

PART 13: STOCK WATER RACES

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13.1 REFERENCED DOCUMENTS

Planning and Policy

- Resource Management Act (RMA) (1991)
- Building Act (2004)
- The Selwyn *District Plan*
www.selwyn.govt.nz/services/planning
- Selwyn District Structure Plans
- Selwyn District Council pamphlet '*A guide to the management of water races in Selwyn district*'.
- Selwyn District Council '*Water Race Management Plan*'
- Canterbury Regional Council *Natural Resources Regional Plan (NRRP)*
www.ecan.govt.nz
- Canterbury Regional Council Transitional Regional Plan (TRP) 1991

Design

- Christchurch City Council *Waterways, Wetlands and Drainage Guide, Ko Te Anga Whakaora mö Ngä Arawai Rēpo (WWDG) (2003) Part A and B*
- Environment Canterbury '*A guide to Managing Waterways on Canterbury Farms*'
- Environment Canterbury '*Caring for Streams of the Canterbury Plains: A Guide to Riparian Management*'.
- Christchurch City Council '*Stream Planting Guide – What to plant and how to maintain native plants along freshwater streams in Christchurch*'
- New Zealand Water Environment Research Foundation '*Sustainable Drain Management, Field Guide*'
- Canterbury Regional Council *Erosion and sediment control Guidelines 2007*
<http://ecan.govt.nz/publications/Pages/erosion-sediment-control-guidelines.aspx>
- NZS 4404: 2004 *Land development and subdivision engineering*
- Transit New Zealand Bridge Manual (2003)
- Selwyn District Council '*Subdivision Design Guide - Design Guide for residential subdivision in the Living 1 zones*'

www.selwyn.govt.nz/data/assets/pdf_file/0016/15163/ADOPTED-SDC-Subdivision-Design-Guide.pdf

- Selwyn District Council Trees and Vegetation in Selwyn District Management Policy Manual

www.selwyn.govt.nz/services/facilities/draft-trees-and-vegetation-policy

Construction

- Christchurch City Council Civil Engineering *Construction Standard Specifications Parts 1-7 (CSS)*
<https://ccc.govt.nz/consents-and-licences/construction-requirements/construction-standard-specifications>

Where a conflict exists between any Standard and the specific requirements outlined in the Infrastructure Design Standard (IDS), the IDS takes preference (at the discretion of the Council).

13.1.1 Source documents

This Part of the Engineering Code of Practice is based, in terms of format on the CCC Infrastructure Design Standard, by agreement, and with the consent of Christchurch City Council.

13.2 INTRODUCTION

Selwyn's design philosophy, objectives and purpose is outlined in the Selwyn District Council Urban Design Strategy and takes preference over Christchurch City Council documents.

13.2.1 Philosophy

The management and operation of the water race network recognises and reflects the values of other resources users. This has required a more structured and effective management process which is outlined in the Councils Water Race Management Plan.

Selwyn District Council has recently adopted a methodology for Strategic Asset Management Planning for the 5 Waters reflecting and defining the four well-beings (environmental, social, economic and cultural) referred to in the Resource Management Act 1991 (RMA) and the Local Government Act 2002 (LGA).

The well-beings are consistent with those that Environment Canterbury previously defined in their Long Term Council Community Plan 2006-2016.

13.2.2 Objectives

The objective of the Stock Water Race System is: “To provide effectively operated and managed stock water race schemes to meet the present and likely future needs of the consumers and promote sustainability”.

This objective provides a clear indication to water users and other resource users of Councils primary objective in operating and managing the water race network. An overall plan guiding the operation and management of the network to meet this objective is specified in the Councils water race management plan.

13.2.3 Purposes

The primary purpose of the water race network is to provide;

- Stock water, and
- Potable drinking water (at the sole risk of the user)

Secondary purposes of the water race network are;

- Irrigation (as governed by policy and/or agreement)
- Fire fighting, and
- Landscape/aesthetics/biodiversity.

13.3 CONSENT AND COMPLIANCE ISSUES

13.3.1 Legislation

The Resource Management Act (RMA) and Local Government Act (LGA) are the principal statutes that controls land development, including water race aspects.

13.3.2 Approval process

New water race systems including diversions require approval from the Council and consent from the Canterbury Regional Council (Environment Canterbury). Approval may be by way of a permitted activity or rule in a regional plan or by permit.

