Kaipara District Council

Engineering Standards

2011

October 2011

Kaipara District Council
Engineering Standards
2011

Table of Contents

1. GENERAL PROVISIONS

1.1 Introduction

The Engineering Standards are intended to apply to all land development and infrastructural projects within the Kaipara District. The Engineering Standards should be read subject to the provisions of the District Plan and any applicable statutes, regulations and bylaws, including (but without limitation):

- The Resource Management Act 1991
- The Local Government Act 1974
- The Local Government Act 2002

The Engineering Standards specify engineering standards for the design and construction of public services and set standards for the design and construction of private infrastructure services. In this way a uniform minimum engineering standard is achieved through the District.

Providing guidance allows for forward planning and a consistent approach to development and allows Council to take over an asset that maintains the level of service the residents and visitors to the Kaipara area expect.

The Engineering Standards apply to new development and are not intended to be retrospective. Existing accesses and infrastructure do not need to be upgraded to comply with the Engineering Standards unless the use of those assets changes.

This document is based on NZS 4404:2010 other relevant engineering standards and Council's policy decisions.

These standards apply equally to Council's own work and to work carried out by private Developers. They are consistent with current Council practice for new and upgraded Council assets (for example seal extensions and area wide pavement treatment). However, it is recognised that there may be practical issues in applying the standards on some sites. In these cases, Council will exercise its discretion and adopt an appropriate standard. Where the standard is related to a District Plan rule then Council will exercise its discretion through the resource consent process.

While this document specifies minimum standards for subdivision and development, Developers are encouraged to adopt higher standards provided they are consistent within the development, appropriate to the environment and an efficient use of resources.

The following table summarises how the Engineering Standards 2011 will apply:

Activity where compliance with Engineering Standards is required	**Method of assessing departure from standards**
Subdivision and land development requiring resource consents	Resource consent (RMA)
New dwellings and buildings with similar or greater effect on traffic and services	Resource consent (RMA)
Private development of Council asset such as forming a public Road	Council resolution
New and upgraded Council works	Design report, safety audit, Council Asset Manager approval, or Council resolution

1.2 Mandatory Standards and Guidelines

The Engineering Standards 2011 contain both standards that must be complied with under the rules of the District Plan and general guidelines for development appropriate to Kaipara District.

Standards using 'shall' or 'must' need to be complied with to satisfy the corresponding rule in the District Plan or condition of a consent granted under the Resource Management Act 1991. Standards are written in normal type.

Sections headed 'Guidelines' or 'Guidance Notes' and text using 'should' or 'may' are intended as general guidelines and are not mandatory. Alternative methods may be utilised to achieve the desired outcome. Guidelines are written in *italic* type.

1.3 Definitions

Annual Exceedance Probability (AEP)	The probability of a storm event being exceeded within a period of one year. (1% AEP is equivalent to 100 year ARI).
Approved	Kaipara District Council's approval in writing.
Applicant	Person(s) or a company ~~s~~eeking Council's approval or resource consent to undertake the activities applied for.
Arterial Road	Major roads with high traffic volumes or a significant component of through traffic. These include major roads into and through the District and roads servicing significant areas of development. Arterial roads are identified in the District Plan.
ARC	Auckland Regional Council.
ARI	Average Recurrence Interval for a storm event – also known as return period. (1% AEP is equivalent to 100 year ARI).
Asset Manager	Council's manager with the responsibility for managing Council's infrastructure and includes those acting for and on behalf of that Council manager.
Berm	A flat area beyond a road Watertable or kerb and channel that is normally grassed and mown.
Business Area	For the purposes of this standard, this is generally land contained within Industrial and Commercial zones in the Operative District plan (February 1997) and the Business: Commercial and Industrial and Estuary Estates sub zones: Business Zone 1, Business Zone 2 and Service Zone 7 in the Proposed District Plan notified in 2009. However, other areas may be added by changes to the District Plan.
Bridge	A structure spanning a river or ravine with a waterway area of $3.5m^2$ or more.
Carriageway	The road width normally traversed or occupied by vehicles. This is illustrated in Drawings S01 and S02 of this document
CBR	(California Bearing Ratio) a measure of subgrade strength in accordance with NZS4402.6.1:1986.
Collector Road	Roads that collect traffic from specific areas, or link important roads or major traffic generators. Collector roads are identified in the District Plan.
Construction Management Plan	A construction management plan prepared in accordance with section 3.3 of these Engineering Standards.

Council	The Kaipara District Council or any Committee, Sub Committee, Council Officer or person to whom the Council's powers, duties and discretions under the Act have lawfully been delegated pursuant to the provisions of the Act or any other statute.
CPEng	Chartered Professional Engineer.
Developer	In relation to resource consent application, is an individual, owner, trust, company, legal entity or organisation having the financial responsibility for the development project.
Regulatory Manager	Council's manager with the responsibility for processing resource consents and includes those acting for and on behalf of that Council manager.
Developer's Professional Advisor	The person, appointed by the Developer, who shall be responsible for: a) The investigation, design and obtaining of approvals for construction; b) Contract administration and supervision of construction; c) Certification upon completion of construction
Diameter (of pipe)	The minimum internal diameter of a pipe.
District Plan	The operative and proposed plans for the Kaipara District and any combination of them applicable to resource consent applications.
DN	The nominal internal diameter of a pipe (mm).
Drain	A pipe or channel that conveys sewage or stormwater flow. Drainage has a corresponding meaning.
Driveway	A permanently formed access for the use of motor vehicles and pedestrians between a road or street and carport, garage, parking space or loading space on a site.
Dwelling	Any self-contained residence of one or more persons as a single household which in each case contains one kitchen, and includes any dwelling house, flat, home unit or townhouse or papakainga housing on ancestral land, but does not include a sleep out.
Earthworks	Any alteration to the shape of the ground contours, including the excavation, backfilling or recompaction of soil and the removal of vegetation and topsoil that requires a resource consent under the District Plan rules.
Engineering Standards	Kaipara District Council's Engineering Standards 2011
Formation width for roads	The road construction including carriageway, feathered Shoulder and Watertables or kerb and channel.
Geo-professional	A Chartered Professional Engineer (CPEng) or an experienced engineering geologist with recognised qualifications and experience in geotechnical engineering and experience related to land development.
Ground	The surface of the earth whether soil or rock.

Household Equivalent	a) A residential dwelling; or b) A development which generates the same demand as four people who reside full time at the location; or c) Any development which generates eight vehicle movements per day following completion of the development.
Hold Point	A stage during construction where a Council Engineer's inspection is required before proceeding further.
IQP	Independently Qualified Person - a specialist approved by Council and having the appropriate skills and qualification to carry out specific procedures.
KDC	Kaipara District Council. Council has the same meaning.
Legal width	The width between legal boundaries on a public Road or Private Way.
Local Roads	Roads not classified as arterial or collector, whose major function is to provide access to properties rather than provide routes for other traffic.
Manholes	Non-pressurised pipe junctions which provide a person with access to the pipes from the ground.
Metal	An unsealed carriageway surface consisting of pavement aggregate and running course.
NIWA	National Institute of Water and Atmospheric Research Limited.
NRC	Northland Regional Council.
NZTA	New Zealand Transport Agency.
Open Drain	An excavated channel for conveying stormwater. It is normally steep sided and unlined (as opposed to 'Swale Drain')
Overland Flow Path	The path taken by stormwater runoff in excess of the Primary Design Flow so that the required protection is provided to the surrounding buildings.
Owner	In relation to any land or interest in land, includes an owner of the land, whether beneficially or as trustee, and their agent or attorney, and a mortgagee acting in exercise of power of sale; and also includes the Crown, the Public Trustee and any persons, Territorial Authority, board, or other public body or authority however designated, constituted, or appointed, having power to dispose of the land or interest in the land by way of sale.
Paper Road	Unformed legal Road.
Pavement	The layer(s) of road formation above the subgrade, incorporating crushed aggregate, stabilised natural granular or other material or rigid material (such as concrete), including any seal coat.
Poo Pit	Wormall Group's trade name for a molded plastic junction and access point for sewer pipes.
Practical Completion	Shall have the same meaning as given in NZS 3910:2003.

Primary Design Flow	The stormwater runoff which will be piped or contained entirely within defined open channels.
Private Way	An access over private land as defined in section 315 of the Local Government Act 1974. A Private Way is not intended to be used by the general public.
Regional Water and Soil Plan	NRC's Regional Water and Soil plan for Northland.
Residential Zone	An area zoned in the District Plan as Residential.
Rider Mains	All pipes less than 100mm in diameter. Includes associated valves.
Rising Mains	All pipes between a pump station and non-pressurised junction or termination including another pump station, manhole, and reservoir or treatment system.
RMA	Resource Management Act 1991 and its amendments.
Road	Any road as defined in section 315 of the Local Government Act 1974, and roading has a corresponding meaning.
Rural	For the purposes of this standard, this is generally land contained within Rural, Maori Purposes, Rural Residential and Coastal under the Operative District Plan (1997) and Rural, Maori Purposes: Maori Land, Maori Purposes: Treaty Settlement Land and Estuary Estates sub zones: Rural Cluster Zone 5 and Rural Residential Zone 6 in the Proposed District Plan notified in 2009. However, other areas may be added by changes to the District Plan.
Service Lanes	This has the meaning given in Section 315 of the Local Government Act 1974 "*any lane laid out or constructed either by the authority of the council or the Minister of Works and Development or, on or after the 1st day of April 1988, the Minister of Lands for the purpose of providing the public with a side or rear access for vehicular traffic to any land".*
Seal	A chip seal or asphaltic concrete (hot mix) pavement surfacing or concrete pavement. Sealed has the same meaning.
Sewer	An enclosed pipe used for conveying sewage by gravity.
Shoulder	A sloping section of compacted aggregate beyond a road carriageway supporting the pavement. Feathered Shoulder has the same meaning.
Soil	An aggregation of mineral and/or organic particles comprising of either peat, clays, silts, sands, gravels, crushed and re-oriented rock fragments, or a mixture of any of the above. The term excludes rock that is intact rock masses whether highly jointed or not.
Stormwater Drainage System	Components installed to capture and convey surface runoff primarily from rainfall.
Stormwater Treatment Pond	A permanent pond, wetland or dry detention basin designed to attenuate peak stormwater flows and provide water quality treatment. Refer Section 6.5.1.

Subdivision	Has the meaning as defined in Section 218 of the Resource Management Act "*(1) In this Act, the term subdivision of land means—* *(a) the division of an allotment—* *(i) by an application to the Registrar-General of Land for the issue of a separate certificate of title for any part of the allotment; or* *(ii) by the disposition by way of sale or offer for sale of the fee simple to part of the allotment; or* *(iii) by a lease of part of the allotment which, including renewals, is or could be for a term of more than 35 years; or* *(iv) by the grant of a company lease or cross lease in respect of any part of the allotment; or* *(v) by the deposit of a unit plan, or an application to the Registrar-General of Land for the issue of a separate certificate of title for any part of a unit on a unit plan; or* *(b) an application to the Registrar-General of Land for the issue of a separate certificate of title in circumstances where the issue of that certificate of title is prohibited by section 226,—* *and the term subdivide land has a corresponding meaning.*
Subgrade	The top 1 metre layer of the road formation below the pavement. Includes any stabilisation, non-granular material or granular material of a lower standard than quarry run aggregate.
Sub base layers	The portion of the pavement between the base and the subgrade.
Sumps	Pits designed to receive storm runoff from the ground, trap grit and convey the runoff into the primary stormwater system.
Supporting Documentation	Documents required by Council's assets department in support of the request for the department to manage and maintain new engineering services.
Survey Plan	As described in Section 2 of the Resource Management Act 1991.
Swale Drain	A grassed sloped surface channel for conveying stormwater (as opposed to 'Open Drain')
Trade Waste	Any liquid with or without matter in suspension or solution, that is or may be discharged from a trade premises in the course of any trade or industrial process or operation, or in the course on any activity or operation of a like nature, but does not include stormwater or domestic sewage.
Ultimate Development	The maximum development intensity allowed as a permitted or controlled activity under the District Plan allowing for associated roads and reserves.

Urban	For the purposes of this standard, this is generally land contained within Residential, Rural-Residential, Commercial or Industrial in the Operative District Plan (1997) and zoned Residential, Business: Commercial and Industrial or Estuary Estates sub zones Residential Zone 3 or Parkside Residential Zone 4 in the Proposed District Plan notified in 2009 and any site of less than 4000m^2 in the District.
Vehicle Crossing	The formed and properly constructed vehicle access from the carriageway of any road up to and including that portion of the road boundary of the site across which vehicle access is permitted and includes any culvert, bridge or kerbing.
vpd	Vehicle movements per day. A return trip is two vehicle movements.
Wastewater	Water that has been used and contains unwanted dissolved and/or suspended substances of a domestic nature, excluding trade wastes.
Watertable	An open drain on each side of a road used to drain the pavement and convey stormwater.

1.4 Standards

Where any apparent conflict exists between any New Zealand Standard and the specific requirements outlined in these Engineering Standards, these Engineering Standards take precedence.

The conditions of any resource consent issued in accordance with the Resource Management Act 1991 shall take precedence over these Engineering Standards.

Any other legislative requirements such as under the Building Act 2004 or regulations made under any legislation shall take precedence over these Engineering Standards, unless these Engineering Standards or the conditions of a resource consent specify that a higher standard is required.

1.5 List of Related Documents

References are made throughout this document to relevant legislation and other standards and guideline documents.

Specifically this standard is based on NZS 4404:2010 Land Development and Subdivision Engineering and documents referenced therein. The most current version of any publication or standard shall supersede any conflicting requirements of older documents.

The following is a list of related documents. Other documents may also be referred to in these Engineering Standards.

1.5.1 Legislation

Health Act 1956 and amendments

Health and Safety Employment Act 1991 and amendments

Local Government Act 1974 and amendments

Local Government Act 2002 and amendments

Public Works Act 1981 and amendments

Resource Management Act 1991 and amendments

The Building Act 2004 and amendments

1.5.2 Standards

AS/NZS 1100:1992 Technical Drawing

NZS 3104:2003 Specification for Concrete Production

NZS 3109:1997 Concrete Construction

NZS 3116:2002 Concrete Segmental Paving

AS/NZS 3725:2007, AS/NZS 2566.2, AS/NZS 2033:2008 Design for Installation of buried concrete, flexible and polyethelene pipes

NZS 4404:2010 Land Development and Subdivision Engineering

NZS/BS 750:1984 Underground Fire Hydrant and Surface Box Frames and Covers

SNZ PAS 4509:2008 New Zealand Fire Service Fire Fighting Water Supplies Code of Practice

1.5.3 Other Guideline Documents

Auckland Regional Council Technical Publication 10 Stormwater Treatment Device Guidelines Manual

Auckland Regional Council Technical Publication 124 Low Impact Design Manual for the Auckland Regions

Auckland Regional Council Technical Publication 58 On-Site Wastewater Disposal from Households and Institutions

Auckland Regional Council Technical Publication 90 Erosion and Sediment Control Guidelines for Land Disturbing Activities

Austroads, AP 17/92 Pavement Design: A guide to the structural design of road pavements

Austroads, Guide to the Geometric Design of Rural Roads

Austroads, Guide to Traffic Engineering Practice Part 12: Roadway Lighting

Austroads, Guide to Traffic Engineering Practice Part 5: Intersections at Grade

Austroads, OAD Safety Audit

Kaipara District Council “Catchment Plan for Mangawhai Heads, Mangawhai Village”

Ministry of Health “Drinking Water Quality Management”

Ministry of Health “Drinking Water Standards”

Molesworth Peninsula Urban Capability Study

New Zealand Building Code

Northland Regional Council Operative “Regional Air Quality Plan for Northland”

Northland Regional Council Operative “Regional Coastal Plan for Northland”

Northland Regional Council Operative “Regional Water and Soil Plan for Northland”

New Zealand Transport Agency (NZTA) Manuals and Technical Documents as listed in the NZTA Standards Criteria and Guidelines Manual

US Water Environmental Federation and American Society of Civil Engineers Guidelines Design and Construction of Urban Stormwater Management Systems

1.6 Engineering Standard Reviews

These standards will be reviewed annually to ensure that references are kept up to date and that innovative materials and methods are incorporated where appropriate. These reviews will be undertaken between March and June each year.

An updated document may be made available in each July following the review. Council may resolve that no revision is necessary in any given year.

2. GENERAL DESIGN PROVISIONS

2.1 Design, Construction and Monitoring

All investigation, calculations, design, supervision and certification of the works referred to in these Engineering Standards shall be carried out by persons who:

- Have the appropriate experience in the relevant areas;
- Hold appropriate qualifications and membership of professional bodies;
- Have professional indemnity insurance to the value of at least $1,000,000.

Provisions for the approval of design and construction are outlined in Section 3.

2.2 Supporting Information and Calculations for Design

Section 88 and the Fourth Schedule of the RMA sets out what information an application for resource consent must include. The information in the application should be at a level of detail sufficient for a person to make an informed judgment on the application.

Information Requirement Guidelines

The following table provides guidelines for the information required to enable engineering assessment as part of the assessment of resource consent applications:

Table 2.1: Supporting Documentation Requirements

Area	***Supporting Documentation***
Earthworks	▪ *Sufficient information to demonstrate that the site is stable and suitable for the proposed use* ▪ *Demonstrate that a building platform is available for each site* ▪ *Demonstrate that there is access to each site that meets these Engineering Standards* ▪ *An assessment of earthworks volumes* ▪ *Measures to mitigate any detrimental effects shall be identified* ▪ *A Construction Management Plan as described in Section 2.3 of this document* ▪ *A geotechnical report may be required – this will be confirmed after discussion with Council*
Roading	▪ *Drawings showing practical access to all building sites* ▪ *Assessment of traffic volumes and vehicle operating speeds* ▪ *Horizontal and Vertical Geometry* ▪ *Sight distances* ▪ *Typical Sections* ▪ *Pavement Design* ▪ *Surfacing Design* ▪ *Design of surface drainage and other road components* ▪ *Utility service locations* ▪ *Any other topographic features e.g.: Fences, Power Poles* ▪ *Identifying Road to vest* ▪ *Management of private ways*
Stormwater	▪ *Plans of a stormwater system to serve the development in accordance with the requirements of these Engineering standards* ▪ *Identify existing and post-development drainage paths and soil conditions*

Area	Supporting Documentation
	▪ *Where appropriate, provide for a piped stormwater system for the primary flow* ▪ *Identify the extent of secondary flowpaths and associated flooding areas for the 100 year ARI flood* ▪ *Identify the need for any vesting of land or easements to enable the discharge of stormwater flows via pipelines or overland flow paths across the lots of the subdivision* ▪ *Identify any requirements for stormwater detention and/or treatment systems* ▪ *The design shall identify all off site effects including changes to flow peaks and frequency patterns, flood water levels, contamination levels and erosion and concentration of stormwater on downstream properties* ▪ *Measures to mitigate any detrimental effects shall be identified* ▪ *Lifecycle maintenance costs and requirements*
Wastewater	▪ *Plans of any communal wastewater system to serve the development in accordance with the requirements of these Engineering Standards including the current development proposal, potential future development and staging and topographical plans.* ▪ *Demonstrate that the reticulation at the point of connection to the existing Council system and any downstream asset, including pump stations, pipe work, and treatment system is capable of taking the flow of the proposed development as well as the existing flow* ▪ *Demonstrate that the proposed reticulation is adequate to serve the proposed development and, where required by Council, the potential upstream catchment* ▪ *The design shall include pipe sizes, materials and layout of the proposed reticulation* ▪ *Hydraulic design, including capacity and self cleaning ability* ▪ *Design of pump stations and rising mains* ▪ *Lifecycle maintenance costs and operational requirements*
Water Supply	▪ *Plans of any communal water supply system to serve the development in accordance with the requirements of these Engineering standards* ▪ *Analysis of water demand including fire fighting capability allowances* ▪ *Establish that the existing water supply reticulation system is adequate to serve the proposed development* ▪ *The proposed reticulation is adequate to serve the proposed development* ▪ *The proposal has no more than minor effects on the environment and other water users* ▪ *Potential water hammer effects are considered and appropriate measures are included* ▪ *Required pressures and flows can be met from all hydrants and service connections* ▪ *Lifecycle maintenance costs and operational requirements*

Area	*Supporting Documentation*
Landscaping	▪ *Plans showing existing mature trees and bush areas within the site, and proposed modifications or enhancements to these areas including any screening of new buildings when required by the District Plan* ▪ *A landscape assessment of all areas to be designated as reserve* ▪ *A development plan for reserves* ▪ *Plans illustrating street planting, reserve planting, the alignment of footpaths, location of park furniture, facilities structures, play equipment, lighting and landscape features such as mounding, stormwater treatment ponds etc. proposed for the development* ▪ *Requirement for irrigation or other services* ▪ *Fencing provisions* ▪ *Lifecycle maintenance costs and operational requirements*

All designs shall be carried out by a qualified professional as outlined in section 2.1 providing certification that the design complies with the necessary standards.

2.3 General Design Information

2.3.1 Council Owned Assets

All new systems which are connected to Council's systems shall be in accordance with Council's resource consents, existing management plans and other legal obligations.

Guidance Notes:

1. *Stormwater discharges should be managed to avoid increases in peak flows and ensure that Council's consent requirements for them are not violated. Particular requirements are detailed in Section 6 of these Engineering Standards.*
2. *Only sewage similar to typical domestic sewage should be discharged into Council systems unless a specific Trade Waste agreement has been agreed to by Council. Council should be consulted about these requirements at the design stage. Particular requirements are detailed in Section 7 of these Engineering Standards.*
3. *Council should be consulted about the requirements for water supply at the design stage. Particular requirements are detailed in Section 8 of these Engineering Standards.*
4. *With the exception of service connection pipes perpendicular to the main pipes along streets, services should be clear of footpaths wherever possible. When this is not considered possible, Council should be consulted at the design stage.*

2.3.2 Privately Owned Assets

Guidance Notes:

1. *Any development which has unit titles or similar and has internal roading, stormwater, wastewater or water systems that are the responsibility of multiple landowners should have an overriding body (a body corporate or similar) with control over these assets. This "body" should be responsible for the maintenance and replacement of these assets and should be sustainable over the life of the asset and change of ownership of individual titles.*
2. *The costs of maintaining these assets are the responsibility of the owners. Council has no responsibility for the maintenance or replacement of these assets.*
3. *It is recommended that where possible the assets are constructed to these Engineering Standards.*

2.3.3 Design Lives

New engineering services shall be designed and constructed to achieve the following design lives (note the physical life shall be as per the manufacturer's life expectation based on research and experience).

The required asset design lives are shown in the table below.

Table 2.1: Asset Design Lives

Asset	Design Life
Bridges and Earth retaining structures	100 years
Road Pavements	25 years
Carriageway Sealing	7 years
Pipes and Fittings	100 years
Manholes, Storage Chambers (including septic tanks and pump chambers) and all underground storage chambers	80 years
Telemetry and Electrical systems	15 years
Valves	40 years
Pumps	15 – 25 years
Wastewater Treatment and Disposal Systems (excluding the items listed above)	40 years

2.4 Vesting and Easements

Roads, stormwater pipelines, land for overland flowpaths and wastewater and water infrastructure shall be vested in Council or protected by easements in gross in favour of Council as specified in Sections 5, 6 and 7 of these *Engineering* Standards.

2.5 Management Entity

Where a subdivision contains private shared accesses or other communal assets, an entity such as a registered company or other corporate body should be formed to:

- *Implement a constitution which contains rules which the owners of the lots are required to comply with;*
- *Co-ordinate and manage the maintenance and use of jointly owned access lots or rights of way;*
- *Maintain and upgrade the shared private access network to a standard that complies with these Engineering Standards, including associated stormwater drainage, subsoil drainage, slip stabilisation works and retaining walls;*
- *Own, operate, maintain, upgrade and administer all matters associated with any communal water supply, wastewater treatment and disposal system or other communal asset;*
- *Maintain any communal landscape works, weed control, pest control and animal control required by the subdivision consent.*

The constitutional document should be submitted to Council for approval prior to registration of the entity. The document should provide an outline of the legal responsibilities of the entity to the satisfaction of the Council, including ensuring that the entity is capable of operating indefinitely. A solicitor's undertaking should be provided to Council confirming that the entity will be duly registered.

2.6 Low Impact Design Principles

In developing these standards Council acknowledges the benefit that Low Impact Design has for both Council's assets and the environment. Accordingly Council encourages design that follows these principles as noted in the various referenced documents, in particular NZS4404:2010 and Auckland Regional Council TP124. The use of Low Impact Design will benefit the community in terms of sustainability of both stormwater and roading infrastructure which in turn will benefit the water quality of Kaipara's waterways.

3. QUALITY ASSURANCE REQUIREMENTS

3.1 General

This section covers the Kaipara District Council requirements for monitoring and testing of physical asset construction to ensure that the final asset delivered to the future owners is a quality product and that statutory obligations are met.

3.2 General Construction and Monitoring Requirements

3.2.1 Independent Qualified Persons

All investigation, calculations, design, supervision and certification of the works referred to in these Engineering Standards shall be carried out by persons who:

- Have the appropriate experience in the relevant areas;
- Hold appropriate qualifications and membership of professional bodies;
- Have professional indemnity insurance to the value of at least $1,000,000.

3.2.2 Contractors

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

- Have the appropriate experience in the relevant areas;
- Have the appropriate equipment;
- Meet the requirements of the Health and Safety in Employment Act 1992;
- Have public liability insurance to the value of at least $2,000,000.

3.2.3 Liability

(a) The approval of engineering plans under the requirements of these Engineering Standards means that, subject to any consent conditions specified, the design of infrastructure systems and development works is deemed to meet the minimum design requirements for these services and structures.

(b) It remains the Consent Holder's responsibility to comply with all statutes, regulations, bylaws, requirements, and obligations, give all notices, obtain all necessary consents and provide for the protection of other property from damage resulting from the development.

(c) The maintenance and repair period for any asset vested in Council or communally owned private asset shall be 12 months (3 years for landscaping work) from the date of issue of the s224(c) Certificate, or as specified in conditions of a resource consent. During this period the Consent Holder is responsible for remedying, replacing or repairing any non-complying or non functioning asset arising from defective materials or construction. The Consent Holder is not responsible for fair wear and tear.

3.2.4 Insurances

(a) The Consent Holder's Contractor shall have public liability insurance in the joint names of the Consent Holder and the Council, for a minimum sum amount of $2,000,000.

(b) IQPs shall have professional indemnity insurance to a minimum value of $1,000,000. All personnel under the IQP's control shall also be covered by professional indemnity insurance to this level.

(c) The Consent Holder shall provide evidence of insurance cover with the Supporting Documentation.

Guidance Note:

Higher sums may be required for larger projects. This will be agreed between the Consent Holder's representative and Council prior to lodgment of the resource consent application.

3.2.5 Health and Safety in Employment Act

(a) Where work is being undertaken on Council controlled land, the Consent Holder, their representative, their contractors and any subcontractors shall comply with all the requirements of the Health and Safety in Employment Act 1992, including any Regulations made pursuant to section 21 of that Act.

(b) The contracts for construction of the works shall include a requirement for the contractor to provide a health and safety plan for construction and nominate a health and safety supervisor.

(c) The Consent Holder shall ensure that their contractors submit to Council site specific health and safety plans for any part of the works on or adjoining public land (including Roads) or private property not in the ownership of the Consent Holder for verification prior to the commencement of works.

