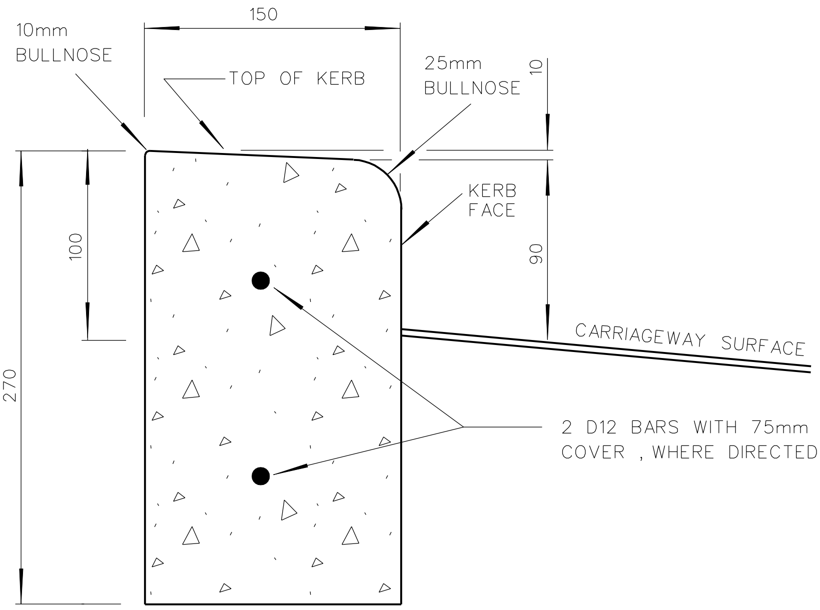
3 Concrete to have a compressive strength of 20 Mpa at 28 days.

4 Kerb levels on plan given to kerb top.

5 Offsets given to kerb face.



KERB ONLY - VEHICLE CROSSING



KERB ONLY

Based on CCC drawing SD602

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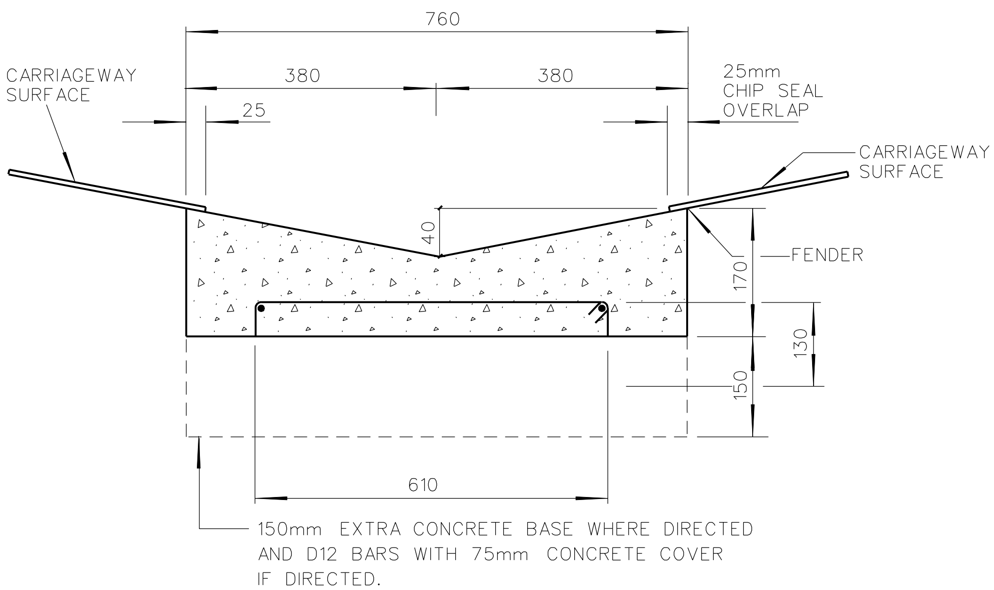
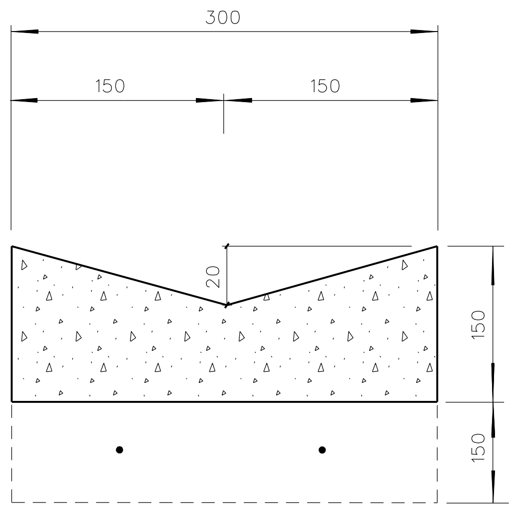
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
		KERB ONLY	STANDARD DRAWINGS	205
				ISSUE C / PLAN No. 600

NOTES

1. Concrete to comply with NZS 3109 : 1997.
2. Slump of concrete 50mm max.
3. Concrete to have a compressive strength of 20 Mpa at 28 days.
4. Levels for Vee Channels given to fender.
5. Offsets on plans are measured to the invert of the channel.
6. Hotmix finished 5mm above level of fender.



LARGE VEE CHANNEL
(NTS)



SMALL VEE CHANNEL
(NTS)

Based on CCC drawing SD601

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WAIMAKARIRI DISTRICT COUNCIL technical services

NOT TO SCALE

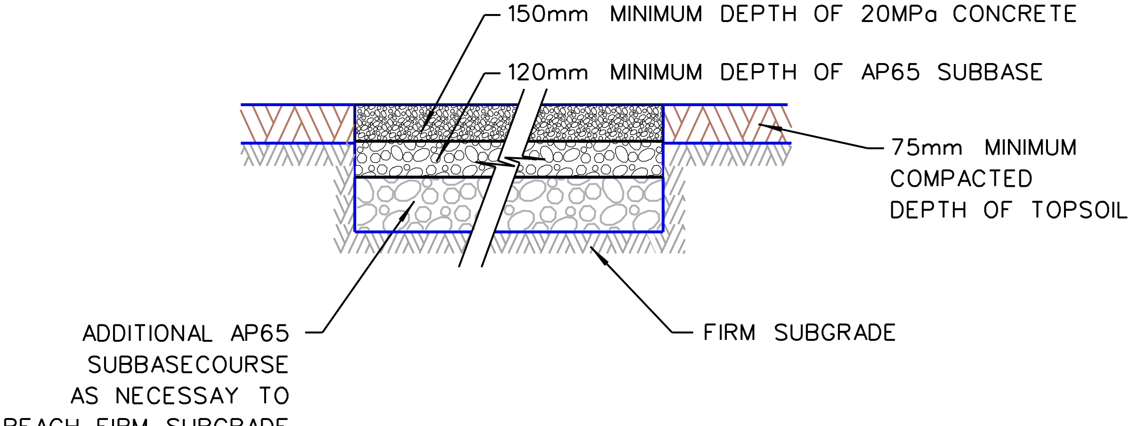
SHEET TITLE: VEE CHANNELS

PROJECT TITLE: STANDARD DRAWINGS

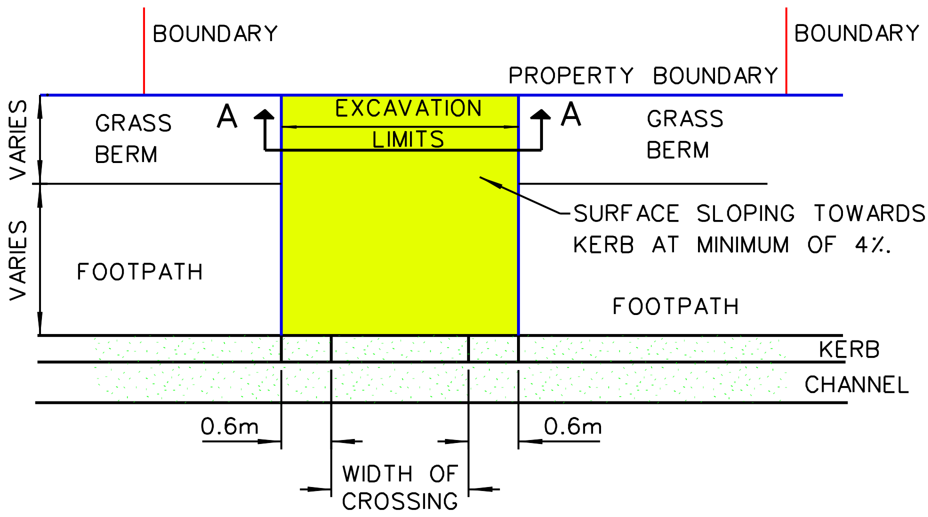
SHEET: 206

ISSUE: D

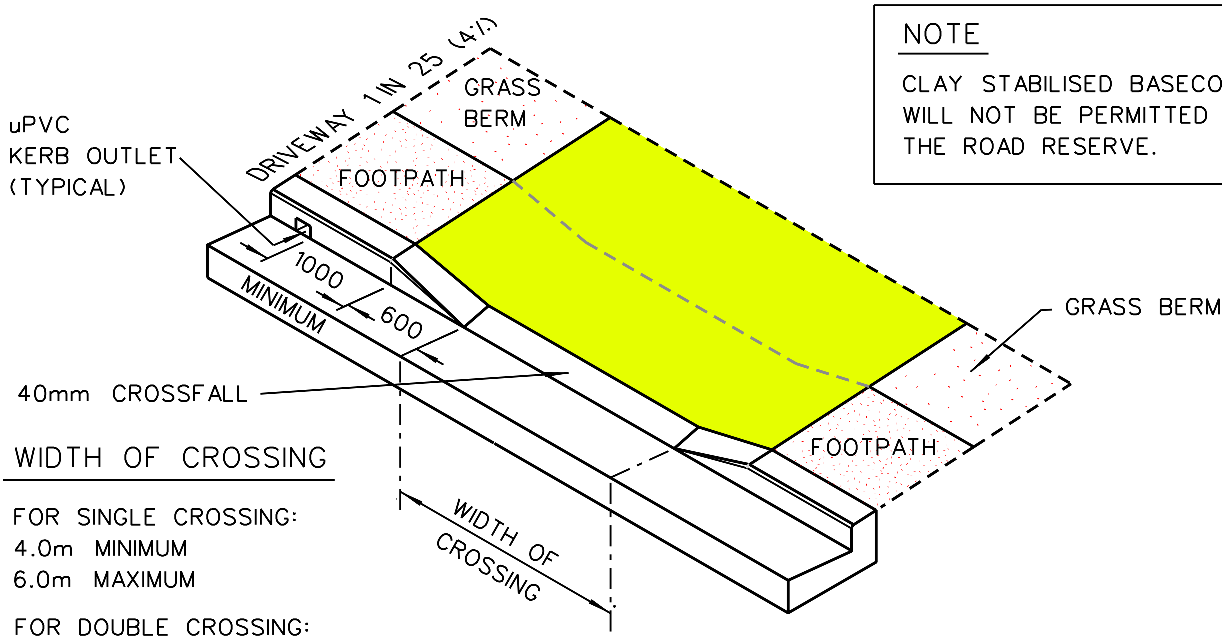
PLAN No.: 600



CROSS SECTION A-A



PLAN



ISOMETRIC VIEW

NOTE

CLAY STABILISED BASECOURSE WILL NOT BE PERMITTED WITHIN THE ROAD RESERVE.

WIDTH OF CROSSING

FOR SINGLE CROSSING:
4.0m MINIMUM
6.0m MAXIMUM

FOR DOUBLE CROSSING:
6.0m MINIMUM
8.0m MAXIMUM

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE Typical Residential Concrete Vehicle Crossing (Flat Channel)	PROJECT TITLE Standard Drawings	SHEET 211A
				ISSUE E / PLAN No. 600

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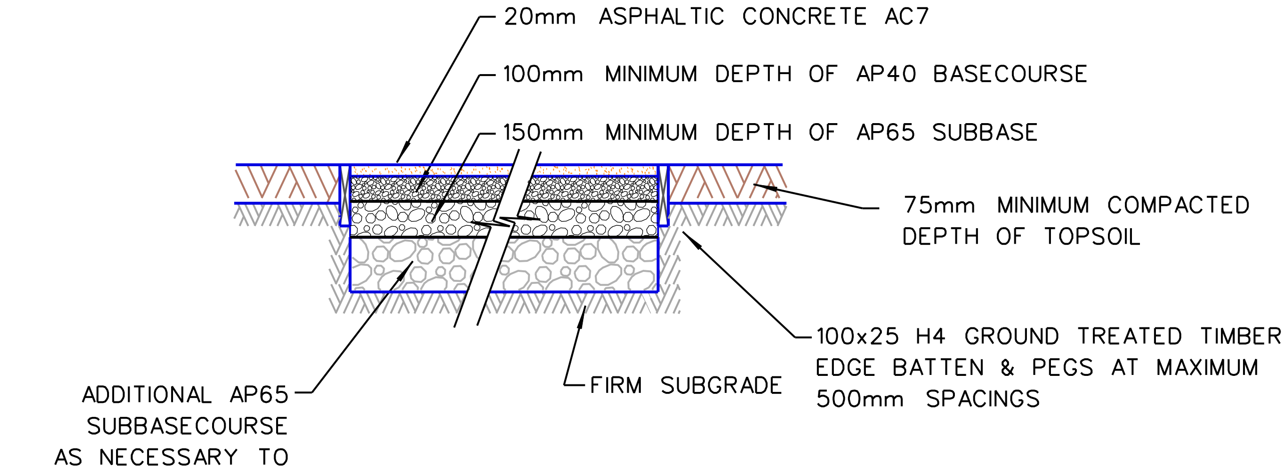
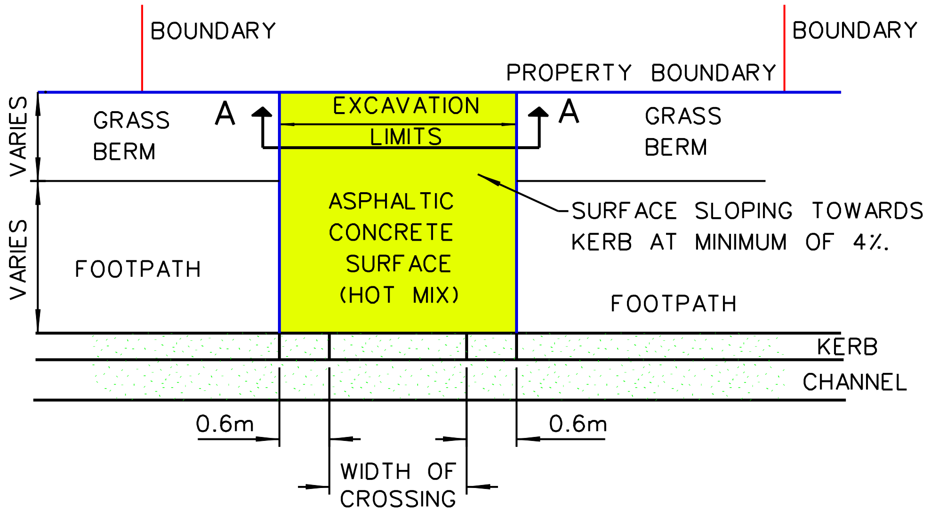
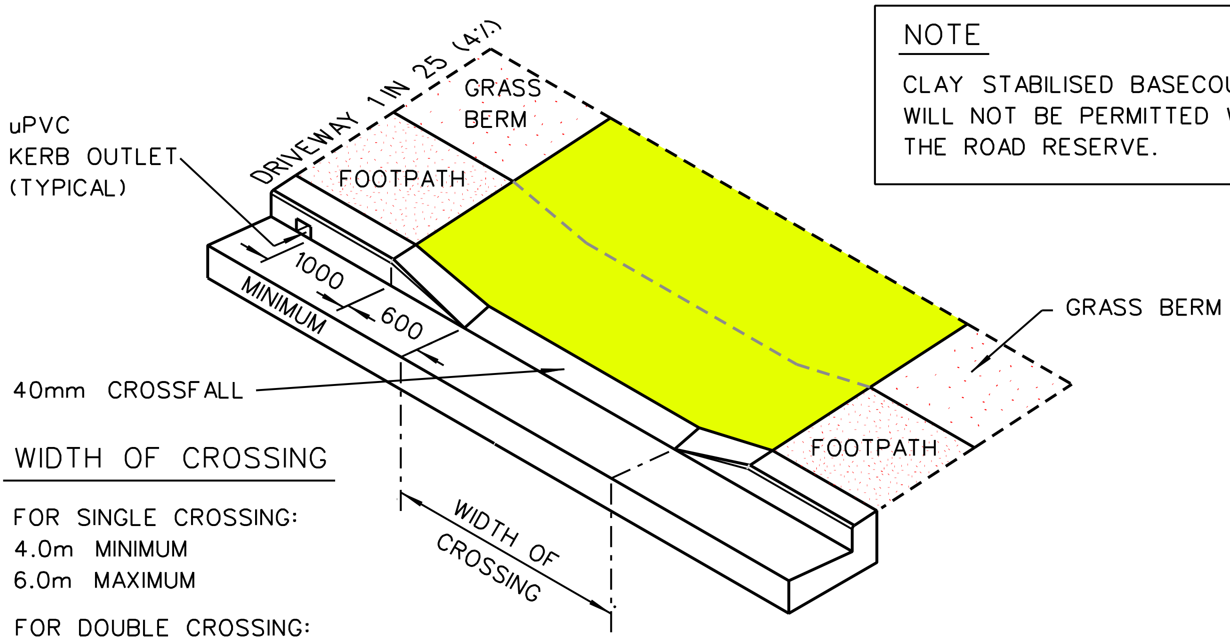


CROSS SECTION A-A



PLAN



NOTE

CLAY STABILISED BASECOURSE WILL NOT BE PERMITTED WITHIN THE ROAD RESERVE.

WIDTH OF CROSSING

FOR SINGLE CROSSING:
4.0m MINIMUM
6.0m MAXIMUM

FOR DOUBLE CROSSING:
6.0m MINIMUM
8.0m MAXIMUM

ISOMETRIC VIEW

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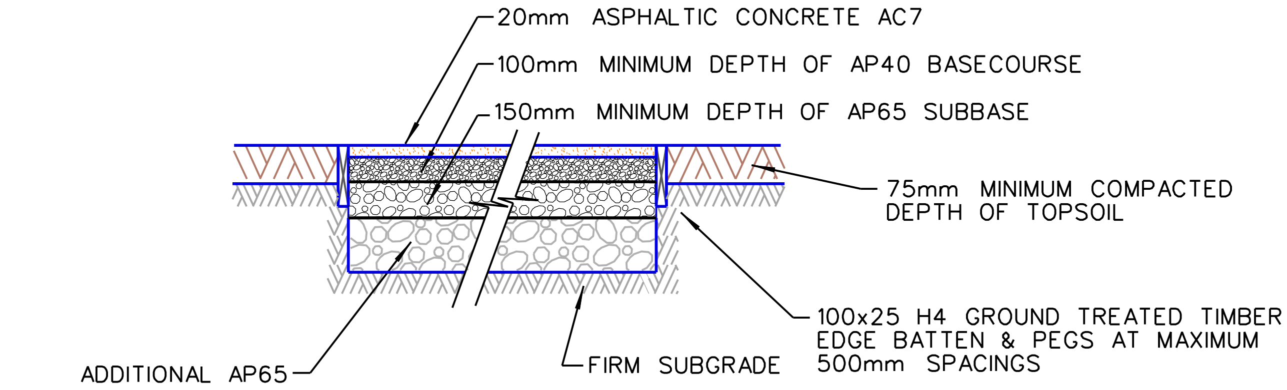
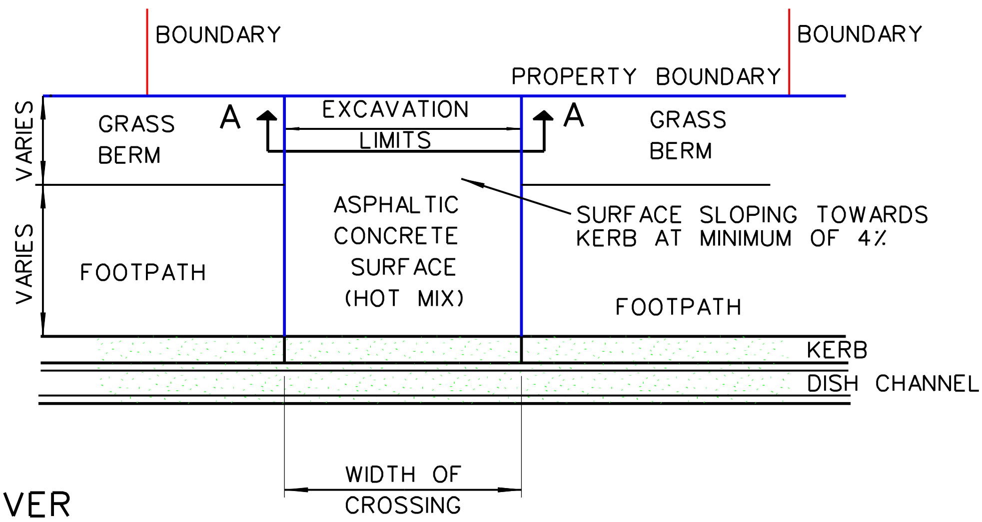
WAIMAKARIRI DISTRICT COUNCIL technical services

NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
	Typical Residential Hot Mix Vehicle Crossing (Flat Channel)	Standard Drawings	211B
			ISSUE: A / PLAN No. 600

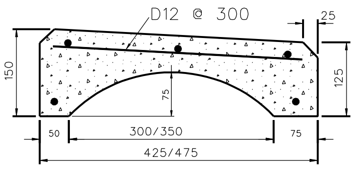


CROSS SECTION A-A



PLAN

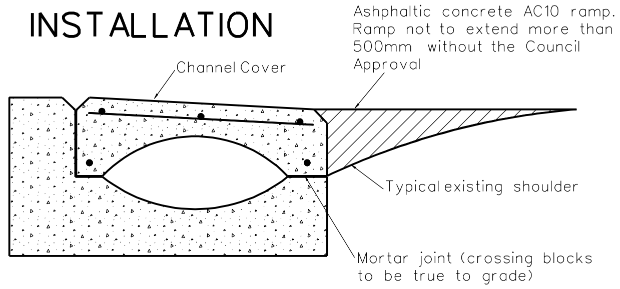
CHANNEL COVER

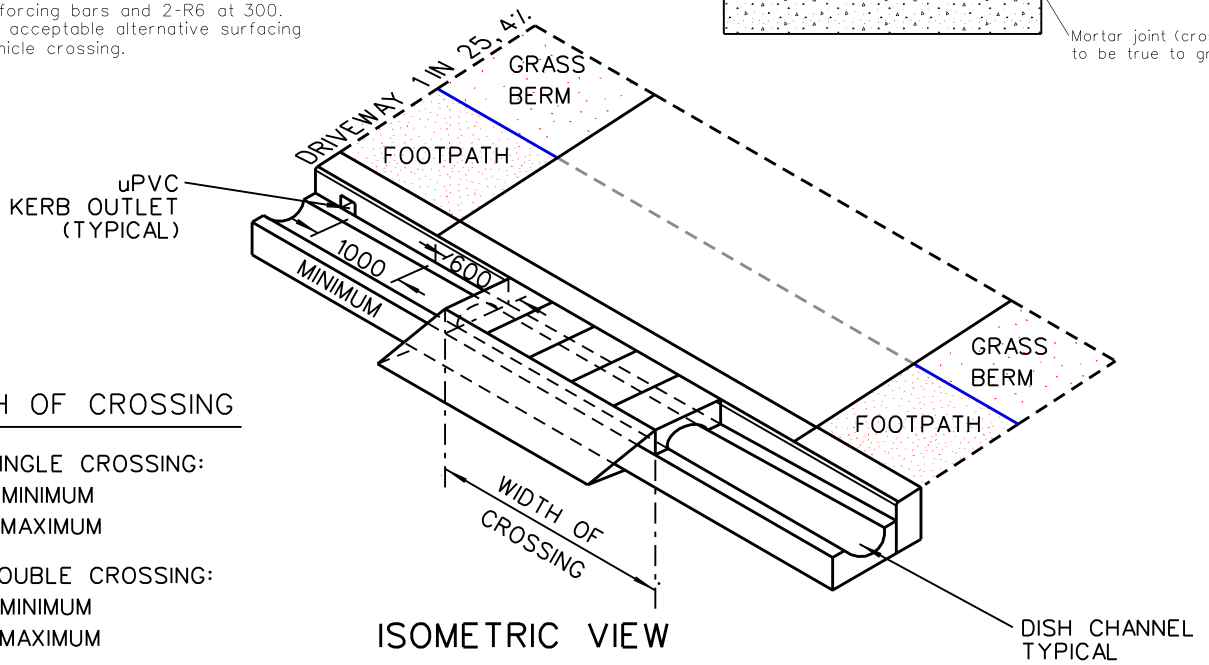


NOTES:

1. All concrete 35 MPa.
2. 5-D12 reinforcing bars and 2-R6 at 300.
3. AC10 is an acceptable alternative surfacing for the vehicle crossing.

INSTALLATION





ISOMETRIC VIEW

WIDTH OF CROSSING

FOR SINGLE CROSSING:
4.0m MINIMUM
6.0m MAXIMUM

FOR DOUBLE CROSSING:
6.0m MINIMUM
8.0m MAXIMUM

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
		Typical Residential Hot Mix Vehicle Crossing (Dish Channel)	Standard Drawings	211C
				ISSUE D / PLAN No. 600

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MINIMUM FORMATION STANDARDS

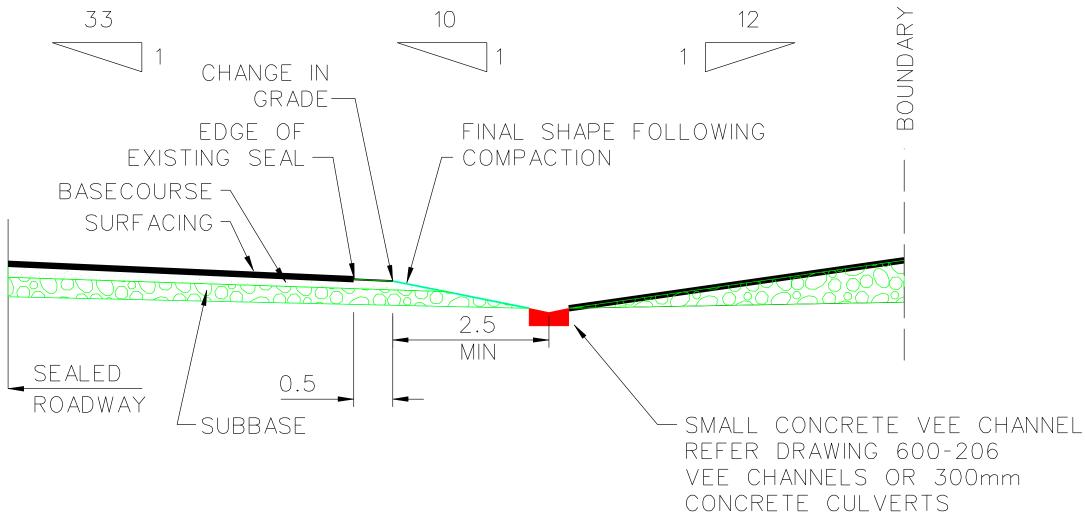
The formation shall extend down to a suitable subgrade which shall be free of organic material.
As a minimum requirement, the formation shall comprise of a 150 mm compacted layer of screened river run sub base (AP65) overlaid with a 100 millimeter compacted layer of crushed base course (AP40).

The top surfacing course shall be applied as follows:

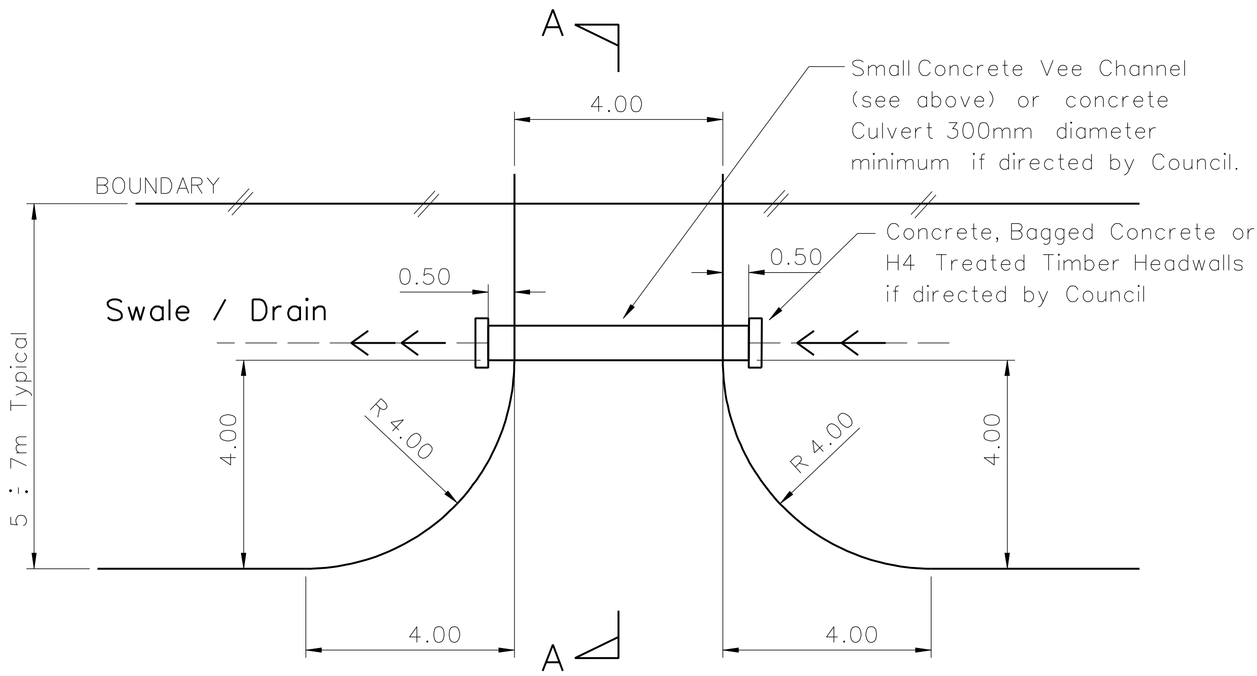
(a) Where the adjacent road formation is sealed, the entrance formation shall be overlaid with a coat of chip seal consisting of hot bitumen sprayed at a rate of 1.8 litres / square metre and Grade 4 chip.

(b) Where the adjacent road formation is metalled, the new entrance formation shall be overlaid with AP20 running course.

(c) Clay stabilised metalcourse will not be approved in the road reserve.



CROSS SECTION A-A



PLAN

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: Typical Residential Vehicle Crossing Zones: 3, 4 & 5	PROJECT TITLE: Standard Drawings	SHEET: 211D; ISSUE: D; PLAN No. 600

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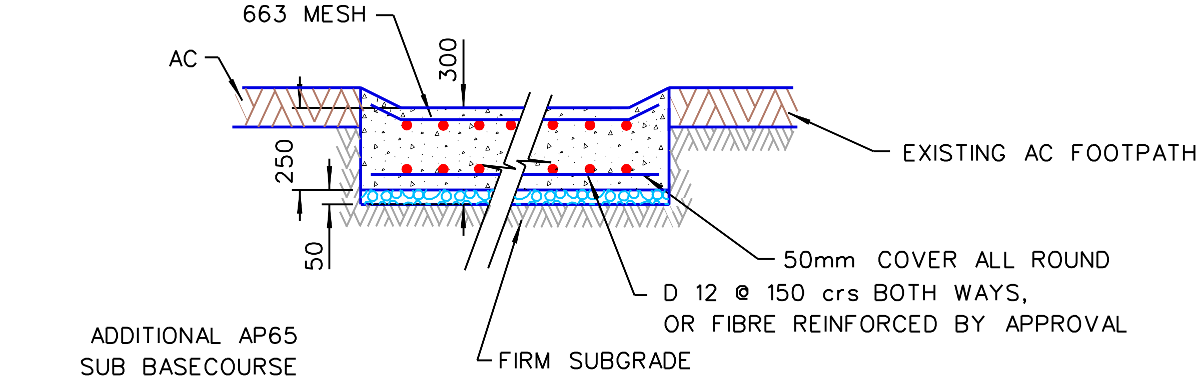
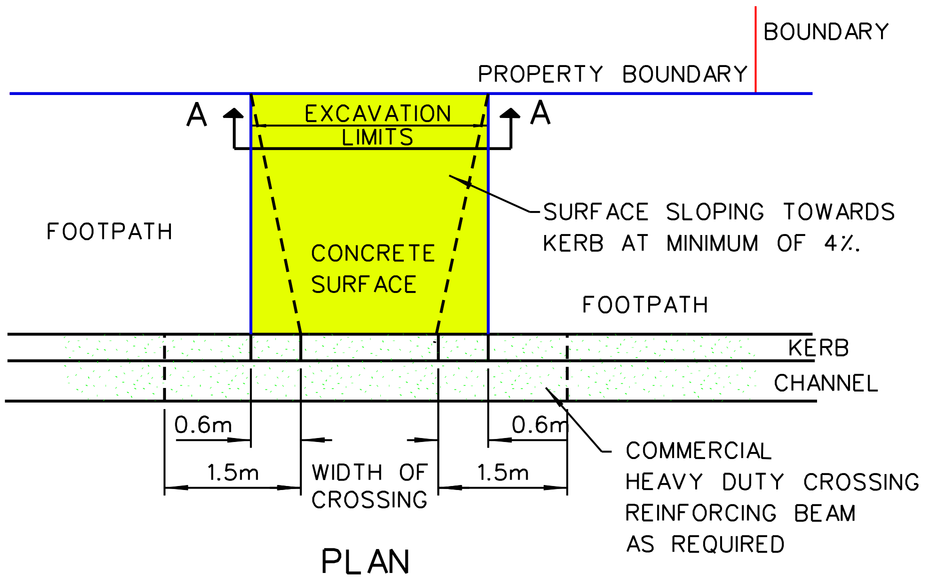
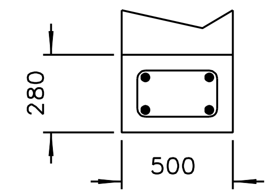


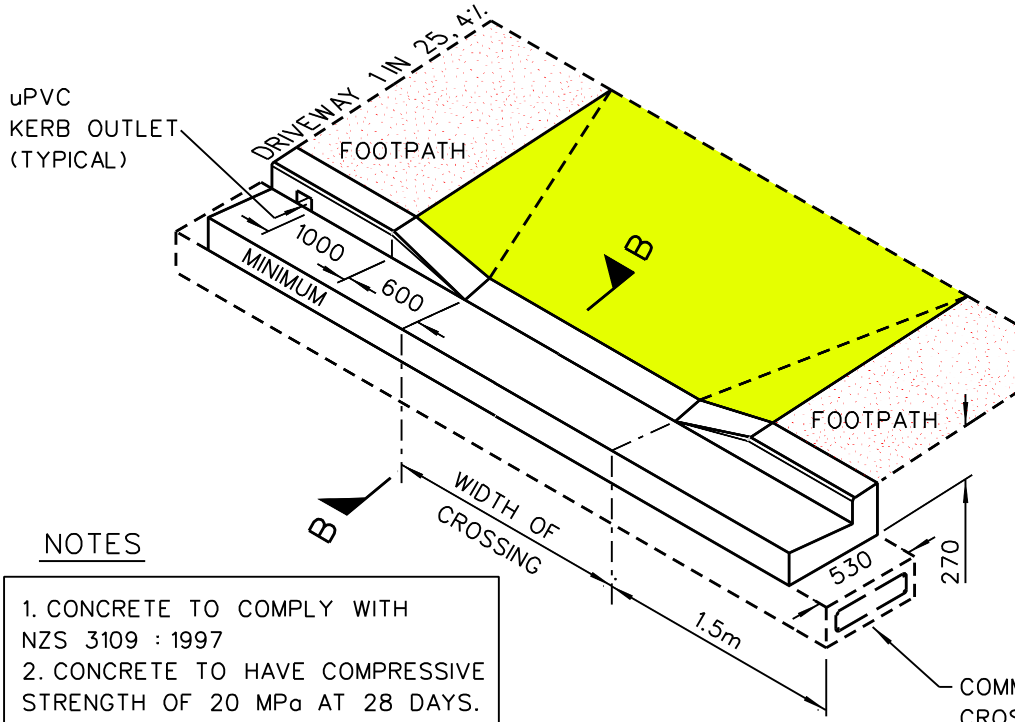
CROSS SECTION A-A



PLAN



SECTION B-B



WIDTH OF CROSSING

BY APPROVAL OF COUNCIL

ISOMETRIC VIEW

NOTES

1. CONCRETE TO COMPLY WITH NZS 3109 : 1997
2. CONCRETE TO HAVE COMPRESSIVE STRENGTH OF 20 MPa AT 28 DAYS.
3. KERB LEVELS ON PLAN GIVEN TO KERB TOP.
4. OFFSETS GIVEN TO KERB FACE.

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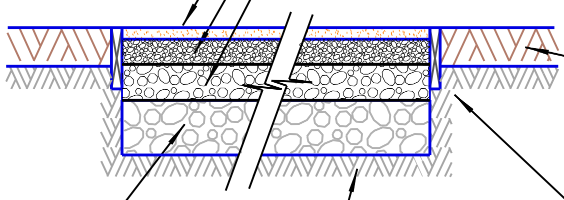
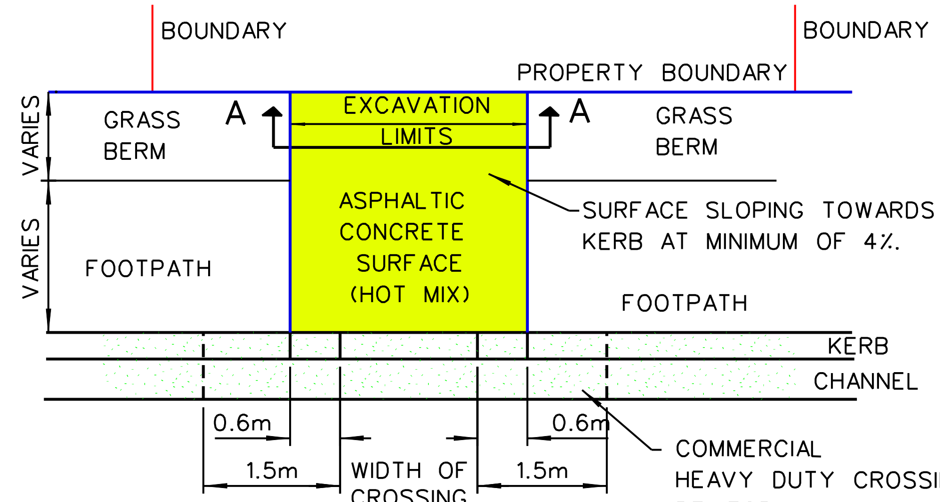
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: Typical Commercial Concrete Vehicle Crossing (Flat Channel)	PROJECT TITLE: Standard Drawings	SHEET: 212A; ISSUE: B; PLAN No.: 600



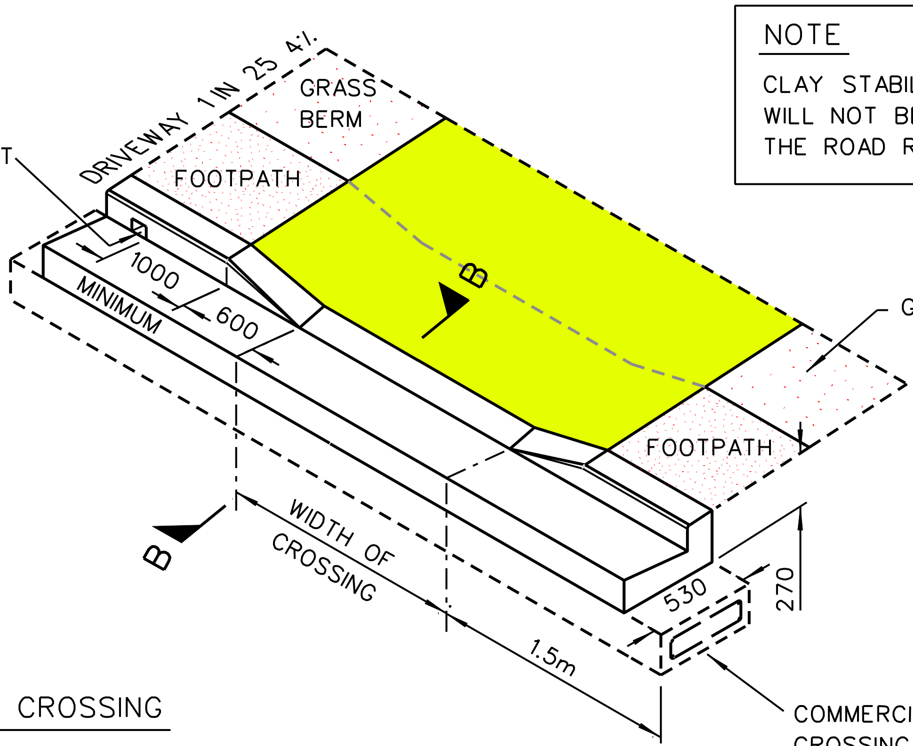
CROSS SECTION A-A

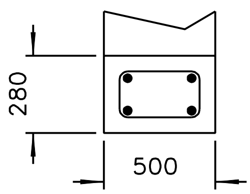


PLAN

NOTE

CLAY STABILISED BASECOURSE WILL NOT BE PERMITTED WITHIN THE ROAD RESERVE.





SECTION B-B

WIDTH OF CROSSING

BY APPROVAL OF COUNCIL

ISOMETRIC VIEW

COMMERCIAL HEAVY DUTY CROSSING REINFORCING BEAM FOR DETAILS SEE 600-201B

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE Typical Commercial Hot Mix Vehicle Crossing (Flat Channel)	PROJECT TITLE Standard Drawings	SHEET 212B
				ISSUE A / PLAN No. 600

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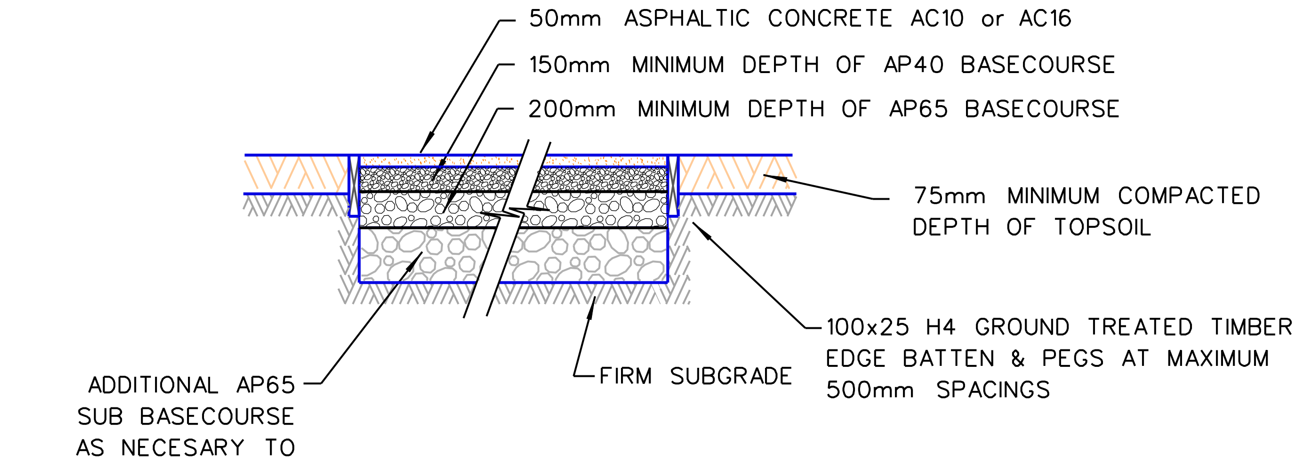
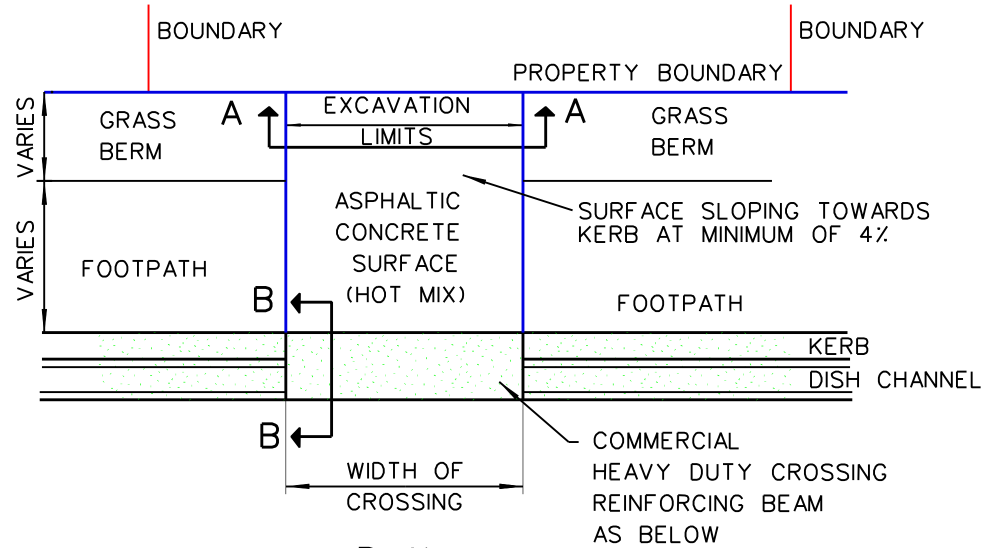
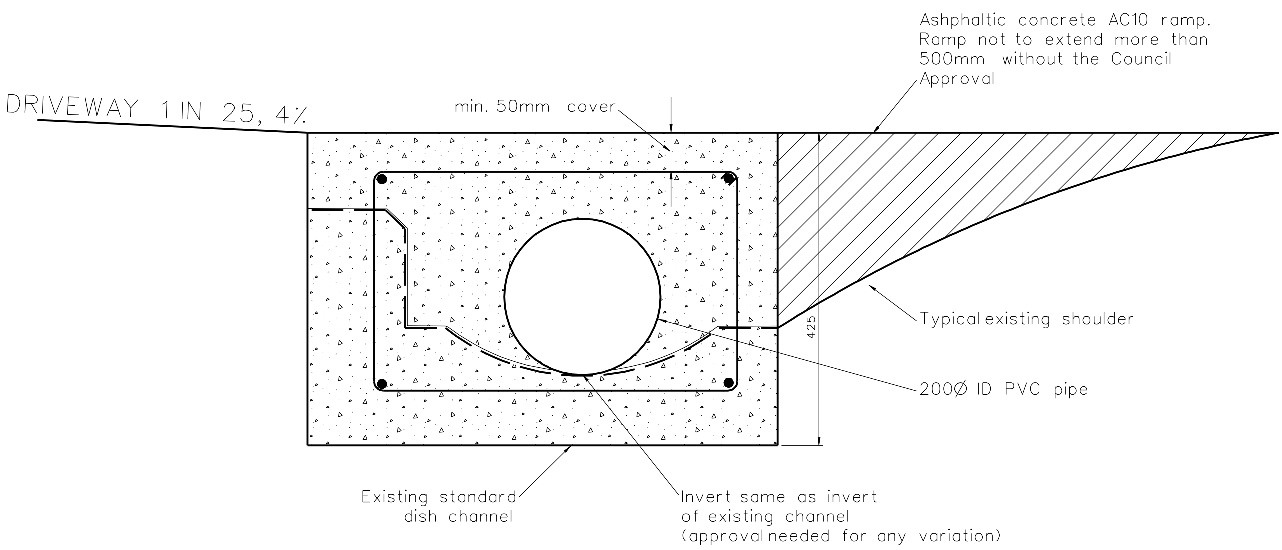


CROSS SECTION A-A



PLAN



CROSS SECTION B-B

NOTES:

1. All concrete 20 MPa at 28 days.
2. 4-D12 reinforcing bars and 6mm stirrups at 600.

WIDTH OF CROSSING

BY APPROVAL OF COUNCIL

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: TYPICAL COMMERCIAL HOT MIX VEHICLE CROSSING (DISH CHANNEL)	PROJECT TITLE: STANDARD DRAWINGS	SHEET: 212C
				ISSUE: C
				PLAN No. 600

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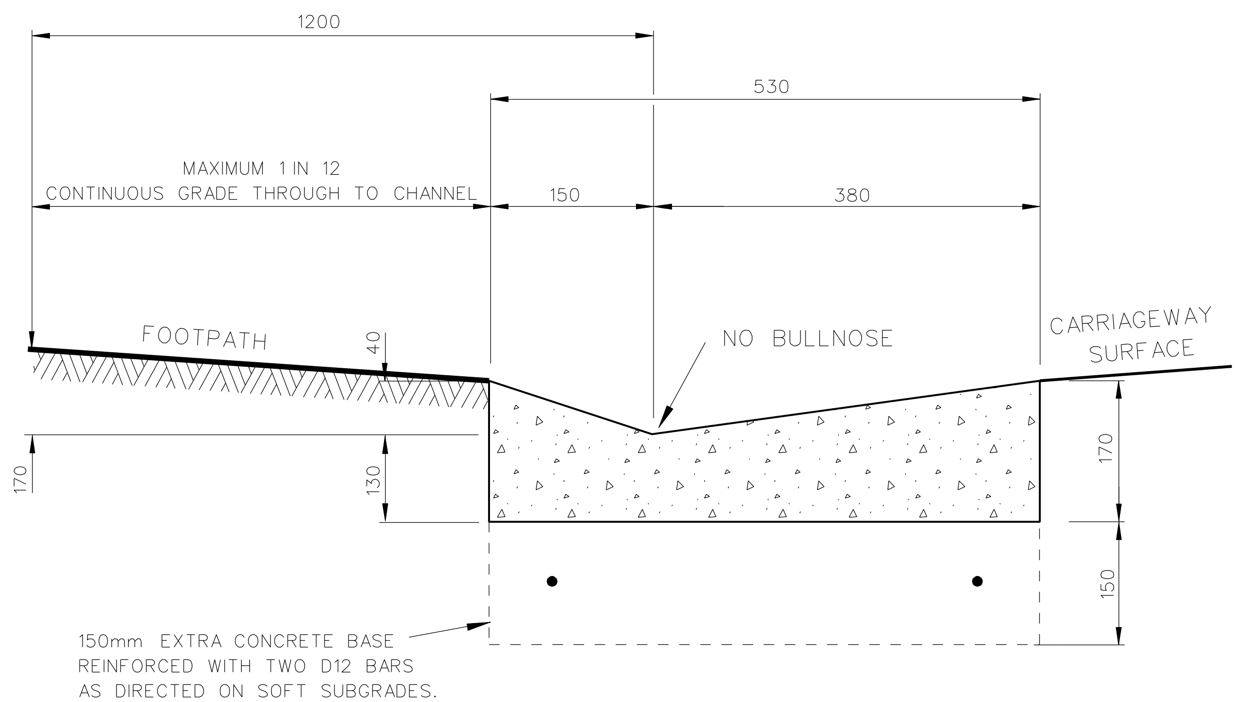
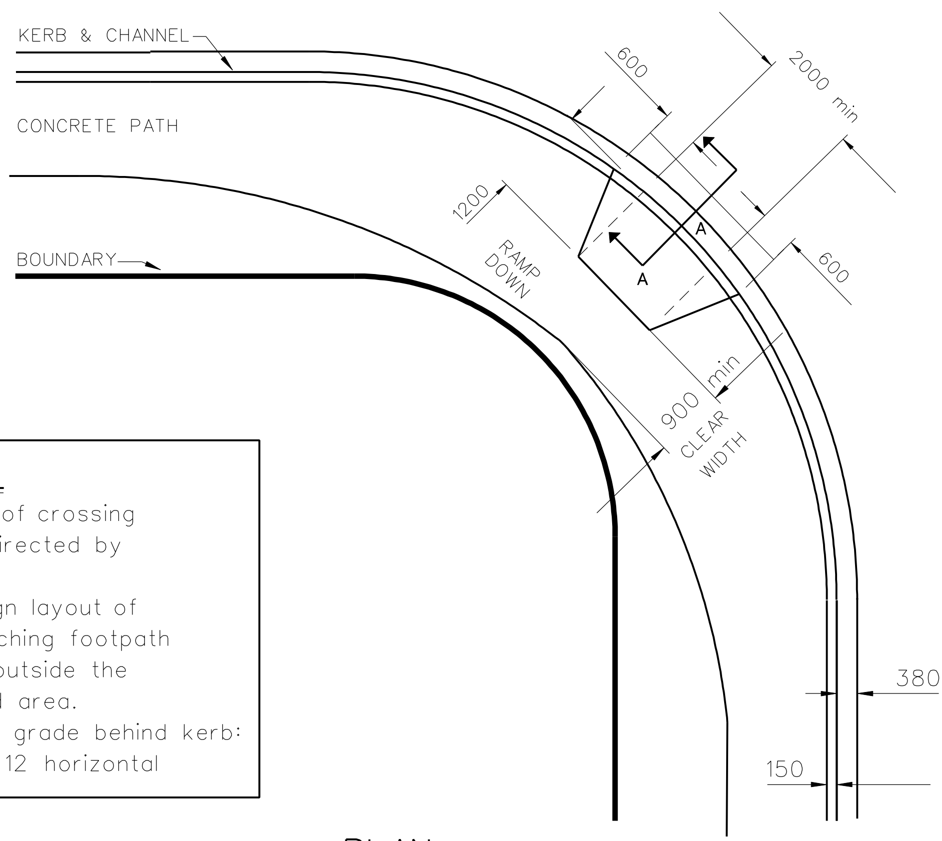


SECTION A-A



NOTE

- Location of crossing to be as directed by Engineer.
- The design layout of the approaching footpath may vary outside the dimensioned area.
- Maximum grade behind kerb: 1 vertical in 12 horizontal

PLAN

Based on CCC drawing SD613

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
		PEDESTRIAN CUTDOWN	STANDARD DRAWINGS	213
				ISSUE: E / PLAN No.: 600

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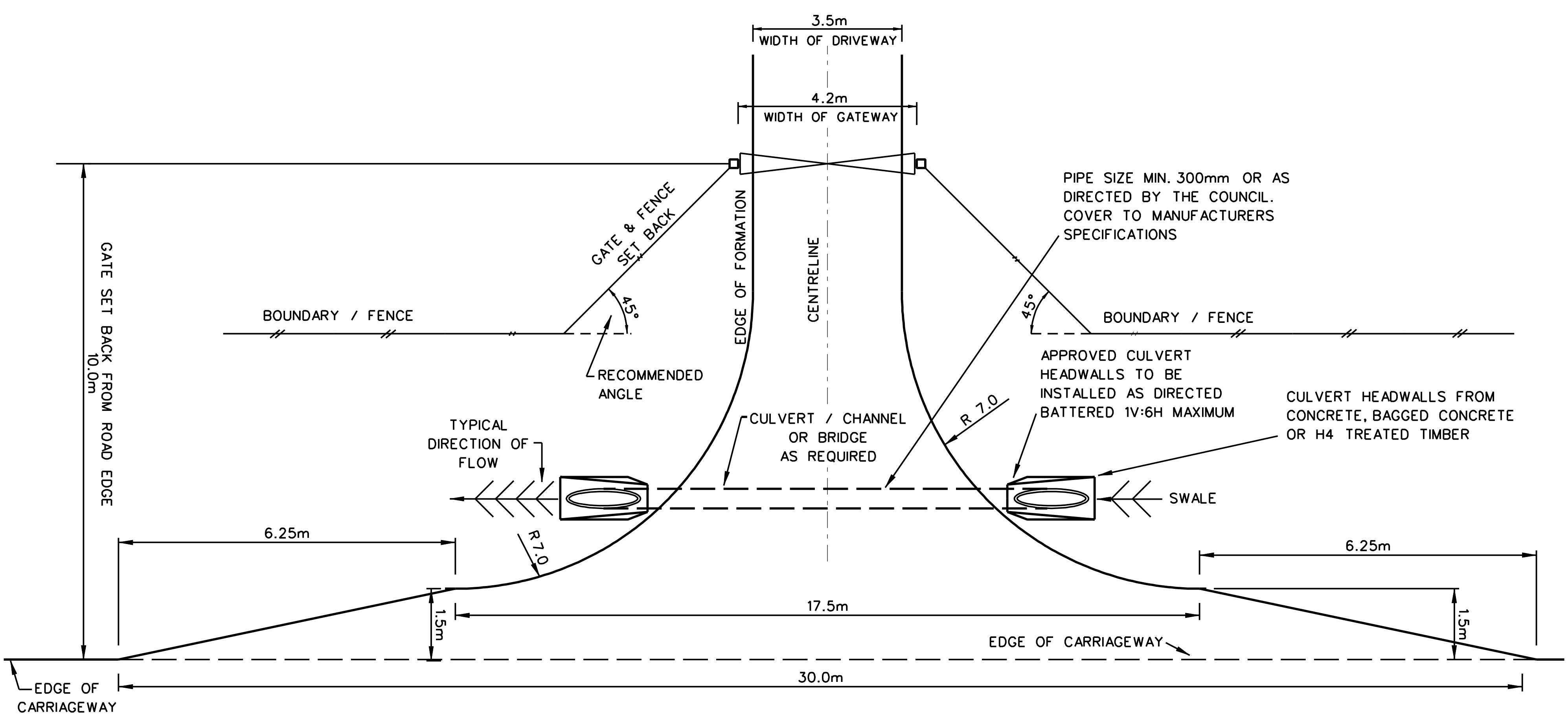

MINIMUM FORMATION STANDARDS

The formation shall extend down to a suitable subgrade which shall be free of organic material.
As a minimum requirement, the formation shall comprise of a 150 mm compacted layer of screened river run sub base (AP65) overlaid with a 100 millimeter compacted layer of crushed base course (AP40).

The top surfacing course shall be applied as follows:

(a) Where the adjacent road formation is sealed, the entrance formation shall be overlaid with a coat of chip seal consisting of hot bitumen sprayed at a rate of 1.8 litres / square metre and Grade 4 chip.

(b) Where the adjacent road formation is metalled, the new entrance formation shall be overlaid with AP20 running course.

(c) Clay stabilised metalcourse will not be approved in the road reserve.

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
		Typical Rural Zone Entranceway	Standard Drawings	217

ISSUE	PLAN No.
D	600

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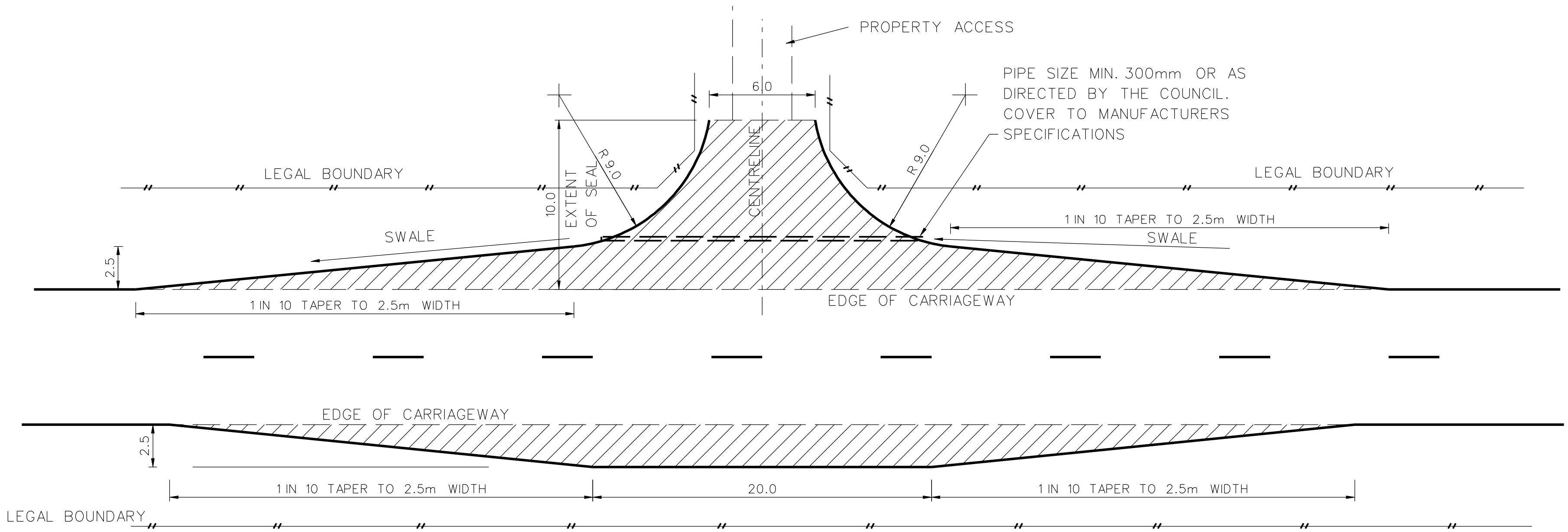


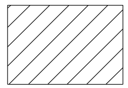
MINIMUM FORMATION STANDARDS

The formation shall extend down to a suitable subgrade which shall be free of organic material. As a minimum requirement, the formation shall comprise of a 150 mm compacted layer of screened river run sub base (AP65) overlaid with a 100 millimeter compacted layer of crushed base course (AP40). The top course shall be applied as follows:

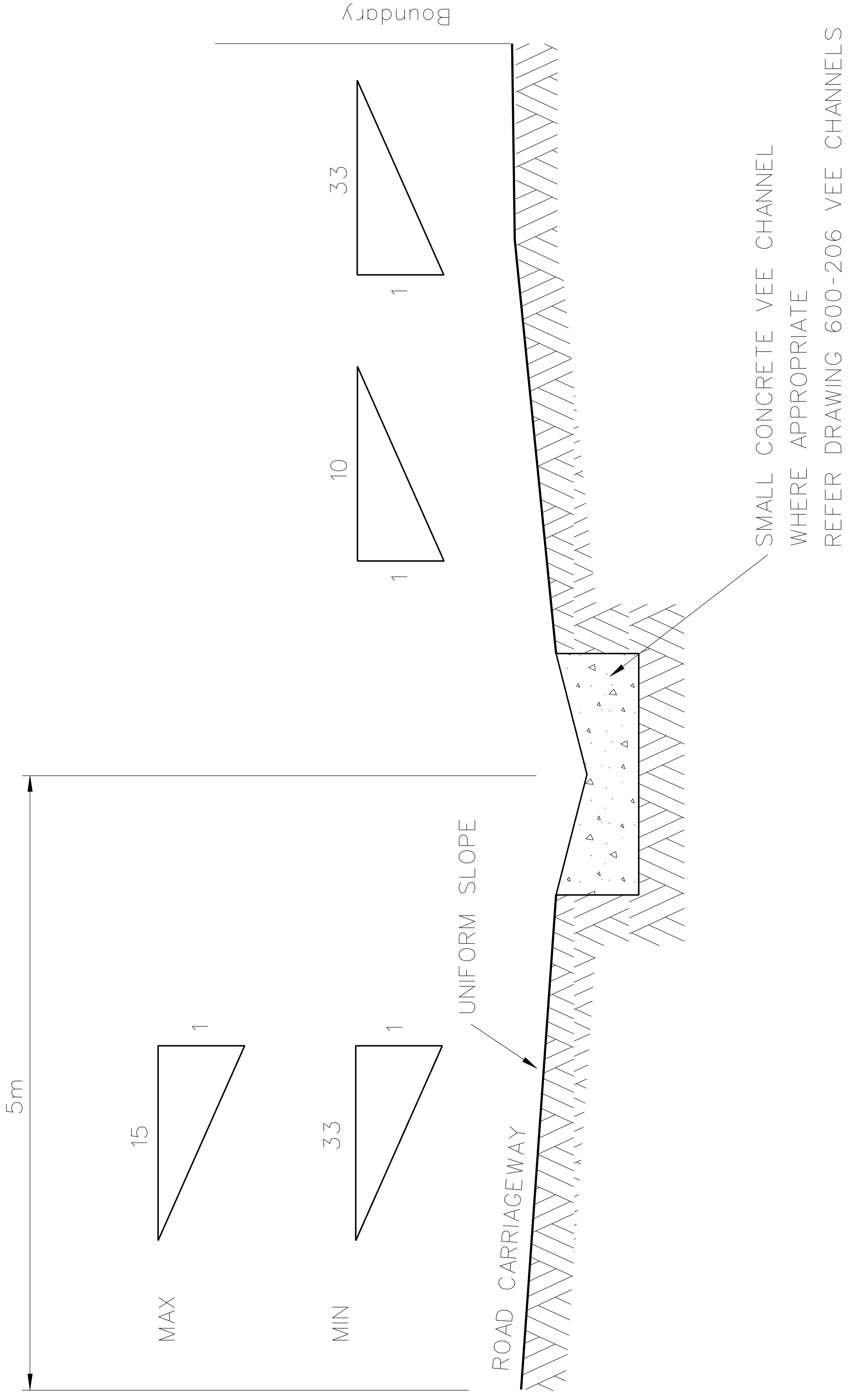
(a) Where the adjacent road formation is sealed, the entrance formation shall be overlaid with a coat of chip seal, consisting of hot bitumen sprayed at a rate of 1.8 litres / square metre and grade 4 stone chip.

(b) Where the adjacent road formation is metalled, the new entrance formation shall be overlaid with AP20 running course.

(c) Clay stabilised metalcourse will not be approved in the road reserve.


SEAL WIDENING, SHOULDER RECONSTRUCTION (& WHERE ROAD CARRIAGEWAY IS SEALED, SEALING)

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: Typical Rural Zone Commercial Access	PROJECT TITLE: Standard Drawings	SHEET 218; ISSUE E; PLAN No. 600



WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE CHANGES OF GRADE AT VEHICLE CROSSING	PROJECT TITLE STANDARD DRAWINGS	SHEET 219 ISSUE C PLAN No. 600

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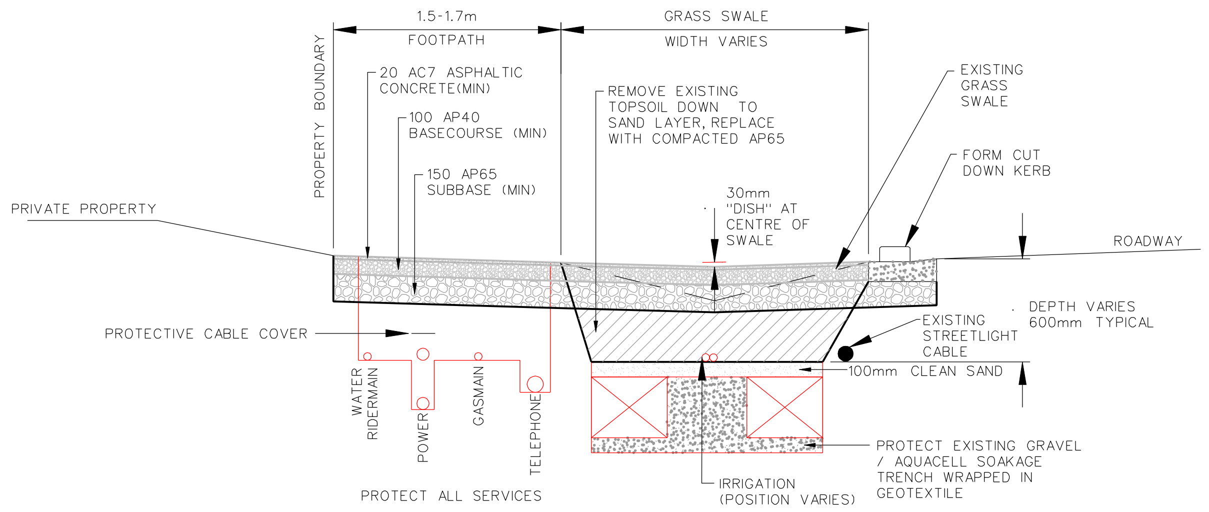
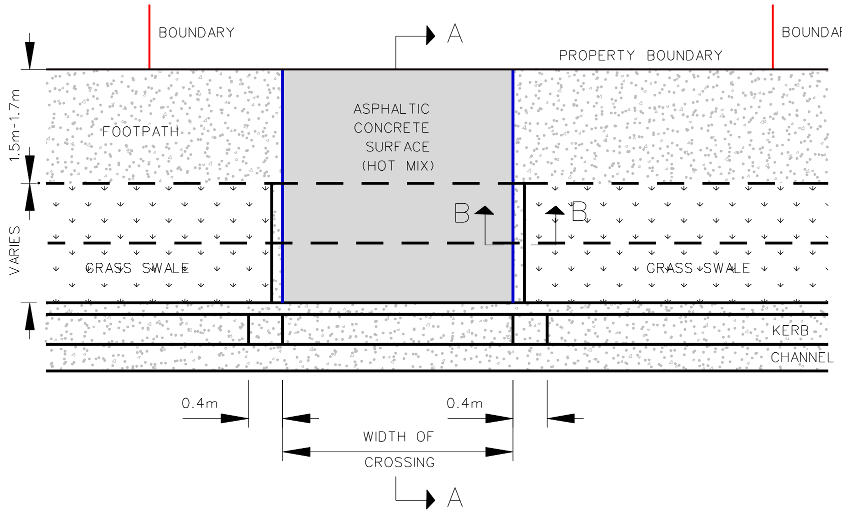
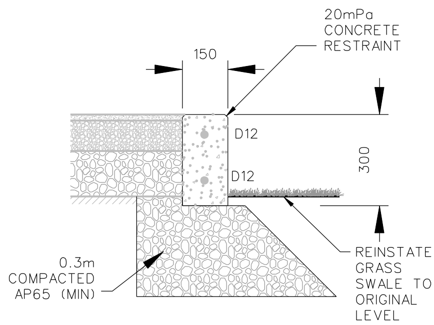


CROSS SECTION A-A



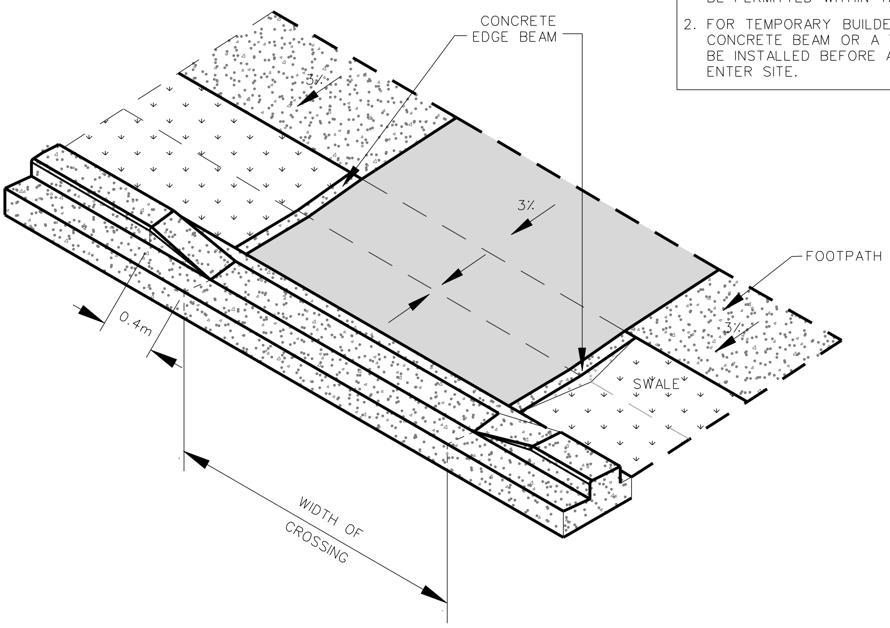
PLAN



CROSS SECTION B-B
CONCRETE EDGE BEAM

NOTE

1. CLAY STABILISED BASECOURSE WILL NOT BE PERMITTED WITHIN THE ROAD RESERVE.
2. FOR TEMPORARY BUILDERS CROSSING CONCRETE BEAM OR A TIMBER BATTEN TO BE INSTALLED BEFORE ANY VEHICLES ENTER SITE.