Consult with authorising officers from both Councils prior to consent application. It is good practice for the Council and the Canterbury Regional Council 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.

13.3.3 Consent from the Canterbury Regional Council

Consent from Canterbury Regional Council will be required for the

- Spraying of water races, and
- Diverting of water races

Council staff can provide assistance with a diversion proposal to Environment Canterbury on behalf of the applicant.

13.3.4 Council requirements

There are separate subdivision and landuse resource consent procedures in which stock water race issues may arise. The input of appropriate Selwyn District Council staff is required. Early discussion, particularly pre-application meetings between the District Council and the applicant, can be an effective way of moving a proposal forward.

Note that the information given in WWDG Part B chapter 17, although useful,

may not be directly transferable to the Selwyn District.

13.3.5 Exercising consents

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

13.4 QUALITY ASSURANCE REQUIREMENTS & RECORDS

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

13.4.1 The designer

The designer of all water race systems/relocations/enhancements that are to be taken over by Selwyn District Council must be suitably experienced. Their experience must be to a level to permit membership in the relevant professional body. Refer to clause 2.6.1 – Investigation and design (General Requirements) for further information.

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

13.4.2 Information to be provided

The survey datum shall be to New Zealand Transverse Mercator 2000 Projection, the level datum used shall be to mean sea level, Lyttelton Datum.

Specific information to be provided with any concept drawings or Resource Consent plans must include:

- the location of existing water race;
- the location of any archaeological and historical features;
- representative pre-existing and post development cross-sections through any water race;
- the proposed proximity of buildings to the water's edge and/or shoulder of the banks;
- identification of any natural or artificially created basins/ponds/wetlands;
- the impact of any proposed filling or excavation on existing water races;
- existing services and easements;
- details of any contaminated ground or historical filling;
- protected trees, other significant vegetation and other features to be protected and retained (e.g. natural landforms, ecological protection areas);

- details of any investigations such as ground water levels, profiles, infiltration testing and effects on the environment and geological or water quality assessments.

13.4.3 Design records

Provide the following information to support the Design Report:

- details and calculations that demonstrate that levels of service required by the *Water Race Management Plan* will be maintained;
- details and calculations that clearly indicate any impact on adjacent areas that the proposed works may have;
- landscape and planting drawings complying to Appendix I - Standard Draughting Layout and Format Requirements (General Requirements).

13.4.4 Construction records

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

- Environment Canterbury compliance monitoring reports;
- all performance test results;
- material specification compliance test results;
- compaction test results;
- subgrade test results;
- infiltration test results.

Provide the Council with a certificate for each length of race / pipeline tested including the date, time and for pipes, the pressure of the test. Provide details in a form complying with the requirements of Part 12: As-Built, including manufacturer, diameter, type, class, jointing and contractor who laid the pipe.

13.4.5 Post-Construction Records

Provide the information detailed in Part 3: Quality Assurance, Part 12: As-Built, and the *Construction Standard Specifications (CSS)*, including where applicable:

- design report;
- completion certificates;
- producer statements – design, construction, construction review;
- commissioning report, including all test results;
- as-built plans and records;
- Easement documents;

- ECan compliance report;

13.5 WATER RACE SYSTEM DESIGN

The water race network is the total system required to convey water for the purpose of supplying farms with water for stock. It consists of a system of open channels, pipes and culverts.

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

- Width, depth and gradient of race;
- size (or sizes) of the pipework throughout the proposed system;
- selection of appropriate pipeline material type(s) and class;
- lining material for the race;
- layout and alignment including: route selection, topographical and environmental aspects, easements, foundation aspects, and clearances;
- hydraulic adequacy including acceptable flow velocities and other requirements where applicable to satisfy *WWDG Part B* chapter 22;
- The race shall be design in such a way as to minimise scouring due to high velocities;
- geotechnical investigations - take into account any geotechnical requirements determined under Part 4: Geotechnical Requirements;
- major reticulation and its potential for significant traffic disruption. Discuss at an early stage with Council.

13.5.1 Design life

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

Maintain fish and invertebrate passage, unless otherwise authorised by the Council or by the Canterbury Regional Council. Refer to *WWDG Part B* clauses 2.2 and 13.2.3.