(d) The plans shall address all known hazards and other health and safety aspects that are particular to the places of work involved. Such aspects include the work practices and work methods that a contractor proposes to use to execute the works as they affect both the contractor's employees and the public in general. The plan shall include traffic management and control procedures to be implemented on adjacent road land and site access points. The plans shall be updated as works progress to incorporate hazards unforeseen at the commencement of the project.

(e) The Council reserves the right to inspect the place(s) of work from time to time to monitor the Consent Holders/contractors compliance with the Act. The inspection and the outcomes there from shall be appropriately recorded. The Consent Holder and contractor shall be represented at such inspections and shall provide the Council, upon request, with the accident/incident reports and statistics maintained for the place(s) of work. The Consent Holder shall be liable for any costs incurred in complying with the Health and Safety in Employment Act following such inspections.

3.2.6 Traffic Management

(a) The Consent Holder shall be responsible for the provision of watchmen/flagmen and the provision, erection, maintenance and, when no longer required, the removal of all barricades, fencing, temporary roadways and footpaths, signs and lighting necessary for the effective protection of property, for control of traffic and for the safety of others.

(b) Traffic management plans are required for all work carried out on a Council Road, including the construction or upgrading of Vehicle Crossings. The traffic management plans shall be submitted to Council for approval and approved prior to construction commencing.

(c) The Council's minimum requirements for traffic control are those standards and rules set out in the New Zealand Transport Agency publication "Code of Practice for Temporary Traffic Management" and its revisions. When relevant, requirements in excess of these will be set out in the consent conditions or the engineering plan approval.

3.2.7 Protection of Existing Assets

(a) Any damage caused by the Consent Holder's works shall be the responsibility of the Consent Holder and shall be repaired as soon as possible to Council's satisfaction. If remedial work is not commenced within 48 hours of the written instruction to do so by Council, the Council may carry out the work at the Consent Holder's cost. This requirement includes the removal of mud and debris from Council Roads. This may be required daily in the interest of traffic safety and protection of road seal.

(b) Where the Council has had to carry out work on behalf of the Consent Holder from an emergency point of view, the cost of the work will be recovered from the Consent Holder.

3.2.8 Hours of Work

Unless otherwise approved by Council's Asset Manager or the conditions of a resource consent, all construction work shall be restricted to the hours of 7.00 am to 7.30pm Monday to Friday and 7.30am to 6.00pm on Saturdays, and during daylight. For the purposes of this clause daylight is defined as the period commencing at the official time of sunrise and ending at the official time of sunset.

3.3 Construction Management Plan

A Construction Management Plan shall be prepared and submitted to Council for approval, for all earthworks and roading works associated with a subdivision or land use consent. As a minimum the Construction Management Plan shall cover the following details:

(i) Details of the site manager including full contact details;

(ii) Construction methodology including proposed plant and machinery to be utilised;

(iii) Proposed procedures for controlling sediment runoff and dust generation;

(iv) Programme of works;

(v) Proposed hours of work on the site;

(vi) Details of the number and timing of truck movements on the access route to the site;

(vii) Details of any proposed materials storage areas;

(viii) Traffic management plans;

(ix) Proposed communication strategy to advise members of the public of the construction works;

(x) For all road construction works, the Consent Holder shall give Council's Asset Manager at least 10 working days notice of commencement of any works on any Council Road.

3.4 Quality Documentation

(a) A quality plan shall be provided detailing all testing to be undertaken during the design and construction phases including location and frequency.

(b) The minimum quality plan requirements shall be as detailed on Table 3.1.

Table 3.1: Construction Quality Documentation Requirements

Area	Supporting Documentation
Roading	▪ Inspection and approval of subgrade, including review of subgrade testing ▪ Approval of aggregate test results, prior to placement of the aggregate ▪ Inspection and approval of compacted basecourse prior to sealing ▪ If concrete is to be used, prepour and boxing inspection ▪ Preparation of kerb lines ready for concrete pouring ▪ Before commencement of pavement sealing ▪ Before commencement of asphaltic concrete paving ▪ After placement of footpath formwork and sub base but prior to concrete/surface placement/construction.
Stormwater	▪ Manhole inlet and outlet levels prior to backfilling for Urban drains ▪ Backfill quality assurance compaction results prior to final surfacing restoration ▪ Video inspection records of all completed pipelines ▪ All pipe line tests shall be witnessed by Council's engineers
Wastewater	▪ Manhole inlet and outlet levels prior to backfilling for Urban drains ▪ Backfill quality assurance compaction results prior to final surfacing restoration ▪ Pressure test results ▪ Video inspection records of all completed pipelines ▪ Pumping trial test results (where applicable) ▪ All pipe line tests shall be witnessed by Council's engineers
Water Supply	▪ Backfill compaction prior to final surfacing restoration ▪ Pressure Tests Results ▪ Pumping Trials Results ▪ Pipe line testing results

3.5 Construction Monitoring

3.5.1 Minimum Notifications and Inspections Required

(a) Council will undertake, as a minimum, formal observation/inspection at the following phases of work for every development requiring development monitoring. In some cases additional inspections may be required. These additional inspections/tests will be outlined in the engineering plan approval.

(b) The Consent Holder's representative shall notify Council in writing (email included) when the Hold Points specified in Table 3.2 have been reached;

Table 3.2: Hold Points

Area	Hold Point
General	▪ Appointment of Contractor ▪ Commencement of Work ▪ Final s224 inspection and walkover with 'As Built' plans.
Earthworks	▪ Completed earthworks
Roading	▪ Prior to any work taking place on a public Road. ▪ Inspection and approval of subgrade, including review of subgrade testing ▪ Approval of aggregate test results, prior to placement of the aggregate ▪ Inspection and approval of compacted basecourse prior to sealing ▪ If concrete is to be used, prepour and boxing inspection ▪ Preparation of kerb lines ready for concrete pouring ▪ Before commencement of street sealing. ▪ Before commencement of asphaltic concrete paving. ▪ After placement of footpath formwork and sub base but prior to concrete/surface placement/construction.
Stormwater	▪ Subgrade and pipe bedding ▪ Manhole inlet and outlet levels prior to backfilling for Urban drains ▪ Backfill quality assurance compaction results prior to final surfacing restoration ▪ Video inspection records of all completed pipelines ▪ All pipe line tests shall be witnessed by Council's engineers
Wastewater	▪ Subgrade and pipe bedding ▪ Manhole inlet and outlet levels prior to backfilling for Urban drains ▪ Backfill quality assurance compaction results prior to final surfacing restoration ▪ Pressure test results ▪ Video inspection records of all completed pipelines ▪ Pumping trial test results (where applicable) ▪ All pipe line tests shall be witnessed by Council's engineers
Water	▪ Subgrade and pipe bedding ▪ Backfill compaction prior to final surfacing restoration ▪ Pressure Tests ▪ Pumping Trials ▪ Pipe line testing ▪ Pipe disinfection ▪ All pipe line tests shall be witnessed by Council's engineers
Landscape Design	▪ Commencement of landscape works ▪ Completion of landscape works.

Guidance Notes

1. *Confirmation from Council that a phase of work has passed an inspection/test and that work may continue does not free or indemnify the Consent Holder's representative from ensuring the works comply with the requirements of the Engineering Standards and resource consent conditions.*
2. *The Council will undertake random observations of the development works at any stage during construction. For large scale developments random inspections will occur, on average, on a weekly basis.*

3.5.2 Procedures for Notification

(a) The Consent Holder's representative shall notify Council in writing (email included), two working days prior to the inspection being required, to attend a formal inspection or test observation. The request to undertake a formal inspection shall confirm that the work requiring inspection or testing has been inspected/pre-tested and has passed the required test and is ready for inspection/testing.

(b) The request for a formal inspection to be undertaken shall be made to Council's Regulatory Manager.

(c) All equipment required for the formal inspection/test shall be on-site and ready for use in the inspection. This includes any equipment required for confined space inspections.

(d) Council will not attend any formal inspections/tests where the work to be inspected/tested has not been pretested and confirmed by the Consent Holder's representative as ready for the formal inspection/test.

(e) Work shall not proceed until the formal inspection has been undertaken by Council, in conjunction with the Consent Holder's representative and that phase of work has passed inspection/test.

(f) Council will advise in writing to the Consent Holder's representative whether the inspection/testing meets the requirements of these Engineering Standards and whether the works may proceed.

(g) Where Council is unable to attend a formal inspection/test then Council may engage a third party to attend the inspection on its behalf or alternatively arrange for the Consent Holder's representative to inspect the work on Council's behalf subject to any specific requirements Council may stipulate. Where this occurs the Consent Holder's representative will be notified in writing, confirming what arrangements/reporting Council may require certifying that this phase of works meets the required testing/inspection. Once the required reporting has been received by Council, Council will notify the Consent Holder's representative in writing that the works may proceed.

(h) All testing documentation shall be submitted to Council regardless of whether a test has been witnessed or not.

3.6 As-Built Documentation

The following section details the requirements for As-built information supplied to Council by Consent Holders. Council will make available information on the location of Council owned or controlled assets on written request to Council's Assets Department. Council has information regarding the location of roading, stormwater, water supply and wastewater assets. In some cases a charge will apply.

3.6.1 As-Built Requirements

The Consent Holder shall provide the following as-built information:

Table 3.3: As-Built Requirements

Area	Supporting Documentation
Roading	▪ Details of all changes to Council Roads (width or alignment, edge treatment, drainage) ▪ Construction details of Roads to vest ▪ Construction details of all internal private shared access (rights of way and jointly owned access lots) ▪ RAMM database information.
Stormwater	▪ Details of all pipe materials, diameters and classes (to be shown on face of plan); ▪ Locations of manholes, junctions and connections by measurement from adjacent boundaries (to be shown on face of plan); ▪ Coordinates of all manholes, junctions and connections (to be shown on face of plan or in tabular format); ▪ Ground level and invert levels of all pipelines at manholes, junctions and connections in terms of Mean Sea Level (to be shown on face of plan or in tabular format); ▪ Gradients of all pipelines (to be shown on face of plan or in tabular format); ▪ Cross sections and longitudinal sections of all Swale Drains and secondary flow paths; ▪ Full details of all stormwater detention and/or treatment ponds; ▪ Operation and maintenance manuals for all stormwater detention and/or treatment ponds.
Wastewater	▪ Details of all pipe materials, diameters and classes (to be shown on face of plan); ▪ Locations of maintenance shafts, junctions and connections by measurement from adjacent boundaries (to be shown on face of plan); ▪ Coordinates of all maintenance shafts, junctions and connections (to be shown on face of plan or in tabular format); ▪ Ground level and invert levels of all pipelines at maintenance shafts, junctions and connections in terms of Mean Sea Level (to be shown on face of plan or in tabular format); ▪ Gradients of all pipelines (to be shown on face of plan or in tabular format); ▪ Hydraulic grade lines at design flows, invert level & ground level for all rising mains, to be shown in section format including location of any valve connections. ▪ Full details of all pump stations; including ▪ Plan details (to scale), ▪ Section details (to scale); ▪ Process and instrumentation diagram (if required); ▪ Operation and maintenance manuals for all pump stations and treatment plants
Water	▪ Details of all pipe materials, diameters and classes (to be shown on face of plan); ▪ Locations of valves, hydrants, junctions and connections by measurement from adjacent boundaries (to be shown on face

Area	Supporting Documentation
	of plan); ▪ Coordinates of all fittings, including valves, hydrants, junctions and connections (to be shown on face of plan or in tabular format); ▪ Ground level and invert levels of all pipelines at valves, hydrants, junctions and connections in terms of Mean Sea Level (to be shown on face of plan or in tabular format); ▪ Full details of all booster pump stations (as necessary); ▪ Operation and maintenance manuals for all water supply boost pump stations (as necessary).
Landscape Design	▪ Location and details of all structures including furniture or playground equipment ▪ Location of all services including amenity blocks ▪ Location of all tracks, access ways or internal roads within the park or reserve.

3.6.2 Drawing Standards

(a) All drawings shall be prepared in accordance with the requirements of AS/NZS1100:1992 and shall contain all the information listed in the As Built requirements listed in each section.

(b) All drawings shall be submitted on standard A3 or A4 drawing sheets. In addition they shall be suitable for photo reduction and microfilming. Lines shall not be finer than 0.25mm. Printing should be spaced sufficiently to retain clarity when reduced. Letters shall not be less than 2.5mm in height (but generally 3.5mm or larger) before reduction.

(c) The standard systems shown in drawing S1 shall be used in all drawing to ensure uniformity. Existing services shall be shown in faint lines (0.25mm and proposed services in heavy bold lines (min 0.5mm)

(d) Electronic copies of the drawings shall also be submitted in Drawing (.dwg) or Digital Exchange (.dxf) format, compatible with Council's GIS system.

(e) For new streets and significant extension of services the following scales shall be used (A3 drawings).

Table 3.4: Drawing Scales

Drawing Type	Option 1	Option 2
Plans	1000	500
Longitudinal Sections - Horizontal - Vertical	 1000 200	 500 100
Cross Sections / Elevation	200	100

(f) Details shall be presented at scales of 1:5, 1:10, 1:20 or 1:50. The scale of all details shall be correct at A3 size. If the original size of the sheet was not A3, then the scales at both original size and the A3 size shall be shown.

(g) In addition, graphic scales shall be shown on all plan views, and sufficient dimensions shown on all components so the scaling off drawings is not necessary.

(h) All engineering surveys for as-builts and all subdivision survey parcel boundary elements shall be in terms of a LINZ approved coordinate system.

(i) Coordinates shall be in terms of Transverse Mercator 2000. Levels or elevations shall be Orthometric Reduced Levels to the LINZ/DOSLI datum (One Tree Point 1964 Datum).

(j) The location of significant features shall be marked from an existing permanent physical feature such as bridges or kerbs where possible. However, physical features shall not be relied upon for reference marks because of the possibility of them being altered in the future.

3.7 Operations and Maintenance Manuals

Operations and maintenance manuals shall be provided for all new or upgraded assets (other than reticulation items) that require ongoing maintenance. This includes but is not limited to, wastewater pump stations, booster pump stations, treatment plants and stormwater treatment ponds.

3.8 Maintenance

3.8.1 Construction Maintenance Requirements

(a) The Consent Holder shall maintain the construction works after the issue of a Practical Completion certificate for a minimum period of 12 months, to allow for the remedy, where required, of design or construction defects and the stabilisation of grassed surfaces, Swale Drains and water channels.

(b) At the end of the maintenance period the Consent Holder shall arrange for the mowing of Berms and batters, the cleaning of Watertable drains, sweeping of kerb and channel, reinstatement of traffic facilities, clean out of sumps, drop structures and the removal of temporary works associated with silt runoff control as well as the repair of other construction defects before the release of the maintenance bond.

(c) The maintenance period shall not apply to the construction of unsealed Rural Vehicle Crossings and rights-of-way unless specified in the consent conditions.

(d) Subsequent damage caused by builders, Developers and road users or through fair wear and tear would not be subject to the Consent Holder's maintenance obligations provided that evidence of such damage is demonstrated as being beyond the control of the Consent Holder.

3.8.2 Landscaping Maintenance Requirements

Landscape work, including any street tree planting, shall be maintained for a period of 3 years.

3.8.3 Construction Maintenance Bond

The value of the construction maintenance bond for both Urban and Rural developments shall be equal to 5% of the value of the construction work based on the contract value (except that this value shall increase to 10% for Rural roading where cut or fill batters exceed 4.5m in height).

The Consent Holder's representative shall present evidence from the contract schedule in support of the bond value submitted

The maintenance bonds shall take the form of a cash payment refundable at the completion of the maintenance period.

3.8.4 Landscaping Maintenance Bonds

Bonds to cover landscaping maintenance shall be held for a period of three years and shall be assessed on current KDC contract rates by Council.

The 3 years landscape maintenance bond shall also include a sum to cover the replacement of plants, trees and other landscape components that are missing at the end of the maintenance period.

3.8.5 Contractors Obligations

It is recommended that the Consent Holder incorporates in contract documents for the development construction work that the contract maintenance period is for the same duration as the periods quoted in Sections 3.8.1 and 3.8.2.

4. LAND STABILITY AND EARTHWORKS

4.1 General

This section covers the Kaipara District Council requirements for earthworks relating to subdivision and development.

Design and quality assurance shall comply with Sections 1 to 3 of these Engineering Standards.

4.2 Resource Management

All earthworks shall be constructed in accordance with the requirements of the Northland Regional Council, especially with respect to the protection of natural water bodies from silt which arises from the works. The provisions of the Regional Water and Soil Plan for Northland, Regional Coastal Plan for Northland and Regional Air Quality Plan for Northland shall be complied with. Where required under the rules of the regional plans, resource consents for the proposed earthworks shall be obtained from the Northland Regional Council prior to carrying out the activity.

Resource consents may also be required for earthworks under the District Plan. Any resource consents required shall be obtained from Kaipara District Council prior to carrying out the activity.

4.3 Erosion, Sediment and Dust Control

All earthworks shall incorporate stormwater controls including watertables, grade control structures and cut-off drains and any other runoff control measures necessary to prevent scour from channelled water and to minimise and control sediment discharges, erosion and dust generation and satisfy the requirements of the Regional Water and Soil Plan for Northland.

Guidance Note:

Acceptable guidelines for erosion and sediment control are documented in the ARC publication TP90.

4.4 Design of Earthworks and Geotechnical Requirements

All Earthworks shall be investigated and designed in accordance with the requirements of NZS4404:2010.

Building foundations, including land stability beneath buildings, shall be designed and constructed in accordance with the Building Act 2004 and the New Zealand Building Code Verification Method B1/VM4.

The minimum factors of safety for earthworks that may impact on Council owned infrastructure shall be 1.5.

4.5 Construction Specification and Quality Control

Earthworks which require certification shall be investigated, designed and constructed as specified in NZS4404:2010 “Land Development and Subdivision Engineering” Part 2 (Land Stability, Foundations and Earthworks).

Earthworks for road formations shall be constructed in accordance with NZTA standard specification F/1 “Earthworks Construction”.

5. ROADS AND ACCESS

5.1 General

This section covers the Kaipara District Council requirements for the design and construction of roads, access ways, access lots, rights of ways, driveways, pan handles and associated infrastructure. Design and quality assurance shall comply with Sections 1 to 3 of these Engineering Standards.

The same standards apply whether an access way is vested with Council or maintained as a private way.

Almost two thirds of the Rural roads in Kaipara District are unsealed. The revised Engineering Standards includes design standards for unsealed roads based on surface friction factors appropriate to an unsealed surface.

The drawings provided in Appendix A detail the specific requirements for Roads and Accesses. The details provided on the drawings in Appendix A over-ride any specific requirement of any other reference document.

5.1.1 Road Vesting

The following requirements shall be met when subdividing land:

(a) Access ways serving 8 or more allotments shall be by public Road vested with Council.

(b) Design and construction shall be to a standard suitable for the number of Household Equivalents served in accordance Table 5.1.

(c) Roads to Vest shall have sufficient legal width in accordance with clause 5.2.4.

(d) A cul-de-sac in accordance with clause 5.2.17 shall be provided at the end of the public Road formation.

Guidance notes:

1. *Roads are required to be designed and constructed in accordance with Sections 5.2 and 5.3 of these Engineering Standards.*
2. *For the purposes of this clause, Road Vesting includes Road Dedication where a right of way or jointly owned access lot is transferred to Council as a public Road.*
3. *Private shared accesses are provided for under this document and are required to be designed and constructed in accordance with Sections 5.2 and 5.3 of these Engineering Standards.*

5.1.2 Use of 'Paper Roads'

On receipt of a written application, Council may allow the formation and use of an unformed legal Road ('Paper Road') to provide access to an existing property or new subdivision.

The following requirements shall be met:

(a) Design and construction shall be to a standard suitable for the number of Household Equivalents served in accordance Table 5.1 except that for a road serving up to 3 household equivalents, the maximum gradient shall not exceed 12.5%.

(b) Any section of Paper Road to be formed shall be connected to an existing Council maintained Road by a continuous road formed to Council standards within an existing legal Road or new Road to be vested with Council.

(c) A cul-de-sac in accordance with clause 5.2.17 shall be provided at the end of the public Road formation;

(d) All design, construction and supervision costs shall be met by the Applicant;

Guidance notes:

1. *Approval to form an unformed legal Road will be made by resolution of Council at a full Council meeting.*
2. *Roads are required to be designed and constructed in accordance Sections 5.2 and 5.3 of these Engineering Standards.*
3. *Single lane Roads (with appropriate passing bays) are allowed in accordance with Table 5.1.*
4. *Council's engineers and contractors will design the Road and carry out construction*
5. *In general, Council will maintain the Road once constructed.*

5.1.3 Work on Council Roads

Guidance notes:

Any construction or upgrading of a formed or unformed legal Road in Kaipara District, other than a State Highway, is subject to the control of Kaipara District Council under section 317 of the Local Government Act 1974. State Highways are under the control of the New Zealand Transport Agency.

Unless provided otherwise under a condition of a land use or subdivision consent, any person wishing to carry out work on a legal Road should obtain the prior written approval of the Road controlling authority.

The formation of an unformed legal Road and any upgrading work on existing Council maintained Roads required as a condition of subdivision or land use consent will be carried out by a Council appointed contractor under the supervision of a Council engineer.

5.2 Design Requirements

5.2.1 Road Standards

The following requirements shall be met:

(a) New Roads, private access ways, rights of way and driveways shall be designed and constructed and/or upgraded to the standards set out in Table 5.1: Roads and Private Ways Design Standards and the typical cross sections shown in drawings S01 and S02.

Table 5.1: Roads and Private Ways Design Standards

Household Equivalents	Minimum Legal Width (Note 1)	Minimum Carriageway Width (Note 2)	Surface (Note 3)	Min Design Speed (Note 4)	Minimum Radius (m)	Minimum SSD (m) (Note 5)	Minimum Crest K (m/%) (Note 5)	Minimum Sag K (m/%)	Maximum Grade
RURAL									
1 (Driveway)	9.0 m	3.0 m	metal		20 m	20 m	1.0	0.5	12.5%
	9.0 m	3.0 m	seal		15 m	20 m	1.0	0.5	20.0%
2 to 3	12.0 m	3.0 m	metal	20 km/h	20 m	40 m*	2.0*	0.5	12.5%
	12.0 m	3.0 m	seal	25 km/h	15 m	40 m*	2.0*	0.5	16.7%
4 to 6	18.0 m	3.0 m	metal	25 km/h	30 m	50 m*	2.5*	1.0	12.5%
	18.0 m	3.0 m	seal	30 km/h	20 m	50 m*	2.5*	1.0	12.5%
7 to 10	20.0 m	5.5 m	metal	35 km/h	55 m	40 m	3.2	1.0	12.5%
	20.0 m	5.5 m	seal	45 km/h	40 m	40 m	3.8	1.6	12.5%
11 to 30	20.0 m	5.5 m	metal	45 km/h	90 m	55 m	7.0	2.6	12.5%
	20.0 m	5.5 m	seal	55 km/h	60 m	55 m	7.0	2.6	12.5%
31 to 50	20.0 m	6.0 m	seal	65 km/h	90 m	75 m	12.0	4.5	12.5%
51 to 100	20.0 m	6.5 m	seal	70 km/h	100 m	85 m	15.0	6.0	10.0%
over 100	20.0 m	6.5 m	seal	80 km/h	160 m	105 m	25.0	10.0	10.0%
URBAN									
1	4.2 m	3.0 m	seal		15 m	20 m	1.0	0.5	20.0%
2 to 3	6.0 m	3.0 m	seal	20 km/h	15 m	30 m*	1.0	0.5	16.7%
4 to 6	12.0 m	3.0 m	seal	30 km/h	20 m	50 m*	1.4	1.0	12.5%
7 to 30	16.0 m	5.5 m	seal	40 km/h	30 m	40 m	3.0	1.5	12.5%
31 to 50	20.0 m	6.0 m	seal	40 km/h	30 m	40 m	3.0	1.5	12.5%
>50	20.0 m	6.5 m	seal	40 km/h	30 m	40 m	3.0	1.5	10.0%

Table 5.1 Notes:

(1). The legal width shall be sufficient for the carriageway (including widening on curves), cul-de-sacs, footpaths and cycleways (where appropriate), parking (where appropriate), public utilities, drainage facilities, grassed Berms, Swale Drains, amenity planting, sight benching and street furniture. Roads to vest shall have sufficient legal width for planned future development. Refer clause 5.2.4

(2). Carriageway width is exclusive of Berms, kerb concrete and parking. Carriageway widths should be increased by up to 1.0m where there is a high proportion of heavy traffic. Additional widening is required on curves in accordance with clause 5.2.5. Passing bays are required on single lane carriageways in accordance with clause 5.2.5.

(3). Carriageway surface shall be sealed in accordance with clause 5.2.6.

(4). Design speeds are based on rolling terrain typical in Kaipara District. Higher design speeds should be considered in flatter terrain.

(5). Safe stopping sight distances marked * have been increased to provide for two vehicles approaching each other on a single lane carriageway to stop before colliding. If a two lane carriageway is proposed for access ways serving 1 to 6 lots, sight distances may be reduced accordingly.
K value is the length of vertical curve (m) divided by the algebraic difference in gradients (%).

(6) Where there is potential for further development under the District Plan, the horizontal and vertical geometry and legal width shall provide for the Ultimate Development.

(7) Collector and Arterial Roads and Roads in Business Zones shall be designed to specific standards approved by Council.

5.2.2 Road Classification

Guidance note:

The width of carriageways will vary according to the traffic carrying capacity of the Road and the associated need for access and vehicle parking. As the traffic function of a Road becomes more important, it will be necessary to provide more specifically for access and vehicle parking so that moving traffic is not impeded. Roads can be classified in the following manner:

a) State Highways – Roads managed by New Zealand Transport Agency. The traffic function is dominant and access is generally restricted. In Urban areas, either a parking prohibition applies with parking on adjacent service streets or parking lanes are provided on both sides of the traffic lanes.

b) Arterial Roads - Traffic function is dominant. In Urban areas, either a parking prohibition applies with parking on adjacent service streets, or parking lanes are provided on both sides of the traffic lanes.

c) Collector Roads - Both traffic and property access functions are important. Traffic requirements are sufficient to justify 2.5 m wide parking lanes on each side of the traffic lanes in Urban areas.

d) Local Roads - Property access is dominant with low traffic volumes and low traffic speeds. In Urban areas, parking should be provided in accordance with clause 5.2.10. Parking areas need not be continuous but broken into parking bays separated by planted trees and shrubs.

e) Private Ways – Short shared accesses not owned or maintained by Council, but by the owners of the properties served. Private access ways can be either jointly owned access lots, or rights of way. Lane sharing by parked and moving traffic is generally acceptable. To enable moving vehicles to pass parked vehicles, a two lane width is provided where the number of households served warrants.

State Highways, Arterial and Collector Roads are shown in the Kaipara District Plan. All other public Roads are classed as Local Roads.

5.2.3 Traffic Volumes

Guidance note:

Traffic counts carried out on no-exit roads in Kaipara District indicate that Annual Average Daily Traffic (AADT) varies from 4 vpd per dwelling in Rural areas to 10 vpd per dwelling in Urban areas.

For residential subdivisions, in both urban and rural areas, Council will generally adopt an AADT of 8 vehicle movements per day for each lot.

Maximum permitted traffic movements to and from a site are specified in the 'District Plan.

5.2.4 Legal Width

The legal width of any Road is the width of any area of land which has been declared Road in accordance with section 114 of the Public Works Act 1981 or the width of private access way shown on the survey plan.