ISOMETRIC VIEW

WIDTH OF CROSSING

4.0m MINIMUM
6.0m MAXIMUM

FOR COMMERCIAL:
BY APPROVAL

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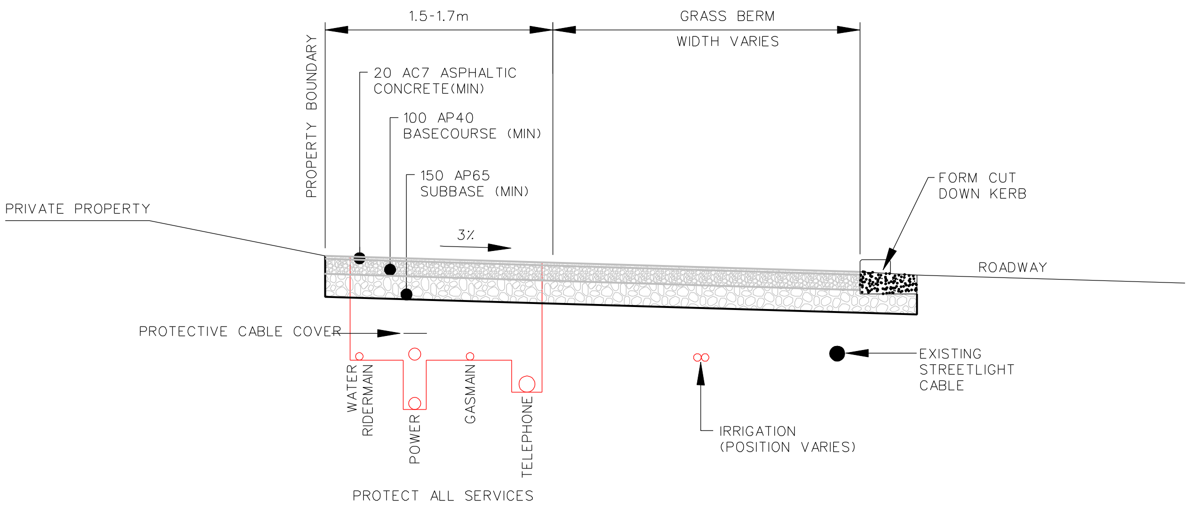
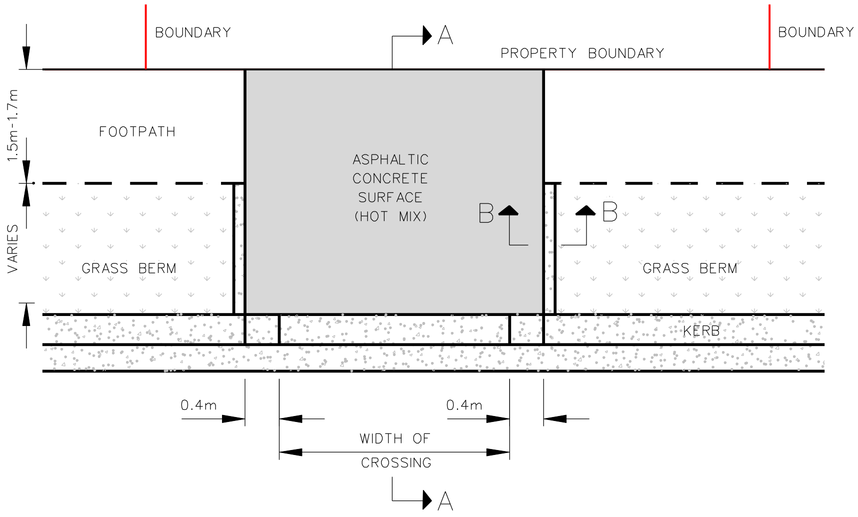
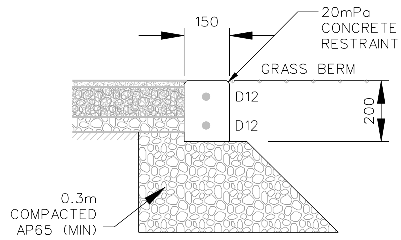
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
		PEGASUS RES6 VEHICLE CROSSING (WITH SWALE)	STANDARD DRAWINGS	220A
				ISSUE: E / PLAN No. 600



CROSS SECTION A-A



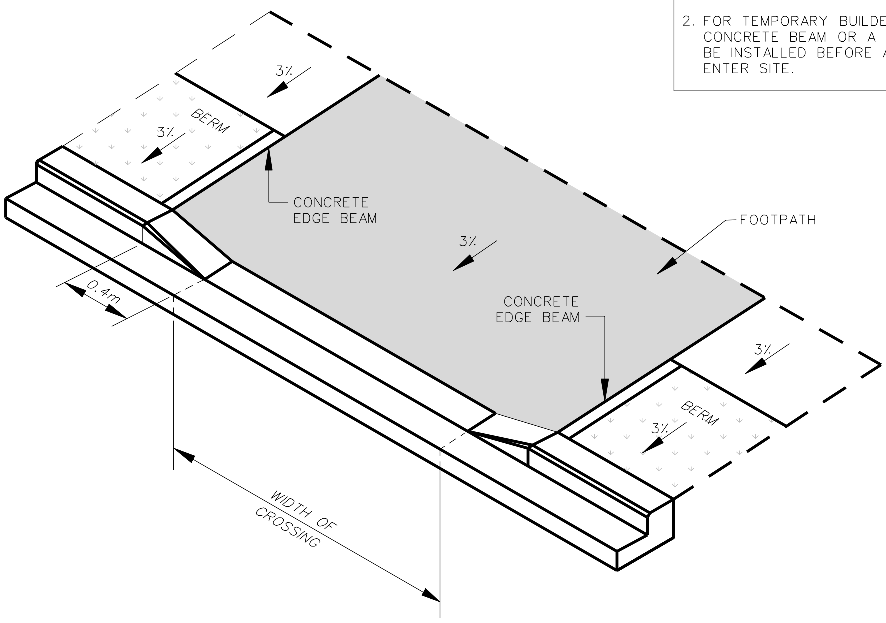
PLAN



CROSS SECTION B-B
CONCRETE EDGE BEAM

NOTE

1. CLAY STABILISED BASECOURSE WILL NOT BE PERMITTED WITHIN THE ROAD RESERVE.
2. FOR TEMPORARY BUILDERS CROSSING CONCRETE BEAM OR A TIMBER BATTEN TO BE INSTALLED BEFORE ANY VEHICLES ENTER SITE.



ISOMETRIC VIEW

WIDTH OF CROSSING

4.0m MINIMUM
6.0m MAXIMUM

FOR COMMERCIAL:
BY APPROVAL

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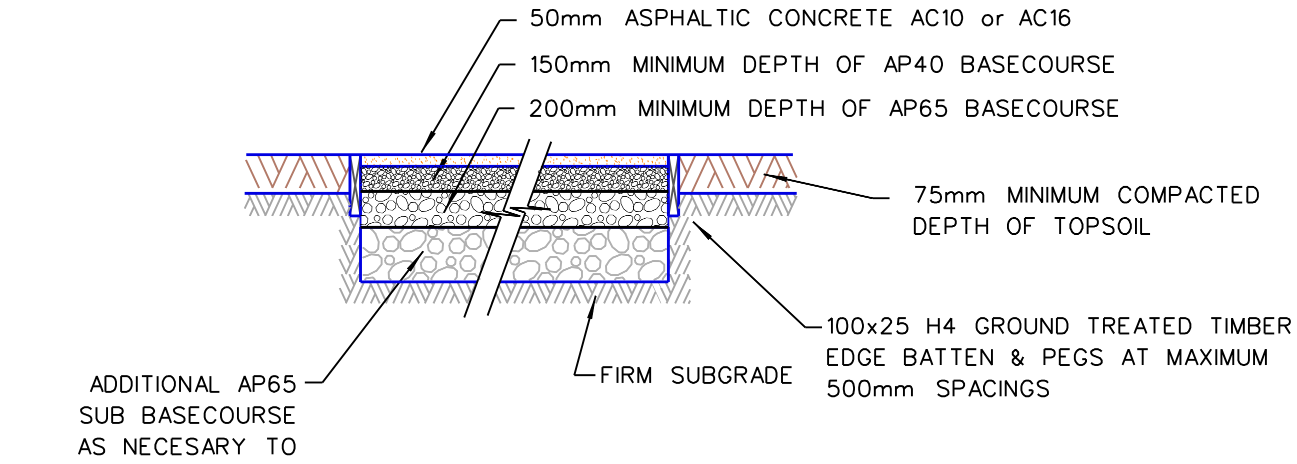
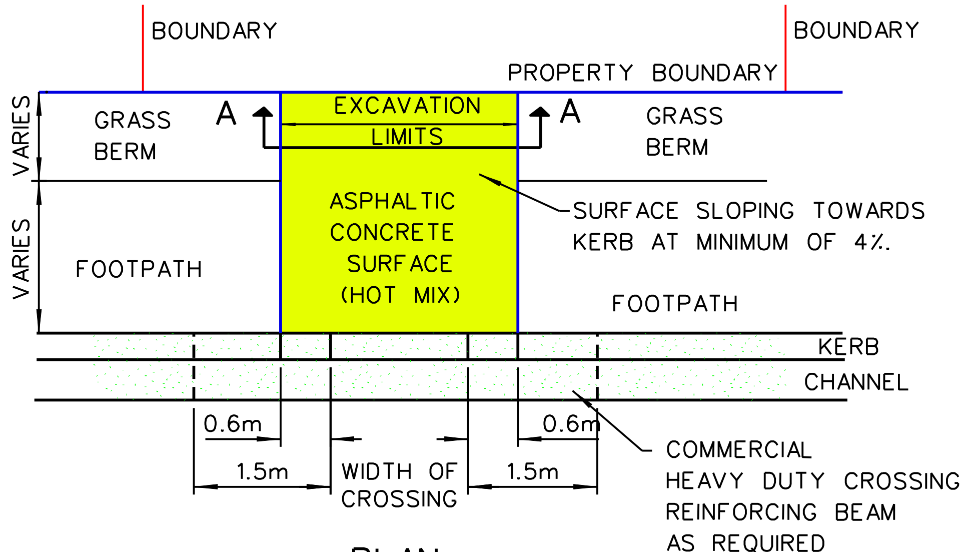
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: PEGASUS RES6 VEHICLE CROSSING (WITHOUT SWALE)	PROJECT TITLE: STANDARD DRAWINGS	SHEET 220B; ISSUE E; PLAN No. 600



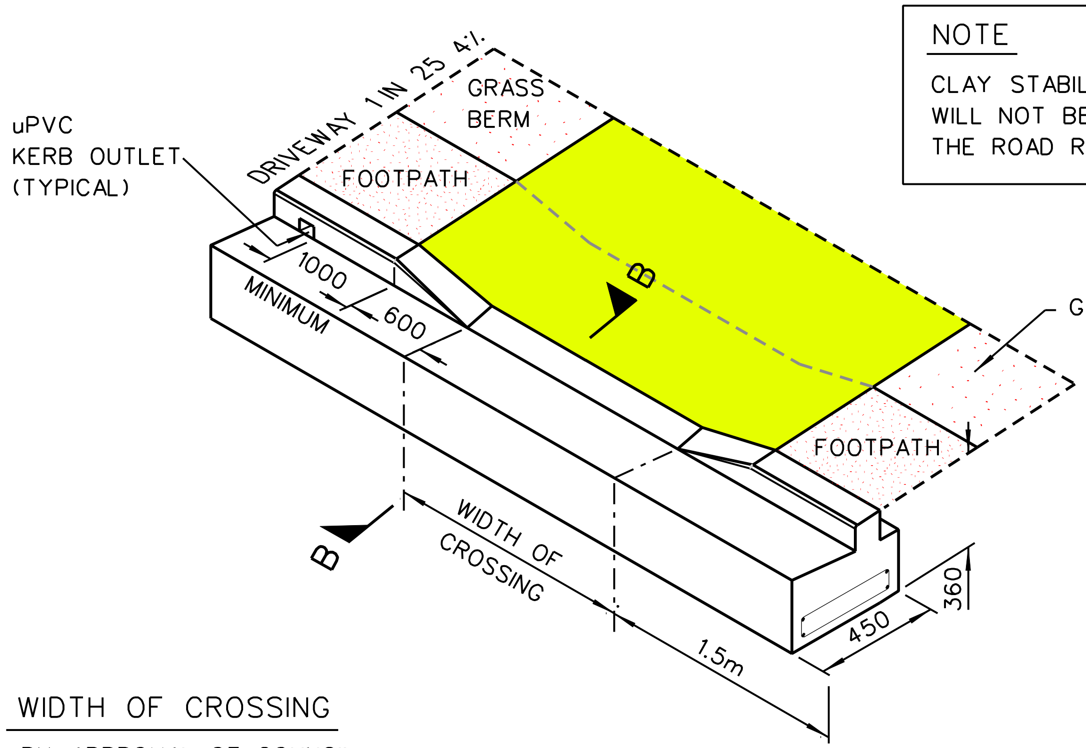
CROSS SECTION A-A

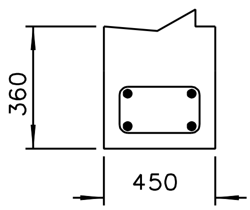


PLAN

NOTE

CLAY STABILISED BASECOURSE WILL NOT BE PERMITTED WITHIN THE ROAD RESERVE.





SECTION B-B

WIDTH OF CROSSING

BY APPROVAL OF COUNCIL

ISOMETRIC VIEW

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: Pegasus Commercial Hot Mix Vehicle Crossing (Flat Channel)	PROJECT TITLE: Standard Drawings	SHEET: 220C; ISSUE: A; PLAN No. 600

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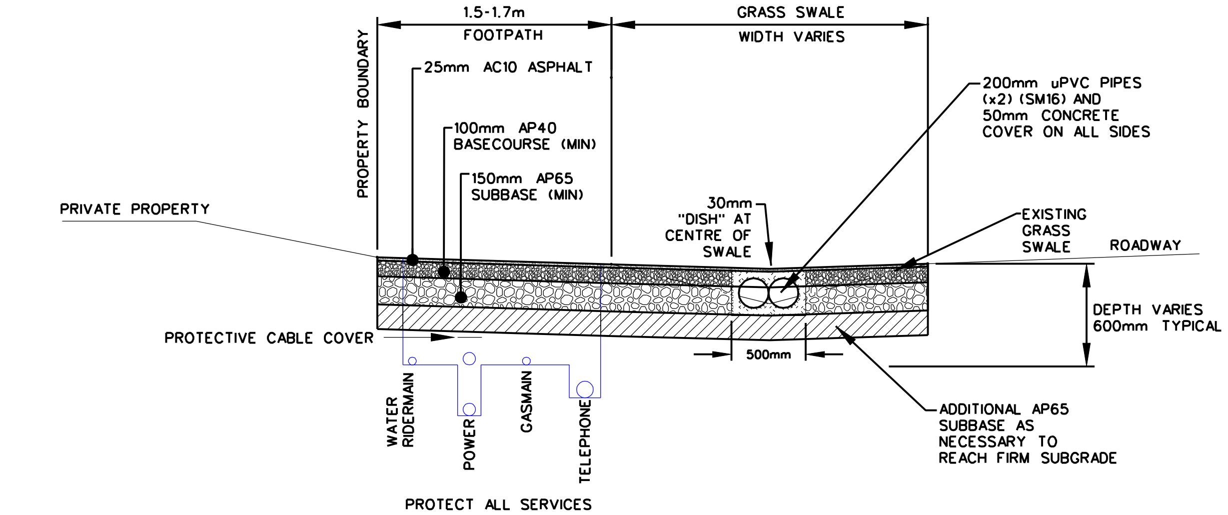
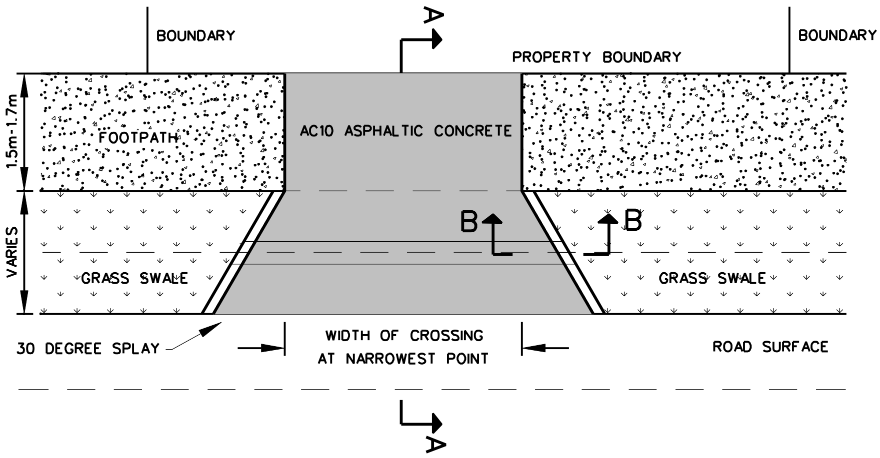
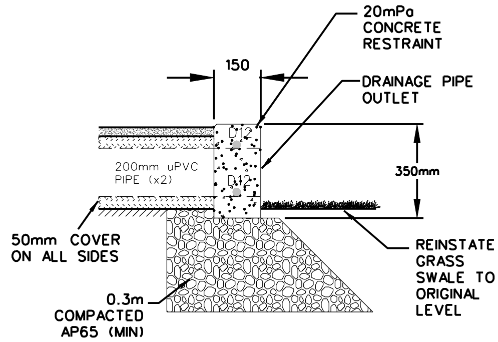


CROSS SECTION A-A





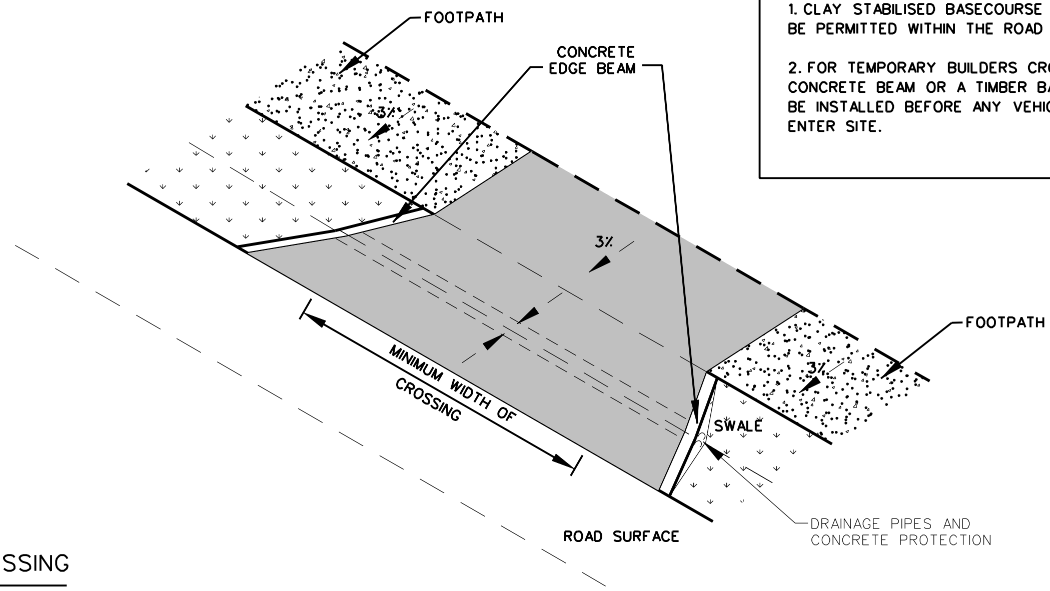
CROSS SECTION B-B
CONCRETE EDGE BEAM

PLAN

NOTE

1. CLAY STABILISED BASECOURSE WILL NOT BE PERMITTED WITHIN THE ROAD RESERVE.

2. FOR TEMPORARY BUILDERS CROSSING CONCRETE BEAM OR A TIMBER BATTEN TO BE INSTALLED BEFORE ANY VEHICLES ENTER SITE.



WIDTH OF CROSSING

4.0m MINIMUM
6.0m MAXIMUM

FOR COMMERCIAL:
BY APPROVAL

ISOMETRIC VIEW

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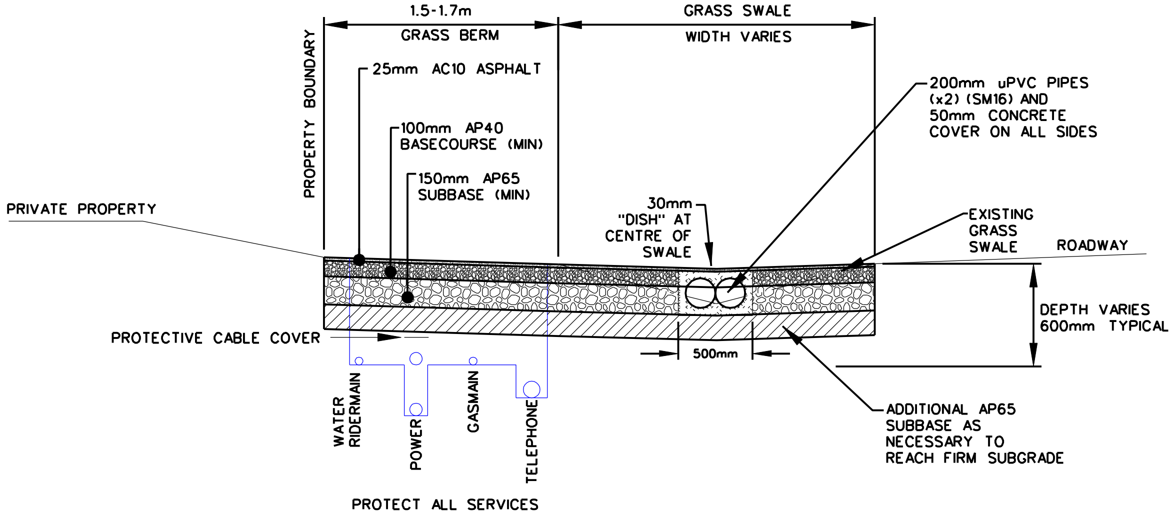
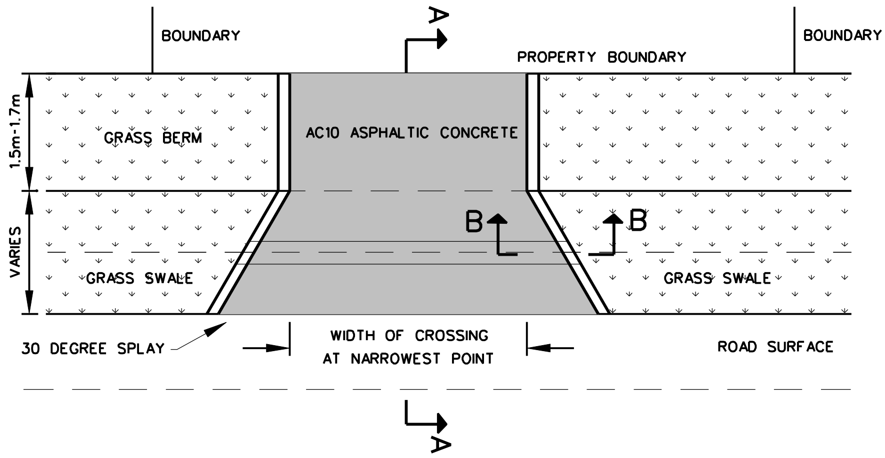
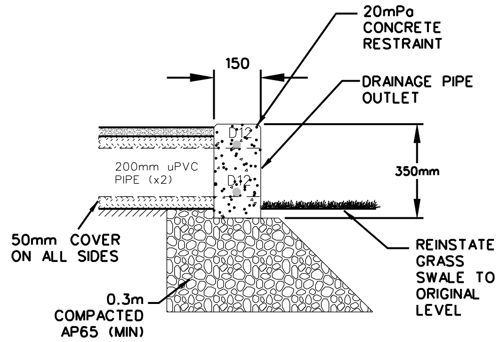
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE MAPLEHAM VEHICLE CROSSING (WITH FOOTPATH)	PROJECT TITLE STANDARD DRAWINGS	SHEET 221A ISSUE A PLAN No. 600



CROSS SECTION A-A



PLAN

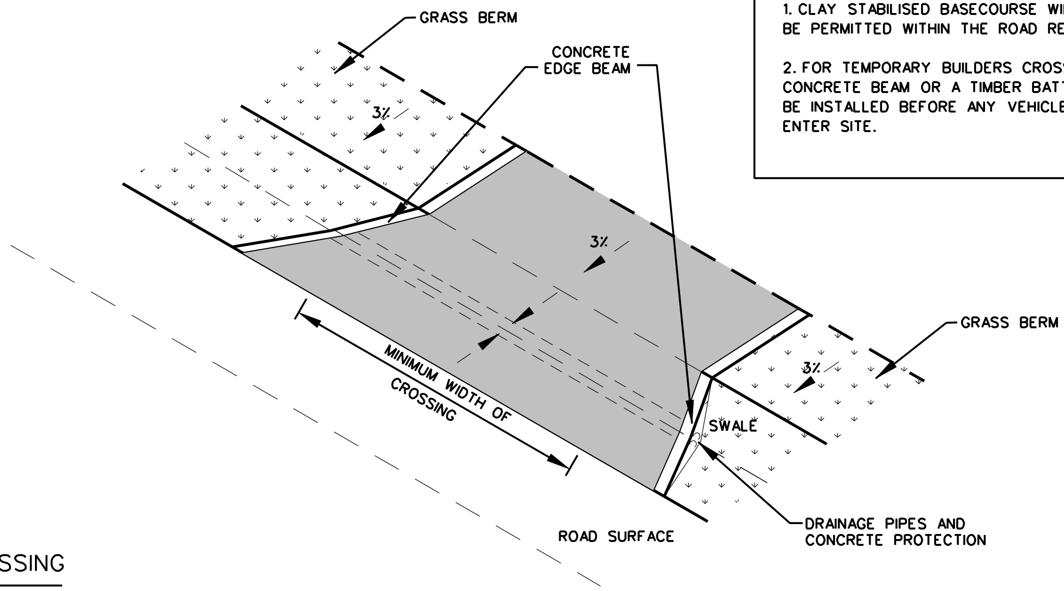


CROSS SECTION B-B
CONCRETE EDGE BEAM

NOTE

1. CLAY STABILISED BASECOURSE WILL NOT BE PERMITTED WITHIN THE ROAD RESERVE.

2. FOR TEMPORARY BUILDERS CROSSING CONCRETE BEAM OR A TIMBER BATTEN TO BE INSTALLED BEFORE ANY VEHICLES ENTER SITE.



WIDTH OF CROSSING

4.0m MINIMUM
6.0m MAXIMUM

FOR COMMERCIAL:
BY APPROVAL

ISOMETRIC VIEW

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: MAPLEHAM VEHICLE CROSSING (WITHOUT FOOTPATH)	PROJECT TITLE: STANDARD DRAWINGS	SHEET: 221B
				ISSUE: A / PLAN No. 600

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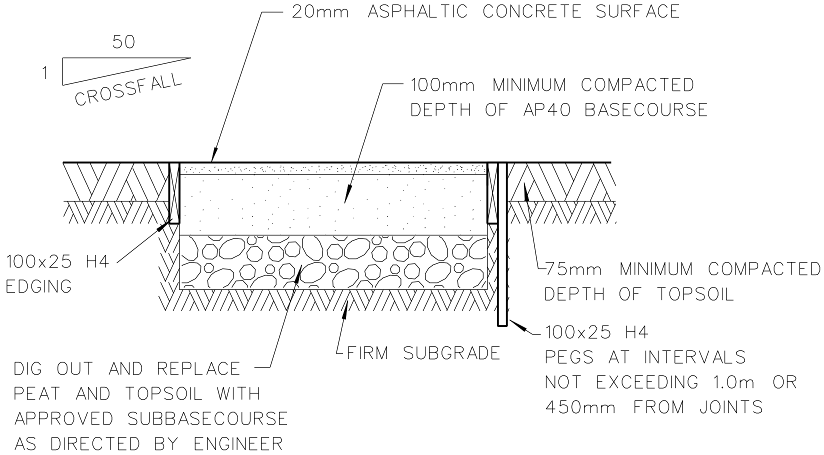
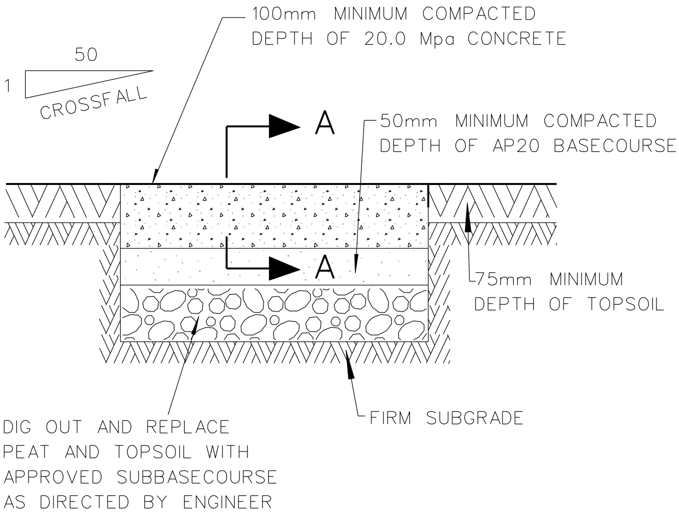


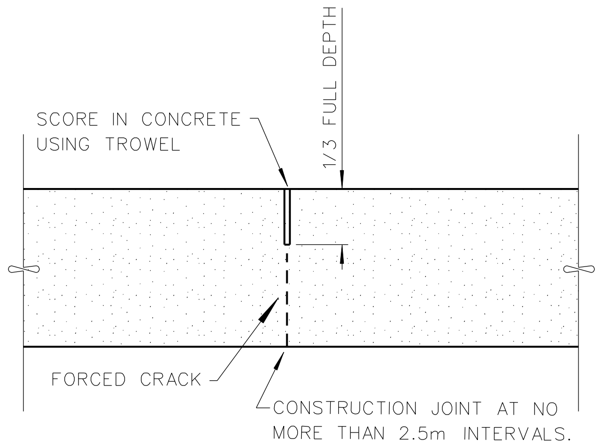
ASPHALTIC CONCRETE
CROSS-SECTION

NOTES

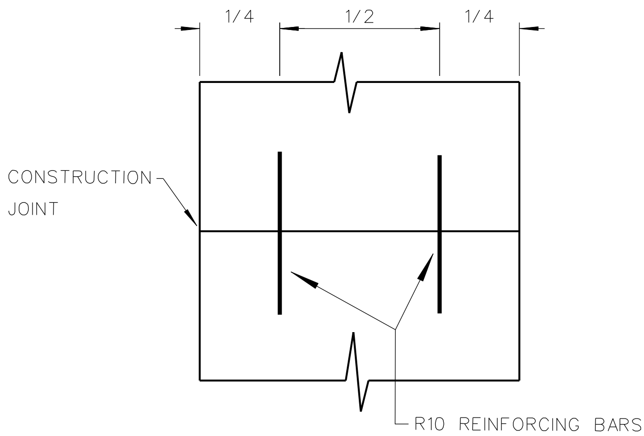
1. This drawing shall be read in conjunction with CCC construction Standard Specification Part 6: Roads.
2. All concrete from special Grade Plant to comply with NZS 3104:2003 Specification for High & Special Grade concrete production
3. Max of 80mm concrete slump.
4. Min of 20.0mPa concrete
5. Concrete construction to comply with NZS 3109:1997 Concrete Construction.
6. Asphaltic concrete to comply with TNZ M/1, P/9 and CCC CSS Part 6.
7. Subbase and basecourse to comply with CCC CSS Part 6



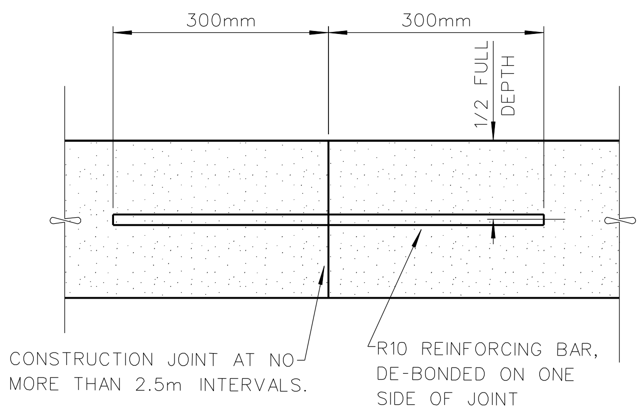
CONCRETE
CROSS-SECTION



SECTION A-A
JOINT FOR CONTINUOUS POUR



CONCRETE FOOTPATH
PLAN



SECTION A-A
JOINT FOR END OF CONTINUOUS
POUR OR POUR IN ALTERNATE BAYS

WAIMAKARIRI
DISTRICT COUNCIL
technical services

NOT TO SCALE

SHEET TITLE
FOOTPATHS
&
BERMS

PROJECT TITLE
STANDARD
DRAWINGS

SHEET
222

ISSUE
E

PLAN No.
600

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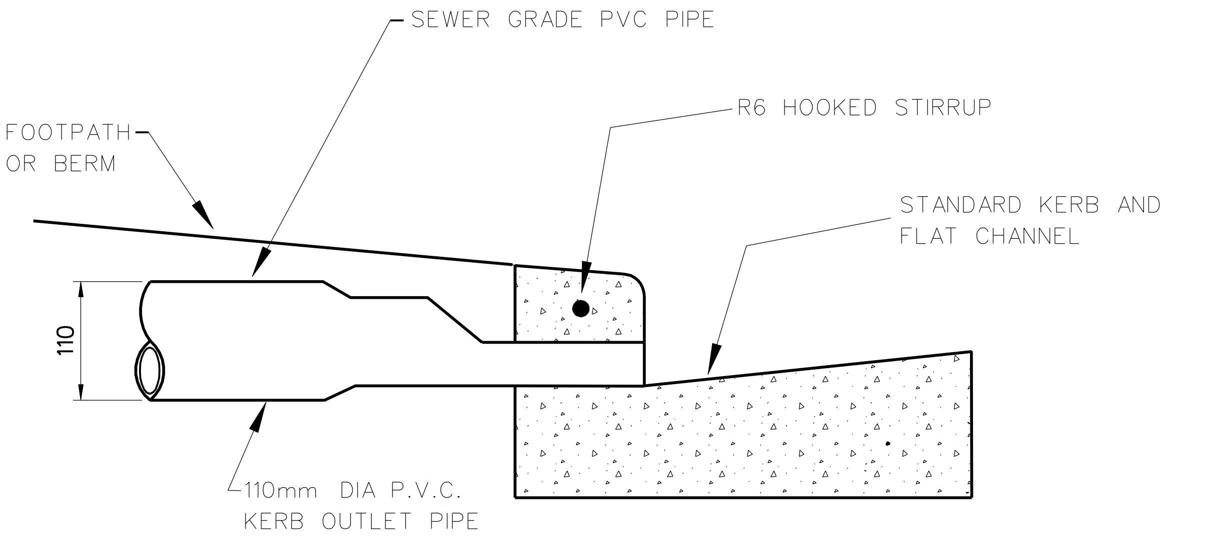
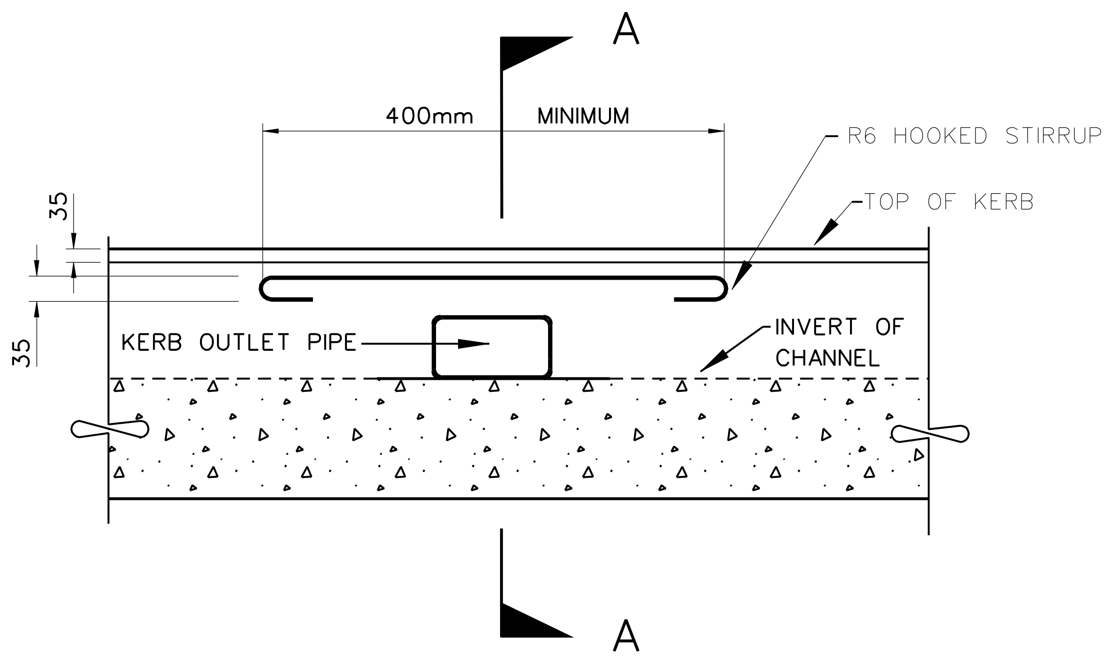


SECTION A-A



FRONT ELEVATION

NOTES

1. Where practical kerb outlets shall not be closer than 1 metre to a kerb cut down.

2. Kerb outlets shall be installed at the time of pouring kerb and channel.

Based on CCC drawing SD605

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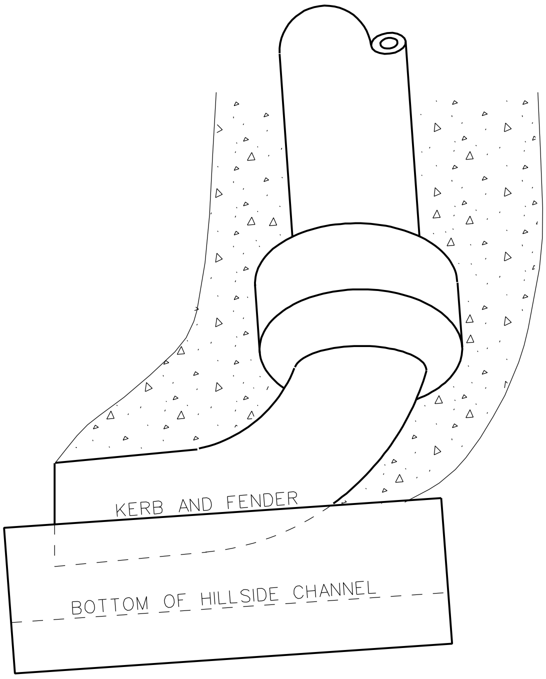
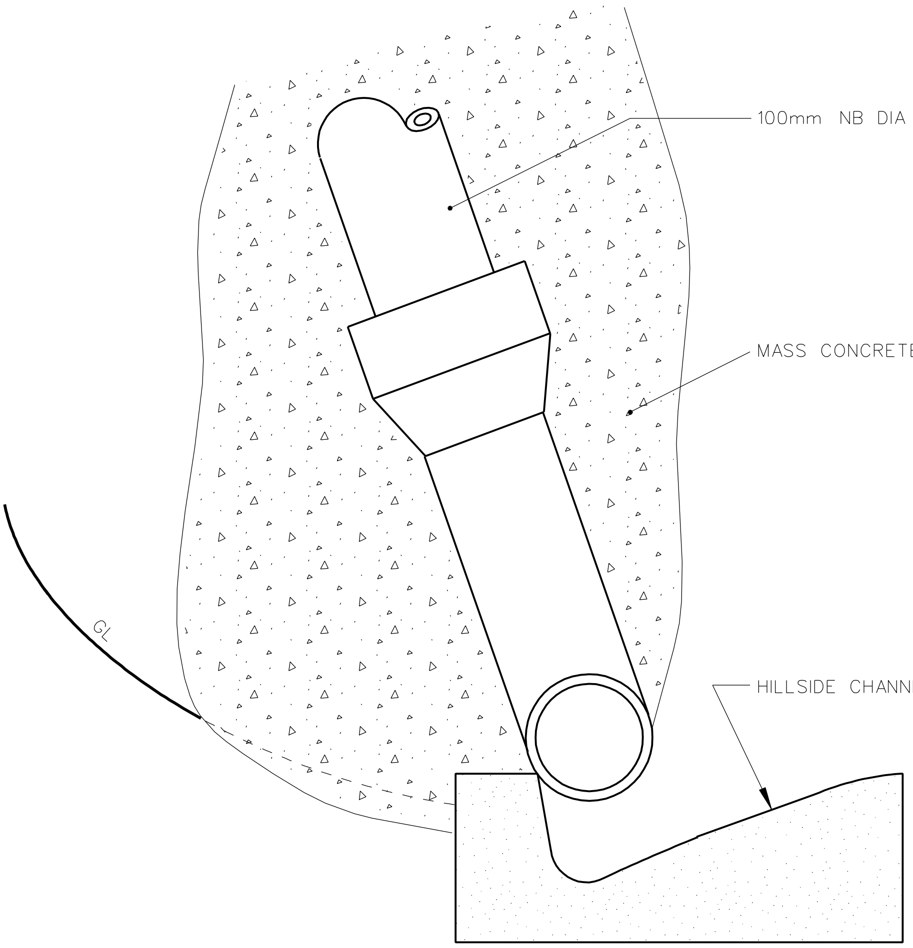
WAIMAKARIRI DISTRICT COUNCIL
technical services

NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET	
	KERB OUTLET	STANDARD DRAWINGS	224	
			ISSUE	PLAN No.
			D	600

NOTES
Pipe may be either u PVC or EW depending on existing down pipe.



TYPICAL ELEVATION
Looking at Bank



TYPICAL SECTION
Looking up Stream

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: HOUSE DRAIN ENTRY TO HILLSIDE CHANNEL	PROJECT TITLE: STANDARD DRAWINGS	SHEET: 226
				ISSUE: C / PLAN No. 600

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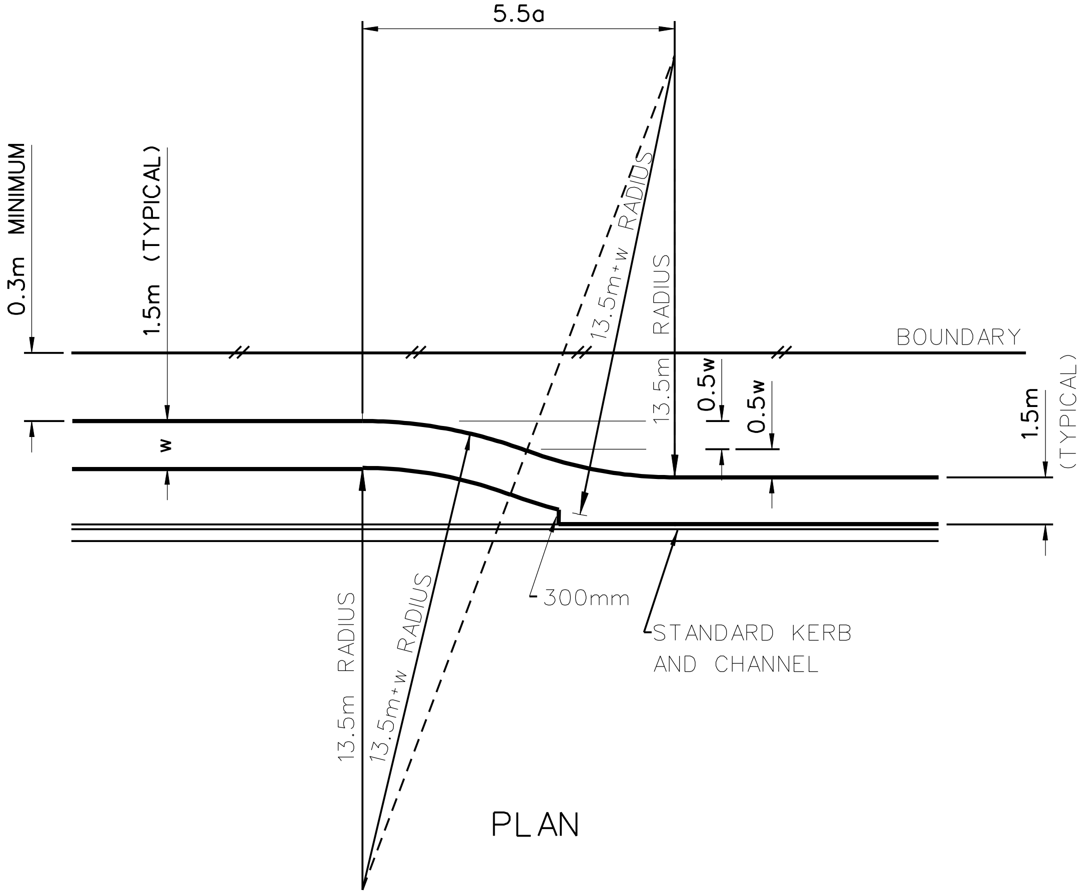
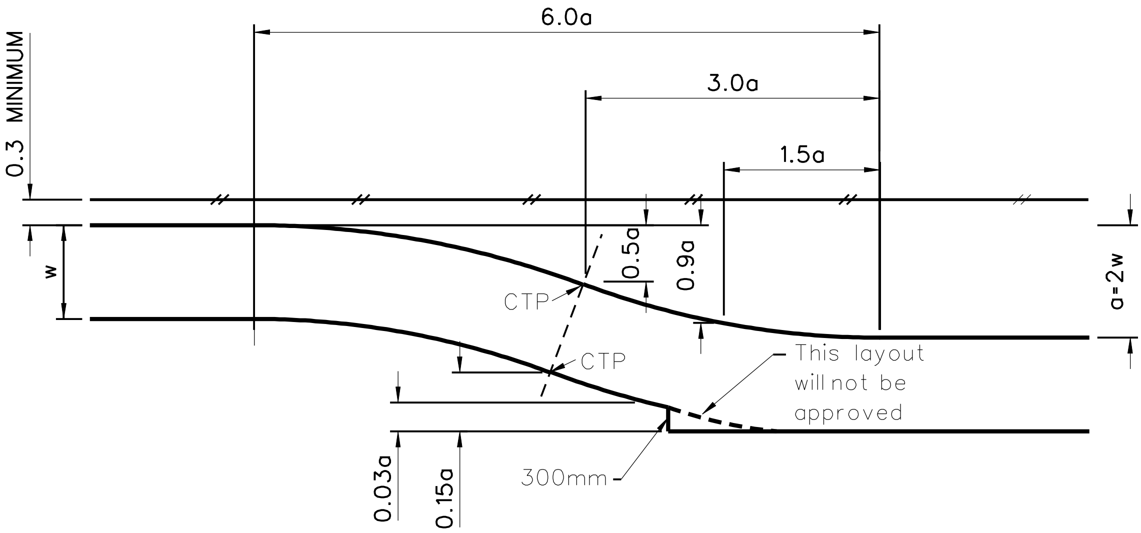


PLAN



SETOUT BY OFFSETS

NOTES

- w = FOOTPATH WIDTH
- BATTENS 100x25 H4 GROUND TREATED TIMBER
- PEGS 100x25 H4 @ 600 SPACINGS MAXIMUM

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: TYPICAL FOOTPATH MEANDER DETAIL	PROJECT TITLE: STANDARD DRAWINGS	SHEET 227; ISSUE D; PLAN No. 600

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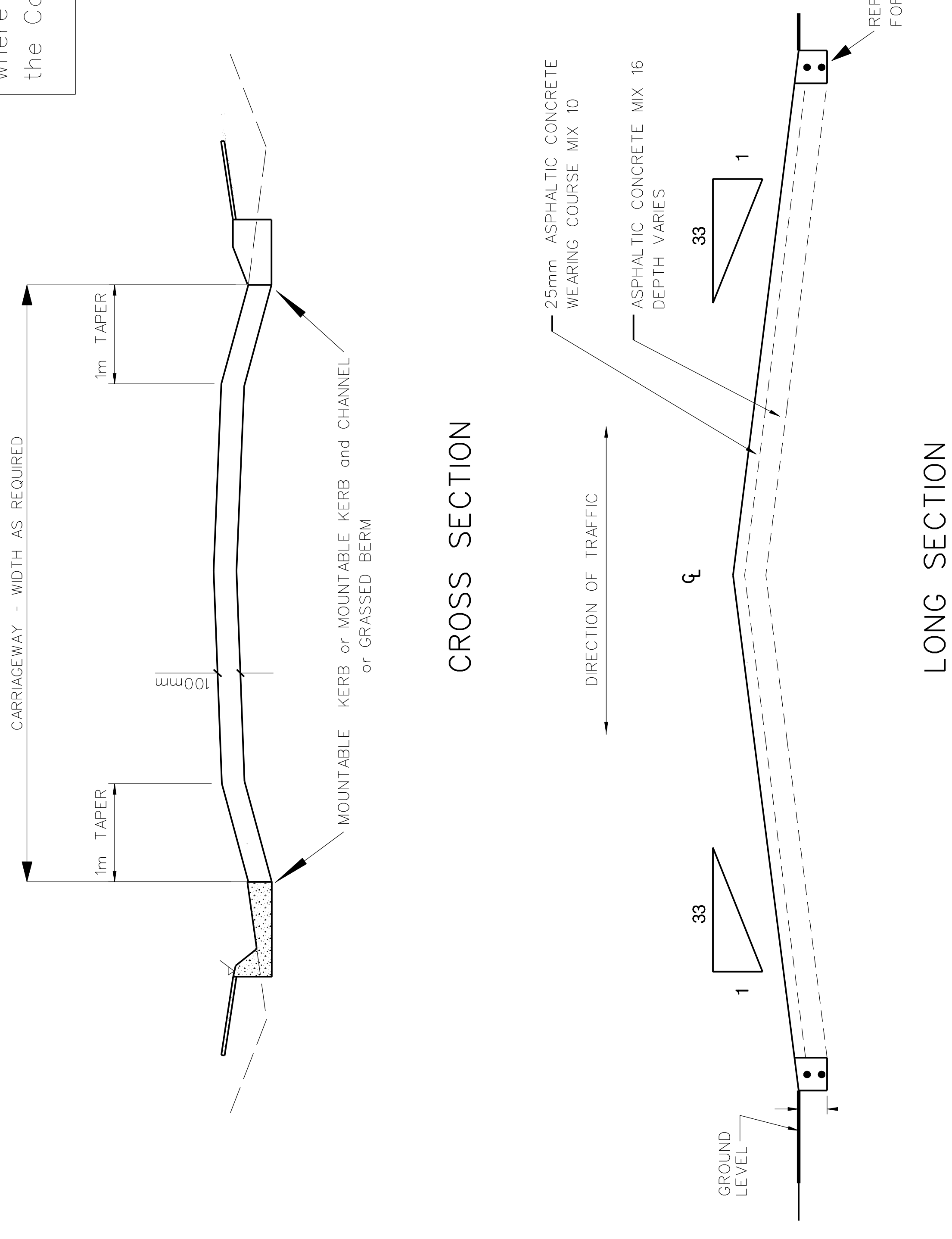
NOTES

The Council generally prefers that Road Humps are not used. However, this detail shall apply where use is approved by the Council.



Based on CCC drawings SD631

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
		ROAD HUMP DETAILS	STANDARD DRAWINGS	231
				ISSUE: D / PLAN No.: 600

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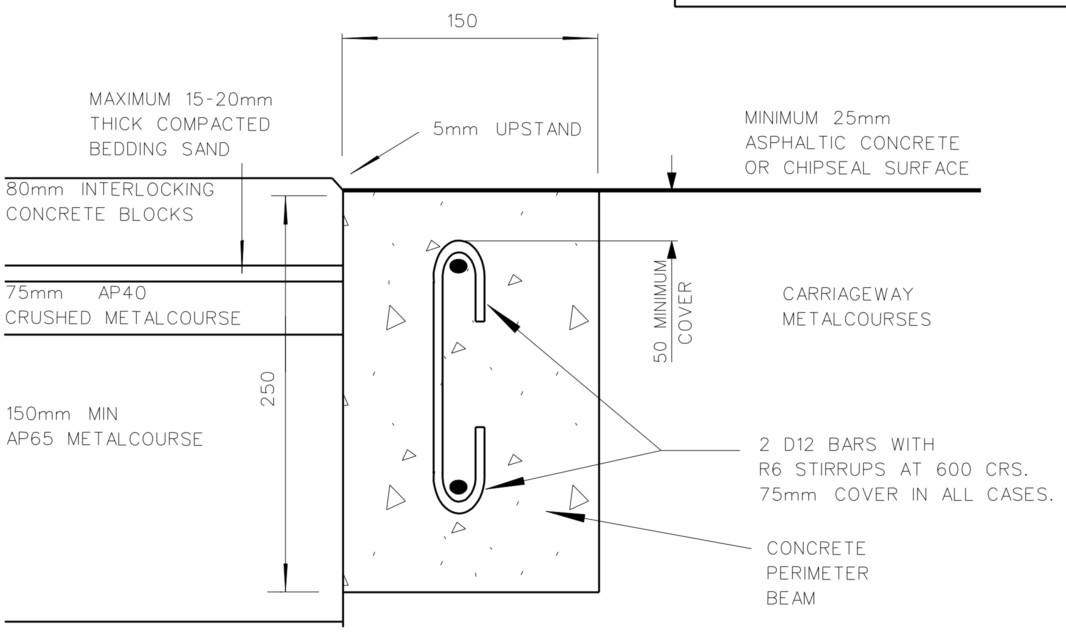
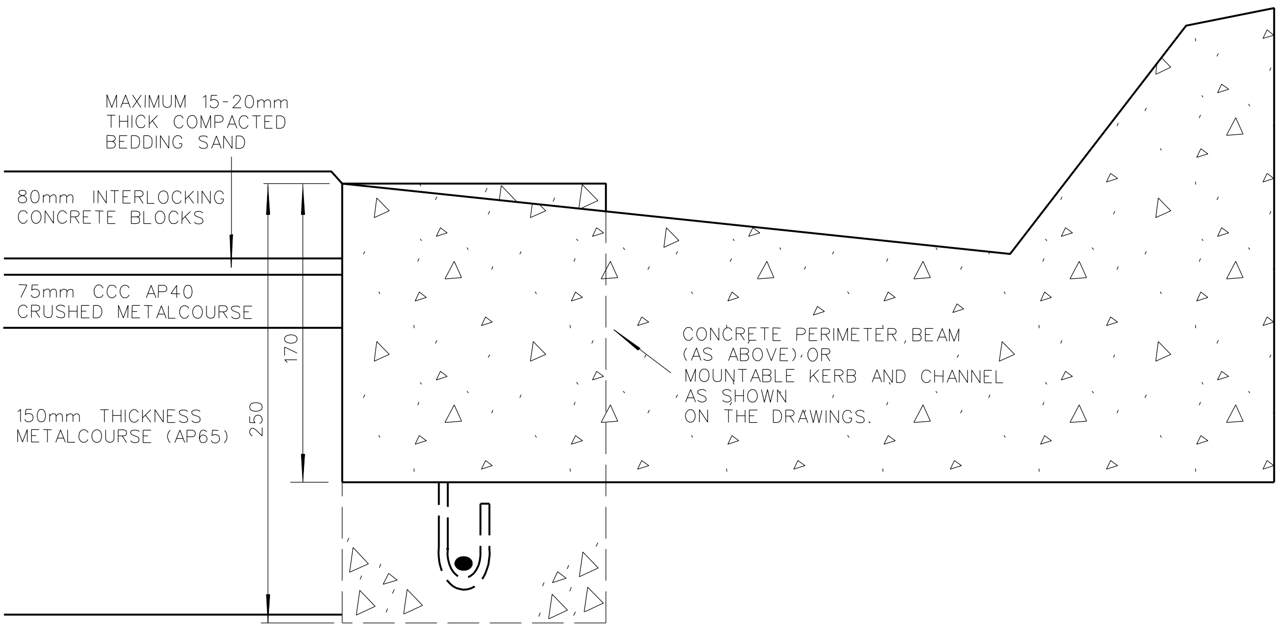
NOTES

1 All concrete to comply with NZS 3109 : 1997.
2 Slump of concrete 50mm max.
3 Concrete strength of 20 Mpa at 28 days.
4 Colour of Interlocking blocks to be as per specification.
5 Concrete blocks shall be manufactured in accordance with NZS 3116:2002.



CARRIAGEWAY THRESHOLDS
LONGITUNDINAL SECTION
PERIMETER BEAM



INTERLOCKING CONC. BLOCKS ADJACENT
TO PLANTING OR GRASS BERM

Based on CCC drawing SD634

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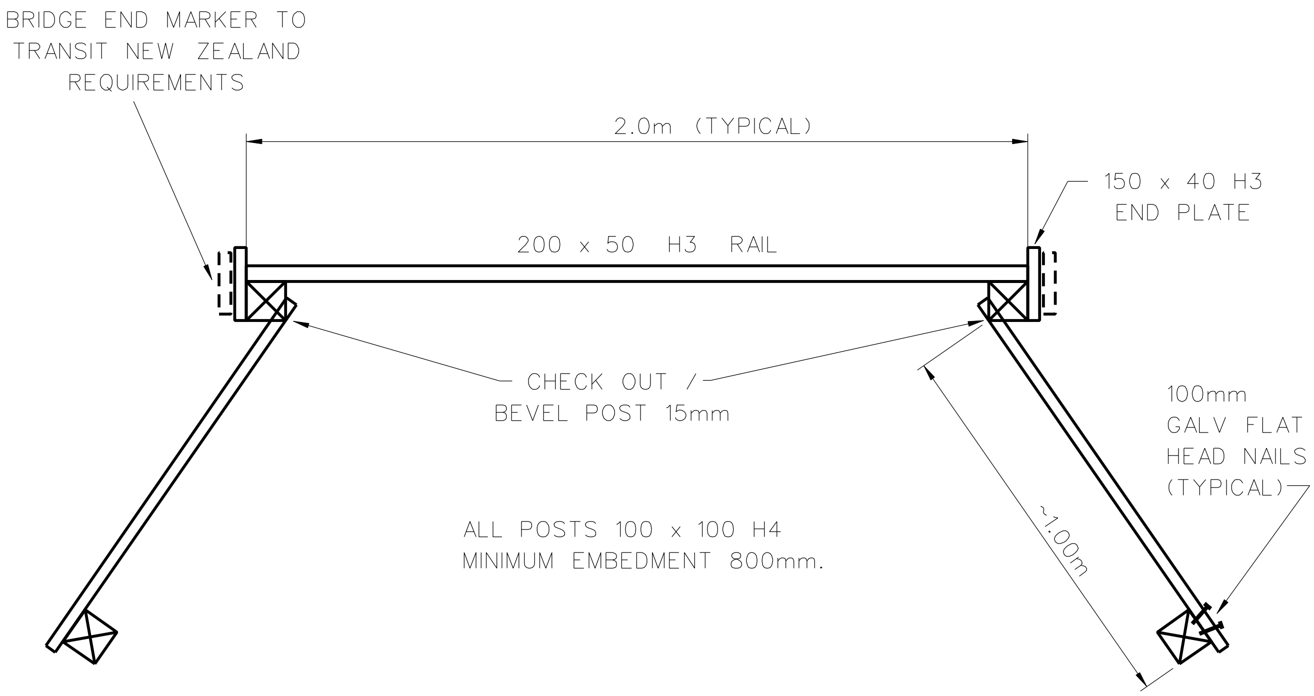
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: Interlocking Concrete Block Pavement Edge	PROJECT TITLE: STANDARD DRAWINGS	SHEET 233
				ISSUE D / PLAN No. 600

ELEVATION



PLAN

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE Rural Zone Local Road Culvert Sight Rail	PROJECT TITLE STANDARD DRAWINGS	SHEET 241 ISSUE: B PLAN No.: 600

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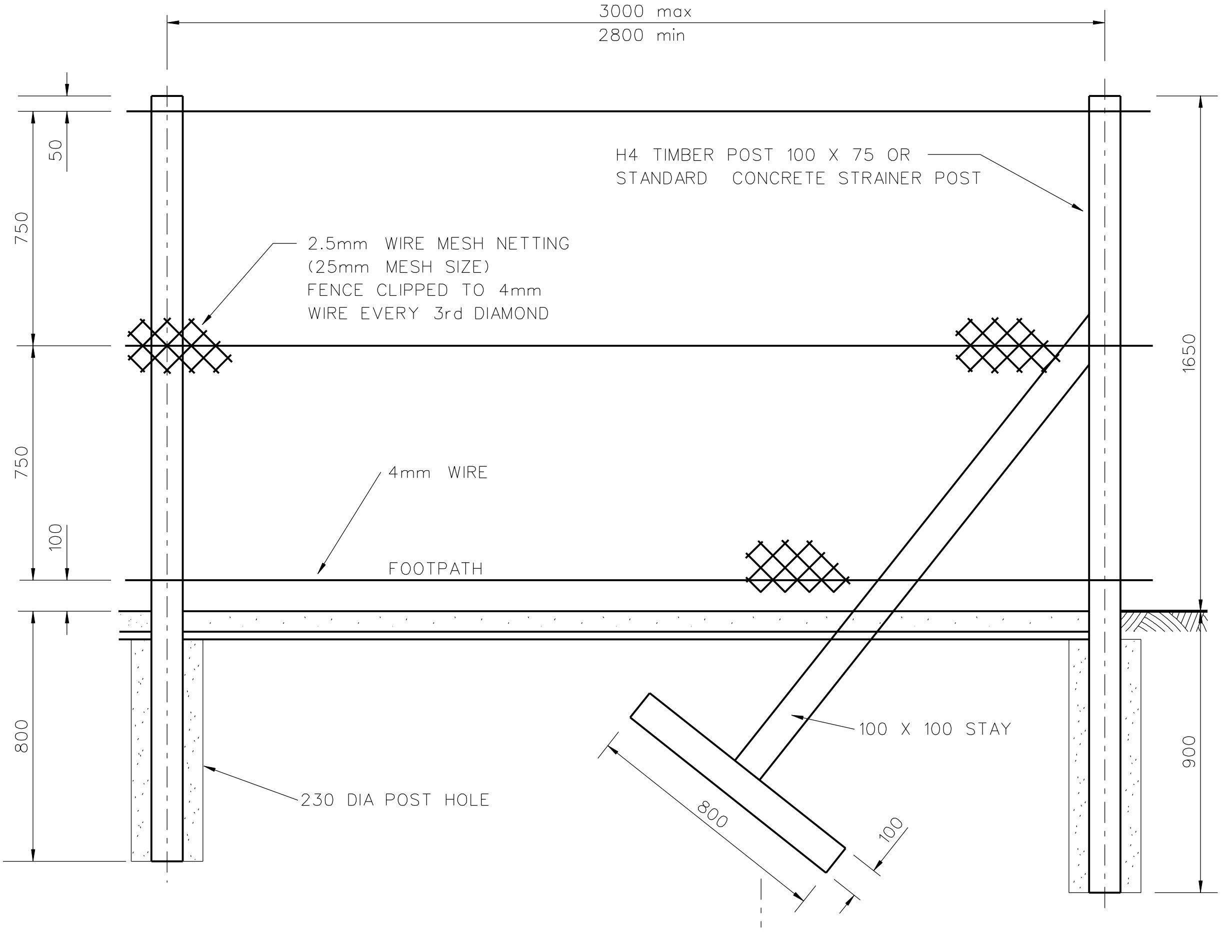

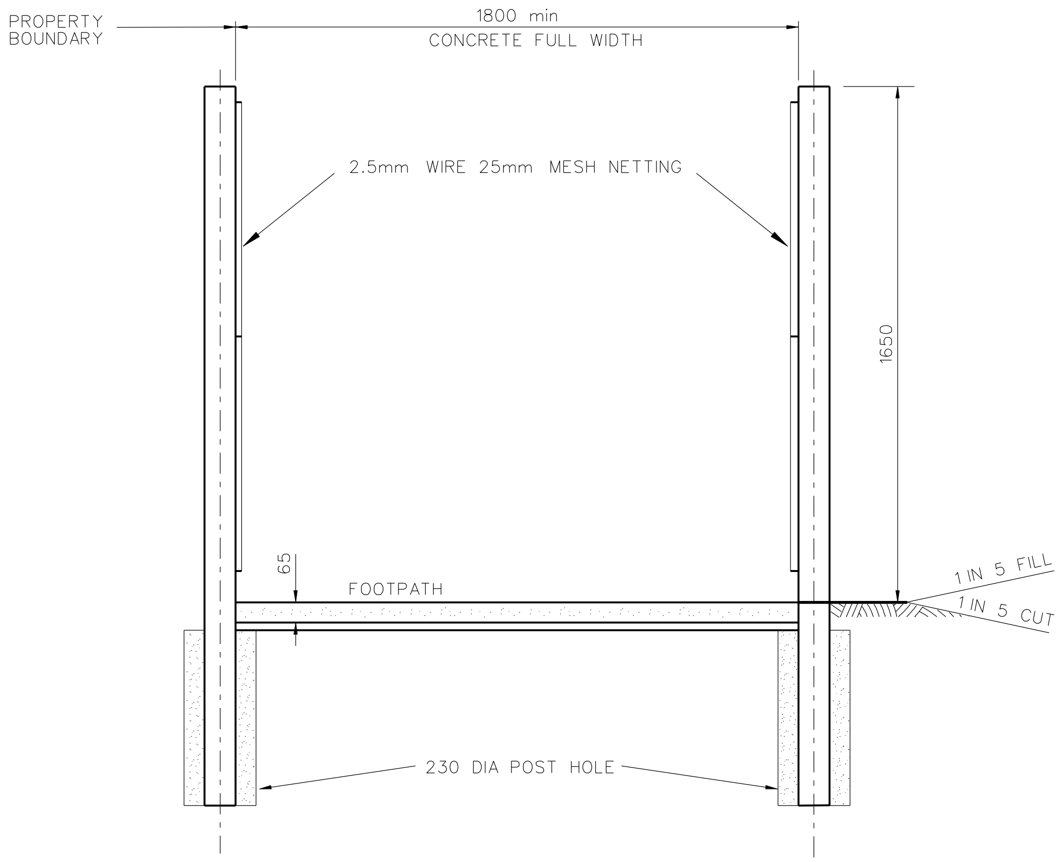

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: TYPICAL WIRE MESH FENCE FOR ACCESSWAYS	PROJECT TITLE: STANDARD DRAWINGS	SHEET: 242
				ISSUE: C — PLAN No. 600

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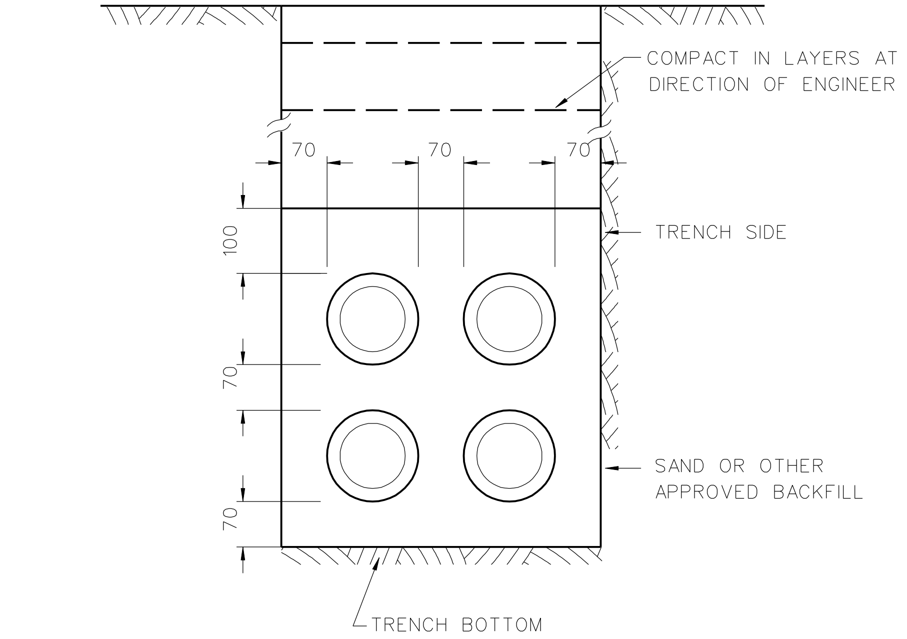
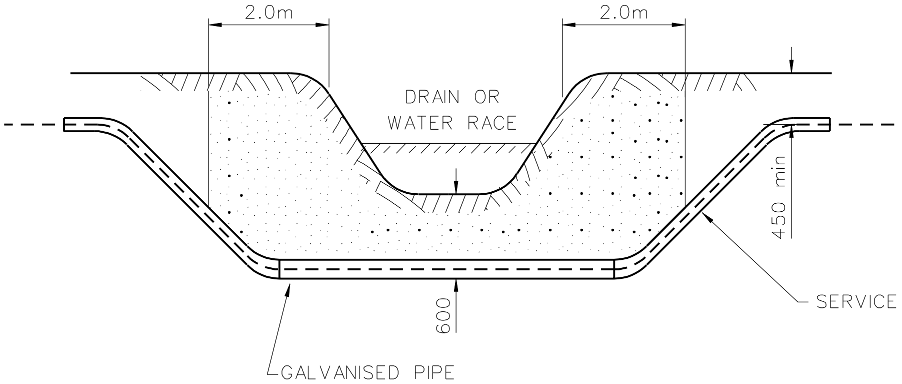
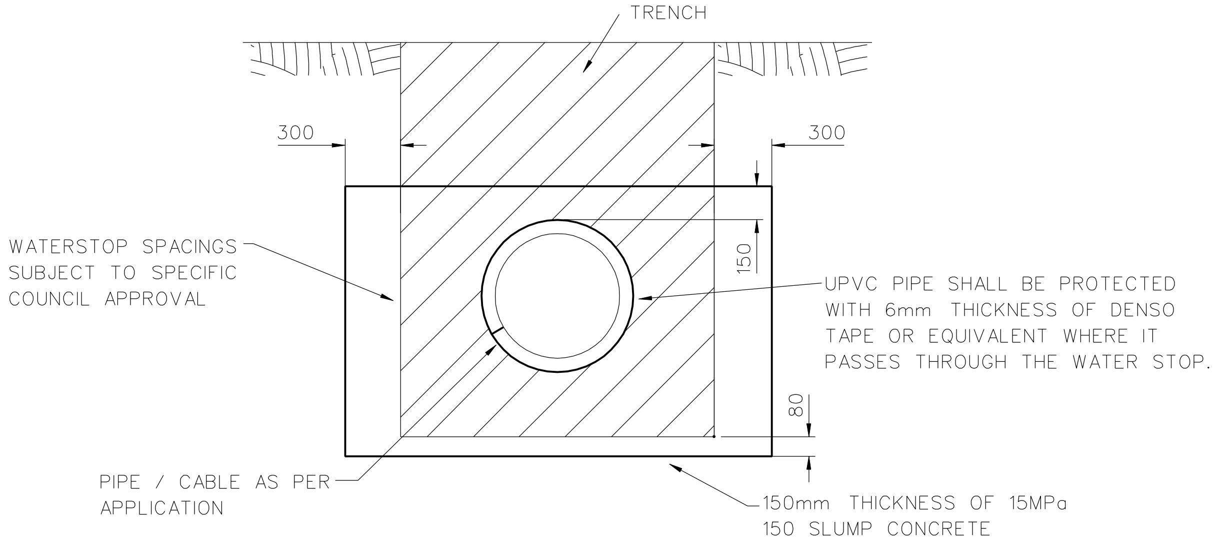


ENERGY & COMMUNICATIONS TRENCH (TYPICAL)
DIAGRAM 1



SERVICE INSTALLATION UNDER DRAIN OR WATER RACE
DIAGRAM 2



WATER STOPS - FOR USE WHEN GRADE > 1:100
DIAGRAM 3

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: TRENCHING IN PUBLIC PROPERTY	PROJECT TITLE: STANDARD DRAWINGS	SHEET: 243
				ISSUE: B
				PLAN No.: 600

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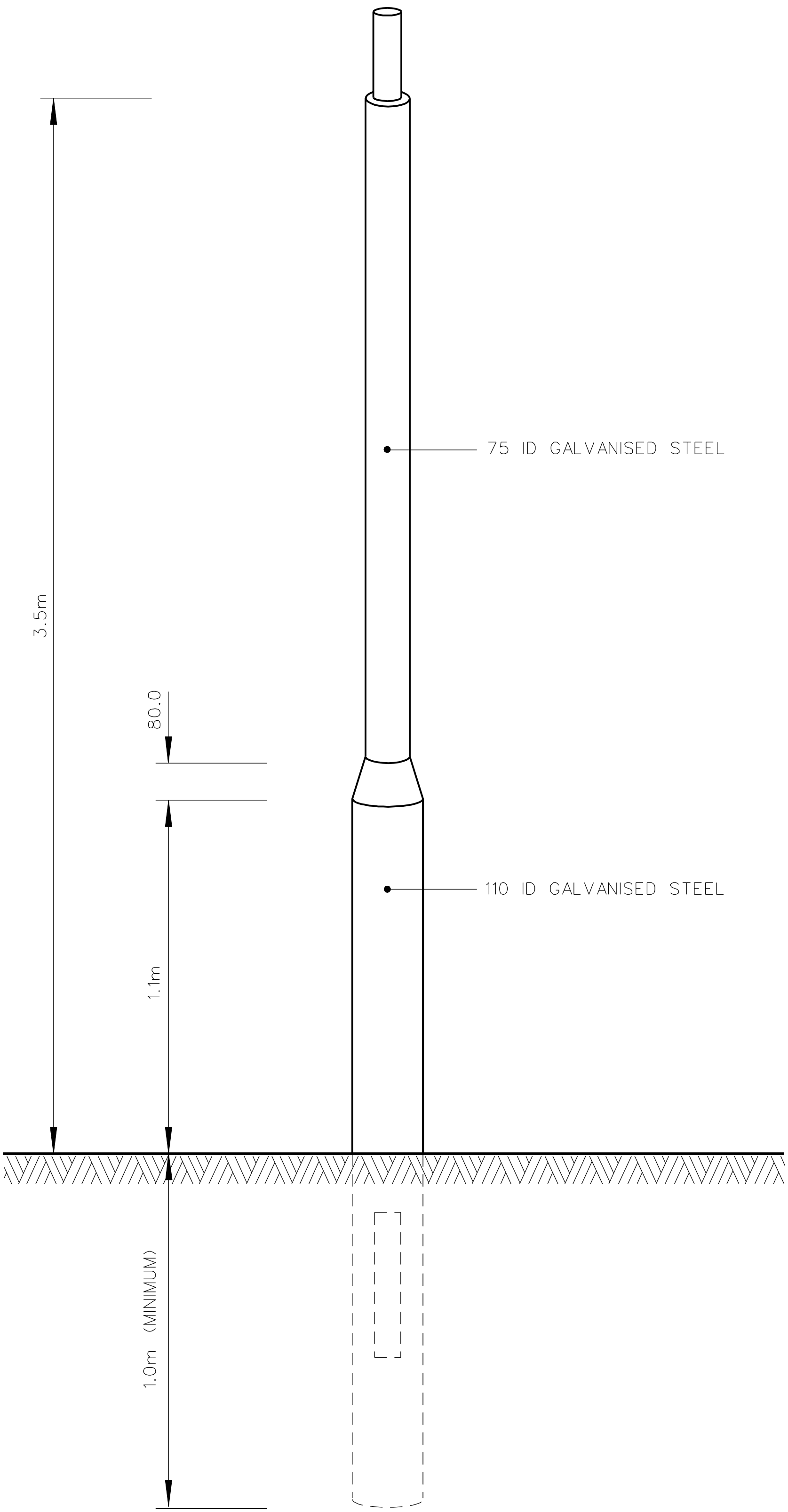

Based on CCC drawing SD501

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
		STANDARD FABRICATED LIGHT POLE	STANDARD DRAWINGS	244
				ISSUE: C / PLAN No.: 600

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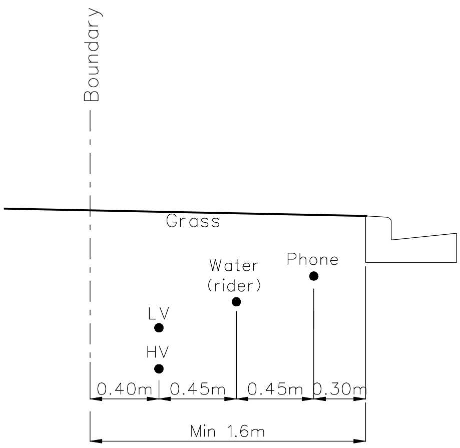
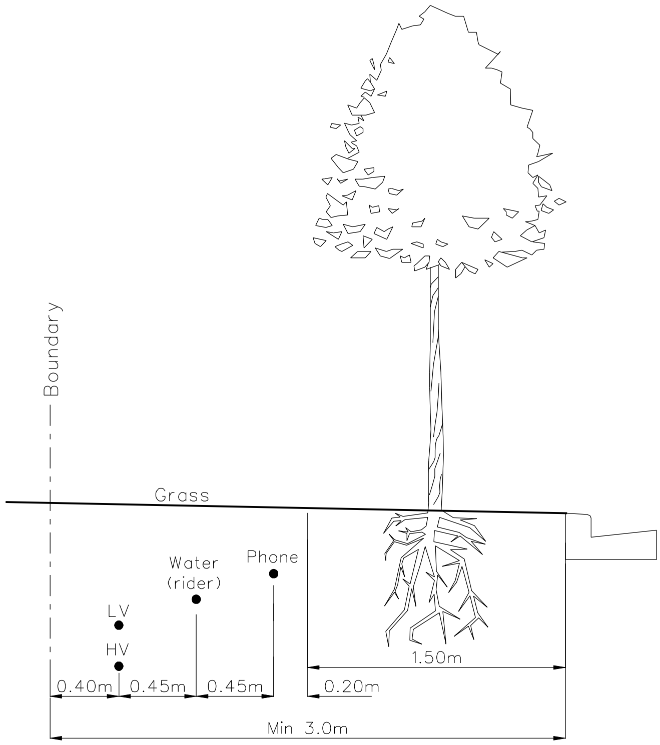
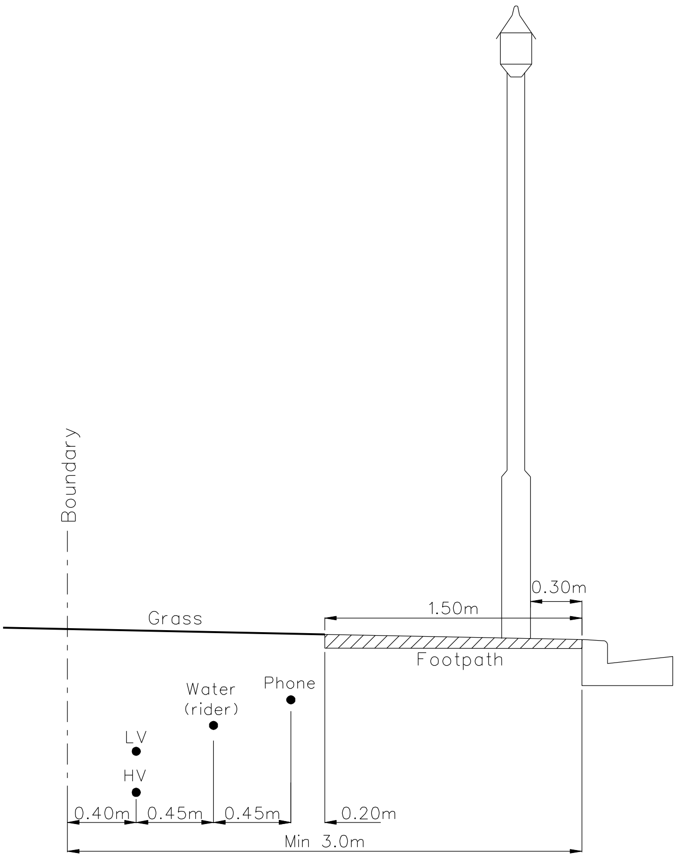
Note: The minimum width of footpath is increased to 2.0m when passing a light standard or other structure. This may overlap the services if the required width is not otherwise available. The length of the widened section shall be no more than 5m.