13.5.2 Minimum protection standards for new developments

Current practice places many residential buildings on slabs 150 mm above the ground. For the protection of buildings, design and build the water race system so that every new building platform is at least 400mm above normal flow levels.

Building setbacks are defined in the Water Race Bylaw.

These are utilised in conjunction with the setting of building levels to ensure that buildings remain free of inundation up to the minimum protection standard. Protection standards are set by the RMA, the *District Plan* and the Building Act

and are discussed in *WWDG Part B* chapter 20.

13.6 WATER RACE DETAILING

13.6.1 Race geometry

The side slope of any new/diverted water race shall be no steeper than 1(V):0.5(H). The base width shall tie-in with the race up and downstream. Base widths are typically 1.0 – 1.5m.

13.6.2 Race formation

The invert and sides (up to normal flow height) of the race, shall be lined with a minimum 100mm thickness of clay or bentonite. This will ensure the race has minimal water loss through infiltration. An additional layer of granular material shall overlay the liner for protection and reduce suspension of fine particles.

13.6.3 Water race in permeable ground

Where a stretch of race is constructed over permeable ground specify backfill material with low permeability as to minimise leakage.

13.6.4 Gradients and acceptable flow velocities

Ensure velocities are non-scouring. Acceptable velocities will depend on soil conditions, but should not exceed the velocities given in *WWDG Part B* Clause 22.7 Table 22-5.

13.6.5 Spoil Cleaning

Where a water race flows through a proposed subdivision, any previous cleaning spoil which have been deposited along the race banks shall be removed as approved by the Asset Manager. The banks of the race shall not be excavated so far as to weaken the bank or cause bank failure/overtopping.

13.6.6 Pipeline connections

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

13.6.7 Minimum pipe sizes

The minimum diameter water race culvert/pipe within the carriageway is 300mm. This may be relaxed to 225mm outside the carriageway where approved by the Council.

13.6.8 Minimum cover

Where the minimum cover complying with the manufacturer's specifications is not achieved, pipelines must be adequately protected from external loadings.

13.6.9 Curved pipelines

The straight-line pipe is usually preferred as it is easier and cheaper to set out, construct, locate and maintain in the future.

Curved pipes must be to the manufacturer's design and construction standards and be used only where approved by the Council.

13.6.10 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 CSS: Part 3 SD 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.

13.6.11 Structures

Design inlets and outlets in accordance with WWDG Part B clauses 14.6 and 14.7. 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 clause 22.9.

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

Where channels/pipes flow onto land or into a waterway outlet, if required 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 Clause 22.7 Table 22-5.

13.6.12 Manholes

Provide manholes in accordance with WWDG Part B clause 14.4 and 14.5 and 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.

Check the effects of turbulence or hydraulic grade on pressure within manholes. No feature should impede flow through a manhole. The flow deviation angle between the inlet and outlet pipes must not be greater than 90 degrees as shown in Figure 1 in clause 6.6.1 – Location and spacing (Wastewater). 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.

Secure manholes against uplift in accordance with WWDG Part B clause 14.4.

Where a special manhole cannot be constructed with a standard riser the lid must:

- meet the WWDG Part B clause 14.4 requirements for structural design, confirmed by a Design Certificate;

- have minimum concrete strength and cover of 40 MPa and 50mm respectively;
- conform to the geometric requirements of SD 302 or SD 303, whichever is relevant.

Manholes shall normally be provided on all water race 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 90m (50m if critical line) for pipes of diameter 1500mm or less.
- At a spacing of not more than 120m for pipes of diameter in excess of 1500mm, with the approval of the Asset Engineer.

13.6.13 Bridges and culverts

Refer to Part 8: Roading and Transport for vehicle crossing design and the *Bridge Manual* and *WWDG Part B* chapter 13 for waterway design at bridges and culverts. All culverts within the stock water race network require headwalls.

13.6.14 Fencing

Fencing over a race is permitted subject to Council approval and conditions. No fence posts are permitted within water race channel. Where the water race is cleared by Council, a gate must be provided for machinery access. Fences must not significantly impede flood flows up to the minimum protection standards (Refer *WWDG Part B* clause 13.9).

13.7 STOCK WATER RACE DISPOSAL

13.7.1 Approved outfall

A suitable outfall and if required a 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.