The following requirements shall be met:

(a) The legal width shall be sufficient for the carriageway (including widening on curves), footpaths and cycleways (where appropriate), parking (where appropriate), public utilities, drainage facilities, grassed Berms, Swale Drains, amenity planting, sight benching and street furniture.

(b) The legal width shall not be less than specified in Table 5.1.

Guidance notes:

1. Roads to vest should have sufficient legal width for planned future development in accordance with Council's structure plans.

2. *In Rural areas, the recommended legal width is based on a one or two lane carriageway with feathered shoulders and Water Tables on each side as detailed on drawing S01. Greater margins are provided on public Rural roads to accommodate earthworks, sight benching and future road improvements.*

3. *In Urban areas, the minimum legal width is based on a one or two lane carriageway with kerb and channel on each side and a footpath on one side as detailed on drawing S02. Greater margins are provided on major Urban roads to accommodate amenity planting, earthworks, sight benching and future road improvements. The minimum legal width shall be increased as necessary to provide for parking, cycleways, amenity planting and swale drains.*

4. *Alternative berm widths may be appropriate in some circumstances. An irregular shaped reserve may be required where a significant natural feature such as a large specimen tree is to be preserved.*

5. *Any strips of unused land between a Road and an adjoining property which are less than 5.0m wide, should be declared legal Road in accordance with Section 114 of the Public Works Act 1981.*

5.2.5 Carriageway Width

The following requirements shall be met:

(a) The minimum carriageway width shall be as specified in Table 5.1 plus additional widening on horizontal curves in accordance with drawing S04.

(b) Passing bays shall be provided on single lane carriageways no further apart than 100m and wherever sight distance along the access is less than the minimum safe stopping distance (SSD) specified in Table 5.1.

(c) Minimum passing bay dimensions shall be as shown on drawing S04.

Guidance notes:

1. *Each carriageway should be designed for two way traffic with lanes of sufficient width to carry heavy vehicles and prevent edge break where the road is to be sealed. The width of the carriageway is related to the volume of traffic expected to be carried, becoming progressively wider as volumes increase. This is to allow for greater clearances between passing vehicles and associated space.*

2. *Carriageway widths should be increased by up to 1.0m where there is a high proportion of heavy traffic to prevent shallow shear failure in the outer wheel tracks. Carriageway widths shall be as specified in Table 5.1 with additional widening on curves as detailed on drawing S04 to provide for the swept path of larger vehicles and wander space at higher speeds.*

3. *On low speed curves, the additional widening is based on the tracking width of an 11m rigid truck. On higher speed curves, additional widening is provided for vehicle wandering. The clearance beyond the vehicle width of 2.5m provided by the minimum specified carriageway width is maintained through the curve.*

4. *On two lane carriageways serving no more than 10 Household Equivalents, only one lane of widening need be provided as it is unlikely that two trucks will need to pass each other.*

5. *In residential areas the carriageway may be split into separate one-way lanes to preserve natural features such as trees or to minimise property access problems on steep terrain.*

5.2.6 Carriageway Surface

The following requirements shall be met:

(a) Urban Roads, Private Ways, rights of way and Driveways shall be sealed.

(b) Rural Vehicle Crossings off sealed roads shall be sealed as follows:

(i) At least to the tangent point / throat of the Vehicle Crossing curve (6m on residential crossings and 10m on commercial crossings) where the Vehicle Crossing is level or slopes down from the road; or

(ii) At least to the gate position (10m on residential crossings and 25m on commercial crossings) where the Vehicle Crossing slopes up from the road;

(c) Rural Roads, private shared accesses and Driveways shall be sealed as follows:

(i) Where the longitudinal gradient exceeds 12.5% (1 in 8);

(ii) For a distance of at least 50m from an existing sealed road where serving 9 to 30 Household Equivalents;

(iii) The entire length where serving 31 or more Household Equivalents (greater than 180vpd).

Guidance note:

1. *Concrete carriageways may be used in place of chip seal or hot mix surfacing on private Vehicle Crossings and accessways.*
2. *Standards for sealing are specified in clause 5.4.2 of these Engineering Standards.*
3. *Carriageways with a longitudinal gradient in excess of 12.5% are required to be sealed to provide sufficient traction and avoid corrugation and aggregate separation.*

5.2.7 Edge Treatment

The following requirements shall be met:

(a) Feathered shoulders, Watertables, kerb and channel and Berms shall be provided as detailed in Table 5.3 and on drawings S01 and S02.

Guidance note:

Alternatives to kerbs, such as dished drains and Swale Drains will be accepted provided that the stormwater design criteria in Section 6 are achieved.

5.2.8 Footpaths

The following requirements shall be met:

(a) Footpaths shall be provided on at least one side of new Roads in residential zones and for residential development in defined growth areas.

(b) Footpaths shall be provided on both sides of the Road in Business Zones and on Urban Strategic, Arterial, Collector Roads and Urban Roads carrying more than 500vpd.

(c) Footpaths shall be of concrete construction, 1.4m wide (exclusive of kerb and channel) and 100mm thick as detailed on drawing S02. On Vehicle Crossings, in Service Lanes and cul-de-sac heads, footpaths shall be 150 mm thick and reinforced as detailed on drawing S05 for Vehicle Crossings.

Guidance notes:

1. *Footpaths should be separated from the road and parking areas by non-mountable kerb and channel or a Swale Drain at least 2.0m wide.*
2. *In general footpaths should be at least 100mm thick to minimise the likelihood of damage. In Service Lanes and cul-de-sac heads, heavy vehicles are likely to mount the footpath occasionally.*
3. *In Business Zones and areas where the footpath extends from the kerb to the front boundary, the footpath may be laid in interlocking paving stones to facilitate ease of repair of buried utility services.*

4. *Footpaths constructed of alternative materials such as asphaltic concrete, masonry blocks or paving units may be permitted in certain circumstances. Early discussion with Council is advisable if any alternative to concrete is proposed.*

5. *A pram crossing shall be provided in the kerb line at all intersections as shown in drawing S15. Where possible, sumps shall be sited upstream of the crossing.*

6. *Where a new Road joins an existing Strategic, Arterial or Collector Road and is likely to generate a significant number of pedestrians who wish to cross the major Road, appropriate crossing facilities shall be discussed with Council prior to finalising the design. These may include pedestrian refuges at the centreline, or full pedestrian crossings, but need to be compatible with Council's strategy for such facilities.*

5.2.9 Cycle Path Guidelines

1. *Cyclists are generally expected to share the traffic lanes on roads. Separate cycle lanes at least 1.5m wide should be considered for Urban Collector, Arterial and Strategic Roads.*

2. *Cycle paths can be omitted from these roads if a satisfactory alternative cycle route exists (e.g. a nearby minor parallel street). If possible cycle paths should be physically separated from the main carriageway.*

3. *Cycle paths separated from road carriageways should be constructed to the standards specified for footpaths. Where used by pedestrians and cyclists, the minimum paved width should be 2.5m assuming no side obstructions or walls. Where these are present, additional clearances should be provided. Appropriate drainage, fencing, handrails and lighting should be provided as necessary for the safety of users, especially at night.*

5.2.10 Parking, Manoeuvring and Loading

The following requirements shall be met:

(a) The quantity and location of off street parking, manoeuvring and loading bays shall be provided in accordance with the District Plan.

(b) Adequate provision shall be made for access between the Road and parking area and for manoeuvring within the site so that vehicles do not reverse out on to the Road.

(c) On-street parking shall be provided for subdivisions in Urban areas. On access ways serving up to 20 dwellings, a 5.5m carriageway width is expected to provide for occasional on-street parking.

(d) On Roads serving more than 20 dwellings in areas zoned Residential; one on-street car park shall be provided for every two dwellings within 50m distance of the site boundary of any dwelling.

(e) Parking bay sizes shall comply with drawing S20, NZS4404:2010: Figure 3.2, AS2890.1 (Light vehicles) or AS2890.2 Commercial as appropriate.

(f) Loading bay sizes shall comply with AS2890.2 Commercial.

(g) On properties used mainly for residential purposes, manoeuvring areas shall be provided for a 5.0m standard car in accordance with drawing S18.

(h) On properties used mainly for business purposes, manoeuvring areas shall be provided for an 11.0m standard truck or articulated truck in accordance with drawing S19.

(i) The maximum longitudinal gradient and maximum crossfall on any area used for parking, loading and manoeuvring shall be 6%

(j) Pavements shall be formed and surfaced in accordance with clauses 5.2.6 and 5.2.13 respectively.

(k) Access and manoeuvring areas shall comply with the New Zealand Building Code acceptable solutions C/AS1 Part 8.1 (Fire Service Vehicular Access).

Guidance Notes:

1. *Parking may be provided either as continuous parallel parking bays on one or both sides of the carriageway or as angle parking bays at discrete locations. In Business zones, parking shall be provided in accordance with the District Plan.*

2. *Consideration should be given to parking alternatives as recommended in Chapter 4 of Auckland Regional Council TP 124 Low Impact Design Manual for the Auckland Region.*

5.2.11 Geometric Design

The following requirements shall be met:

(a) Design Methods

The horizontal and vertical geometry of Rural and Urban Roads shall be designed in accordance with the following paragraphs:

The design speed of a horizontal curve shall be calculated according to the formula:

$$V = [127\ R\ (e + f)]^{0.5}$$

Where V = vehicle speed (km/h)

R = curve radius (m)

e = superelevation (m/m)

f = side friction

Safe Stopping Distance shall be calculated according to the formula:

$$SSD = \frac{R_T . V}{3.6} + \frac{V^2}{254(d+g)}$$

Where R_T.= reaction time (seconds)

V = vehicle speed (km/h)

d = rate of deceleration

g = longitudinal gradient (m/m)

The minimum reaction time used in calculations shall be 2.0 seconds. On Arterial and Collector Roads the reaction time shall be increased to a minimum of 3.0 seconds.

Design values for side friction coefficients and rate of longitudinal deceleration shall be as follows:

Table 5.2: Design Side Friction and Rate of Longitudinal Deceleration

Design Speed	Side Friction		Rate of Longitudinal Deceleration	
(km/h)	sealed	unsealed	sealed	unsealed
<50	0.35	0.12	0.52	0.27
60	0.33	0.11	0.48	0.27
70	0.31	0.10	0.45	0.26
80	0.26	0.10	0.43	0.25
90	0.20	0.09	0.41	0.24
100	0.16	0.09	0.39	0.23

Vertical curves shall be designed for driver eye heights of 1.05m (crest curves) or 1.8m (sag curve with overhead obstruction) and an object height of 200 mm.

(b) Horizontal Alignment

Horizontal alignment of roads and access ways shall be designed in accordance with Table 5.1. Each horizontal curve shall consist of a single circular arc. Spiral transitions shall be provided on horizontal curves on Collector and Arterial Roads.

(c) Vertical Alignment

The vertical alignment on all roads shall be designed to provide gradients and minimum K values in accordance with Table 5.1. The design speed of the vertical alignment (based on Safe Stopping Sight Distances) shall match or exceed that of the horizontal alignment.

(d) Superelevation

The horizontal alignment of all new or upgraded Rural roads and Urban Collector, Arterial Roads and Right of Ways shall have superelevation which provides for the minimum design speed specified in Table 5.1.

Urban local Roads shall have, as a minimum, 3% normal camber.

Where superelevation is required, the rate of superelevation rotation shall be 0.035 radians per second for design speeds up to 70 km/h and 0.025 radians per second for design speeds of 80 km/h or higher.

(e) Sight Lines

Sight benching shall be provided within the Road reserve as required to provide at least stopping sight distances along the road. Stopping sight distance shall be calculated in accordance with clause 5.2.11(a), but shall not be less than as specified in Table 5.1.

Guidance Notes:

1. *These design principles are consistent with Austroads Rural Road Design: Guide to the Geometric Design of Rural Roads and Australian Road Research Bureau Unsealed Roads Design Guidelines. Further design guidance may be obtained from these documents.*
2. *The minimum sight distances in Drawing S10 are based on 85 percentile operating speeds, 2.0 second reaction time and level gradients.*
3. *The horizontal alignment should be designed to guide drivers into choosing an appropriate speed for the environment. The design should provide for a consistent standard of alignment with no curve less than 15 km/h lower than the 85th percentile operating speed at the site.*
4. *Minor adjustments to kerb levels to provide an evenly sweeping kerb line are acceptable. If necessary a graphical plot of each kerb profile, using a horizontal/vertical scale ratio of the order of 10 to 1, shall be used to ensure even profiles. Care shall also be taken to ensure that gradients along the inside kerb are acceptable. Where applicable, superelevation can be added to the inside profile to obtain acceptable gradients.*

5.2.12 Traffic Calming Guidelines

On Local Roads and private ways, lower traffic speeds are desirable for the safety of pedestrians and turning traffic.

Traffic speed is influenced by a number of factors including:

- *Horizontal alignment*
- *Sight distance along the road*
- *Lane width*
- *Line markings*

- *The degree of built environment*
- *Vertical elements close to the road*
- *Physical restrictions such as chicanes and speed humps.*

The carriageway widths and design speeds (horizontal and vertical alignment) specified in Table 5.1 for local roads (up to 30 Household Equivalents) are towards the lower end of national and international roading standards and therefore promote lower traffic speeds.

Higher vehicle speeds may result when the horizontal alignment is inconsistent with the function of the road, such as long straight sections of road in a Rural-residential subdivision. In these cases, it may be appropriate to introduce additional horizontal curves, particularly if these follow the contour of the land.

Trees or road cuttings on the outside of curves help to provide visual clues to the curve alignment for approaching traffic and can slow traffic speeds without compromising sight distances along the road.

'Threshold' or 'gateway' treatments may be appropriate where a change in the built environment needs to be reinforced by specific traffic calming measures.

Whenever traffic calming measures are proposed, care must be taken to maintain safe stopping sight distances consistent with the likely operating speed.

Further guidance on traffic calming can be obtained from the Land Transport New Zealand Research Report 300 'Speed Change Management for New Zealand Roads' 2006 available from the New Zealand Transport Agency website.

5.2.13 Pavement Structural Design

The following requirements shall be met:

(a) Pavements shall be designed for a life of at least 25 years.

(b) For roads and access ways serving up to 100 Household Equivalents, 25 year design loads shall be as specified on drawing S03.

(c) The minimum design loads for sealed pavements shall be as specified on Table 5.7.

(d) The design loads for concrete pavements shall be based on the estimated traffic volume of the potential development.

(e) Design loads for major roads (greater than 600vpd) shall be determined from the known heavy vehicle usage of the road, or, in the absence of such information design loading may be calculated according to the formula:

Equivalent Standard Axles (ESAs) per lane = 400 x AADT,

where AADT is the Annual Average Daily Traffic Volume (including cars) in both directions. An AADT of 6vpd / Household Equivalent shall be used for pavement design.

(f) The minimum basecourse (top layer) depth on sealed pavements shall be:

(i) 150mm for lime stabilised pavements

(ii) 250mm for TNZ M/4 basecourse.

(g) Unsealed road pavements shall include an upper layer of well graded running course aggregate of maximum particle size 20mm, minimum layer thickness 50mm and containing sufficient fine material to bind the layer and confine larger particles in the underlying structural pavement layer.

(h) Concrete or sealed carriageways shall be provided wherever the gradient exceeds 12.5%.

(i) Subgrade and pavement testing shall be carried out in accordance with Table 5.7 and drawing S03. The depth of subgrade tested shall be from 0 to 1.0m below

design subgrade level. The lowest CBR recorded in this depth range shall be the CBR value recorded at that test location. The design CBR for each uniform pavement design shall be the 10 percentile CBR value; that is the value exceeded by 90% of the test results.

Guidance notes:

1. *Further guidance on pavement design can be obtained from the Austroads Pavement Design Manual (including New Zealand supplement); 90% confidence level charts.*
2. *The minimum basecourse (top layer) depth of 250mm on sealed pavements is to minimise the creation of perched watertables in the pavement.*
3. *The minimum standard design loadings are based on 10%HCV, 0.9 ESA/HCV or 400 x AADT ESAs per lane on a 2 lane carriageway. An AADT of 6vpd / Household Equivalent shall be used for pavement design.*
4. *The minimum design loadings for sealed pavements are based on occasional use by heavy vehicles.*
5. *Where the gradient is between 16.7% and 20%, concrete carriageways are recommended. Concrete carriageways should be designed in accordance with Section 9 of the Austroads Pavement Design Manual (including the New Zealand supplement). Access ways with a gradient greater than 20% require specific Council approval.*
6. *Solid masonry paving units may be used on private Urban accesses and may also be an alternative in light duty areas such as shopping malls and courtyards, where a surface appearance is a consideration. Masonry units should be readily available standard units, and should comply with NZS 3116:2002. These pavements shall be designed to have a 25 year life under all expected local conditions. The edges of the paved areas should be adequately confined, normally by concrete nibs.*

5.2.14 Bridge Design

The following requirements shall be met:

(a) All Bridges shall:

- (i) be designed in accordance with the Transit New Zealand Bridge Manual;
- (ii) Have 600mm clearance above the 1% AEP flood level on Arterial Roads. For other roads, be at or above the 1% AEP flood level during that flood;
- (iii) Provide an 8.0m clear width between rails if located on a bend with a radius less than 300 metres or on any road with traffic volumes greater than 500 vehicles per day. Otherwise a 4.5m clear width between rails is acceptable.
- (iv) Have W-section bridge steel guard-rail across the bridge and on the approaches for a minimum distance of 20m from each abutment, terminating in breakaway cable terminals. This requirement can be waived if there is less than a 3.0m drop below the bridge deck and the formation width required for the applicable road type is provided.
- (v) Have resource consent from the NRC if required by the Regional Water and Soil Plan.
- (vi) Have a Building Consent unless exempted under Schedule 1(k) of the Building Act 1994.

Guidance note:

1. *Bridges should be designed taking into account average annual daily traffic volumes and associated heavy vehicle requirements.*

5.2.15 Culvert Design

The following requirements shall be met:

(a) All culverts shall be designed to ensure:

(i) There is no flooding of the road Carriageway in a storm event of 10%AEP or less;

(ii) On Arterial and Collector Roads, the depth of flood water measured at the road centreline shall not exceed 100mm during a 1% AEP storm event;

(iii) On Local Roads and private access ways, the depth of flood water measured at the road centreline shall not exceed 200mm during a 1% AEP storm event.

(b) The culvert shall also have resource consent from the Northland Regional Council if required by the Regional Water and Soil Plan.

5.2.16 Intersection Design

The following requirements shall be met:

(a) The intersection of public Roads and private access ways serving more than 30 Household Equivalents shall be sealed intersections designed in accordance with Austroads Guide to Traffic Engineering Practice Part 5: Intersections at Grade: 2005 (Austroads Intersections at Grade) and the New Zealand Transport Agency Manual of Traffic Signs and Markings (MOTSAM).

(b) Intersections shall be designed and located such that the Approach Sight Distance (ASD) and Safe Intersection Sight Distance (SISD) in Tables 6.3 to 6.4 of Austroads Intersections at Grade: 2005 are achieved. In both cases the visibility shall be measured from a location 7.0m back from the intersection limit lines.

(c) Intersections shall be designed in accordance with Austroads Intersections at Grade to accommodate, at the carriageway level, a turning circle with a 15.0m outside radius and swept path 6.0m wide. An additional 1.0m overhang shall be accommodated outside this circle at a height 1.0m above the Carriageway surface.

(d) Left and right turn bays shall be provided where turning movements comply with the auxiliary lane warrants in Austroads Intersections at Grade: 2005 Figure 6.41.

(e) Longitudinal gradient and crossfall at intersections shall comply with the following:

- The crossfall shall not exceed 8%
- The adverse crossfall shall not exceed -6%
- The effective crossfall (vectorial sum of the longitudinal gradient and crossfall) shall not exceed 6%

Guidance notes:

1. The number of intersections should be minimised.

2. The preferred angle of intersection is 90 degrees, with a minimum angle of 80 degrees: Carriageway alignment may be offset from the Road reserve alignment to improve the intersection angle. Acute angle, 'Y' and multi-leg intersections are not acceptable.

3. Non-priority intersection legs should be offset from each other by a minimum of 15m so that they do not form a straight route through the intersection. In this case the intersection of each minor road leg should be designed as a separate intersection. Exceptions to this are roads which are legs of a roundabout or intersections that are controlled by traffic signals.

4. Austroads Intersections at Grade:2005 Entering Sight Distance (ESD) is rarely achievable and need not be provided.

5. *Intersections which have ultimate peak daily traffic flows greater than 1,000 vehicles per day through them should have a safety audit carried on them by an experienced traffic safety auditor as part of the design certification.*

6. *Where appropriate and with the written approval of Council's Asset Manager, intersections on public Roads may be constructed as roundabouts. The design of roundabouts should be in accordance with Austroads Guide to Traffic Engineering Practice Part 6: Roundabouts and the New Zealand Transport Agency Manual of Traffic Signs and Markings (MOTSAM).*

5.2.17 Cul-de-Sacs

The following requirements shall be met:

(a) Cul-de-sacs shall be provided in accordance with drawing S16 at the end of any no-exit public Road or private access way serving 4 or more lots.

(b) Longitudinal gradients and crossfalls at the cul-de-sac shall comply with the following:

- The crossfall shall not exceed 8%
- The adverse crossfall shall not exceed -6%
- The effective crossfall (vectorial sum of the longitudinal gradient and crossfall) shall not exceed 6%

Guidance Notes

1. *Each cul-de-sac should be provided with a place where light vehicles may turn without reversing. Provision should also be made, near the end of a cul-de-sac of such length as to preclude "backing up" of larger vehicles, for three point or two point turning utilising insets in the kerb line or kerb crossings. The principal design features of a short cul-de-sac are illustrated in drawing S16.*

2. *Kerb and channel grading around the cul-de-sac should be based on the adoption, as far as practical, of the standard 1 in 30 (3%) carriageway cross fall at critical points in the arc length with easing of changes in grade by designed vertical curves as required. Off centre cul-de-sac heads should be designed by offsetting the road carriageway crown to create symmetrical conditions with the channel being designed accordingly.*

3. *In industrial areas "no exit" roads should be avoided wherever possible. Where they cannot be avoided a turning circle radius of 15m (excluding the footpath) should be provided.*

4. *For roads which are likely to be continued at a later date, including roads which end at land zoned Rural in the District Plan, an all-weather vehicle-turning area of minimum diameter 20m shall be provided.*

5.2.18 Vehicle Crossings

5.2.18.1 Obligation to Provide and Maintain Vehicle Crossings

The following requirements shall be met:

(a) The consent holder, owner or occupier of each site shall provide and maintain at least one Vehicle Crossing so as to enable vehicles to pass freely to and from the site. Each Vehicle Crossing shall be formed with an all weather surface between the edge of the road carriageway and boundary of the site, and have associated stormwater drainage facilities.

(b) The crossing shall be maintained by the owner or occupier of the site in such a condition as to ensure that stormwater and detritus including gravel, dirt and other materials do not migrate onto the road surface.

5.2.18.2 Location of Vehicle Crossings

The following requirements shall be met:

(a) Each Vehicle Crossing shall be located in such a position as to provide motorists entering and leaving the site with adequate visibility and not adversely affect the free flow of traffic on the adjoining road, provided that the following minimum requirements shall be met:

(b) Sight distances at the Vehicle Crossing shall comply with the sight line provisions shown on drawing S10. Sight lines shall be contained within the Road reserve legal boundaries.

(c) In Rural areas, the following minimum distances shall apply:

  (i) No Vehicle Crossing onto any Collector or Arterial Road shall be situated within 60m of any road intersection (as measured from the nearest road boundary).

  (ii) No Vehicle Crossing onto any Local Road shall be situated within 30m of any intersection (as measured from the nearest Road boundary).

  (iii) The minimum spacing between Vehicle Crossings on the same side of any Collector or Arterial Road shall be 60m unless the consent of the Road controlling authority is otherwise obtained.

  (iv) The minimum spacing between Vehicle Crossings on the same side of any Local Road shall be 30m unless the consent of the Road controlling authority is otherwise obtained.

(d) In Urban areas, the following minimum distances shall apply:

  (i) No Vehicle Crossing shall be situated within 20m of any road intersection (as measured from the meeting point of the main kerb alignments).

  (ii) The minimum spacing between Vehicle Crossings on the same side of any road shall be 10m unless the consent of the road controlling authority is otherwise obtained.

(e) No more than two crossings shall be provided on any site which has a street frontage of 40m or less.

(f) The total crossing width of any front or corner site shall not exceed 50% of its street frontage, except for service stations and other similar activities where the standards in the Ministry of Transport's Traffic Engineering Information Bulletin No 1 Standard For Service Stations 1963 shall apply.

(g) Written approval shall be obtained from the New Zealand Transport Agency for any new Vehicle Crossing or change in use of an existing Vehicle Crossing on a State Highway.

Guidance Notes:

Access on to State Highways is controlled by the New Zealand Transport Agency. Vehicle crossing standards on state highways are higher than for local roads and must be compiled with.

5.2.18.3 Design and Construction of Vehicle Crossings

The following requirements shall be met:

(a) Each Vehicle Crossing shall be designed and constructed to the relevant design specified on drawings S05 to S09.

(b) Vehicle Crossing pavements shall be designed for the number of Household Equivalents served in accordance with clause 5.2.12, Table 5.6 and drawing S03

(c) All Vehicle Crossings shall be sealed as specified in clause 5.2.6 except Vehicle Crossings in Rural areas where the main road is unsealed and the crossing serves no more than 30 Household Equivalents.

(d) Vehicle Crossings shall comply with the breakover and departure angles specified on drawing S17.

(e) Vehicle Crossings on state highways shall comply with NZTA requirements.

Guidance Notes:

1. *These standards are designed to ensure that the 90th percentile vehicle does not "bottom out" when using them and the design vehicles do not cross the centreline when turning left into the side road.*
2. *Where a Vehicle Crossing is removed the area concerned should be reinstated as verge and any footpaths and kerbs replaced within 6 months of the crossing point removal. The cost of such work will be borne by the owner or occupier of the site concerned.*

5.2.18.4 Loading Ramps

The following requirements shall be met:

(a) No loading ramp shall be located within 25m of the edge of a traffic lane.

5.2.19 Driveways

The following requirements shall be met:

(a) The owner or occupier of each site shall provide and maintain a Driveway for the purposes of providing safe and convenient vehicular access from the road to on-site loading and parking spaces where such are required under the District Plan.

(b) Driveways shall be formed and maintained with an all weather surface and provided with associated stormwater drainage so as to minimise soil erosion.

(c) Minimum Carriageway width - The minimum Carriageway width of any Driveway shall be 3.0m

(d) The maximum gradient of any Driveway shall be 1:5 (20.0%) for any sealed Carriageway and 1:8 (12.5%) for any metalled Carriageway provided that all Driveways shall be designed to meet the break over and departure angles shown on drawing S17.

(e) All properties shall have a turning area on site so that vehicles do not need to reverse on to a Road or shared private way.

(f) Accessways serving more than one Household Equivalent shall be designed and constructed in accordance with Table 5.1 and clause 5.2.1 of these standards.

(g) Access and manoeuvring areas shall comply with the New Zealand Building Code acceptable solutions C/AS1 Part 8.1 (Fire Service Vehicular Access).

5.2.20 Gates

The following requirements shall be met where a private access joins a public Road with an 80 or 100km/h speed limit:

(a) Where a private access way is gated, the gates shall be located at least 13m from the edge of the public Road Carriageway where the gate opens away from the Road or 13m plus the gate width where it opens towards the Road.

(b) All gated accesses shall be provided with turning provisions, such that a 90th percentile car may enter the access way and turn around, without passing the gates or affecting through traffic on the public Road.