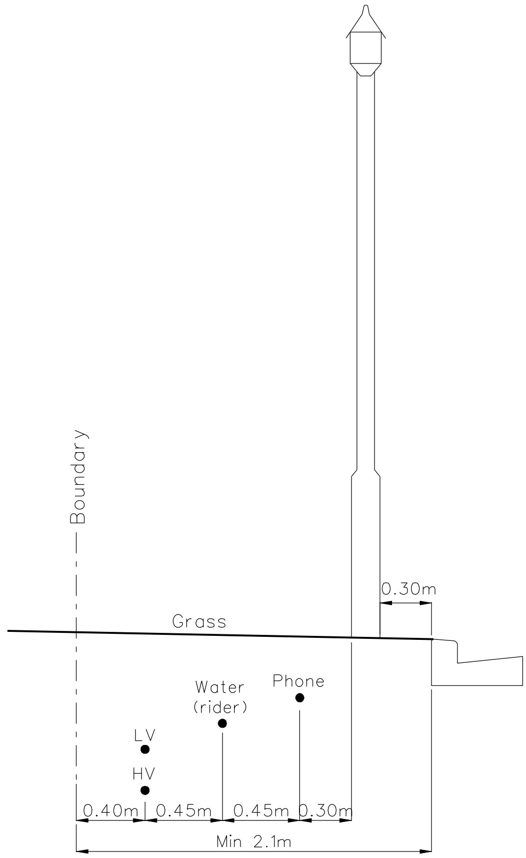
Services Only
1.6m – 2.1m wide



Services & Street Tree
3.0m – 4.5m wide



Services & Footpath
3.0m – 4.5m wide



Services & Light Standard
2.1m – 3.0m wide

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: SERVICES IN THE ROADSIDE (SHEET 1 OF 2)	PROJECT TITLE: STANDARD DRAWINGS	SHEET: 245A
				ISSUE: A — PLAN No. 600

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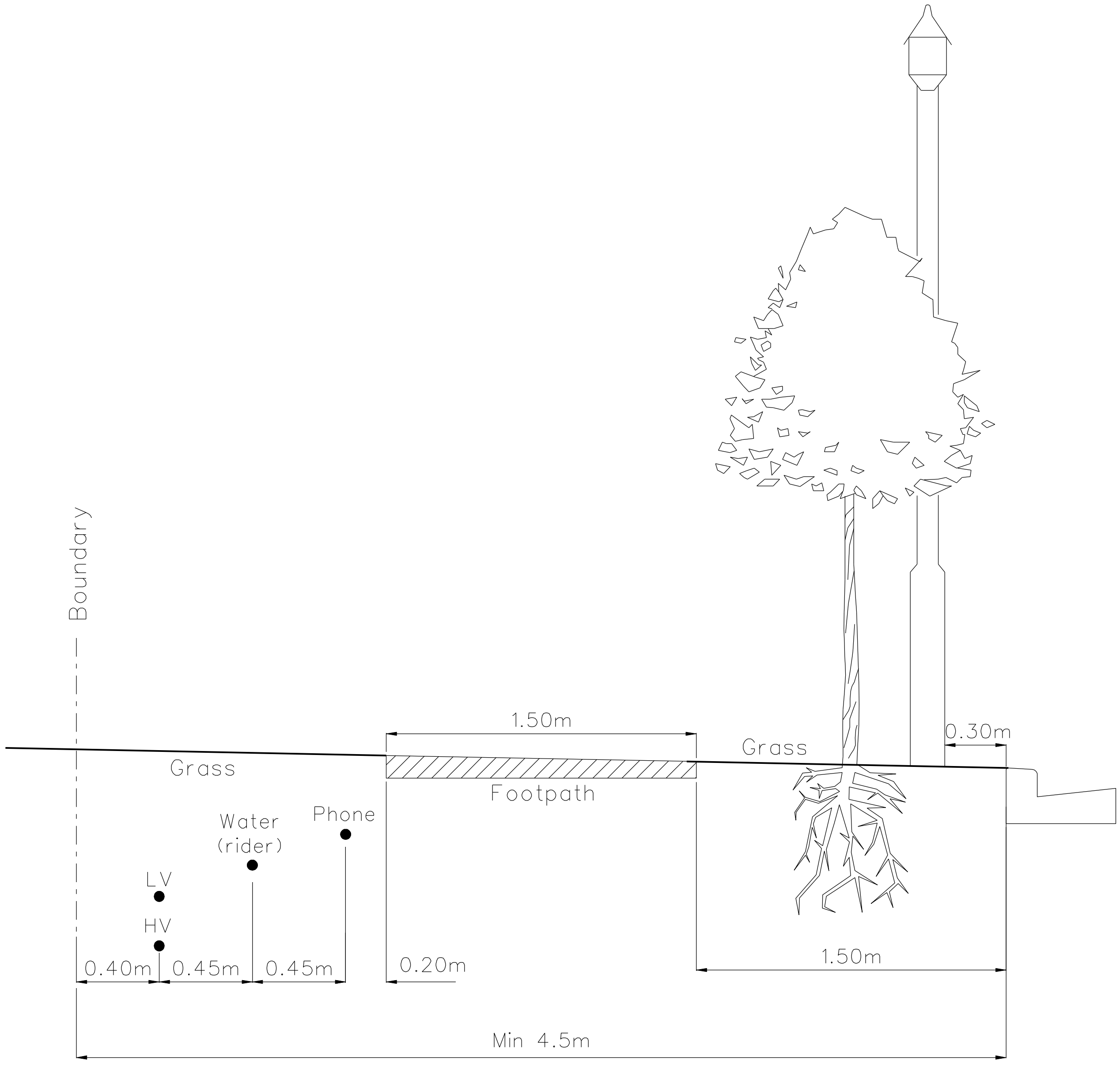

Minimum Widths for a Typical Full Width Berm
(See District Plan for required components)
Must be greater than 4.5m wide

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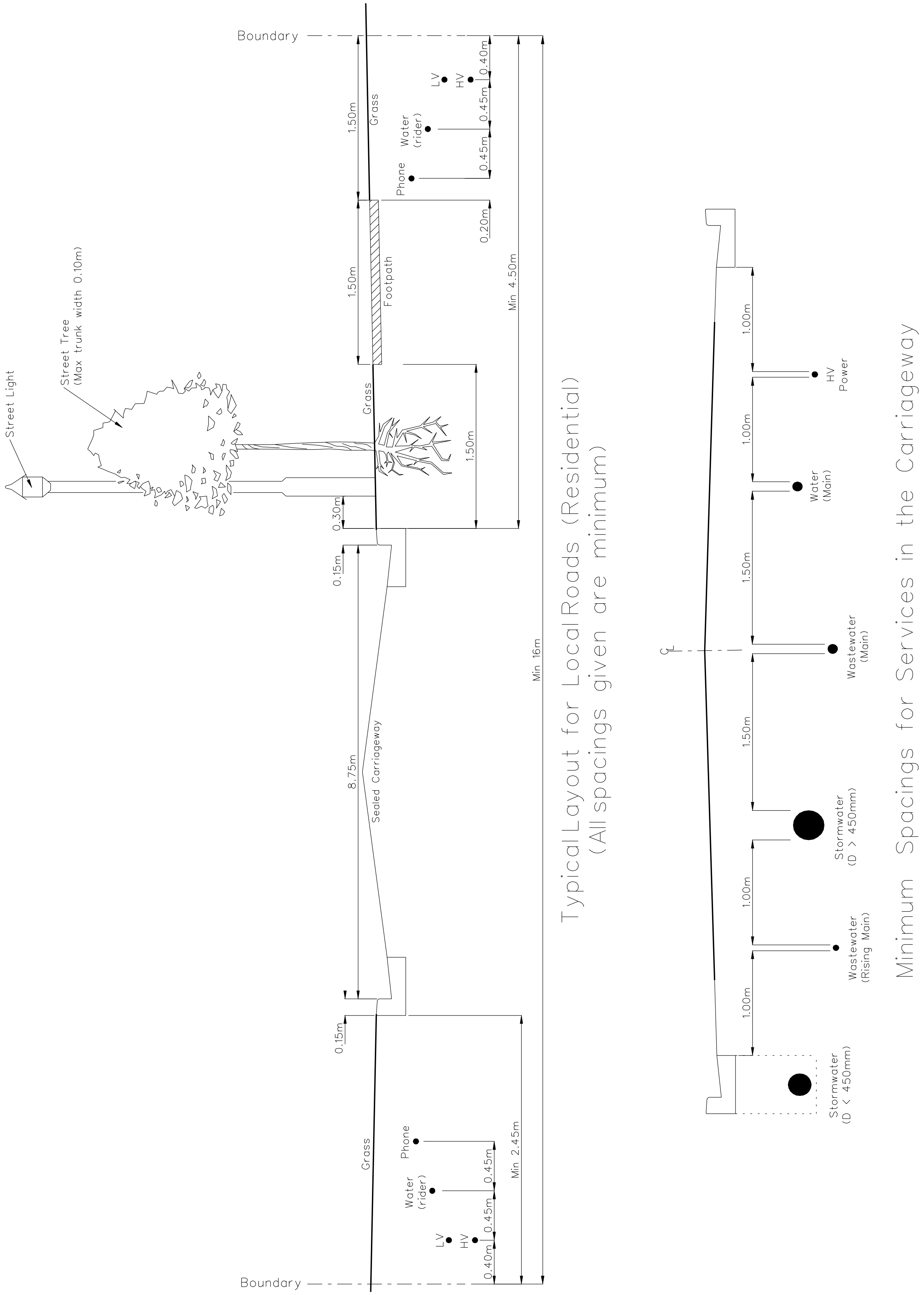
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE SERVICES IN THE ROADSIDE (SHEET 2 OF 2)	PROJECT TITLE STANDARD DRAWINGS	SHEET 245B ISSUE A PLAN No. 600



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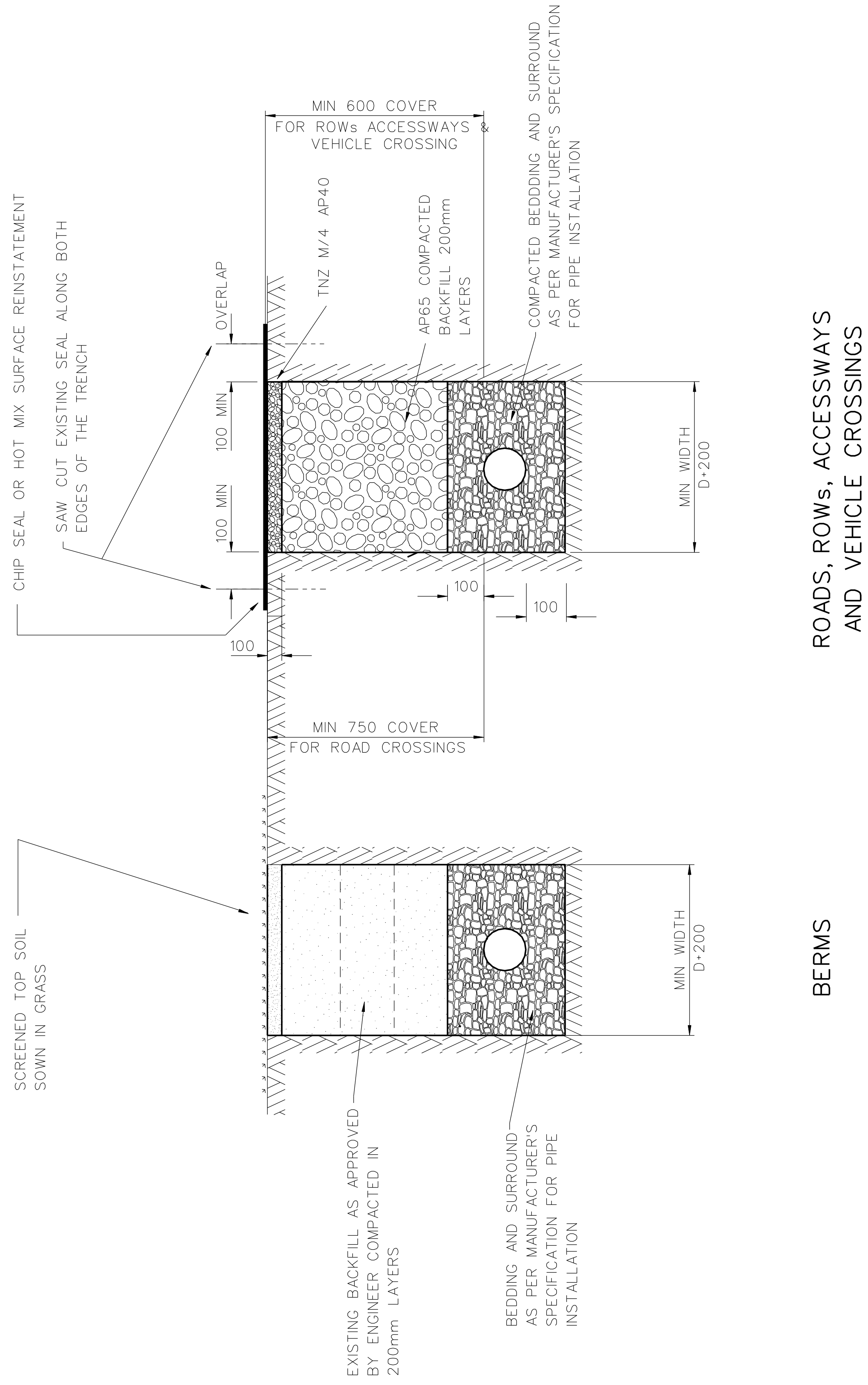
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: MINIMUM SETOUT OF SERVICES IN ROAD RESERVE	PROJECT TITLE: STANDARD DRAWINGS	SHEET: 245C
				ISSUE: D
				PLAN No.: 600



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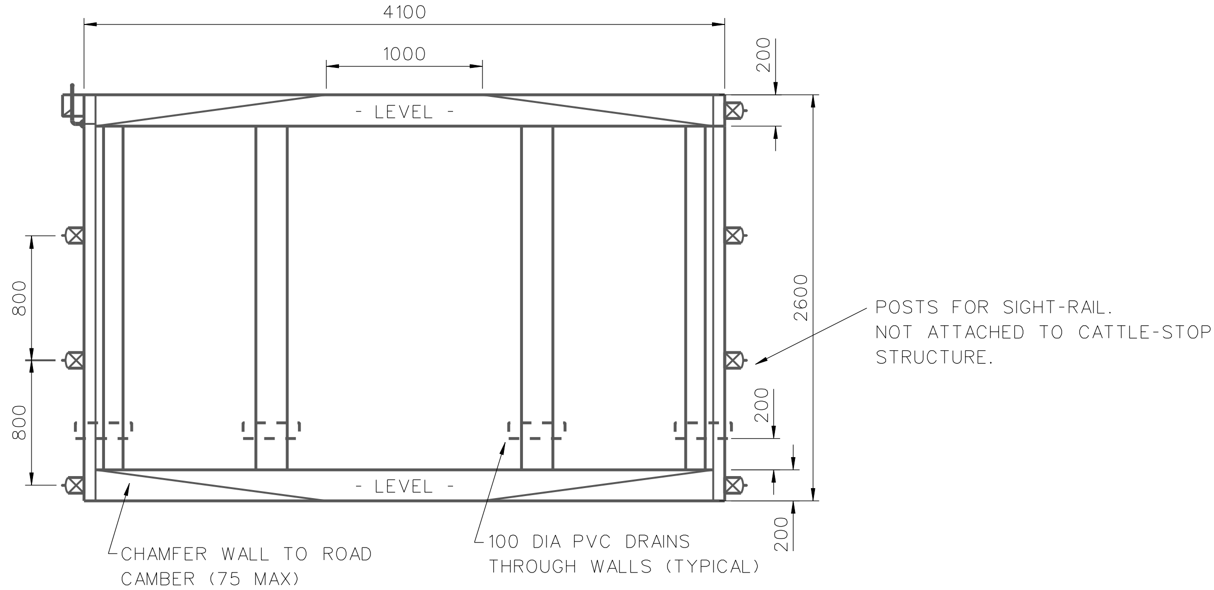
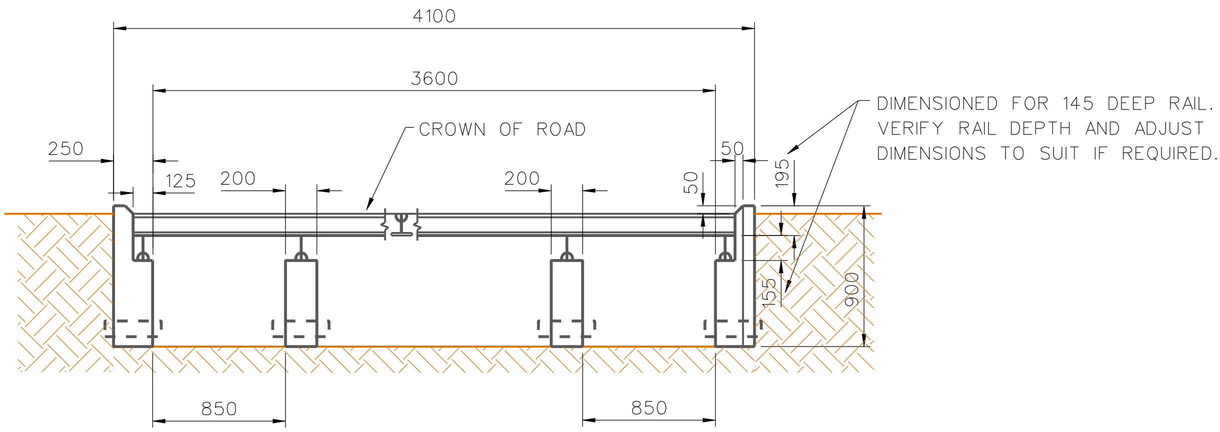
WAIMAKARIRI DISTRICT COUNCIL
technical services

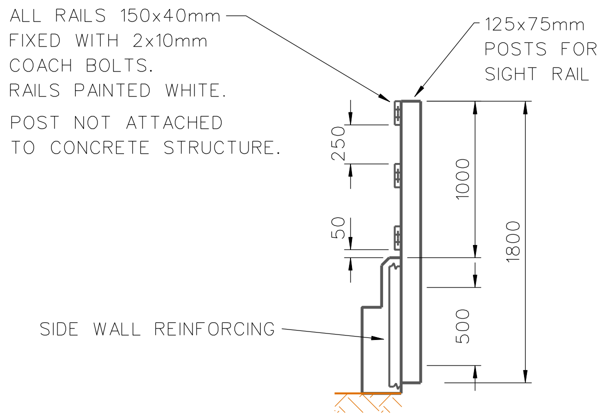
NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
	TRENCH INSTALLATION OF PVC PIPES	STANDARD DRAWINGS	246
			ISSUE: D / PLAN No.: 600



PLAN



SECTION



DETAIL

WALL STEEL & GUARD RAIL

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: CATTLE STOP PLAN & SECTION	PROJECT TITLE: STANDARD DRAWINGS	SHEET: 248A
				ISSUE: B — PLAN No. 600

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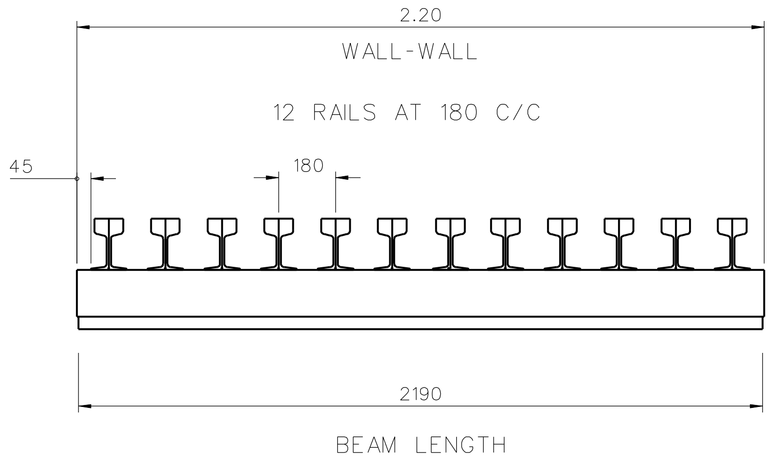
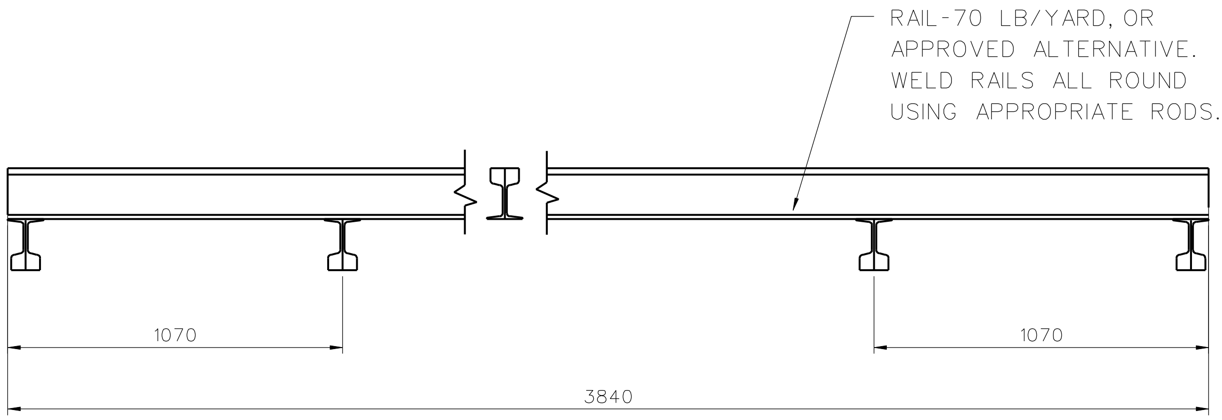
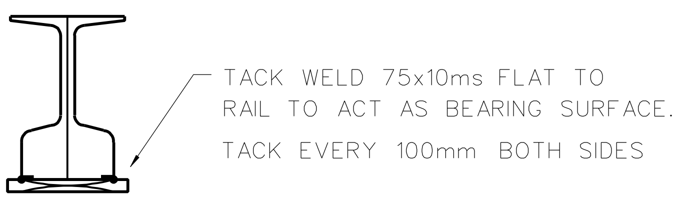




CATTLE STOP GRID - STEEL WORK



NTS

NOTE

1. SITE MEASURE WALLS BEFORE CUTTING AND FABRICATING GRID STEEL
2. AIM FOR 2 mm MINIMUM TO 5 mm MAXIMUM CLEARANCE ALL ROUND GRID.

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: CATTLE STOP STEELWORK DETAIL	PROJECT TITLE: STANDARD DRAWINGS	SHEET: 248B
				ISSUE: B / PLAN No. 600

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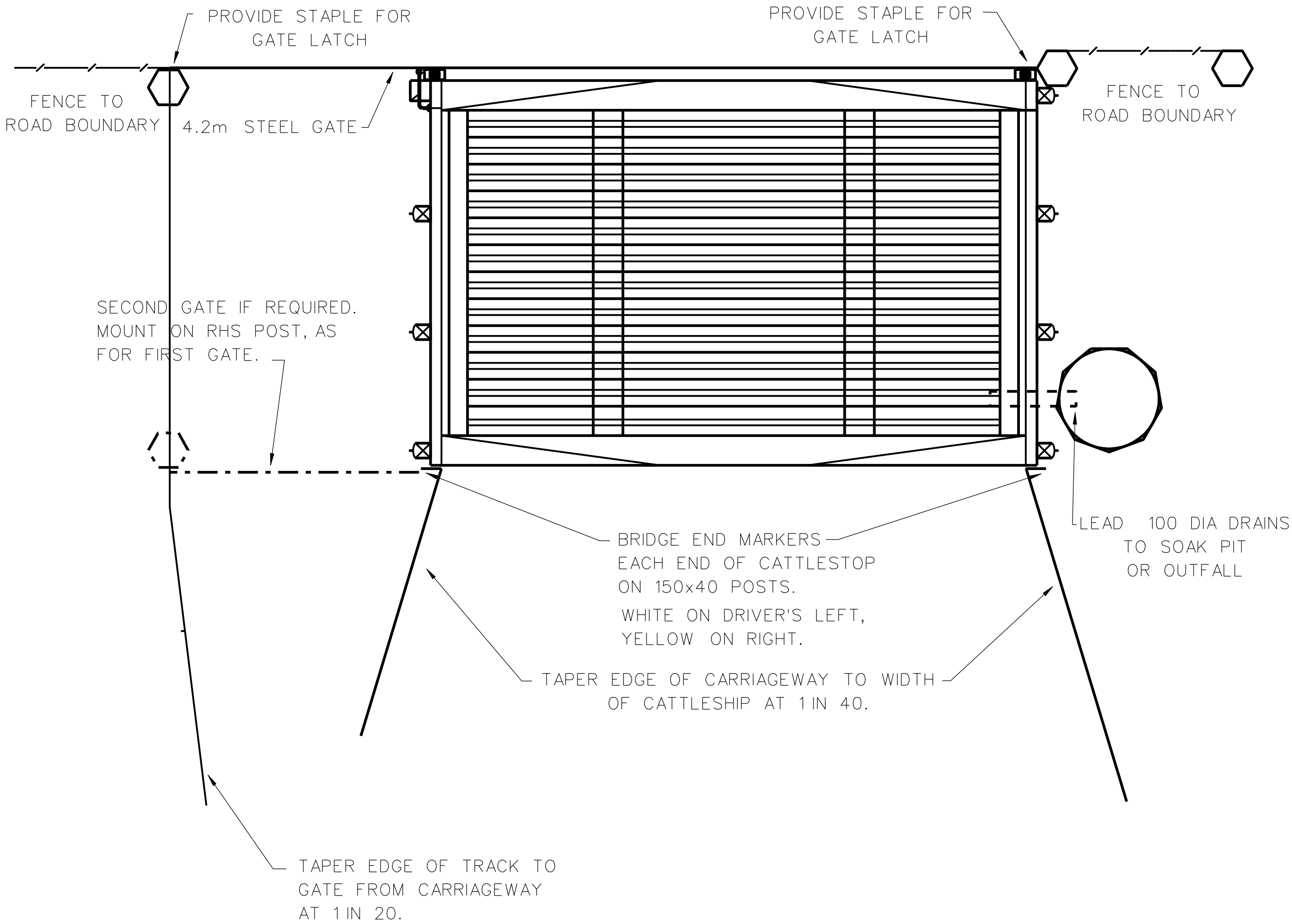

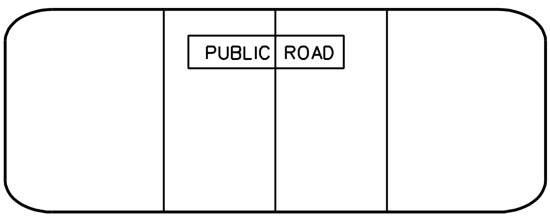

VIEW OF GATE SHOWING NOTICE TO BE FIXED TO BE VISIBLE BOTH SIDES OF EACH GATE.

NOTICE TO BE 1500 LONG BY 250 HIGH.
DOUBLE-SIDED.
BLACK TEXT (75mm HIGH "TRANSPORT MEDIUM")
ON ENGINEERING GRADE REFLECTORISED
YELLOW BACKGROUND.

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WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
		CATTLE STOP GENERAL LAYOUT	STANDARD DRAWINGS	248C
				ISSUE B / PLAN No. 600

Sign Dimensions

Urban (Small)	– 600mm	x 1200mm
Urban (Large)	– 900mm	x 1800mm
Rural	– 1200mm	x 2400mm

Font: Myriad Pro

Colours as indicated:

WDC Blue	– Pantone: 2925
	– CMYK: 84/23/0/0
Green	– Pantone: 369 U
	– CMYK: 50/0/70/29
Black	– Pantone: Black 3
	– CMYK: 10/10/10/100

IMPORTANT: THIS DRAWING IS AN EXAMPLE ONLY
USE APPROVED FILE "600–sht250–d (PRINTER).pdf" TO CREATE SIGN

WORDING FOR THE "PROMOTIONAL LINE", "PROJECT TITLE" AND "PROJECT DETAIL" SHOULD BE CONFIRMED WITH THE COMMUNICATIONS ADVISOR

WAIMAKARIRI DISTRICT COUNCIL
technical services

NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET		
	CONSTRUCTION INFO SIGN	STANDARD DRAWINGS	250	ISSUE: D	PLAN No.: 600

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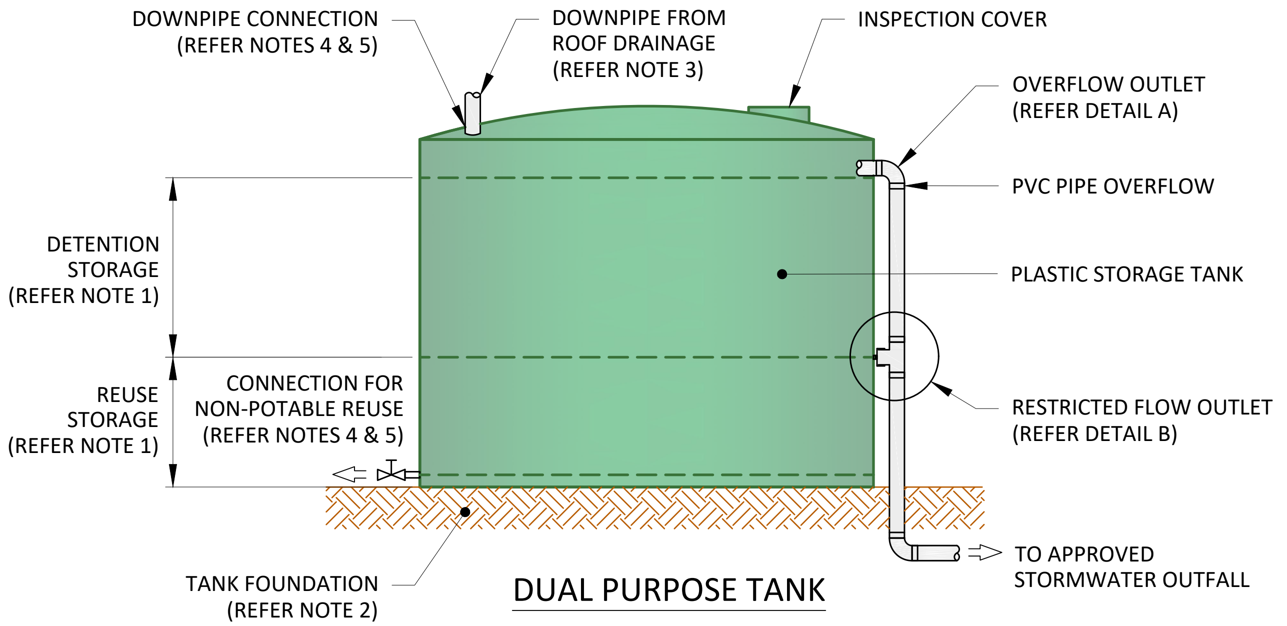
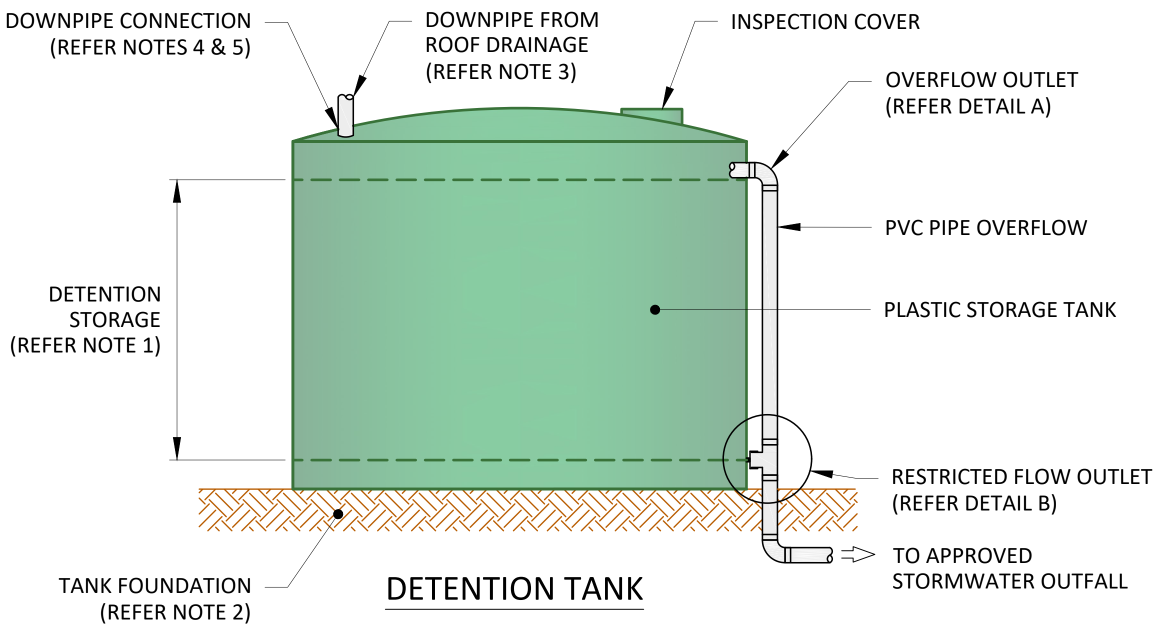
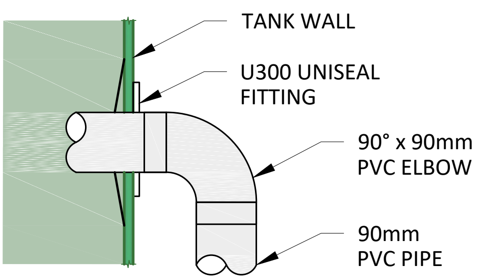


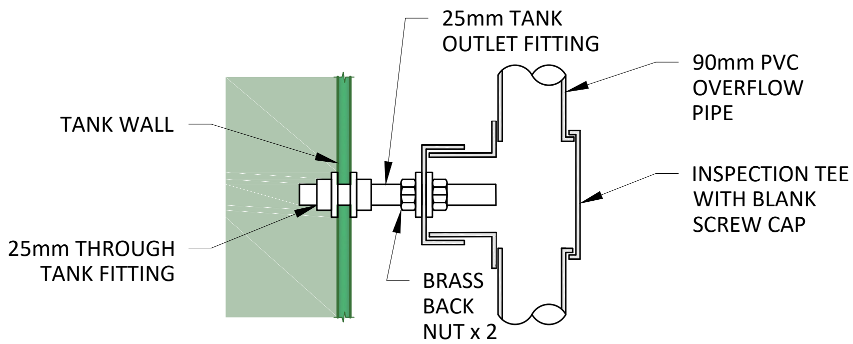
DUAL PURPOSE TANK



DETENTION TANK



DETAIL A

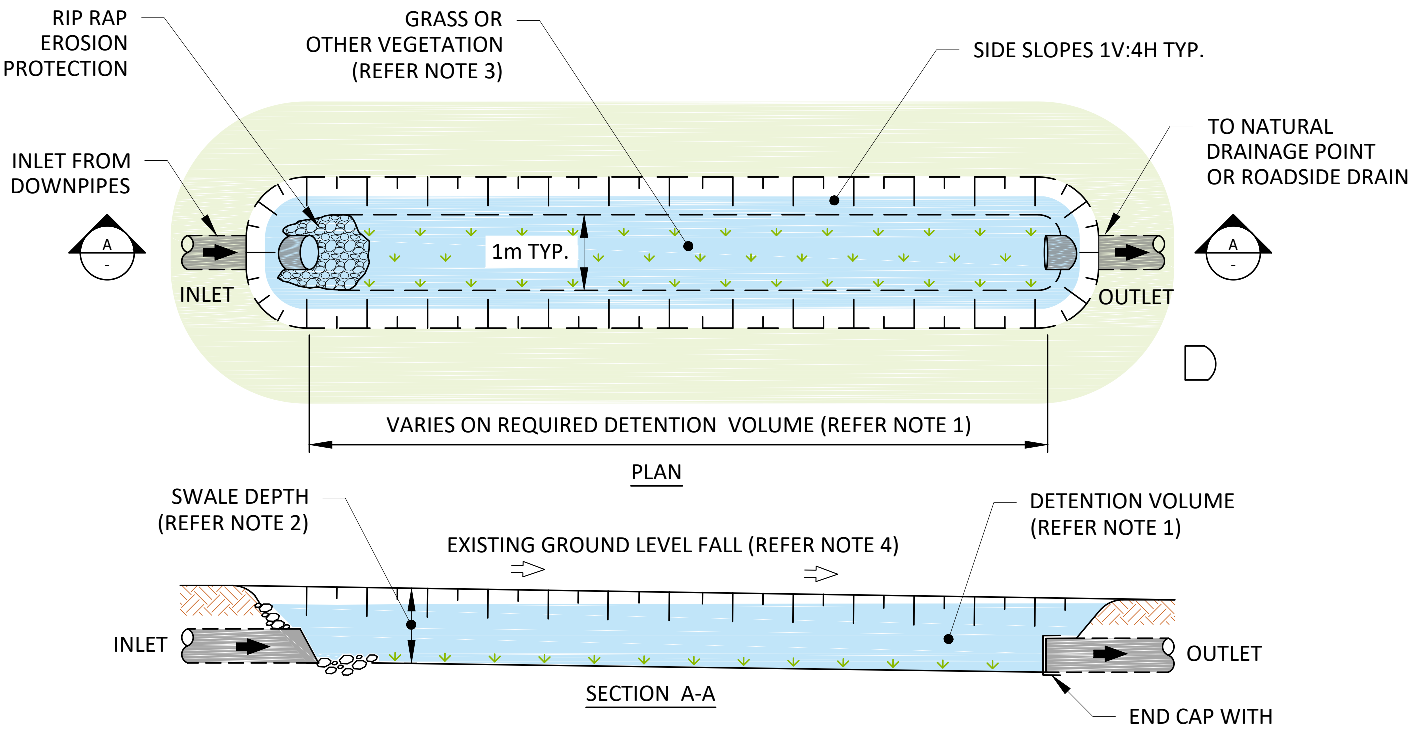


DETAIL B

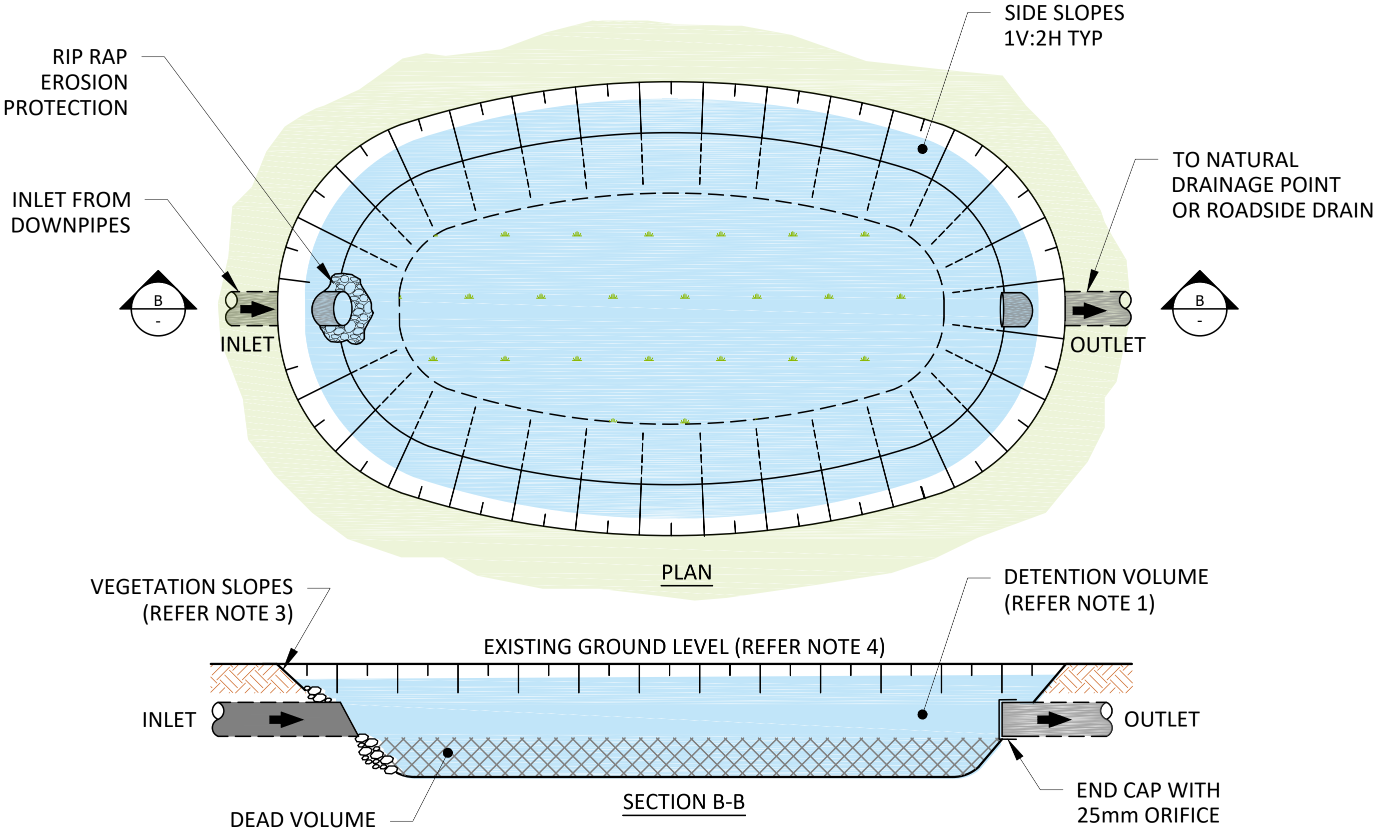
NOTES:

1. TANK SIZE BASED ON PROVIDING A DETENTION STORAGE VOLUME OF $2m^3$ PER $100m^2$ OF ROOF AREA. REUSE STORAGE VOLUME IS TYPICALLY HALF THE DETENTION STORAGE VOLUME.
2. TANK FOUNDATION AND FIXING TO GROUND TO BE IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS.
3. DEBRIS DIVERTER/LEAF GUARD TO BE INSTALLED ON DOWNPIPES IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS.
4. FIT UNISEAL IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS.
5. HOLES DRILLED THROUGH TANK WALL TO BE IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS.

WAIMAKARIRI DISTRICT COUNCIL	PROJECT TITLE: ONSITE STORMWATER TANKS	SHEET TITLE: STANDARD DRAWINGS	SHEET: 251
			ISSUE: B / PLAN No. 600



DETENTION SWALE PLAN



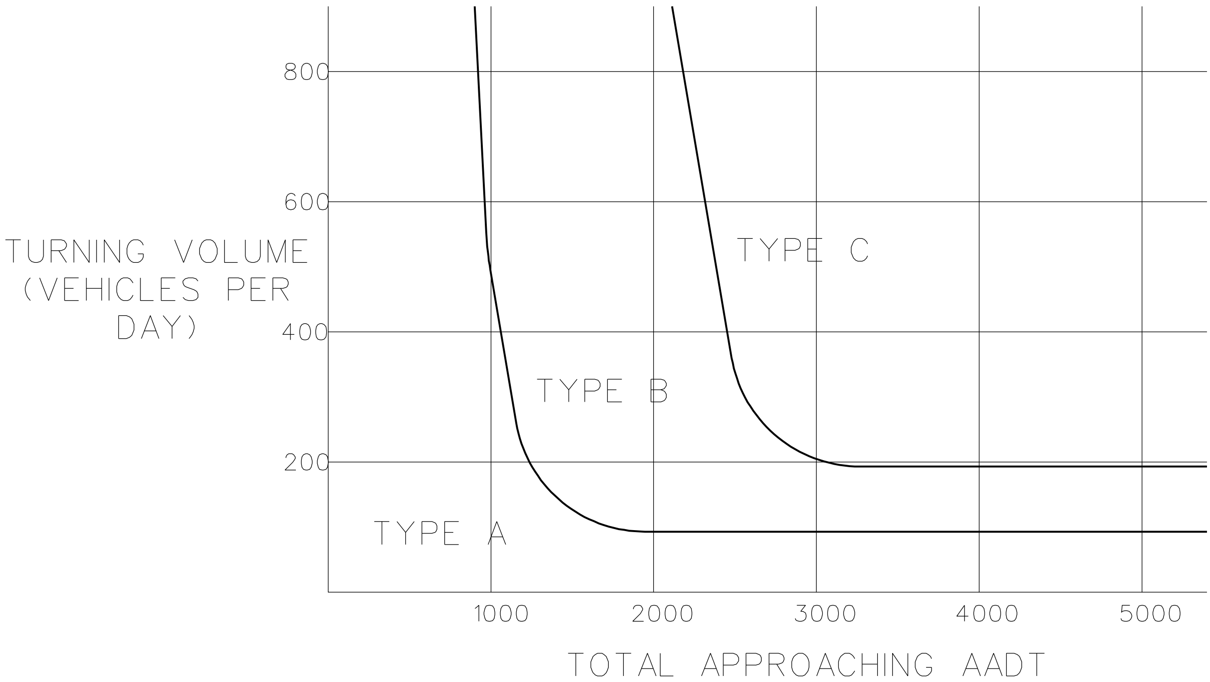
DETENTION POND

NOTES:

1. DETENTION VOLUME SIZING - PROVIDE 2m³ OF STORAGE VOLUME PER 100m² OF ROOF AREA.
2. INVERT LEVEL OF SWALE TO BE ABOVE THE SEASONAL HIGH GROUNDWATER LEVEL.
3. SLOPES TO BE VEGETATED WITH GRASS (FOR SWALES) OR SUITABLE 'LOWER BANK' VEGETATION AS SET OUT IN THE CHRISTCHURCH CITY COUNCIL STREAMSIDE PLANTING GUIDE.
4. DETENTION PONDS ARE GENERALLY SUITED TO FLAT LAND, WHILE DETENTION SWALES ARE GENERALLY SUITED TO LAND WITH A FALL (<1:100) IN STEEPER AREAS (>1:50) CHECK DAMS MAY NEED TO BE PROVIDED TO ACHIEVE THE REQUIRED DETENTION VOLUME.
5. DETENTION PONDS WITH SHALLOW DEAD STORAGE DEPTHS MAY NOT BE SUITABLE IN SOME LOCATIONS, DUE TO THE POTENTIAL FOR INSECTS AND MIDGES TO BREED. DETENTION PONDS WITH DEEP STORAGE DEPTHS WILL NEED TO CONSIDER THE REQUIREMENTS OF BUILDING CODE CLAUSE F9.

WAIMAKARIRI DISTRICT COUNCIL	PROJECT TITLE	SHEET TITLE	SHEET
	ONSITE DETENTION SWALE / POND	STANDARD DRAWINGS	252
			ISSUE A / PLAN No. 600

INTERSECTION - TYPE DECISION CHART



Use this chart to determine which of the standard details attached is the most appropriate." Turning volumes for cross-roads are single-leg volumes but the greater volume sets the standard for both sides of the intersection

NOTES:

1) This standard is to be regarded as a minimum treatment.
2) Design vehicle: B-Train
3) For pavement markings refer to Transit New Zealand MOTSAM, Part II: Markings.
4) Dimensions to pavement markings are to the centreline of the marking.
5) All pavement markings are a minimum of 100mm wide unless otherwise specified.
6) A minimum berm width of 2.0m shall be established.
7) Where location of legal boundary prevents 15.0m radius on kerbs this may be reduced in consultation with the roading manager.
8) If cycle lanes are required specific design will be necessary.
9) Where there are tapered lanes, RRPM's are to start 25m before the start of taper.

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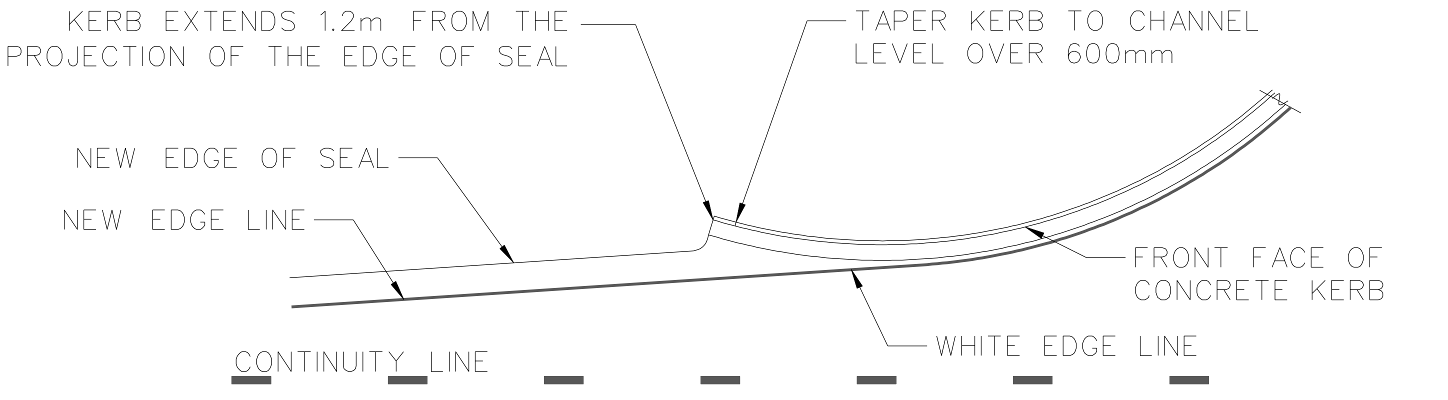
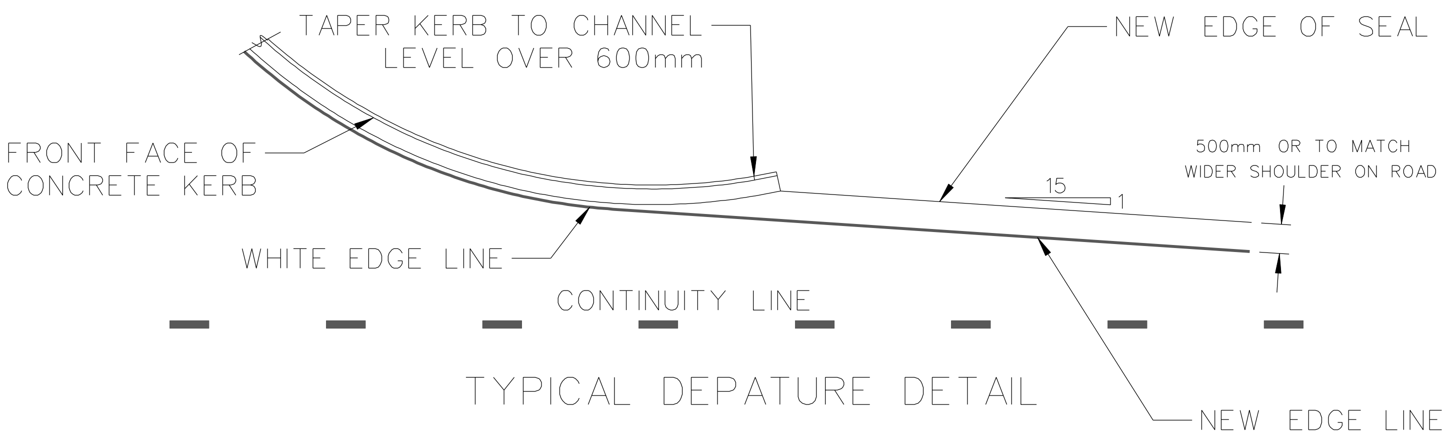
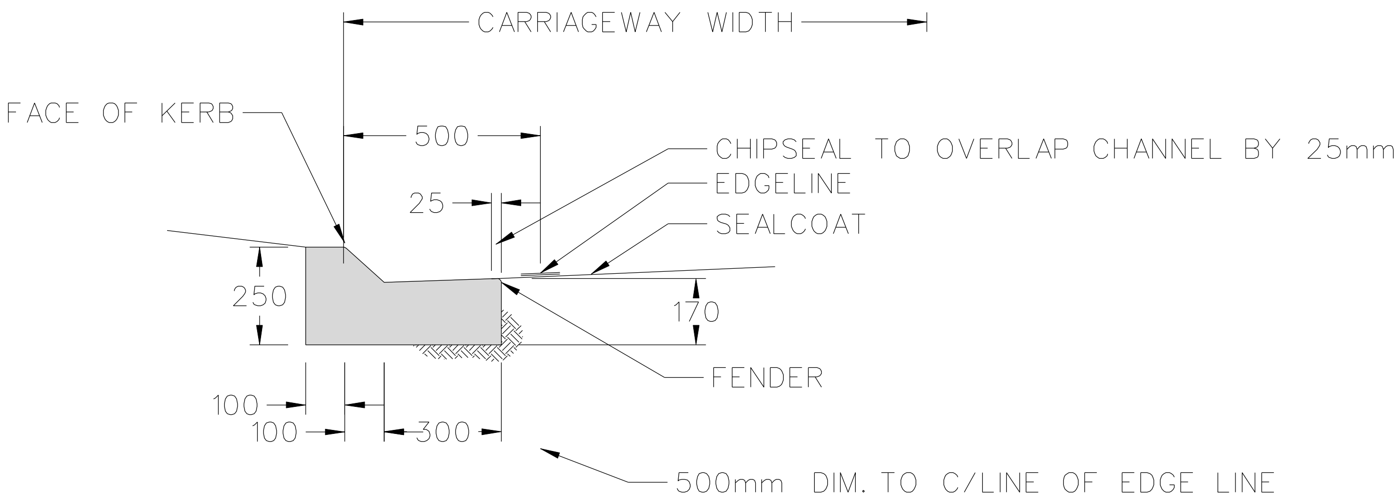
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: STANDARD RURAL "X" & "T" JUNCTIONS NOTES	PROJECT TITLE: STANDARD DRAWINGS	SHEET: 260A ISSUE: B PLAN No.: 600



TYPICAL APPROACH DETAIL



TYPICAL DEPATURE DETAIL



MOUNTABLE KERB & CHANNEL DETAIL

WAIMAKARIRI DISTRICT COUNCIL
technical services

NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
	STANDARD RURAL JUNCTION DETAIL QUADRANT KERB	STANDARD DRAWINGS	260B
			ISSUE: C / PLAN No. 600

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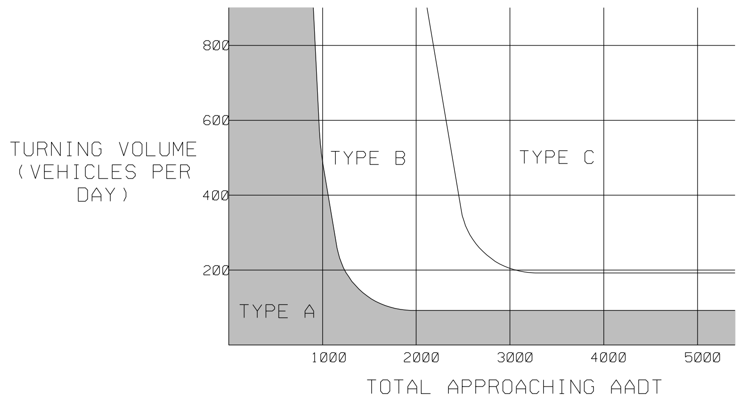
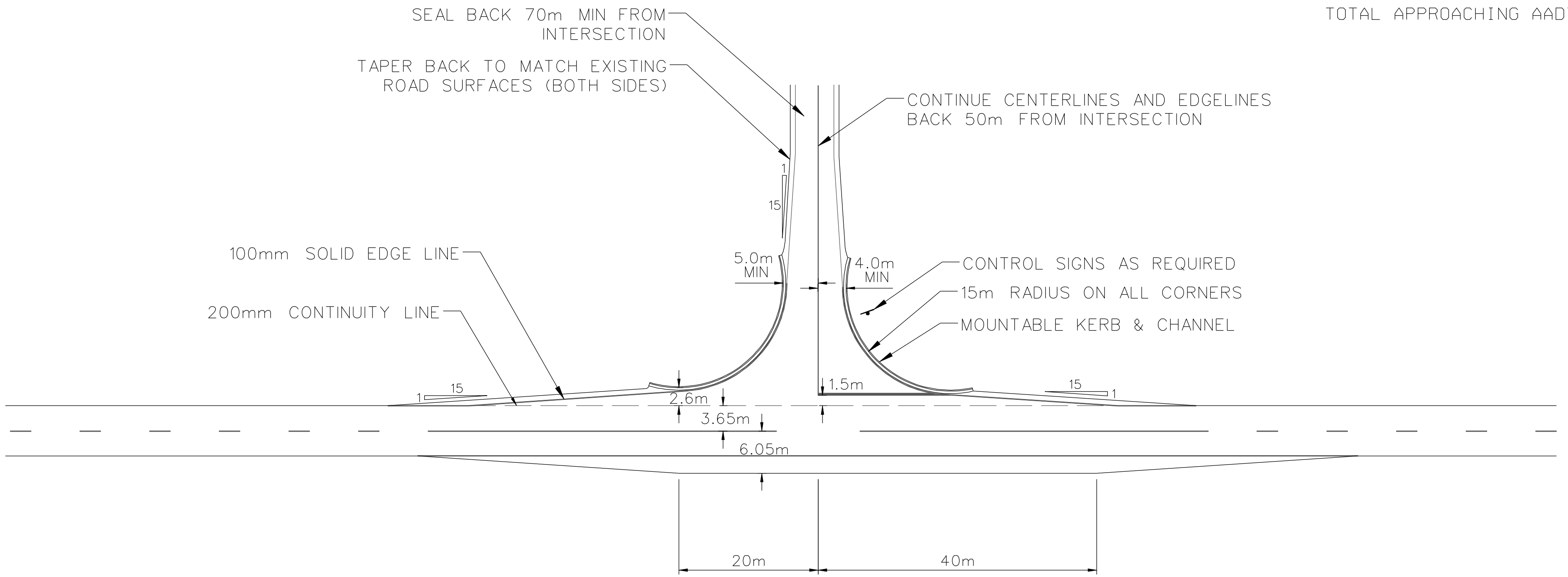
NOTES:
1) Where heavy vehicles make a significant proportion of the left-turning traffic, the entry width will need to be reviewed.
2) Where side road volumes are less than AADT 50 or heavy vehicles less than 4 per day, then kerb & channel may be replaced with an additional 1.0m width of seal





WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: STANDARD RURAL "T" JUNCTION TYPE A	PROJECT TITLE: STANDARD DRAWINGS	SHEET 261A; ISSUE F; PLAN No. 600

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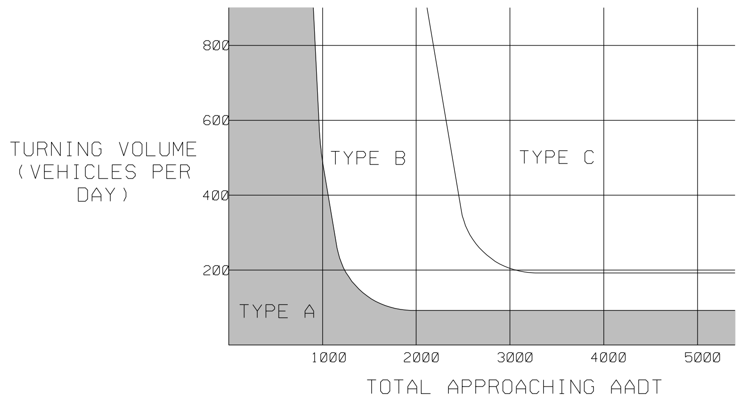
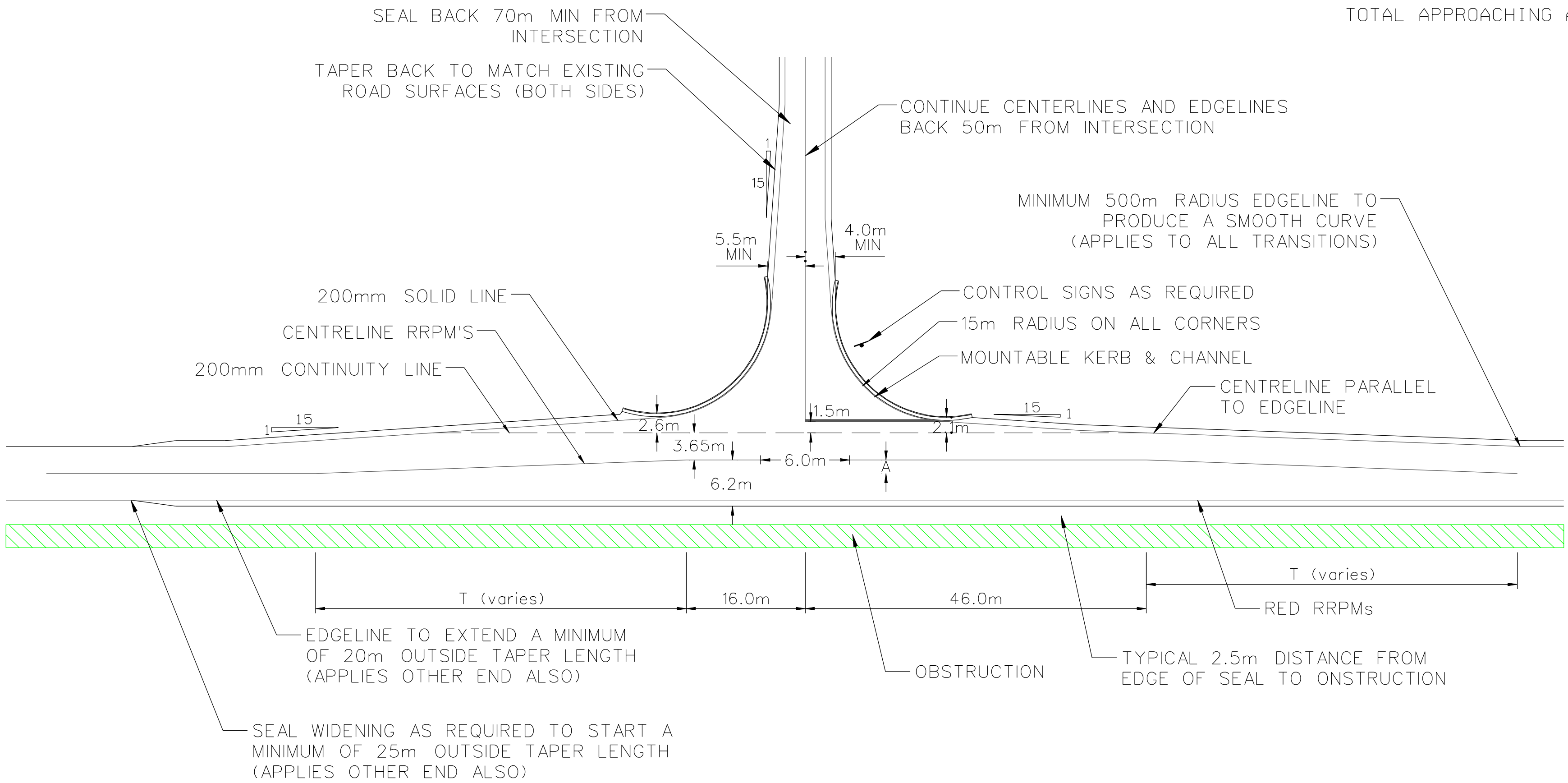
NOTES:
1) Where heavy vehicles make a significant proportion of the left-turning traffic, the entry width will need to be reviewed.
2) Where side road volumes are less than AADT 50 or heavy vehicles less than 4 per day, then kerb & channel may be replaced with an additional 1.0m width of seal.





A = Centreline offset = Half the lane width

T = Length of flush median taper (VxA)/2.16 (Round to nearest 5m)
where V = Operating (85 percentile) Speed

WAIMAKARIRI DISTRICT COUNCIL
technical services

NOT TO SCALE

SHEET TITLE
STANDARD RURAL "T" JUNCTION TYPE A (Constraint)

PROJECT TITLE
STANDARD DRAWINGS

SHEET
261B

ISSUE
F

PLAN No.
600

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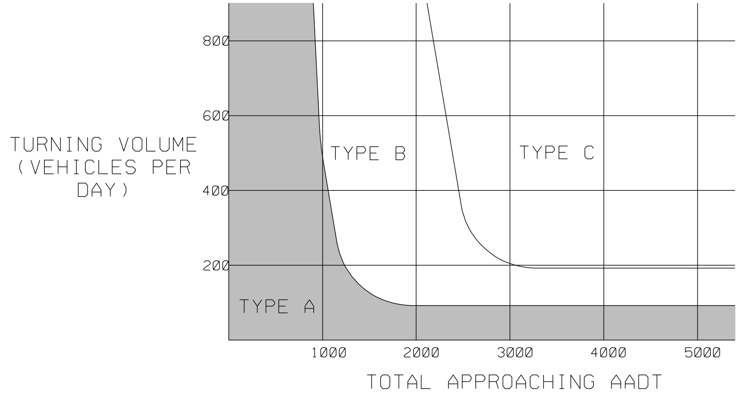
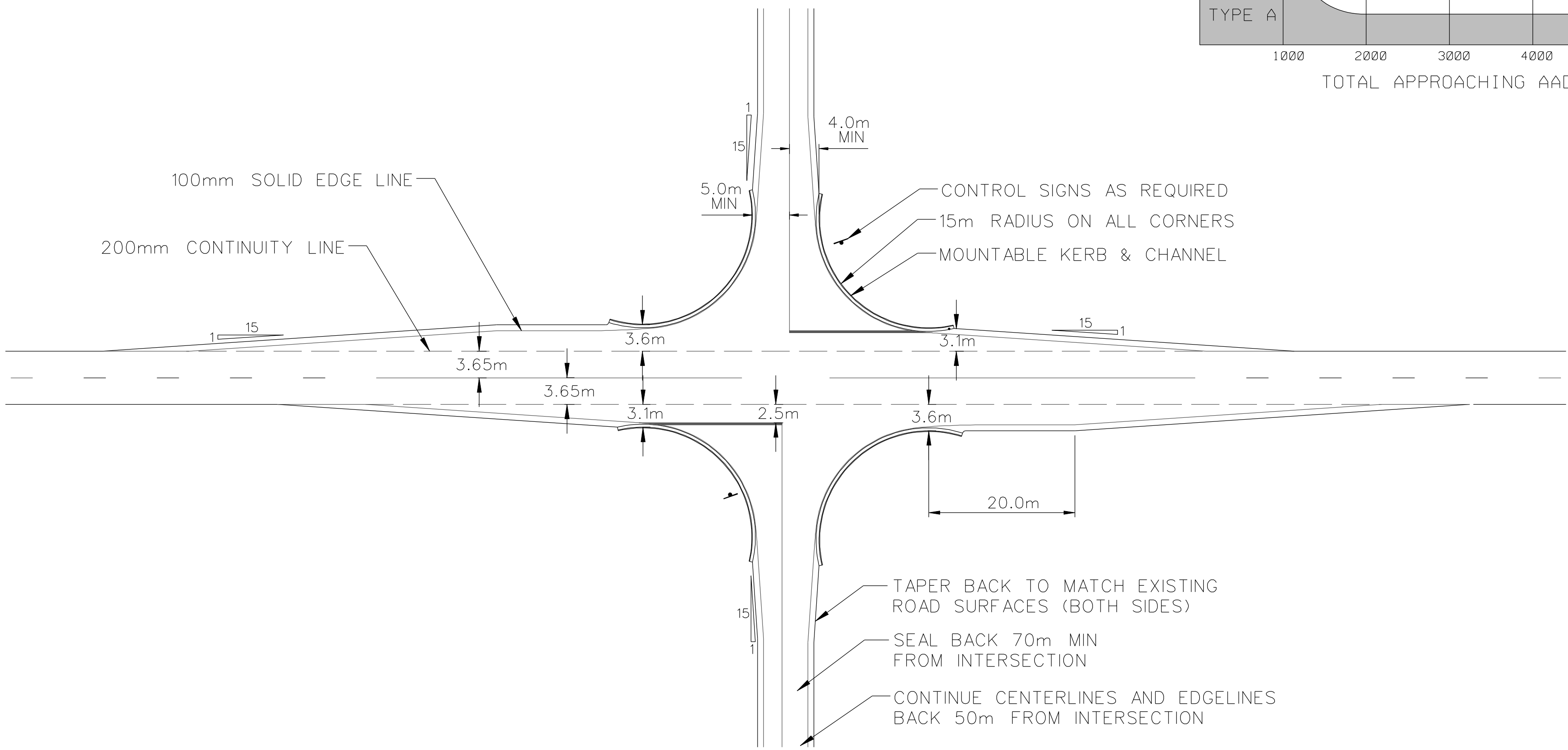
NOTES:

1) Where heavy vehicles make a significant proportion of the left-turning traffic, the entry width will need to be reviewed.
2) Where side road volumes are less than AADT 50 or heavy vehicles less than 4 per day, then kerb & channel may be replaced with an additional 1.0m width of seal





WAIMAKARIRI DISTRICT COUNCIL technical services

NOT TO SCALE

SHEET TITLE: STANDARD RURAL "X" JUNCTION TYPE A

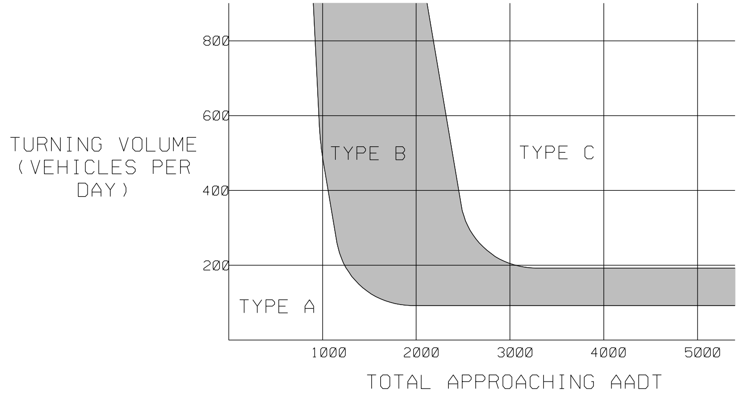
PROJECT TITLE: STANDARD DRAWINGS

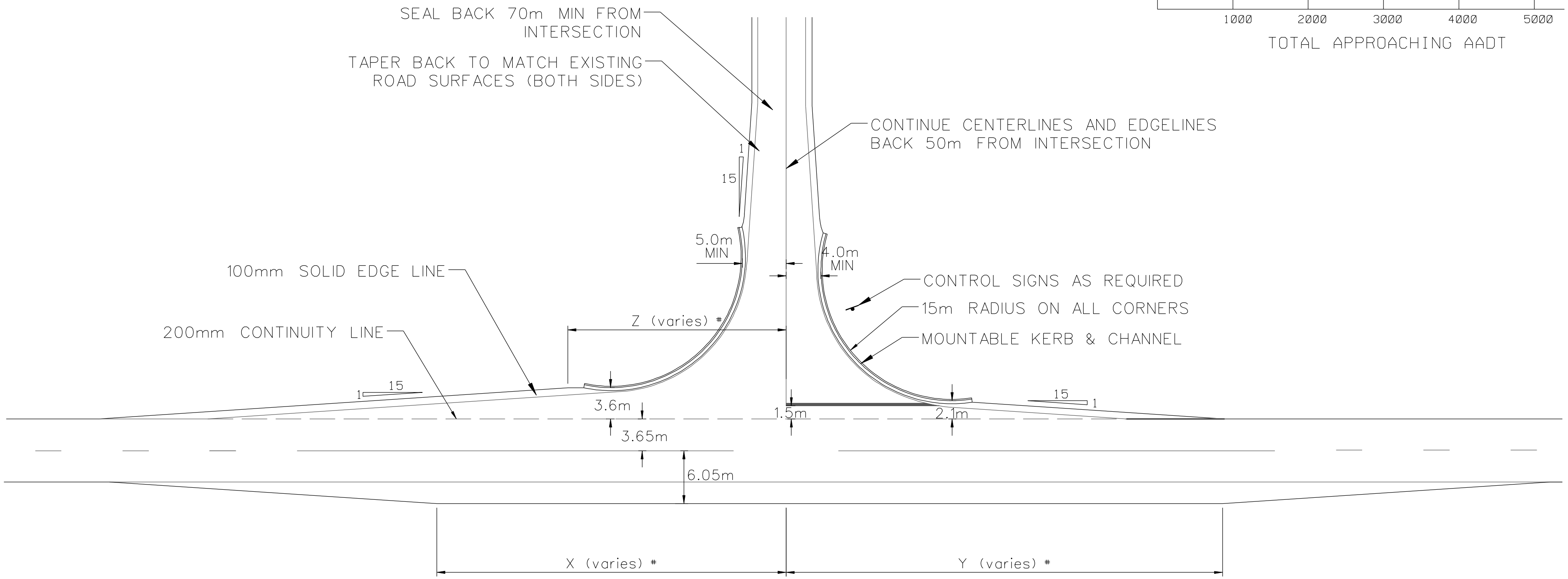
SHEET: 261C

ISSUE: F

PLAN No.: 600

NOTES:
1) Minimum pavement markings shall consist of solid intersection lines on the through road and appropriate intersection controls on the side road.