13.7.2 Discharge to ground

Surface water infiltration systems may be used for developments in rural areas or for developments in urban areas, if ground conditions are suitable for soakage (Refer to *WWDG Part B* 6.5). Carry out a geotechnical assessment including soakage tests when considering the large-scale use of infiltration systems.

A discharge consent may be required from the Canterbury Regional Council for additional discharge to soakage.

Design and locate infiltration systems to allow easy access for maintenance.

13.8 RETICULATION LAYOUT

13.8.1 Topographical considerations

In steep terrain, the location of pipes is governed by topography. Gravity pipelines operating against natural fall create a need for deep installations, 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, provide a fail-safe outlet. At basins a higher level of service for the downstream primary system may be required.

13.8.2 Location and alignment of water race pipelines

Locate water race pipeline mains within the legal road corridor (but not under the crown of the carriageway unless the wastewater sewer is located elsewhere) 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.
- within private property (if unavoidable) adjacent to, and if possible parallel to, boundaries, with a minimum offset to the pipe centreline of one metre.

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.

13.8.3 Clearances from other services or structures

Clause 9.5.3 – Typical services layout and clearances (Utilities) summarises clearances for utility services. Confirm these clearances with the network utility operators, before deciding on any utility layout or trench detail.

Locate race and associated pipe work 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 pipe work;
- long term maintenance access for the race and pipe work;
- protection of the existing structure or building.

Specify the protection on the engineering drawings.

13.8.4 Building over pipelines

Building over pipelines and pipeline easements are not accepted practice, and will not be approved where alternative options such as relocating or re-sizing the building or diverting the pipeline around the building are available. If accepted, it will be subject to at least the following minimum conditions:

- Provide an alternative route protected by easement;
- Provide manholes both sides of the building on the stormwater pipeline;
- The pipeline must be on an even vertical grade and in a straight horizontal alignment;
- There must be no entry points or junctions to the line under the building;
- Check the pipeline by closed circuit television (CCTV) before and after the works;
- Provide specific foundation design to ensure structures do not impose loadings on the pipeline;
- A memorandum of encumbrance will be drawn up at the applicant's expense to protect the Council.

13.8.5 Easements

Water race systems shall generally be located within a reserve, easement or road reserve. Using easements or road reserves in Residential or Business zones is subject to approval by the Asset Engineer.

Provide access of 6m width along at least one side of any race for maintenance, taking into account the "reach" of cleaning machinery. Vegetate berms and banks and construct at slopes that are stable, not prone to scour in flood flows and maintainable.

The easement width is the greater of:

- $1.5 \times \text{width of drain} + 6\text{m}$
- 8m

Note: Width of race is measured between tops of bank

The easement registration must provide the Council with rights of occupation and access and ensure suitable conditions for operation and maintenance.

Protect water races, which will be maintained by the Council, by easement where they will not be placed in public ownership.

13.9 MEANS OF COMPLIANCE

Only contractors approved by the Selwyn District Council are permitted to install pipework or relocate races that will be vested into the Council and any pipework that is located within legal roads.

13.10 CONSTRUCTION

Construction must be carried out in accordance with *CSS: Part 3*.

Wherever works are installed within existing legal roads, the developer must obtain a Road Opening Notice (RON) for that work. The works must comply with requirements as set out in *CSS: Part 1* for this type of work.

13.10.1 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.
- 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/.

13.10.2 Materials

All materials be of a high quality.

Proposed pipes and concrete structures that are likely to lie within *Aggressive Groundwater Map* will need additional protection such as an external plastic wrapping membrane.

13.10.3 Bedding, haunching and backfill

Design bedding, haunching and backfill to conform to *WWDG Part B* clause 14.2.3. Bedding and haunching materials must comply with *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 *CSS: Part 1* clause 23.0 - Backfilling and clause 5.10.8 - Pipelines in permeable ground.

13.11 AS-BUILT INFORMATION

Present as-built information which complies with Part 12: As-Built and this Part.

APPENDIX 1 STANDARD DRAWINGS

- WR 4.4A Water Race Weir and Gate Concrete and reinforcement detail
- WR 4.4B Weir Control for Water Races
- WR 4.4C Control Gate design for Water Race pipe ID 110-250 mm