Guidance Notes:

1. *Gates or cattle stops are not permitted on public Roads unless the written permission of Council has been obtained under section 344 of the Local Government Act 1974.*
2. *Access on to State Highways is controlled by the New Zealand Transport Agency. Standards for gate setbacks on state highways may be higher than for local Roads and must be compiled with.*

5.2.21 Road Drainage

The following requirements shall be met:

(a) Stormwater drainage on roads shall comply with the permitted activity rules of the Regional Water and Soil Plan for Northland or have a resource consent from the Northland Regional Council;

(b) Stormwater drainage on roads shall provide positive drainage from the road surface such that ponding does not occur, the pavement does not become saturated, scour is avoided and discharges do not result in adverse effects on private property.

(c) Stormwater side drains and culverts under roads and entranceways shall be designed for at least a 10% AEP rainfall event. The minimum pipe size shall be 375mm diameter under roads unless the entry is protected by a sump, in which case, the minimum diameter is 300mm. The minimum pipe size under Vehicle Crossings shall be 300mm diameter.

Guidance Notes:

1. *In general, Rural roads should be built higher than the adjacent flood levels and Urban roads should be built lower than the adjacent flood levels.*
2. *Stormwater runoff from roads should be controlled within the Road reserve to discharge to natural drainage paths. Stormwater runoff should not flow overland over the footpath or through Urban properties.*
3. *Stormwater drainage on roads should comply with Section 6 of these Engineering Standards.*
4. *Stormwater drainage on roads should be designed in accordance with New Zealand Transport Agency's guideline document "Highway Surface Drainage; Design Guide for Highways with a Positive Collection System" for applicable roads, except that stormwater runoff should not be discharged into any sewers;*
5. *Unless otherwise Approved by Council, stormwater control in Urban areas should comply with Table 5.3.*

Table 5.3: Specific Area Requirements for Stormwater Control

Area	***Stormwater Control Method***
Dargaville *Paparoa* *Maungaturoto* *Kaiwaka*	*Kerb and Channel*
Mangawhai *Te Kopuru* *Baylys Beach* *Glinks Gully* *Tinopai* *Pahi / Whakapirau*	*Concrete Edging and Swale Drains or modified piped swale drains*

6. *Concrete kerb or kerb and channel can be either cast in situ, slip-formed or constructed with kerb blocks in accordance with drawing S12. This includes kerbing on traffic islands. Heavy duty kerb and channel should be constructed in all commercial and industrial Roads, Service Lanes and commercial rights of way and where directed by the Council.*

7. *Swale drains or modified piped swale drains constructed in accordance with drawing S13 should be installed in Rural and semi-Urban areas and can be used in moderate development areas.*

8. *On all surface water channels where the gradient is steeper than 1V:15H, scour protection should be provided in accordance with Section 6 of these Engineering Standards.*

9. *Any groundwater which can reach the road subgrade, e.g. from cut slopes above the road, should be cut off with an approved filter drain pipe such as perforated HDPE 50-100 mm diameter, in a trench backfilled with 20/17 aggregate, and discharged into the nearest stormwater system.*

10. *In addition to the requirements of the NZTA Highway Drainage Guideline, sumps should be provided at the following locations:*

    - *at intersections at the tangent points of kerb lines;*
    - *on the high side of pram crossings;*
    - *At changes of gradient or direction in the channel where there may be a tendency for water to leave the channel.*

11. *If the nearest associated stormwater Drain has a diameter greater than 600 mm and a manhole is not conveniently located, the sump lead may be saddled directly to the pipe. If sumps are discharged into open drains, then an outlet structure in accordance with drawing S11 should be provided.*

12. *Where possible, inset parking bays should have the same cross-fall as the associated road. Where this is not practical, a 600 mm wide dish channel should be constructed as shown in Drawing S12.*

5.2.22 Road Signs and Markings

The following requirements shall be met:

(a) Signs and roadmarking shall be provided on public Roads in accordance with New Zealand Transport Agency's "Manual of Traffic Signs and Markings" and NZS 5414:1977 Specification for Construction of Traffic Signs.

(b) Rural Roads shall be marked with edge lines, a dotted centreline and white raised pavement markers at 20m intervals along the centreline. Edge marker posts are not required. Traffic lanes shall be half the Carriageway width or 3.5m wide, whichever is less.

Guidance Notes:

1. *Edge marker posts are appropriate on sealed Arterial and major Collector Roads.*

2. *All warning signs on Urban Arterial Roads should have Class 1 sheeting in accordance with AS/NZS 1906.1. All other signs should have Class 2 sheeting. The sign sheetings should be designed to adhere fully to the backing for at least ten years.*

3. *Sign supports on traffic islands should be a recoverable or breakaway type.*

5.2.23 Road Names

The following requirements shall be met:

(a) Road names shall be as determined by Council.

(b) Road name signs shall be in accordance with the Table 5.4 below:

Table 5.4: Road Name Signage

Parameter	Rural Roads	Urban Roads	Private Ways
Background Colour	Blue	Blue	White
Letter Colour	White	White	Blue
Letter Height	100mm	75mm	75mm
Letter Type Series	Transport	Transport	Transport

(c) Road name, walkway and Service Lane signs shall be erected at all intersections as appropriate.

(d) “No Exit" signs shall be erected on all cul-de-sacs or dead-end roads

Guidance Notes

1. *New Roads will be named by Council in accordance with Council’s Road naming policy. Copies of the policy are available from council offices and website.*

2. *The Applicant should select a choice of 3 names for each new public Road being constructed and forward them in order of preference to the Council with the application for resource consent. A brief explanation of the reasons for the selection should also be submitted. The Council's decision will be notified to the Applicant so that provision of Road name signage can be made.*

5.2.24 Roadway and Intersection Lighting

The following requirements shall be met:

(a) Roadway lighting shall be provided on Urban Roads in accordance with NZS 6701:1983: Engineering Standards for Road Lighting and AS/NZS1158:2005. For the purposes of that standard, Kaipara District Arterial Roads shall be classified as intermediate roads and all other roads shall be classified as minor roads.

(b) Rural road intersections shall have a low intensity "flag" light installed in line with the intersecting road on the opposite side of the priority road.

(c) Cabling shall be taken to the closest pillar box and a fuse shall be provided at this location. Lighting columns shall be either reinforced concrete or galvanised hollow steel, and be of the breakaway type. Lamps shall be down facing on outreach arms and comply with NZS 6701:1983.

Guidance Notes:

1. *Intersections which have ultimate peak daily traffic flows greater than 1,500 vehicles per day through them should be fully lit as set out in Austroads Guide to Traffic Engineering Practice, Part 12 : Roadway Lighting, including a minimum luminance of 10 lux on the edges of roundabouts and the noses of all other islands.*

5.3 Unsealed Road Guidelines

1. *Guidelines for the design and construction and maintenance of unsealed roads are contained in Australian Road Research Bureau Unsealed Roads Design Guidelines.*

2. *The key factor in maintaining unsealed roads is good drainage. All sections of carriageway should have a crossfall of at least 6%. Feathered shoulders and Watertables should be provided as shown on drawing S01.*

3. *Particular care is required on the top side of superelevated curves and on the transitions between superelevated curves to avoid 'flat spots'. Bridge approaches may need to be sealed if 6% crossfall cannot be achieved.*

5.4 Construction Requirements

5.4.1 Pavement Materials

5.4.1.1 Quarry Aggregate

The following requirements shall be met:

Quarry aggregate used in shoulder checkouts, under cuts and general filling operations shall have the following properties:

(a) A crushing resistance of between 100kN and 200kN when tested in accordance with NZS 4407:1991 Test 3.10.

(b) Grading such that 100% of the material is less than 100 mm maximum size with no more than 65% passing a 19.0 mm sieve and 3%-18% passing a 1.18 mm sieve (when delivered).

(c) Clay Index greater than 3.5 and less than 8.0 when tested in accordance with NZS 4407:1991 Test 3.5.

5.4.1.2 GAP 65 Subbase

The following requirements shall be met:

The GAP 65 subbase shall have the following properties:

(a) A crushing resistance of at least 120 kN when tested in accordance with NZS 4407:1991 Test 3.10.

(b) Grading such that 100% of the material is less than 65 mm maximum size with between 70 – 85% passing a 37.5mm sieve, 50 – 64% passing a 19 mm sieve and 10 - 20% passing a 1.18 mm sieve (when delivered and following compaction).

(c) Clay Index greater than 3.5 and less than 8.0 when tested in accordance with NZS 4407:1991 Test 3.5.

(d) Lime reactivity when tested by the Soaked CBR Test 3.15 of NZS 4407:1991 for 0% and 3% of lime (calcium oxide) by weight with NZ vibrating hammer compaction. The soaked CBR of the 3% lime sample shall:

  (i) exceed the soaked CBR value of the 0% lime sample by more than 150% and

  (ii) have a CBR value greater than 170%.

5.4.1.3 GAP 40 Ordinary Basecourse

The GAP 40 ordinary basecourse shall have the following properties:

- A crushing resistance of at least 120 KN when tested in accordance with NZS 4407:1991 Test 3.10.
- Grading such that 100% of the material is less than 37.5 mm maximum size with between 63-81% passing a 19 mm sieve and 12-25% passing a 1.18 mm sieve (when delivered and following compaction).

- Weathering Quality index in accordance with the TNZ M/4 Basecourse Specification.
- Clay Index greater than 3.5 and less than 8.0 when tested in accordance with NZS 4407:1991 Test 3.5.
- Lime reactivity when tested by the Soaked CBR Test 3.15 of NZS 4407:1991 for 0% and 3% of lime (calcium oxide) by weight with NZ vibrating hammer compaction. The soaked CBR of the 3% lime sample shall:

  i. exceed the soaked CBR value of the 0% lime sample by more than 150% and

  ii. have a CBR value greater than 170%.

5.4.1.4 Quality Basecourse Material

The basecourse is the top layer of the pavement and is required in the layer described as "base material" in Figure 8.4 of Austroads Pavement Design Manual.

Two types of crushed rock material are acceptable for use as pavement basecourse:

- AP40 complying with NZTA M/4 Specification, or
- lime/cement stabilised GAP 40 aggregate.

PAP40 may be used in place of NZTA M/4 basecourse where M/4 is unavailable.

The following requirements shall be met:

PAP40 shall comply with NZTA M/4 AP40 specification, except for the following properties:

Table 5.5: PAP 40 Premium Quality Basecourse

Sand Equivalent	Plasticity Index	Clay Index
Minimum 36	Maximum 6	Maximum 4

GAP 40 aggregate used in lime stabilised basecourse shall have the following properties:

(a) A crushing resistance greater than 130 kN when tested in accordance with NZS 4407:1991 Test 3.10.

(b) Grading and Weathering Quality index in accordance with the NZTA M/4 Basecourse Specification.

(c) Clay Index greater than 3.5 and less than 8.0 when tested in accordance with NZS 4407:1991 Test 3.5.

(d) Lime reactivity when tested by the Soaked CBR Test 3.15 of NZS 4407:1991 for 0% and 3% of lime (calcium oxide) by weight with NZ vibrating hammer compaction. The soaked CBR of the 3% lime sample shall:

  (i) exceed the soaked CBR value of the 0% lime sample by more than 150% and

  (ii) have a CBR value greater than 170%.

5.4.1.5 Running Course

(a) The running course on an unsealed pavement shall consist of GAP 20 or GAP25 aggregate with the following properties:

- A crushing resistance of 110kN to 230kN when tested in accordance with NZS 4407:1991 Test 3.10.
- Clay Index greater than 3.5 and less than 10.0 when tested in accordance with NZS 4407:1991 Test 3.5.

- Grading as follows:

Table 5.6: GAP 20 and GAP 25 Running Course Grading

Aggregate Type	Sieve Size mm	26.5	19.0	9.5	4.75	2.36	0.425	0.075
GAP 25	Percentage passing	100	80-90	58-75	37-56	29-42	11-20	4-11
GAP 20	Percentage passing	100	93-100	64-85	44-64	32-47	13-22	3-11

- The ratio of Fines to Sand shall lie within the range:

$$0.2 < \frac{\%\text{ less than 0.075 mm}}{\%\text{ less than 2.36 mm}} < 0.4$$

- Aggregate sources that produce stones that are hard, elongated, and with sharp cutting edges capable of puncturing car tyres shall not be used for maintenance aggregate.

(b) The running course used on a pavement prior to sealing shall be grade 5 sealing chip in accordance with the TNZ M/6 Specification.

5.4.2 Carriageway Sealing

The following requirements shall be met:

(a) The following Roads shall be sealed in accordance with Section 5.2.6:
  (i) All Urban Roads; and
  (ii) Rural Roads as specified in clause 5.2.6

(b) The full carriageway width of Roads listed in clause 5.2.6 shall be sealed. Specific Seal design shall be carried out for each road in accordance with the New Zealand Transport Agency Guideline: "Bituminous Sealing Manual". The following paragraphs describe the minimum requirements for the various road types. These may not be suitable in unusual or high-stress situations (e.g. steep intersections, tight bends on steep hills) in which case more robust systems shall be used.

(c) Seal binder and chip shall be in accordance with NZTA Specifications M/1, M/6 and M/13 and applied in accordance with NZTA P/3 with a distributor which is certified in accordance with NZTA E/2. A two coat bitumen seal is required for all chip sealed surfaces.

(d) Rural Roads shall be sealed with a Grade 3 chip seal followed by a Grade 5 wet lock coat within 5 hours of sealing.

(e) Urban Roads shall be two coat sealed with a Grade 3 chip followed by a Grade 5 chip. In cul-de-sacs, Grade 4 chip seal followed by a Grade 6 chip is acceptable, to be sealed on the same day.

(f) Urban Collector, Arterial and Strategic Roads shall be two coat sealed with pre-coated Grade 2 chip followed by pre-coated grade 4 chip.

5.4.3 Reinstatement and Berms

The following requirements shall be met:

(a) On completion of all other works, the Berms shall be spread with clean topsoil which is lightly compacted to a depth of 100 mm. The topsoil shall be graded to kerb top and footpath edges, and may be finished 15 mm high to allow for settlement except on the low side of the footpath where the topsoil shall be finished flush to prevent water ponding.

(b) After top soiling, the Berms shall be sown with a seed mixture for grass which is low growing, with a robust and deep rooting characteristic, and well suited to the soil conditions. An 80% grass strike shall be achieved and the grassed areas shall be maintained free of excessive weed growth and shall be kept mown throughout the maintenance period. Vehicles shall be prevented from using the Berm until the grass has become established.

(c) All poles, sign posts, light standards, markers, power transformers, boxes etc, set in grassed Berms shall be finished off with a concrete mowing strip surrounding the base, flush with finished ground level, 150 mm (minimum) wide and 75 mm thick on firm base.

5.4.4 Construction and Quality Control Guidelines

1. *All construction works should be in accordance with an Approved Construction Management Plan as detailed in section 3.3.*

2. *Subgrade and pavement construction and quality control requirements vary widely depending on the type of pavement. These are general requirements only, rather than full specifications and should not be considered to be comprehensive. Construction should be controlled by comprehensive specifications which have been prepared by the IQP responsible for pavement design. IQPs should have appropriate experience in the design and construction of these pavements.*

3. *Subgrade may be fill or undisturbed material, but should be free of organic matter or other harmful material. It should be prepared in accordance with NZTA F/1, taking particular care to avoid compacting material which is weaving due to excessive moisture. Such material should be removed and replaced.*

4. *The subgrade surface should be trimmed to grade and cross fall and tested to ensure compliance with specified requirements before the pavement construction commences.*

5. *Control of subgrades should be carried out using in-situ density testing by nuclear densometer, which is correlated with compacted laboratory strength testing of the same material. Compaction should be to at least the dry density obtained in the laboratory at optimum moisture content under NZ standard compaction in accordance with NZS 4107 Part 4.*

6. *Any weak areas of the subgrade that are identified should be improved by replacement of the weak material or specific design using a geotextile. Placement and compaction of any granular subgrade fill should be in accordance with NZTA B/2.*

7. *If stabilised subgrades are used, care should be taken to allow appropriate curing before spreading the pavement aggregate. No vehicles should be permitted to run on the stabilised layer until the full pavement thickness is available above it.*

8. *The subbase and basecourse layers should be spread, graded and compacted to the correct formation level in accordance with NZTA B/2. The basecourse should be compacted to achieve a maximum of 20% total voids, with a clean-stone mosaic surface, prior to sealing.*

5.4.5 Final Acceptance

The following requirements shall be met:

(a) All subgrade, sub-base, basecourse and final seal testing (as applicable) shall comply with the minimum Pavement Quality Standards specified in Table 5.7.

(b) For all subdivisions serving more than 7 allotments with a sealed surface, the final pavement shall pass a Falling Weight Deflectometer (FWD) test 3 months prior to the expiry of the defects liability period. For avoidance of doubt, the works will be considered to be defective until the FWD testing of the completed

pavement in the spring following completion of the construction works demonstrates a residual life of at least 25 years.

(c) For all subdivisions serving 2 to 6 allotments for both a sealed and unsealed surfaces, and 7 to 30 allotments for unsealed surfaces only, the final pavement shall pass a Benkleman Beam test 3 months prior to the expiry of the defects liability period.

Table 5.7: Roads and Private Ways: Pavement Quality Standards

Household Equivalents	Surface	Minimum Design ESA/lane	Subgrade Strength Test	Sub Base Clegg Test	Top Layer Clegg Test	Top Layer Total Voids	Construction 95%ile	9-12 Month 95%ile Residual Life FWD/BB
1 Driveway	metal	5×10^3	90%ile scala	No	All>clegg 25	No	N/A	N/A
	seal	5×10^4	90%ile scala	All>clegg 20	All>clegg 40	No	N/A	N/A
2 to 3	metal	1.5×10^4	90%ile scala	No	All>clegg 25	No	2.3mm BB	N/A
	seal	5×10^4	90%ile scala	All>clegg 20	All>clegg 40	No	1.8mm BB	1.8mm BB
4 to 6	metal	3×10^4	90%ile scala	No	All>clegg 30	No	2.1mm BB	N/A
	seal	5×10^4	90%ile scala	All>clegg 20	All>clegg 40	No	1.8mm BB	1.8mm BB
7 to 10	metal	3×10^4	90%ile scala	All>clegg 15	All>clegg 30	No	1.9mm BB	N/A
	seal	5×10^4	90%ile scala	All>clegg 20	All>clegg 40	No	1.8mm BB	FWD
11 to 30	metal	7×10^4	90%ile scala	All>clegg 15	All>clegg 30	No	1.7mm BB	1.7mm BB
	seal	1×10^5	95%ile scala	All>clegg 20	All>clegg 45	All<21%	1.6mm BB	FWD
31 to 50	seal	1.5×10^5	95%ile scala+lab soaked CBR	All>clegg 20	All>clegg 45	All<20%	1.5mm BB	FWD
51 to 100	seal	2.5×10^5	95%ile scala+lab soaked CBR	All>clegg 20	All>clegg 45	All<20%	1.3mm BB	FWD
over 100	seal	400 x AADT	95%ile scala+lab soaked CBR	All>clegg 20	All>clegg 50	All<19%	KDC determination	FWD

Testing Methods:

- Clegg Impact Hammer (clegg) value
- Benkleman Beam (BB) deflection
- Falling Weight Deflectometer (FWD) remaining life greater than 25 years

Testing frequency shall be in accordance with drawing S03.
Minimum design loadings (ESA/lane) for 1 to 6 Household Equivalents are based on single lane carriageways.

6. STORMWATER DRAINAGE

6.1 General

This section covers the Kaipara District Council requirements for the design and construction of stormwater control devices and associated structures. Design and quality assurance shall comply with Sections 1 to 3 of these Engineering Standards.

6.1.1 Minimum Requirements

The following requirements shall be met:

(a) Stormwater drainage in subdivision and land development shall:

(i) Comply with the permitted activity rules of the Regional Water and Soil Plan for Northland or have a resource consent from the Northland Regional Council;

(ii) Recognise and protect existing overland flow paths, ephemeral watercourses and natural wetlands, streams and rivers;

(iii) Protect buildings from flooding in accordance with clause 6.2.3 and 6.2.4;

(iv) Provide for any future increase in runoff from upstream catchment land zoned for development in accordance with the District Plan.

(b) In Urban areas, on-site stormwater detention shall be provided to attenuate post-development peak stormwater flows to no more than pre-development peak flows for storm events of up to 100 year ARI (1%AEP).

(c) In Residential and Business Zones all drains shall be piped except for Swale Drains designed in accordance with clause 6.4.3, natural streams (as defined in the RMA), contour cut-off drains and as provided for in clause 6.1.1(d).

(d) Where a Drain requires a pipe in excess of 1200mm in diameter the Drain may remain open, provided that the channel is designed not to scour during design flows (e.g. by lining the sides or installing energy dissipating weirs). Adequate permanent access shall be provided for the Council to all Open Drains to allow maintenance to be carried out.

(e) Stormwater systems shall drain by gravity unless pumping is specifically Approved by Council.

Guidance Notes:

1. *In Rural areas stormwater may be taken to open drains or existing natural watercourses*

2. *Where stormwater attenuation is required, stormwater detention ponds or basins should be provided to serve the entire site catchment. A proliferation of small stormwater ponds or individual detention tanks will not generally be accepted because they are not as reliable or efficient as larger detention ponds or basins.*

3. *Water quality treatment options should be considered where appropriate, particularly in conjunction with stormwater attenuation.*

6.1.2 Drainage Reserves and Easements

The following requirements shall be met:

(a) In areas zoned Residential and Business, all stormwater pipelines, overland flowpaths and stormwater treatment / detention ponds or basins that are not contained within Roads or private ways shall be within a reserve vested with Council or easement in gross in favour of Council.

(b) In areas zoned Rural, all overland flow paths on lots of less than 4.0ha shall be identified and protected by an easement in gross in favour of Council.

(c) The minimum width of land to vest or easement shall be 3.0m

Guidance Notes:

1. *In Rural areas with lot sizes of 4.0ha and greater, stormwater control is expected to be via existing overland flow paths, ephemeral watercourses and natural wetlands, streams and rivers.*
2. *Stormwater overland flow paths and detention ponds or basins should be designed as an integral part of a subdivision or land development. As well as providing for stormwater requirements, these areas can provide recreational, access and aesthetic opportunities.*

6.1.3 Catchment Management Planning

Guidance Notes:

1. *Stormwater planning should be carried out on a coordinated and comprehensive catchment-wide basis. Although this is primarily the responsibility of Council, consideration should be given to catchment-wide issues by designers at the concept design stage.*
2. *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.*
3. *Any catchment management planning issues should be discussed with Council at an early stage.*
4. *At present (September 2009), Council has draft Stormwater Management Plans for Mangwhai, Dargaville and Baylys Beach. Council will review the need for Stormwater Management Plans in other Urban areas and update those that are considered appropriate.*

6.1.4 Low Impact Design Principles

Guidance Notes:

1. *The new NZS4404 has a section 4.3.7 on Low Impact Design. This section covers stormwater systems aimed to minimise environmental impact. It incorporates the use of detention ponds, wetlands, rain gardens, rainwater tanks and the like.*

6.2 Design Criteria

6.2.1 Design Methods

The following requirements shall be met:

(a) Stormwater conveyance systems (including pipes, open drains, and channels through junctions) shall be designed using Manning's equation with the value of Manning's "n" shown in Table 6.1.

Table 6.1: Values of Manning's "n"

Channel Surface	**Manning's "n" ($m^{1/3}$-s)**
PVC and PE pipes	0.009
Concrete pipes	0.012
Corrugated pipes and flumes	0.024
Swale drains with mown grass	0.040
Swale drains with dense unmown grass or reeds	0.060

Unlined open channels in earth and gravel with some bends in fair condition	0.025
Unlined open channels with rough stoney bed or with weeds on earth bank and natural streams with clean straight banks	0.030
Winding natural streams with irregular cross section and some obstruction with vegetation and debris	0.045
Irregular natural streams with obstruction from vegetation and debris	0.060
Very weedy irregular winding stream obstructed with significant overgrown vegetation and debris	0.100

(b) Other systems, including grassed swales and channels, shall be designed using the Building Industry Authority New Zealand Building Code E1: Surface Water and the Auckland Regional Council Technical Publication 10.

Guidance Notes:

1. *Design of outfalls should assume the receiving stream is flowing at its 2% Annual Exceedance Probability (AEP) flood level. If this level is higher than the pipe inlet invert level, then an Approved flood gate should be installed at the pipe outlet.*

2. *When super-critical flow will be experienced in the primary design system at flows less than its capacity, specific design should be carried out to prevent scouring of the pipe or ground at the outlet. Care should also be taken to design intermediate manholes of these pipes to be adequate for the energy losses which will occur in them.*

6.2.2 Primary and Secondary Flow paths

The following requirements shall be met:

(a) The Primary Design Flow shall be confined entirely within the defined stormwater system and shall not spill into overland flow channels.

(b) The required design Annual Exceedance Probability (AEP) / Average Annual Recurrence Interval (ARI) for the design flow of primary stormwater systems shall be as specified in Table 6.2.

Table 6.2: Design Periods for Primary Design Flow of Stormwater Systems

Land Use	Design AEP	Design ARI
Rural and Residential	20%	5 year
Industrial	10%	10 years
Commercial	5%	20 years
Rural Road Culverts	10%	10 years

(c) Secondary flow paths shall be designed for an AEP of 1% (100 year ARI) for all land uses, with an additional freeboard of 100mm. Secondary or overland flow paths shall be provided to give protection to surrounding buildings and service when flow exceeds the primary flow and/or the primary system becomes blocked.

Guidance note:

When assessing the capacity of the stormwater system downstream of a development, the effect of any flow concentration by the confinement of flows into primary or secondary flow paths within the development should be considered.

6.2.3 Freeboard

The following requirements shall be met:

(a) The minimum freeboard height to floor level above the 100 year ARI flood level shall be as follows.

Table 6.3: Freeboard

Building	Minimum Freeboard
Habitable Building floors	500mm
Commercial and Industrial Buildings and non-habitable buildings such as garages and sheds	300mm

6.2.4 Tidal Areas

The following requirements shall be met:

(a) The minimum floor level of any new dwelling shall be 5.0m above mean sea level.

Guidance Notes:

1. *In low lying areas, stormwater flows may be influenced by backwater effects from the tide. In these areas, the effects of high tide, storm surges and rising sea levels should be allowed for.*
2. *The minimum floor level of 5.0m above mean sea level is a conservative estimate of minimum requirements in the absence of a site specific analysis.*
3. *A short term increase in sea level can arise from low atmospheric pressure and wind driven sea water during storms. Guidelines should be sought from NRC and NIWA on storm surge heights applicable in low lying areas.*
4. *A rise in sea level is anticipated as a result of climate change. Developments should allow for changes in sea level as recommended by the Ministry for the Environment. The current guidelines are contained in the publication 'Coastal Hazards and Climate Change: A Guidance Manual for Local Government in New Zealand' published by the Ministry for the Environment, July 2008.*
5. *The current guidelines for subdivision and development (planning and decision timeframes to 2099) are:*

- *a base value sea-level rise of 0.5 m relative to the 1980–1999 average should be used, along with*
- *an assessment of the potential consequences from a range of possible higher sea-level rises (particularly where impacts are likely to have high consequence or where additional future adaptation options are limited). At the very least, all assessments should consider the consequences of a mean sea-level rise of at least 0.8 m relative to the 1980–1999 average.*

6. *For planning and decision timeframes beyond 2100 where, as a result of the particular decision, future adaptation options will be limited, an allowance for sea-level rise of 10 mm per year beyond 2100 is recommended (in addition to the above recommendation)*

6.2.5 Rainfall Intensity

The following requirements shall be met:

(a) Stormwater systems shall be designed for storm events of up to 100 year ARI, including an allowance for the anticipated effects of climate change.