* DRAWN FOR 80KM/H TREATMENT, REFER TO TABLE FOR OTHER SPEEDS

DIMENSION	OPERATING SPEED (km/h) 80	90	100
X	40m	45m	55m
Y	50m	55m	65m
Z	25m	30m	35m

WAIMAKARIRI DISTRICT COUNCIL technical services

NOT TO SCALE

SHEET TITLE
STANDARD RURAL "T" JUNCTION TYPE B

PROJECT TITLE
STANDARD DRAWINGS

SHEET 262A

ISSUE F

PLAN No. 600

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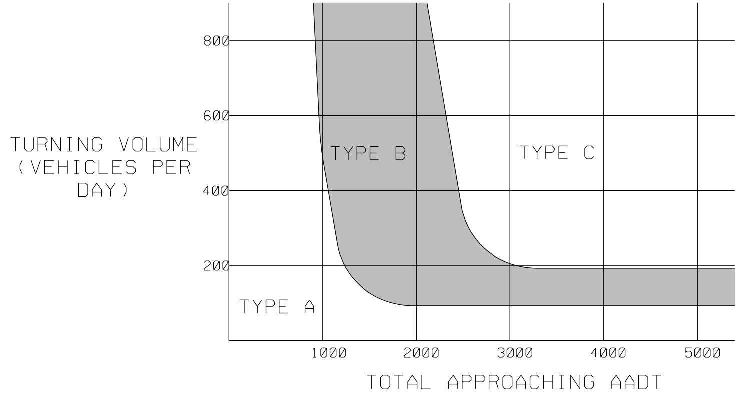
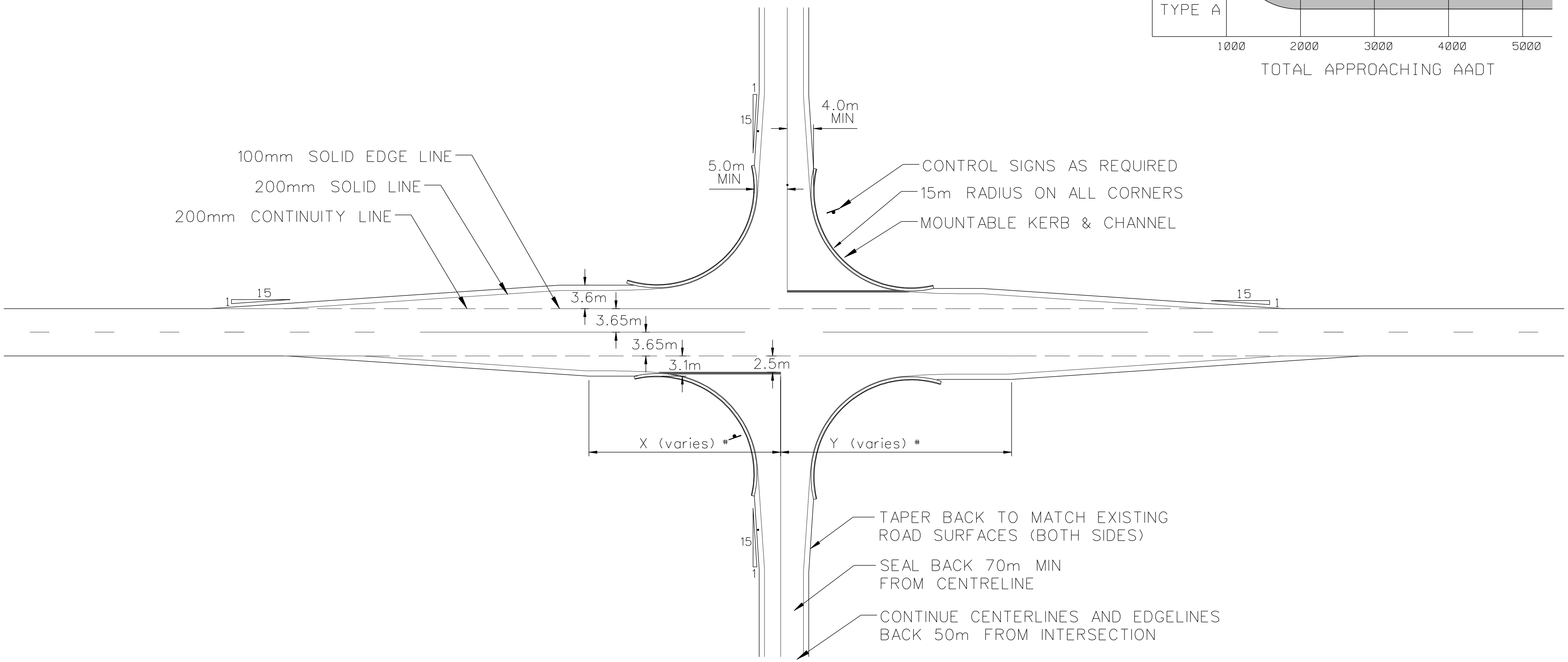
NOTES:
1) Minimum pavement markings shall consist of solid intersection lines on the through road and appropriate intersection controls on the side road





DRAWN FOR 80KM/H TREATMENT, REFER TO TABLE FOR OTHER SPEEDS

	OPERATING SPEED		
DIMENSION	80 km/h	90 km/h	100 km/h
X	40.0m	45.0m	55.0m
Y	50.0m	55.0m	65.0m

WAIMAKARIRI DISTRICT COUNCIL
technical services

NOT TO SCALE

SHEET TITLE
STANDARD RURAL "X" JUNCTION TYPE B

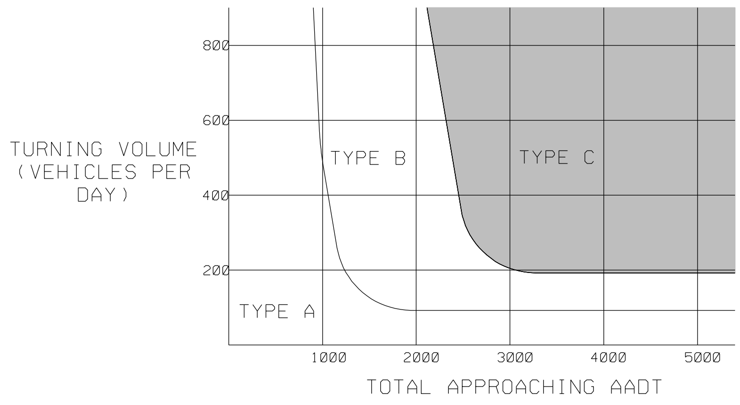
PROJECT TITLE
STANDARD DRAWINGS

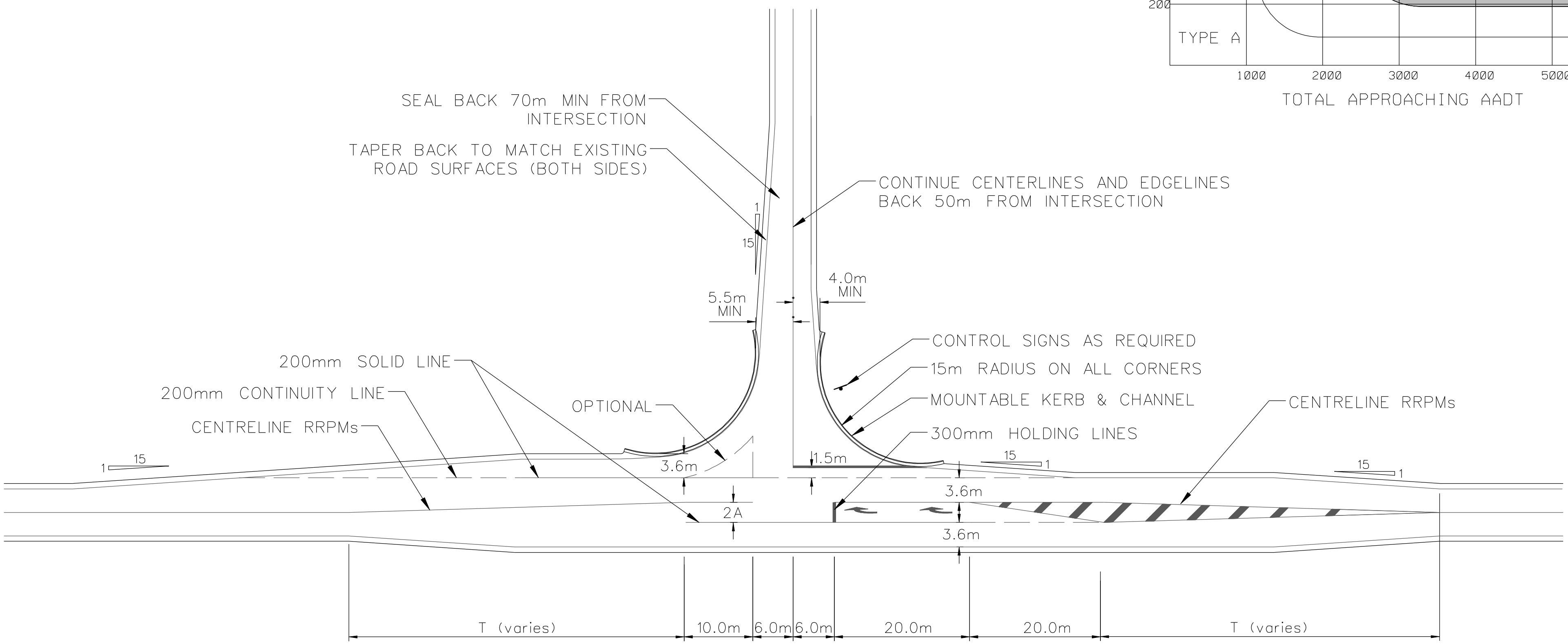
SHEET
262B

ISSUE
F

PLAN No.
600

NOTES:
1) Minimum pavement markings shall consist of solid intersection lines on the through road and appropriate intersection controls on the side road
2) RRPM's to start 25m before the start of taper (T).





A = Centreline offset = Half the lane width

T = Length of flush median taper (VxA)/2.16 (Round to nearest 5m)
where V = Operating (85 percentile) Speed

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: STANDARD RURAL "T" JUNCTION TYPE C	PROJECT TITLE: STANDARD DRAWINGS

SHEET 263A

ISSUE F

PLAN No. 600

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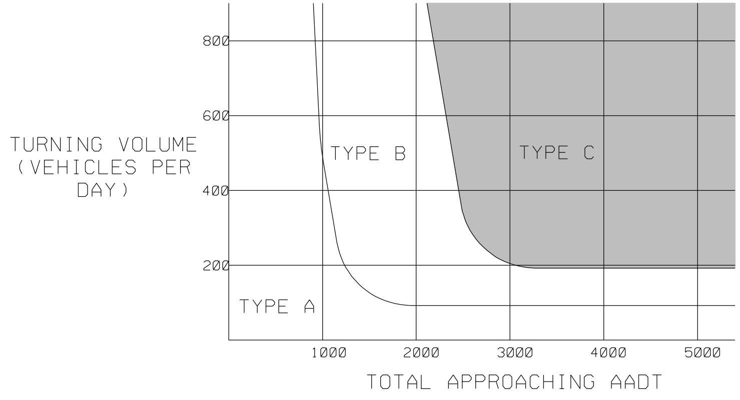
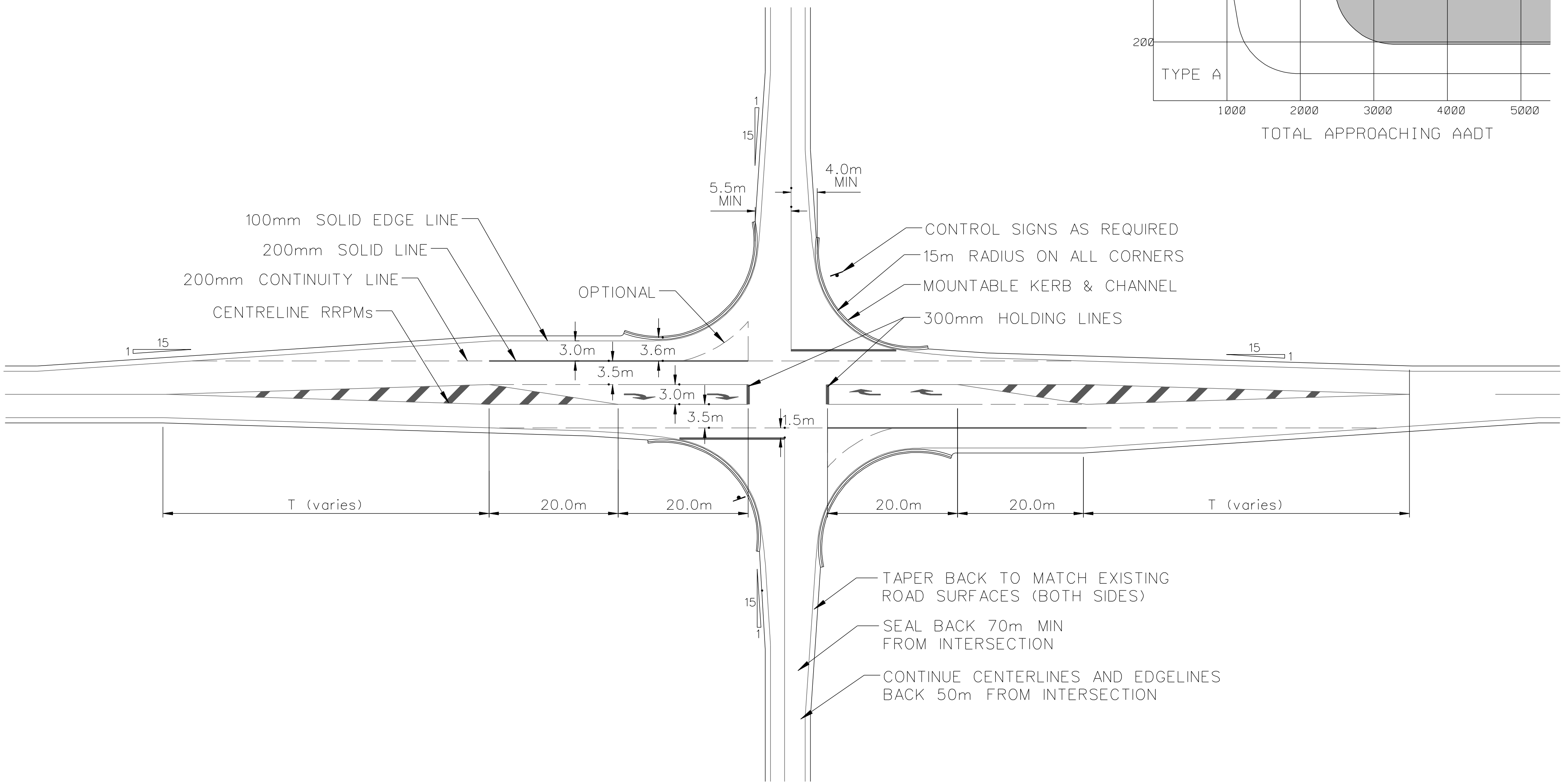
NOTES:
1) Minimum pavement markings shall consist of solid intersection lines on the through road and appropriate intersection controls on the side road
2) RRPM's to start 25m before the start of taper (T).





A = Centreline offset = Half the lane width

T = Length of flush median taper (VxA)/2.16 (Round to nearest 5m)
where V = Operating (85 percentile) Speed

WAIMAKARIRI DISTRICT COUNCIL technical services

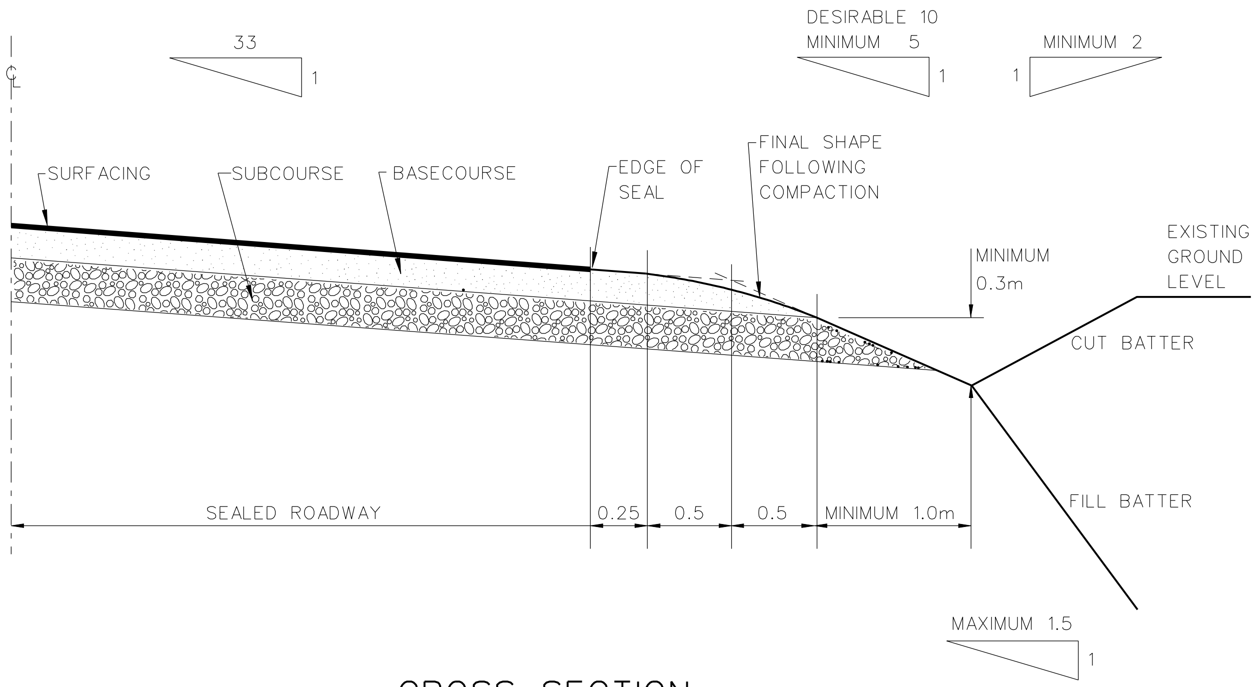
NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
	STANDARD RURAL "X" JUNCTION TYPE C	STANDARD DRAWINGS	263B
			ISSUE F / PLAN No. 600

NOTES

1 Surfacing : Single coat hot bitumen and grade 4 chip or 50mm AP 20 running course.

2 Basecourse : Minimum of 100mm TNZ M/4 AP40.

3 Subcourse : Minimum of 150mm TNZ M/5 AP65.



CROSS SECTION

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: TYPICAL ROAD CROSS-SECTION IN RURAL ZONE	PROJECT TITLE: STANDARD DRAWINGS	SHEET 270
				ISSUE D / PLAN No. 600

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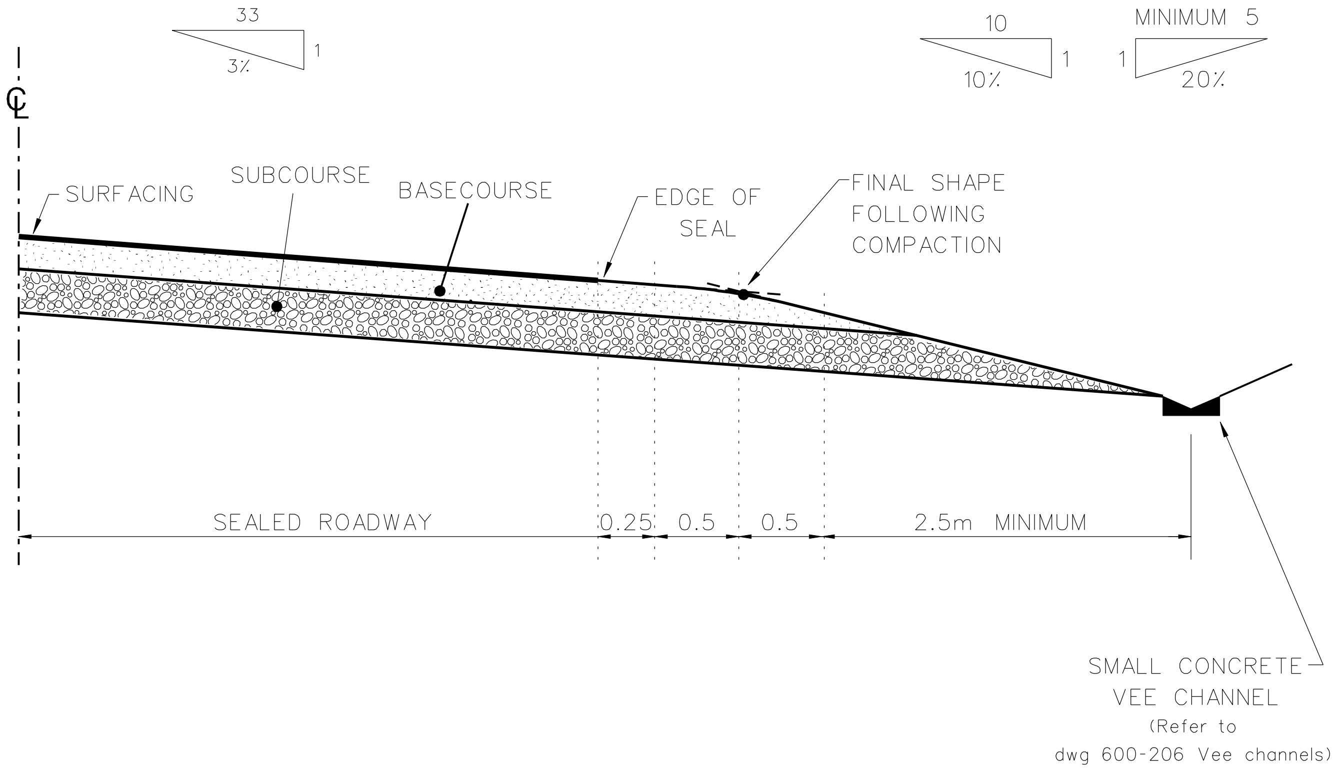

NOTES

1. SURFACING: SINGLE COAT HOT BITUMEN AND GRADE 4 CHIP OR 50mm AP20 RUNNING COURSE.
2. BASECOURSE: MINIMUM OF 100mm TNZ M/4 AP40
3. SUBCOURSE: MINIMUM OF 150mm TNZ M/5 AP65
4. VEE CHANNEL TO DRAIN TO APPROVED SOAKHOLE OR OUTFALL.
SOAKHOLES TO BE SPACED AT INTERVALS TO BE APPROVED AND NOT GREATER THAN 100m

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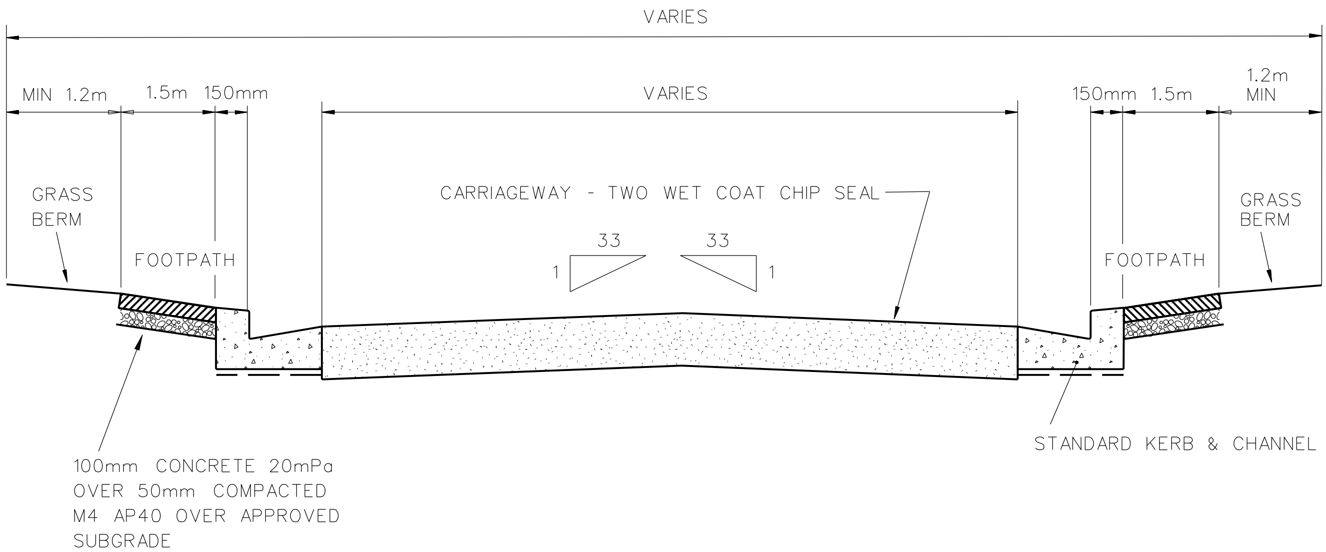
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE TYPICAL ROAD CROSS-SECTION RESIDENTIAL 4A/4B	PROJECT TITLE STANDARD DRAWINGS	SHEET 271 ISSUE D PLAN No. 600

NOTES

1. Surfacing : Two wet coat hot bitumen and chip or 50mm AP 20 running course.
2. Basecourse : Minimum of 100mm TNZ M/4 AP40.
3. Subcourse : Minimum of 150mm TNZ M/5 AP65.
4. Refer DISTRICT PLAN Section 30 - Utilities & Traffic Management Table 30.1 for road dimensions
5. Footpath to have 1.5m useable width. Location either against kerb or 300 from boundary, meandered paths are acceptable.
6. Only one footpath unless otherwise approved or required.



CROSS SECTION

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: TYPICAL ROAD & CUL–DE–SAC CROSS–SECTION	PROJECT TITLE: STANDARD DRAWINGS	SHEET 272; ISSUE D; PLAN No. 600

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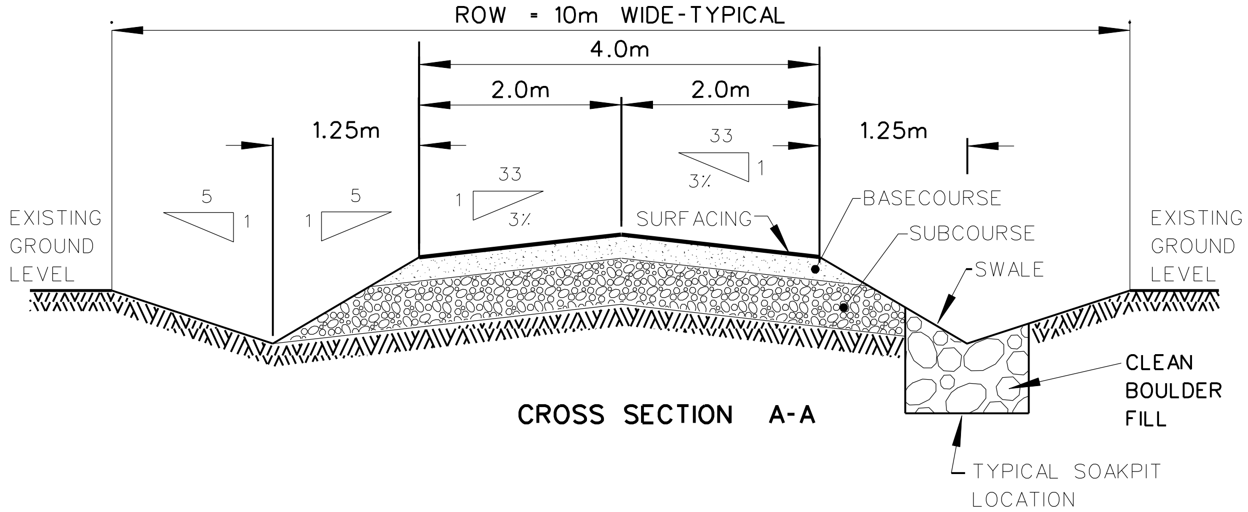
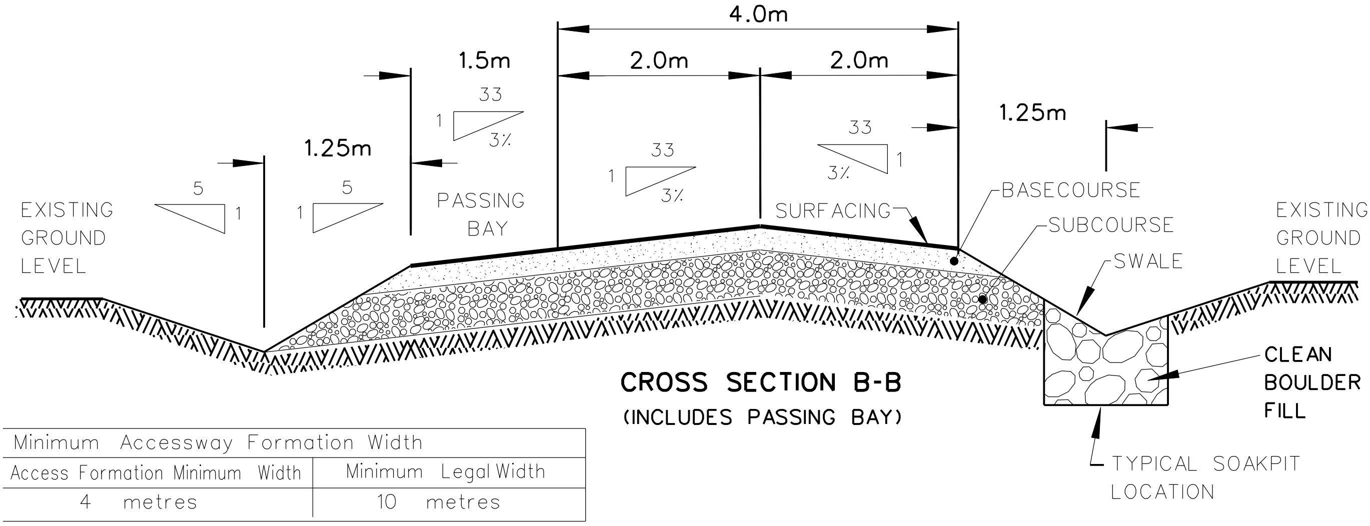
NOTES
1. Surfacing : Single coat hot bitumen and grade 4 chip or 50mm AP20 running course.
2. Basecourse : Minimum of 100mm TNZ M/4 AP40.
3. Subcourse : Minimum of 150mm TNZ M/5 AP65.

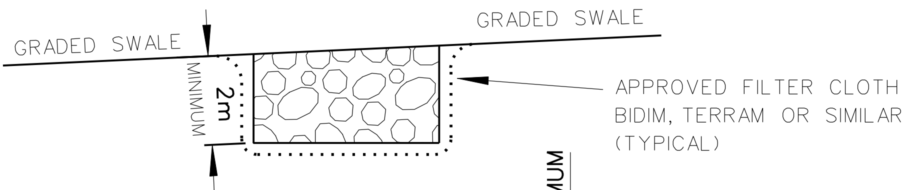


CROSS SECTION A-A

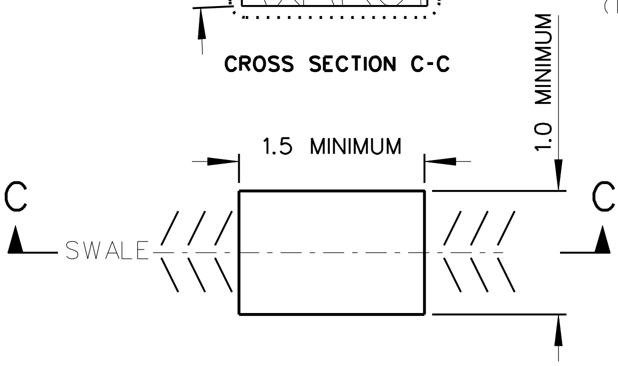


CROSS SECTION B-B
(INCLUDES PASSING BAY)

Minimum Accessway Formation Width	
Access Formation Minimum Width	Minimum Legal Width
4 metres	10 metres

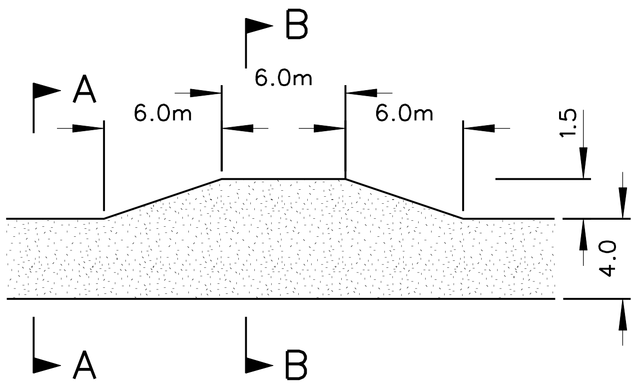


CROSS SECTION C-C



PLAN OF SOAK PIT

Soak Pits shall be installed where appropriate. Spacing of Soak Pits shall not be greater than 100m intervals and should be installed in all low points of swales. The minimum depth of Soak Pits is 2.0m.



PLAN OF PASSING BAY

Where the length of the ROW exceeds 100m and there are 2 or more lots serviced by the ROW then Passing Bays shall be installed at not more than 90m intervals.

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: TYPICAL RURAL CROSS–SECTION RIGHT–OF–WAY	PROJECT TITLE: STANDARD DRAWINGS	SHEET 273 ISSUE D PLAN No. 600

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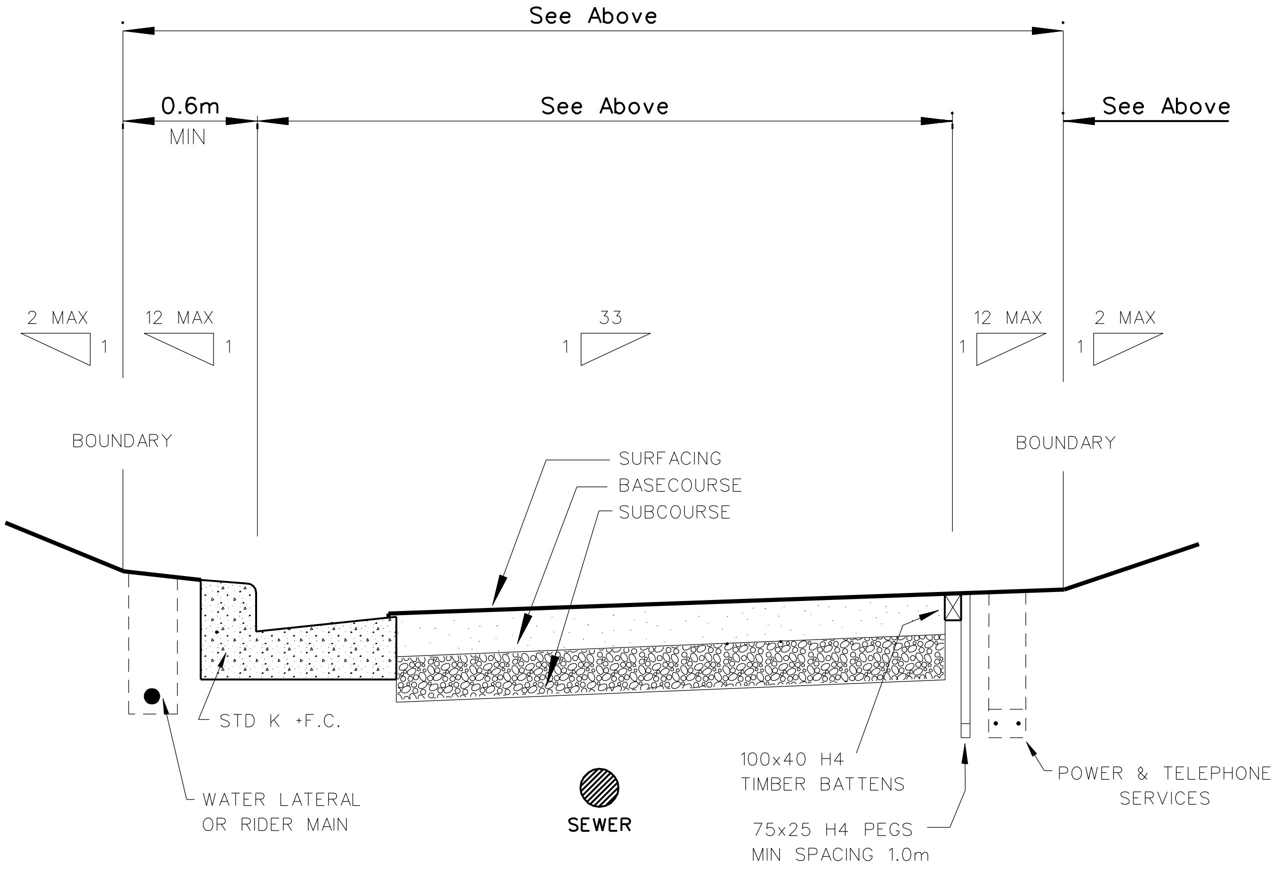
Zone	Land Use or Activity	Access Formation minimum Width (meters)	Minimum Legal Width (meters)
Residential Zones	0 to 2 dwellinghouses	3	4
	3 to 6 dwellinghouses or any other land use	5	7
Business Zones	Any land use	6m, or separate entry and exit carriageways of 3m each	8m or two separate carriageways of 5m



NOTES

1. Surfacing : Single coat hot bitumen and grade 4 chip or bitumen prime coat and 20mm asphaltic concrete.
2. Basecourse : Minimum of 100mm TNZ M/4 AP40
3. Subcourse : Minimum of 150mm TNZ M/5 AP65

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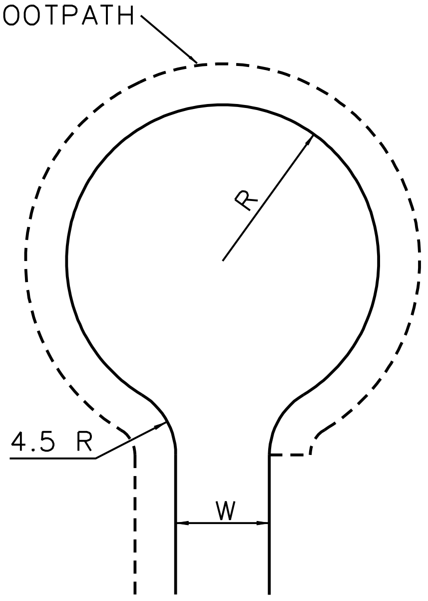
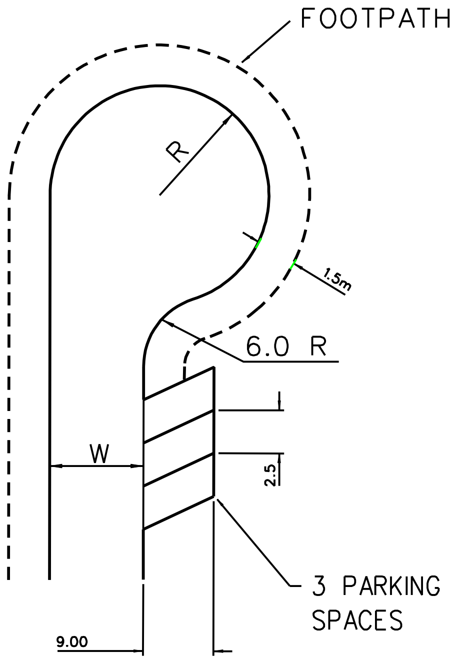
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: TYPICAL R.O.W CROSS–SECTION RES. & BUSINESS	PROJECT TITLE: STANDARD DRAWINGS	SHEET 274	ISSUE D	PLAN No. 600



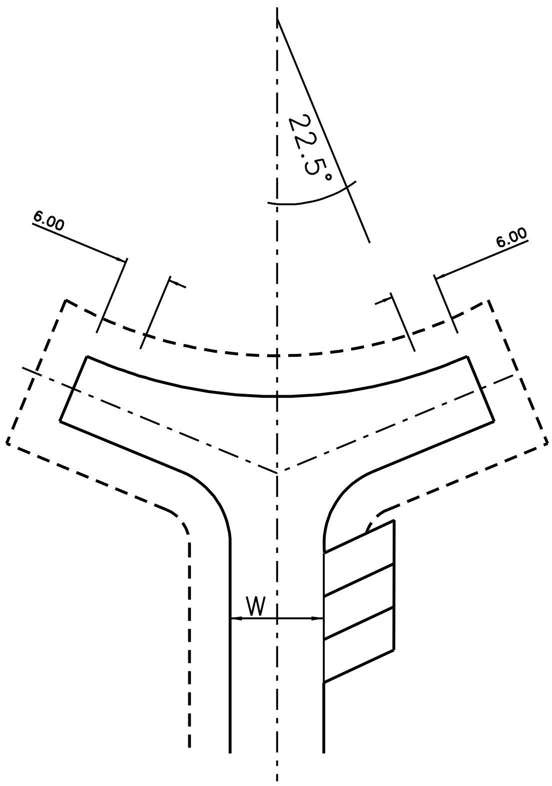
TYPE A (Rural)

R = 12.0 FOR W ⩾ 6.0

R = 8.0 FOR W ⩽ 6
OR 10.0 WITH PARKING



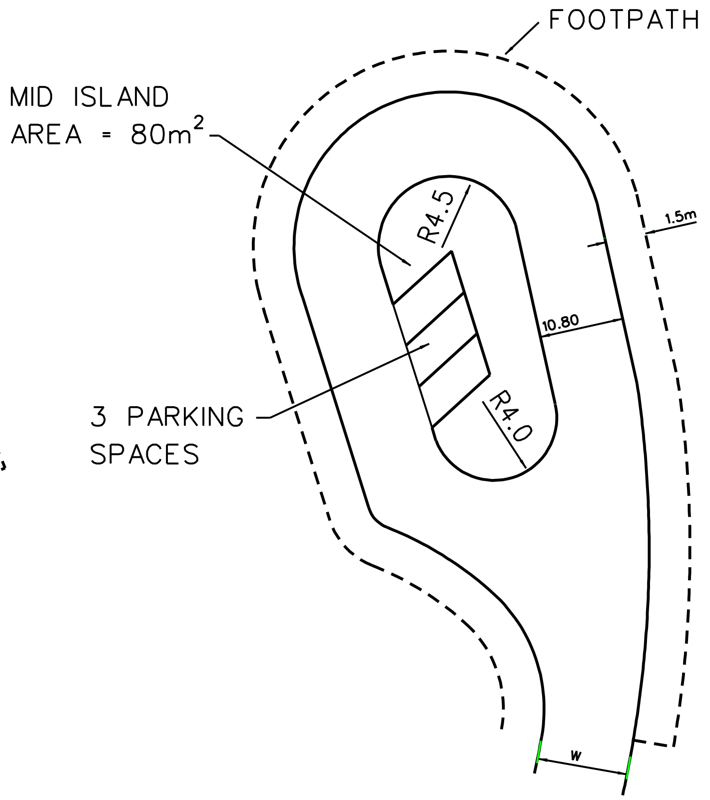
TYPE B (Residential)



TYPE A (Residential)

W < 6.0

MAXIMUM LENGTH OF CUL-DE-SAC 100m
FOR RESIDENTIAL AND BUSINESS ZONES
WITH THIS CONFIGURATION TURNING HEAD



TYPE D (Residential)

W ⩽ 7.0

NO 'PRIVATE WAYS' OFF THIS
CONFIGURATION TURNING HEAD

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
		CUL–DE–SAC TURNING AREAS	STANDARD DRAWINGS	275
				ISSUE C / PLAN No. 600

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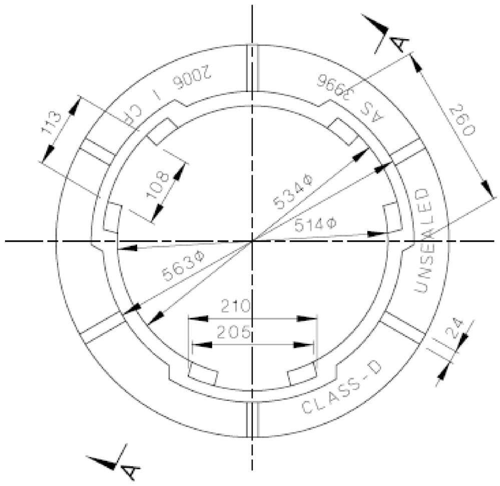
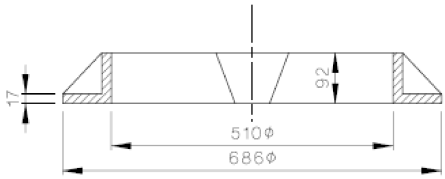
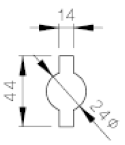


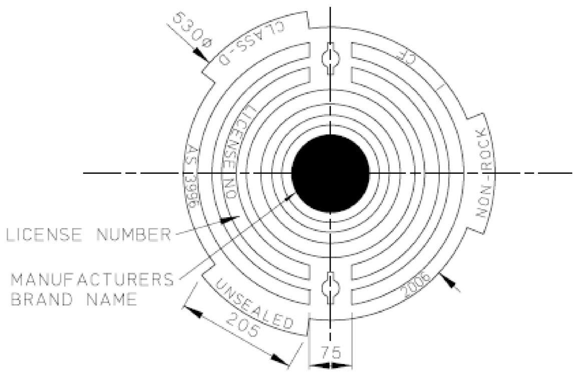
FRAME PLAN



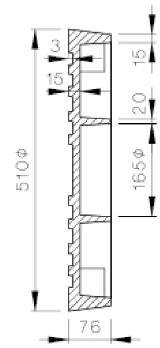
SECTION A-A



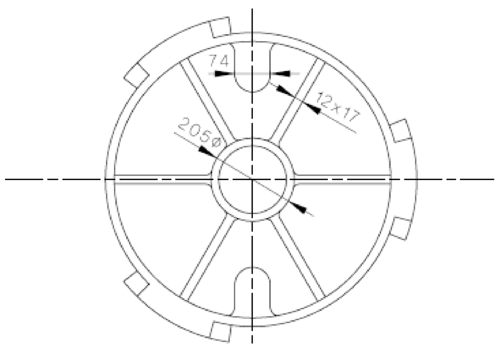
KEYHOLE

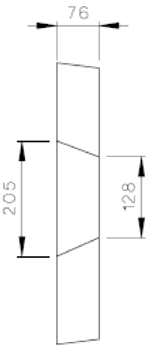


COVER TOP



COVER SECTION





PERMISSIBLE VARIATIONS IN DIMENSIONS

FRAME
Cover opening diameter: +/- 2.0mm
Cover opening depth: +1.5mm, -1.0mm
Height: +/- 2.0mm
Flange: +/- 3.0mm
Clear Opening: -1.0mm, +3.0mm
COVER
Cover diameter: +/-2.0mm
Seat depth: +1.0mm, -1.5mm

COVER BOTTOM

COVER ELEVATION

NOTES:

1. Manufacture to be in accordance with AS 3996-2006
2. Material Grey Iron, Grade T 220 of AS 1830
3. Avoid sharp corners at the rib joints of the cover
4. Set weight: 89 Kgs (Tolerance: +/- 3%)

Based on CCC drawing SD301/1

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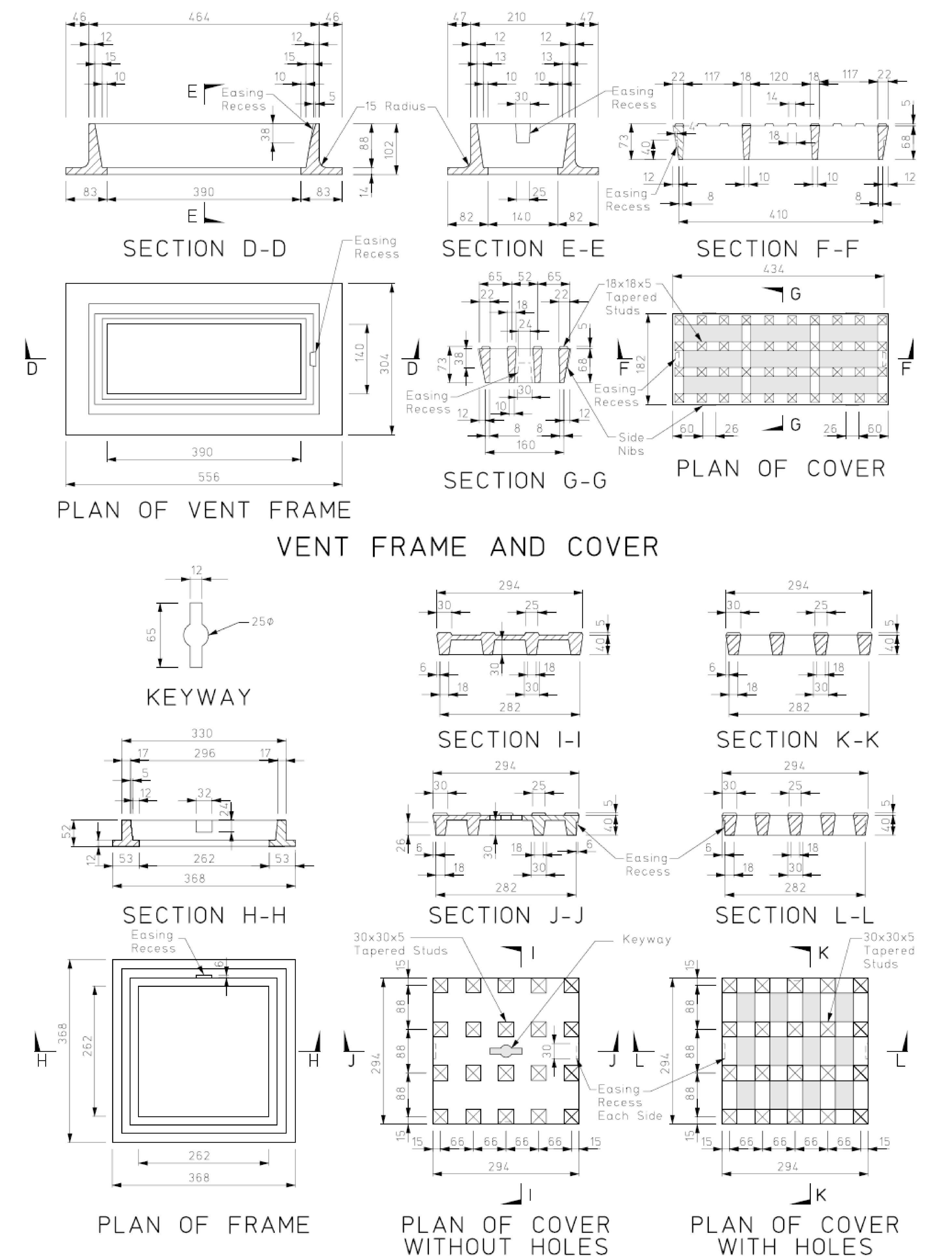
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
	TO BE REVISED	MANHOLE CASTING COMPONENT DETAILS	STANDARD DRAWINGS	301A
				ISSUE C / PLAN No. 600



TRAFFICABLE HOUSE DRAIN SUMP FRAME AND COVERS

Based on CCC Drawing SD301/2

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE TO BE REVISED	SHEET TITLE Manhole Vent & Trafficable House Drain Sump Frames & Covers	PROJECT TITLE STANDARD DRAWINGS	SHEET 301B ISSUE: B PLAN No. 600

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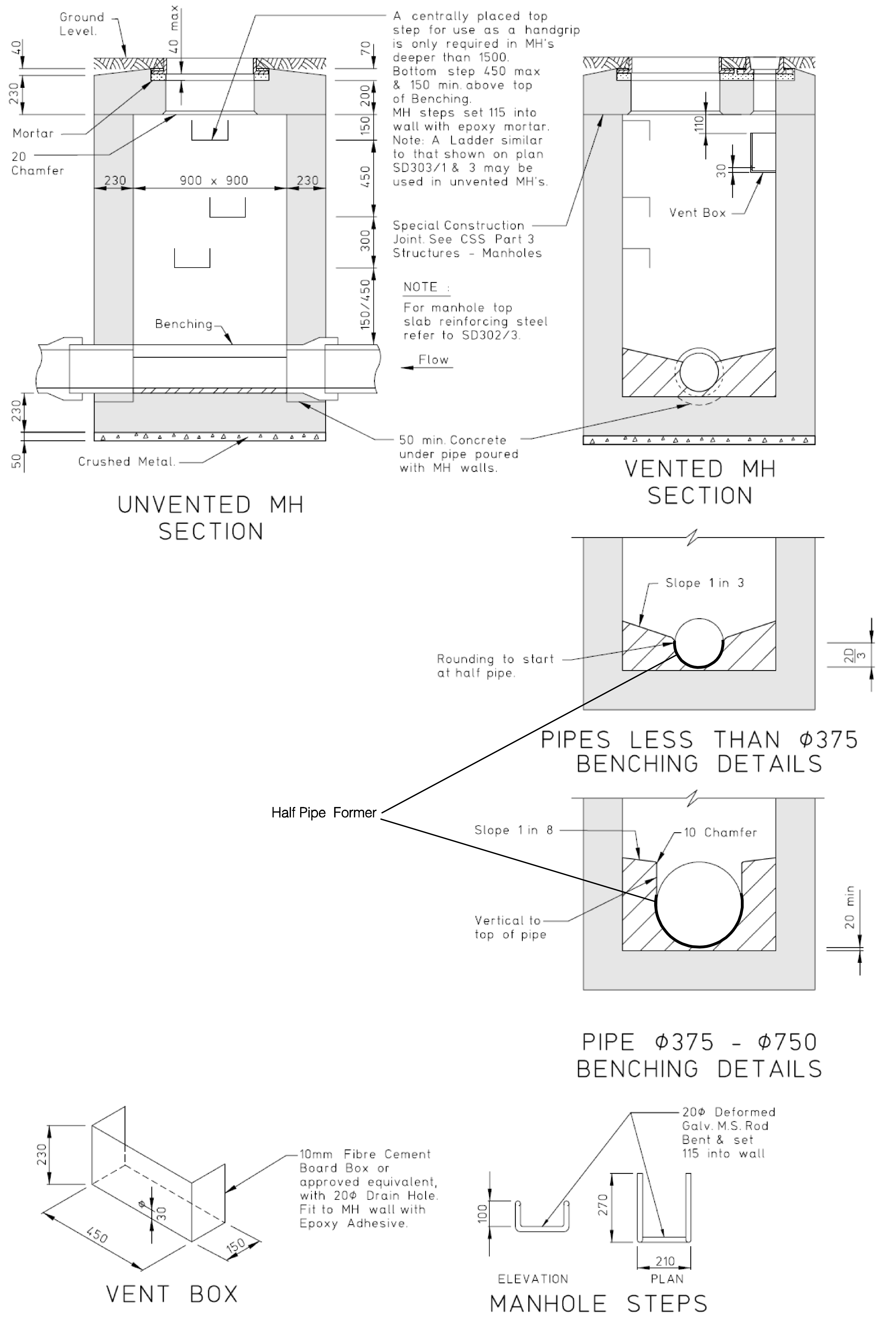

Based on CCC SD302/1

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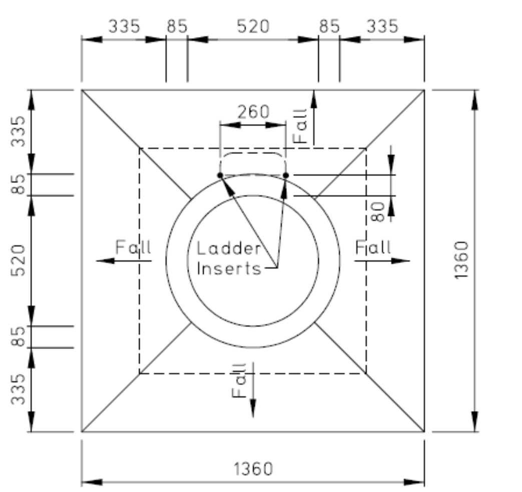
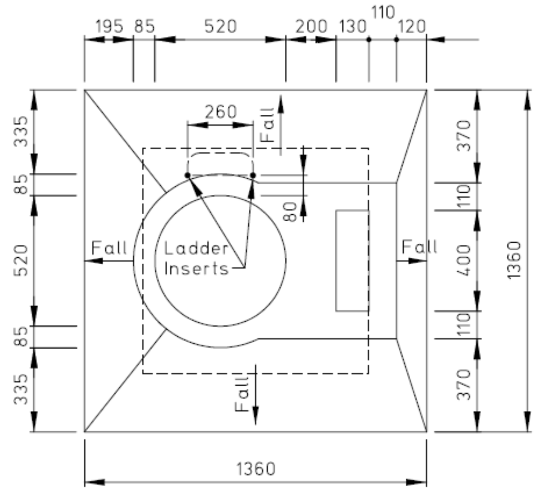
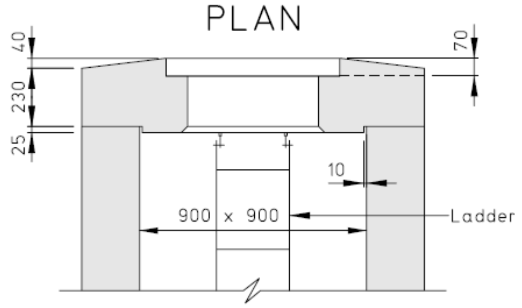
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE TO BE REVISED	SHEET TITLE SQUARE MANHOLES CAST IN–SITU	PROJECT TITLE STANDARD DRAWINGS	SHEET 302A ISSUE C PLAN No. 600



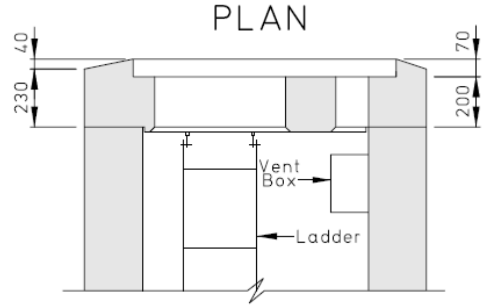
UNVENTED MH
PLAN



VENTED MH
PLAN



PRECAST TOP
UNVENTED MH



PRECAST TOP
VENTED MH

NOTES:

1. For manhole top slab reinforcing steel refer to SD302/3.
2. Precast tops to be seated on a cement sand mortar bed. Excess mortar on inside of MH to be struck clean.
3. MH and Vent Frames to be seated on 15mm min. up to 40mm max. of cement sand mortar.
4. 2 M12 cast in fixings in precast tops for lifting.
5. Form channels in benching in smooth easy curves as directed.
6. See also the notes on SD303/3.
7. See plan SD301/1, 2 & 3 for manhole frames, lids & ladder.

Based on CCC SD302/2

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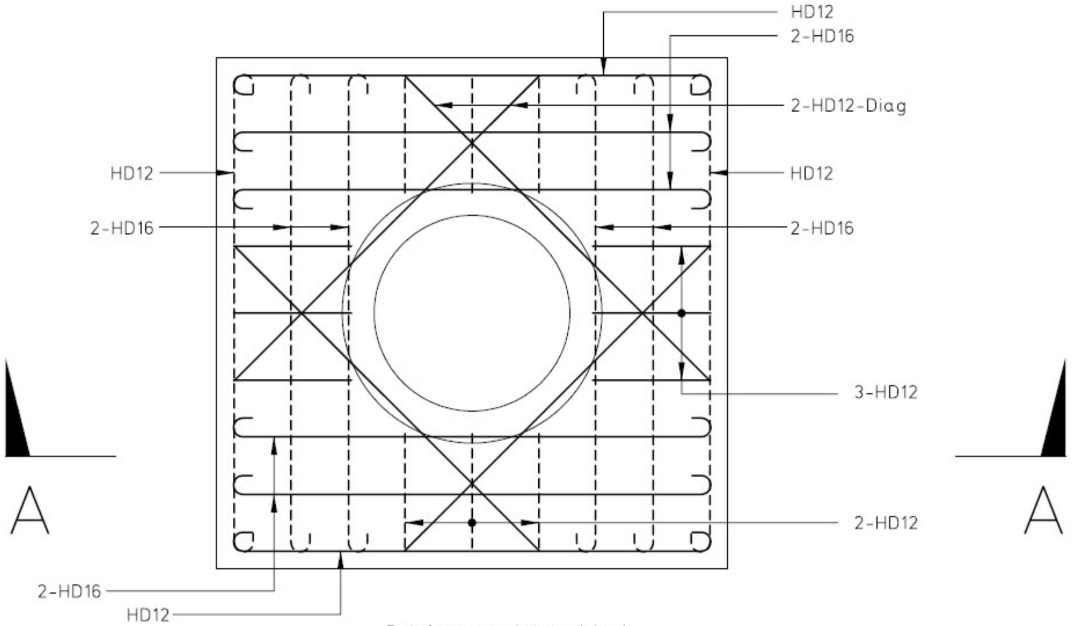
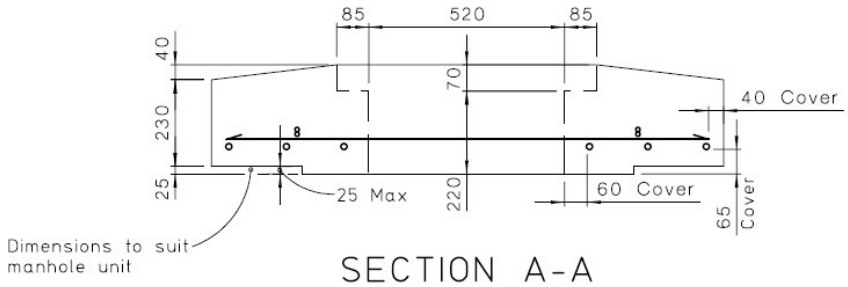
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE TO BE REVISED	SHEET TITLE SQUARE MANHOLE TOP	PROJECT TITLE STANDARD DRAWINGS	SHEET 302B ISSUE C PLAN No. 600

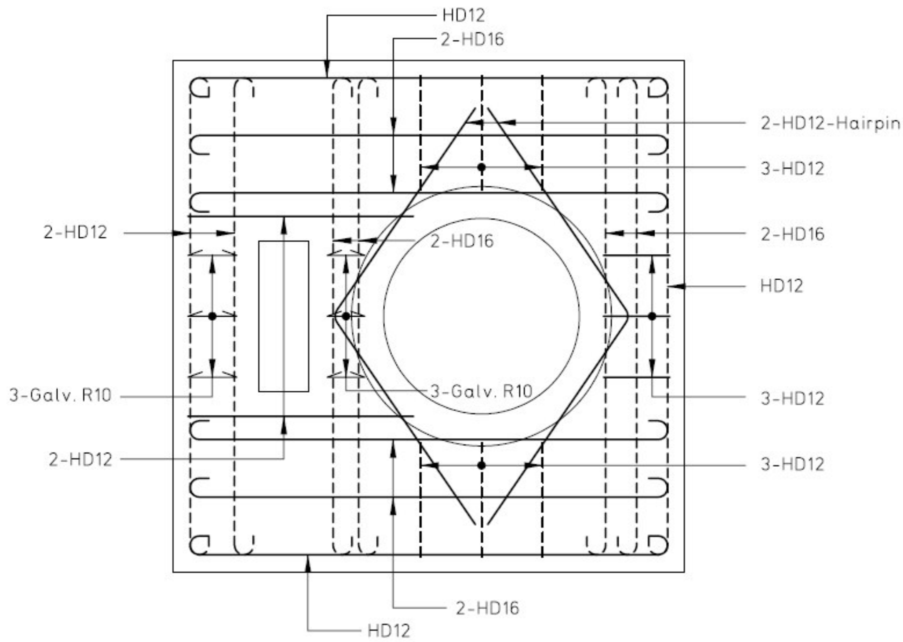


Reinforcement symetrical about both centre lines

UNVENTED MH PLAN



SECTION A-A



VENTED MH PLAN

NOTES:

1. All concrete to be 40 MPa.
2. All manhole tops to be precast.
3. Design Loading: HN-HO-72

Upper layer ————
Lower layer – – – – –

Based on CCC SD302/3

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE TO BE REVISED	SHEET TITLE SQUARE MANHOLE REINFORCEMENT	PROJECT TITLE STANDARD DRAWINGS	SHEET 302C ISSUE: A PLAN No. 600

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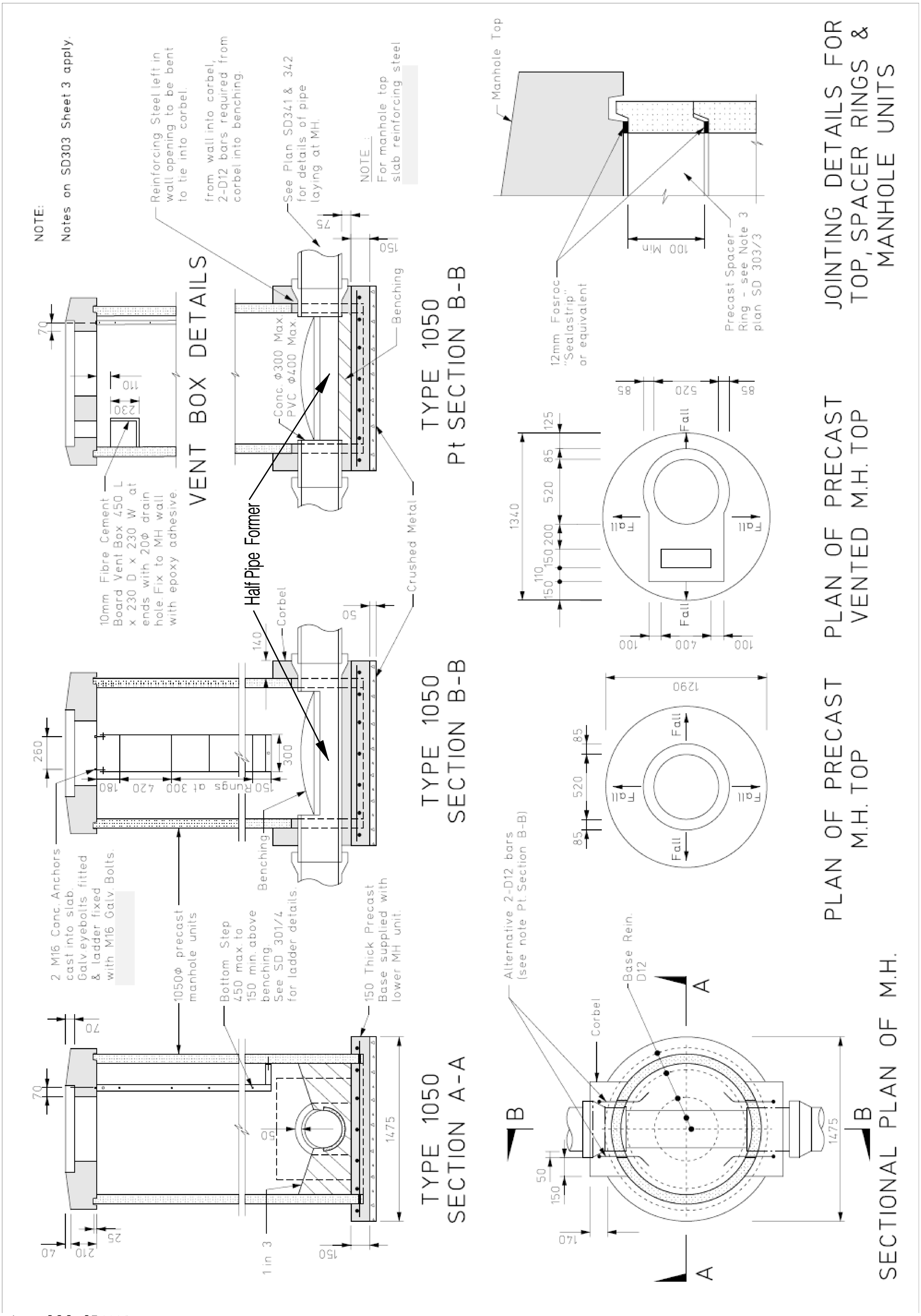

Based on CCC SD303/1

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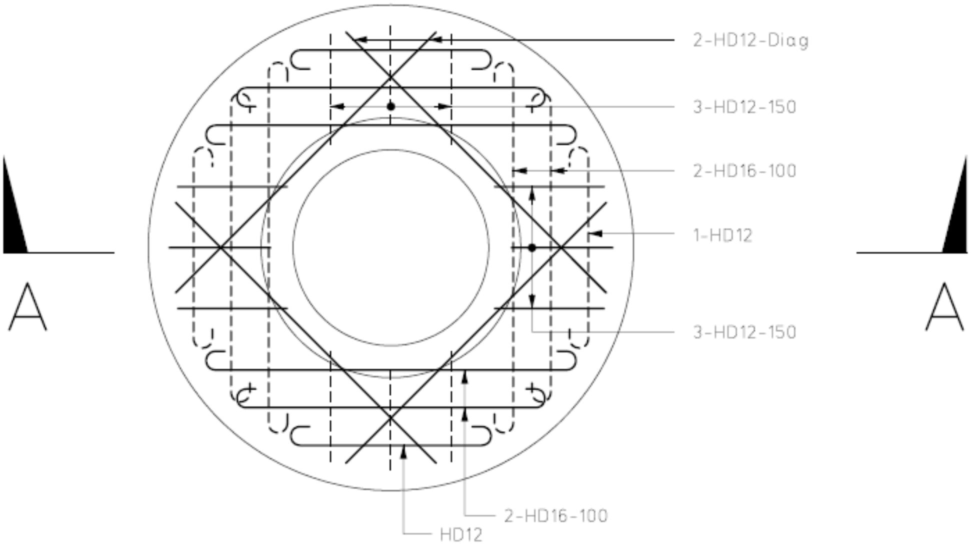
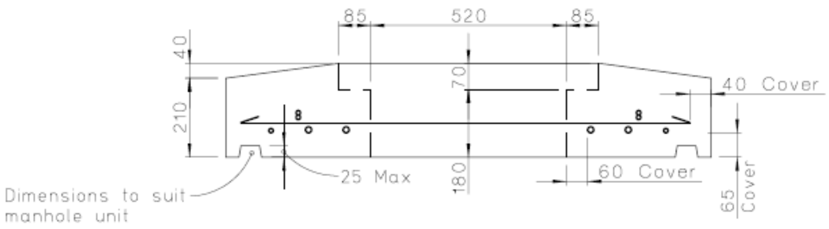
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE TO BE REVISED	SHEET TITLE PRECAST MANHOLES CIRCULAR	PROJECT TITLE STANDARD DRAWINGS	SHEET 303A ISSUE B PLAN No. 600

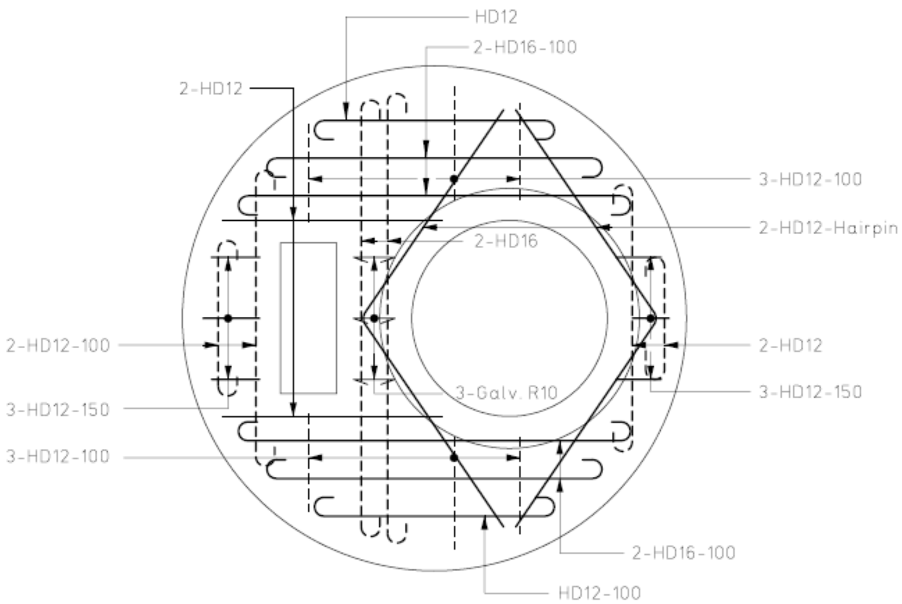


Reinforcement symetrical
about both centre lines

UNVENTED MH PLAN



SECTION A-A



VENTED MH PLAN

NOTES:

1. All concrete to be 40 MPa.
2. All manhole tops to be precast.
3. Design Loading: HN-HO-72

Upper layer ————
Lower layer ------

Based on CCC SD303/2

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE TO BE REVISED	SHEET TITLE PRECAST MANHOLES CIRCULAR (TOP)	PROJECT TITLE STANDARD DRAWINGS	SHEET 303B ISSUE C PLAN No. 600

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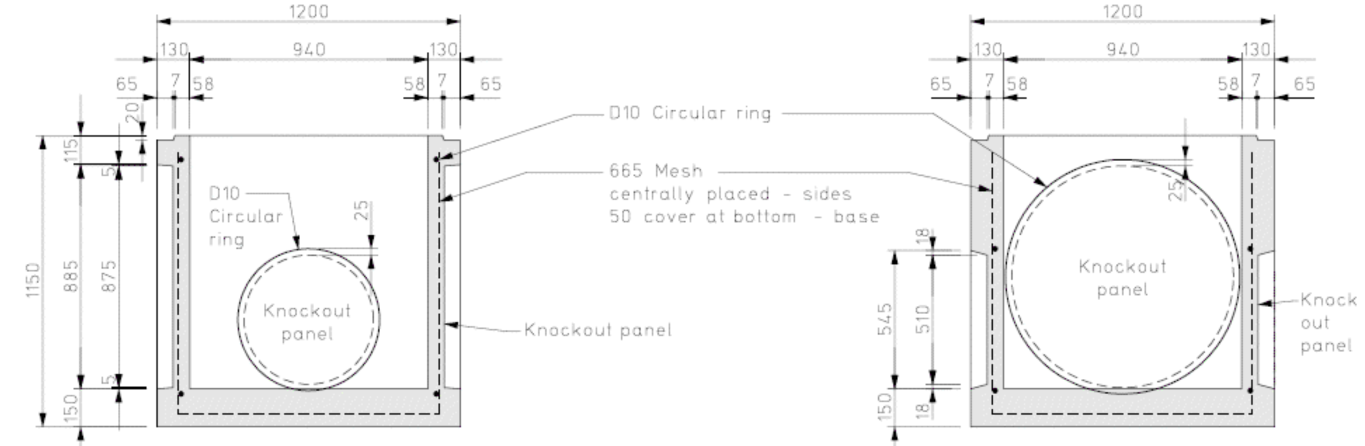
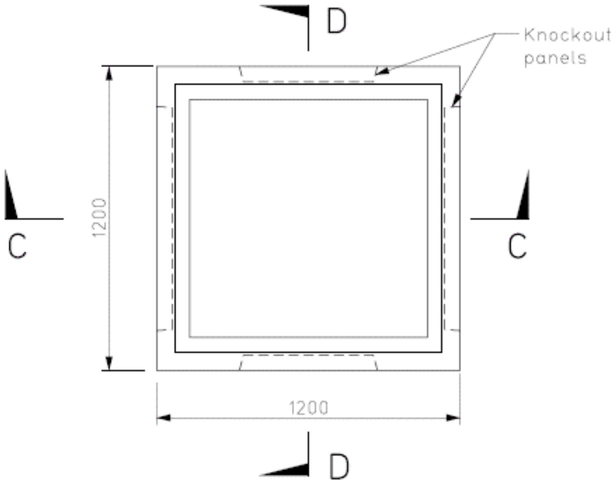


SECTION C-C

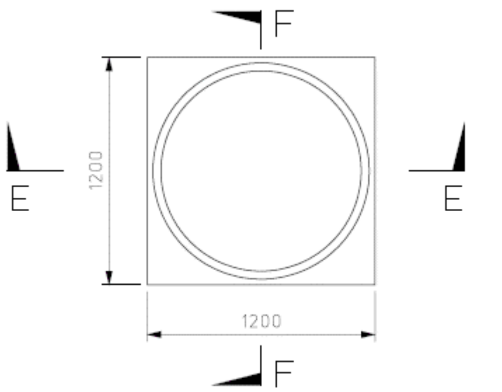
SECTION D-D



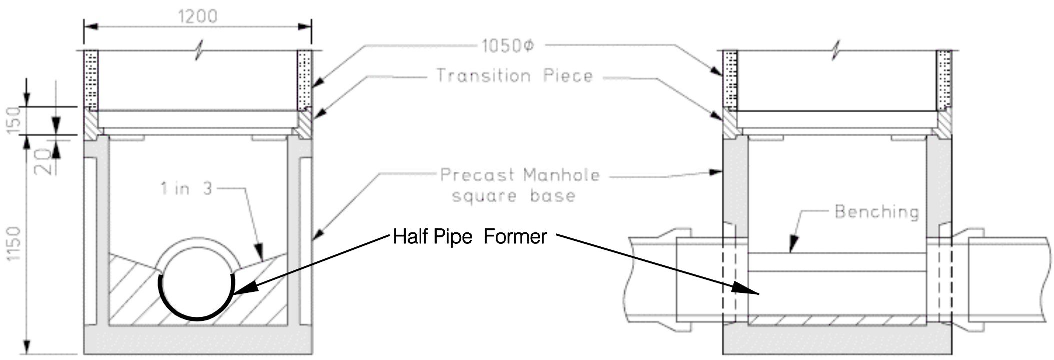
PLAN PRECAST MANHOLE

NOTES:

1. Joints shall not exceed 5mm at any point.
2. All joint are to be positioned as high as possible.
3. Where required to bring the MH up to the correct level a <u>spacer ring</u> shall be placed immediately below the manhole top.
4. Approved sealing strip shall be used for sealing all joints. All joints shall be clean. Jointing work shall be protected from rain. All sealing strip joints shall be butted, with a short lapping piece on the outside.
5. See SD301/4 for ladder details.
6. <u>Benching</u> details shall be in accordance with SD302/1.
7. <u>Circular base</u> precast manholes shall be used for pipes up to 400mm OD, <u>square base</u> precast manholes for pipes up to 750Φ.
8. <u>Maximum Depth</u> (G.L. to invert) for standard manholes shall be 5m.
9. <u>Resistance to flotation</u> is dependent on well compacted backfilling.
10. Unused Knockout panels to be filled to full wall width.