Guidance notes:

Designers may use the rainfall depth tables provided in Tables 6.4 to 6.7 below. Design rainfall depths have been based on the NIWA High Intensity Rainfall Design System (HIRDS) version 2 database, adjusted to provide 95% confidence level.

Table 6.4: Dargaville Rainfall Depth (mm)

ARI	*Duration*									
years	*10 min*	*20 min*	*30 min*	*60 min*	*2 hour*	*6 hour*	*12 hour*	*24 hour*	*48 hour*	*72 hour*
2	*12.5*	*17.6*	*21.4*	*29.6*	*38.4*	*56.9*	*73.2*	*93.2*	*111.5*	*123.6*
5	*15.5*	*21.6*	*26.2*	*36.1*	*46.6*	*69.1*	*88.7*	*113.1*	*133.9*	*147.7*
10	*18.4*	*25.6*	*31.0*	*42.5*	*54.9*	*81.2*	*104.3*	*132.9*	*156.3*	*171.8*
20	*21.4*	*29.7*	*35.9*	*49.2*	*63.3*	*93.8*	*120.4*	*153.2*	*179.0*	*196.2*
50	*26.3*	*36.3*	*43.8*	*59.9*	*77.2*	*113.7*	*146.2*	*186.0*	*215.0*	*234.5*
100	*31.0*	*42.6*	*51.3*	*70.0*	*89.9*	*132.6*	*170.3*	*216.5*	*248.2*	*270.0*

Table 6.5: Tinopai Rainfall Depth (mm)

ARI	*Duration*									
years	*10 min*	*20 min*	*30 min*	*60 min*	*2 hour*	*6 hour*	*12 hour*	*24 hour*	*48 hour*	*72 hour*
2	*13.9*	*19.5*	*23.8*	*33.3*	*43.3*	*64.9*	*83.1*	*107.0*	*126.9*	*138.9*
5	*16.8*	*23.6*	*29.0*	*40.5*	*52.7*	*79.0*	*101.1*	*130.5*	*153.2*	*166.6*
10	*19.7*	*27.8*	*34.2*	*47.8*	*62.2*	*93.1*	*119.2*	*154.0*	*179.4*	*194.4*
20	*22.6*	*32.0*	*39.3*	*55.3*	*72.0*	*107.5*	*138.0*	*178.3*	*206.0*	*222.4*
50	*27.2*	*38.6*	*47.6*	*67.2*	*87.9*	*131.2*	*168.6*	*217.5*	*248.1*	*266.9*
100	*31.6*	*44.7*	*55.3*	*78.6*	*102.8*	*153.0*	*197.2*	*254.2*	*287.1*	*307.7*

Table 6.6: Maungaturoto Rainfall Depth (mm)

ARI	*Duration*									
years	*10 min*	*20 min*	*30 min*	*60 min*	*2 hour*	*6 hour*	*12 hour*	*24 hour*	*48 hour*	*72 hour*
2	*13.7*	*19.4*	*24.0*	*33.9*	*45.6*	*72.8*	*97.9*	*131.8*	*159.3*	*176.5*
5	*16.6*	*23.6*	*29.2*	*41.4*	*55.5*	*88.4*	*119.1*	*160.3*	*191.9*	*211.5*
10	*19.6*	*27.8*	*34.4*	*48.9*	*65.5*	*104.0*	*140.2*	*188.8*	*224.4*	*246.5*
20	*22.5*	*32.1*	*39.6*	*56.6*	*76.0*	*120.5*	*162.0*	*218.4*	*257.5*	*281.8*
50	*27.4*	*38.9*	*48.1*	*69.1*	*92.9*	*146.6*	*197.6*	*265.6*	*309.9*	*338.0*
100	*31.7*	*45.3*	*56.0*	*80.7*	*108.8*	*171.4*	*231.0*	*309.9*	*358.6*	*389.8*

Table 6.7: Mangawhai Rainfall Depth (mm)

ARI	*Duration*									
years	*10 min*	*20 min*	*30 min*	*60 min*	*2 hour*	*6 hour*	*12 hour*	*24 hour*	*48 hour*	*72 hour*
2	*14.7*	*21.0*	*25.6*	*36.3*	*47.1*	*70.0*	*88.8*	*114.7*	*137.7*	*152.9*
5	*17.9*	*25.5*	*31.1*	*44.4*	*57.4*	*85.1*	*108.1*	*139.7*	*166.3*	*183.8*
10	*21.1*	*30.0*	*36.6*	*52.4*	*67.8*	*100.2*	*127.3*	*164.8*	*194.8*	*214.6*
20	*24.3*	*34.9*	*42.5*	*60.8*	*78.8*	*116.3*	*148.0*	*191.4*	*224.8*	*246.8*
50	*29.8*	*42.8*	*52.0*	*74.8*	*96.9*	*142.9*	*182.2*	*235.2*	*273.4*	*299.2*
100	*35.1*	*50.2*	*61.1*	*88.3*	*114.7*	*168.5*	*215.3*	*277.2*	*319.8*	*348.8*

For other locations, rainfall data for the closest specified town may be used. Alternatively, designers may use HIRDS Version 2 rainfall depths + 1.65 standard error + 17% climate change allowance.

An increase in storm frequency and severity is predicted as one of the anticipated outcomes of predicted global warming. The publication 'Climate Change Effects and Impacts: A Guidance Manual for Local Government in New Zealand' published by the Ministry for the Environment, May 2008 estimates a mean air temperature increase of 2.1℃ by 2090. For extreme storm events, an 8% increase in rainfall is anticipated for each 1℃ increase in temperature. An additional 17% has therefore been allowed for the effects of climate change.

6.2.6 Specific Area Requirements for Stormwater Control

The following requirements shall be met:

Carriageway drainage in Urban areas shall comply with Table 5.3 unless otherwise Approved by Council.

6.2.7 Stormwater Discharge Consents

The following requirements shall be met:

(a) The consent holder shall obtain all necessary consents from NRC before commencing physical works on site.

(b) In the cases where the consent is to transfer to Council, the Applicant shall present a copy of the proposed NRC conditions to Council for approval prior to uplifting the consent.

(c) Once maintenance certificates have been issued at the satisfactory completion, of the maintenance period, such consents shall be transferred to Council.

6.3 Piped Stormwater System

The requirements specified in clauses 6.3.1 to 6.3.15 inclusive shall be met:

6.3.1 Minimum Requirements

(a) Piped stormwater systems shall be provided where specified in clause 6.1.1.

(b) Stormwater lines to be vested with Council shall not be less than 300 mm diameter.

(c) The minimum pipe size shall be 375mm diameter under Roads unless the inlet is protected by a sump.

(d) The piped system shall be designed to cater for the design flow, without surcharge.

(e) A minimum flow velocity of 0.7m/s for pipes flowing full shall be provided.

(f) The velocity at the point of discharge shall be dissipated using approved dissipation methods.

(g) Manholes shall be provided at each change of grade or direction, and the upper end of all primary piped stormwater reticulation and at all changes of direction or pipe junctions and at a spacing of not more than 100 metres.

6.3.2 Minimum Cover over the Pipe

All pipes shall have a minimum cover of 600mm from the top of the pipe to the ground level. An exception is for Vehicle Crossings where 300mm cover is allowed.

Alternative depths may be approved with supporting documentation. This will be dependent on pipe type and class, location and length.

6.3.3 Reticulation Layout

The layout of the primary reticulation shall follow the street pattern unless it can be demonstrated that this is not possible. Any deviation from this alignment will require approval from Council's Assets Manager.

6.3.4 Pipe Locations

In the case of subdivision, the stormwater drainage system shall be constructed over the entire area of land subject to the subdivision.

Where the reticulation lines are located in the front yard of lots the invert level shall be deep enough not to interfere with any future driveway construction.

6.3.5 Pipe Materials

(a) Stormwater Pipes shall be:

- uPVC pipe to AS/NZS 1254 Class SN 4
- PE pipe to AS/NZS 5065 Class SN 4 or
- Corrugated aluminium pipe to NZS2041:1998.

Other pipe types may be permitted subject to the approval of the Council.

(b) Stormwater pipes under Roads or pipelines to be vested with Council shall be reinforced concrete rubber ring jointed pipes unless the specific written approval of Council's Asset Manager is obtained.

(c) Galvanised steel shall not be used below ground level or the normal water level in streams.

6.3.6 Pipe Joints

All stormwater pipes shall have flexible sealed joints and be installed in accordance with the manufacturers specifications.

6.3.7 Bedding and Protection

All pipe bedding and protection shall be in accordance with manufacturer's recommendations and drawing S25.

6.3.8 Manholes

All Manholes shall comply with the following:

(a) Be located where pipelines join and at a maximum spacing of 100m centres. Where the main pipe exceeds 600 mm diameter, spacing may be increased to 150 m, and where the main pipe exceeds 1050 mm diameter, up to 200 m. For pipes over 1050 mm diameter curved lines may be approved, but Council shall be consulted about this at the design stage.

(b) Have a minimum internal diameter of 1050mm;

(c) Have a pre-cast base on the lowest riser. Cast in-situ bases are not acceptable except in the case of cast in-situ manholes Approved by Council.

(d) Consist of a single riser if shallower than 2.5m;

(e) Have joints between risers spaced a minimum 2.5m apart for manholes deeper than 2.5m;

(f) Where pipe sizes change at a manhole, the soffit of the outlet pipe shall be no higher than the soffit of the largest inlet pipe. The pipe sizes through a manhole shall not decrease in size.

(g) Have invert details that minimise energy loss. This shall include an invert channel which is at least the same depth as the outlet pipe. This channel shall be at the pipe gradient plus a minimum additional fall of 20 + 5mm per 10 degree of the angle of change of flow within the manhole. If the outlet cannot provide the required slope through the manhole, then the outlet shall be designed as a reservoir outlet with a head loss coefficient of 4 and a freeboard of 200mm to the lid or the invert of the incoming pipes at their inlets, at the design flows;

(h) Be stable under all load conditions likely to be imposed, including when completely empty;

(i) Where manholes are constructed in soft or unsuitable ground, the area under the manhole shall be excavated and backfilled with suitable granular fill.

(j) When installed on new fills or soft, under-consolidated soil, flexible joints 1.0m from the manhole on all inlets and outlets and / or have a larger pipe enclosing the inlets and outlets;

(k) Have non-slip step irons or a ladder installed over the outlet (or immediately alongside the outlet if its diameter is greater than 450mm). All steel components shall be galvanised.

(l) Manholes on pipelines of more than 900 mm diameter and on smaller pipelines where the use of standard manholes is not suitable, may be specifically designed utilising larger diameter manholes, cast in-situ reinforced chambers or a combination of the two.

(m) In areas where there is both stormwater and sewerage reticulation, stormwater manhole lids shall be painted blue and sewerage manhole lids shall be painted red.

6.3.9 Deep Manholes

(a) Where manholes are more than 5.0m deep they shall be specifically designed and shall incorporate intermediate landing platforms or grills not more than 3.0m from the surface and not more than 3.0m apart. These platforms shall be designed to carry two people with an adequate factor of safety.

6.3.10 Inlet and Outlet Structures

(a) Where stormwater drains discharge into open channels, the outlet shall be protected from scour. A suitable reinforced concrete outlet structure is shown on drawing S24. Other erosion protection, such as Reno Mattresses or stone pitching, may be installed as appropriate.

(b) Any inlets 375mm or greater in diameter without an alternative open exit point within 10m should have a grill fitted for child safety. Where appropriate, this includes securing manholes, and / or collection chambers (scruffy domes). Culvert outlets shall remain open or be hinged to allow objects to exit the system.

(c) All outlets shall comply with any Northland Regional Council requirements and, where adopted by Council, any Kaipara District Council stormwater management plan.

6.3.11 Sumps

All sumps shall:

(a) Discharge into a stormwater manhole unless Council or NRC consent is obtained for discharges to other sumps or direct discharges to waterways;

(b) Be designed as a reservoir and outlet with an outlet head loss coefficient of 4 (unless hydraulic calculations justify a lesser coefficient) and a freeboard of 200 mm to the top inlet at design flows;

(c) Have inlets designed in accordance with New Zealand Transport Agency's publication Highway Surface Drainage except that grates within carriageways at the edges of roads shall be perpendicular to the road centreline.

Guidance Note

Sump details are shown in drawings S28 to S30.

6.3.12 Soakage Pits

(a) Soakage pits may be used in free draining soils to reduce stormwater runoff. As soakage systems generally become less effective over time, where the stormwater system includes soakage systems, the overland flow paths shall be designed to take both primary and secondary flows with the freeboards specified in clause 6.2.3.

6.3.13 Domestic Connections

(a) Stormwater connections shall be located so that each property is serviced by gravity from ground level. All lots shall be provided with one stormwater connection.

(b) Residential service connections to a reticulated stormwater system shall be at least 150 mm diameter provided a grade of 1 in 100 (1%) can be achieved for a lot size of 800 to 1,000m^2. A 100 mm diameter connection may be used if the lot size is less than 800m^2. Specific design shall be carried out for lots larger than 1,000m^2.

(c) The connection provided for each residential lot shall be of a type capable of taking the spigot end of an Approved drainpipe of the appropriate size.

(d) The connection shall be positioned at sufficient depth to enable the entire buildable area of the property to be serviced, and to allow for the collection of surface run-off and the provision for field sumps and cut-off drains as required.

6.3.14 Commercial and Industrial Connections

(a) Connections for commercial and industrial lots shall not be less than 150 mm diameter discharging into a reticulated system and be designed to take the full design flow from the area served by the connection. All lots shall be provided with one stormwater connection.

(b) Service connections of diameter smaller than 300 mm (including leads 300 mm in diameter) may be saddled on to pipes 600 mm diameter and larger.

6.3.15 Testing

(c) The testing of stormwater mains or branch pipelines will not normally be required.

(d) Acceptance will be on the basis of the quality of materials and the standard and accuracy of construction. Pipelines shall be clean and free from debris.

6.4 Overland Flow Paths

6.4.1 Overland Flow Paths

The following requirements shall be met:

(a) All overland flow paths shall be designed to safely convey stormwater while maintaining the freeboards specified in clause 6.2.3.

(b) Overland flow paths shall be designed for an AEP storm of 1% (100 year ARI) as specified in clause 6.2.2(c).

Guidance Notes:

1. Overland flow paths include:

- *Drains and flood paths designed for primary and secondary stormwater flows in Rural areas.*
- *Swale drains designed for primary and secondary stormwater flows in Urban areas.*
- *A secondary stormwater system designed to carry stormwater flows in excess of the capacity of the primary system;*

2. Acceptable solutions include:

- *Temporary ponding on local and Collector Roads. Height and velocity should be such that the carriageway is still passable.*
- *Temporary flow along local and Collector Roads. Height and velocity should be such that the carriageway is still passable.*
- *All temporary ponding should drain away within 24 hours of the peak rainfall intensity.*
- *Flows across Council owned land such as Road reserves and recreational reserves.*

- *Flow across private property. Flow must be in a defined channel or swale, clear of existing or future building sites, and protected by easements or vesting in accordance with clause 6.1.2.*
- *Fencing should not be permitted across overland flow paths unless it is specifically designed to allow the passage of water.*

3. *Lots should generally be shaped such that they fall towards roadways which may be used as secondary flow paths. Where secondary flow paths cannot, with good design, be kept on roads, they should be kept on public land such as access ways, parks and reserves or designated by legal easements over private land. This design principle allows residential land to be used for its intended purpose free from the risk of flooding from overland flow paths.*
4. *Secondary flow paths should be designed so that erosion or land instability caused by the secondary flows will not occur. Where necessary the design should incorporate special measures to protect the land against such events.*

6.4.2 Open Drains

Guidance Notes:

1. *Where open drains are constructed, they should be designed to be stable, not prone to scour and able to be maintained, with adequate access for maintenance machinery. Generally concrete lined open drains will not be permitted.*
2. *Designs should be suitable to support and facilitate the movement of aquatic life. Planting adjacent to the waterways must be suitable to stabilise the banks without causing a maintenance liability in the future by their presence.*

6.4.3 Swale Drains

Swales drains shall be designed using the following design parameters;

(a) Maximum side slope of 6H : 1V

(b) Subsoil drains shall be provided in areas with a high Watertable.

(c) Shall be well vegetated with hardy grass species such as Kikuyu

(d) Vehicle Crossings shall be formed with maximum side slopes of 10H : 1V and shall be shaped to provide vehicle clearance in accordance with drawing S17.

(e) The swale drains shall be level with the Vehicle Crossing on either side.

(f) Swale drains surfaces shall be formed and maintained in a manner suitable for maintenance by conventional mowers. Surface armouring with concrete, rock riprap, Gobi blocks or check dams or similar will not be accepted by Council in Urban areas.

(g) Stormwater flows in swale drains shall comply with the following standards;

- For the 20% AEP event water depths shall not exceed 100mm, velocities shall not exceed 0.5m/s and water shall not remain on the surface for more than 1 hour following the cessation of rainfall.
- For the 1% AEP event velocities shall not exceed 1.5m/s

Guidance Notes:

1. *In low density residential areas, swale drains with field cesspits will generally be appropriate as the means of collecting stormwater from roads and lawns.*
2. *A combination of swale and piped system may be required to convey the necessary of quantity of water while complying with the Swale Drain design criteria.*

6.5 Stormwater Control and Treatment Devices Guidelines

Guidance Notes:

1. *In Urban areas, clause 6.1.1(a)(iv) will normally require the provision of on-site stormwater detention to attenuate post-development peak stormwater flows to no more than pre-development peak flows for storm events of up to 100 year ARI (1%AEP).*
2. *Where stormwater attenuation is required, stormwater detention ponds or basins should be provided to serve the entire site catchment. A proliferation of small stormwater ponds or individual detention tanks will not generally be accepted because they are not as reliable or efficient as larger detention ponds or basins.*
3. *When the final outlet from the new stormwater system is into natural waterways, stormwater treatment devices which provide water quality in accordance with the requirements of the NRC should be provided. These may include vegetative filter strips, coarse sediment traps or oil separators. Design should be in accordance with the Auckland Regional Council's Technical Publication 10 or other approved guideline.*
4. *When the discharge is into a Council-managed system, Council should be consulted as to water quality requirements and existing or planned treatment devices which the discharge may flow through. If no suitable Council-managed treatment devices exist or are planned, then the discharge should be treated as if it is being made into a natural water body (refer to the previous paragraph).*

6.5.1 Stormwater Detention / Treatment Ponds

Stormwater ponds are an accepted method of improving stormwater quality and reducing peak downstream flow rates.

Stormwater treatment ponds can be of two types:

- *Wet Pond – a permanent pond or wetland that has a standing pool of water. These ponds, through their normal storage of water, or in conjunction with extended detention, provide water quality treatment. They can, also in conjunction with extended detention, provide protection of downstream channels by attenuating peak stormwater flows.*
- *Detention Basin – a designed basin that temporarily stores stormwater runoff to control the peak rate of discharges and provide some water quality treatment, primarily through the incorporation of extended detention. These basins are normally dry between storm events and can be used for recreational purposes.*

Unless otherwise specified in the conditions of consent, stormwater treatment/detention ponds should be designed for:

- *A water quality volume of 1/3 of the 2 year -24 hour rainfall event in accordance with TP10;*
- *The reduction of post-development discharge rates to no more than pre-development discharge rates for storm events of 20, 10 and 1% AEP (5, 10 and 100 year ARI).*

All pond surrounds should be earth bunded, landscaped and grassed; the pond may need to be fully lined subject to soil permeability testing.

Ponds may require consent from the Northland Regional Council.

Specific points to focus on are:

- *Side slopes with safety considerations (recommended maximum 1:4 slope)*
- *Ease of maintenance including mowing and silt clean-out and access to public roads*
- *Shape and contour for amenity value*

- *An effective outlet structure*
- *Overflow Design*
- *Landscape planting and maintenance*
- *Pest Control.*

Stormwater treatment/detention ponds are required to be located on land owned by Council as specified in clause 6.1.2.

6.6 Stormwater from Industries Which Use Hazardous Substances

Guidance Notes:

1. *In industrial or commercial developments which deal with environmentally hazardous substances (e.g. service stations, electroplating factories, timber treatment yards), the stormwater system should be protected from the entry of any of the hazardous substances and comply with the Rules for Industrial or Trade Discharges in the Regional Water and Soil Plan for Northland.*
2. *If necessary, the development should be surrounded with a bund that will contain any spills, and from which the storm runoff can be treated separately before discharge to the trunk system. The water quality in all such discharges should be the same or better than the water quality requirements of Council's resource consent for the ultimate stormwater discharge.*

6.7 Building Over Pipelines

Guidance Notes:

1. *Buildings should not be constructed over pipelines. Alternative options such as relocating the building or diverting the pipeline around the building are required for new pipelines.*
2. *Buildings and other structures are not permitted within drainage easements or reserves vested with Council.*

6.8 Construction Requirements

The following requirements shall be met:

(a) All pipeline construction shall conform to the requirements set out in NZTA specification F/3, AS/NZS 3725:2007, AS / NZS 2566.2 or AS/NZS 2033:2008 as appropriate.

(b) Culvert bedding and backfill shall be in accordance with drawing S25. Scour blocks and pipe protection shall be provided as required in accordance with drawing S26.

(c) All excavations shall be kept dry. If subsoil or trench water is discharged to existing stormwater drains, it shall be free of sediment and other harmful contaminants. No water may be discharged into existing sewerage systems from the operation.

(d) Wherever possible, pipes shall be laid in straight lines between start and finish points, junctions, valves, changes of direction or changes of grade. Any curvature shall be gradual and even.

(e) In the case of pressure pipes, any horizontal or vertical curvature to minimise pipe depths shall be gradual and even, and shall not result in crests in the pipe where air could accumulate.

(f) Unsatisfactory foundation material shall be undercut and replaced with compacted granular material such that a suitable foundation is achieved.

(g) All pipes shall be laid on granular bedding material of clean, evenly graded GAP 5 aggregate. The depth of bedding material beneath the pipe shall not be less than

100 mm and in rock or rocky soils, the depth shall be increased to 200 mm. The granular bedding material shall be thoroughly compacted by hand tamper around and over the pipe to a height of at least 100 mm above the crown of the pipe.

(h) All pipes and fittings shall be thoroughly cleaned inside before use. Temporary open ends of laid pipes shall be closed with plates or flanges whenever work is discontinued to prevent foreign matter from entering the pipe.

(i) The ordinary backfill shall be placed in layers not exceeding 300 mm compacted depth, each layer thoroughly compacted to a firm, unyielding surface. Suitable material excavated to form the trench can be used, and sufficient additional material shall be imported.

(j) Where a pipe changes direction and a manhole is not installed, thrust blocks shall be installed. The blocks shall be sized to immobilise passive resistance. The soil at the bearing surface (whether pipe or block) shall be free of organic matter and thoroughly compacted against the bearing surface. Drawing S39 gives details of thrust blocks.

7. WASTEWATER RETICULATION AND ON-SITE TREATMENT

7.1 General

This section covers the Kaipara District Council requirements for the design and construction of wastewater reticulation, on-site treatment and associated structures.

Wastewater reticulation, including pump stations and rising mains and the connection of domestic and trade waste flows shall comply with Council's Wastewater Drainage Policy and Bylaw March 2009 and Council's particular requirements for each wastewater system. The Council is responsible for the strategic planning of the District's wastewater systems.

Design and construction should be in accordance in NZS4404:2010: Part 5 and the following standards and guidelines.

Design and Quality Assurance shall comply with Sections 1 to 3 of these standards and shall aim to minimise operation and maintenance cost.

All stormwater and groundwater shall be excluded from the reticulation system.

Connection of new reticulation to the existing KDC public reticulation shall only be carried out by KDC approved contractors at the land developer's cost. Connection of existing houses shall not be made until the private drainage system has passed a pressure test and all stormwater infiltration has been excluded.

7.1.1 Council Systems

Council operates wastewater reticulation and treatment systems in the following areas:

- Mangawhai
- Kaiwaka
- Maungaturoto
- Dargaville
- Te Kopuru
- Glinks Gully

Generally within these catchments all domestic wastewater shall discharge to the public reticulation.

The following requirements shall be met:

(a) Where subdivision or land development is within the area served by a Council system or an extension to a Council system is proposed, the written approval of Council's Asset Manager shall be obtained and provided with the application to confirm that the Council sewerage system can be extended to serve the subdivision or development. The Council is responsible for the assessment and approval of the Developer's detailed design of proposed extensions to the sewerage system.

Council will advise the Developer's designer of any limitations that may exist to the number of sections, peak flows or timing of flows that may exist.

If the existing network does not have sufficient capacity at the nominated connection location to receive the number of sections or peak flows from the development, the Developer will either need to:

- Design and construct an appropriately sized attenuating storage to reduce peak flows to level compatible with the network.
- Convey sewage to a different location in the network where adequate capacity exists.
- Pay for the required upgrade to the system.

(b) The Resource Consent application shall include a contoured concept plan showing current and future potential development proposals and proposed staging.

(c) Following the granting of the Resource Consent the Developer shall contact Council to obtain information on flow estimation methodology, discharge point and requirement for integrating the proposed new work into the existing system.

(d) The Developer shall undertake the design and construction of the proposed extension to the sewerage system using the services of a CPEng experienced in wastewater engineering, who will certify that the design and construction is in accordance with the standards.

7.1.2 Vesting and Easements

The following requirements shall be met:

(a) All wastewater pipelines, pump stations and rising mains serving more than five single dwelling units shall be vested with Council unless a management entity to own operate and maintain the system has been Approved by Council.

(b) Wastewater systems to be vested with Council that are not contained within roads shall be within reserves vested with Council or easements in gross in favour of Council. The minimum width of the land to vest or easement shall be 3.0m.

(c) Where a private sewer crosses a neighbouring property or properties, an easement shall be provided in favour of the servient lot.

(d) All sewage pump stations servicing more than one property shall be on their own separate lot and vested in Council or, where a management entity has been Approved by Council to serve a number of lots, a separate lot owned by the management entity.

7.2 Design Criteria

7.2.1 Design Flows

The following requirements shall be met:

(a) Domestic wastewater flows shall be calculated in accordance with NZS4404:2010 clause 5.3.5, domestic wastewater flows for reticulated wastewater systems on the following basis:

i. Average Dry Weather Flows – 210 litres / day / person

ii. Number of Persons per Household Equivalent – 4.

(b) Industrial flow and Trade Waste shall be calculated as follows:

i. When the industrial waste and Trade Waste from a particular industry are known, these shall be used for the sewer design;

ii. When this information is not available, the dry weather flow rates shown in Table 7.1 may be used as a design basis for industrial area.

Table 7.1: Default dry weather flows from industrial areas

Minimum Design Flow	Flow Rates (l/s/ha)
Light Water Usage	0.4
Medium Water Usage	0.7
Heavy Water Usage	1.3

Guidance Notes:

1. *For the purposes of treatment and disposal system design these commercial and industrial flows shall be taken to occur for ten hours per day. The design shall take note of any factory with a production cycle more than ten hours.*
2. *For domestic occupancies peak design (wet weather) flow rates shall be advised to the designers by KDC based on site specific circumstances. For non-domestic occupancies peak factors shall be determined by the designers based on site specific assessment.*
3. *Dry weather peak flow should be taken to be 2.0 times average daily dry weather flow. This can be reduced for larger catchments where it can be demonstrated that, because of flow routing effects, these peak flows are not possible.*

7.3 Reticulated (Gravity) Sewerage Systems

The requirements of clauses 7.3.1 to 7.3.7 shall be met in the design and construction of reticulated gravity sewerage systems connected to a Council wastewater system and/or vested with Council:

7.3.1 Reticulation Layout

(a) Wastewater reticulation shall be located within Council Roads and private ways unless it can be demonstrated that this is not possible. Any deviation from this alignment will require approval from the Development Manager.