PLAN TRANSITION PIECE



SECTION E-E

SECTION F-F

PRECAST MANHOLE AND TRANSITION PIECE

Based on CCC SD303/3

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE TO BE REVISED	SHEET TITLE PRECAST MANHOLES SQUARE BASE	PROJECT TITLE STANDARD DRAWINGS	SHEET 303C ISSUE A PLAN No. 600

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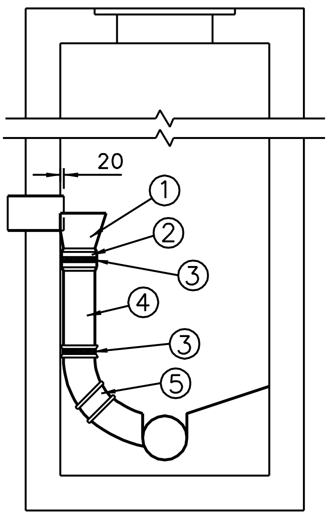
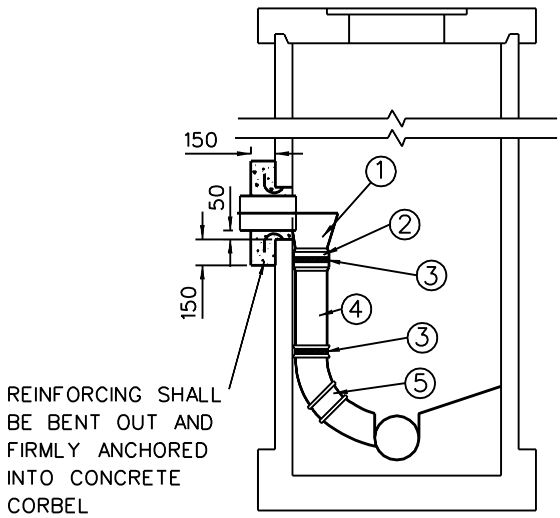
DROP INSTALLATION IN STANDARD MANHOLE

DROP INSTALLATION IN PRECAST MANHOLE

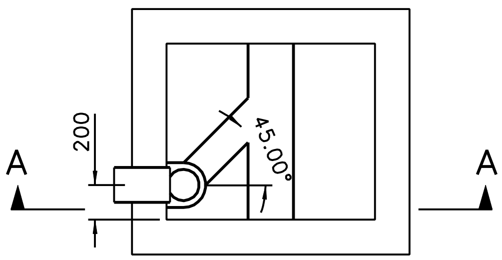
SECTION A-A



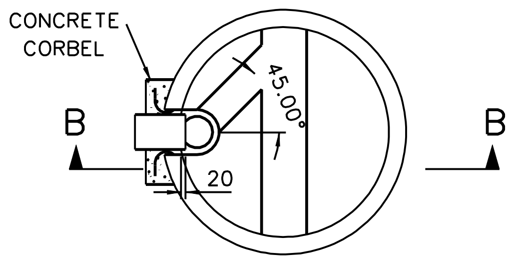
SECTION B-B

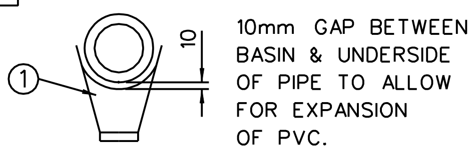


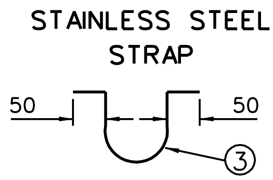
PLAN



PLAN







NOTES

1. Manholes to be constructed as detailed on drawings 600-301A, 302A,B &303A.
2. Pipelaying at manholes to be constructed as detailed on drawings 600-341 &342.
3. Channeling in new manholes shall be vertical to top of main sewer and benching graded at 1 in 3 or 1 in 8 as applicable.
4. Benching and channeling in existing manholes shall be reformed in easy curves.
5. In standard and precast manholes where the main sewer exceeds 600 dia a channel shall be formed in the benching under the 150 dia sewer pipe (4). A 135 deg bend (5) shall not be used.
6. In existing manholes steps or ladders shall be relocated if required to permit access.
7. PVC fittings to be solvent jointed.
8. Opening for manhole starter and corbel shall be clear of any joint in precast manhole by at least 300mm minimum.

PARTS LIST

1. Fabricated PVC basin.
2. 150 diameter PVC sewer pipe straight coupling.
3. 25mm wide 1.25 dia 316 stainless steel strap fixed to manhole wall with 2-38mm X 10 gauge stainless steel self tapping screws and rawlplugs.
4. 150 diameter PVC sewer pipe.
5. 150 diameter sewer pipe 135 deg bend.

Based on CCC Drawing SD 305

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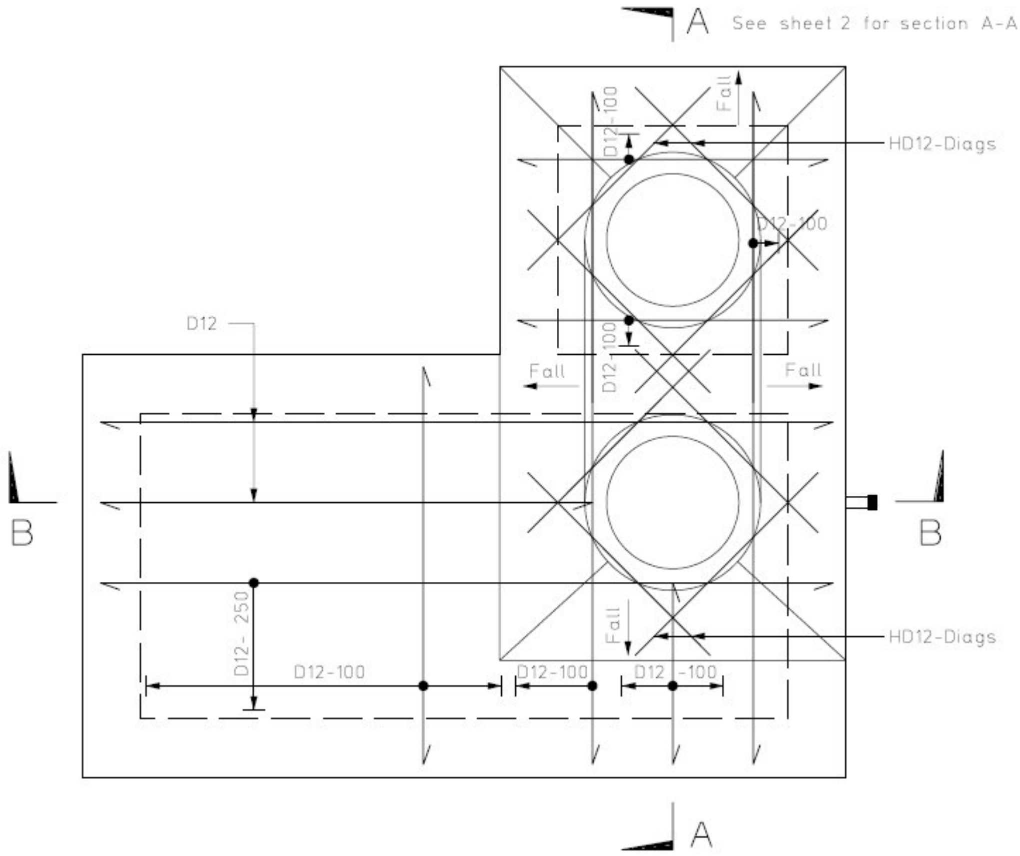
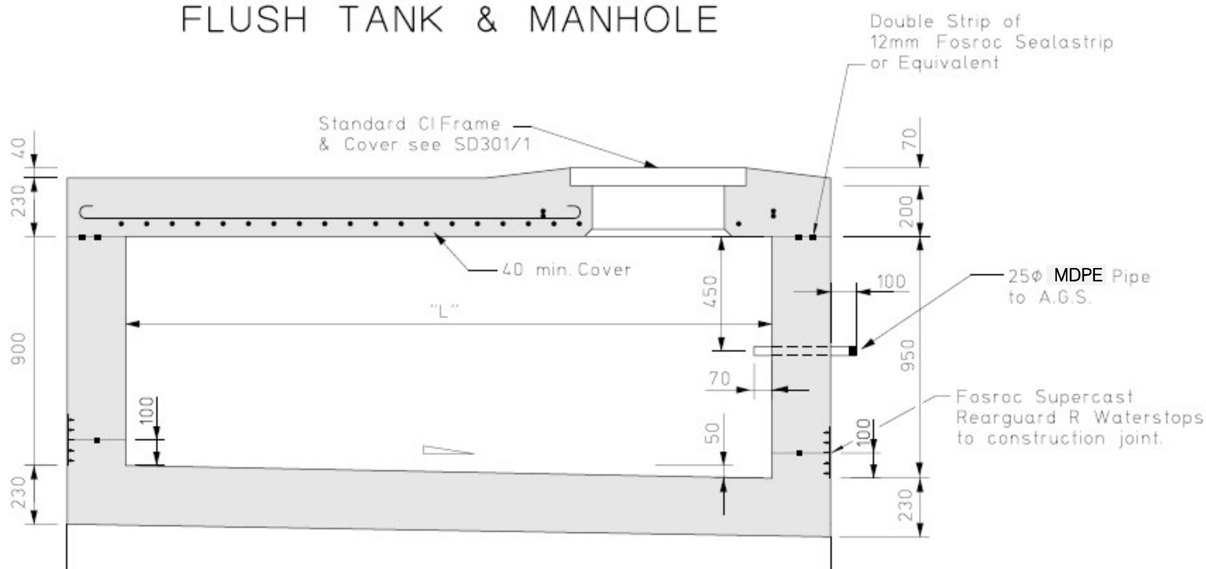
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE DROP MANHOLES 150mm NB DIAMETER	PROJECT TITLE STANDARD DRAWINGS	SHEET 305
				ISSUE C / PLAN No. 600



PLAN OF COMMON WALL
FLUSH TANK & MANHOLE



SECTION B-B THROUGH STANDARD
FLUSH TANK

NOTES:

1. The nominal capacity of the flush tank, (cubic metres) shall be as specified and shall equal the internal length "L" in metres.

2. Unless specified otherwise the length of the tank shall be parallel with the direction of the sewer.

3. For cast-iron frames and covers see SD301/1.

4. Where "L" exceeds 4m the floor slab and longitudinal wall shall be reinforced with 665mm mesh with 50mm internal cover.

5. Setting of flush tank top slab must allow for road crossfall.

6. See Plan SD313 for air gap separator.

7. All concrete to be 40 MPa.

Based on CCC Drawing SD311, sheet 1

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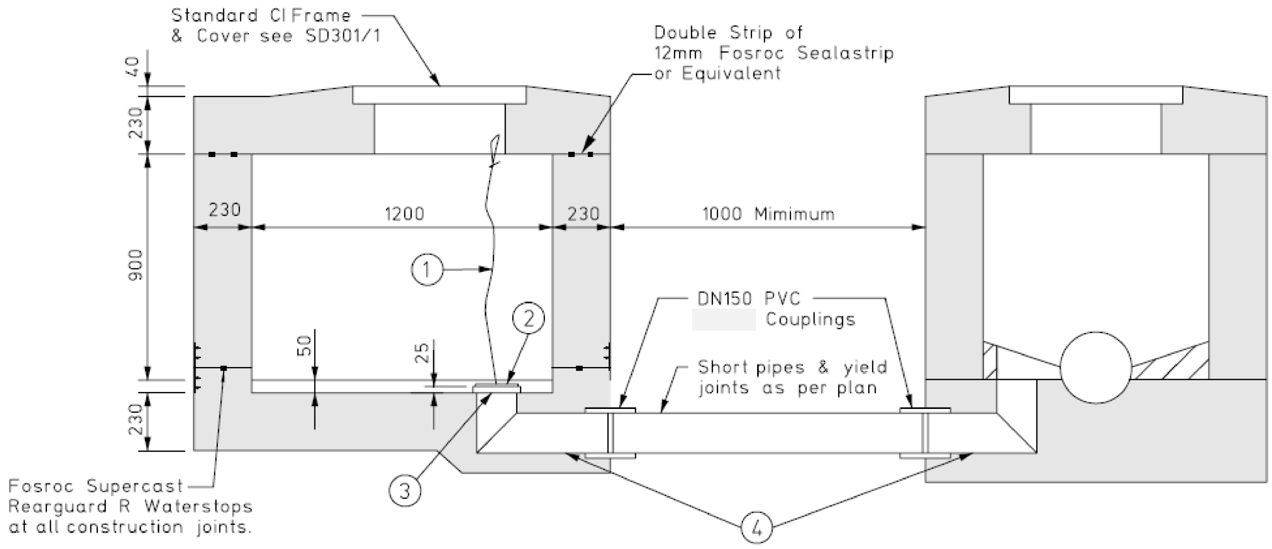
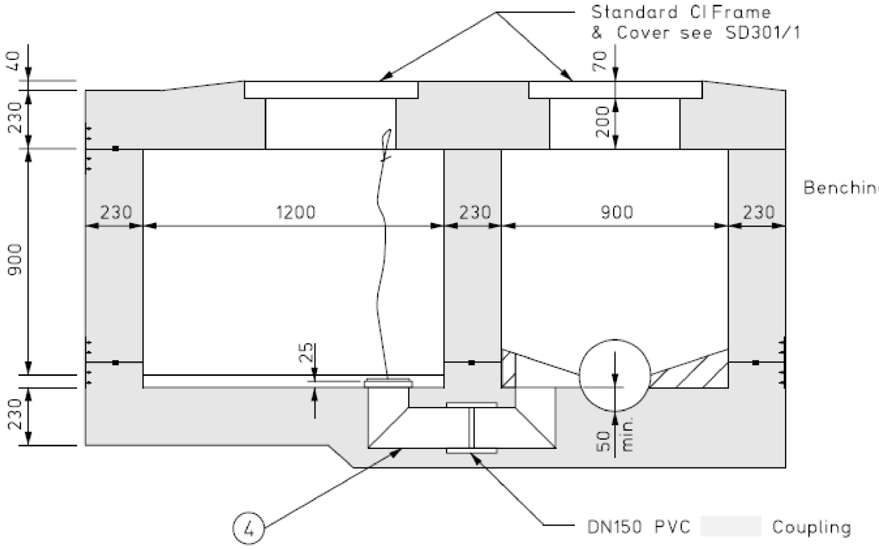
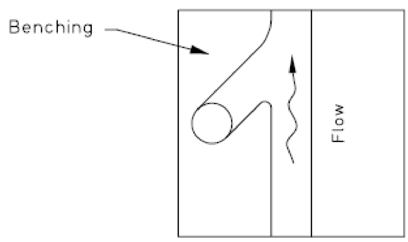
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE TO BE REVISED	SHEET TITLE FLUSH TANKS	PROJECT TITLE STANDARD DRAWINGS	SHEET 311A ISSUE B PLAN No. 600



SECTION THROUGH REMOTE FLUSHTANK & MANHOLE





SECTION A-A THROUGH COMMON WALL FLUSHTANK & MANHOLE

(FOR LOCATION SEE Sheet 1)

NOTES:

1. 8ϕ Polypropylene Rope complete with Shackle.
2. Flushtank Plug.
3. PVC Insert.
4. 2 special PVC pipes.
5. All concrete to be 40 MPa.

Based on CCC Drawing SD311, sheet 2

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE TO BE REVISED	SHEET TITLE FLUSH TANKS	PROJECT TITLE STANDARD DRAWINGS	SHEET 311B ISSUE B PLAN No. 600

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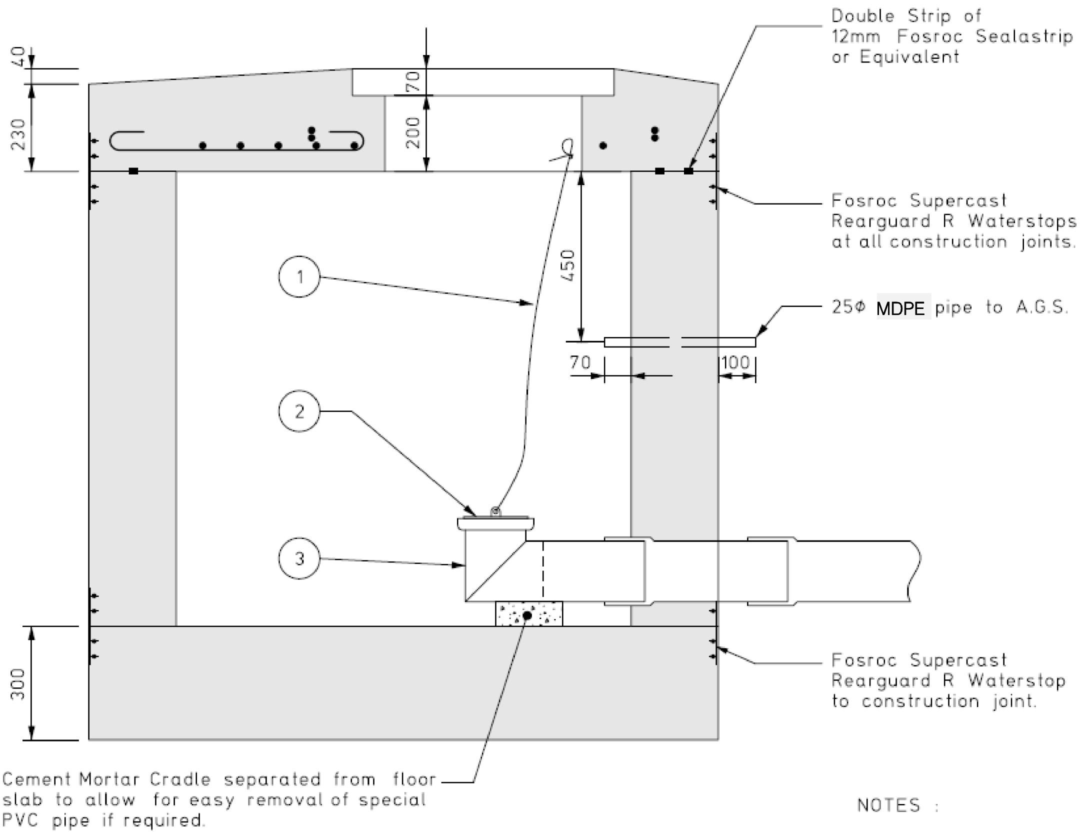
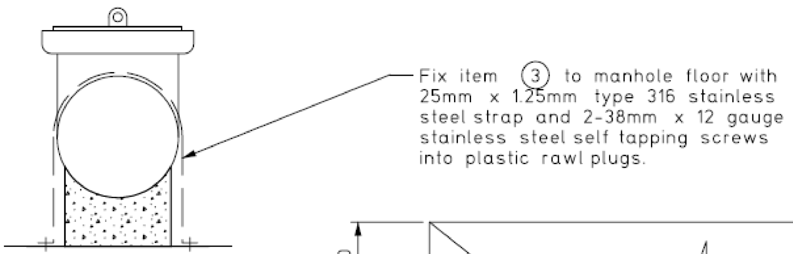
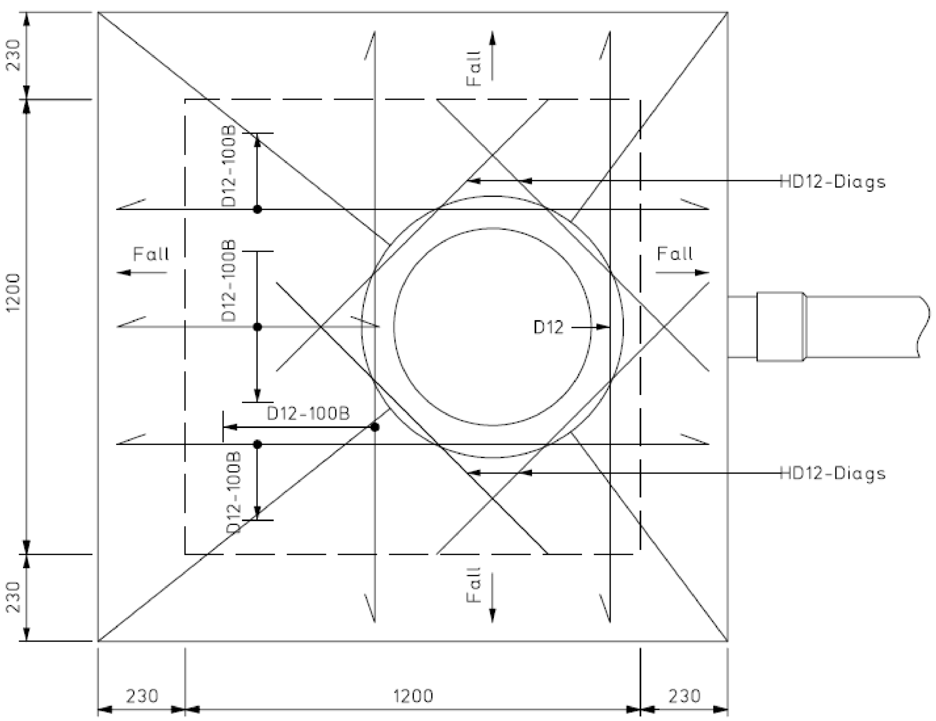


NOTES :

1. See SD302 for further construction details.



1. 8Φ Polypropylene rope complete with Shackle.
2. Flush tank plug.
3. Special PVC pipe.



Based on CCC Drawing SD312

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE TO BE REVISED	SHEET TITLE FLUSH MANHOLES	PROJECT TITLE STANDARD DRAWINGS	SHEET 312 ISSUE A PLAN No. 600

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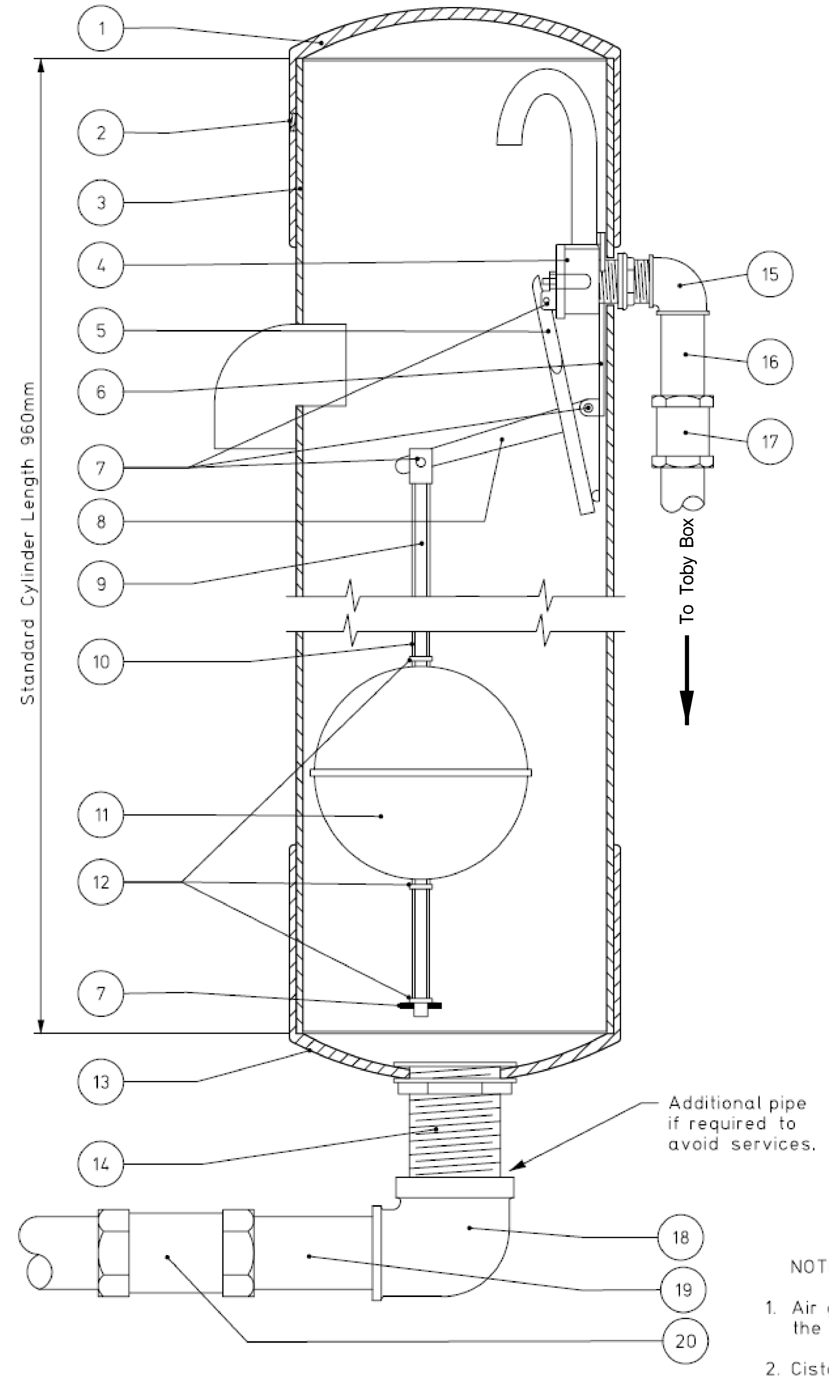


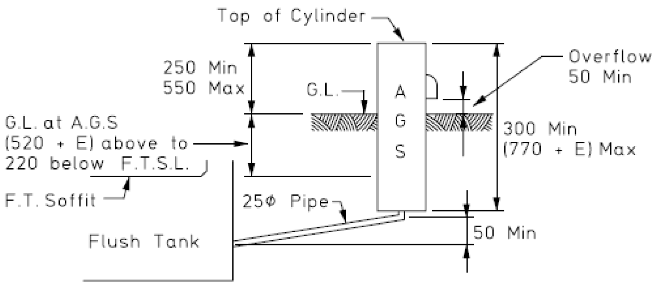
1. Top cap - PVC removable.
2. 10mm x 10mm hex socket head S.S. grubscrew.
3. Cylinder 150mmΦ PVC class C pipe with overflow.
4. "Secol" diaphragm valve, backnut and delivery tube.
5. Valve lever.
6. Valve assembly back plate.
7. Split pins.
8. Bell crank lever.
9. Float rod and clevis.
10. Plastic float adjustment tube.
11. PVC float.
12. Washers
13. Bottom cap - PVC cemented in place.
14. 38mmΦ shower waste sealed in bottom cap.

PARTS NOT SUPPLIED WITH UNIT:

15. 15mmΦ G.W.I. elbow.
16. 15mmΦ G.W.I. pipe.
17. 15mmΦ G.W.I. Johnson coupling.
18. 38 - 25mmΦ PVC reducing elbow.
19. 25mmΦ HDPE pipe.
20. 25mmΦ HDPE Johnson coupling.

NOTES :

1. Air gap separators shall be located within the limits shown in the diagram above.
2. Cistern shall be placed in footpath as close as possible to the road/property boundary and to a common lot boundary.
3. High pressure water connection shall be made to water main wherever possible but where connection has to be made to a small service pipe a flexible loop of 15mm Φ polythene pipe shall be used between the water meter and the air gap separator cistern to reduce water hammer effects.
4. The float shall be adjusted by manipulating distance pieces to obtain water level 30 +/- 10mm above tank soffit, but enough adjustment will be left to allow W.L. to be set 30mm below tank soffit.
5. A special extended air gap separator will be required when ground level is too high, ie, standard barrel and float rod shall be extended by length E with maximum of 500mm. E = 0 mm for Standard air gap separator.
6. 25mmΦ pipe to be laid on grade, as shown, to prevent air locks and debris accumulation.



Based on CCC Drawing SD313

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE TO BE REVISED	SHEET TITLE AIR GAP SEPARATOR	PROJECT TITLE STANDARD DRAWINGS	SHEET 313 ISSUE B PLAN No. 600

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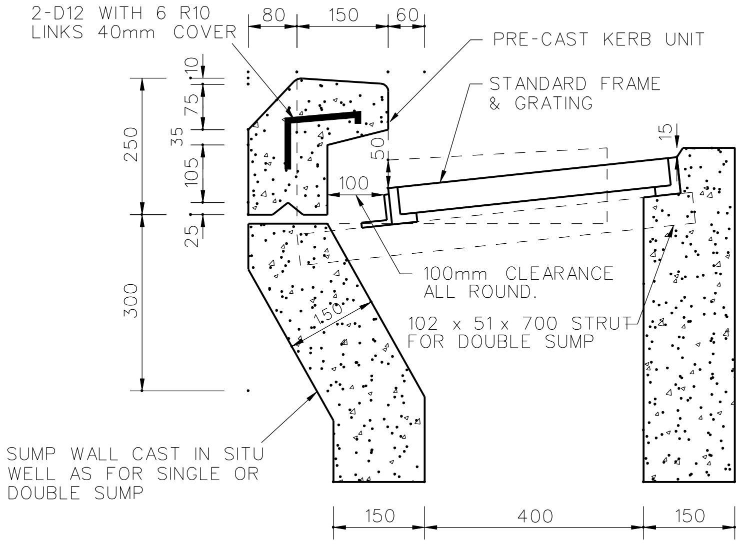
NOTES

1 Concrete work to comply with NZS 3109:1980

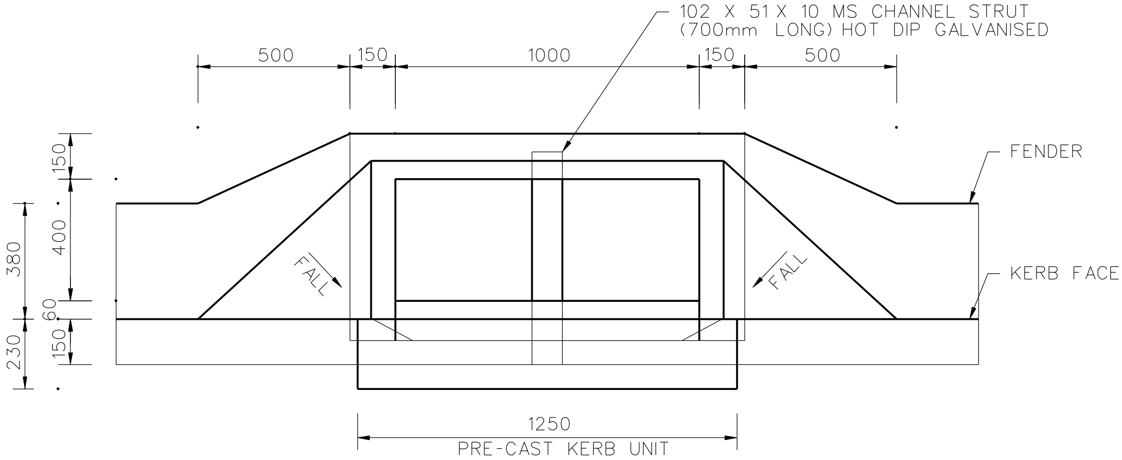
2 Concrete to be high grade with 30 MPa compressive strength.

3 Coat end faces of precast units with an approved epoxy tiecoat before jointing.

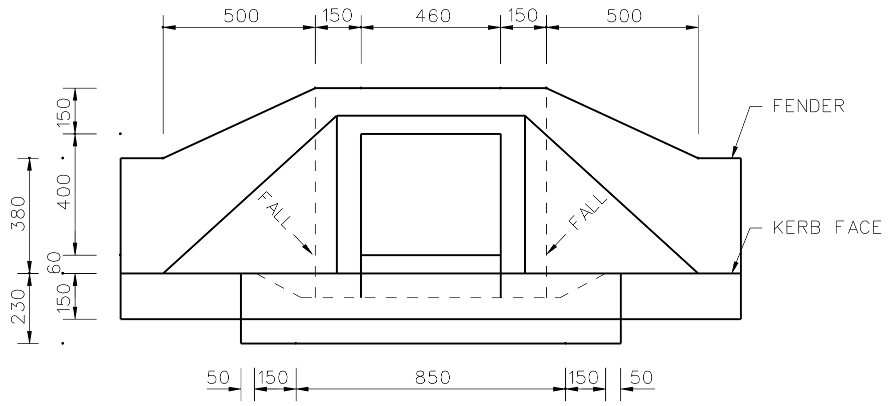
4 Use 50 X 50 X 8 Angle 700mm long (hot dip galvanised) to support end of frame at K & F.C./K & D.C. junction.



SECTION



PLAN - Side Entry Double Sump



PLAN - Side Entry Single Sump

Based on CCC drawings SD321

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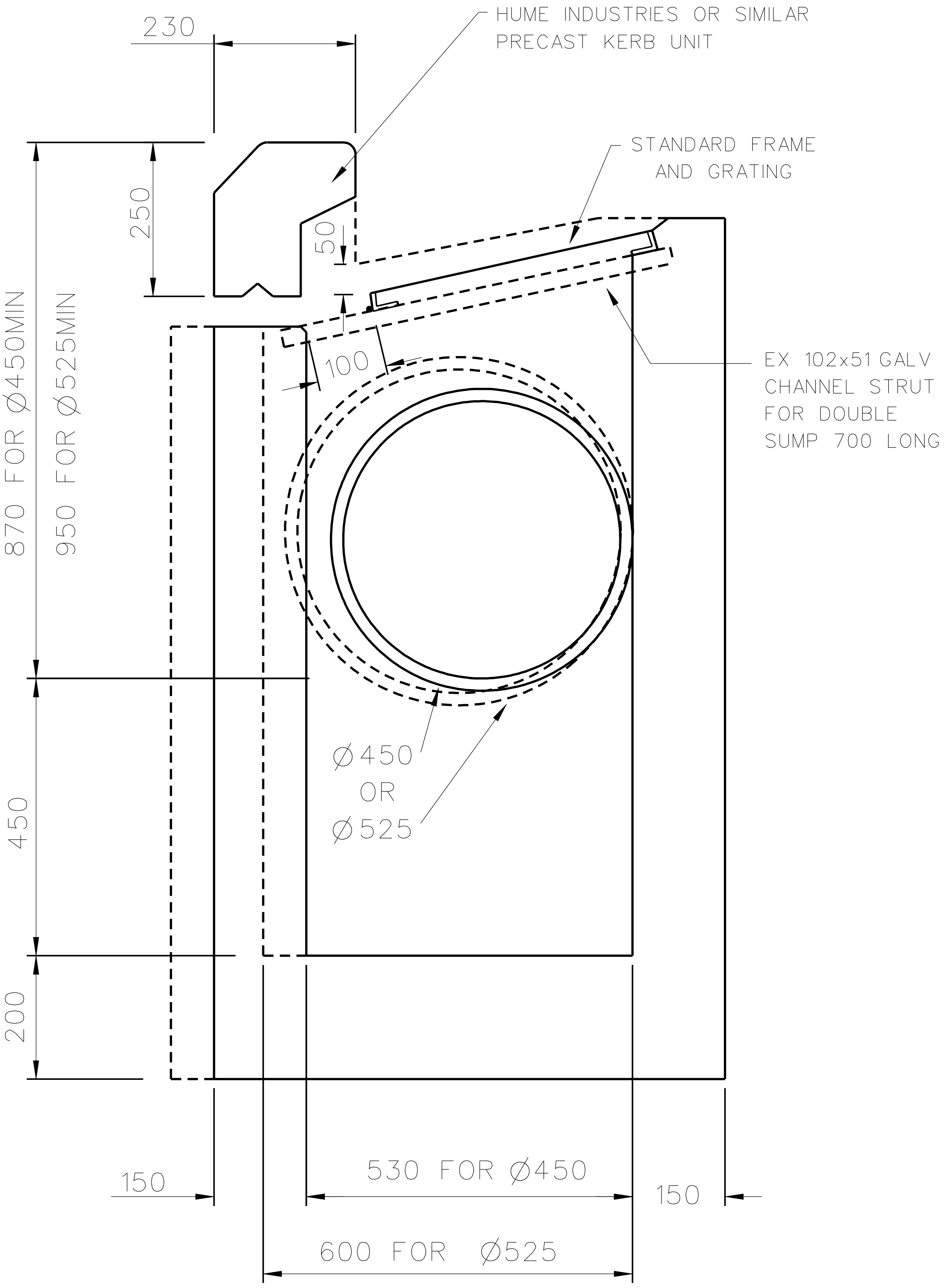
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE SIDE ENTRY SUMPS – PRECAST KERB UNIT	PROJECT TITLE STANDARD DRAWINGS	SHEET 321 ISSUE C PLAN No. 600



Based on CCC drawings SD322

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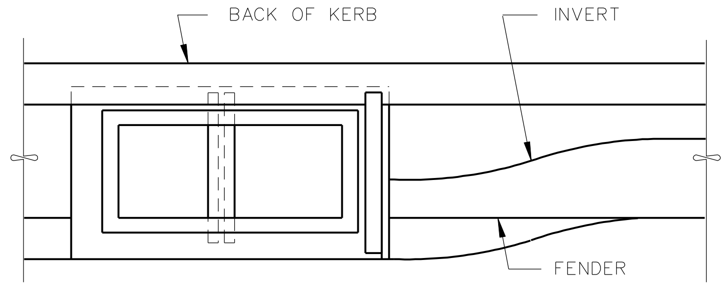
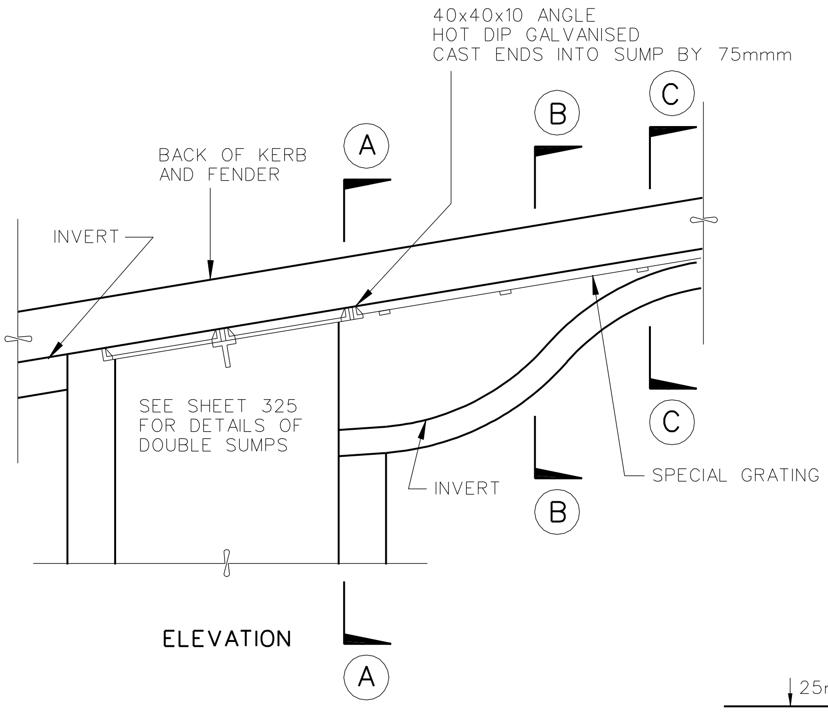
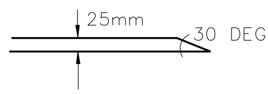
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE SIDE ENTRY ENLARGED SUMPS	PROJECT TITLE STANDARD DRAWINGS	SHEET 322 ISSUE C PLAN No. 600

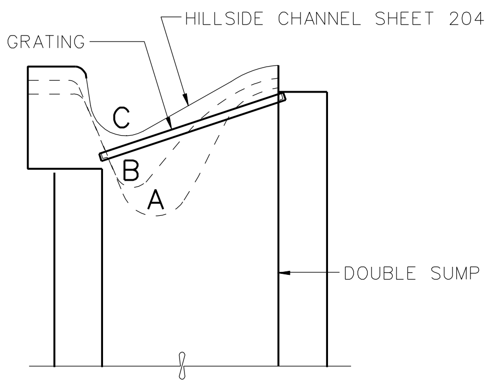


PLAN

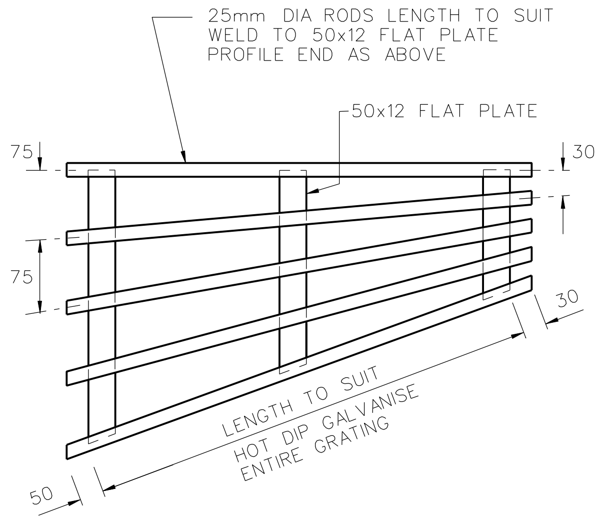


ELEVATION





SECTIONS A-A B-B C-C



SPECIAL GRATING

Based on CCC drawings SD324

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: HILLSIDE SUMP	PROJECT TITLE: STANDARD DRAWINGS	SHEET: 324
				ISSUE: C
				PLAN No.: 600

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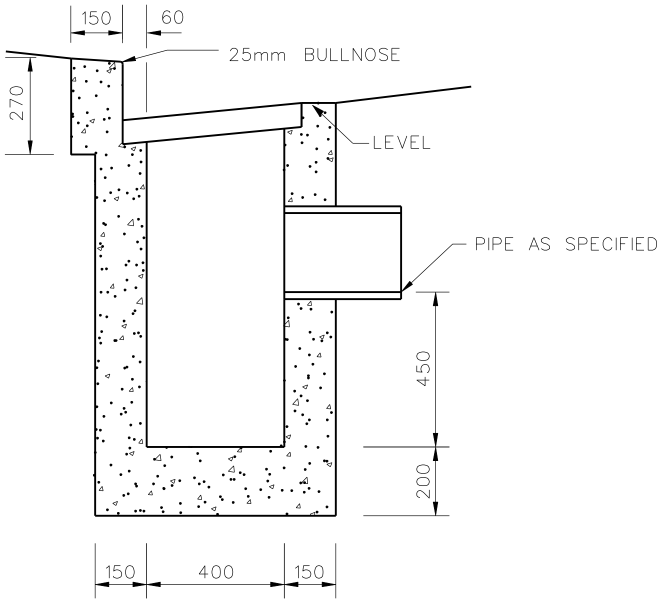
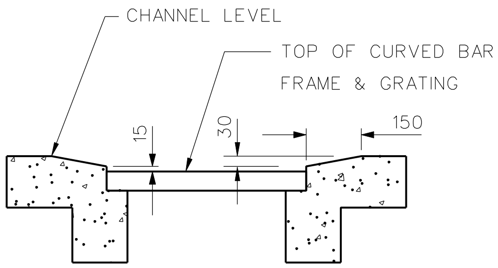
NOTES

1. Ramp down channel 30mm max over 150mm as shown in section A-A

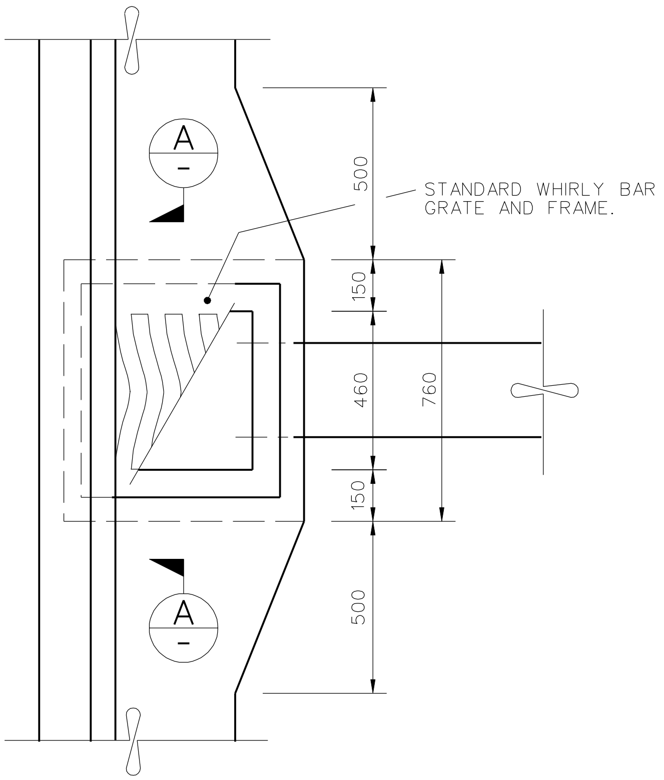
2. Grating / Frame set 15mm below ramp bottom.



ELEVATION



SECTION A-A



PLAN

Based on CCC drawings SD325

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE SINGLE SUMP KERB & FLAT CHANNEL	PROJECT TITLE STANDARD DRAWINGS	SHEET 325 ISSUE D / PLAN No. 600

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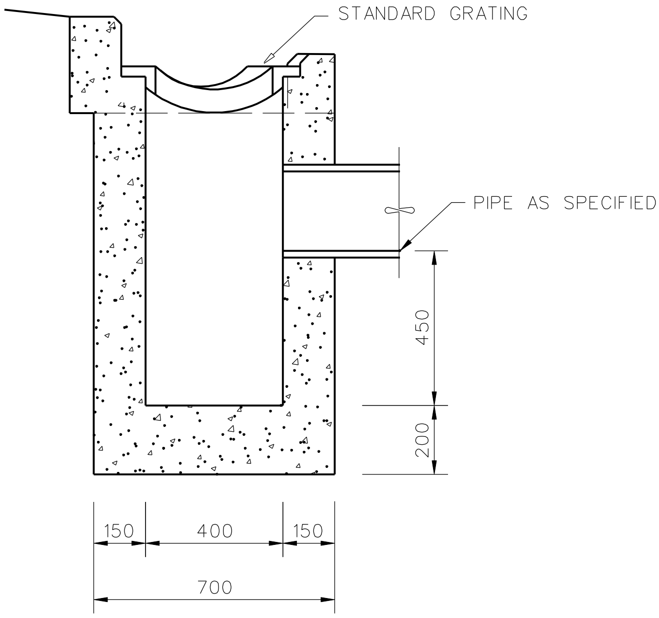
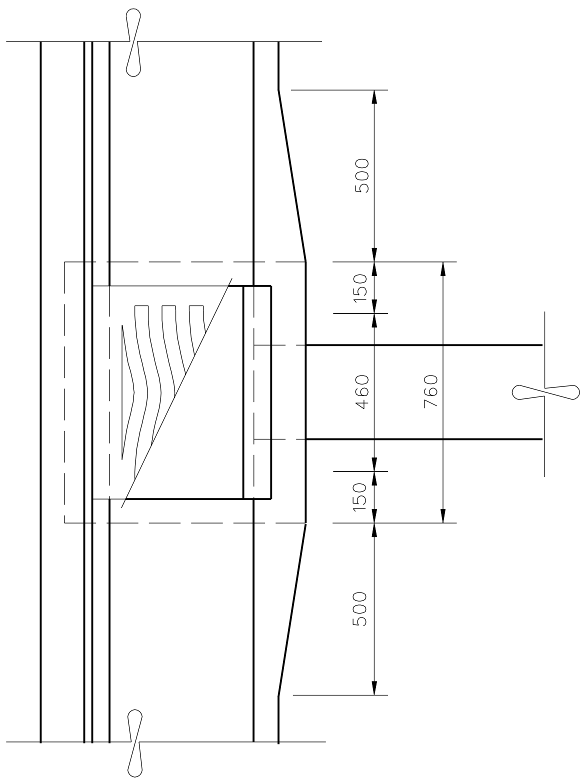
NOTES

1. FOR DRAINAGE AND CLEANING OPENINGS, CONSTRUCT SINGLE SUMP WITHOUT 450mm WELL.
2. THE GRATINGS SHALL BE DEPRESSED 30mm BELOW CHANNEL LEVEL.



ELEVATION



PLAN

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE SINGLE SUMP KERB & DISH CHANNEL	PROJECT TITLE STANDARD DRAWINGS	SHEET 326 ISSUE D PLAN No. 600

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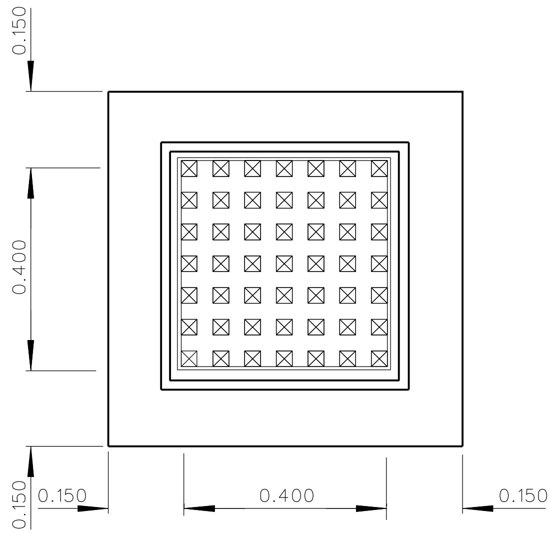
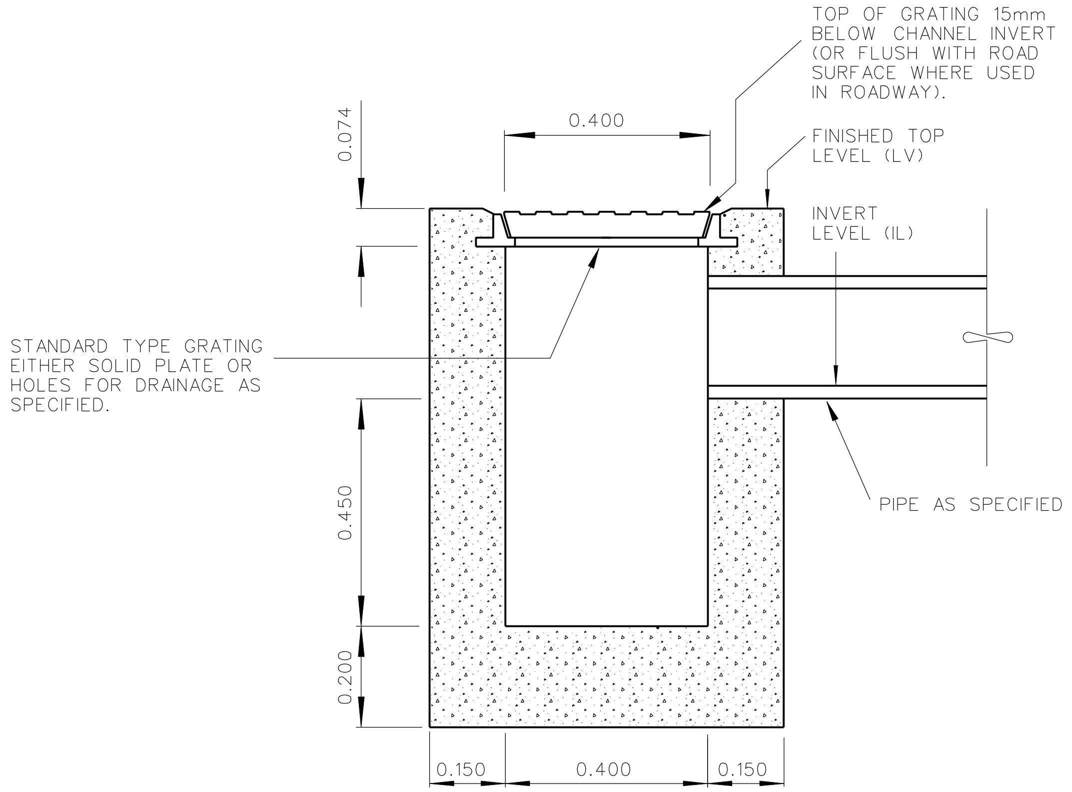


PLAN



ELEVATION

Based on CCC drawings SD327

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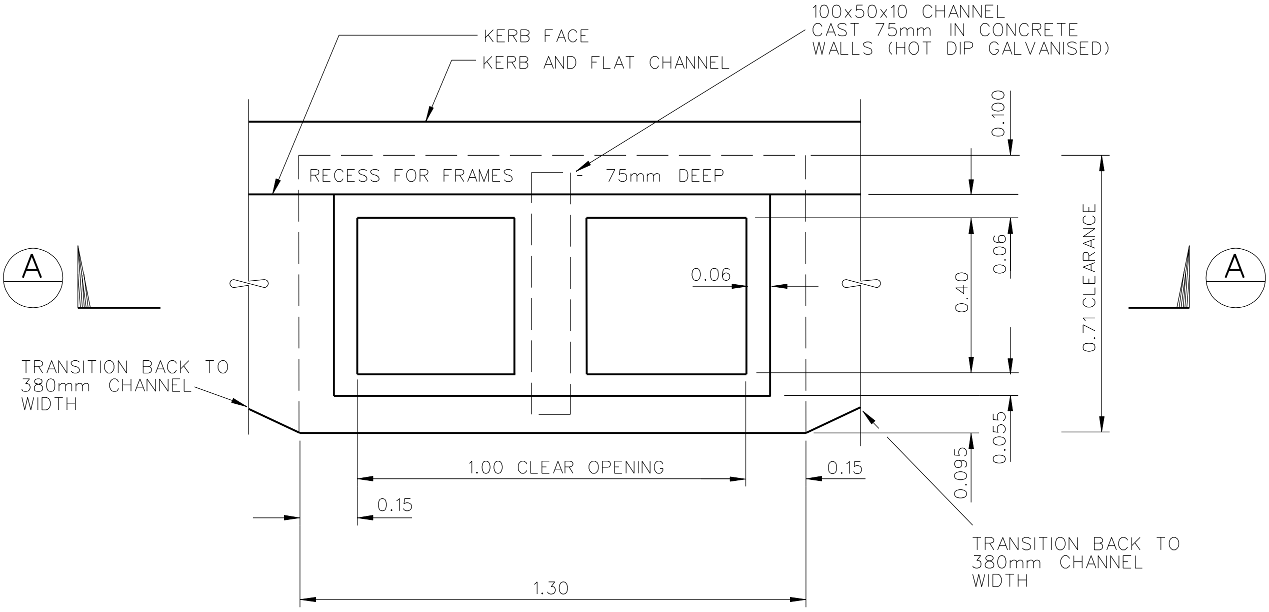
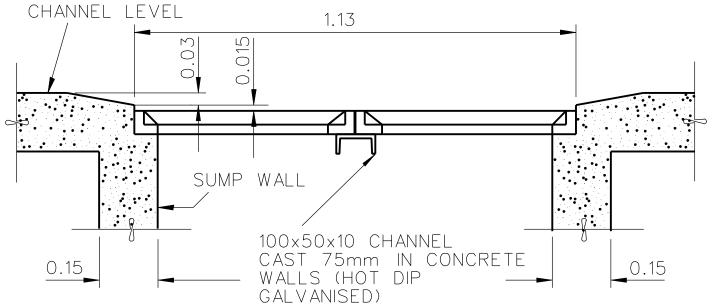
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
		CORNER SUMP	STANDARD DRAWINGS	327
				ISSUE C / PLAN No. 600

NOTES

1 Sump wall thickness , base thickness and well depth etc same as for single sump.



PLAN



SECTION A-A

Based on CCC drawings SD325

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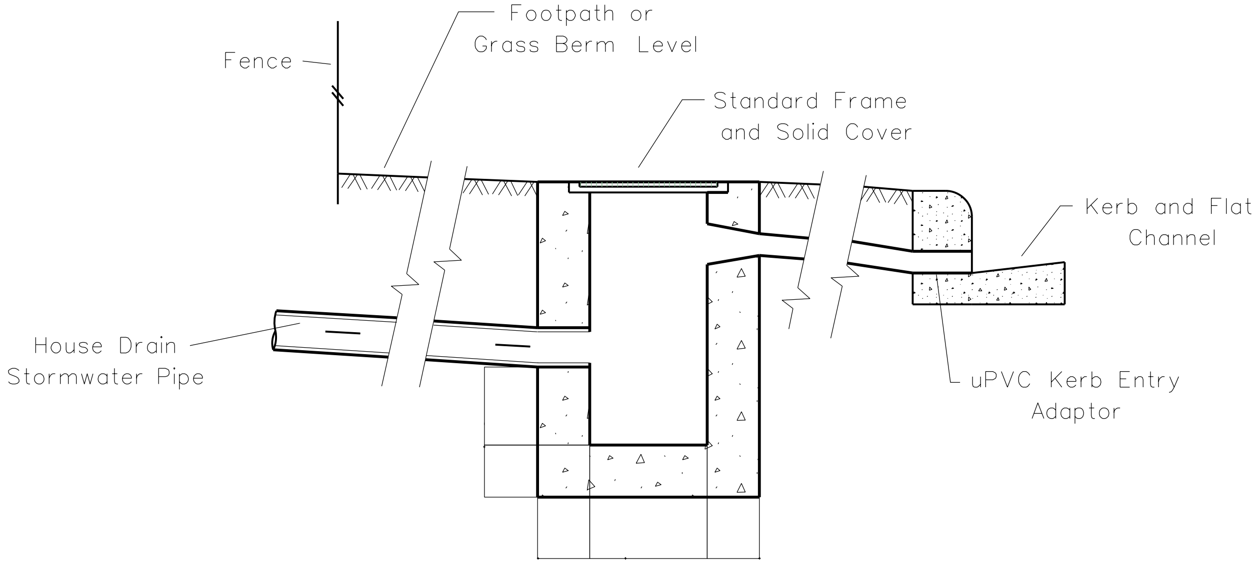
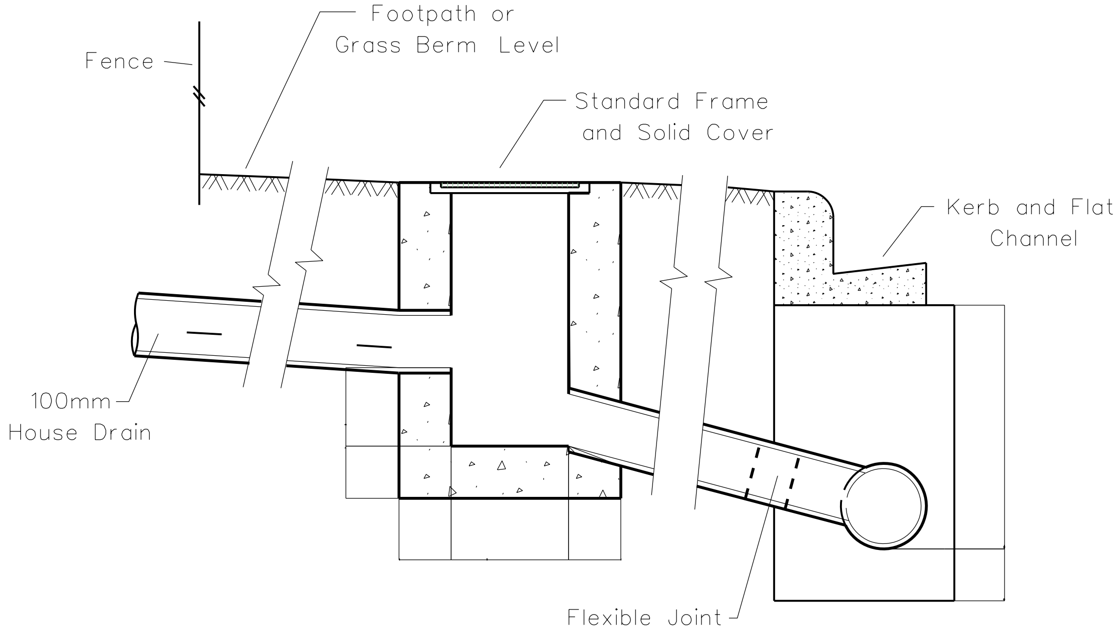
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
		DOUBLE SUMP FLAT CHANNEL	STANDARD DRAWINGS	328
				ISSUE C / PLAN No. 600



Type A



Type B

NOTES:

1. All concrete to be 20MPa at 28 days
2. All stormwater piping to comply with CSS Part 3
3. Inspection Box Sizes:
Use 225x125 box up to 450 depth to invert (lowest pipe)
Use 300x175 box over 450 depth to invert (lowest pipe)
4. 225x125 or 375 or 175 Inspection Box
Size depending on depth;
To be sited as close to kerb and channel as possible;
Supervising Engineer to confirm position on site;
In berm areas frame to be 5mm below kerb level.

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: HOUSE DRAIN INSPECTION BOX & KERB ADAPTOR	PROJECT TITLE: STANDARD DRAWINGS	SHEET: 329
				ISSUE: C / PLAN No. 600

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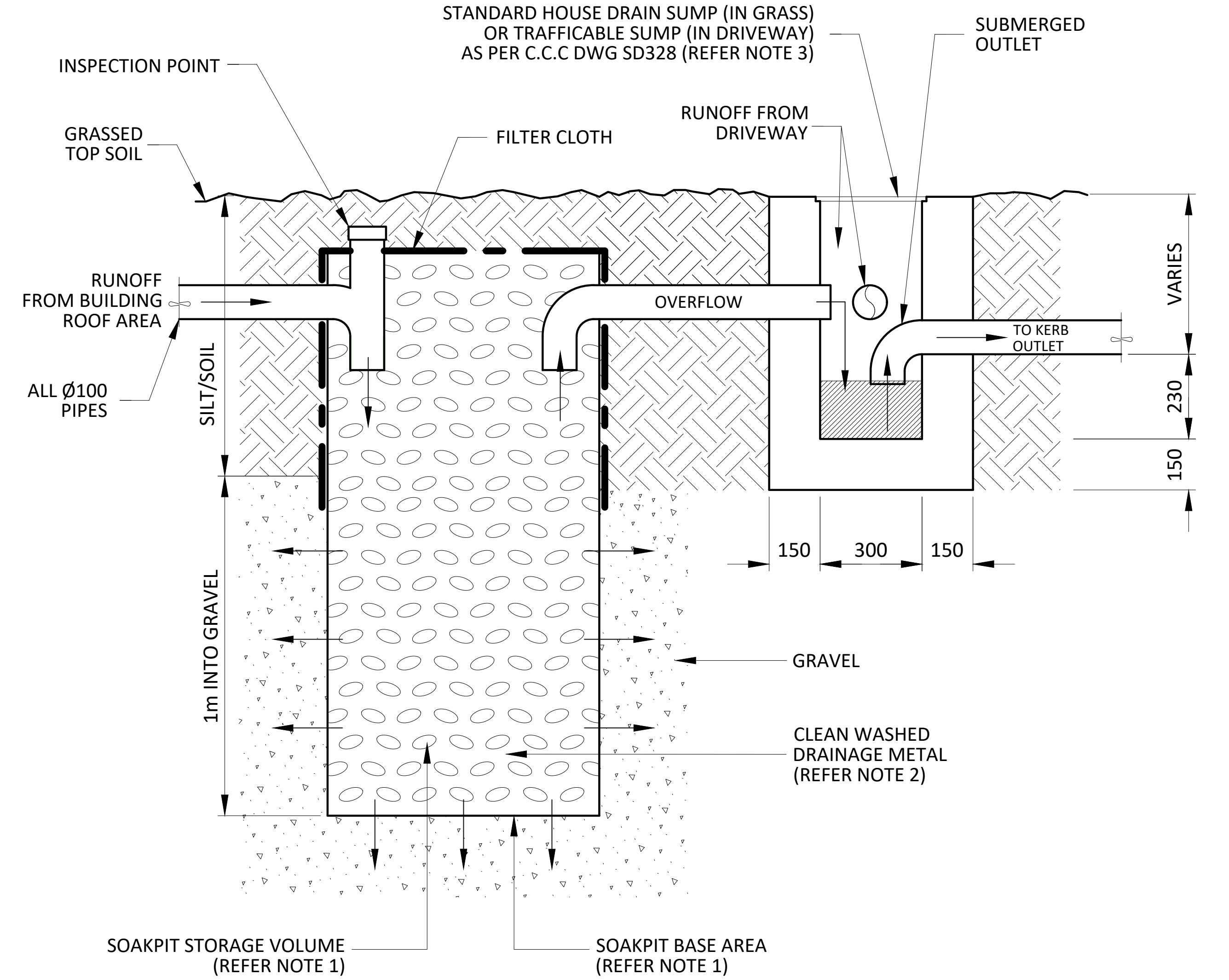
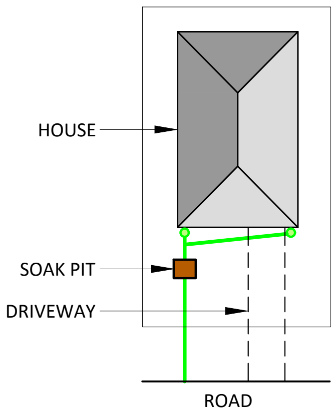


NOTES:

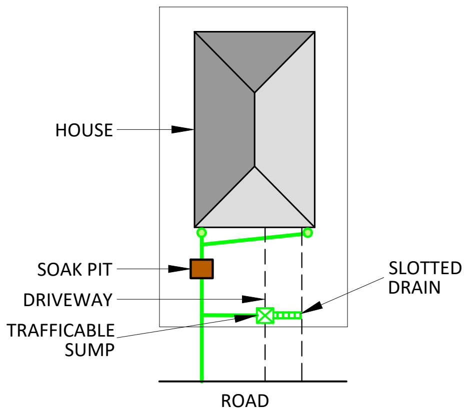
1. SOAK PIT SIZING - PROVIDE 1m^2 OF BASE AREA PER 100m^2 OF ROOF AREA AND 2m^3 OF STORAGE VOLUME PER 100m^2 OF ROOF AREA (ALLOW 0.38 FACTOR FOR VOID SPACE) OR ALTERNATIVELY PROVIDE FULL DESIGN CALCULATIONS IN ACCORDANCE WITH VERIFICATION METHOD E1/VM1 SECTION 9.

2. CLEAN WASHED DRAINAGE METAL - TO BE EITHER TAILINGS 20mm-40mm, ROUNDS 40mm-65mm, BOULDERS 65mm-120mm, ROCKS 100mm-150mm OR SIMILAR.

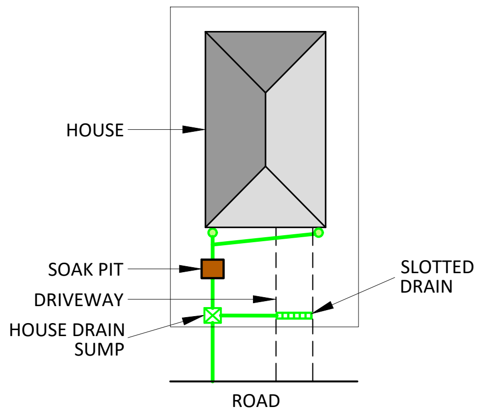
3. A HOUSE DRAIN SUMP OR SMALL TRAFFICABLE SUMP IS ONLY REQUIRED WHERE RUNOFF FROM THE DRIVEWAY IS CONNECTED TO THE OUTLET PIPE (REFER INDICATIVE LAYOUT DIAGRAMS BELOW).



NO SUMP REQUIRED



SUMP IN DRIVEWAY

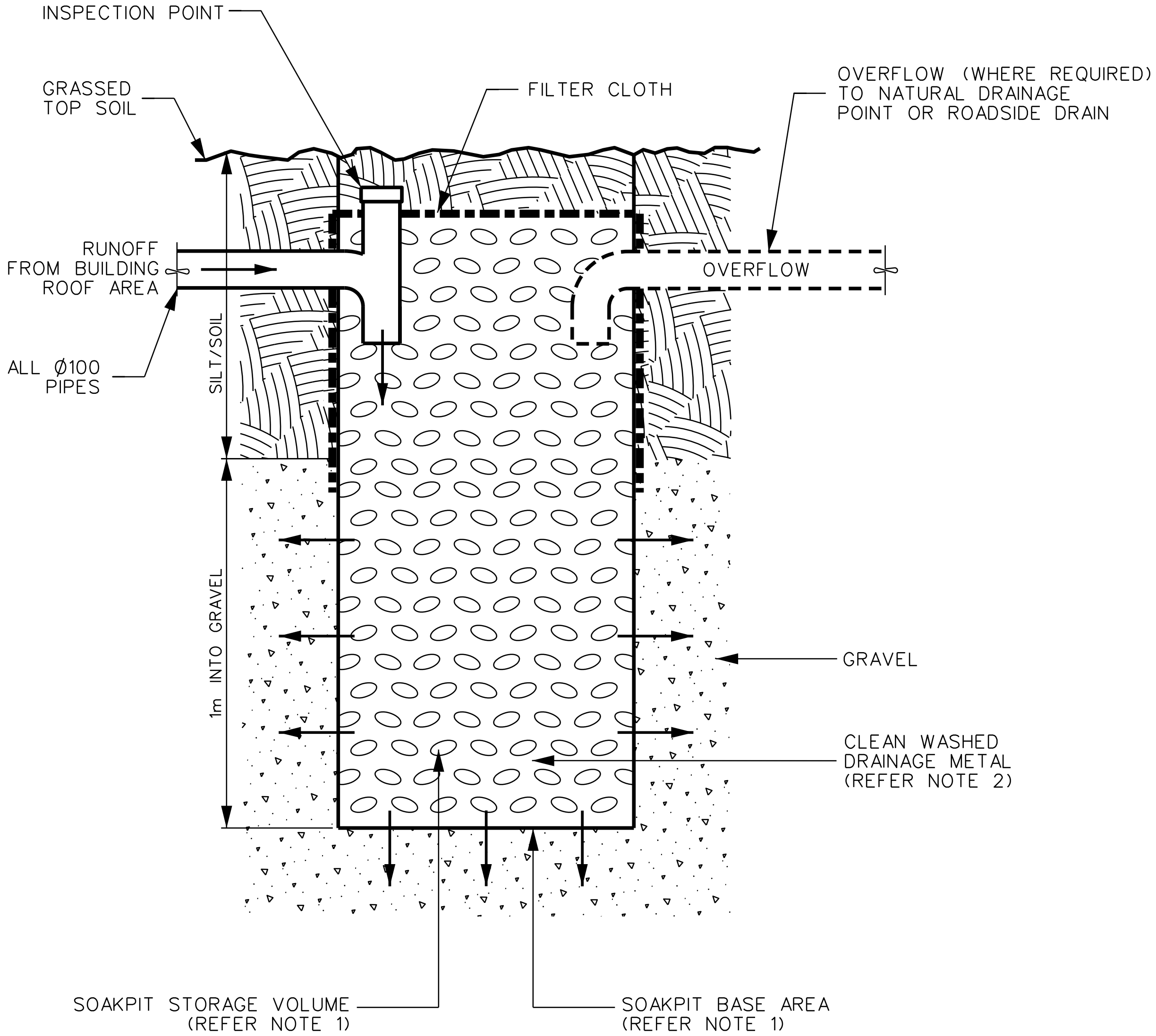


SUMP IN GRASS

WAIMAKARIRI DISTRICT COUNCIL

PROJECT TITLE	SHEET TITLE	SHEET
URBAN SOAK PIT	STANDARD DRAWINGS	330A

ISSUE	PLAN No.
C	600



NOTES:

1. SOAK PIT SIZING - PROVIDE $1m^2$ OF BASE AREA PER $100m^2$ OF ROOF AREA AND $2m^3$ OF STORAGE VOLUME PER $100m^2$ OF ROOF AREA (ALLOW 0.38 FACTOR FOR VOID SPACE) OR ALTERNATIVELY PROVIDE FULL DESIGN CALCULATIONS IN ACCORDANCE WITH VERIFICATION METHOD EI/VMI SECTION 9.