(b) Where practicable, reticulation shall be located in the Road berms. Where the reticulation lines are located in the front yard of lots, the invert level of the sewer pipes shall be deep enough so as not to interfere with any future driveway construction.

(c) New public sewers shall be located at least 1.5m clear of existing buildings plus any additional setback specified in clause 8.2 of Council's Wastewater Drainage Bylaw March 2009.

(d) Sewerage systems shall drain by gravity wherever practicable. Private wastewater pump stations will be Approved only where there are no practical alternatives for a gravity flow to the public sewer.

(e) Pipeline crossings of rivers shall be via public road bridges. If this is not possible, then Council shall be consulted about alternatives.

(f) All new pump stations, manholes and maintenance structures shall be installed clear of boundary lines and new boundary lines shall be clear of all existing pump stations manholes and maintenance structures.

(g) The designer shall determine the alignment and the diameter of sewers on the basis of the ultimate number of sections that can discharge into the length of sewer under consideration. The ultimate number of sections will include:

- Future stages within the development.
- Future subdivision of sections to the minimal size permitted by Council.
- Flows from existing or future sections from neighbouring or upstream parcels of land (as advised by Council).

In choosing the alignment of the sewers in areas of high groundwater, consideration shall be given to the potential for infiltration of groundwater into the sewers. In such instances Council may direct that either:

- Low pressure sewer systems be adopted or
- Alternative gravity sewer alignments be chosen to reduce the risk of groundwater infiltration.

7.3.2 Hydraulic Design

(a) The hydraulic design of wastewater pipelines shall be based on the Colebrook-White or Manning formulae.

(b) The flow velocity in gravity reticulation shall be not less than 0.65 m/s with 0.75 m/s as the desirable minimum velocity. Unless the catchment has Ultimate Development exceeding 250 household equivalents, and where no flow from a pumping station is involved, 150mm diameter pipes laid no flatter than 1 in 180 (0.55%) will be adequate without specific hydraulic design.

(c) All pipeline construction shall conform to the requirements set out in NZS 2032:2006 (PVC pipe systems) or NZS 2033:2008 (PE pipe systems).

(d) External scour protection blocks, to draining S33 (Steep Pipe Details) or in accordance with a specific design carried out by an Approved IQP, shall be provided along applicable pipelines.

(e) Rising mains shall be specifically designed with flow velocities within the range of 1.0m to 2.0m per second.

(f) Detention times shall be minimised by avoiding the use of pumping stations wherever practical.

(g) Unnecessary turbulence shall be avoided at junctions and changes of grade.

Guidance Notes:

1. Coefficients for use in the Colebrook- White formula are as follows:

Table 7.2 Coefficients for Gravity lines

Material	*Colebrook-White Coefficient K(mm)*	*Manning roughness coefficient (n)*
VC	*1.0*	*0.012*
PVC	*0.6*	*0.011*
PE	*0.6*	*0.011*
GRP	*0.6*	*0.011*
Cement lining	*1.0*	*0.012*
PE or epoxy lining	*0.6*	*0.011*
NOTE: *These values taken into account effects of rubber ring joints, slime, debris etc.* *The K values apply for pipes up to 300mm nominal diameter*		

2. Calculation methods other than the Colebrook-White or Manning formulae will require approval by Council at the initial design stage.

3. All pipelines should be specifically designed to carry all forces and flows expected to be applied to them, in accordance with the manufacturer's recommendations.

4. In potentially unstable ground, filled ground, and in marine locations or where special protection is required, the wastewater pipelines shall be specifically designed. In flat or rolling country every effort should be made in the design to have the gradient of the wastewater pipes as steep as reasonably possible.

7.3.3 Pipe Materials (**Refer also NZS 4404 Table 4.3)**

(a) Gravity Sewer Pipes shall be:

- PVC-U pipe to AS/NZS1260:2009 Class SN 6 (DN 100), SN 8 (DN 150 or larger);
- PE 80 or PE 100 pipe to AS/NZS 5065 SDR17

Pressure Sewer pipes shall be

- PVC-U pipe to AS/NZS1477:2009 (minimum Pressure Rating PN 9), PVC-O to AS / NZS 4441 (minimum Pressure Rating PN 10) or PVC-M to AS / NZS 4765:2007
- PE 80 or PE 100 pipe to AS/NZS 4130:2009 (minimum Pressure Rating PN 10)
- All pressure sewer pipes shall include specific design for dynamic stresses (fatigue)

(b) Low Density Polyethylene pipe (Alkathene) or any PE pipe not fully compliant with AS / NZS 4130 shall not be used.

(c) PVC pipe sections shall be joined by rubber ring joints. PE pipe shall have electrofusion or butt welded jointing. Steel pipes shall be welded.

(d) Steel or DI pipe may be used for sleeving of uPVC or PE pipe.

7.3.4 Minimum Pipe Sizes

(a) The minimum sizes of property connection and reticulation pipes shall be not less than those shown in table 7.3 below.

Table 7.3 Minimum pipe size for wastewater reticulation and property connections

Pipe	**Minimum Diameter (mm)**
Connection servicing 1 Household Equivalent	100
Connection services more than 1 Household Equivalent	150
Connection servicing Business and Residential lots	
Reticulation servicing residential lots	

7.3.5 Minimum Pipe Gradients

(a) All gravity pipes shall be self cleaning. This shall be achieved by providing minimum grades as specified in the following tables.

Table 7.4 Minimum Grades for Wastewater Pipes

Pipe Size DN	Population	Absolute minimum grade (%)
150	Up to 12	1.0
150	60	0.67
150	160	0.55
150	>160	0.50

225		0.33
300		0.25

Table 7.5 Minimum Grades for Property Connections and Permanent Ends

Situations	Minimum Grade (%)
100mm diameter property connections	1.65
150mm diameter property connections	1.20
Permanent upstream ends of DN 150, 225 and 300 pipes in residential areas with populations ≤20 persons	1.00

7.3.6 Minimum Cover over the Pipe

(a) All pipes on private residential property shall have a minimum cover of 750mm from the top of the pipe to the ground level. For non-residential property the minimum cover shall be 900mm. An exception is for concrete Vehicle Crossings where 300mm cover is allowed.

(b) No pipes shall be installed at a depth of greater than 4.0m.

Guidance Note

1. Alternative depths may be approved with supporting documentation. This will be dependent on pipe type and class, location, bedding and length.

7.3.7 Pressure Sewers (Rising Mains)

(a) Rising mains shall meet the requirements for the construction of water supply pipes in NZS4404:2010:2004 Part 6 except that disinfection is not required.

(b) In the case of pressure pipes, any horizontal or vertical curvature to minimise pipe depths shall be gradual and even and shall not result in crests in the pipe where air could accumulate.

7.3.8 Sewers in unstable or slip prone areas

Guidance Notes:

Unstable or slip prone areas have the potential to promote:

- *Opening up of pipe joints with the consequence that groundwater, roots, and soil enter the sewer system.*
- *Movement of pipe to allow backfall to occur with the consequence that putrescent material accumulating along the sewer and generation of odours.*
- *Passage of groundwater may wash away bedding material leading to deformation of pipe.*

Where such conditions are encountered, the Developer should, as appropriate, implement:

- *Pipe jointing systems that ensure that the joint can remain water tight.*
- *Pipe foundations that ensure that the design pipe grade is maintained throughout the live of the pipeline.*
- *Bedding and surround designs that maintain adequate pipe support.*

7.4 Manholes and Maintenance Structures

The requirements of clauses 7.4.1 to 7.4.5 shall be met in the design and construction of reticulated gravity sewerage systems connected to a Council wastewater system and/or vested with Council:

7.4.1 General

(a) Manholes shall be constructed on wastewater pipelines over 200mm diameter to best practice in accordance with Drawings S31 and S32 and the manufacturer's requirements. Sulphate Resistant Cement shall be used. Where surface flooding or surcharging of sewers is possible Council may require bolt down manhole covers to be installed.

(b) Poo Pits (Drawing S34) shall be provided in place of Manholes on wastewater pipelines up to and including 200mm diameter.

(c) Manholes or Poo Pits shall be provided in the following situations;

- At a change of direction or gradient
- At each branching wastewater pipe line
- At each end of rising mains (unless the main terminates at another pump station)
- At a spacing of not more than 100m

(d) In areas where there is both stormwater and sewage reticulation, stormwater manhole lids shall be painted blue and sewerage manhole lids shall be painted red.

(e) Other maintenance structures shall be manufactured from rotationally molded Linear Medium Density Polyethylene. The product shall have been technically appraised by a New Zealand or Australian Water agency for compliance with AS/NZS 4798 2005 (or similar UK standard). A successful product appraisal by WSAA (Water Service Association of Australia) is acceptable.

The appraisal should state the tests undertaken for each relevant property, QA processes used, field testing results for a range of conditions, and the findings/recommendations of the testing agency. Properties of interest include items such as thermal stability, tensile strength, slow crack growth resistance, creep rate under test conditions versus that predicted by a finite element analysis, capacity of jointing systems to resist tree root intrusion and life expectancy.

7.4.2 Deep Manholes

(a) Where Manholes are more than 5.0m deep they shall be specifically designed and shall incorporate intermediate landing platforms or grills not more than 3.0m from the surface and not more than 3.0m apart. These platforms shall be designed to carry two people with an adequate factor of safety.

7.4.3 Drop Connections

(a) Manholes which have a drop in excess of 500 mm from the soffit of any inlet to the soffit of the outlet shall have a properly constructed drop connection into the base of the manhole. For pipe sizes up to 250 mm diameter this shall be in accordance with Drawing S32. Drops in larger diameter pipelines shall be specifically designed to achieve all performance criteria of this document.

7.4.4 Step Irons

(a) Step irons shall not be provided in sewer Manholes.

7.4.5 Maintenance Shafts and Inspection Shafts

(a) Maintenance shafts shall be located such that they are likely to be accessible by jetting or CCTV equipment.

(b) A separate water tight screw on cap is to be fitted on the vertical riser shaft.

Guidance Note:

The lid and cover design for maintenance shafts and inspection shafts allow the surface fittings to move independently of the vertical riser shaft. In this way, disturbance to the surface fittings will not impact on the vertical riser shaft.

7.5 Construction and Testing

The requirements of clauses 7.5.1 to 7.5.6 shall be met in the design and construction of reticulated gravity sewerage systems connected to a Council wastewater system and/or vested with Council:

7.5.1 Manhole Testing

(a) All Manholes shall be completely watertight including covers, frames, adjustment rings and lids and shall require testing at the Council's direction. The test involves plugging and filling the manhole with water (including time allowed for absorption).

(b) On inspection of the test the level of water in the Manhole shall not drop more than 10 mm per metre depth of the Manhole per hour.

(c) There shall be no evidence of weeping of water into manholes.

7.5.2 Sewer Pipeline Testing

(a) Each separate pipe shall be set true to line and grade and each joint shall be completed before the next section of pipe is commenced. All sewers shall be flushed clear of mud and debris. The Contractor shall ensure that neither the flush water nor the mud/debris enters the operating Council network.

(b) During pipe laying and when each pipe is completed, but prior to testing, the contractor shall check the invert levels of the laid pipes. The following level tolerances apply:

- Maximum deviation per length of pipe from grade: +/-3mm with no backfall at any point.
- Departure from grade between two points 8 metres apart: not more than 6mm.
- Departure from invert level at any manhole, maintenance shaft or inspection shaft: 10mm higher or 50mm lower.

If these tolerances are exceeded, the Developer shall notify Council prior to continuing with construction of the next line and agree with Council on appropriate remedial action.

(c) All wastewater pipes including connections shall be tested before the joints are backfilled. There shall be no water in the trench above invert level. New wastewater reticulation shall be completely and permanently isolated from the "live" sewer reticulation, until all the tests are passed, and authority from the Council to connect to the live sewer is obtained. The pipeline test procedure is as follows:

The use of the standard low pressure air test (to 300mm water head) is not approved.

All sewers are to be air tested as follows:

- 100mm and 150mm diameter sewers tested to 28 kPa pressure for 6 minutes with zero allowable pressure drop.

- 225mm and 300mm diameter sewers tested to 28 kPa pressure for 9 minutes with zero allowable pressure drop.

Testing shall be undertaken using air introduced to the sewer via a compressor. Testing plugs shall be securely positioned and tommed within manholes to safeguard against blowout under pressure. The testing gauge shall be available to Council representatives for examination.

The Developer shall allow Council representatives to witness the filling of the sewer with air, the test pressures achieved and the release of air after testing.

All leaks shall be identified and repaired. Air testing will be repeated until a successful test is achieved.

7.5.3 Infiltration Testing

7.5.4 Adopt field test requirements of NZS 4404:2010 Appendix B 2.1.1

(a) All sewers shall be tested for infiltration. The allowable quantity of water that can enter the sewer per day per kilometer length is:

- Zero for sewers with the free standing groundwater level no more than 1.5 metres above the sewer invert level.
- 5 litres per mm diameter for sewers with invert levels more than 1.5 metres below the free standing groundwater level.

7.5.5 Ovality Testing

(a) No earlier than 14 days after the completion of backfilling of sewer trenches, the sewer line shall be tested for ovality. The maximum deflection is 3% of the internal pipe diameter. This procedure is detailed in AS / NZS 2566.2.

7.5.6 CCTV Testing

(a) All sewers shall be examined by CCTV to confirm:

- All debris has been removed.
- No ponding of water exists in the sewers.
- No defects exist in the jointing or pipes.

7.5.7 Backfill Compaction

(a) All sewer trenches shall be tested to Council's specified compaction standard. Particular care shall be taken to ensure that:

- The specified compaction is achieved around property service connections, manholes, maintenance shafts and inspection shaft.
- The compaction method does not adversely affect the integrity of the structures.

7.6 Reticulation (Low Pressure)

Several areas of the district are or may be serviced by Low Pressure Sewers. This system is also known as a Grinder Pump System. The system operates by way of each property pumping sewage into a small diameter pressure pipe network which discharges either to the downstream gravity sewer network or into a communal pump station.

The requirements of clauses 7.6.1 to 7.6.7 shall be met in the design and construction of low pressure reticulated sewerage systems connected to a Council wastewater system and/or vested with Council:

7.6.1 Design Standards

The design of Low Pressure Sewer systems shall be to the following code:

- WSA – 07 2007 “Pressure Sewer Code of Australia”

References in the code to the “Water Agency” mean Kaipara District Council. The specific requirements, practices and standards of Council are described in the paragraphs below.

The following sections have requirements in addition to those set out in WSA 07:

Pressure Sewer Systems
The Grinder Pump System is the approved pressure system. The system includes three components:

- Grinder Pump:- a pumpwell with macerating pump. Where a development incorporates an existing house, the Developer shall design and install the grinder pump in accordance with these design standards as part of the sewer conditions applying to the development. For vacant sections in a development, the grinder pump will be designed in accordance with these design standards and be undertaken as part of the building consent process. Council will not own or operate the grinder pump.
- On Property pipework:- a small diameter pressure pipe will convey macerated sewage from the grinder pump to a boundary kit located at the property boundary. Council will not own or operate this pipe. The boundary kit will be owned by Council.
- Pressure pipe network:- located in the street terminates with a boundary kit at each property. Together, the pressure pipe network and the boundary kit form the public sewer network.

The use of septic tank effluent pump (STEP) systems is not approved for new developments.

Scope
Council will be responsible for:

- The high level strategic planning of sewer infrastructure for the Mangawhai Community or other Council Scheme
- The assessment and approval of detailed designs for sewer infrastructure
- Undertaking all live sewer connection works (cost of which is to be borne by the Developer)

Council may engage external engineering consultants to carry out these responsibilities.

The Developer is responsible for:

- Undertaking the detailed design, construction and installation of sewer infrastructure for his project (provide the “Designer”)
- Ensuring that the detailed design shall be undertaken by a professional engineer with specific experience in the design of Low Pressure Systems
- Satisfying Council that the constructed sewer infrastructure has been designed and constructed in accordance to the Engineering Standards.
- Defects maintenance

Planning and Design Responsibilities and Interfaces
The Developer shall provide Council with a Concept plan showing:

- Current development proposal
- Potential future development of balance sections
- Approach to staging of development
- Contour plans of the total development area

Council has a strategic plan for the sewer infrastructure required to service the Mangawhai Community Wastewater scheme.

This concept will be modified from time to time as developments proceed. In some instances Council will seek input from Developers to assist in its periodic reviews of its strategic plan.

Council will advise the Developer of the strategic plan for the parcel of land subject to development and will provide the Developer with the following information:

- Flow estimating methodology
- Collection/pump unit type
- Discharge point
- Requirements for integrating the infrastructure within the development into the Council system.

Council will advise the Developer whether Gravity or Low Pressure Sewer systems are required or whether any other Developer has any discretion in the choice of systems for the proposed development.

Low Pressure Sewer systems will be adopted when:

- Council's strategy for the development and abutting areas is for a Low Pressure network to be adopted, or
- Sewage from the proposed development discharges into a Low Pressure Sewer network, or
- Environmental or physical constraints cause trenched gravity sewers to be inappropriate for the location.

In some instances Council may direct that a combination of Gravity and Low Pressure Systems must be adopted.

Sewer Systems Design Approach
In addition to the objectives set out in 1.6.2 of WSA 07, Council requires that its customers receive the following level of service from the sewer system:

- All domestic wastewater is catered for
- All stormwater (groundwater and surface water) is excluded from the sewer system
- Provision of 12 hours of emergency storage with grinder pumps

Design Responsibilities
The Concept plan provided by Council will be of a high level strategic nature.

The Concept design referred to in 1.7.2 of WSA 07 will be prepared by the Developer.

7.6.2 Concept Design

The following sections have requirements in addition to those set out in WSA 07:

Materials Design
The pressure pipe network will be constructed using PE80 and PE100 pipe with a minimum pressure rating of PN12.5.

Isolation valves shall be fusion bonded epoxy coated and resilient seated gate valves.

Septicity Control
The Developer's design submission to Council shall include calculations of the detention time in each pipeline in the Developer's network.

Commissioning Plan

After completion of construction and prior to acceptance of the system by Council the Developer shall:

- Flush all matter from the piped network
- Fill the piped network with water
- Pressure test (using water) the piped network using a testing method that accounts for creep and assesses the rate of pressure decay over time.

The "Poliplex Polyethylene Pipe Design Textbook", Iplex Pipes Pty Ltd describes the required testing procedure.

7.6.3 General Design

The following sections have requirements in addition to those set out in WSA 07:

Design Tolerances
Reference to MGA, GDA and AHD is removed. Horizontal and vertical survey control shall be recorded to NZGD2000.

Environmental Considerations
In addition to meeting these design standards, the Developer's design shall comply with the requirements of Resource Consent conditions and Archaeological requirements

Easements
Pressure sewers shall not be located within private property.

7.6.4 Hydraulic Design

The following sections have requirements in addition to those set out in WSA 07:

Gravity Systems
The designer will ensure that the pressure pipe network does not have any free draining sections in it. When submitting the design to Council for review, the Developer's designer shall include sufficient topographic data to demonstrate that the piped network will remain full at all times.

Design inputs and Outputs
The probability design method is an acceptable method for designing grinder systems unless the limitations noted in section 4.4.4.1 of WSA 07 apply.

During the Developer's design process Council will nominate the interface point on Council's existing system that the Developer needs to convey sewage to, the pressure in the Council's system at the interface point and flow limitations that might apply.

Design Flows and their Variability

Sanitary Flows
For domestic properties each section shall be designed to:

- Accommodate 4 people
- Average daily flow rate of 210 litres per person per day

When estimating flows, allowances shall be made for future subdivision of all lots to the minimum permitted size.

For non-domestic occupancies, the Developer shall provide hydraulic computations to Council justifying the expected flowrate. To provide for future change in occupancy, the assessed flowrate shall be a least equal to the flowrate determined from the flow section of this standard.

Infiltration and Inflows
The grinder pumpwell shall be designed to prevent ingress of infiltration and inflows.

Existing houses will not be connected to the system until all drains discharging into the grinder pumpwell have been:

- Pressure tested to verify that they are water tight
- Separated from any stormwater drainage pipes

Peak flows from houses and required pumping rates
Pumped discharges from swimming pools into the pipe network are not permitted.

For non-domestic occupancies, the Developer shall provide hydraulic computations to Council justifying the expected peak hourly flowrate.

Design Flows
The Developer's design submission to DKC shall include calculations of the design flows adopted for each pressure sewer line.

Sizing of Pressure Sewers
Council may direct the Developer's designer to increase the diameter of pressure sewers to account for adjoining developments or on the basis of its own operation experience.

7.6.5 Pressure Sewer Design

The following sections have requirements in addition to those set out in WSA 07:

Valves
Isolation valves shall be installed at the junction between each pressure pipe.

7.6.6 On Property Design

The following sections have requirements in addition to those set out in WSA 07:

Property Sewer Service Diagram
The Developer shall provide Council with as constructed records showing:

- Coordinates of each bend in the pipeline network, junction, stop valve, air valve and flushing point
- Offset of each pipeline from the property boundary
- Record offsets at each location where the offset changes
- Pipe diameters, material type and class with limits for each type clearly shown
- Coordinates of each boundary kit
- Location of any Collection Pit installed as part of the Developer's works

Where the pipes are laid in a curve, the tangent points, inflexion points and radius of the curve shall be recorded.

The Developer shall obtain from Council details of its GIS specification to enable Council's laying, line type and text conventions to be complied with.

Design Tolerances
Reference to MGA, GDA and AHD is removed. Horizontal and vertical survey control shall be recoded to NZGD2000.

Vacant Lots
Boundary Kits will be provided at each vacant lot to facilitate connection of new houses to the system after the pressure network becomes live.

7.6.7 Collection/ Pump Units

The following sections have requirements in addition to those set out in WSA 07:

General Design Requirements
The collection tank shall be

- Manufactured from UV stabilised heavy duty polypropylene

- A single piece tank
- Fitted with a lid with a seal capable of resisting water ingress to a flood level of one metre above lid
- Manufactured with pre-set inlet connection points

The pump shall be:

- Progressive cavity / helical rotor type
- Mounted in a dry well recess at the top of the collection tank
- Easily accessible from the surface for maintenance purposes
- Capable of reducing sewage solids to a size of 1 to 2 mm
- Fitted with overload protection via over temperature protection

The pump controller unit shall have the following alarms:

- Over pressure or over current :- to prevent pressure in rising main exceeding its capacity
- Maximum pressure / current trips:- trips when the number of pressure trips exceeds a preset value
- Exceed maximum run time :- to present the pump running longer than its maximum period
- Exceed maximum pump starts per hour: - to prevent the pump from starting more frequently than it is designed for
- High level:- to alert landowner that sewage level has risen above alarm level
- Visible flashing alarm

The boundary kit shall consist of:

- Isolation valve
- Flushing access point
- Check valve
- All valves will be made of stainless steel

Emergency Storage
The collection / pump units shall have a minimum of 600 litres emergency storage between the high level alarm level and the overflow level

Location
Each lot shall have its own collection / pump unit.

Maximum Flows to Collection / Pump Units
The maximum inflow into the collection pit is limited by:

- The duty of the pumps
- The maximum pump run period
- The minimum rest period between pump runs

Over the course of the peak hour, the maximum pump rate shall be 0.5 L/s

For non residential connections, the designer shall provide additional storage to attenuate the peak inflows.

7.7 Wastewater Pump Stations

The requirements of clauses 7.7.1 to 7.7.16 shall be met in the design and construction of wastewater pump stations connected to a Council wastewater system and/or vested with Council. If there is insufficient detail in the Standards in this section the Council will advise of appropriate standards. In the absence of such advice WSA 04 2005 shall apply.

7.7.1 General

All pumping stations shall be specifically designed to the approval of the Council and the requirements of the following sections. Early consultation with Council is advisable to identify any additional specific requirements for the proposed station.

The Developer shall:

- Provide detailed commissioning of the pump station in the presence of Council operations staff prior to handover of the pump station to Council.
- Provide operation and maintenance manuals to Council written specifically for the pump station.
- Pay Council for any costs incurred by Council during the Developer's defects liability period in responding to:
    i. System faults and failures apart from normal operational matters.
    ii. (power supply outages or brown outs excluded).
    iii. (routine maintenance excluded).
    iv. (landowner misuse excluded).

Where it is determined that a pump station is required to service the development, Council will determine the location of the pump station so that it:

- Provides best service to the future staging of the development.
- Provides best service to the surrounding region.
- Accords with Council sewer strategy for the district.

Council will advise the Developer of design details such as:

- The invert level of future incoming gravity sewers.
- The site for the pump station.
- The general requirements for vehicular access.
- Provision for current and future emergency storage.
- Discharge point for rising main into the existing system.

The key performance objectives of the pump station design are

- Compliance with Resource Consents
- Water tightness
- Corrosion protection
- Odour minimisation and mitigation
- Minimisation of maintenance costs
- Design to allow operation to meet a high standard of Health and Safety.

Unless otherwise specified by Council's Asset Manager, the requirements of clauses 7.7.2 to 7.7.16 below shall be met.

7.7.2 Pump Station Site

All sewage pump stations servicing more than one property shall be on their own separate lot and vested in Council or, where a management entity has been Approved by Council to serve a number of lots, a separate lot owned by the management entity.

Where there are multiple inlet sewers they shall be collected in a satellite manhole with a single inlet connection to the pump station. A knife gate valve shall be connected within the wetwell and the inlet pipe shall have a vertical drop pipe designed to control turbulence.

All-weather vehicle access shall be provided to all pump stations. This access shall, as a minimum, include an easement in gross in favour of Council over an area 4.0m in width between the component and the nearest public Road. In addition, all-weather access shall be provided to within 10m of all sewage manholes. A hardstand area shall be provided for maintenance of the pump station including temporary power generation. The surface between the top of the pump station and adjacent shall be landscaped and the station shall be protected with bollards.

7.7.3 Pump Station Services

Pump Station power supply shall be three phase and entirely underground. All power shall be supplied and connected in accordance with the Electricity Act. The pump motors shall be adequately protected from electrical power surges or phase failures.

All pump stations shall have a fresh water supply from a standard 25 mm connection at a minimum static pressure of 300 kPa. If the same water supply is used for drinking, backflow prevention shall be provided in accordance with the NZ Building Code approved Document G12.

7.7.4 Odour Control

The pump station designer shall assess the potential for unacceptable odour to be released at the pump station when in operation and shall provide a satisfactory odour control system as necessary. The system chosen shall be reliable, suitable for a transient population, able to achieve consistent public satisfaction and minimise operator input.

7.7.5 Chamber Design

All pump stations and valve chambers shall comply with the following requirements:

- The chamber shall be circular and sized large enough for ultimate development conditions.
- The chambers shall be constructed with high durability reinforced concrete using sulphate resistant cement with a minimum content of 345 kg/m^3 cement.
- The pump chamber shall be stable under all load conditions likely to be imposed, including when the chamber is completely empty.
- A lockable galvanised steel, stainless steel or marine grade aluminium hinged, water tight lid covering an opening of 600 mm (minimum) clearance and able to be opened by a single person by hand, shall be provided in the top of the wet well and over all storage tanks. The size and position of the opening(s) shall provide for direct and easy removal of the pumps and valves. The opening shall be fitted with a removable grill or other fall hazard protection.
- All pump stations shall have cast iron, stainless steel or marine grade aluminium lids that require a standard manhole key to open them. The lids shall be fitted with neoprene seals.
- The pump well, valve chamber, power box and all control boxes shall be lockable.
- The valve chamber shall have a drain connection to the wet well with a water trap.
- The minimum lid level selected shall be such that inundation of the station will not result from flood waters or sea levels during a 100 year storm (1% AEP).

- The top surface of the station, and its electrical equipment and switch board, shall be located above all possible flood water levels and shall be raised at least 500 mm above the surrounding ground level. Alternatively, the entire station shall be bunded to prevent flood water reaching it or the wells shall be made completely water-tight and the electrical controls located in a remote location above all possible flood levels.
- All pipes and fittings shall be thoroughly cleaned inside before use. Temporary open ends of laid pipes shall be closed with plates or flanges whenever work is discontinued to prevent foreign matter from entering the pipes.
- All fittings shall terminate with a flange on both sides, including fittings which are joined to other fittings. Where fittings are located in on-line positions flexible (gibault) joints subject to approval of the Council may be permitted. Flanges shall be in accordance with AS/NZS 433 1.
- The maximum velocity through a valve which is used for permanent flow control shall be 3 metres per second.
- Mass concrete benching shall be installed in the base of the well to direct solid material towards the pump inlets and to reduce the detention time in the well. The slope of the benching shall be 1:1. Where the benching interfaces with the wet well wall, the wall will be scrabbled to ensure sound bonding of the mass concrete with the wall.
- The lid opening for the valve chambers shall be sized to allow all valves to be removed and lifted directly out of the chamber

7.7.6 Emergency Storage Design

Emergency storage shall be provided in accordance with the controlled activity rules of the Regional Water and Soil Plan for Northland for the Ultimate Development of the station catchment. The design requirements of pump stations shall also apply to emergency storage.

All pump stations shall have a gravity storage chamber capable of holding at least twelve hours average dry weather flow (based on full catchment development) in the case of an emergency. Storage within the pipe system is not considered part of the twelve hour storage requirement.

Emergency storage tanks shall be self draining back into the wet well by gravity.

Key points in the design are:

- The overflow structure within the pump station include a vertical tee so that sewage enters the overflow through the bottom opening of the tee. This allows:
  i. Floatable matter to continue to rise, outside the tee, to the overflow level and
  ii. Minimises the amount of floatable matter being drawn into the emergency storage.
- The vertical tee on the overflow structure shall have its top opening open, so that in the event that the bottom opening become blocked, sewage could still escape into the storage.
- The inlet structure within the storage shall include a vertical tee, drop pipe and bend to direct sewage onto the invert of the storage and reduce turbulence.
- The return pipeline from the emergency storage back into the pump station shall be:
  i. Set at the invert level of the emergency storage to ensure all matter in the storage can be washed back into the pump station.

ii. Fitted with a stop valve which will normally be closed, but will be opened when emergency storage is being drained.

- The storage shall be fitted with manhole openings and covers to allow inspection and insertion/manoeuvring of cleaning hoses into the storage.
- The manhole covers are to be standard or heavy duty covers of the type used for sewer manholes. They shall be greased to seal them from ingress of water or egress of sewer gases.
- The storage shall be graded towards the return outlet to prevent water ponding permanently in the storage.
- Manhole openings on the storage will be provided over:
  i. The storage outlet.
  ii. The other end of a piped storage.
  iii. The far side of a tank storage (for the purpose of providing ventilation and light during cleaning).
- A sump will be provided at the storage outlet to allow a temporary pump to assist in the removal of all water.
- Sufficient area (as agreed with Council) will be set aside at the site to enable the storage to be increased in size in the future if:
  i. Future development occurs in upstream gravity catchments.
  ii. In service system performance demands additional storage.
- If a piped storage option is chosen it shall be either the Hynds Retention Tank system with Mul-T-Level outlet or similar style approved by Council.
- Consideration shall be given by the designer to where the system overflow point will be, in the event that the emergency storage fills completely. The objective is to ensure that in the extreme event that system overflow does occur:
  i. The location is not within private property or environmentally sensitive areas.
  ii. Does not escape into the storm drainage system.
  iii. Can be contained within a small region where it can be cleaned up without causing an uncontrolled nuisance.
- The emergency storage will be fitted with level control monitoring that will report to the central telemetry communications center that the emergency storage is approaching full storage.

7.7.7 Emergency Storage Overflow

The maximum level at which the overflow shall operate is a minimum of 500mm freeboard to the lowest manhole lid within the pumped catchment under peak flow conditions.

7.7.8 Pump Design

All pumps shall comply with the following requirements:

- The pumping equipment shall be Flygt submersible pumps or approved equivalent with non-clogging impellers that have a minimum 76mm outlet orifice.
- Each pump shall:
  - Provide a minimum pumping velocity of 0.9m per second in the rising main;
  - Deliver the design peak flows from the ultimate catchment development;
  - Be self seating. Dry mounted pumps shall be free-standing on concrete plinths.

- Be removable and re-installable from above, by hand, by a single person. If each pump weighs more than 20 kilograms, guide rails and a rotating winch shall be included;
- Have macerating impellers for rising mains less than 80 mm diameter;
- Have backflow prevention and isolating valves on their outlets. The isolating valve shall be a screwed gate valve installed downstream of the backflow prevention valve. Both valves shall be located outside the chamber in a concrete valve box that has a lockable stainless steel, galvanised steel or aluminium chequered plate lid. One set of valves shall be provided for each pump. Valve chamber shall drain back to wet well.

- One standby pump shall be provided per station.
- Pumps over 5kW should be soft start or have a variable speed drive. The electricity supplier should be consulted about the specific requirements for each pump.
- Both pumps shall be automatically controlled as specified in clause 7.6.8.
- All steel connections shall be Grade 316 stainless steel fastenings.
- Float cables and lifting chains shall have hook plates.

7.7.9 Pump Station Controls and Telemetry

All pump stations shall comply with the following requirements:

- The pumps shall be automatically controlled by float switches or other Council approved or required methods compatible with other pump stations in the areas. The volume between the pump-on and off levels shall be a minimum of 6% of the design peak hourly flow rate. Probe-type water level controls are not acceptable. A manual override of the automatic controls shall be provided by means of a clearly marked switch on the switch board;
- An automatic changeover between the duty and stand by pumps shall be installed so that the standby pump is run at (maximum) weekly intervals and/or if the duty pump breaks down. A clearly marked switch shall be provided on the switchboard that manually switches control between pumps while not overriding the future automatic changeovers.
- Pump controls shall include
    a) Duty standby system
    b) One ammeter per pump
    c) One hour meter per pump
    d) One reverse switch per pump
    e) Inhibit system
- Audible and rotating re-light alarms shall be provided and activated by float controls at a level 100 mm above the normal pump-off level. The emergency storage shall be provided above this alarm activation level.
- Pump stations serving 3 household equivalents or more shall be connected to Council's telemetry network. This shall monitor pump hours, high and low water levels and pump failure. Council shall be consulted about the means of connecting to the Telemetry, and it shall be compatible with existing systems.
- The pump controls will include locking out when a downstream receiving pump station fails, to prevent downstream overloading of emergency storage capacity.
- Pump station telemetry in the Mangawhai Community sewerage system shall comply with the ‘Communication Standard Pump Stations’ requirements included in Appendix B

7.7.10 Pipework

Pipework shall be designed to accommodate the shut off head of the pumps, water hammer forces resulting from sudden pump stop, fatigue loading caused by pump operation over a minimum of sixty year life. The use of DICL is preferred.

Valves shall have an O ring seal on the stem with resilient seat. Interior coating will be thermal bonded, polymeric or approved equivalent.

Check valves will be swing check type with an access hatch for removal of debris by maintenance operators.

Bolts, nuts, bracing, fixings, anchors shall all be grade 316 stainless steel.

7.7.11 Pump Station Electrical

The switchboards shall be housed in a marine grade aluminium cubicle. The location of the cubicle shall be determined in consultation with Council with the objectives of:

- Allowing operators to attend to the cubicle and observe pump operation simultaneously.
- Being sufficiently remote from wet well openings that operators cannot step back from the cubicle into the well.
- Out of the way of maintenance vehicles.
- Unobtrusive to the general public.

The switchboard design shall have:

- Capacity to deliver the ultimate power requirements for the pump station based on duty/stand by operation of the pumpsets.
- Space for telemetry facilities (described in a separate section).
- Battery backup for telemetry facilities to allow continuous communication with the central communications centre.
- Lighting within switchboard.
- Switchboard heater.
- Ventilation fan.
- Connection to operate odour control facilities.
- Spare poles.
- GPO.
- A plug/socket for connection to a mobile emergency generator.

The switchboard design shall make provision for:

- Future lighting within the wet well.
- Flow meter (Council may direct that the Developer is to install a meter in major pump stations).

7.7.12 Rising Mains

The following requirements are in addition to those set out in WSA 07. Rising mains will be designed using normal sewer design practices with:

- Minimum diameter being 80mm.
- Adequate capacity for ultimate requirements of the pumped catchment.
- Pipe friction calculated using a Colebrook-White k factor obtained from the “Wallingford Hydraulics Research – Charts for the hydraulic design of channels and pipes” in accordance with the relevant pipeline velocity and normal conditions.

- A desirable minimum velocity of 0.9 m/s in order to strip sulphide producing slimes from the pipe walls.
- Water hammer assessment required to determine pipe class.
- Fatigue analysis to verify that the pipe material is suitable to achieve a life of at least 100 years for the expected number of pump cycles.
- A return pipeline shall be installed to allow the rising main to bypass pumps and drain into the wet well.

Particular care will be taken to ensure that:

- No section of the rising main is free draining.
- Sewage air release valves are installed that achieve Water industry standard performance.

7.7.13 Design Certification

Prior to the commencement of construction the Developer's designer shall submit to Council documentary evidence that:

- Structural design of all structures is fit for purpose.
- Floatation of pump wells and emergency storage facilities have been assessed.
- The required storage volume has been achieved in the system.
- Pipe class is adequate for the 100 year design life of the pipelines.
- Odour management has been assessed and risks mitigated adequately.
- All other aspects of Council's design criteria have been incorporated into the design.

In order to allow Council to provide operational comment on the design proposal and finalise detailed operational requirements, the Developer's designer shall submit to Council, prior to the Developer commencing construction, the following documents:

- Hydraulic computations to show the system curve for the rising main in conjunction with the pump curve.
- All design drawings for all elements.
- Technical schedules for the pump sets.

7.7.14 Commissioning

Prior to Council accepting any assets as being fit to receive raw sewage and connect to the system the Developer will need to provide Council with evidence that all works have been constructed in accordance with the approved design plans and that the following commissioning activities have been completed:

Structures

- Visual inspection to verify:
  - All structures are watertight (test for leakage into and out of well).
  - All structures are vertical.
  - All mud, construction debris and foreign objects are removed from the wells.
  - All water is removed from wells after testing
  - Concrete surfaces are free of defects

Pumps

- Visual inspection to verify:

- Pumps operate without excessive vibration.
- Pumps can be removed from well and re-engaged successfully.

- Test to verify:
  - Pump draw down test undertaken to verify that pumps deliver the specified pump duty current and power drawn during operation match expectations.
  - Manual and auto run for each pump is operational.
  - All levels sensors and alarm are functional.
- Receive copies of factory test certificates as supplied for each pump

Pipework

- Visual inspection to ensure:
  - Leakage does not occur at any joint during pump operation.
  - All pipework is adequately braced.

Electrical

- Visual check that:
  - Switchboard is fully functional.
  - Electrical conduits and gas tight compartments are fully sealed.
  - Doors closed and lock.
  - Insulation is provided between dissimilar materials.
  - Receive test certificate to verify that works have been undertaken to the required electrical standards and is electrically safe.
  - Receive verification that all requirements of the energy suppliers have been complied with.
  - Demonstrate that the emergency generator connection is operational.

Telemetry

- Test to verify that all telemetry signals are being sent to the central telemetry communications centre.

7.7.15 Operation and Maintenance Manuals

The Developer shall provide Council with 3 copies of manuals which shall contain sufficient information for the installation, operation and maintenance of the equipment supplied.

Each copy of the Manual shall be adequately bound or contained in three (3) ring, hard cover binder. The page format shall be A4, and printed in a clear typeface with a 35 mm margin for binding. Alternative methods of binding and page size format can be submitted, but acceptance of these would be subject to approval. The contents shall be presented as follows (alternative compilation would be subject to approval):

Title Sheet – containing:

(1) Name of Scheme and of each pumping station.

(2) Contract Details.

(3) Name of Supplier.

(4) Address for Service Calls.

The following information shall be provided and listed as follows:

Chapter	(1)	:	Description
Chapter	(2)	:	Technical Data
Chapter	(3)	:	Principles of Operation
Chapter	(4)	:	Occupational Health & Safety Issues
Chapter	(5)	:	Operating Instructions
Chapter	(6)	:	Installation and Commissioning Instruction
Chapter	(7)	:	Routine Maintenance
Chapter	(8)	:	Periodic Maintenance
Chapter	(9)	:	Repair and Overhauling
Chapter	(10)	:	Test Data and Troubleshooting
Chapter	(11)	:	Spare Parts List
Chapter	(12)	:	PLC Program
Chapter	(13)	:	As-Installed Electrical & Mechanical Drawings

The information on Chapters 1 to 6 must be included for each item supplied, while the extent of information in Chapters 7 to 10 may vary with the complexity of the equipment.

The information to be supplied in each Chapter shall be as follows (where applicable):

Chapter (1) : Description – a full description of the equipment with a tabulation of dimensions and performance ratings.

Chapter (2) : Technical Data – a completed copy of Technical Data of the equipment and as constructed drawings.

Chapter (3) : Principles of Operation – a basic working description, including novel features and any automatic control.

Chapter (4) : Occupation, Health and Safety – issues and procedures that are required to be undertaken.

Chapter (5) : Operating Instructions – a step-by-step procedure organised into sections, entitled:

- Checks before Starting
- Starting
- Continuous Operation
- Stopping
- Emergency Stopping
- Abnormal Operation as Applicable

Chapter (6) : Installation and Commissioning Instructions – details of Standards and procedures for mounting or erecting, wiring and lubricating the equipment. The commissioning instructions shall include step-by-step procedures for checks before the first start, first start, checks after starting and operational tests. They should be coordinated with Chapters 3 and 8 and may refer to both.

Chapter (7) : Routine Maintenance step-by-step procedures for preventative maintenance work carried out at intervals of four (4) weeks or less.

Chapter	(8)	:	Periodic Maintenance step-by-step procedures for preventive maintenance carried out at intervals in excess of four (4) weeks, involving replacement of consumables only.
Chapter	(9)	:	Repair and Overhauling step-by-step procedures for fault correction and preventative maintenance, involving parts other than consumables. A list of any necessary special tools should be included.
Chapter	(10)	:	Test Data and Troubleshooting – instructions to qualified Tradesman for assessing the operational performance of the equipment.
Chapter	(11)	:	Spare Parts List – illustrations and Schedules for identification and specifications for all items in the equipment. Exploded diagrams are preferred. The recommended spare parts stock must be indicated.
Chapter	(12)	:	PLC Program – the full ladder logic program complete with hard copy and disk format.
Chapter	(13)	:	As-Installed Electrical & Mechanical Drawings shall include • Up-to-date changes at the time of commissioning. • Schematic and circuit diagrams. • Cable entry details. • Full construction details of switchboard, pump set installation and all associated equipment and • Schedule of equipment installed in switchboard and associated field equipment.

7.7.16 Handover

After acceptance of commissioning of the pump station and prior to handover of the asset to Council, the Developer shall undertake a training session with Council to ensure that its operators are fully conversant with the equipment and its operation.

The Developer shall undertake a training review session with Council two months (or as negotiated) after the first sewer inflows are received.

7.8 On Site Treatment and Disposal Systems Guidelines

7.8.1 General

On Site Treatment and Disposal Systems should be investigated and designed using accepted design practice, documented and/or local operational data and wastewater characteristics, for which extensive literature exists.

Where more than two dwellings are being proposed within a subdivision development consideration should be given to utilising a community wastewater treatment and disposal system in accordance with AS/NZS1547:2008 Onsite Wastewater Management Standard. A community system servicing multiple lots should be installed if determined to be the best practicable option.

Detailed design guidelines are not given here, but the following is a list of factors which should be considered in design.

- *Scope of land disposal*
- *Proximity to dwellings / development*
- *Potential for offensive odours*

- *Site and land availability*
- *Sensitivity and quality of receiving waters*
- *Scope for future extensions*
- *Value of site to the community*
- *Landscape effects*
- *The ease, convenience and required frequency of system maintenance.*

All on-site wastewater systems should dispose of treated wastewater to land.

New on-site sewerage systems for individual properties should be designed in accordance with AS/NZS1547:2008 Onsite Wastewater Management Standard. In addition to the requirements of these guidelines, proprietary effluent filters such as Innoflow "Biotubes" should be installed in all septic tanks. These filters should be designed and installed strictly in accordance with the manufacturer's instructions.

New septic tanks should have a minimum diameter riser of 600 mm between the tank top and ground surface, with a watertight lid. Their inlet pipes should be vented outside the tank. The tanks should be completely watertight and be designed to:

- *Withstand all soil loads and the load of a light vehicle running over the top of them*
- *Be stable when empty under winter groundwater conditions*
- *All tanks should meet the minimum design and installation requirements of AS/NZS 1546:2008 Septic Tank Standard*

7.8.2 Plant Capacity

Where the specific flows from the catchment areas are known these should be used as a basis for the treatment plant design.

When the above information is not available the design flows provided in AS/NZS 1547:2008 should be used. The plant should be designed for a minimum life of 50 years except for electrical and mechanical components which should have a design life of at least 15 years and telemetry equipment 10 years.

The plant should be designed to cater for all flow rates throughout the design life of the plant. Staged construction/upgrades over the plant life should also be defined assuming Council agreed growth rates.

7.8.3 Effluent Discharge

Any discharge should be in accordance with the permitted activity rules of the Regional Water and Soil Plan for Northland or the condition of the relevant resource consent obtained from the Northland Regional Council.

Council will not take control of any treatment plant until all consent conditions are met for a minimum continuous period of 12 months.

7.8.4 Treatment Process

Only treatment systems that comply with AS/NZS 1547:2008 and any relevant NRC requirements should be used.

7.8.5 Operations and Maintenance

Wastewater treatment plants should have documented control and operational procedures including maintenance, health and safety and renewal plans.

Renewal documentation should account for the expected life of each part of the plant and show a planned component replacement schedule together with replacement cost valuations.

A schedule for the correct disposal of all by-products of the treatment process and emergency procedures is required should the plant not be able to treat waste for reasons of failure, emergency repairs or planned upgrade/maintenance.

Maintenance of wastewater systems should be in accordance with the Regional Water and Soil plan for Northland and the manufacturer's requirements.

7.8.6 Monitoring

A monitoring programme should be used to meet consent conditions and to monitor the efficiency and effectiveness of the plant.

Should sampling or monitoring piezometers be required, the pipes are to be a minimum of 100mm in diameter, have a lockable cap, have filter cloth around the outside and be surrounded by 100mm of drainage metal. An identification plate is also required on the outside.

The monitoring programme will be actively enforced under the Resource Management Act 1991, the Building Act 2004 and any future standard required by the Ministry for the Environment to ensure all on site treatment and disposal systems are appropriately maintained.

8. WATER SUPPLY AND RETICULATION

8.1 General

This section covers the Kaipara District Council requirements for the design and construction of water supply services and associated structures.

Water supply reticulation shall comply with Council bylaws and Council's particular requirements for each water supply system.

Design and construction should be in accordance in NZS4404:2010 Part 6 and the following standards and guidelines.

Design and Quality Assurance shall comply with Sections 1 to 3 of these standards.

8.1.1 Council Systems

Council operates water supply systems in the following areas:

- Dargaville
- Baylys Beach
- Glinks Gully
- Ruawai
- Maungaturoto

The following requirements shall be met:

(a) Where subdivision or land development is within the area served by a Council system or an extension to a Council system is proposed, the written approval of Council's Asset Manager shall be obtained and provided with the application to confirm that the Council water supply system can be extended to serve the subdivision or development.

8.1.2 Vesting and Easements

The following requirements shall be met:

(a) All water pipelines and pump stations serving more than five properties shall be vested with Council unless a management entity to own operate and maintain the system has been Approved by Council.

(b) Water systems to be vested with Council that are not contained within Roads shall be within reserves to vest or easements in gross in favour of Council. The minimum width of the land to vest or easement shall be 3.0m.

(c) Where a private water pipe crosses a neighbouring property, an easement shall be provided in favour of the servient lot.

(d) Any water pump stations servicing more than one property shall be on their own separate lot and vested in Council or, where a management entity has been Approved by Council to serve a number of lots, a separate lot owned by the management entity.

8.2 Design Requirements

The following requirements shall be met:

(a) Water supplies to all developments shall meet the requirements of the Building Act.

(b) Reticulated water supplies to all developments shall:

(i) Include an isolation valve installed immediately after the meter on every new connection.

(ii) Have an approved backflow preventer installed on every new commercial or industrial connection.

(iii) Be adequate for fighting purposes in accordance with NZ Fire Service's Code of Practice SNZ PAS 4509:2008.

Guidance note:

Where the existing supply is insufficient the Developer shall be responsible for the upgrading of the existing reticulation up to the nearest 150mm supply (or trunk component whichever is the closest). Where the headworks are insufficient the extent of additional works required should be referred to Council's Asset Manager prior to the formal lodgment of the subdivision or development proposal.

8.2.1 Fire Fighting Supply Requirements

The fire risk classifications shall be as follows:

Table 8.1: Fire Fighting Supply Requirements

Risk Class	Details	Flow (l/s)	Minimum Number of Hydrants
B	Congested Business areas containing multi-storey buildings, large department stores, extensive shopping malls, factories, commercial and office property, theatres, cinemas and bulk liquid fuel terminals etc:	200	5
C	Concentrated built up areas not falling within class B, areas of multiple industrial risk, large schools, large colleges, and large hospitals etc:	100	4
D	Business areas not falling within classes B or C	50	3
E	Any area within a fire district that has a reticulated water supply and does not have risks that would place it into classes B, C or D including detached and semi-detached household units	25	2
Isolated Risks	Any isolated risks within an area with a lower water supply classification should be classed at a level appropriate to the risk.		

Guidance Notes:

1. An isolated risk within a reticulated area that has a significantly higher fire risk category than the surrounding area may use auxiliary water to make up the balance of the water supply required. When this is done the auxiliary supply should provide the required flow for 1 hour and access to that water should be available within 90 m of the risk. Hydrants, connections and access to the auxiliary supply should be provided to the standard required by the local New Zealand Fire Service Area Commander.

2. *An isolated risk classified B, C, D within an unreticulated area, should have sufficient auxiliary water provided to meet the required flow for 1 hour and access to this auxiliary water should be available within 90m of the risk. Hydrants, connections and access to the auxiliary supply should be provided to the standard required by the Fire Fighting Code.*

3. *The minimum standard of water supply for firefighting should be as set out in the Table 6. The required flow should be obtained from the maximum number of fire hydrants as scheduled within a 270m radius of any fire risk.*

4. *The minimum fire fighting residual running water pressure should be 100 kPa at any fire hydrant. The minimum working residual water pressure, in other than fire fighting conditions, shall be 300 kPa at the ground level of the building site in each lot.*

8.3 Reticulated Water Supply Systems

The requirements of clauses 8.1.1 to 8.3.10 shall be met.

8.3.1 Minimum Pipe Sizes

The reticulation shall be sized appropriate to the service being provided. Minimum acceptable sizes are shown in Table 8.2:

Table 8.2: Minimum Water Supply Pipe Size

Pipe Type	Minimum Diameter (mm)	Meter Size
Principal Main	400	50
Rider Main	50	40
Service Connection	Large 25	20
	Medium 20	15
	Small 15	15

8.3.2 Pipe Location Depth

(a) A principal main fitted with fire hydrants shall be laid on one side of all through streets and one side of every dead-end road. Principal mains shall be laid both sides of roads which service large developed areas so that supply can be maintained to that area if one of the pipes breaks or is otherwise shut down. Appropriate valves shall be installed so that breakages in either main can be isolated and supply maintained to the area.

(b) A rider main shall be laid along the road frontage of all lots not fronted by a principal main, including cul-de-sac heads, and shall be designed as ring mains.

(c) Service connection pipes shall have minimum cover of not less than 600 mm in carriageways and not less than 350 mm under footpaths and Berms terminating at a depth of 225 mm at the boundary. The sections of pipe adjacent to a carriageway crossing shall be gradually deepened, to allow the required cover under the carriageway without provision of vertical bends.

(d) Where possible, all water mains should be laid at a higher level than sewers to avoid cross contamination, and shall not be laid in the same trench as sewers or stormwater drains, nor pass through manholes.

8.3.3 Pipe Materials

(a) Pipes shall be:

- PVC-U pipe AS/NZS1477:2006, PVC-O to AS / NZS 4441 or PVC-M to AS / NZS 4765:2007
- PE 80 or PE 100 pipe to AS/NZS 4130:2009 or
- steel (concrete lined and externally wrapped) to NZS4442:1988.

(b) Low Density Polyethylene pipe (Alkathene) or any PE pipe not fully compliant with AS / NZS 4130 shall not be used.

(c) UPVC pipe sections shall be joined by solvent cementing for under DN50 diameter pipes and rubber ring jointed for DN50 diameter and over. PE pipe shall have electrofusion jointing. Steel pipes shall be welded.

8.3.4 Pipe Protection, Bedding and Backfill

All pipe bedding and protection shall be in accordance with manufacturer's recommendations and as per Drawings CM-001 and CM -002 in NZS 4404.

8.3.5 Hydrants

(a) Fire hydrants shall be clockwise closing, screw-down type in accordance with BS 750, and shall wherever practicable be medium or tall pattern.

(b) Hydrants shall be fixed opposite the common boundaries of lots and spaced at intervals not exceeding 135m within residential areas and 90m within Business zones. The terminal hydrant shall be within 135m radius of the furthermost portion of any building site. Where necessary a 100mm diameter principal main shall be constructed within a private road to ensure coverage.

(c) Fire hydrants shall be readily accessible for fire appliances and should generally be positioned near street and private way intersections and not less than 6.0m from any buildings.

(d) Hydrant risers shall be used where necessary to ensure that the top of the spindle is not less than 175mm or greater than 250mm below finished surface level. Hydrants are required at all dead ends and low points to enable mains flushing if a normal washout cannot be fitted.

(e) The location of fire hydrants shall be marked with yellow plastic marker posts which are fixed 225 mm from the street boundary at the closest point to and facing the hydrant, with the top of post 600 mm above finished ground level. A concrete mowing strip 150 mm wide shall surround the post and the distance between marker and hydrant in metres (bottom number) shall be stencilled in black paint at the top of the post. For maximum night visibility, a blue raised pavement marker shall be installed on the road centreline at each hydrant location.

8.3.6 Tapping Bands

(a) All tapping bands shall provide a total encirclement of the pipe and shall be able to be installed without shutting down the pipe.

(b) Tapping bands on uPVC pipes shall be of an approved Gunmetal, aluminium-bronze, or ductile iron type, or other materials to AS / NZS 4793 approved by the Council and complying with the manufacturer's recommendations. Tapping bands on other pipes shall be specifically designed.