2. CLEAN WASHED DRAINAGE METAL - TO BE EITHER TAILINGS 20mm-40mm, ROUNDS 40mm-65mm, BOULDERS 65mm-120mm, ROCKS 100mm-150mm OR SIMILAR.

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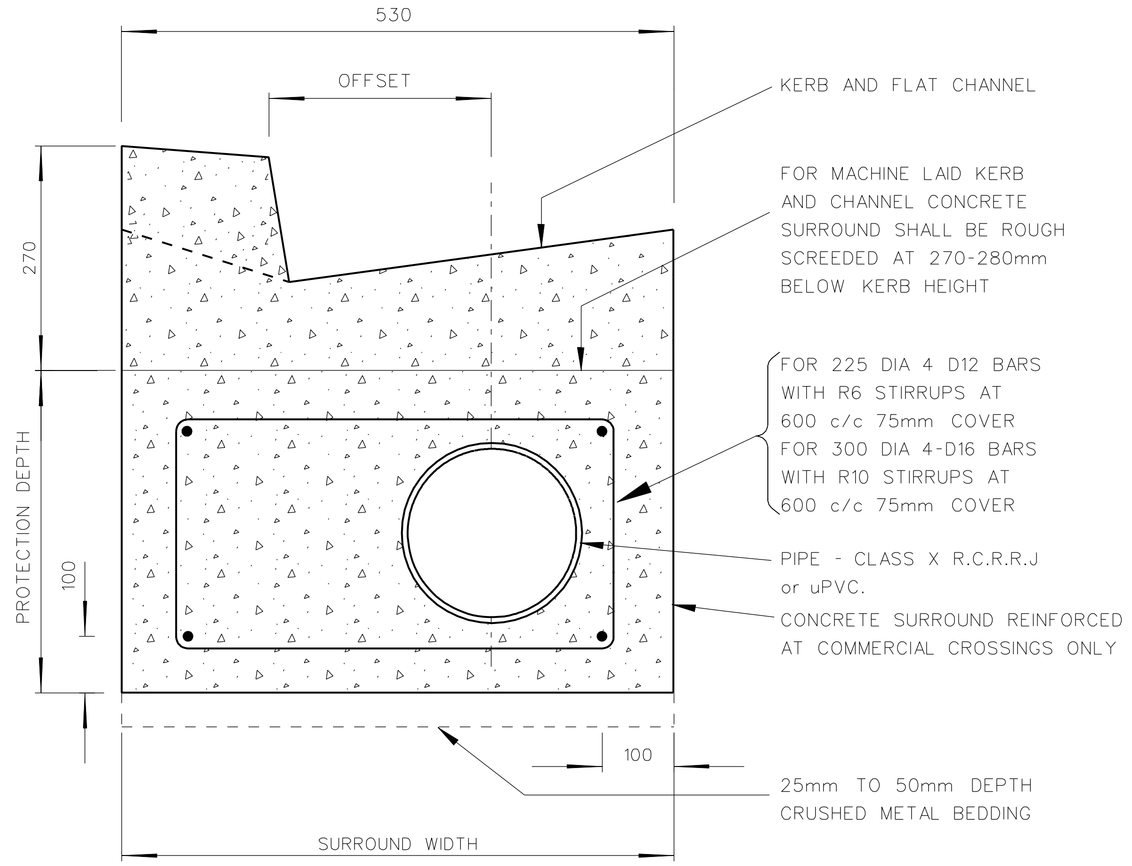
WAIMAKARIRI DISTRICT COUNCIL	NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
		RURAL SOAK PIT	STANDARD DRAWINGS	330B
				ISSUE: B / PLAN No. 600

NOTES

1. Concrete to comply with NZS 3109:1997.
2. Slump of concrete 50mm max.
3. Concrete kerb & channel shall have a minimum compressive strength of 20 MPa at 28 days.
4. Concrete surround and haunching for pipes shall have a minimum compressive strength of 15 MPa at 28 days.
5. Offsets on plans are measured to the invert of the channel.
6. Steel reinforced concrete surround shall extend each side of any commercial vehicle crossing by a minimum distance of 1.5m (see also drawings 600-201B, 600-212A and 600-212B).
7. Concrete protection shall terminate at a pipe joint.
8.

Pipe dia	Min depth kerb to invert	Conc surround width	Protection depth	Pipe offset from kerb face
225	620	560	460	180
250	650	580	490	190
300	700	630	530	210



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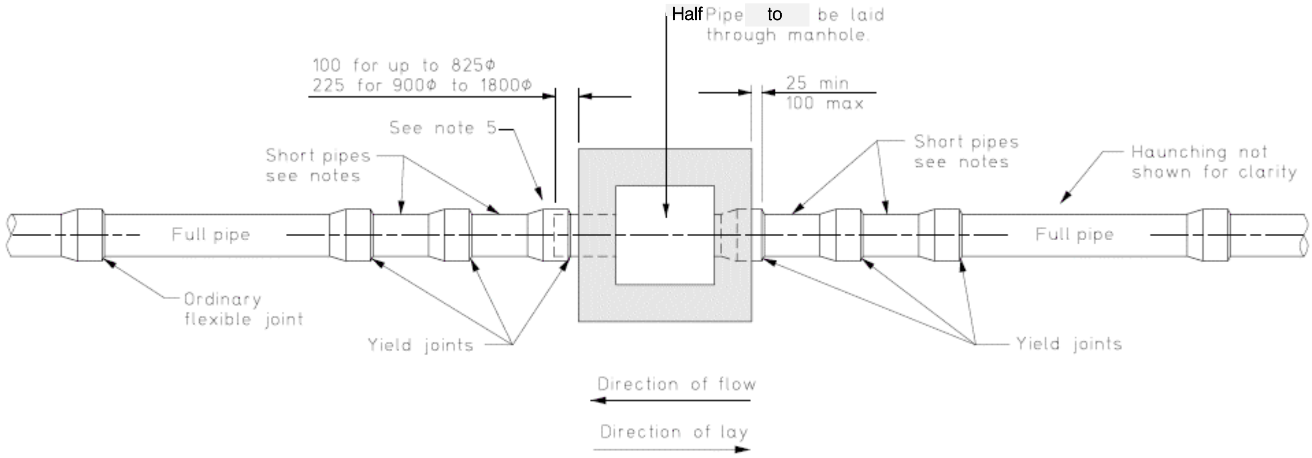
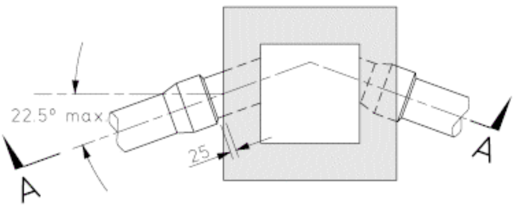
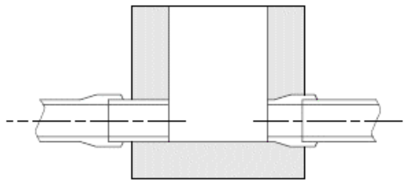
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: Concrete Surround for Under Channel Piping 225mm – 300mm dia.	PROJECT TITLE: STANDARD DRAWINGS	SHEET 331; ISSUE D; PLAN No. 600



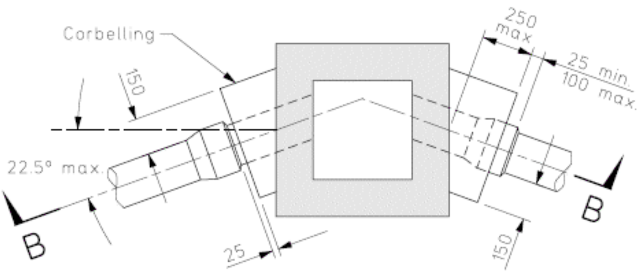
GENERAL METHOD OF PIPELAYING AT MANHOLES AND SUMPS



ANGLE CONNECTIONS

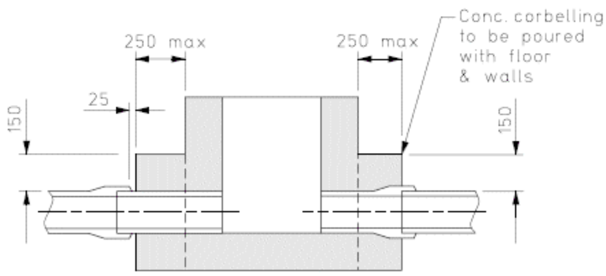


SECTION A-A



CORBEL DETAILS

Applies to straight & angle connections. Angle connections will be permitted for 100Φ to 300Φ pipelines. Special design required for pipes greater than 300Φ.



SECTION B-B

NOTES:

1. Pipelines that are concrete haunched or concrete surrounded shall have the concrete interrupted at each yield joint with softboard or equivalent.

2. Ceramic and vertically cast short pipes shall be minimum of 500mm & maximum of 800mm long.

3. For reinforced concrete short pipes the following table shall appy.

PIPE DIAMETER	MIN	MAX
225	600	800
300	750	1000
375	900	1200
450	1100	1450
525	1300	1700
600	1500	1900
675	1700	2100

4. At each pipeline connecting to a manhole or sump, the No. of short pipes and yield joints shall comply with the following table:

PIPE DIAMETER	SHORT PIPES	YIELD JOINTS
100 to 525	2	3
600 to 675	1	2
750 to 2100	0	1
Sump	1	2

5. This pipe may be double spigot pipe with a socket finisher in the manhole wall with Engineer's approval. Maximum length pipe 1300mm, minimum length 450mm.

6. Corbelling where suitable pipe lengths are not available shall only be used with the Engineer's approval. For corbelling on precast manholes see SD303/1.

7. Gibault joints shall not be used as yield joints unless approved by the Engineer.

Based on CCC Drawing SD341/1

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE TO BE REVISED	SHEET TITLE PIPELAYING AT MANHOLES & SUMPS Concrete & Ceramic Pipes	PROJECT TITLE STANDARD DRAWINGS	SHEET 341A ISSUE A PLAN No. 600

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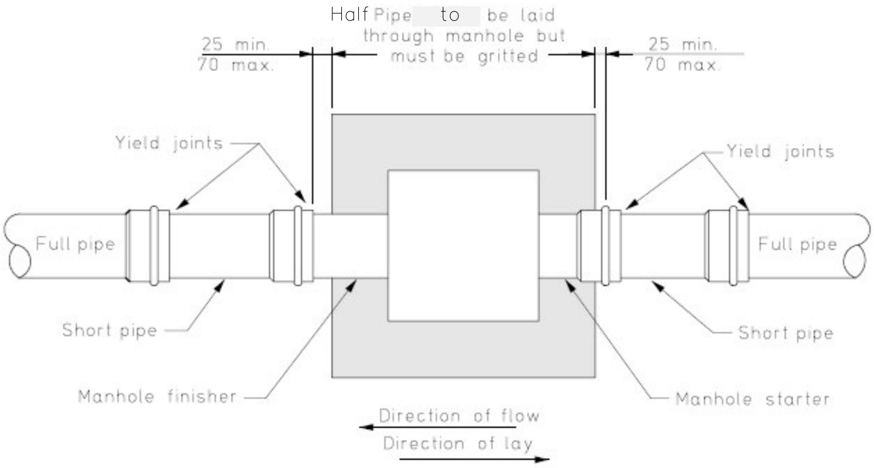

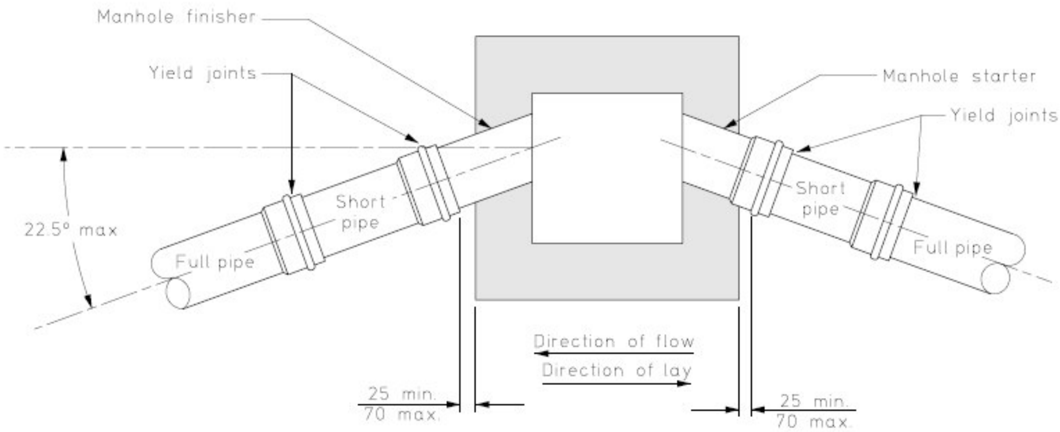

NOTES:

1. Manhole starters and finishers must be to plan SD343.
2. Short pipes shall have a minimum length of 700mm & a maximum of 1000mm.
3. On each pipeline connecting to a manhole there shall be one short pipe and two yield joints.
4. Pipelines which are concrete haunched shall have the concrete interrupted at each joint with softboard or equivalent.

Based on CCC Drawing SD341/2

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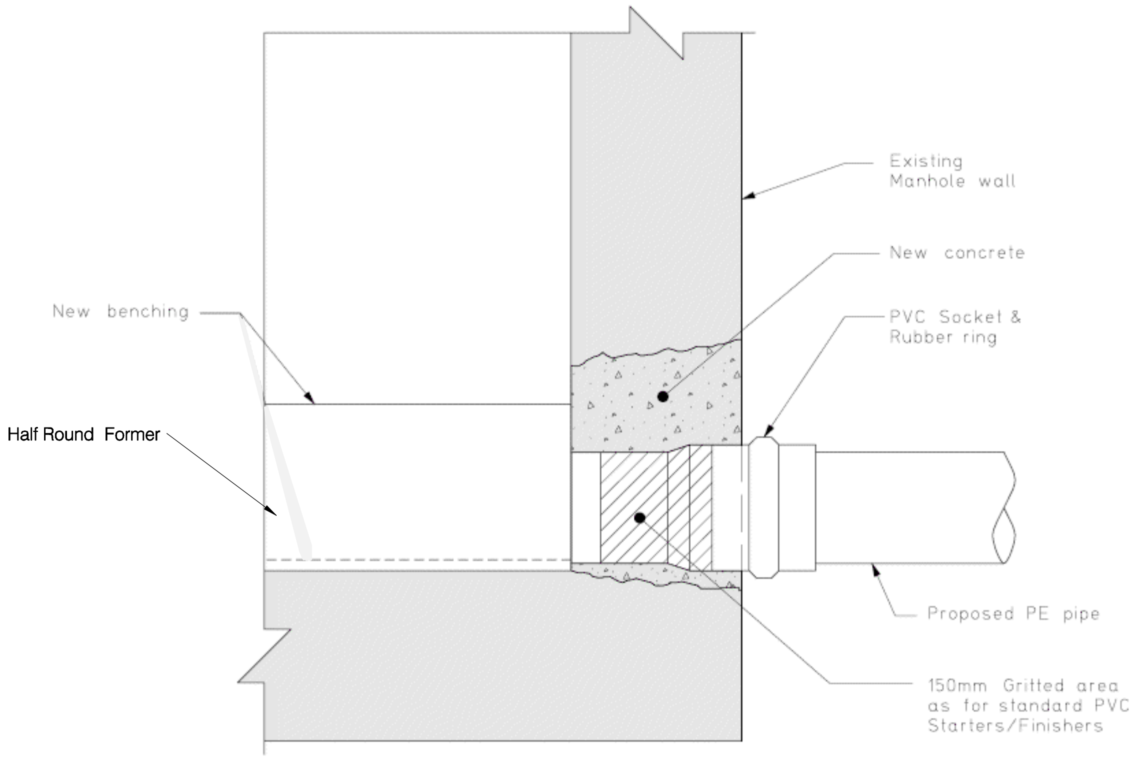
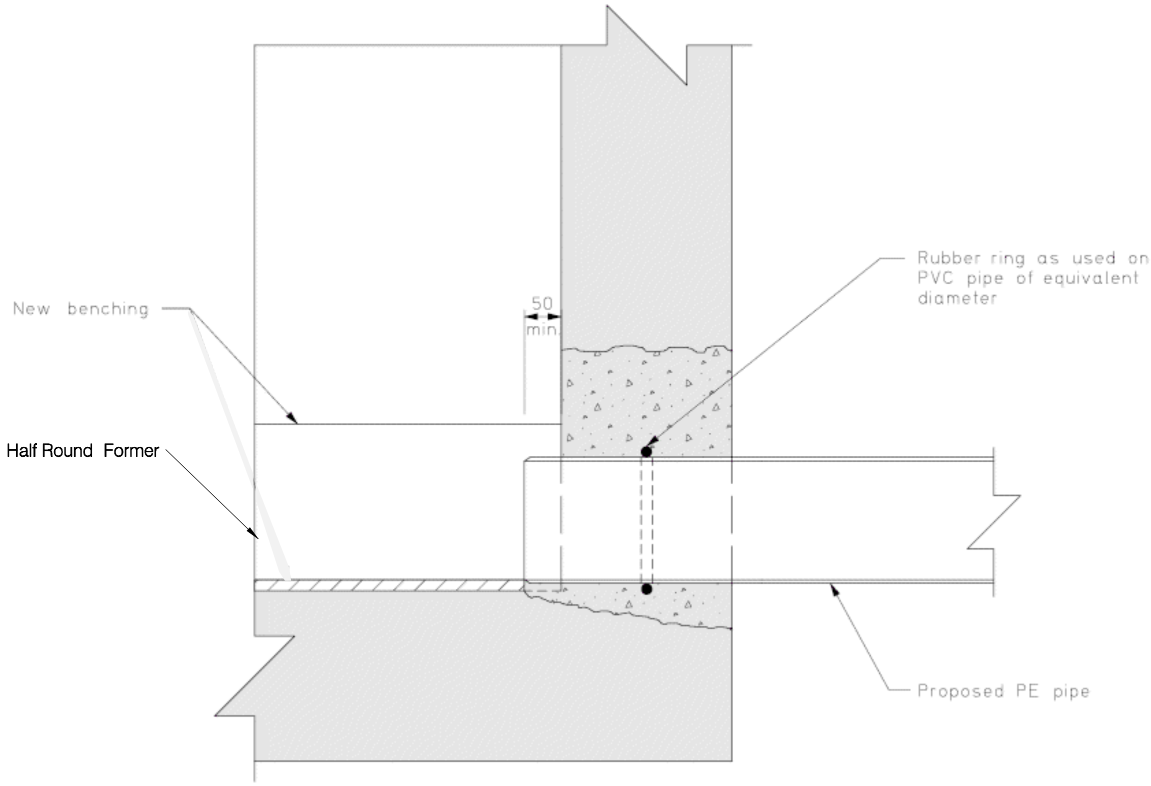
WAIMAKARIRI DISTRICT COUNCIL
technical services

NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
TO BE REVISED	PIPELAYING AT MANHOLES & SUMPS PVC Pipes	STANDARD DRAWINGS	341B
			ISSUE: A
			PLAN No.: 600



PVC SOCKET METHOD



RUBBER RING METHOD

Based on CCC Drawing SD341/3

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE TO BE REVISED	SHEET TITLE PIPELAYING AT MANHOLES PE Pipes	PROJECT TITLE STANDARD DRAWINGS	SHEET 341C ISSUE A PLAN No. 600

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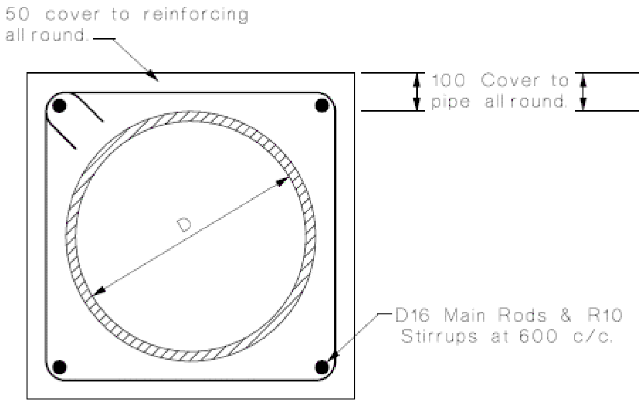
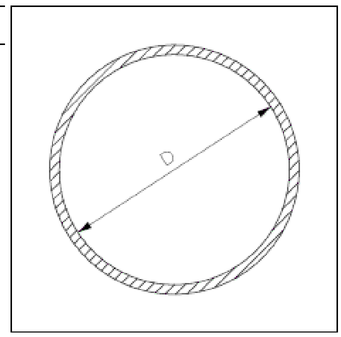
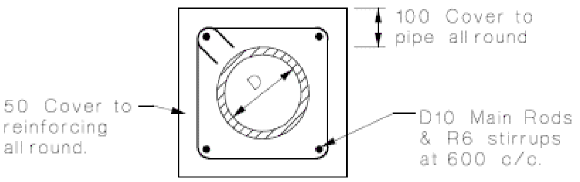


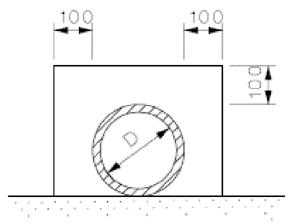


REINFORCED
CONCRETE SURROUND
D=150Φ to 450Φ
TYPE A

PLAIN
CONCRETE SURROUND
D=150Φ to 450Φ
TYPE B



REINFORCED
CONCRETE SURROUND
D=100Φ
TYPE C



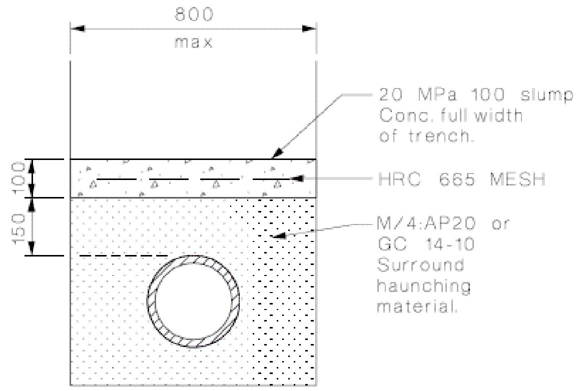
CONCRETE COVER
D=100Φ
TYPE D

NOTES:

1. For diameters greater than 450mm special design applies.
2. Concrete shall be 20 MPa 100 slump with a tolerance of +0,-20mm.
3. Type of surround shall be specified.
4. Concrete surround shall terminate at a pipe joint.
5. Contraction joints shall be formed at pipe joints by interrupting concrete with 12mm Softboard or equivalent and applying approved sealant to the pipe joint to prevent entry of concrete. Any reinforcing steel shall be stopped unhooked 50mm from joint.
6. Contraction joint spacing - maximum:

	R.C.R.R.	Ceramic Pipes or vertically cast
Type A	10m	3.2m
Type B	5m	1.6m
Type C	Engineer to specify	3.2m
Type D		1.6m

7. With PVC pipe Type E protection to be used unless otherwise specified.



CONCRETE PROTECTION SLAB
MAXIMUM PIPE SIZE 375Φ
TYPE E

Based on CCC Drawing SD342

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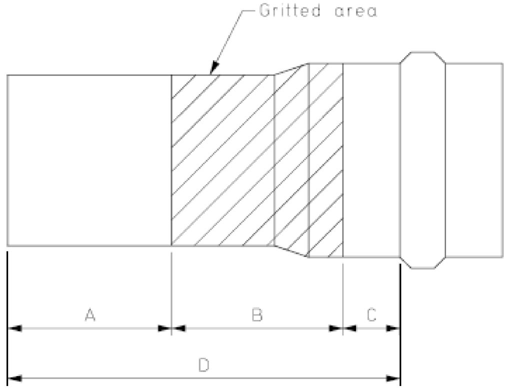
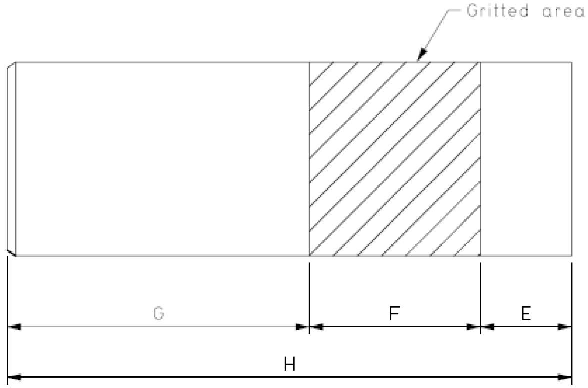
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE TO BE REVISED	SHEET TITLE PIPE PROTECTION	PROJECT TITLE STANDARD DRAWINGS	SHEET 342 ISSUE B PLAN No. 600





Pipe DN	A	B	C	D
100	144	150	50	344
150	129	150	50	329
175	113	150	50	313
225	95	150	50	295
300	82	150	50	282

Pipe DN	E	F	G	H
100	80	150	265	495
150	80	150	268	498
175	80	150	272	502
225	80	150	276	506
300	80	150	290	520

FOR STRAIGHT THROUGH, 90° & CIRCULAR MANHOLES

100	130	200	100	430
150	130	200	100	430
175	100	200	150	450
225	130	200	150	480
300	170	200	150	520

100	110	250	230	590
150	120	250	230	600
175	140	250	260	650
225	120	250	280	700
300	150	250	310	770

FOR ANGLE MANHOLES

MANHOLE STARTERS

MANHOLE FINISHERS

Based on CCC Drawing SD343

WAIMAKARIRI DISTRICT COUNCIL technical services

NOT TO SCALE

TO BE REVISED

SHEET TITLE
PVC MANHOLE STARTERS & FINISHERS

PROJECT TITLE
STANDARD DRAWINGS

SHEET 343

ISSUE A

PLAN No. 600

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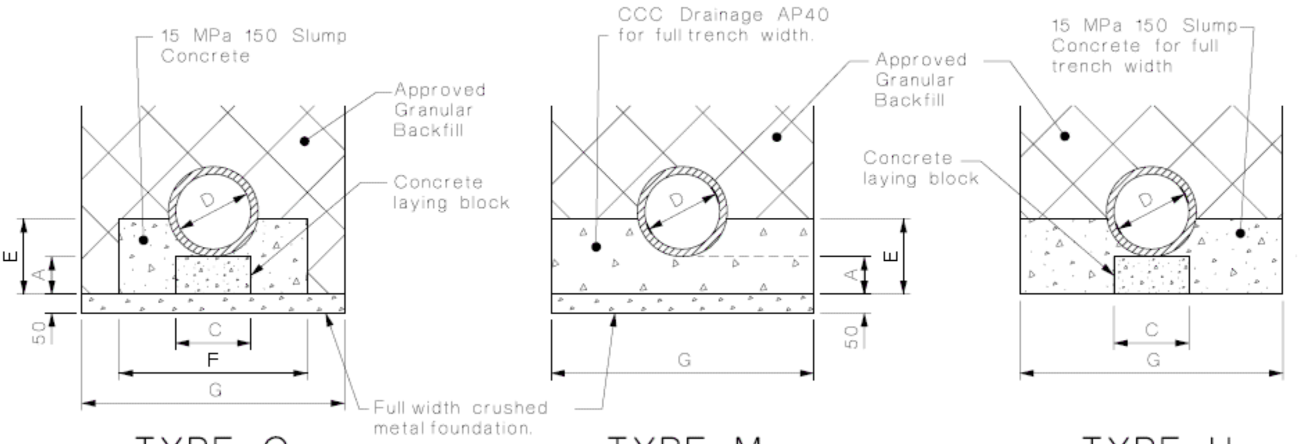


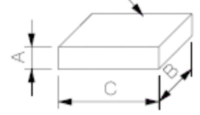
TYPE C
Concrete Haunching

TYPE M
Metal Haunching

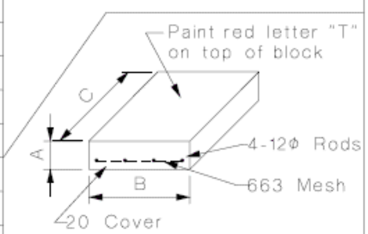
TYPE H
Concrete Haunching without Foundation Metal

PIPE Φ D	CONCRETE LAYING BLOCK DEPTH A	LENGTH B	WIDTH C	WEIGHT kg	E	F	G
100	75	150	150	4.1	145	350	450
150	100	150	150	5.4	170	450	650
200	100	150	200	7.2	200	500	700
225	100	150	200	7.2	200	500	700
250	100	150	250	9	200	500	800
300	100	150	250	9	200	580	800
375	100	200	300	14.4	200	660	900
450	120	200	350	20	250	720	1000
525	120	200	400	23	250	840	1100
600	150	200	400	29	300	900	1200
675	150	200	500	36	300	1000	1300
750	150	250	600	54	350	1060	1300
825	150	250	600	54	350	1160	1400
900	150	300	600	65	350	1240	1500
975	150	300	700	76	350	1300	1600
1050	150	300	700	76	400	1400	1700
1200	150	300	800	86	400	1560	1900
1350	150	300	900	97	450	1720	2100
1600	150	350	900	113	450	1950	2400
1800	150	450	1000	162	500	2200	2600
2100	150	600	1000	216	500	2500	2900

LAYING BLOCKS



Concrete Laying Block



Reinforced Concrete Laying Block

NOTES:

1. Contraction joints shall be formed at pipe joints by interrupting with softboard or equivalent. Any reinforcing steel shall be stopped unhooked 50mm from joint.

2. 100Φ with type M haunching shall have a minimum of 25mm foundation metal.

3. In fine grain soils and where crushed metal haunching is used the haunching shall be fully wrapped in an approved geotextile.

Based on CCC Drawing SD344/1

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WAIMAKARIRI DISTRICT COUNCIL technical services

NOT TO SCALE

TO BE REVISED

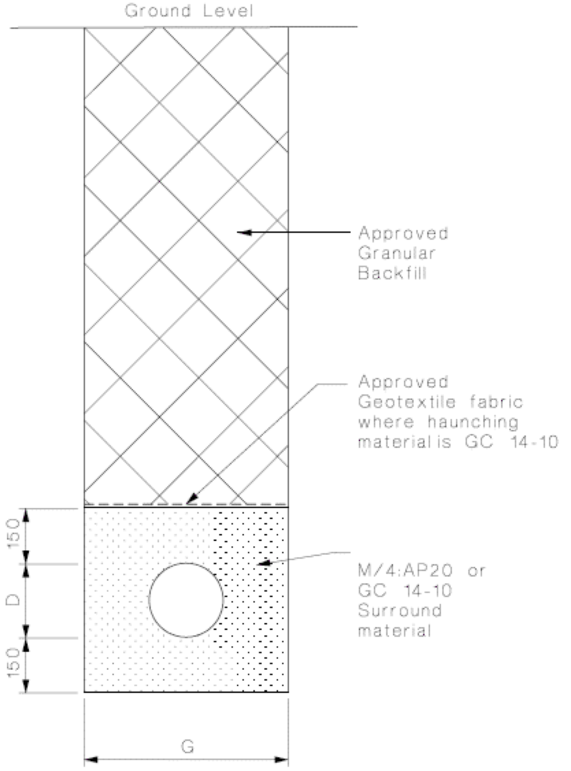
SHEET TITLE: PIPELAYING HAUNCHING DETAILS Concrete Pipes

PROJECT TITLE: STANDARD DRAWINGS

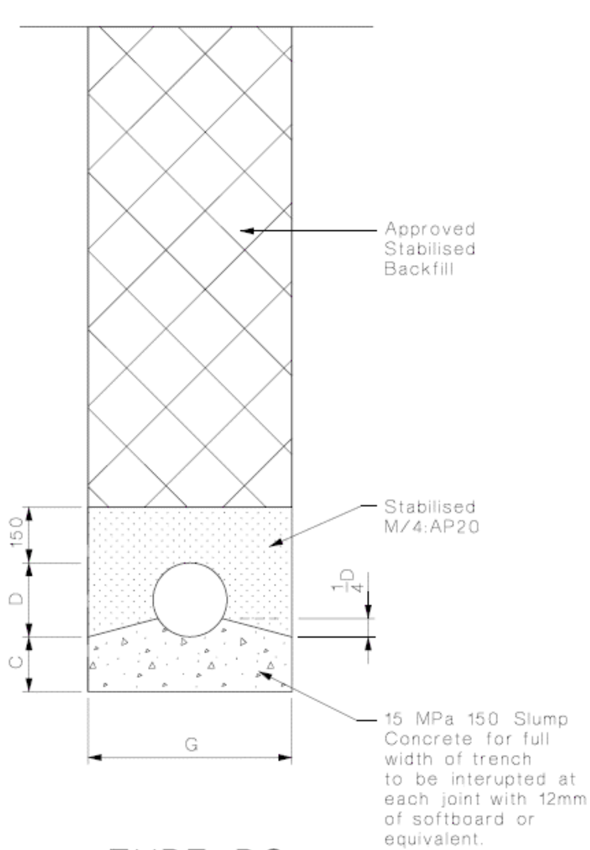
SHEET: 344A

ISSUE: A

PLAN No.: 600



TYPE P
Standard Haunching



TYPE PC
Concrete Haunching

Nominal Pipe Diameter DN	Trench Width ✳G	Concrete haunching $\frac{1}{4}$D	C
100	450	25	75
150	500	40	100
175	550	50	100
225	600	60	100
300	650	80	100
375	750	100	100

✳ In very soft ground G may need to be increased.
See manufacturers guidelines.

NOTE:

1. In fine grain soils and where GC 14-10 surround is used the surround shall be fully wrapped in an approved geotextile.

Based on CCC Drawing SD344/2

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
	TO BE REVISED	PIPELAYING HAUNCHING DETAILS Flexible/Ceramic Pipes	STANDARD DRAWINGS	344B
				ISSUE A / PLAN No. 600

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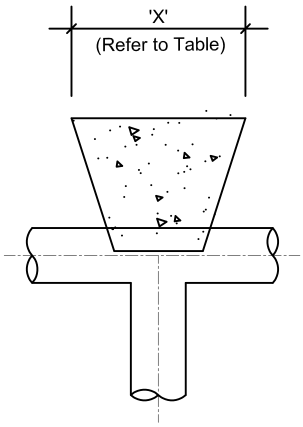
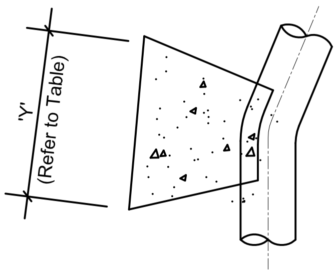
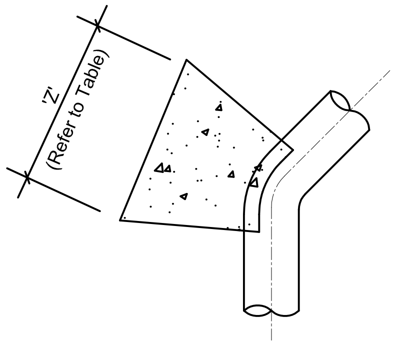


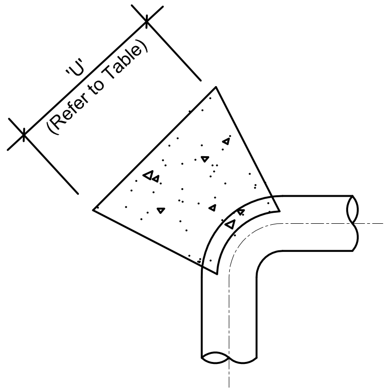
TEE JUNCTION



22.5° BEND



45° BEND



90° BEND

PIPE OUTSIDE DIAMETER, OD (m)	TEE HEIGHT / WIDTH (m)	22.5°BEND HEIGHT / WIDTH (m)	45°BEND HEIGHT / WIDTH (m)	90°BEND HEIGHT / WIDTH (m)
OD	$X = \sqrt{\frac{OD^2xP}{64}}$	$Y = \sqrt{\frac{OD^2xP}{164}}$	$Z = \sqrt{\frac{OD^2xP}{83}}$	$U = \sqrt{\frac{OD^2xP}{45}}$
0.115	0.50x0.50	0.31x0.31	0.44x0.44	0.59x0.59
0.165	0.72x0.72	0.45x0.45	0.63x0.63	0.85x0.85
0.180	0.78x0.78	0.49x0.49	0.68x0.68	0.93x0.93
0.225	0.98x0.98	0.61x0.61	0.85x0.85	1.16x1.16
0.250	1.09x1.09	0.68x0.68	0.95x0.95	1.29x1.29
0.280	1.22x1.22	0.76x0.76	1.06x1.06	1.45x1.45
0.315	1.37x1.37	0.85x0.85	1.20x1.20	1.63x1.63
0.355	1.54x1.54	0.96x0.96	1.35x1.35	1.83x1.83
0.400	1.74x1.74	1.08x1.08	1.52x1.52	2.07x2.07
0.500	2.17x2.17	1.36x1.36	1.90x1.90	2.58x2.58

- For pipe sizes specified and for a design pressure of 1200kPa, use the thrust block dimensions specified in the Table
- For non-standard pipe size or where the design pressure is not 1200kPa, use the formula supplied, which requires the following inputs
  - OD = Design Pipe Outside Diameter (m)
  - P = Design Pressure (kPa)

Notes:

- Faces X, Y, Z and U to be poured against natural ground.
- Thrust blocks designed for minimum soil bearing capacity of 50kPa. Thrust blocks in unsuitable soils required specific design.
- Concrete to be 15MPa, 150mm slump, unreinforced.
- Do not use for upward thrust (specific design required).
- Bends and tees adjacent to concrete shall be wrapped with 6mm Denso tape or 250 microns Polyethylene film or equivalent.
- A safety factor is not included or required unless otherwise stated by Council.

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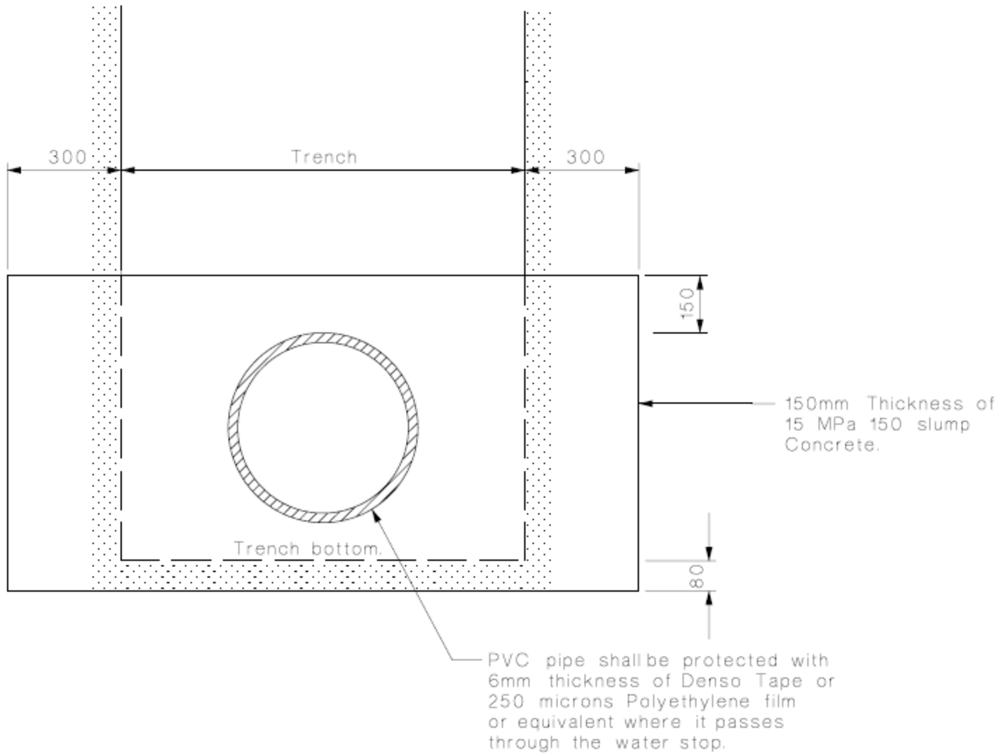
WAIMAKARIRI DISTRICT COUNCIL

PROJECT TITLE	SHEET TITLE	PLAN No.	ISSUE	SHEET
Standard Drawings	Thrust Blocks	600	B	346



NOTES:

1. Water stops shall generally be at the following spacings:

PIPE GRADIENT	MAXIMUM SPACING (metres)
1 : 15 or steeper	12
1 : 25	15
1 : 50	30
1 : 100	60

Provided:

a. Intermediate grades are determined by interpolation.

b. Manholes poured against a trimmed excavation may be reckoned as water stops.

c. Where a flatter grade occurs below a steeper grade, at least one further water stop shall be located on the upper section of the flatter grade at a distance from the change in grade equal to the above table spacing for the upper grade.

Based on CCC Drawing SD347

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
	TO BE REVISED	WATER STOPS	STANDARD DRAWINGS	347
				ISSUE B / PLAN No. 600

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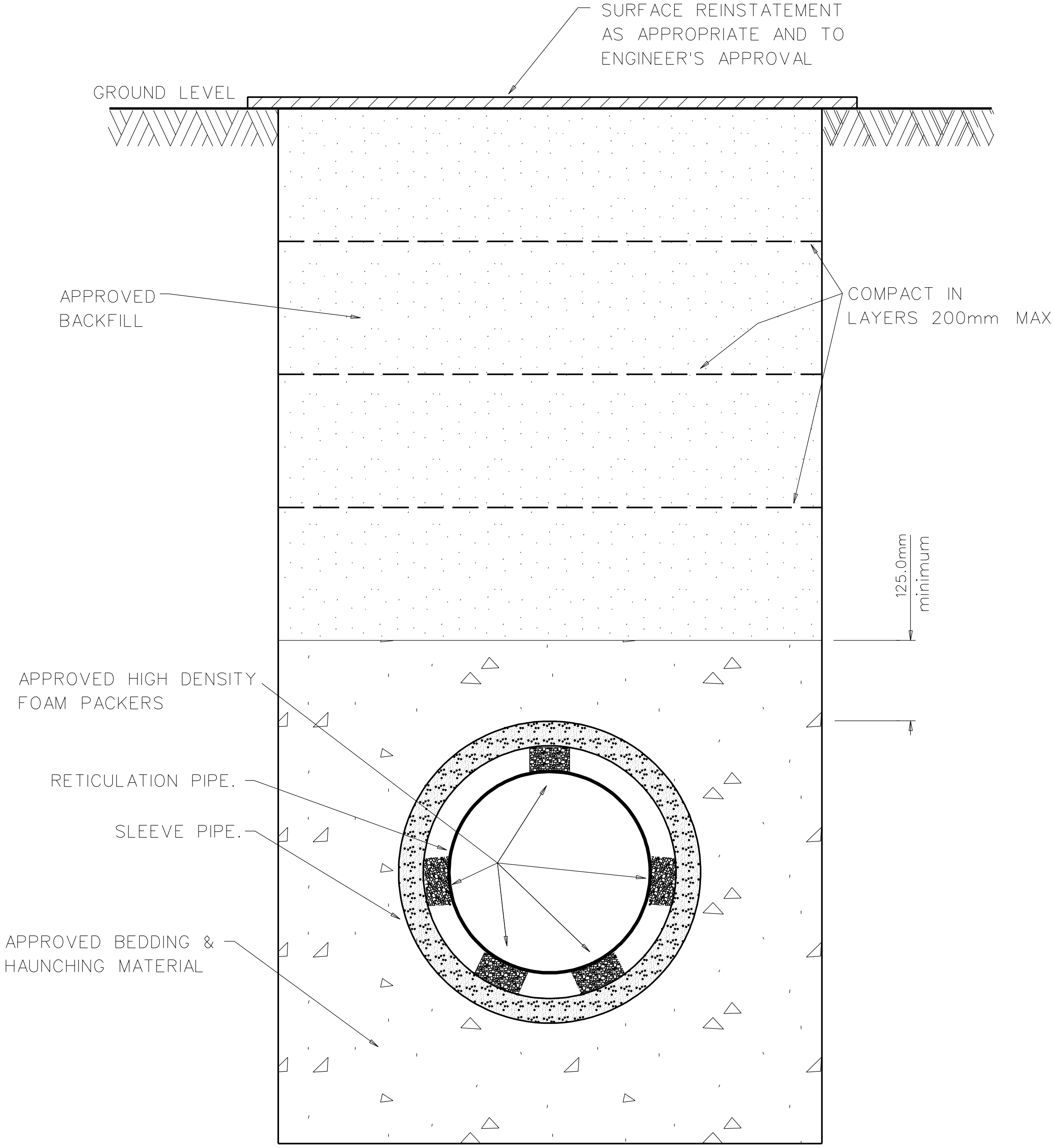

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WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
		SLEEVING RETICULATION MAINS	STANDARD DRAWINGS	351
				ISSUE: C / PLAN No. 600

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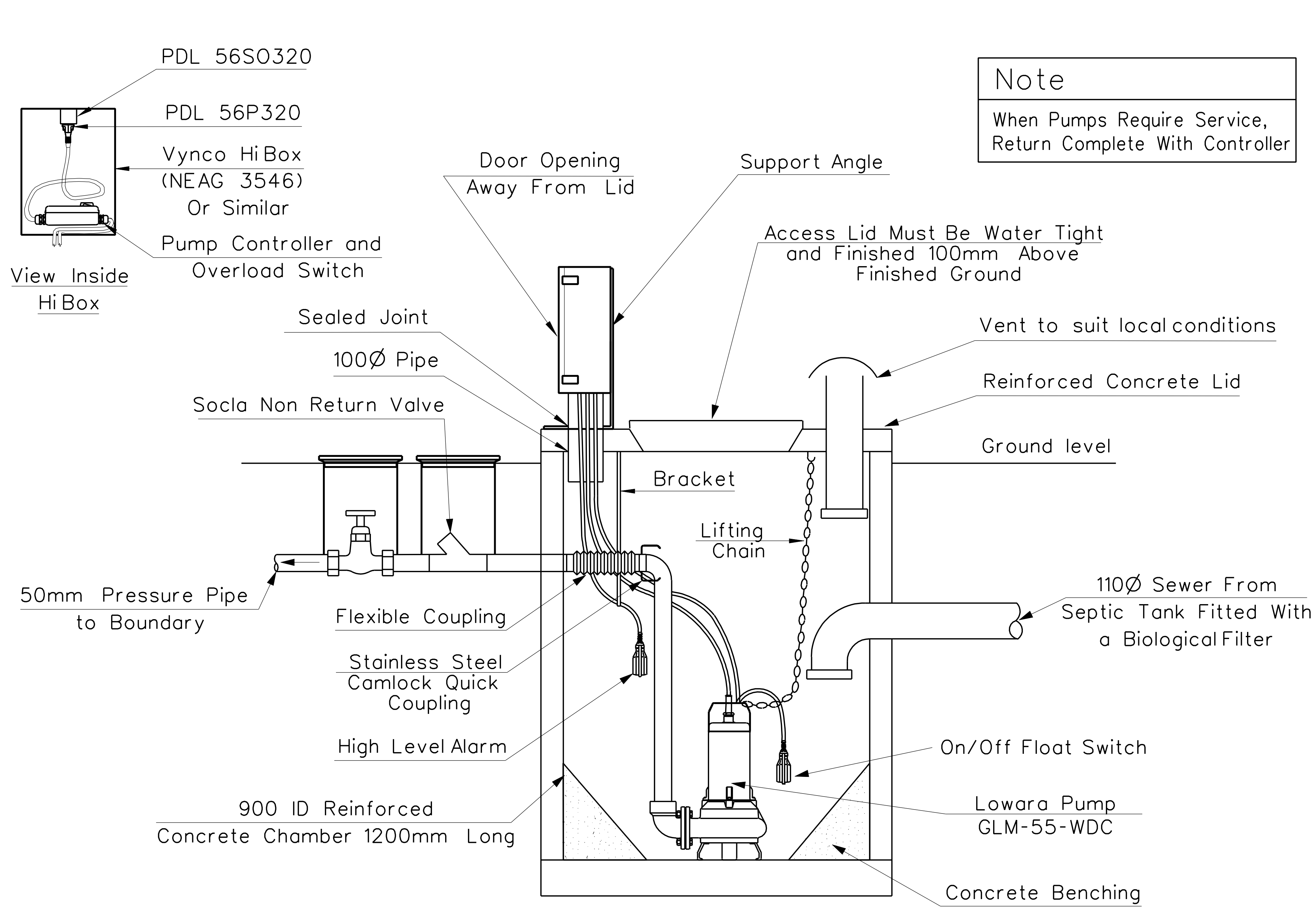


WAIMAKARIRI
DISTRICT COUNCIL
technical services

NOT TO SCALE

SHEET TITLE
Septic Tank Wet
Wells on Council
Retic. Rural Schemes

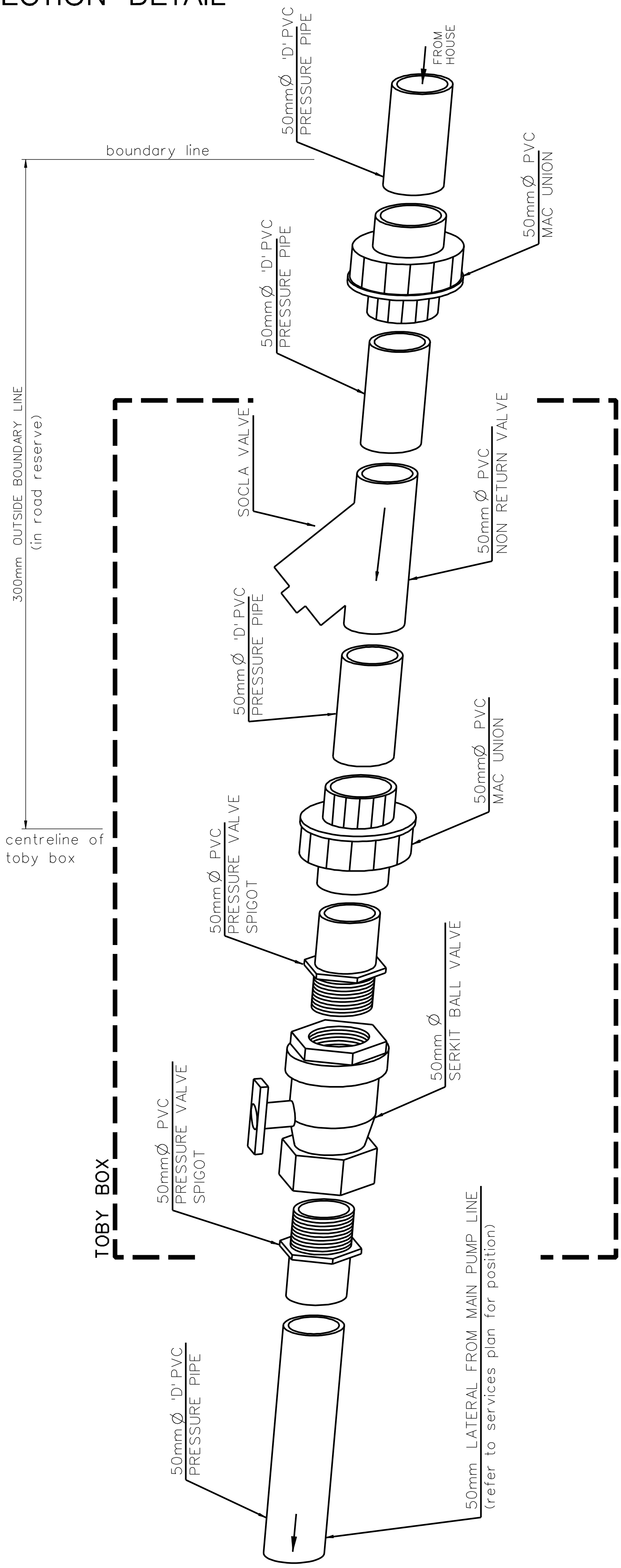
PROJECT TITLE
STANDARD
DRAWINGS

SHEET
352A

ISSUE
E

PLAN No.
600

TYPICAL CONNECTION DETAIL



WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE Rural Zone Package Sewage Treatment Service Lateral	PROJECT TITLE STANDARD DRAWINGS	SHEET 352B
				ISSUE D / PLAN No. 600

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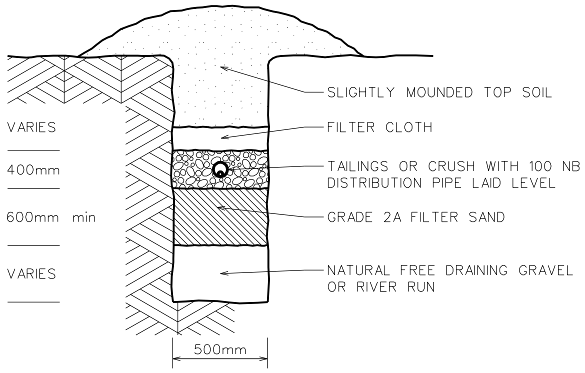
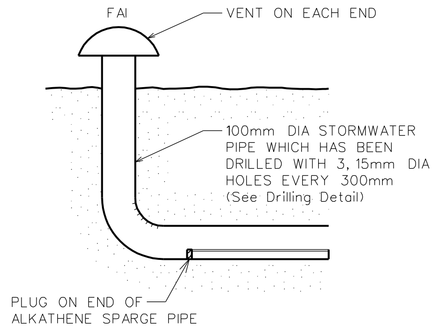
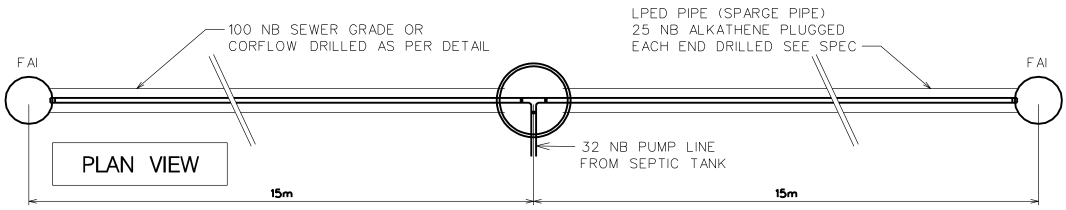
STANDARD 30m SAND FILTER SUITABLE FOR EFFLUENT TREATMENT DISPOSAL INTO FREE DRAINING GRAVEL WITH GROUND WATER GREATER THAN 1.5m DEEP



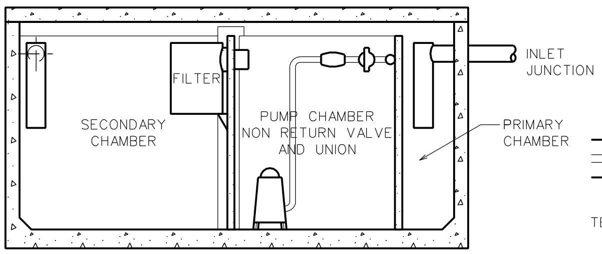
TRENCH CROSS SECTION



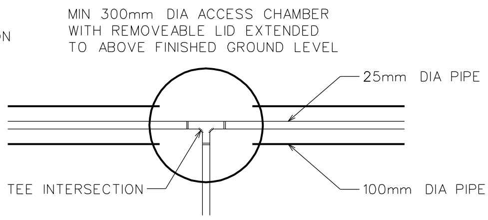
SECTION THROUGH VENT ON END OF 100mm PIPE



PLAN VIEW

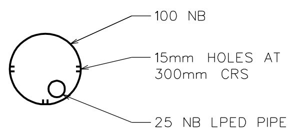


TYPICAL 5000 LITRE MULTI CHAMBER SEPTIC TANK AND PUMP SETUP



DETAIL OF JUNCTION BOX (PLAN VIEW)

DRILLING DETAIL



SPECIFICATION NOTES:

1.) GENERAL: THIS SYSTEM IS DESIGNED FOR TREATMENT/DISPOSAL OF HIGH QUALITY SEPTIC TANK EFFUENT TO MAXIMUM WASTEWATER FLOW OF 800 LITRES PER DAY ROUGHLY THE FLOW FROM A THREE-BEDROOM RESIDENTIAL HOUSE WITH 5-6 PEOPLE IN RESIDENCE. NO OTHER DRAINAGE WATER SHALL ENTER THE SYSTEM, EITHER BEFORE OR AFTER THE SEPTIC TANK STAGE.

2.) SEWAGE FROM THE HOUSE SHALL BE PRE-TREATED AS A MINIMUM BY A TWO CHAMBER OR DUAL SEPTIC TANK AS PER THE CAPACITY RECOMMENDATIONS OF NZS 4610:1982. CONNECTION FROM THE FIRST CHAMBER TO THE SECOND, AND THE FINAL OUTLET SHALL BE BY "TEES" HAVING THE SUBMERGED INLET FITTED WITH A GAS-DEFLECTING BAFFLE. A LIST OF COMMERCIAL SUPPLIERS OF SUITABLE TWO-CHAMBER SEPTIC TANKS (THAT INCLUDES ALSO AN ANAEROBIC UPFLOW ROCK FILTER (UARF)) MAY BE OBTAINED FROM THE COUNCIL.

3.) THE SEPTIC TANK EFFLUENT SHALL BE COLLECTED IN A PUMP CHAMBER FITTED WITH A SUBMERSIBLE OR SURFACE-MOUNTED PUMP CONTROLLED BY FLOAT SWITCH(S) TO DELIVER A 200 LITRE DOSE VIA A FEED PIPE TO THE LOW PRESSURE DISTRIBUTION PIPE. THERE SHALL BE A VALVE FITTED TO PREVENT BACKFLOW. SUITABLE PUMPS ARE CENTRIFUGAL PUMPS HAVING ZERO FLOW AT A STATIC HEAD IN THE RANGE 5 TO 10 METRES AND A PUMPING CAPACITYOF 50 TO 150 LITRES/MINUTE AT 2m STATIC HEAD. THERE SHALL BE AN ALARM FLOAT SWITCH INSTALLED TO GO ON AT WATER LEVEL 100mm ABOVE OPERATING HIGH WATER LEVEL; THE ALARM SHOULD BE SUITABLY LOCATED IN THE DWELLING. THERE SHOULD BE FAILURE STORAGE OF ABOUT 200 LITRES BEFORE THE SYSTEM BACKS UP. THERE SHOULD NOT BE A FAILURE OVERFLOW DRAIN.

4.) THE FEED PIPE FROM THE PUMP TO THE LOW PRESSURE DISTRIBUTION PIPE (LPDP) SHOULD BE 32 OR 40mm DIAMETER PVC PIPE. IT SHOULD BE BURIED TO PROTECT IT FROM MECHANICAL DAMAGE AND FROM FREEZING. IF USE OF LONG FEED LINE (GREATER THAN 50 METRES) OR AN ELEVATION OF GREATER THAN 1.0m FROM THE HIGH WATER LEVEL IN THE PUMP-SUMP TO THE INVERT OF THE LPDP IS REQUIRED, THEN A LARGER PUMP MAY BE NEEDED. IF THERE IS A FALL OF GREATER THAN 2.5m FORM THE OUTLET OF THE TANK TO THE LPDP, THEN THERE IS THE POSSIBILITY OF USING A TIPPING BUCKET OR DOSING SIPHON INSTEAD OF A PUMP FOR LOADING THE LPDP.

5.) SIZING AND SPACING OF HOLES IN 25mm LDPE PIPE: BEFORE THE 25mm PIPE IS PLACED INSIDE THE 110 STORMWATER PIPE, IT IS IMPORTANT TO TEST THE HOLE SIZING AND SPACING AND MATCH THESE HOLES TO THE CAPACITY OF THE PUMP BEING USED. START WITH 5mm HOLES EVERY 1000mm (1.0m), PLUG THE END AS SHOWN ON THE PLAN, CONNECT BOTH 25mm RUNS OF PIPE, BUT LAY ON GROUND ADJACENT TO TRENCH, CONNECT THE 32mm PIPE FROM THE PUMP CHAMBER, SO THAT THE DISTANCE THE EFFLUENT IS PUMPED IS SIMILAR. FILL CHAMBER, SET PUMP OPERATING, AND CHECK FLOW OF WATER OVER THE COMPLETE LENGTH OF BOTH RUNS OF THE 25mm PIPE. THE SIZE OF HOLES MAY NEED TO BE INCREASED SLIGHTLY AT THE END, AND POSSIBLY THE SPACING OF THE HOLES DECREASED, SO THAT A SIMILAR FLOW OF WATER IS ACHIEVED FROM EACH PIPE OVER THE COMPLETE LENGTH.

SEE ALSO GENERAL SEPTIC TANK INSTALLATION SPECIFICATIONS.

IN ALL CASES EFFLUENT DISPOSAL MUST COMPLY WITH THE CANTERBURY REGIONAL COUNCILS GENERAL AUTHORISATION.

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: LAND BASED TREATED EFFLUENT DISPOSAL SYSTEM 1D	PROJECT TITLE: STANDARD DRAWINGS	SHEET: 354A
				ISSUE: B
				PLAN No.: 600

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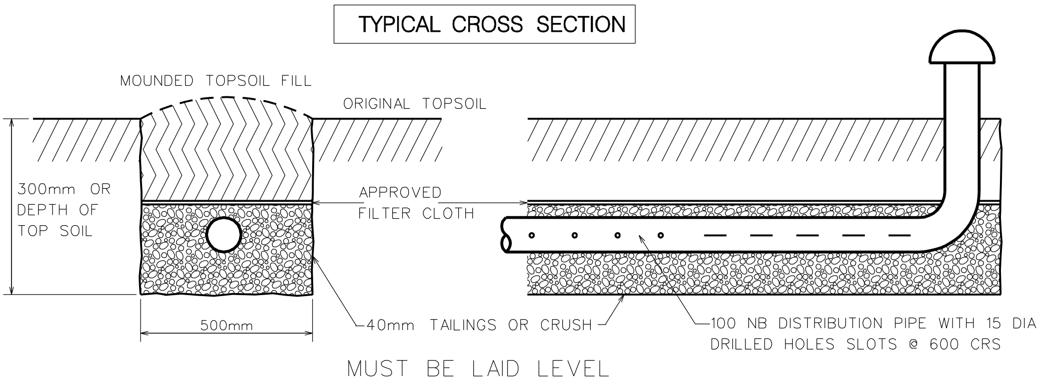
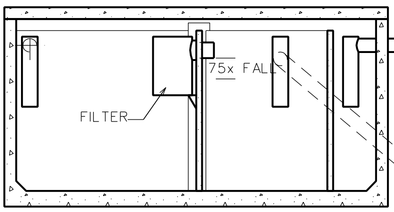
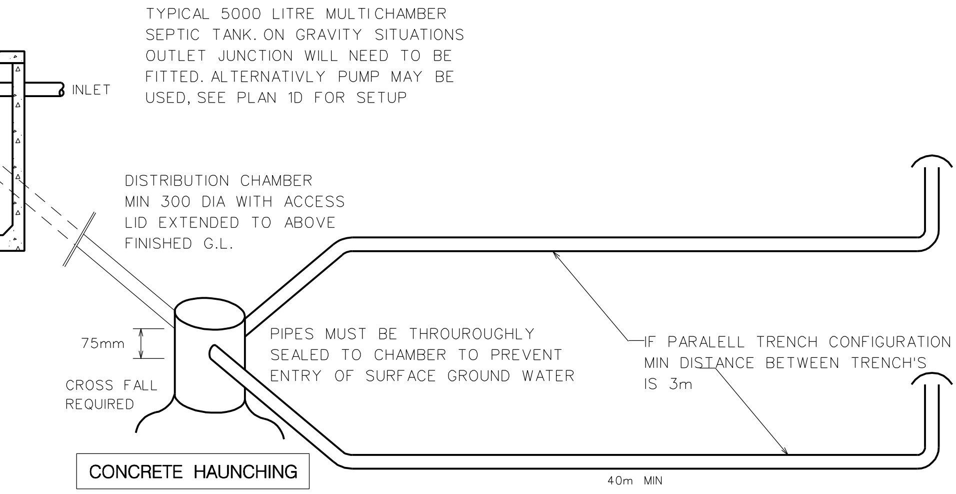
TYPICAL CROSS SECTION

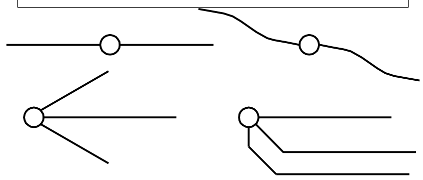


PARTIAL EVAPOTRANSPIRATION SHALLOW TOP SOIL EFFLUENT DISPOSAL SYSTEM (EUT, FIELD TILE) FOR USE OVER CLAY WHERE GROUND WATER CONTAMINATION IS UNLIKELY.





ALTERNATE TRENCH CONFIGURATIONS



SPECIFICATION NOTES:

1.) INITIALLY BASED ON NZS4610 BASIC FIELD TILE SYSTEM AND SOIL LIMITATION CATEGORY C–D. LOCAL EXPERIANCE HAS SHOWN IN MOST CASES THAT 80m IN LENGTH WILL BE SUFFICIENT BASED ON A MINIMUM OF 300mm OF TOP SOIL COVER AND AN 800 LITRE PER DAY MAX FLOW RATE.

2.) SITING: THE TRENCH SYSTEM SHOULD BE SITED IN A HIGH AND DRY AREA EXPOSED TO THE SUN AND WIND FOR BEST RESULTS AND AWAY FROM LARGE TREES, OPEN DRAINS, STREAMS OR PONDS. THE AREA SHOULD BE AS LEVEL AS POSSIBLE. SURFACE AND STORMWATER MUST BE DIRECTED AWAY FROM THE DISPOSAL AREA AND ON HILL SITES SURFACE WATER CUT OFF DRAINS SHOULD BE INSTALLED GENERALLY HILL SITES GREATER THAN 15 WILL NOT BE SUITABLE WITHOUT SPECIAL DESIGN CONSIDERATIONS.

3.) TRENCH'S SHOULD BE CAREFULLY EXCAVATED WITH UNIFROM WIDTH AND DEPTH AND TO FOLLOW GROUND CONTOURS, LOW SPOTS SHOULD BE AVOIDED OR MAY NEED TO BE BUILT UP. EXCAVATION BEYOUND THE TOP SOIL DEPTH INTO THE CLAY WILL NOT BE BENIFICIAL AND SHOULD BE AVOIDED. THE TRENCH SIDES AND BASE MUST BE SCARIFIED BEFORE PLACING ANY FILTER MATERIAL.

4.) THE DISTRIBUTION PIPES MUST BE DRILLED OR SLOTTED EVENLY ALONG EACH SIDE OF THE PIPE AND MUST BE LAID LEVEL WITH A MINIMUM OF 100mm OF MEDIA BENEATH. THIS IS TO PROMOTE AN EVEN DISTRIBUTION OF EFFLUENT OVER THE WHOLE TRENCH SYSTEM.

5.) THE DISTRIBUTION CHAMBER SHOULD BE CENTRALLY LOCATED TO THE TRENCH SYSTEM AND BE LARGE ENOUGH TO PERMIT READY ACCESS FOR CLEANING AND INSPECTION. THE CHAMBER MUST EXTEND TO ABOVE THE FINISHED GROUND LEVEL. IF A PVC CHAMBER IS USED IT SHOULD BE SET IN A MIN 150mm CONCRETE BASE HAUNCHED AND PLASTERD TO THE INSIDE. THE INLET AND DISTRIBUTION PIPES MUST BE SEALED TO
THE CHAMBER. ON PVC, EPOXY RESIN SHOULD BE APPLIED TO THE INSIDE
AND OUTSIDE OF THE CHAMBER AFTER BACKFILL COMPLETION TO AVOID DISTRUBANCE OF THE JOINT.

SEE ALSO GENERAL SEPTIC TANK INSTALLATION SPECIFICATIONS.

IN ALL CASES EFFLUENT DISOSAL MUST COMPLY WITH THE CANTERBURY REGIONAL COUNCILS, GENERAL AUTHORISATION.

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
		LAND BASED TREATED EFFLUENT DISPOSAL SYSTEM 2	STANDARD DRAWINGS	354B
				ISSUE: B / PLAN No. 600

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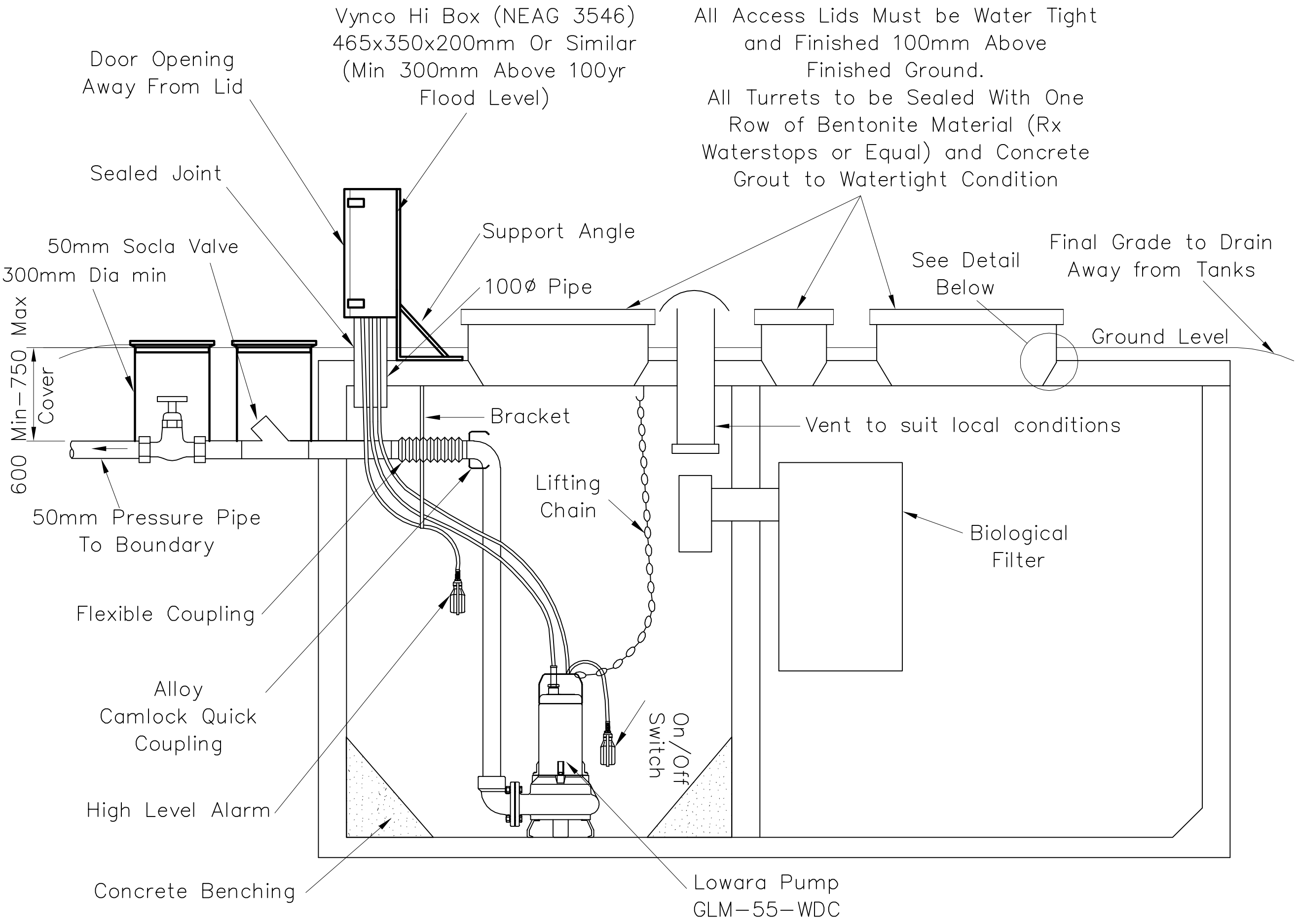
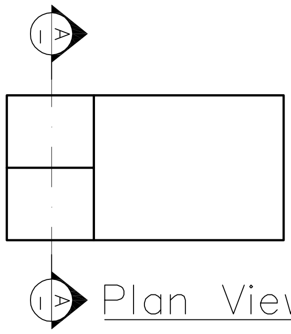
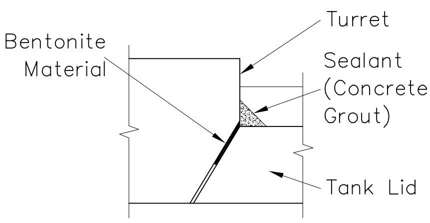


Section A-A

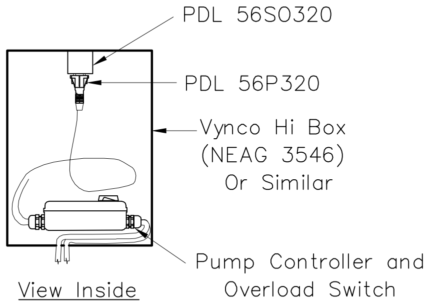


Plan View

Typical Three Chamber
Septic Tank



Lid Sealing
Detail



View Inside
Hi Box

The Wastewater Treatment Unit shall be a Three-Chamber Septic Tank designed to cater for the number of people for which the dwelling is designed.

The Wastewater Unit shall be designed in accordance with AS/NZS 1546.1:2008. The Wastewater Unit may require a hydrostatic flange to be included in some areas.

The Wastewater Unit shall have a biological filter to screen suspended solids from entering the pump chamber.

The Pump shall be a Lowara GLM-55-WDC
(Brown Brothers Christchurch).

The Wastewater Unit Shall Have a Maximum Depth of 1.5m and shall not be sited in areas susceptible to surface flooding.

All lids shall be watertight and permanently accessible. Lids to be Securely Sealed (Concrete or Plastic) to Prevent Unintentional Access. Specific approval is required if risers are to be installed. The camlock fitting must be accessible without entry into the pumping chamber.

A High Level Warning Alarm is required to be installed. This should be located in the dwelling house. The High Level Alarm should be set to operate 100mm above the normal on position. In the event of a pump failure this should allow sufficient time for repairs.

The Property Owner is responsible for all maintenance associated with the Septic Tank and associated pipeline to the boundary, including mechancial and electrical.

NOT TO SCALE

WAIMAKARIRI DISTRICT COUNCIL	PROJECT TITLE	SHEET TITLE	PLAN No.
	SEPTIC TANK ON COUNCIL RETICULATED STEP SCHEMES	STANDARD DRAWINGS	355A
			ISSUE H / SHEET 600

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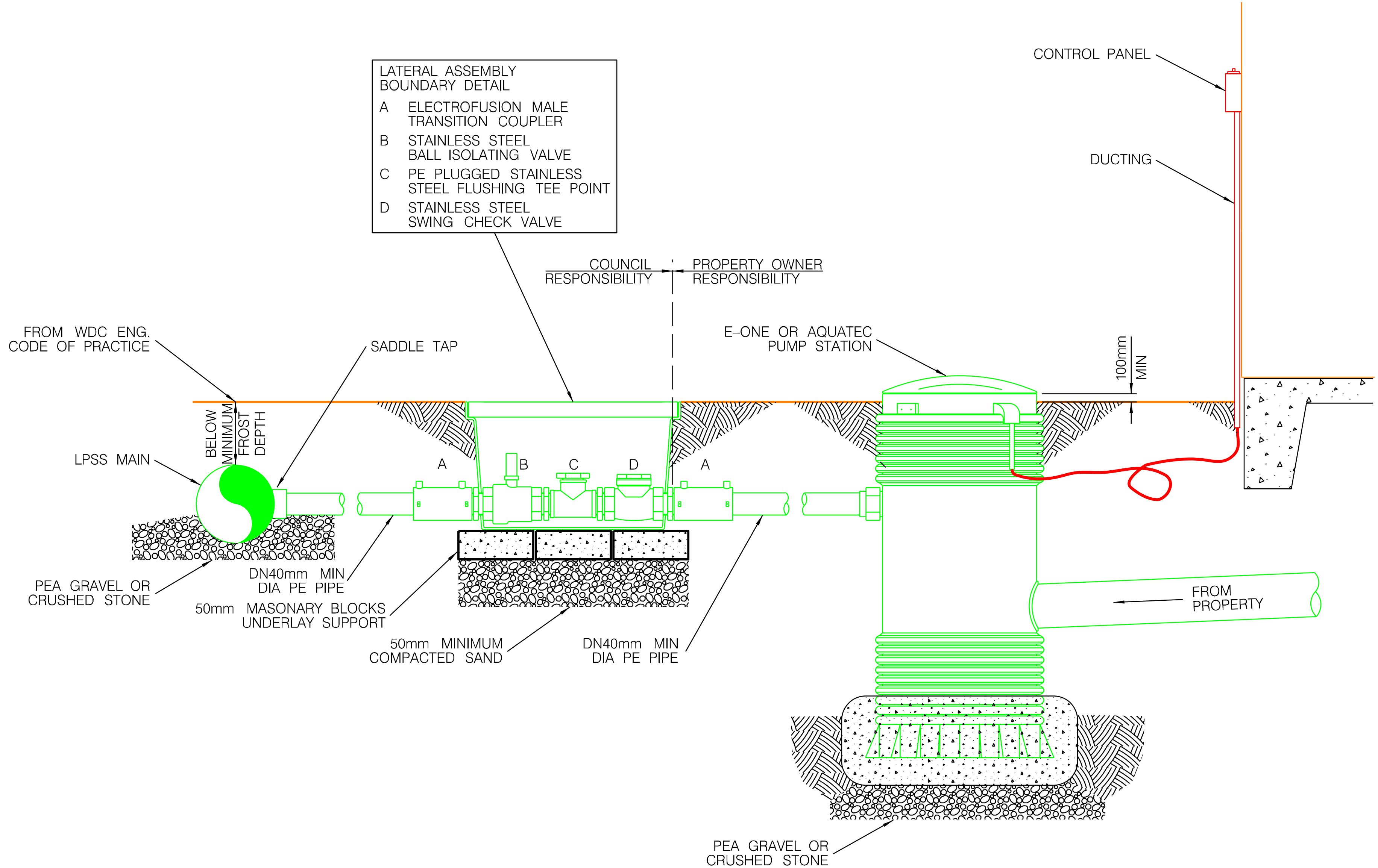

WAIMAKARIRI DISTRICT COUNCIL

ISSUE	AMENDMENT
A	FIRST ISSUE

NOT TO SCALE

SHEET TITLE: LATERAL CONNECTION FOR SINGLE RESIDENTIAL PROPERTY ON PRESSURE SEWER COUNCIL RETICULATED SCHEMES

PROJECT TITLE: STANDARD DRAWINGS

SHEET: 355B

ISSUE: B

PLAN No.: 600

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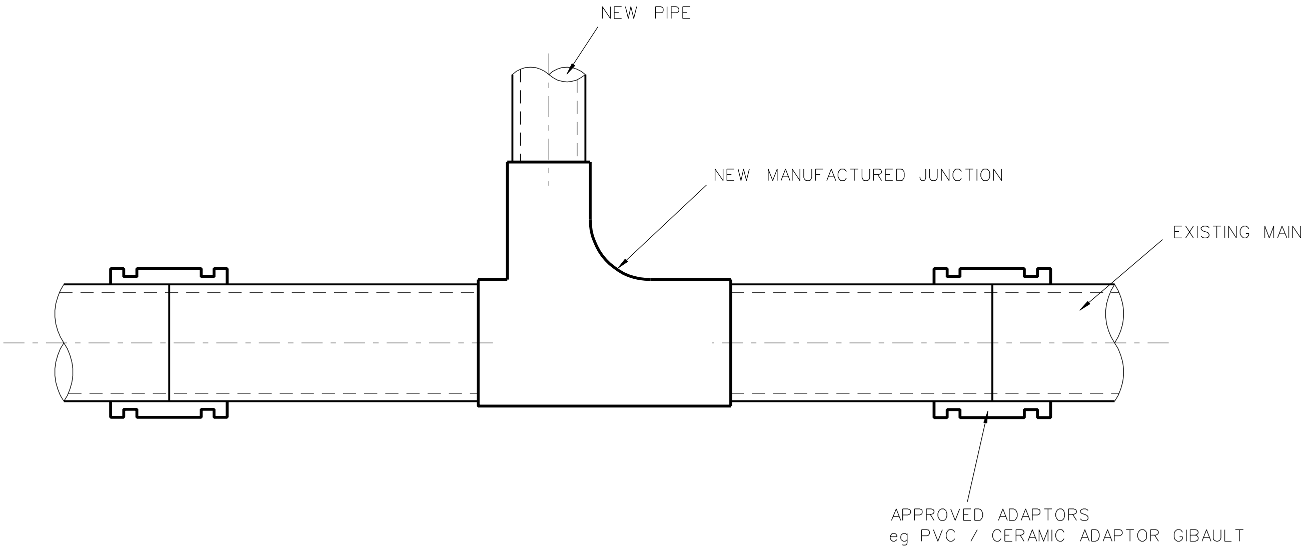
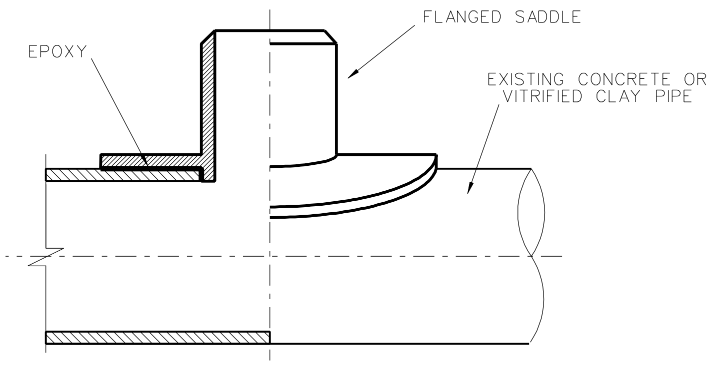


JUNCTIONS INSERTED INTO
EXISTING MAINS < OR = 300mm



VITRIFIED CLAY SADDLE INSERTED
INTO EXISTING PIPE > 300mm

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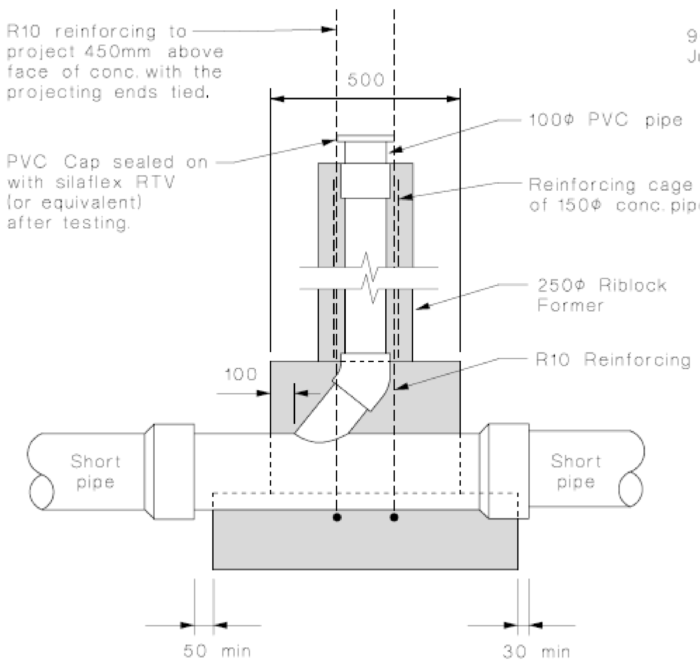
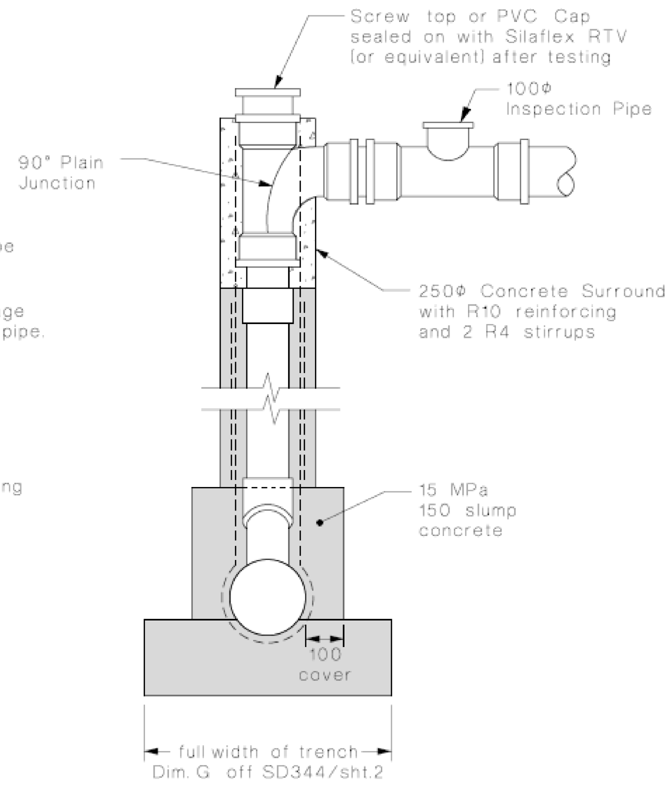
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: DIRECT CONNECTIONS TO EXISTING PIPES	PROJECT TITLE: STANDARD DRAWINGS	SHEET: 361; ISSUE: B; PLAN No. 600



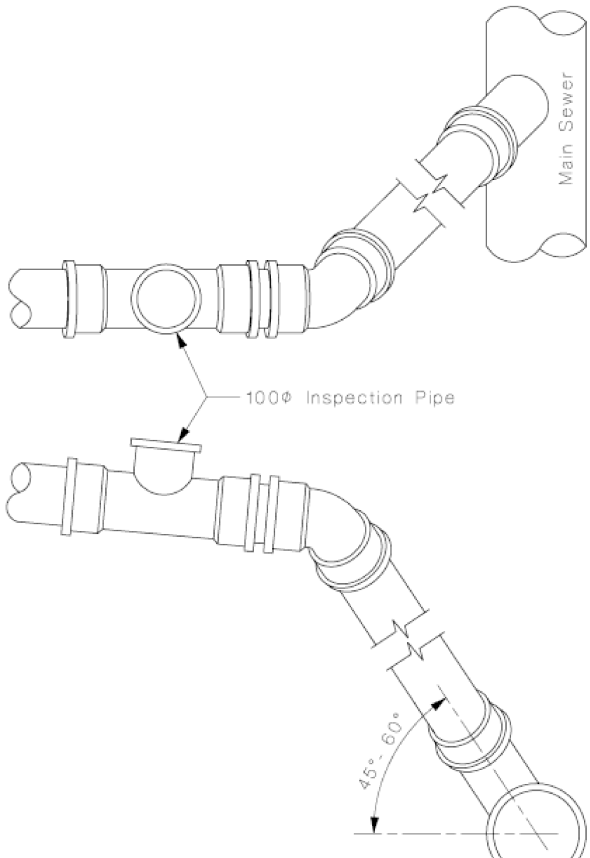
VERTICAL RISER JUNCTION



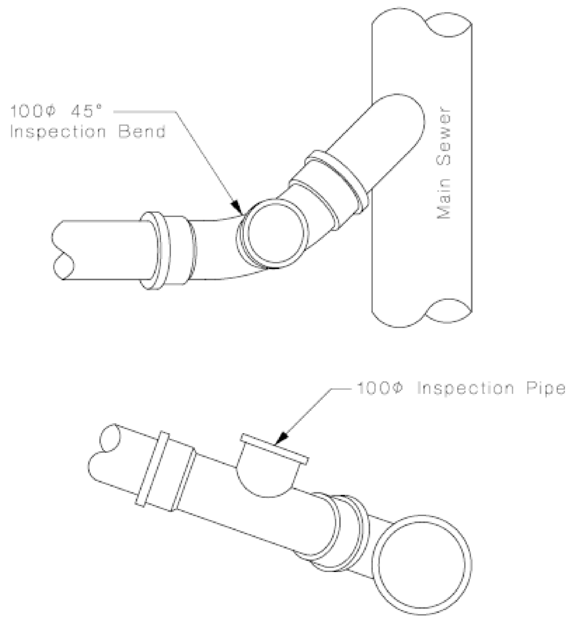
VERTICAL RISER JUNCTION AND CONNECTION

NOTES:

1. PVC pipes adjacent to concrete shall be wrapped with 6mm Denso tape or 250 microns Polyethylene film or equivalent.
2. Bottom of trench to be a stable and approved foundation.



CONNECTION BY RAMPED RISER



CONNECTION TO 45° SIDE JUNCTION

Based on CCC Drawing SD311A

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE TO BE REVISED	SHEET TITLE PIPELAYING JUNCTIONS OFF FACTORY MOULDED & VERTICAL RISER	PROJECT TITLE STANDARD DRAWINGS	SHEET 363 ISSUE A PLAN No. 600

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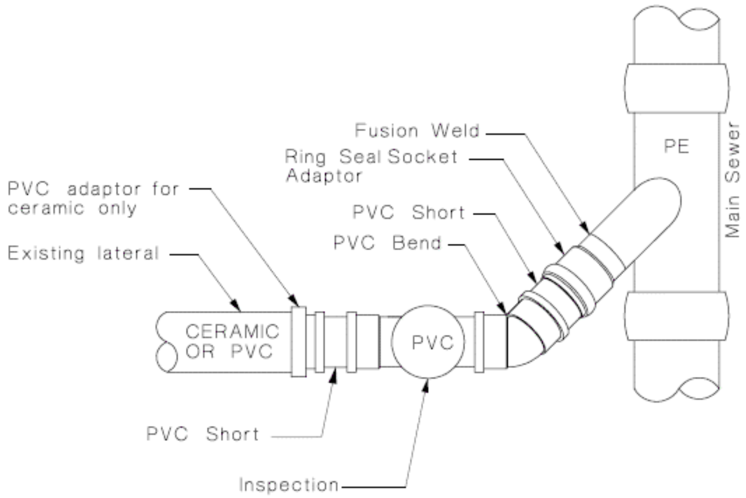
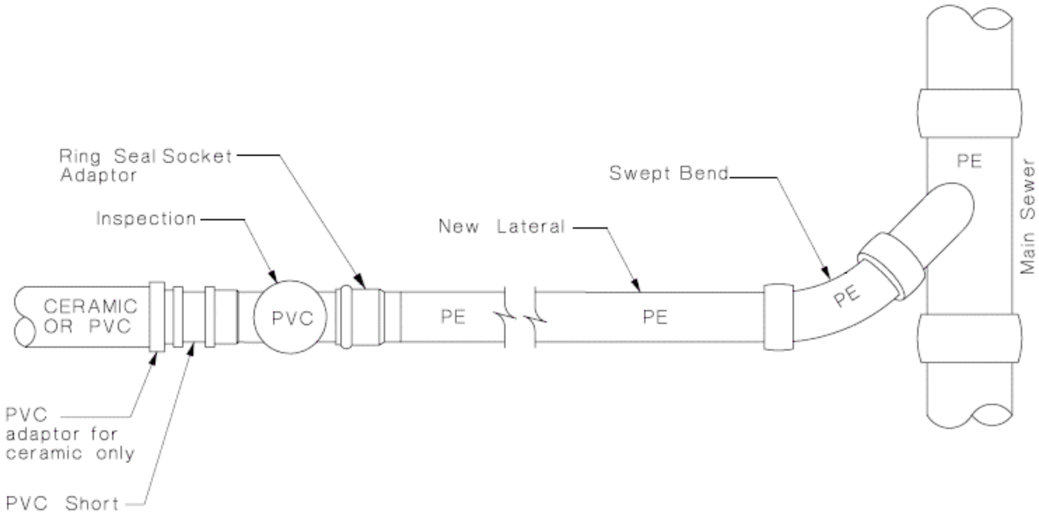
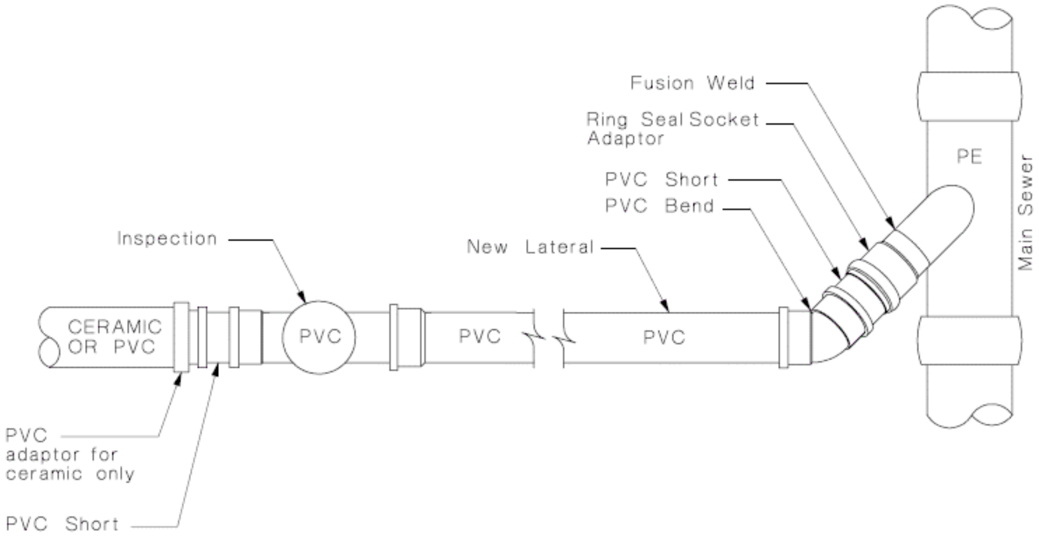


TYPE 1



TYPE 2



TYPE 3

Based on CCC Drawing SD364

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE TO BE REVISED	SHEET TITLE PE JUNCTIONS, SWEPT BENDS INSPECTIONS & ADAPTORS	PROJECT TITLE STANDARD DRAWINGS	SHEET 364 ISSUE A PLAN No. 600

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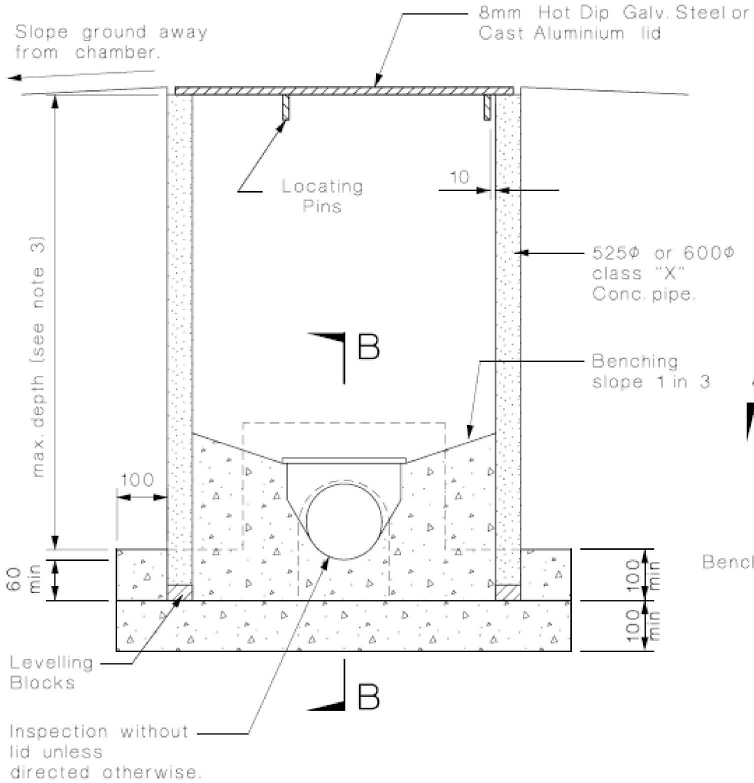
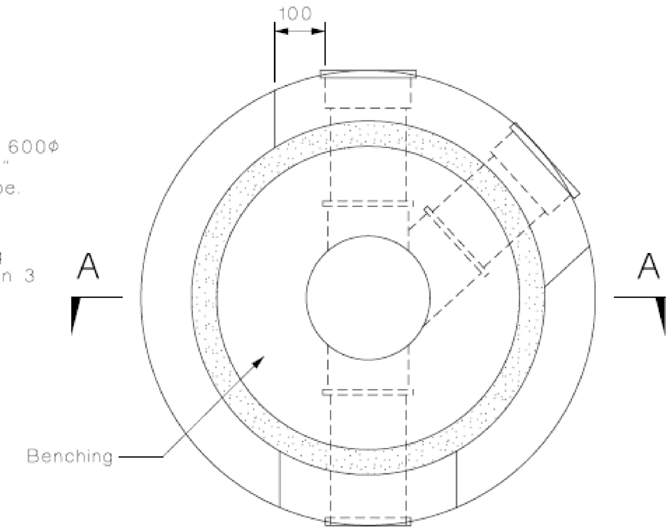
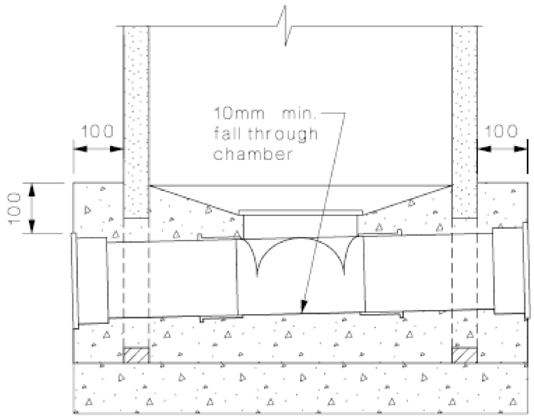


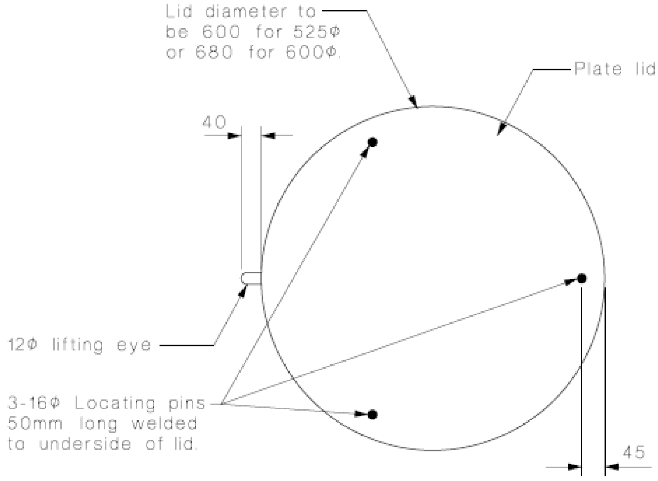
SECTION A-A



PLAN



SECTION B-B



LID DETAIL

NOTES :

1. Inspection chamber as detailed shall not be subject to traffic loading.
2. Diameter of inspection chambers:
   Up to 700mm deep - 525Φ
   700mm to 900mm - 600Φ
   A standard manhole shall be used when the depth exceeds 900mm.
3. Inspection chambers on drains connected to sanitary sewer shall be positioned so as to avoid the entry of surface water and grit.
4. Bends adjacent to the inspection chamber shall not be greater than 45°.
5. Steel lids shall be hot dip galvanised after fabrication. Lids shall be a good fit to avoid rocking or jamming.

Based on CCC Drawing SD376

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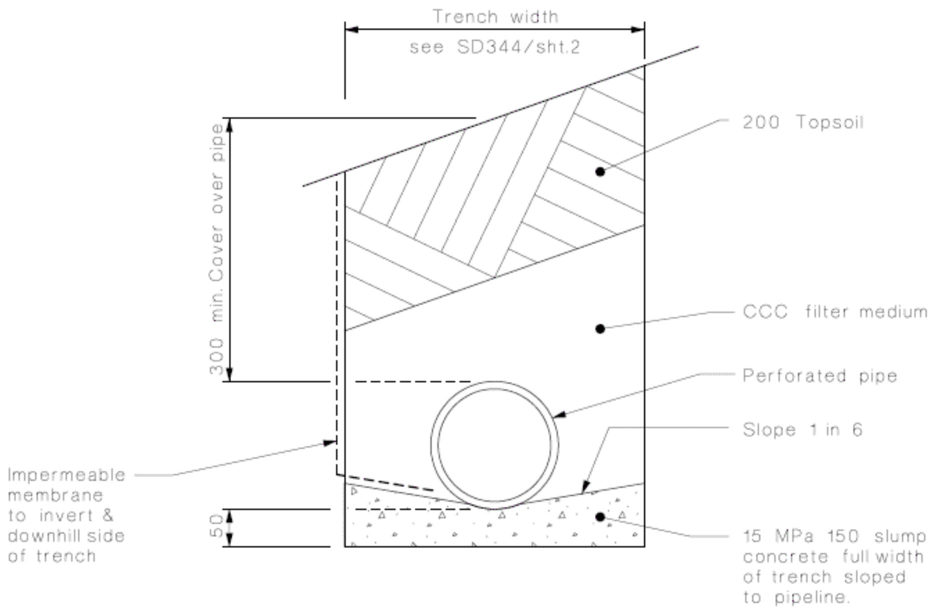
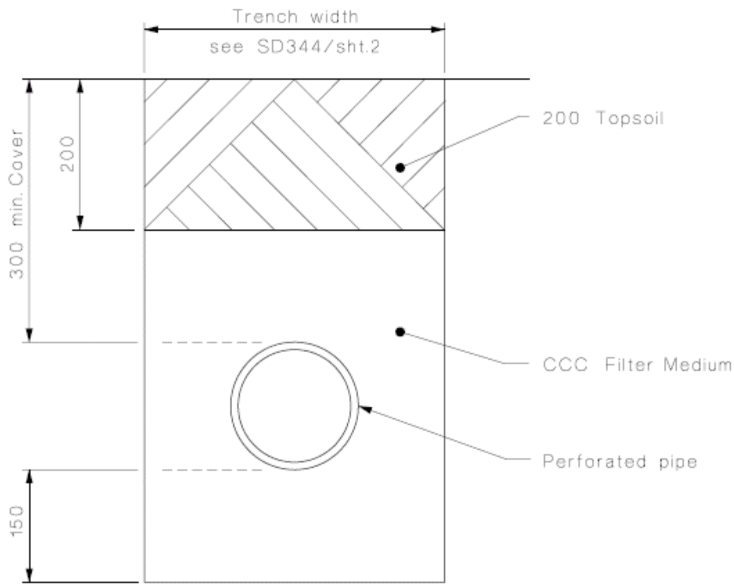
WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE TO BE REVISED	SHEET TITLE STANDARD CIRCULAR INSPECTION CHAMBER	PROJECT TITLE STANDARD DRAWINGS	SHEET 376 ISSUE A PLAN No. 600



HILLSIDE INTERCEPTOR DRAIN



INTERCEPTOR DRAIN

Based on CCC Drawing SD377/1

WAIMAKARIRI DISTRICT COUNCIL
technical services

NOT TO SCALE

TO BE REVISED

SHEET TITLE
SUBSOIL DRAIN INTERCEPTORS

PROJECT TITLE
STANDARD DRAWINGS

SHEET
377A

ISSUE
A

PLAN No.
600

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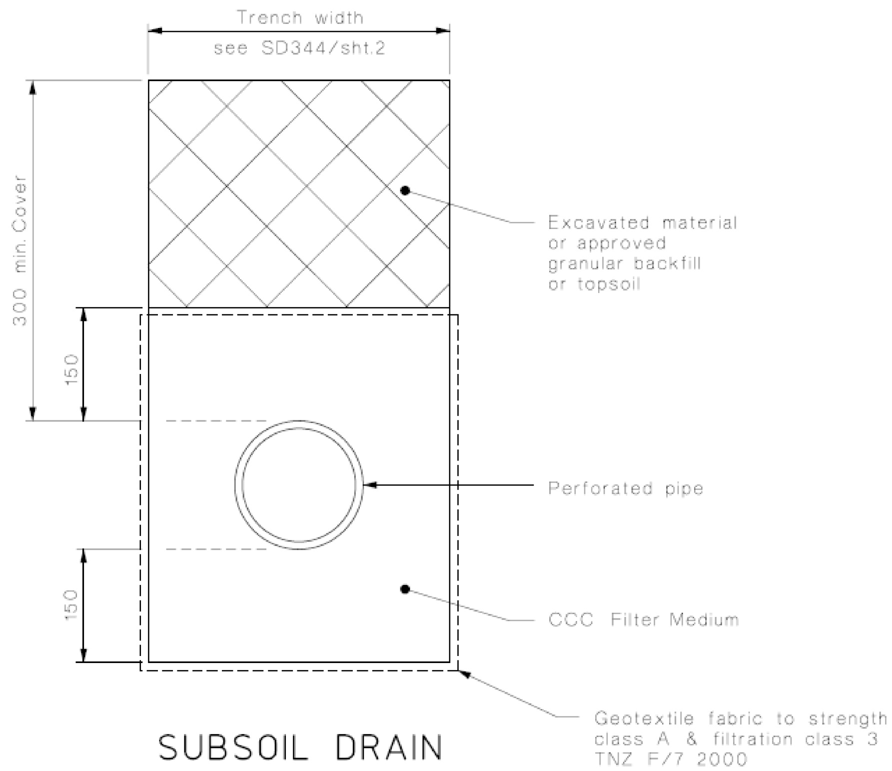
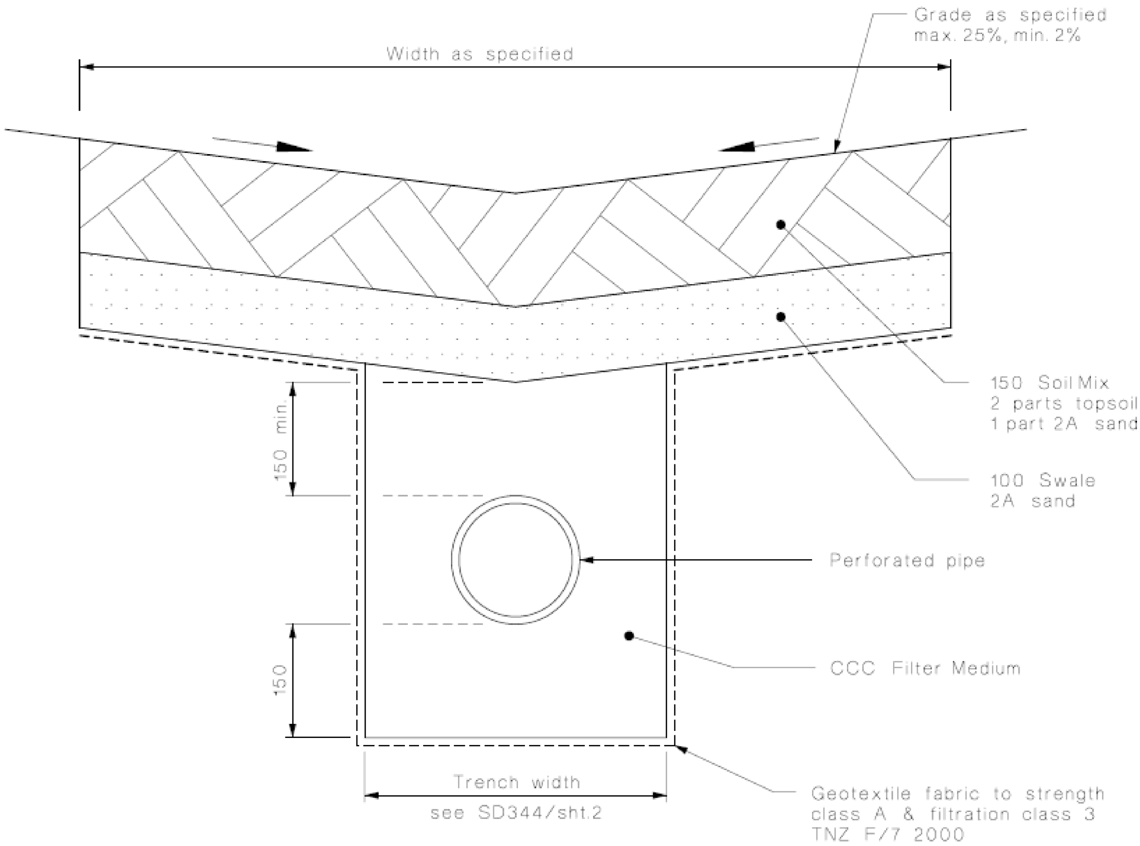


SUBSOIL DRAIN



SWALE SUBSOIL DRAIN

Based on CCC Drawing SD377/2

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE TO BE REVISED	SHEET TITLE SUBSOIL DRAIN SWALES	PROJECT TITLE STANDARD DRAWINGS	SHEET 377B ISSUE A PLAN No. 600

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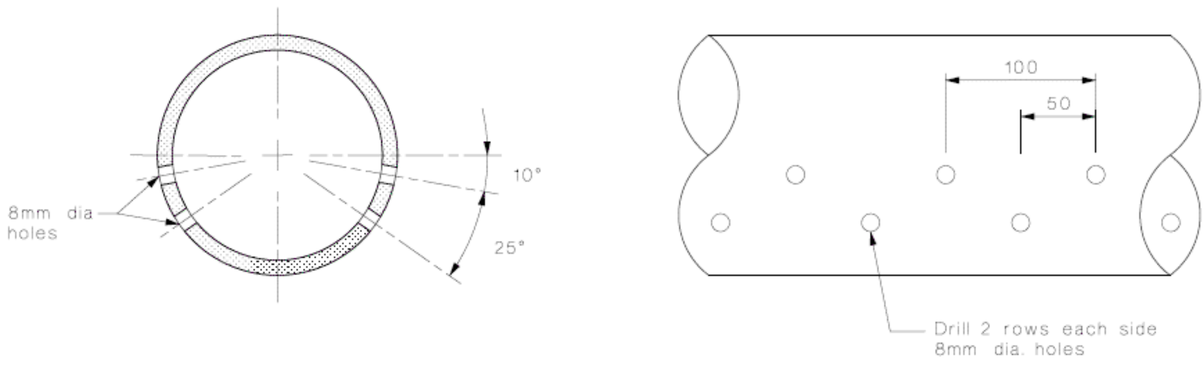
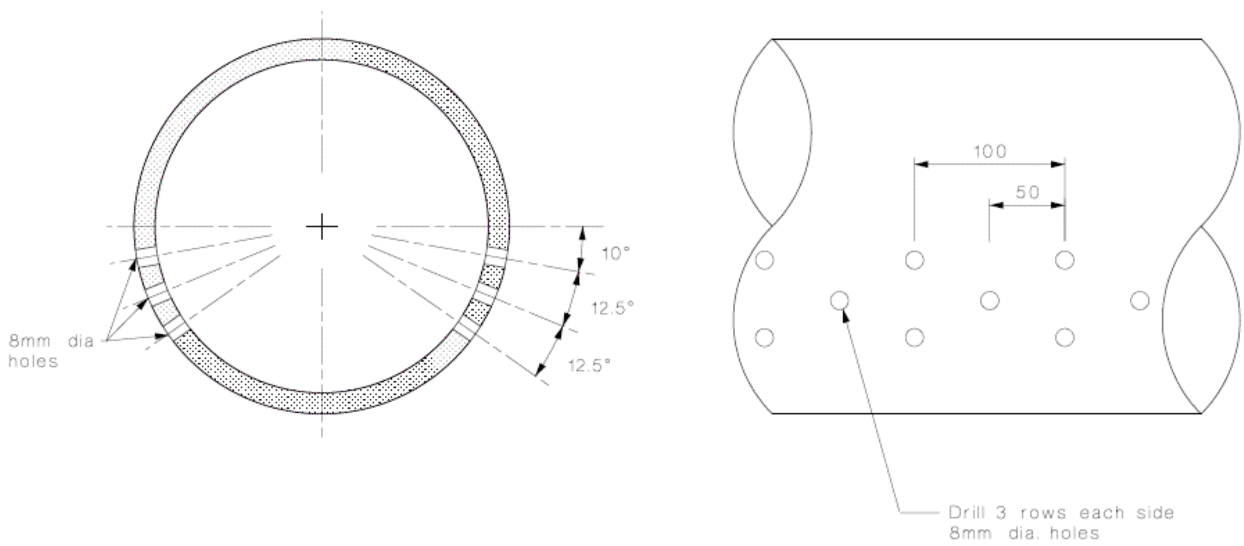


DN100 and DN150



DN200, DN225 and DN300

Based on CCC Drawing SD377/3

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
	TO BE REVISED	SUBSOIL DRAIN PIPES	STANDARD DRAWINGS	377C
				ISSUE A
				PLAN No. 600

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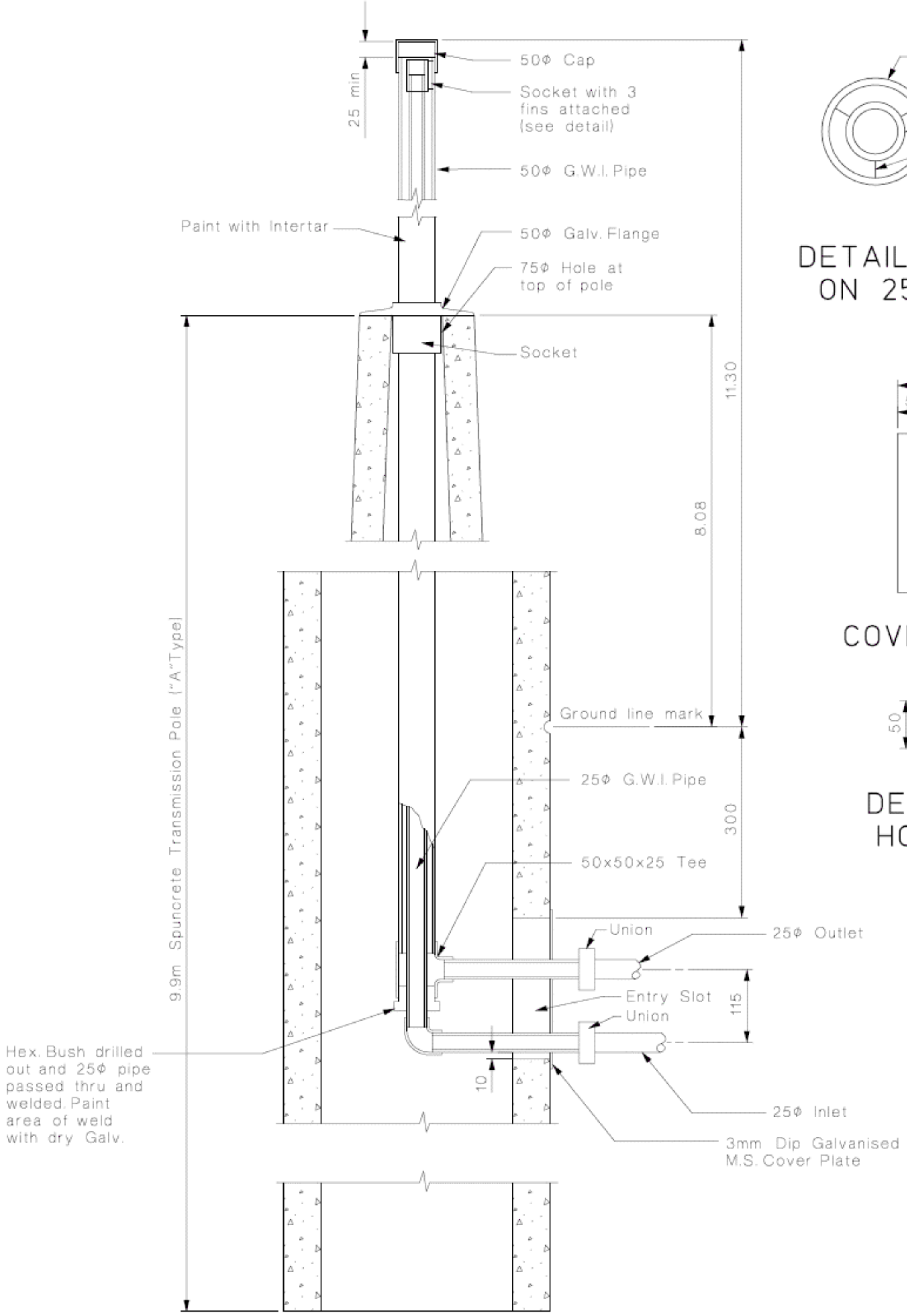
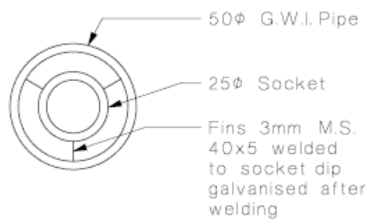
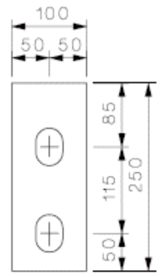


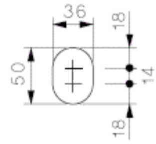
SECTION ON CENTRE LINE



DETAIL OF SOCKETS ON 25φ G.W.I. PIPE



COVER PLATE



DETAIL FOR HOLE SIZE

Based on CCC Drawing SD381

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE TO BE REVISED	SHEET TITLE VACUUM COLUMN BACKFLOW PREVENTER	PROJECT TITLE STANDARD DRAWINGS	SHEET 381 ISSUE A PLAN No. 600

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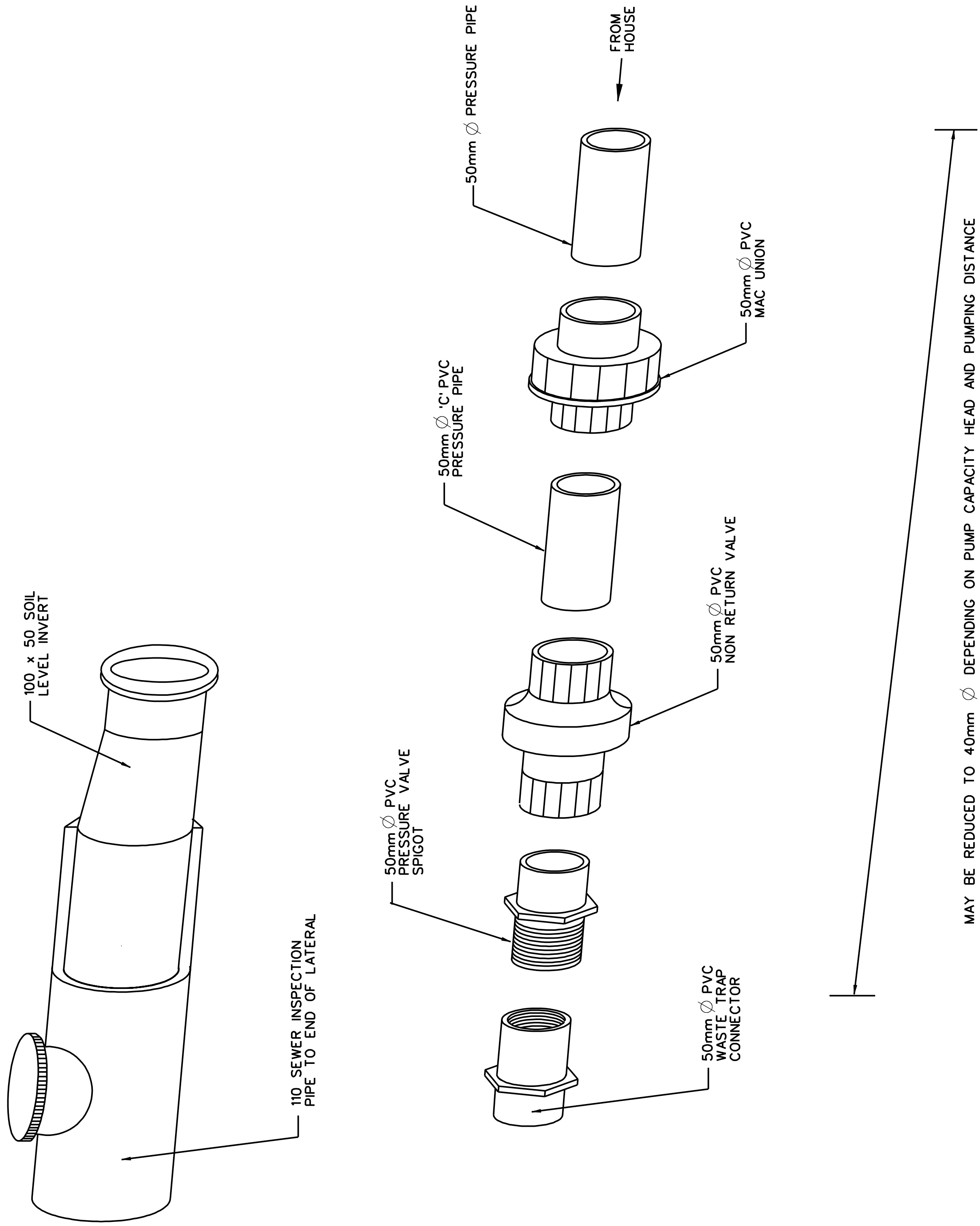

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE STANDARD PUMP LINE CONNECTION TO GRAVITY WASTEWATER LATERAL	PROJECT TITLE STANDARD DRAWINGS	SHEET 382 ISSUE B PLAN No. 600

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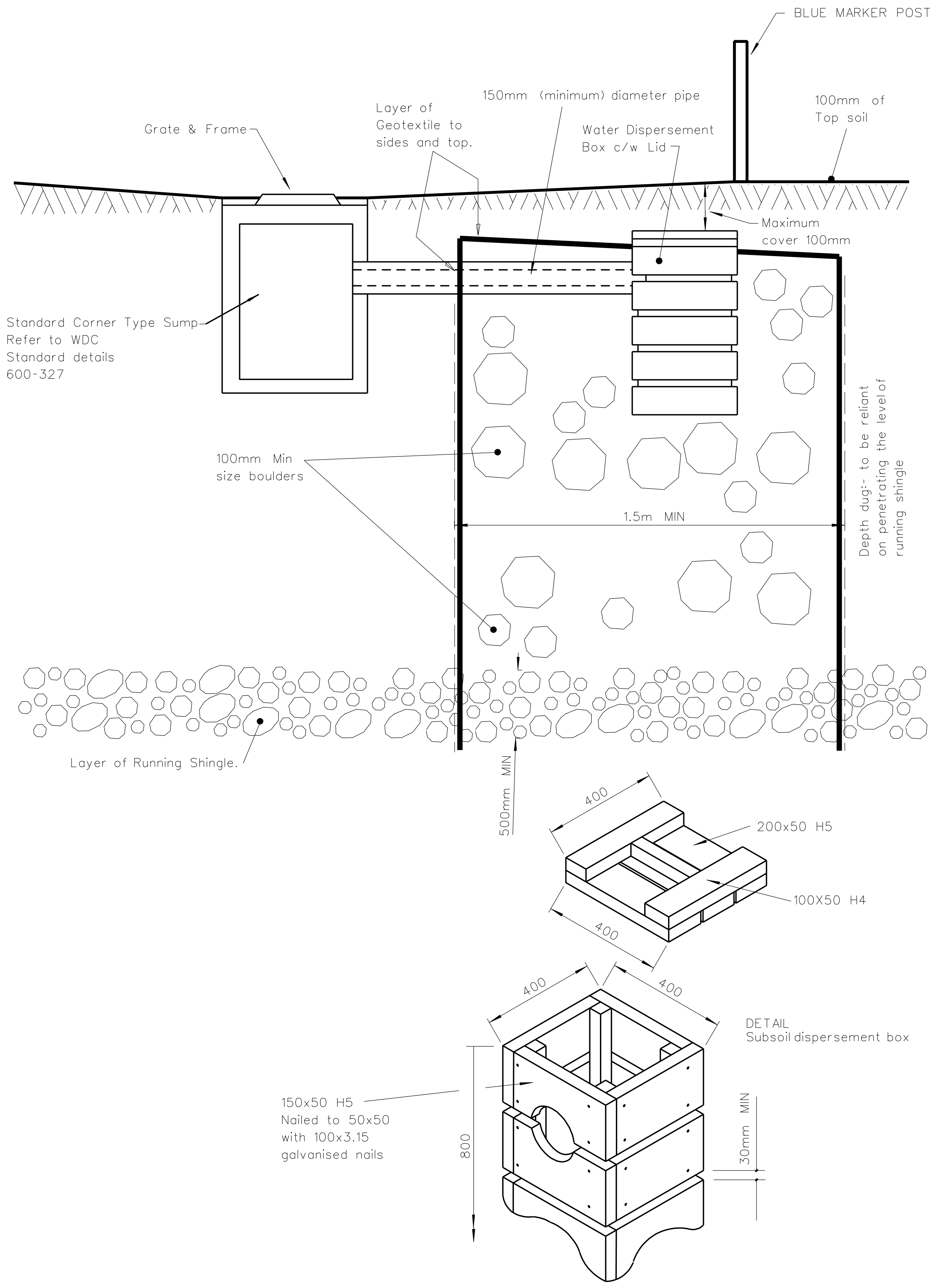

ROADSIDE SOAKHOLE

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
		ROADSIDE SOAKHOLE	STANDARD DRAWINGS	390
				ISSUE: F / PLAN No. 600

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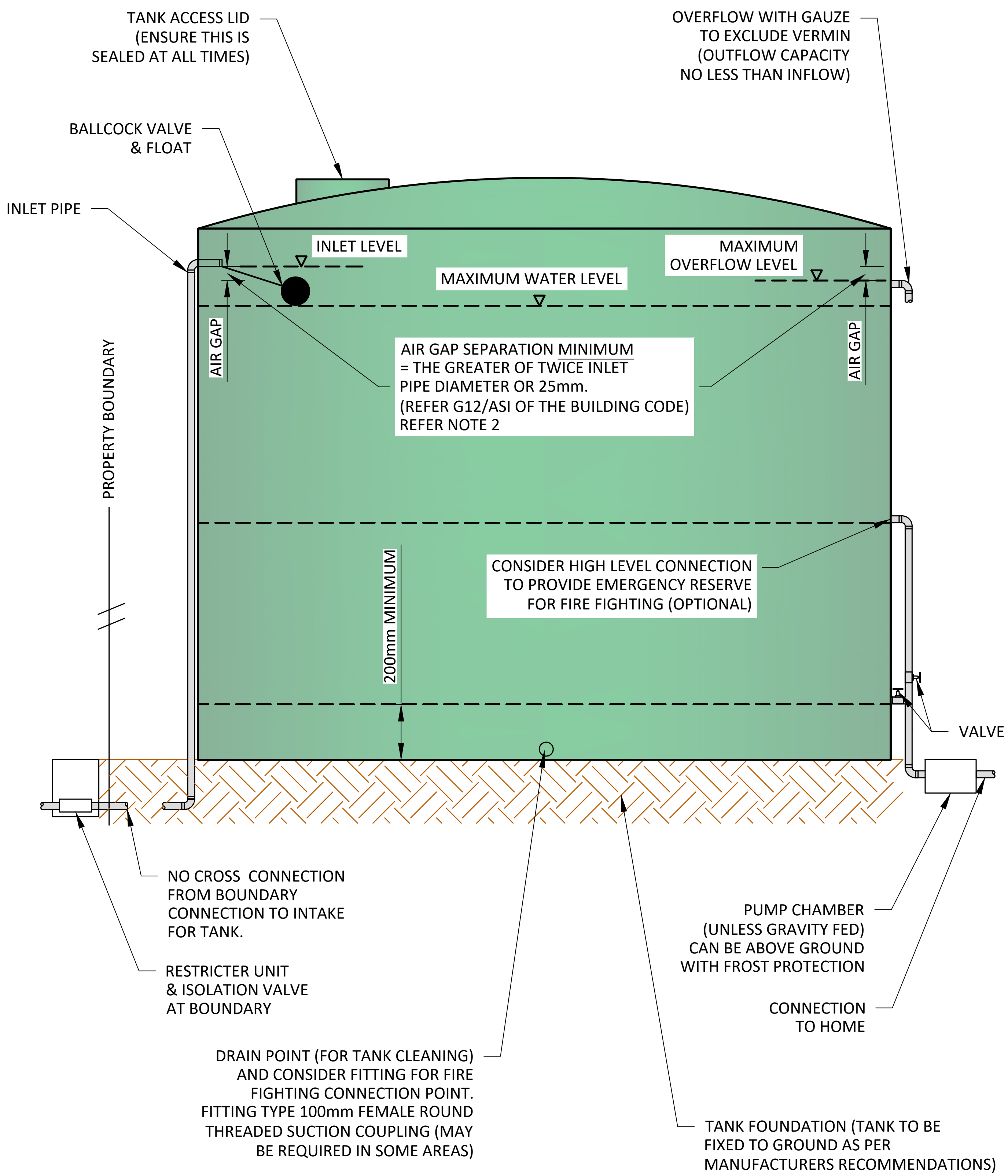
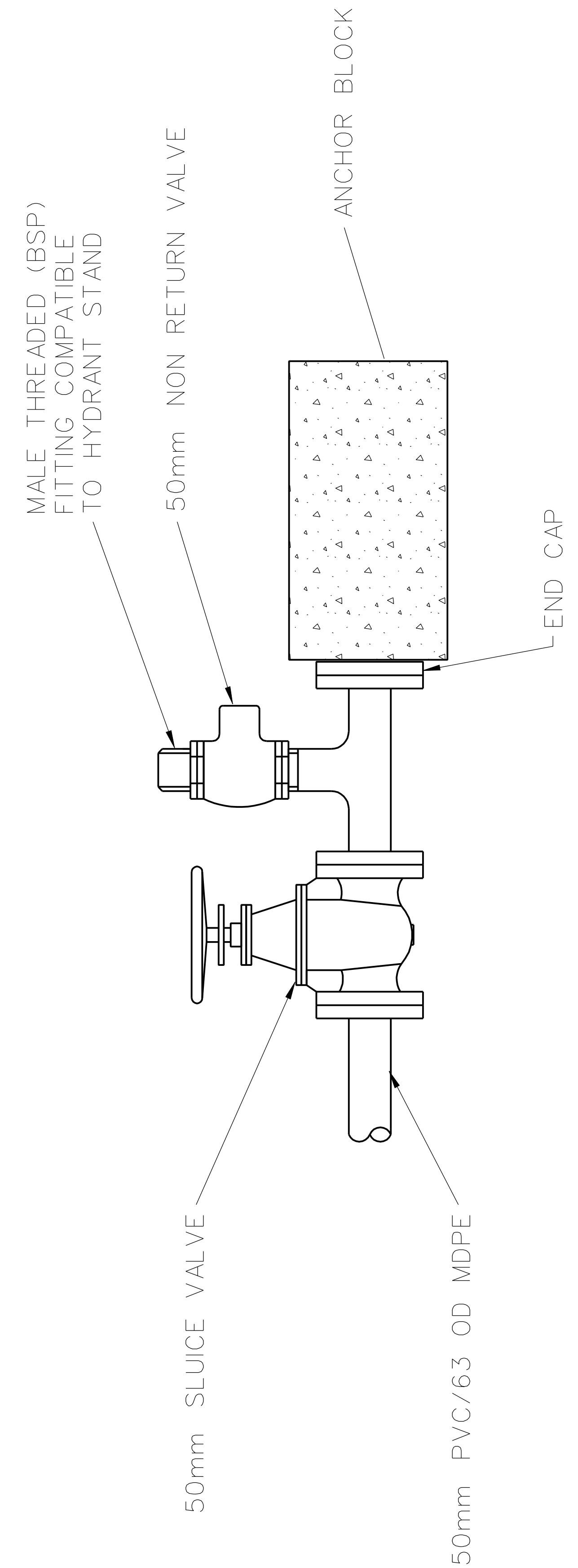


NOTES:

1. TANK TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.
2. AIR GAP IS THE HEIGHT SEPARATION BETWEEN THE INLET LEVEL AND MAXIMUM OVERFLOW LEVEL.

WAIMAKARIRI DISTRICT COUNCIL	PROJECT TITLE	SHEET TITLE	SHEET
	PRIVATE WATER TANK (RESTRICTED SCHEME)	STANDARD DRAWINGS	403
			ISSUE: A — PLAN No. 600



WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE FLUSHING POINT (DEAD–END ON 50MM MAIN)	PROJECT TITLE STANDARD DRAWINGS	SHEET 404 ISSUE B PLAN No. 600

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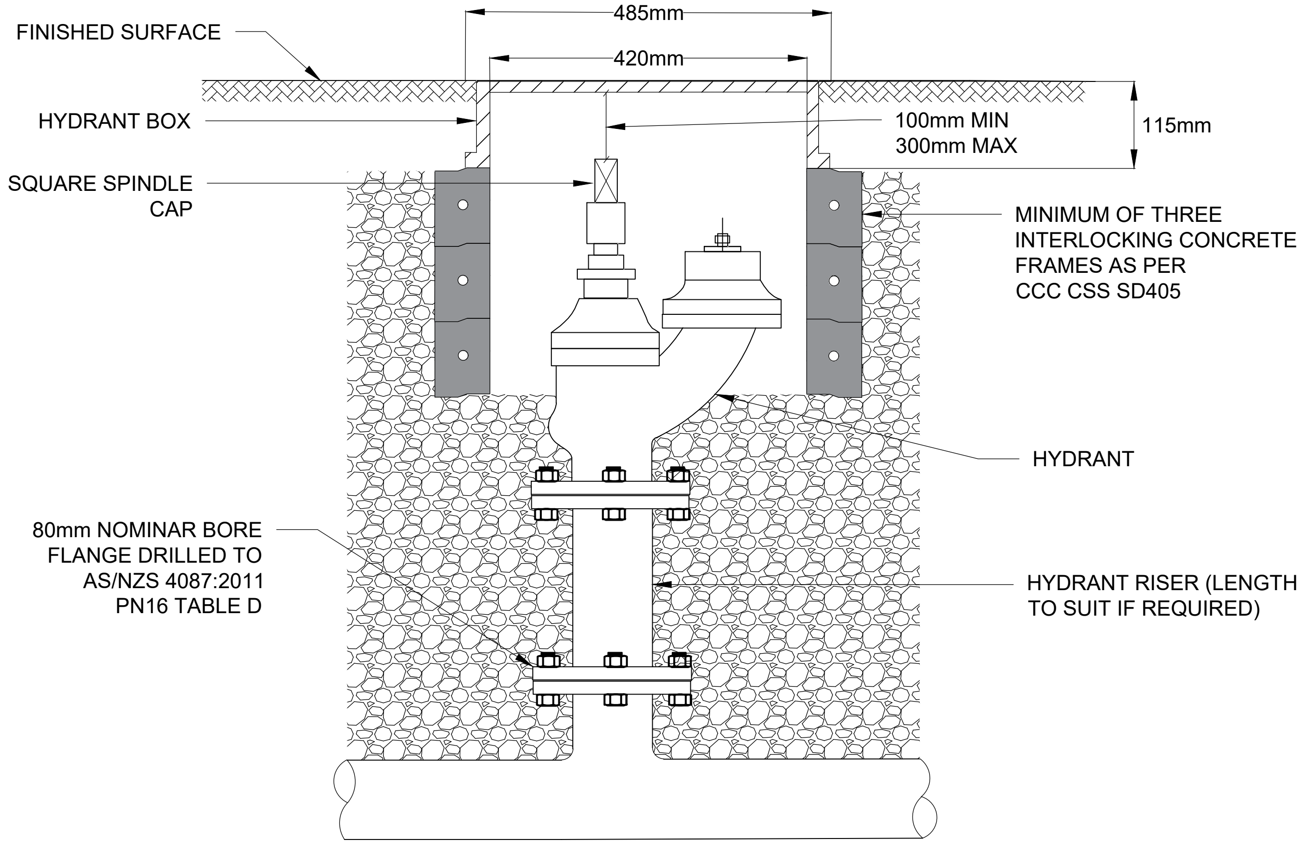
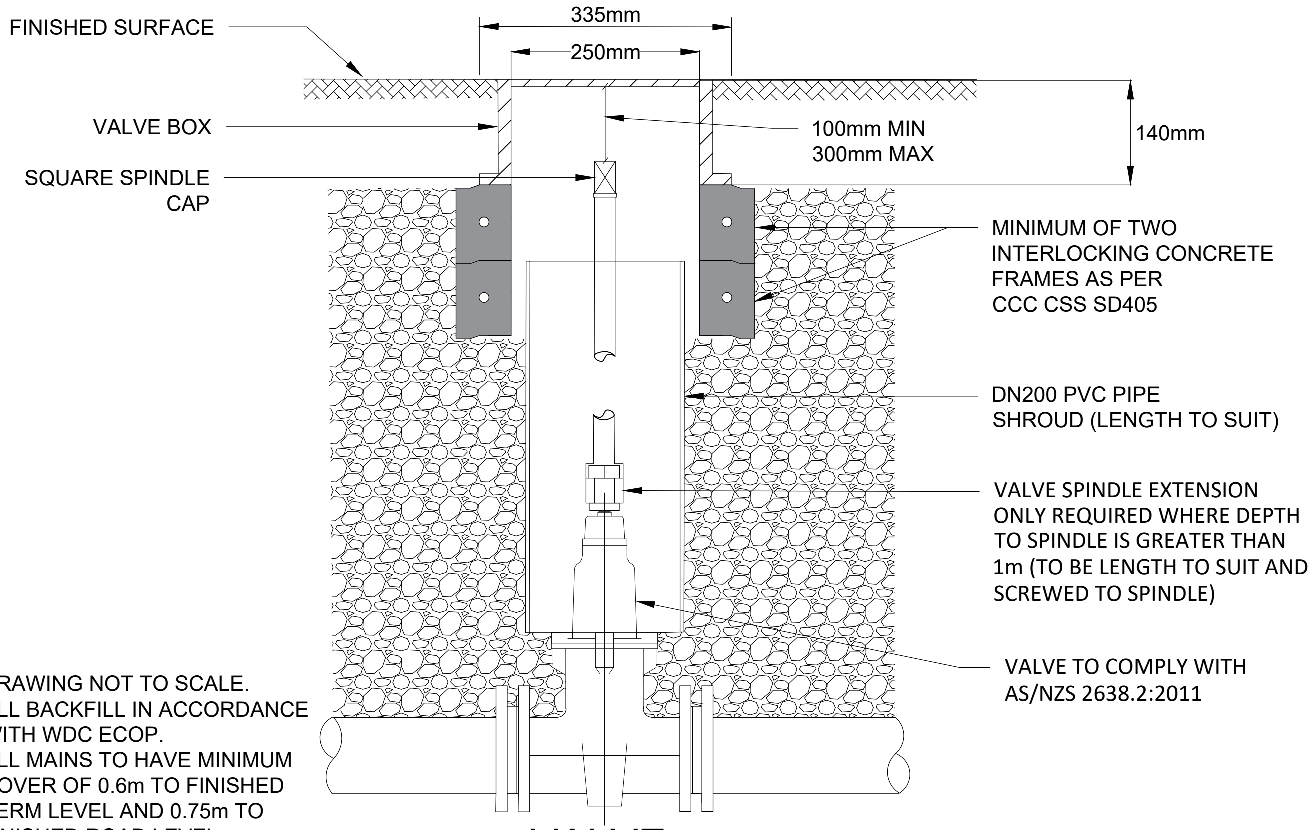


FIRE HYDRANT



VALVE

NOTE:

1. DRAWING NOT TO SCALE.
2. ALL BACKFILL IN ACCORDANCE WITH WDC ECOP.
3. ALL MAINS TO HAVE MINIMUM COVER OF 0.6m TO FINISHED BERM LEVEL AND 0.75m TO FINISHED ROAD LEVEL, UNLESS OTHERWISE APPROVED.

WAIMAKARIRI DISTRICT COUNCIL

SHEET TITLE	PROJECT TITLE	SHEET
WATER VALVE AND HYDRANT INSTALLATION	STANDARD DRAWINGS	406

ISSUE	PLAN No.
C	600

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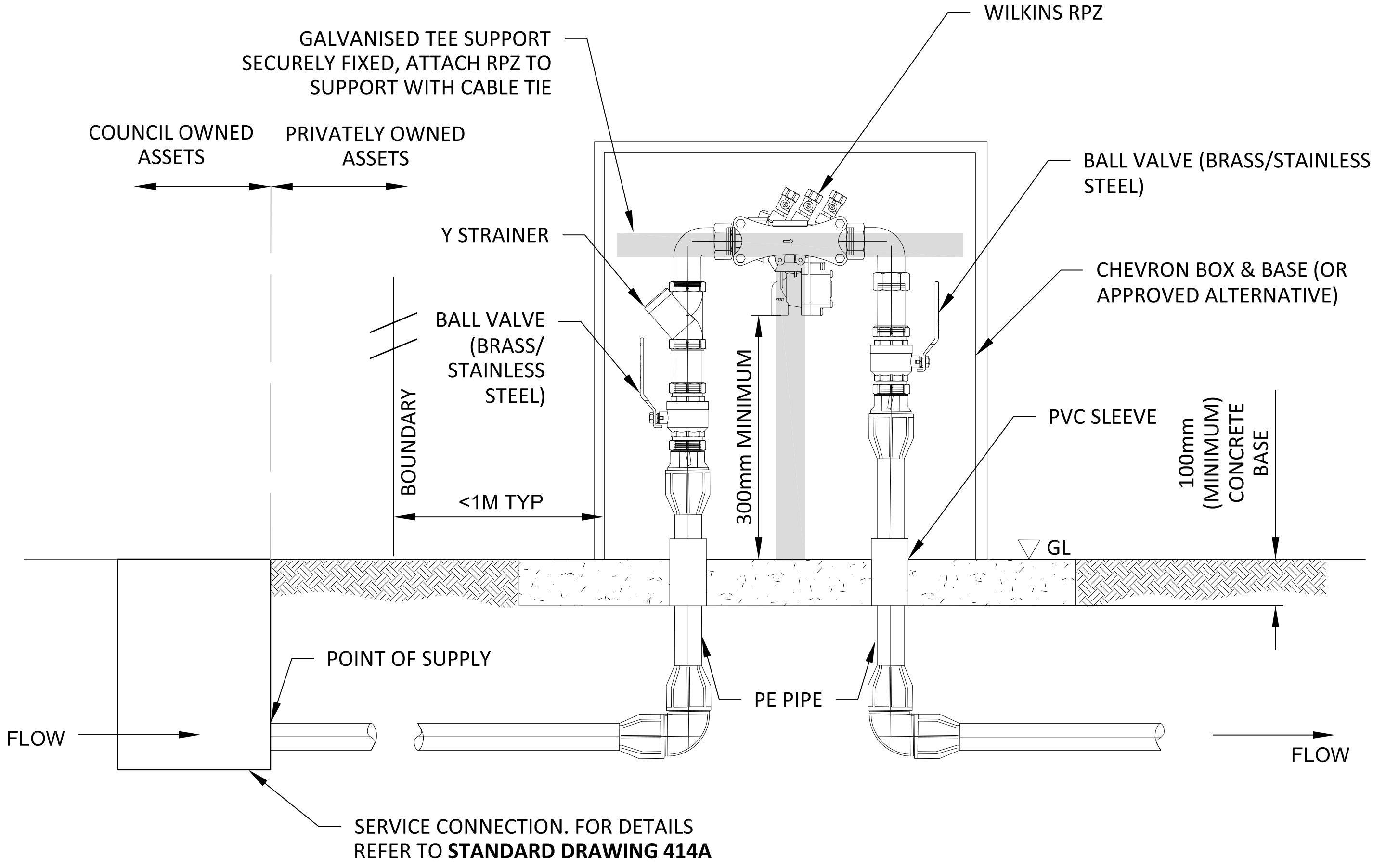
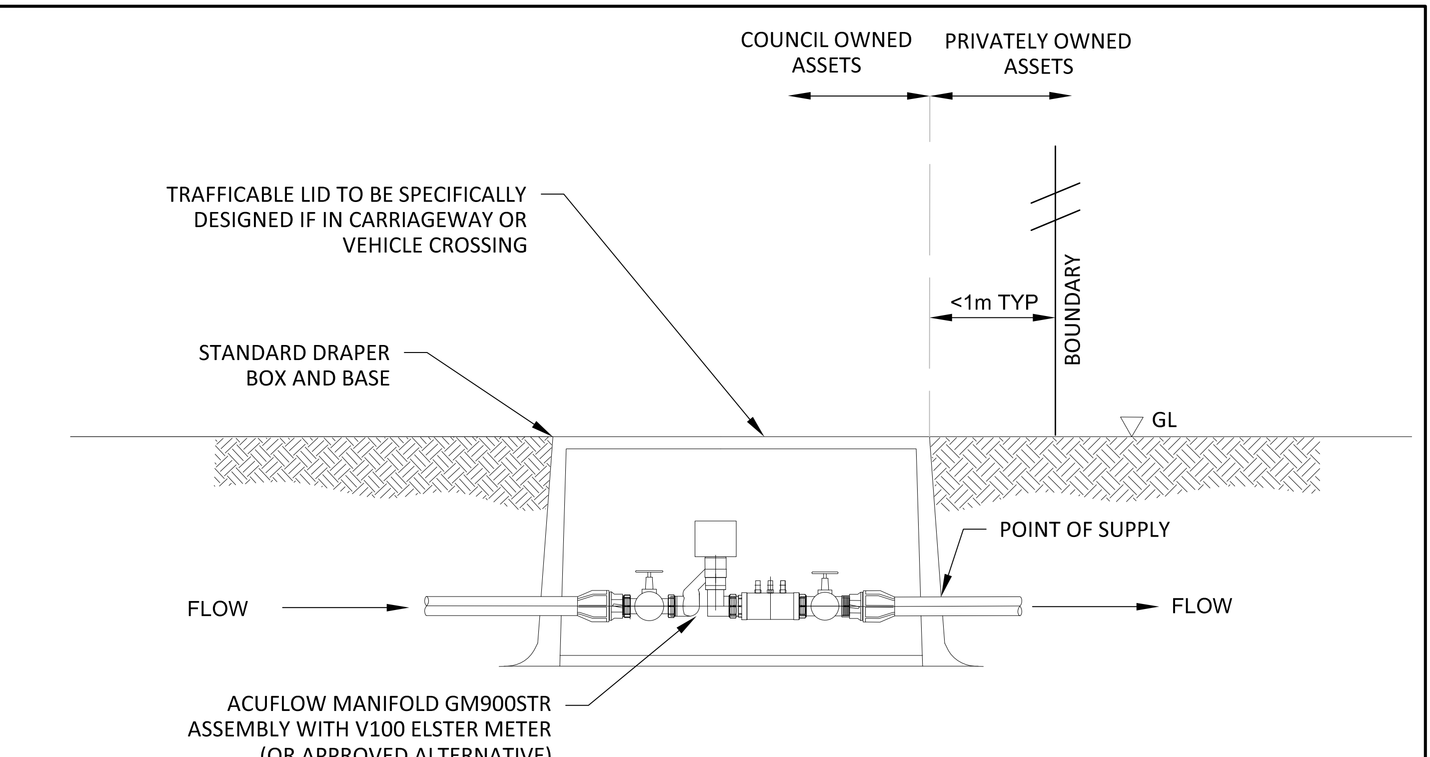
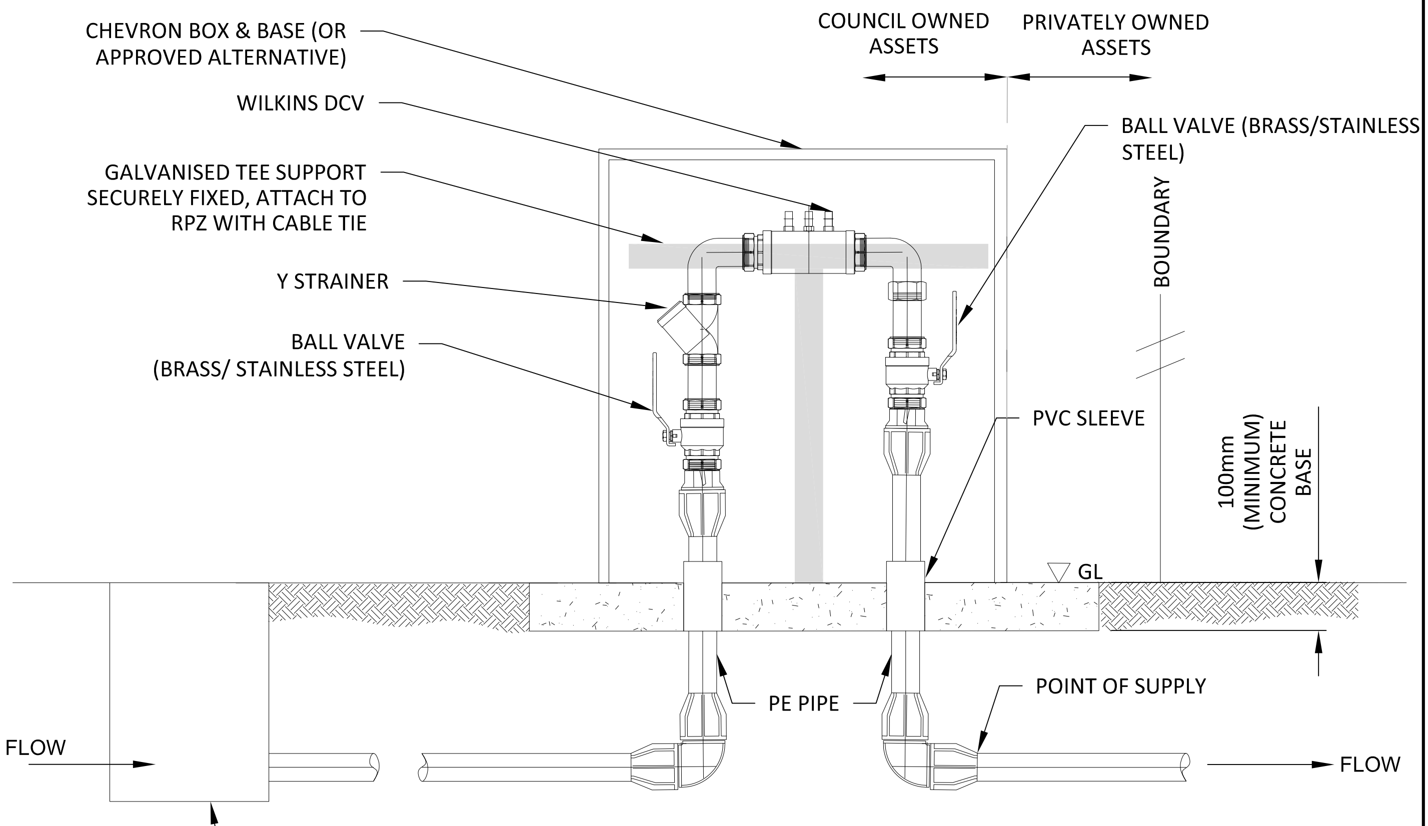


REDUCED PRESSURE ZONE BACKFLOW PREVENTER
Ø15 - 50mm I.D.
N.T.S.

WAIMAKARIRI DISTRICT COUNCIL	PROJECT TITLE: STANDARD DRAWING	SHEET TITLE: HIGH HAZARD BACKFLOW PREVENTER	PLAN No. 600
			ISSUE: B — SHEET: 409A



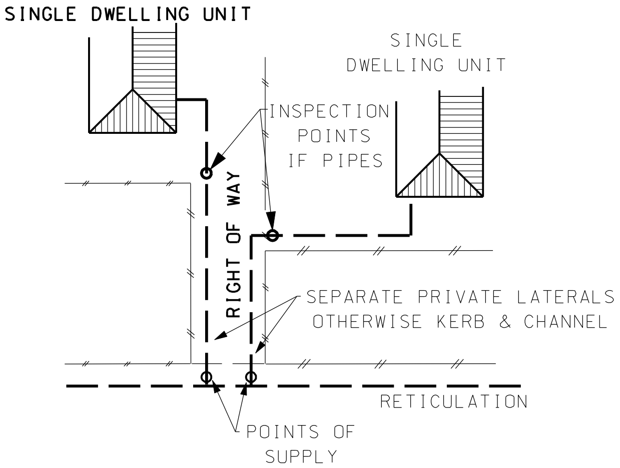
DOUBLE CHECK VALVE
BACKFLOW PREVENTOR
Ø15 - 20mm I.D.
N.T.S



DOUBLE CHECK VALVE
BACKFLOW PREVENTER
Ø25 - 50mm I.D.
N.T.S

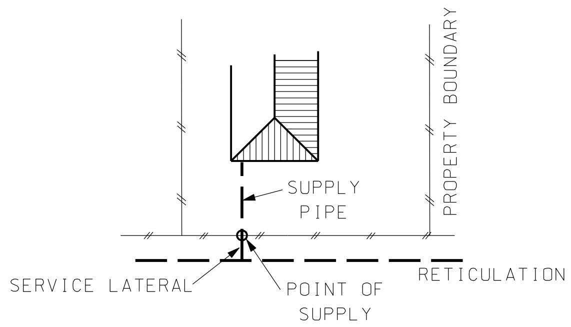
WAIMAKARIRI DISTRICT COUNCIL	PROJECT TITLE STANDARD DRAWING	SHEET TITLE MEDIUM HAZARD BACKFLOW PREVENTER	PLAN No. 600 ISSUE B SHEET 409B

FOR ALL NEW INSTALLATIONS



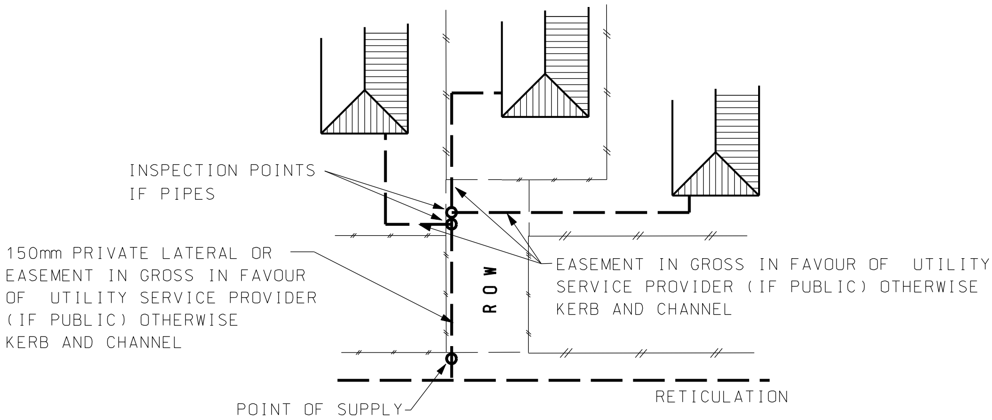
WITH STREET FRONTAGE

See Note



Point of supply location – single dwelling units

NOTE: Where the lateral connection discharges to kerb & channel, the pipe may be redirected from a sump to meet the kerb face, as necessary. Kerb outlets shall not be placed in vee-channel or cutdowns.



REAR LOTS ON RIGHT OF WAY

See Note

NUMBER OF LOTS	Compliance Criteria for Residential Zone Lots Between 300 & 800m^2
1	100mm DIAMETER
2	100mm DIAMETER
3	MAX of Design Storm 20% AEP or 150mm DIA, otherwise Kerb & Channel
4	MAX of Design Storm 20% AEP or 150mm DIA, otherwise Kerb & Channel
5	Design Storm 20% AEP (BY SPECIFIC DESIGN)
6	Design Storm 20% AEP (BY SPECIFIC DESIGN)
7	Design Storm 20% AEP (BY SPECIFIC DESIGN)
Detention & Secondary Flow Path Requirements shall be met where Council Requires. Refer Section 6 "STORMWATER & LAND DRAINAGE"	

Refer also NZS 4404 CODE OF PRACTISE FOR URBAN LAND SUBDIVISION

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE: RESIDENTIAL STORMWATER LATERAL LOCATION	PROJECT TITLE: STANDARD DRAWINGS	SHEET 410; ISSUE B; PLAN No. 600

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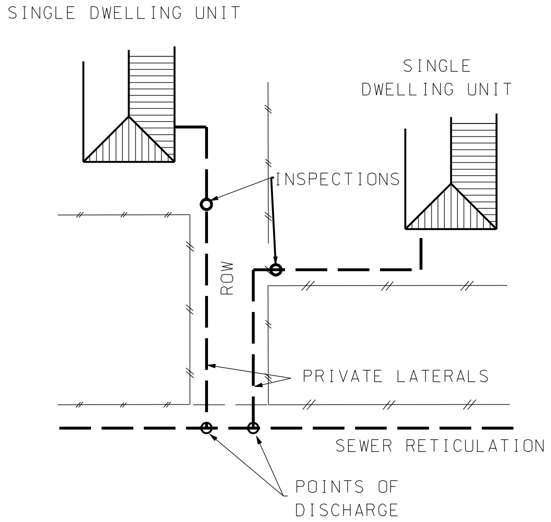
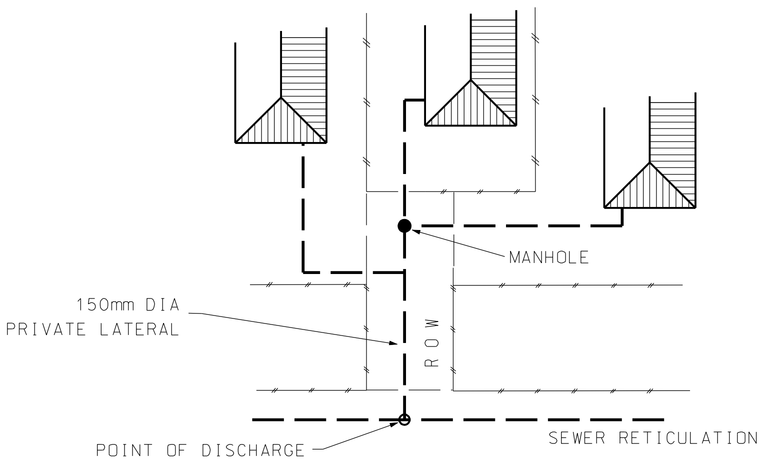
POINT OF SUPPLY LOCATION:
SINGLE DWELLING UNIT -

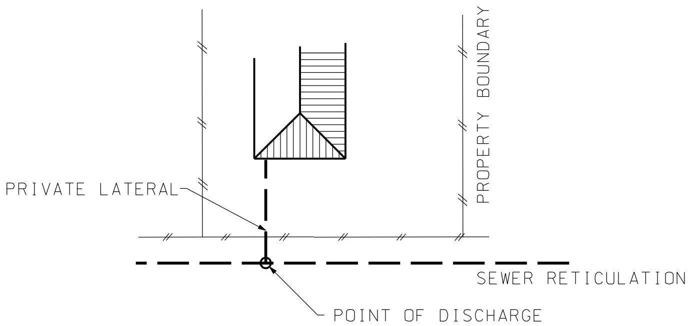


WITH STREET FRONTAGE



REAR LOTS ON RIGHT-OF-WAY

(eg. Ø150mm WHERE COUNCIL HAVE TAKEN OVER THE MAIN)



FOR ALL NEW INSTALLATIONS

(TYPE 2)

NOTES:
Refer WDC COP Part 6: Wastewater, and also
NZS 4404 Code of Practice for Urban Land Subdivision

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE RESIDENTIAL WATSTEWATER LATERAL LOCATION (Over Public Land)	PROJECT TITLE STANDARD DRAWINGS	SHEET 411A
				ISSUE C / PLAN No. 600

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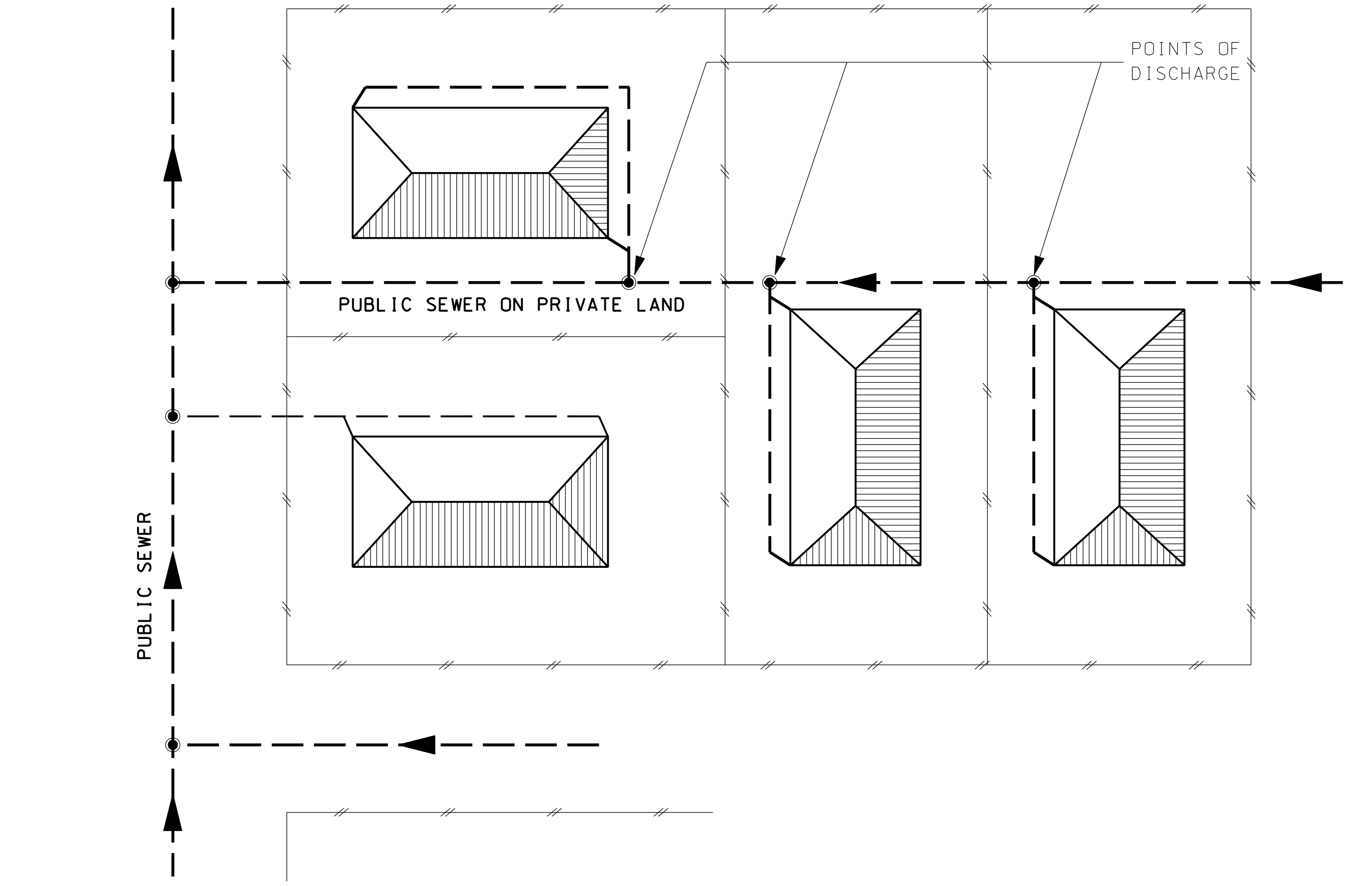
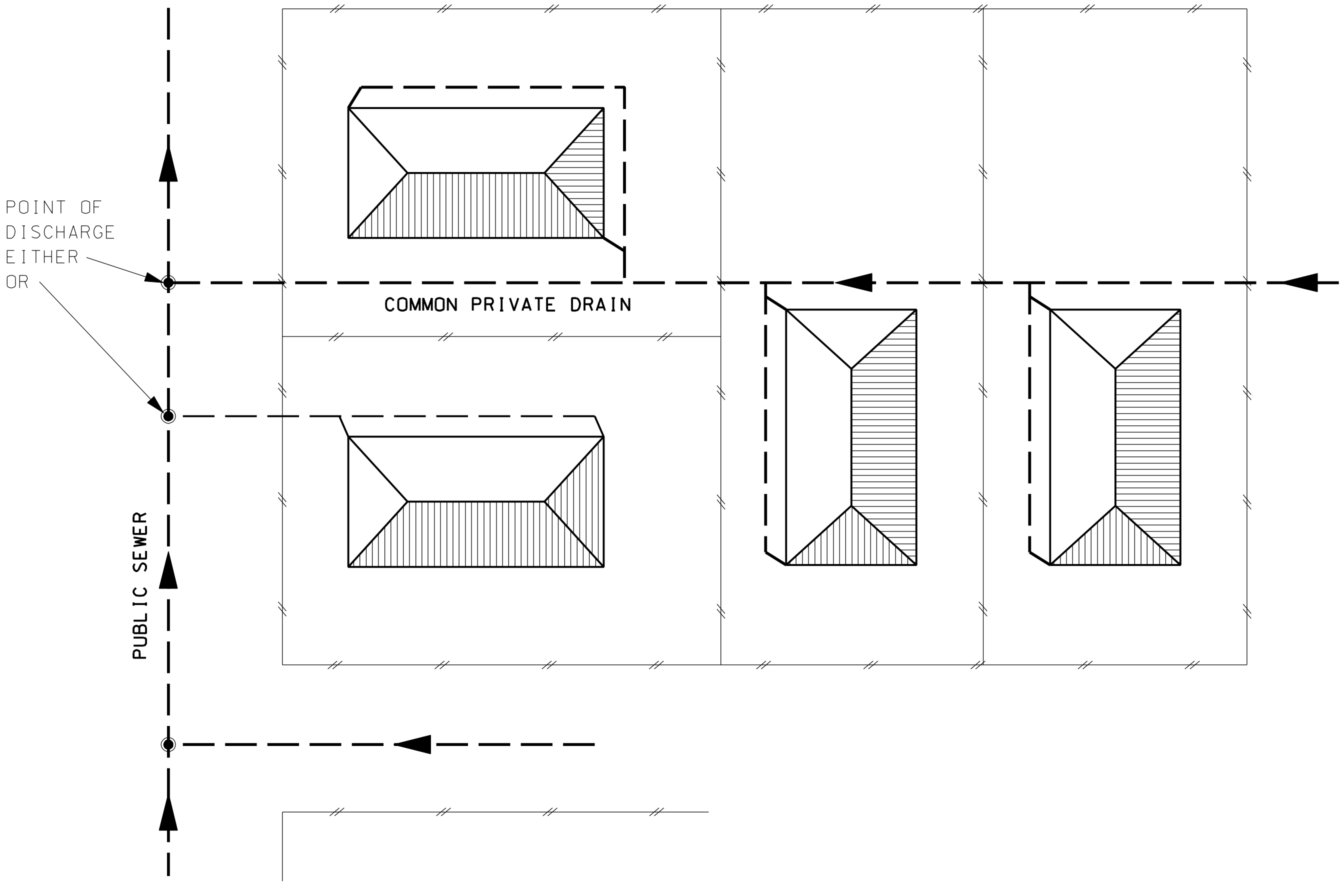


PUBLIC SEWER ON PRIVATE LAND



COMMON PRIVATE DRAIN

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE RESIDENTIAL WASTEWATER LATERAL LOCATION (Over Private Land)	PROJECT TITLE STANDARD DRAWINGS	SHEET 411B ISSUE: B PLAN No.: 600

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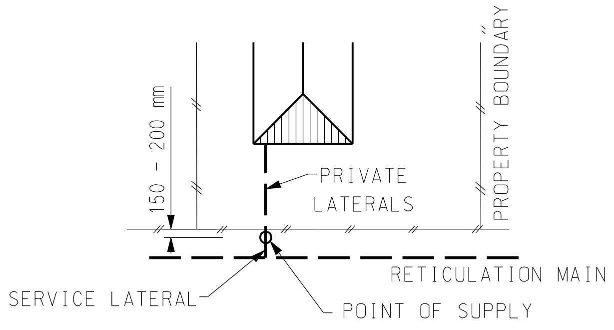
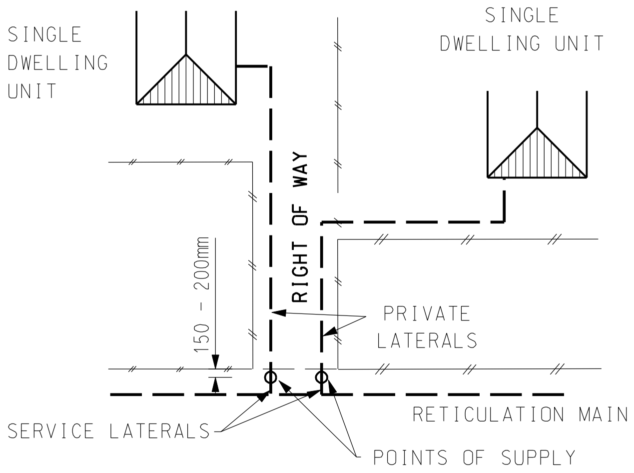
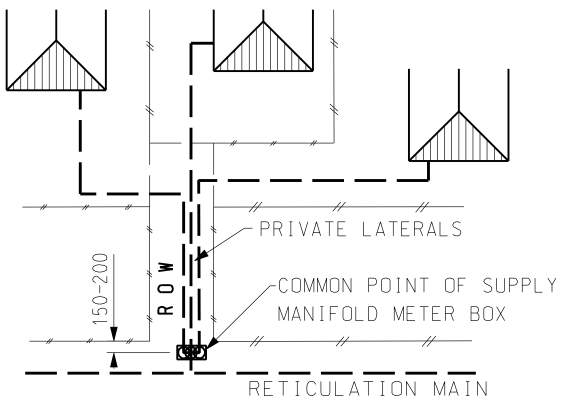
POINT OF SUPPLY LOCATION:
SINGLE DWELLING UNIT -



WITH STREET FRONTAGE
(SERVICE PIPE NOMINAL 15mm DIAMETER)



REAR LOTS ON RIGHT-OF-WAY
(2 DWELLING SERVICE LATERALS & SUPPLY PIPES EACH NOMINAL 20mm DIAMETER)



READ LOTS ON RIGHT-OF-WAY
(3 OR MORE DWELLINGS)

NOTES:
Refer WDC COP Part 7: Water Supply, and also
NZS 4404 Code of Practice for Urban Land Subdivision

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE RESIDENTIAL WATER SUPPLY LATERAL LOCATION	PROJECT TITLE STANDARD DRAWINGS	SHEET 412 ISSUE B PLAN No. 600

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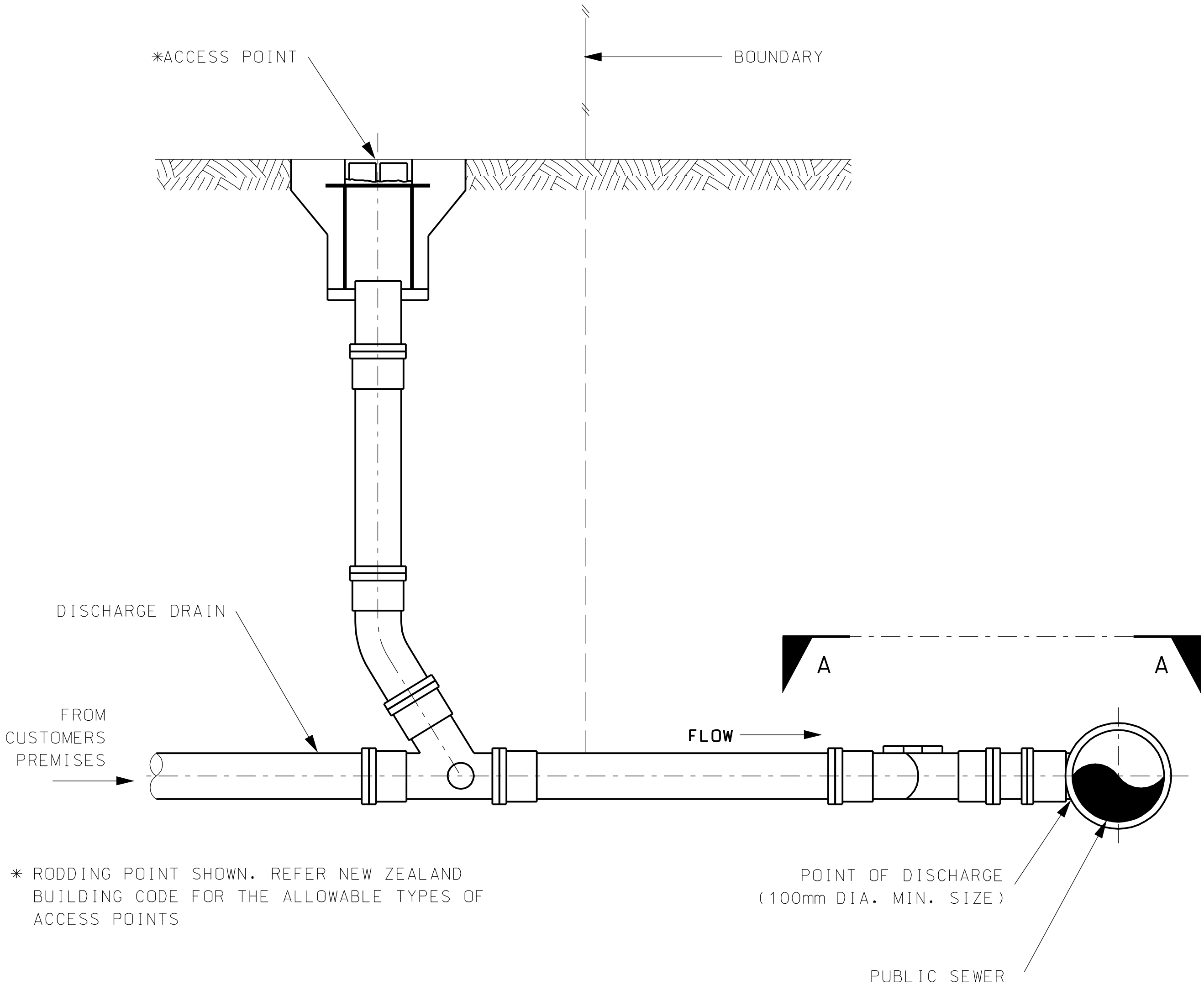
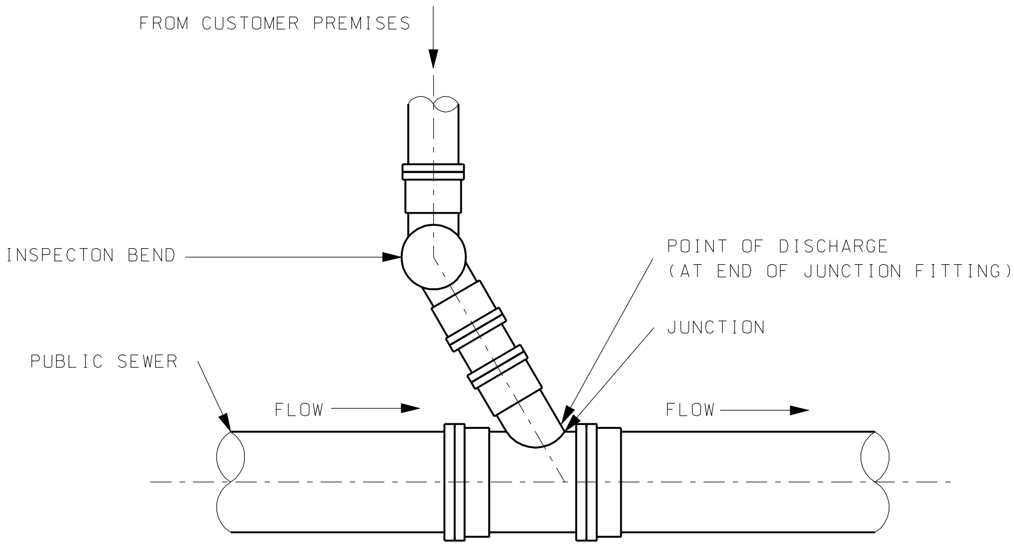


* RODDING POINT SHOWN. REFER NEW ZEALAND BUILDING CODE FOR THE ALLOWABLE TYPES OF ACCESS POINTS

EXAMPLE 1 – DOMESTIC DISCHARGE



SECTION A-A PLAN VIEW

EXAMPLE 2 – DOMESTIC DISCHARGE TO PUBLIC SEWER ON PRIVATE LAND AND A–A FROM EXAMPLE 1

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE RESIDENTIAL SEWER LATERAL LAYOUT AT POINT OF DISCHARGE	PROJECT TITLE STANDARD DRAWINGS	SHEET 413A ISSUE B PLAN No. 600

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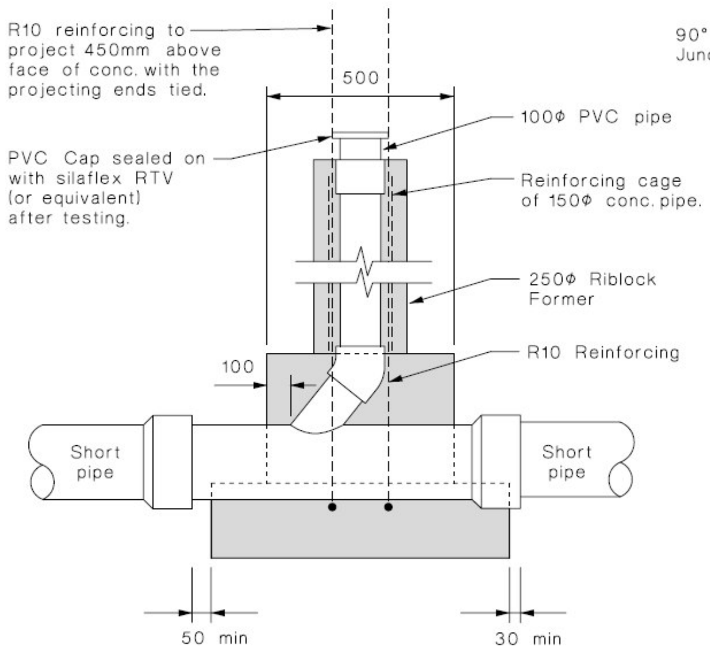
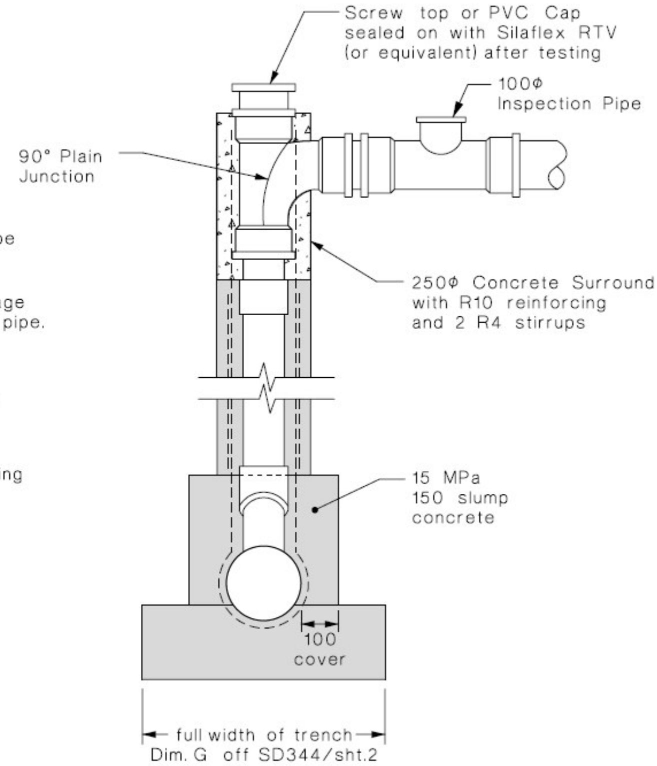


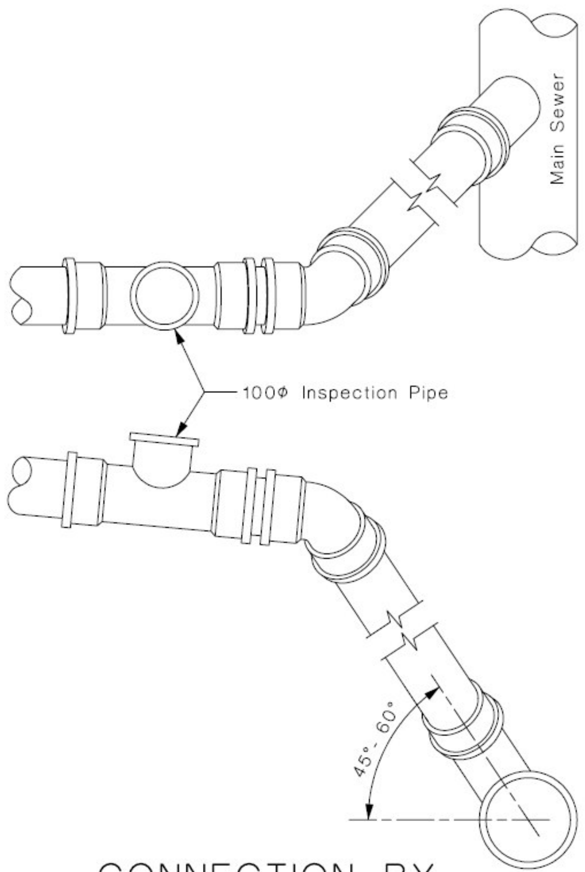
VERTICAL RISER JUNCTION



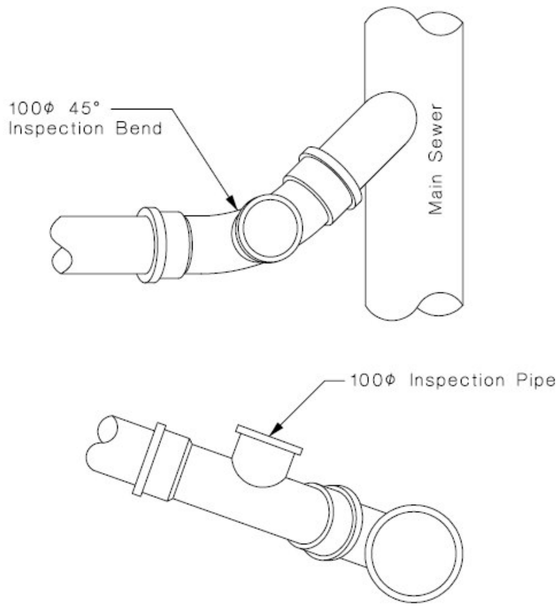
VERTICAL RISER JUNCTION AND CONNECTION

NOTES:

1. PVC pipes adjacent to concrete shall be wrapped with 6mm Denso tape or 250 microns Polyethylene film or equivalent.
2. Bottom of trench to be a stable and approved foundation.



CONNECTION BY RAMPED RISER



CONNECTION TO 45° SIDE JUNCTION

Based on CCC drawing SD363

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE TO BE REVISED	SHEET TITLE RESIDENTIAL SEWER LATERAL JUNCTIONS	PROJECT TITLE STANDARD DRAWINGS	SHEET 413B ISSUE: C PLAN No.: 600

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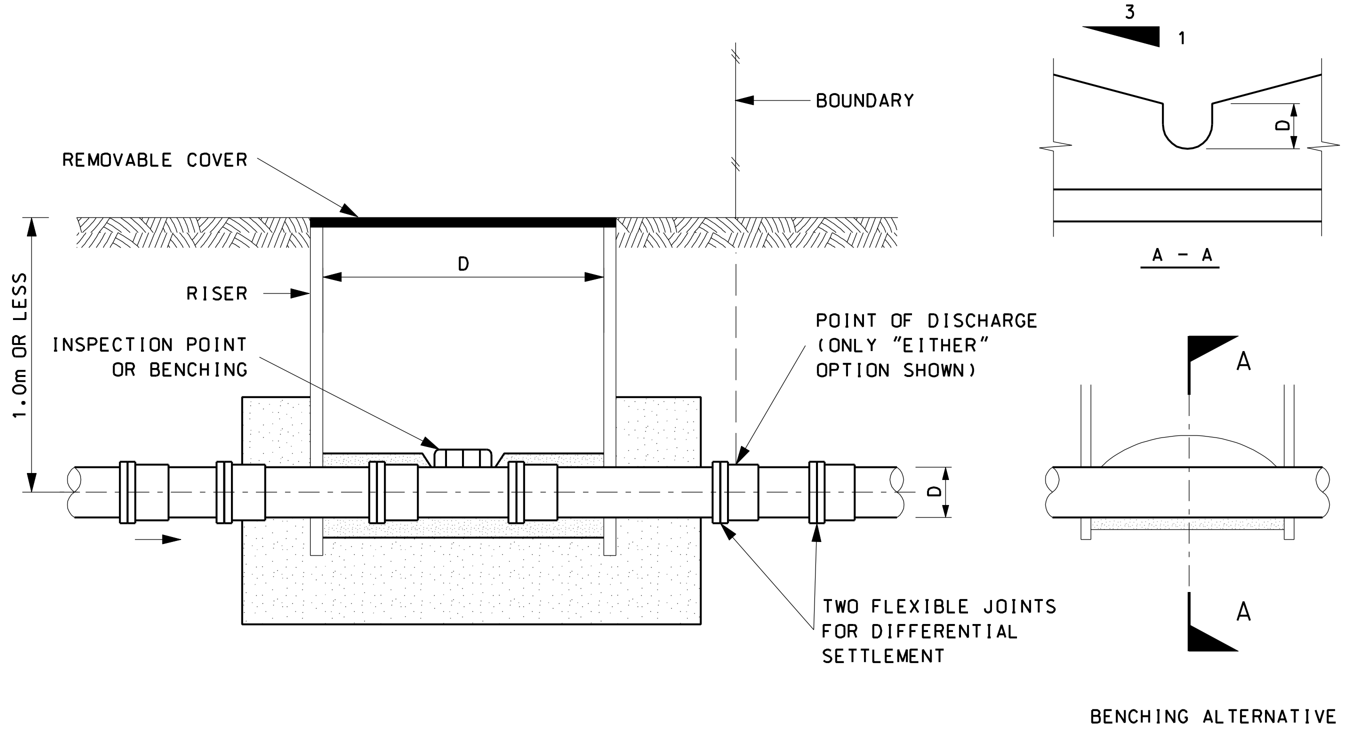
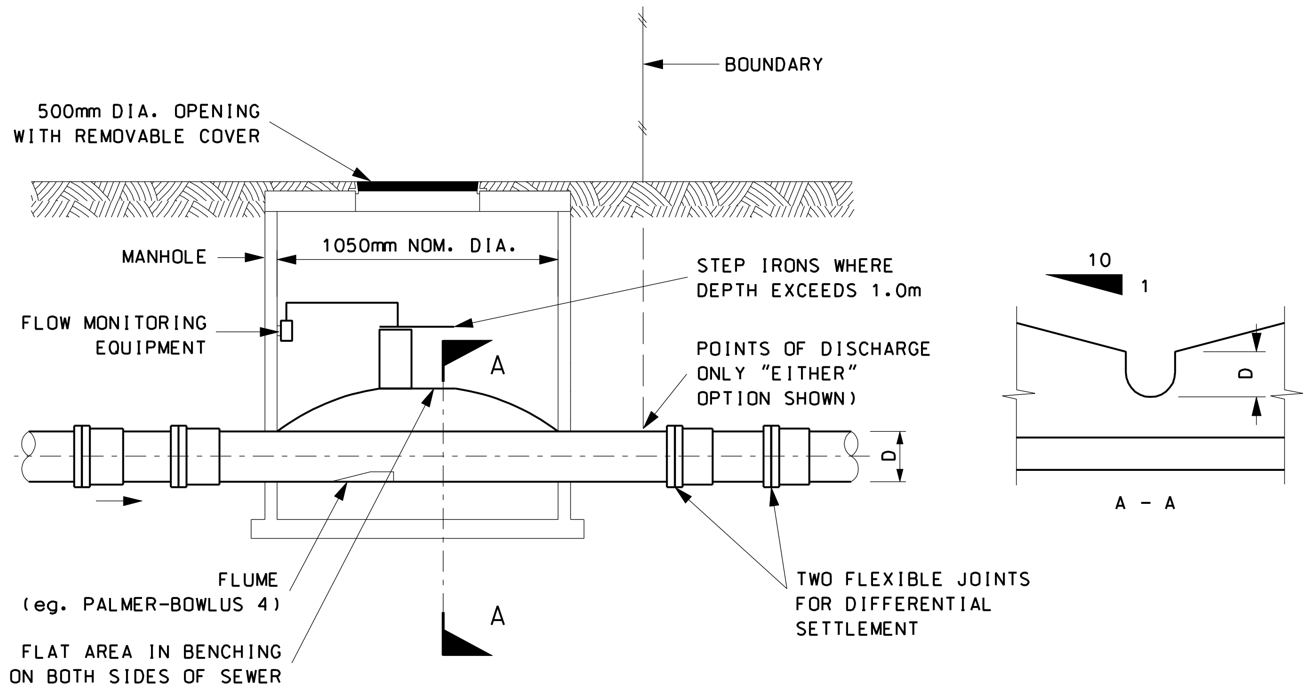
D = 450mm DIA. FOR D = 100mm DIA.
D = 600mm DIA. FOR D = 150mm DIA.



EXAMPLE 3 – CONTROLLED TRADE WASTE
DISCHARGES, NOT GREATER THAN 1.0m DEEP



EXAMPLE 4 – OTHER TRADE WASTE DISCHARGES

WAIMAKARIRI DISTRICT COUNCIL technical services

NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
	TRADE WASTE POINT OF DISCHARGE	STANDARD DRAWINGS	413C

ISSUE	PLAN No.
B	600

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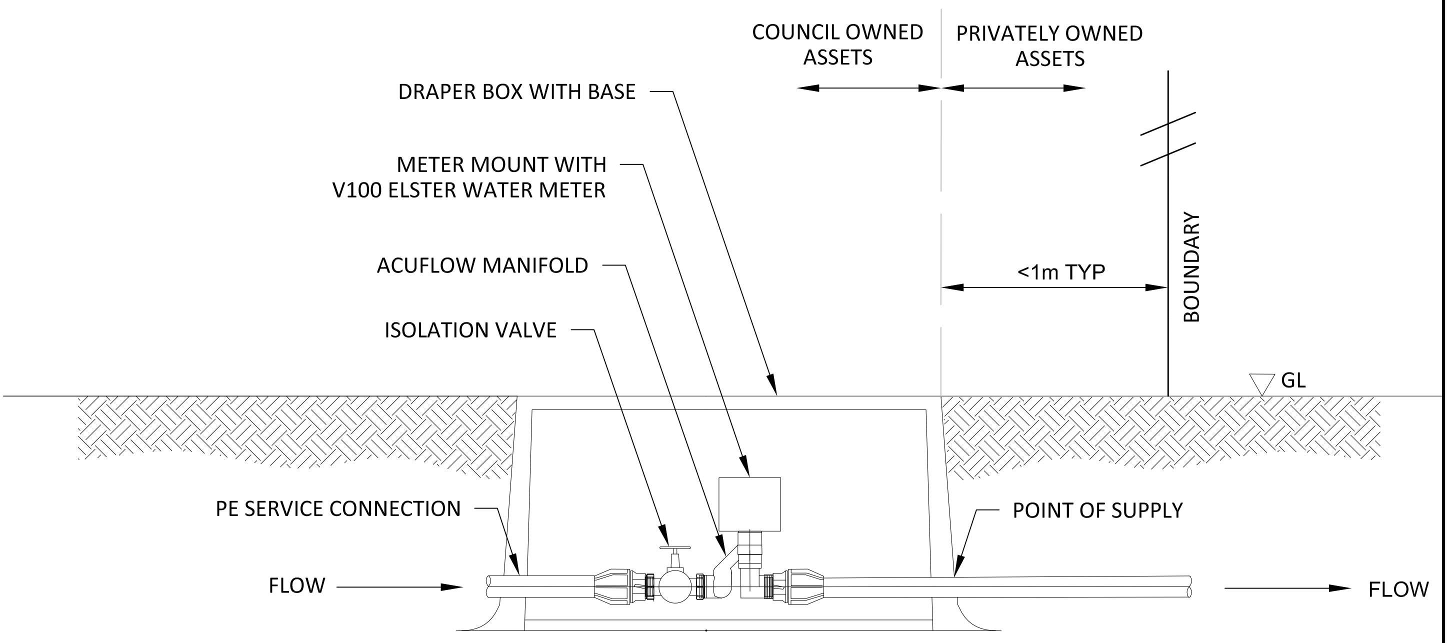
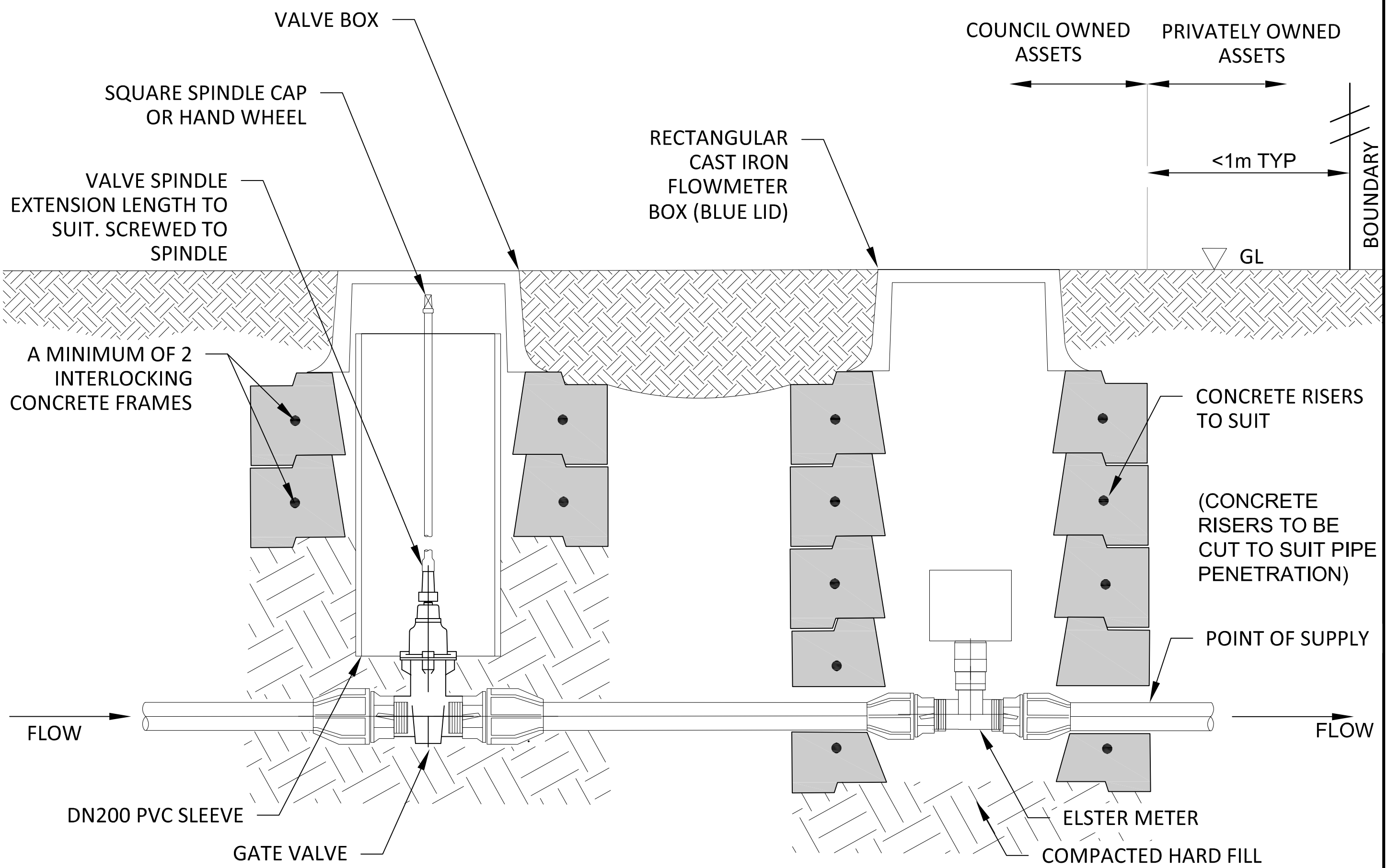


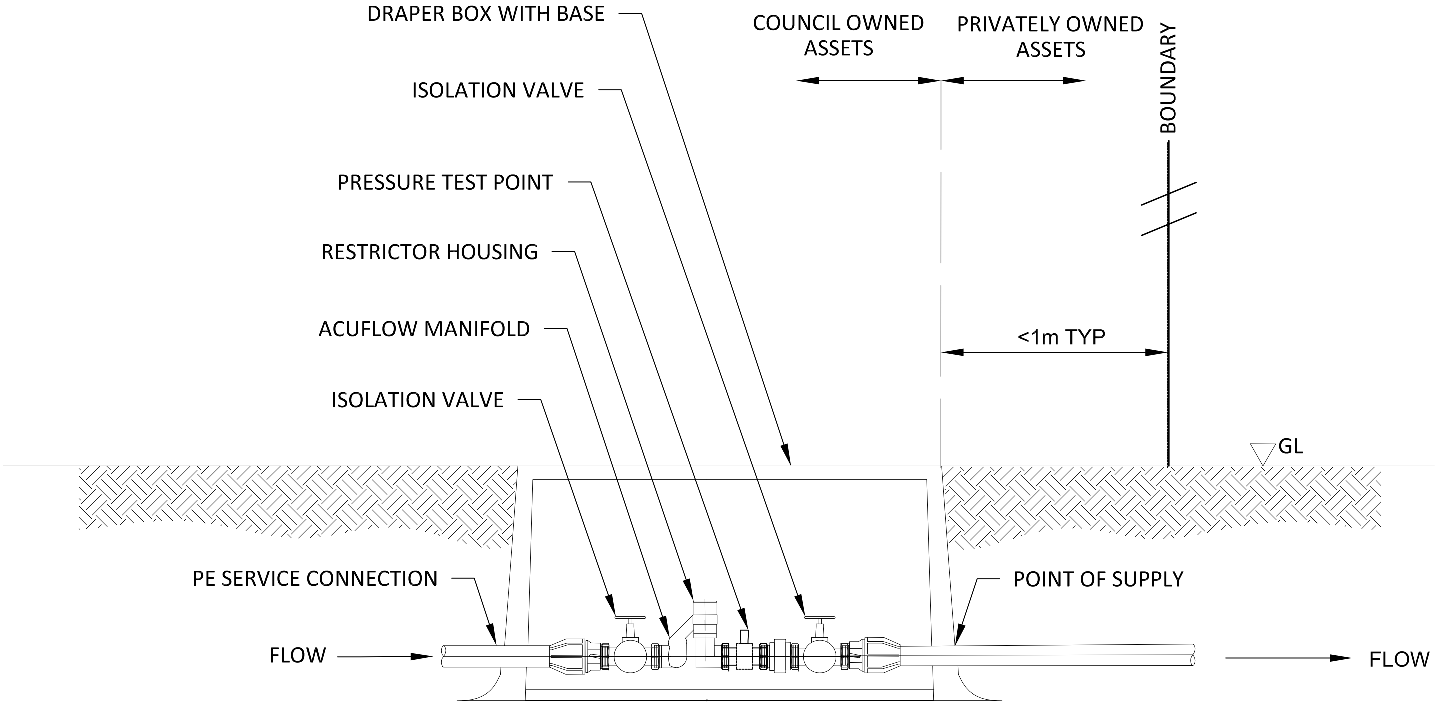
ON-DEMAND SERVICE CONNECTION
Ø15 - 20mm I.D.
N.T.S.



ON-DEMAND SERVICE CONNECTION
> 20mm I.D.
N.T.S.

NOTE:
1. IF IN ACCESSWAY, SPECIFIC DESIGN REQUIRED
2. CONNECTIONS >20mm I.D. MUST HAVE A BACKFLOW PREVENTION DEVICE IN ACCORDANCE WITH 409A OR 409B

WAIMAKARIRI DISTRICT COUNCIL	PROJECT TITLE	SHEET TITLE	PLAN No.	
	STANDARD DRAWING	URBAN WATER SUPPLY CONNECTION	600	
			ISSUE	SHEET
			D	414A



RESTRICTED SERVICE CONNECTION
N.T.S.

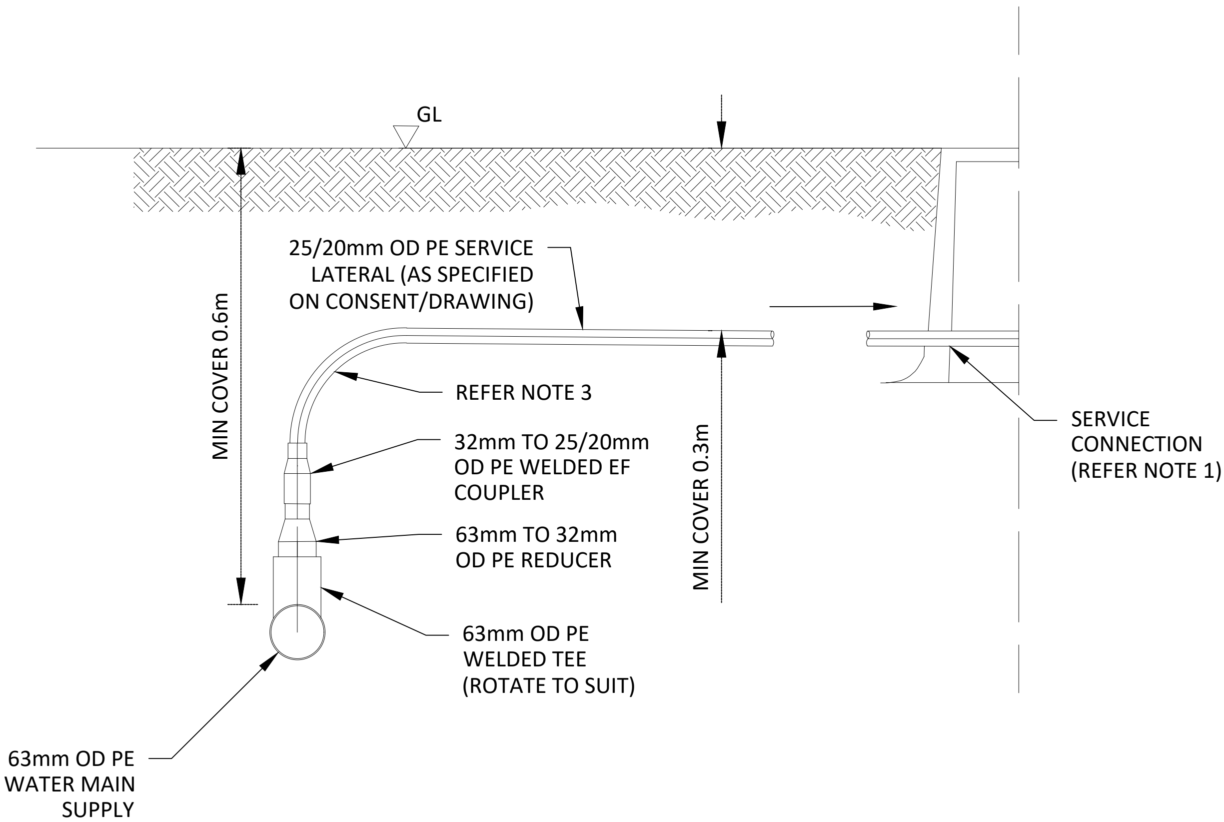
NOTE:

1. LOCATE RESTRICTED CONNECTION TOBY BOXES ADJACENT TO PROPERTY ACCESS/ ENTRANCES WHERE POSSIBLE.
2. ALL TOBY BOXES TO BE MARKED BY MARKER POST AS PER ENGINEERING CODE OF PRACTICE.

WAIMAKARIRI DISTRICT COUNCIL	PROJECT TITLE STANDARD DRAWING	SHEET TITLE RURAL & RURAL RESIDENTAL WATER SUPPLY CONNECTION	PLAN No. 600 ISSUE D SHEET 414B

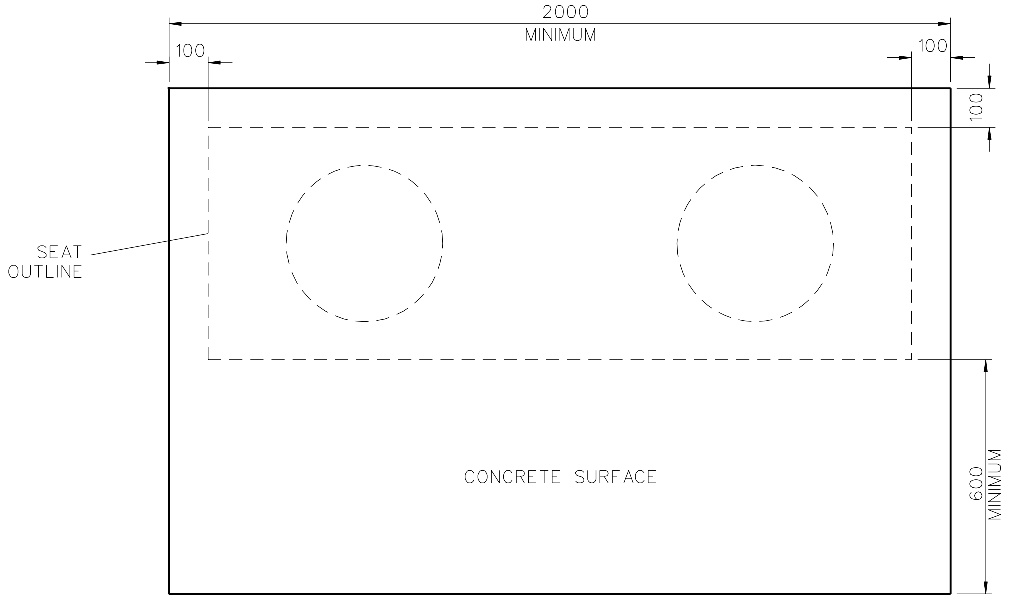
NOTE:

1. REFER TO WDC ECOP STANDARD DRAWINGS 600-414A FOR ON DEMAND OR 600-414B FOR RESTRICTED SERVICE CONNECTIONS.
2. WHERE LATERAL CONNECTION IS OFF A 63mm OD PE WATER MAIN, 63mm OD PE EQUAL TEES ARE REQUIRED (NOT SADDLES). WHERE PE LATERALS CONNECT TO PE PIPE WORK LARGER THAN 63mm OD PE, WELDED PE SADDLES ARE ACCEPTABLE.
3. WHERE MINIMUM BEND RADIUS OF PE PIPE IS LESS THAN 35 TIMES DIAMETER OF PE PIPE, CONTRACTOR TO ALLOW FOR WELDED PE BEND.
4. THIS DRAWING SHOWS A TYPICAL CONNECTION OFF A 63mm OD PE RIDER MAIN, IF CONNECTION IS TO PVC PIPE THEN THE FOLLOWING NOTES APPLY.
   a. TAPPING SADDLES ARE REQUIRED IN PLACE OF WELDED PE TEES OR SADDLES. IN THIS CASE, 4N TAPPING SADDLES ARE TO BE USED (GUN METAL IS NOT APPROVED).
   b. ANY TAPPING INTO PVC PIPE SHALL BE LESS THAN $\frac{1}{3}$ OF PIPE DIAMETER.

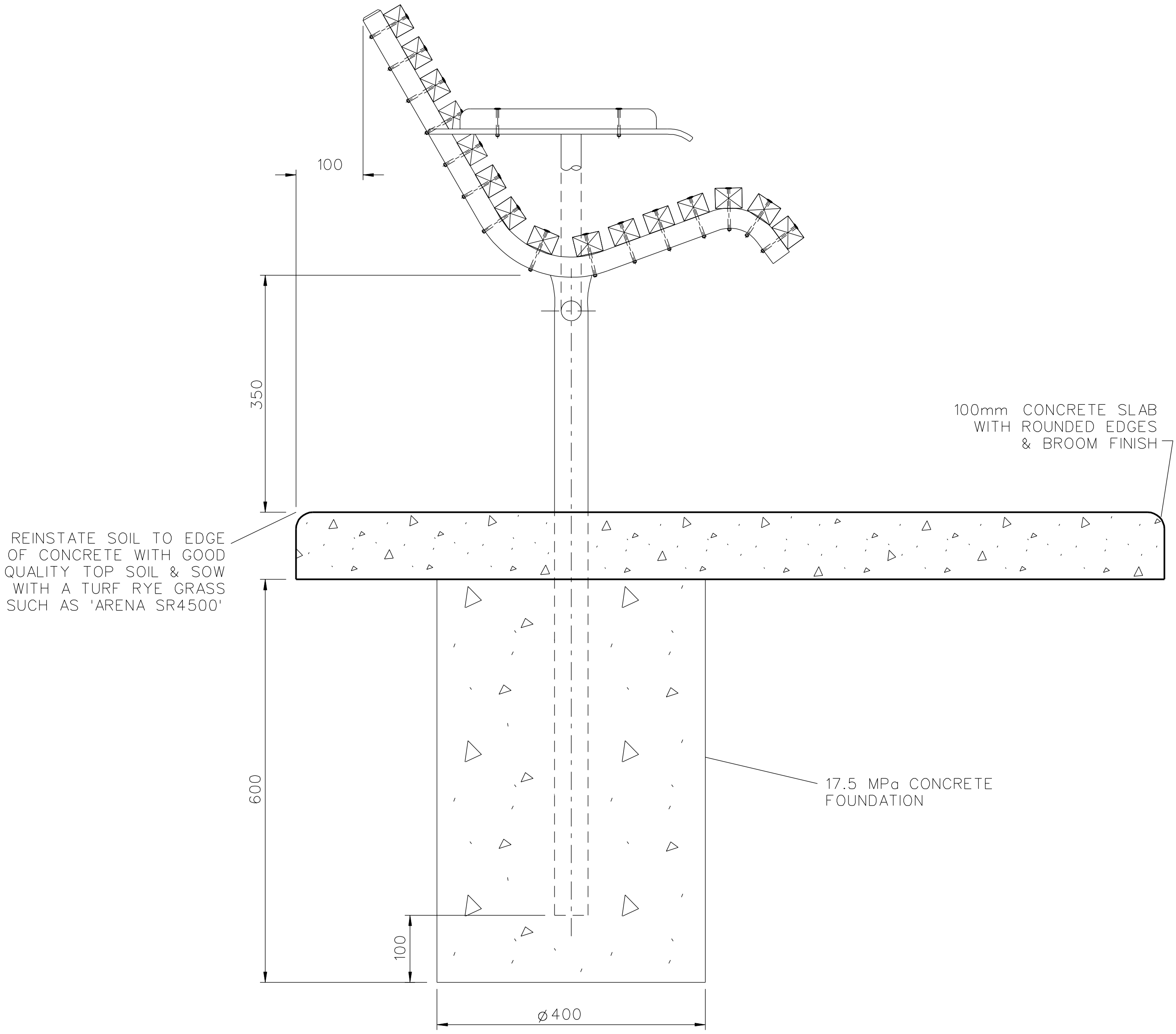


Ø25 - 20m
LATERAL CONNECTION FROM 63mm OD PE WATER MAIN - REFER TO NOTES 2 AND 4 FOR OTHER WATER MAIN MATERIALS AND SIZES

WAIMAKARIRI DISTRICT COUNCIL	SHEET TITLE SERVICE LATERAL CONNECTION FROM WATER MAIN	PROJECT TITLE STANDARD DRAWINGS	SHEET 414C ISSUE A PLAN No. 600



FOUNDATION PLAN



FOUNDATION DETAIL

Based on CCC drawing SD712

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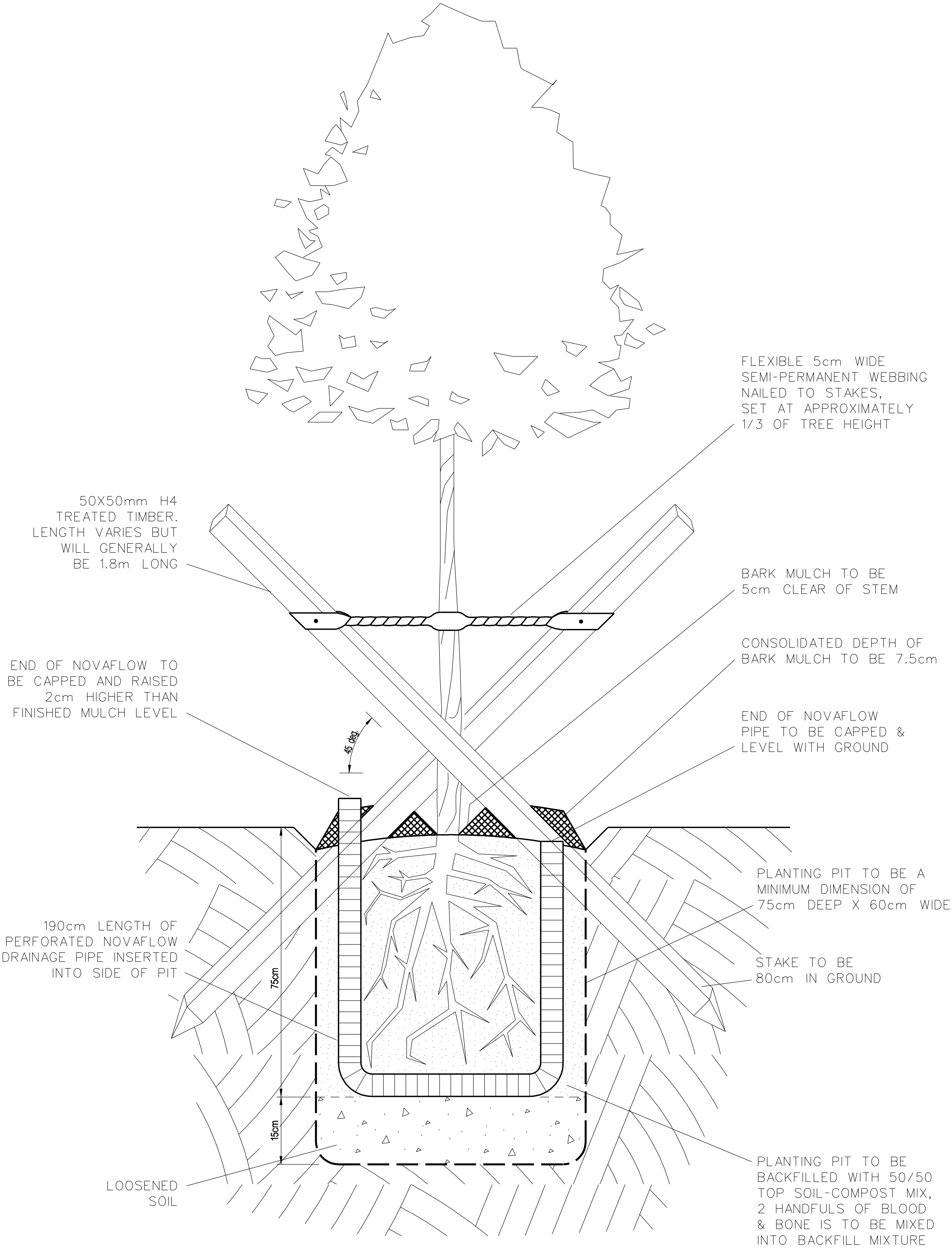
WAIMAKARIRI
DISTRICT COUNCIL
technical services

NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
	STREET BENCH INSTALLATION	STANDARD DRAWINGS	500

ISSUE	PLAN No.
B	600



Based on CCC drawing SD701

WAIMAKARIRI DISTRICT COUNCIL technical services

NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
	DIAGONAL TREE STAKING	STANDARD DRAWINGS	501A

ISSUE	PLAN No.
B	600

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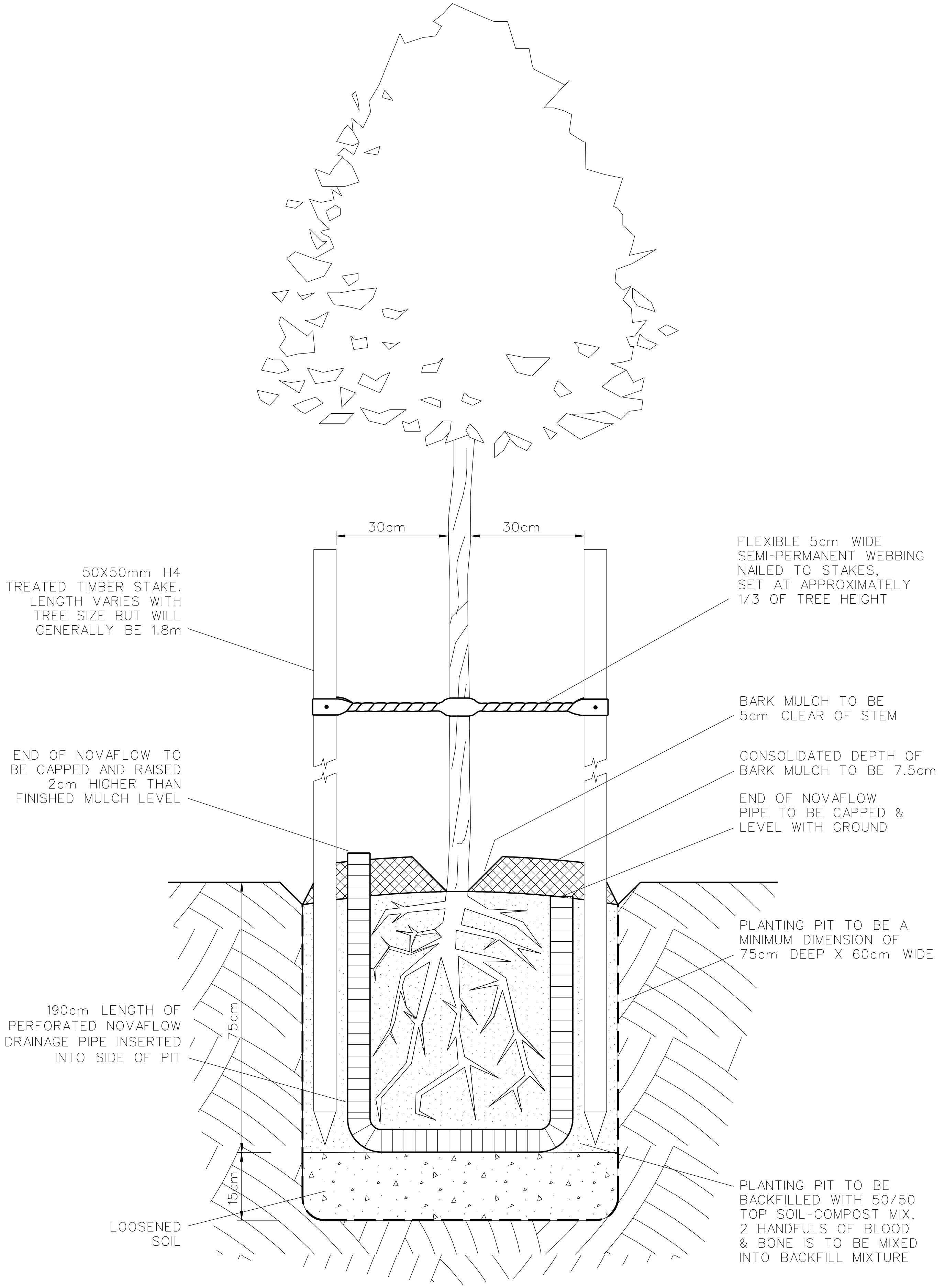

Based on CCC drawing SD702

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE	PROJECT TITLE	SHEET
		VERTICAL TREE STAKING	STANDARD DRAWINGS	501B
				ISSUE: B / PLAN No. 600

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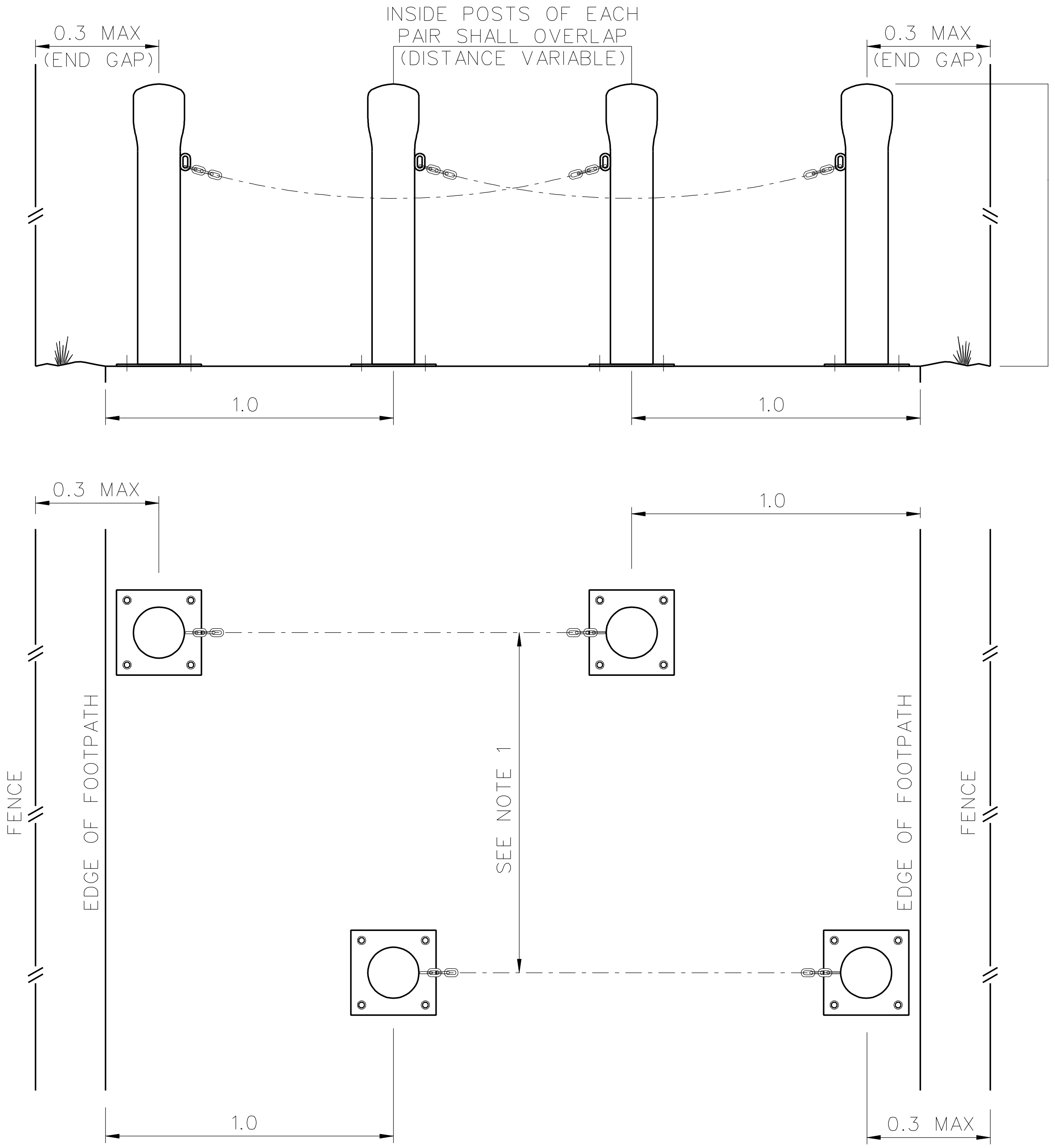

SURFACE MOUNTED STEEL BOLLARDS

NOTES:

1. FOR LARGER DIAMETER BOLLARDS MAINTAIN MINIMUM 0.9m INSIDE CLEARANCE IN BOTH DIRECTIONS (OTHERWISE 1.0m CENTRES).
2. CHAINED LENGTH (OR EQUIVALENT) WILL VARY DEPENDING ON PATH WIDTH.
3. DIMENSIONS APPLICABLE TO DIFFERENT SURFACES AND STEEL OR WOODEN BOLLARDS.

STEEL BOLLARD SPECIFICATION

USE APPROVED 0.8m HIGH STEEL BOLLARDS, LUGGED ON ONE SIDE AND POWDER COAT FINISHED IN APPROVED COLOUR. BOTTOM PLATE TO BE 6mm THICK WITH 4 HOLES SUITABLE FOR 12mm x 100mm GALVANISED THRU BOLTS (STAINLESS STEEL IN BEACH ENVIRONS). CONCRETE SURFACES TO BE MINIMUM DEPTH OF 100mm. ALL BOLTS TO BE SECURELY TIGHTENED, EXCESS THREAD REMOVED AND REMAINDER BURRED OVER AND ZINC SPRAYED TO PREVENT LOOSENING AND RUST.

WAIMAKARIRI DISTRICT COUNCIL technical services	NOT TO SCALE	SHEET TITLE PEDESTRIAN ACCESSWAY CHICANE	PROJECT TITLE STANDARD DRAWINGS	SHEET 502 ISSUE B PLAN No. 600

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