8.3.7 Valves

(a) Gate valves in accordance with AS/NZS 2638.2:2011 shall be used on principal mains. They shall be resilient seated valves with thermoplastic polymer 'Levasint' or equivalent coating, suitable for working pressures up to 1600 kPa and also complying with the following requirements:

(i) They shall be anti-clockwise closing, and shall be provided with cast iron spindle caps.

(ii) The stem material shall be Grade 431 stainless Steel in accordance with AS2837 with an integral thrust collar.

(iii) The wedge shall be cast in Ductile Iron and fully encapsulated in an approved synthetic rubber. Partially coated wedges are not acceptable.

(iv) The valve body, bonnet and top castings shall be manufactured from ductile iron and fully enveloped with a fusion powder coating, applied by the fluidised bed technique, conforming to AS 4158. Alternatively, components may be manufactured from an approved corrosion resistant material without protective coatings.

(v) All external fasteners shall be Denso system wrapped.

(vi) The stem seal shall be effected by a minimum of two "0" rings, which are able to be replaced under full working pressure.

(b) Peet valves used on rider mains shall be in accordance with NZS/BS 5163

(c) Butterfly valves or plug-type valves (including ball valves) shall not be used.

(d) All valves shall be designed so that they can be opened and closed manually by a single person with a spanner in not more than one minute.

(e) A permanent spindle extension to the ground surface shall be provided on valves which are more than 500 mm deep.

(f) Air release valves shall be installed at all changes of gradients in pipes on which there are no service connections. They shall be either an accordingly designed fire hydrant or a 20 mm diameter ferrule. A permanent cover is required for all ferrules.

(g) All air release valves shall have isolating gate valves installed between themselves and the pipeline, and shall be positioned such that water cannot enter the pipeline through them at negative pressure. The air release system on all pipelines shall be designed so that the pipes can be both filled and emptied within one hour without being damaged.

(h) Where scouring of mains is needed as a frequent operation, a connection to the stormwater system shall be provided from scour points. Automatic air release valves shall be provided and positioned so that ground water cannot enter the main at negative pressure.

(i) Valves located at intersections shall be fixed on all legs of a tee or cross installation and shall be located in the Berm areas free of the carriageway.

(j) The position of all valves on water mains shall be indicated by a white plastic indicator post to the Council's approval bearing the inscribed letters 'SV', 'PV' in black to indicate either sluice valve or peet valve respectively.

8.3.8 Anchor or Thrust Blocks

(a) Cast in-situ concrete anchor blocks shall be provided at all points where an unbalanced thrust occurs on mains exceeding 50mm ID.

(b) The design of anchor blocks shall be based on the bearing value of the site soil conditions, except that the maximum value used shall be 75 kPa. The inner face of the block shall not be of a lesser thickness than the diameter of the fittings and shall be so constructed as not to impair access to the bolts on the fittings. Concrete shall have a minimum compressive strength of 20 MPa at 28 days (A typical anchor block is shown in drawing S39).

(c) A protective non compressible membrane to prevent abrasive damage to the water main shall be provided between the pipe (irrespective of the pipe material) and the concrete anchor and thrust blocks.

8.3.9 Service Connections

(a) A service connection shall be provided for each single lot or Household Equivalent with individual street frontage. The valve shall be covered with a short length of 100 mm diameter pipe slotted above the connection pipe and protruding 50 mm above ground level. Connections shall be in uPVC pipe in accordance with AS/NZS 1477:2006 or PE 80 PE pipe coloured blue or with Blue outer extruded skin, to AS / NZS 4130, unless otherwise approved.

(b) Service connections to be located within Road reserve and no less than 300mm from section boundary.

(c) All service connections shall include backflow prevention in accordance with the NZ Building Code Approved Documents G12.

(d) Service connections to households shall be a minimum of 20 mm in diameter. For multiple connections refer Drawing S35.

(e) Industrial areas, the connections shall not be made until the Building Consent stage, to ensure that the backflow prevention is appropriate.

(f) For private ways and private roads, a single connection, with size determined as for a rider main shall be provided to within 250 mm of the public Road boundary. Separate connections shall then be provided to each lot from that boundary. Where appropriate, because of the number and length of connections required, or to provide for firefighting coverage where the furthermost building side is greater than 135 m from the public Road, approval may be given for reticulation of the private way or Road. In such cases, an easement in favour of Council over the private way or Road will be required.

(g) Connections to a principal main or rider main shall be with a tapping band and a ferrule with the flow of water controlled by a screwed brass plug. They shall be at right angles to the lot frontage, shall be generally central on the front boundary and clear of driveways.

(h) Where water is supplied via a rider main located in the same general area as a principal main then the number of service connections able to connect to the rider main as given in Table 8.3 (working pressures other than when fire fighting)

Table 8.3: Maximum Allowable Numbers of Service Connections

Principal Main Working Pressure	**<400 kPa**		**400 – 600 kPa**		**>600 kPa**	
Maximum number of domestic service Connections	1 – Main Connect	2 – Main Connects	1 – Main Connect	2 – Main Connects	1 – Main Connect	2 – Main Connects
	7	15	15	30	20	40

(i) The physical work of connecting to the existing reticulation after the new reticulation has been tested and passed as satisfactory shall have prior approval of the Council before onsite work commences. Connection shall only be made by Council-approved contractors at the Consent Holder's expense.

(j) Upon connection the new reticulation shall be flushed to the satisfaction of the Council, and then left operational.

(k) The position of the service connection shall be marked on the kerb top with a 125 mm square of blue paint; in addition, a notch 12 mm wide and 12 mm deep shall be cut in the top of the kerb before painting.

8.3.10 Service Storage

All new or upgraded service storage reservoirs shall completely isolate the water from the ground, be covered and have sufficient storage to supply the Ultimate Development in its catchment for 24 hours at the required pressure.

8.4 Disinfection and Testing

(a) Prior to commissioning, all pipes, valves, service connections, storage reservoirs and other fittings shall be pressure tested and disinfected.

(b) Disinfection of new pipes carried out using the process set out in the Ministry of Health's Guidelines for Drinking Water Quality Management in New Zealand (Chapter 3).

(c) Service storage reservoirs shall be disinfected by spraying or inundating all internal services (including the ceiling) with water which has a minimum 5 grams per cubic metre of free available chlorine. The reservoir shall then be filled with water.

(d) On completion of the disinfection, water samples shall be taken from the far end of all trunk water pipes and from at least 3 separate locations inside any new storage reservoirs. The water samples shall be completely free of faecal coliform bacteria and the Free Available Chlorine concentration shall be between 0.2 and 5 grams per cubic metre.

(e) Before joints, fittings and specials are covered, but after anchor blocks are completed, each section of the reticulation shall be pressure tested. The section of reticulation to be tested shall be filled with potable water at least 24 hours before the test and all free air expelled. With all permanent valves open, the test section shall be pumped up to a pressure 1.5 times the working pressure or the safe working pressure of the pipe at any point in the system, whichever is less. A calibrated pressure gauge shall be installed at the lowest practicable point in the reticulation.

(f) The test section shall stand, without makeup pressure, for one hour and shall show no evidence of leaks following visual inspection, and the pressure drop shall not exceed 10% of the test pressure.

(g) Notwithstanding any sub-sections of the new reticulation which are pressure tested, the entire reticulation shall be tested on its completion.

(h) Once it has passed all tests, the new reticulation shall be kept continuously charged with water under pressure.

9. LANDSCAPE DESIGN AND PRACTICE

9.1 General

This section covers the Kaipara District Council requirements for landscape design and practices within Road reserves.

The following requirements shall be met

(a) Landscape planting in Road reserves shall comply with NZS4404:2010: Part 7.

(b) Landscape planting shall be maintained for a period of 3 years following construction. A Performance Bond will be required for the works in terms of Section 1.10.3 of these Standards.

10. NETWORK UTILITIES

10.1 General Requirements

This section covers the requirements for the provision of power, telecommunications and gas.

The following requirements shall be met:

(a) The Developer shall arrange with the appropriate network utility operators for the supply of electricity, street lighting, telecommunications and gas reticulation as appropriate.

(i) Reticulated electricity and telecommunications shall be provided to the boundary of each new lot, including that of the balance allotment.

(ii) Where applicable, electrical and telecommunication easements shall be registered over new and existing plant to ensure the security of supply.

Guidance Notes:

1. *Where it can be demonstrated that the intended land usage does not warrant a power or telecommunications connection, (e.g. Forestry, run off blocks), or where it is uneconomic to provide such services to the boundary, then the Council or controlling utility service operators may approve the use of a `no power' or `no telecommunications' encumbrance or similar legal instrument registered on the new title.*

2. *It is the incoming owner's responsibility (not withstanding prior arrangements) to meet the costs of any internal power and telecommunication reticulation and/or any network upgrade that may be necessary to supply loads above and beyond that designed for.*

10.2 Design Drawings

The following requirements shall be met:

Design drawings that comply with Section 2 shall be provided for approval.

10.3 Electricity

The following requirements shall be met:

(a) In Urban areas, and where practicable in other areas the supply of electric power shall be made by means of an underground ducted system installed at the time of Road construction. Sites for power transformers and switching stations shall be provided for as and where required.

(b) Power cables, lines and plant constructed on public land or on private property and secured by an easement in gross; need to be signed over to a recognised network operator to meet the requirements of the Electricity Act 1992.

10.4 Telecommunications

The following requirements shall be met:

(a) Telecommunications reticulation in Urban areas shall be an underground system installed at the time of roading construction. Sites for necessary services and equipment shall be provided for as and where required at no cost to the Council.

10.5 Service Location

The following requirements shall be met:

(a) Preferred service locations in Berms are as shown on Drawing S11.

10.6 As-Built Plans

The following requirements shall be met:

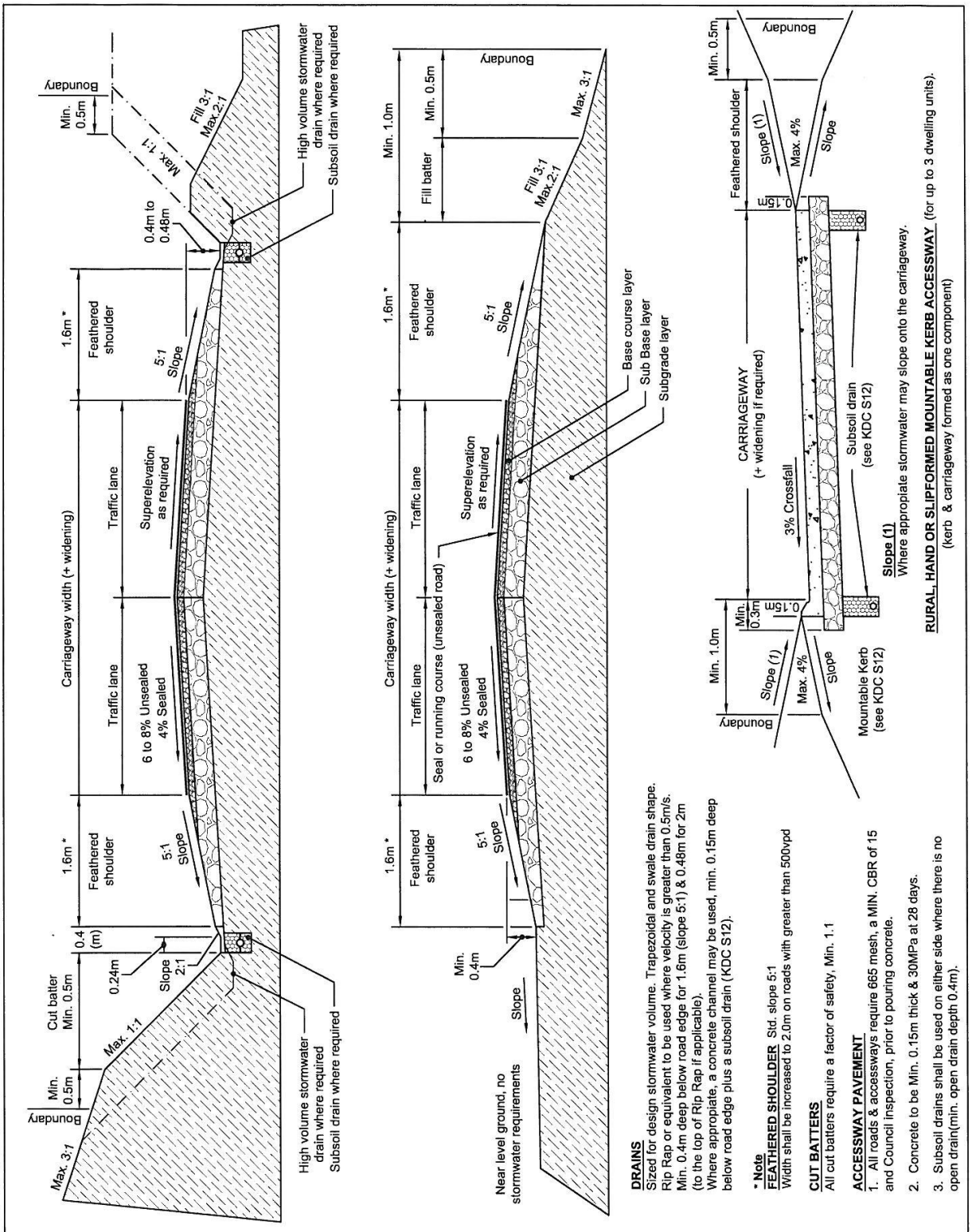
(a) A set of drawings and a schedule of asset information shall be submitted as per Section 2.5 of this Standard. The drawings shall clearly and accurately show the locations of all power, telecommunication and gas reticulation.

11. APPENDIX A

Drawings

S01	Typical Rural Road Cross Sections
S02	Typical Urban Road Cross Sections
S03	Pavement Design Chart and Schedule of Testing
S04	Passing Bay Details, Carriageway Widening and Curve Radius Guidelines
S05	Urban Vehicle Crossing : Roads with Kerb and Channel
S06	Vehicle Crossing Unkerbed Roads: Single Domestic Vehicle Crossing – up to 3 Dwellings
S07	Vehicle Crossing Unkerbed Roads: Double Domestic Vehicle Crossing – 4 to 6 Dwellings
S08	Vehicle Crossing and Intersection Layout Type 1
S09	Vehicle Crossing and Intersection Layout Type 2
S10	Vehicle Crossing: Sight Distance and Vertical Geometry Standards
S11	Vehicle Crossing Cross Sections: Kerbed and Unkerbed Roads
S12	Kerb and Channel, Subsoil and Batter Drain Details
S13	Swale Drain Design
S14	Footpath Construction Details
S15	Pram Crossing Details for Urban and Business Environments
S16	Cul-de-sac Details
S17	Access and Vehicle Crossings: Minimum Serviceability Requirements
S18	Tracking Curves: Design Car
S19	Tracking Curves: Design Trucks
S20	Carparking Layouts and Dimensions
S21	Standard Street Signs for Public Roads

S22	Standard Access Name Signs
S23	Fence Types
S24	Inlet and Outlet Structures
S25	Culvert: Bedding and Backfill Details
S26	Pipe Protection and Bulkhead Details
S27	Standard Symbols
S28	Catch Pits
S29	Sump Details
S30	Stormwater Soakpit
S31	Standard Precast Manhole (Sewer and Stormwater)
S32	Drop Manhole, Wormall Rodding Eye and Mini Manhole Details
S33	Lampholes, Stormwater and Sewer Connections
S34	Wormall Poo-Pit
S35	Multiple Water Connections and Backflow Preventers
S36	Water Pipeline Details
S37	Air Valve Details
S38	General Scour Valve Installation Details
S39	Anchor Block and Installation Details
S40	Boundary Connection Kit



DRAINS
Sized for design stormwater volume. Trapezoidal and swale drain shape. Rip Rap or equivalent to be used where velocity is greater than 0.5m/s. Min. 0.4m deep below road edge for 1.6m (slope 5:1) & 0.48m for 2m (to the top of Rip Rap if applicable). Where appropiate, a concrete channel may be used, min. 0.15m deep below road edge plus a subsoil drain (KDC S12).

*** Note**
FEATHERED SHOULDER Std. slope 5:1
Width shall be increased to 2.0m on roads with greater than 500vpd

CUT BATTERS
All cut batters require a factor of safety, Min. 1.1

ACCESSWAY PAVEMENT
1. All roads & accessways require 665 mesh, a MIN. CBR of 15 and Council inspection, prior to pouring concrete.
2. Concrete to be Min. 0.15m thick & 30MPa at 28 days.
3. Subsoil drains shall be used on either side where there is no open drain(min. open drain depth 0.4m).

Slope (1)
Where appropiate stormwater may slope onto the carriageway.

RURAL, HAND OR SLIPFORMED MOUNTABLE KERB ACCESSWAY (for up to 3 dwelling units).
(kerb & carriageway formed as one component)

TYPICAL RURAL ROAD CROSS SECTIONS

No.	Revisions	Date
Designed	M.WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

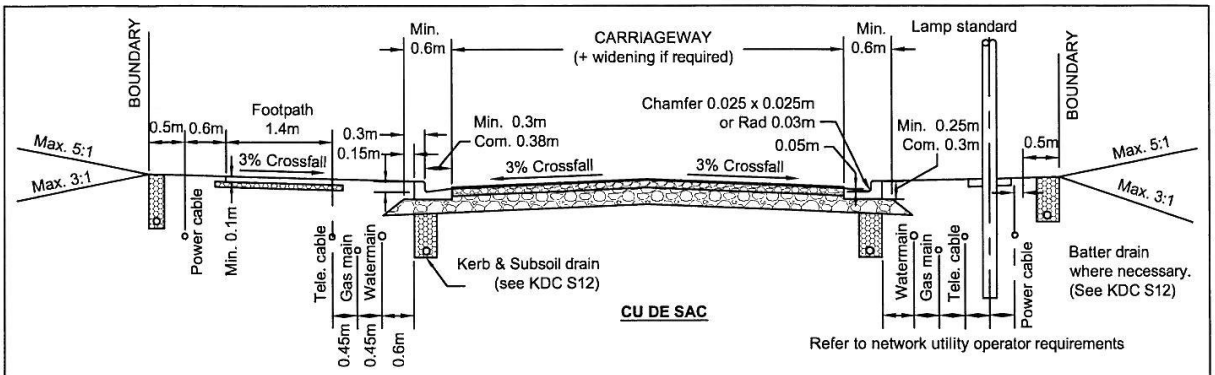
KAIPARA DISTRICT
Kaipara te Oranganui • Two Oceans Two Harbours

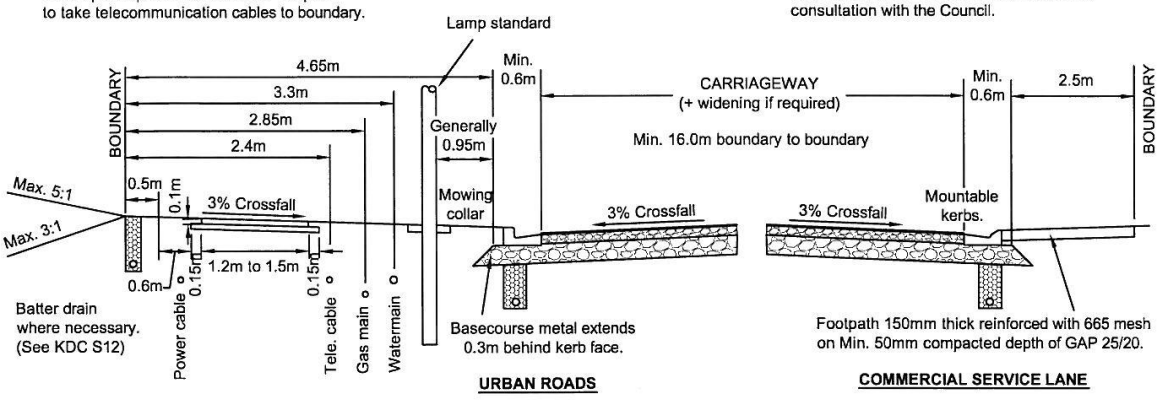
KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

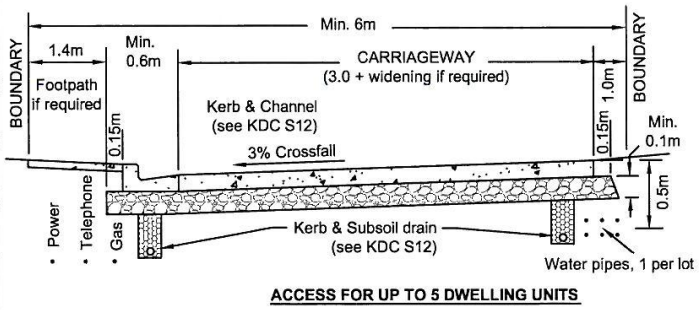
Drawing S01
Revision 0
Scale N.T.S.

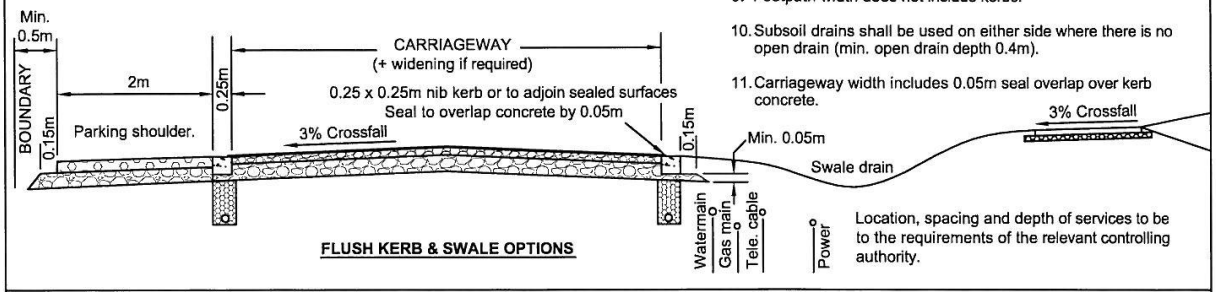
ORIGINAL SIZE:mm A4

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S01.dwg , Plotted By Anniversita Pilapil at 28/09/2009 5:00:35 p.m. Scale 1:46.82









NOTES (Urban)

1. Ground to be compacted before pouring. Low or soft ground to be made good with compacted fill. Footpaths have a min. 0.05m basecourse of GAP 7 to GAP 15.
2. Use min. 0.1m, of compacted GAP40 basecourse and 665 mesh prior to pouring concrete.
3. All roads & accessways require Council inspection and a min. CBR of 15, prior to pouring concrete.
4. Commercial, curves and tangent point intersection channel to be reinforced with 3-D12. See KDC drawing S12 for kerb details.
5. Seal as specified.
6. Concrete to be min. 0.15m thick & 30MPa at 28 days with centrally placed 665 reinforcing mesh.
7. Footpath concrete to be not less than 0.1m thick, ordinary grade 20MPa at 28 days, with constuction joints at 3.5m centres.
8. Slope shall be varied from those shown to suit existing footpaths.
9. Footpath width does not include kerbs.
10. Subsoil drains shall be used on either side where there is no open drain (min. open drain depth 0.4m).
11. Carriageway width includes 0.05m seal overlap over kerb concrete.

Location, spacing and depth of services to be to the requirements of the relevant controlling authority.

TYPICAL URBAN ROAD CROSS SECTIONS

No	Revisions	Date	
Designed	M WINCH	08/08	
Approved		09/09	
Drawing Status	IMPLEMENTATION		
Office Location	CPG, WHANGAREI		

KAIPARA DISTRICT

KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

Drawing S02
Revision 0
Scale N.T.S.

ORIGINAL SIZE mm A4

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S02.dwg , Plotted By Anniversita Pilapil at 28/09/2009 5:00:11 p.m. Scale 1:46.82

NOTES

For roads and accessways serving up to 100 household equivalents, 25 year design loads shall be as specified in Table 5.6 and shown on the pavement design chart.

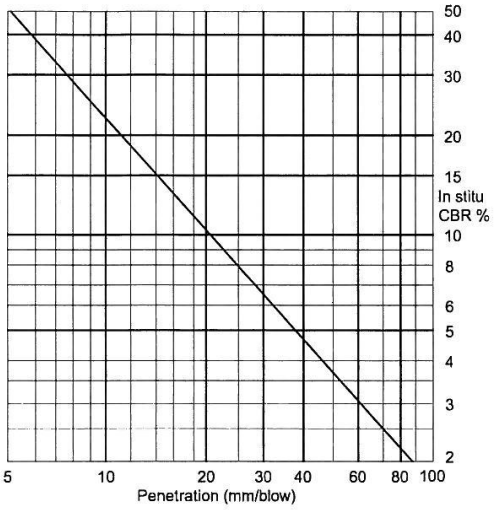
The minimum basecourse (top layer) depth on sealed pavements shall be:

- 150mm for lime stabilised pavements
- 250mm for TNZ M/4 basecourse.

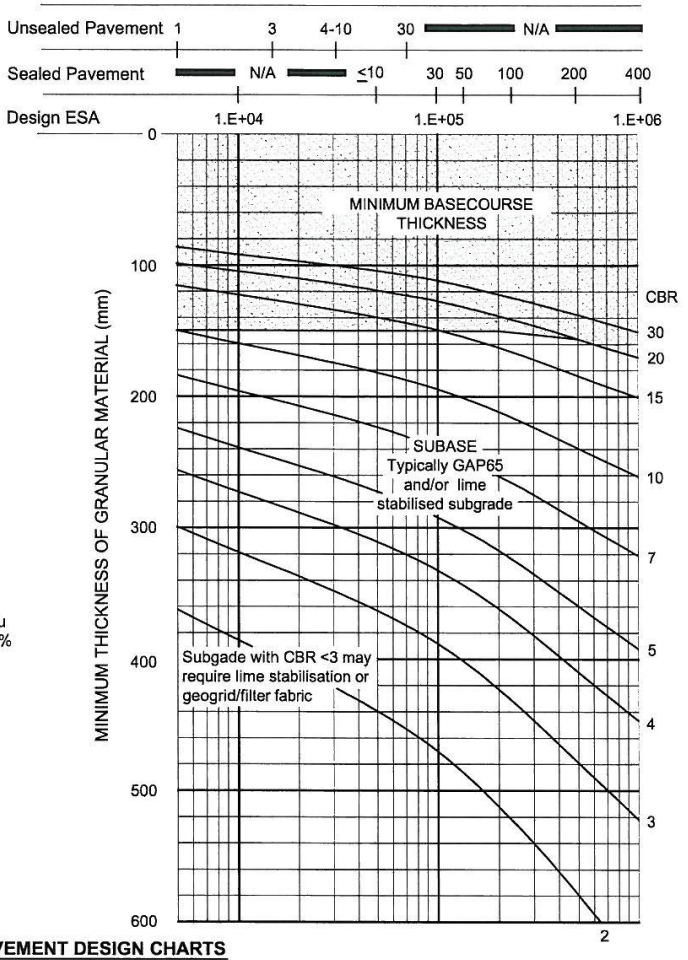
Unsealed road pavements shall include an upper layer of well graded running course aggregate of maximum particle size 20mm, minimum layer thickness 50mm and containing sufficient fine material to bind the layer and confine larger particles in the underlying structural pavement layer.

Refer Section 5.2.12 for further details.

SUBGRADE PENETROMETER CHART



PAVEMENT DESIGN CHARTS



Test	Relevant Standard	Frequency	IANZ Lab Required
Subgrade Strength Tests			
Scala Penetrometer	NZS 4402	Minimum of 10 per uniform design length taken at the edge of carriageway on alternate sides of the road. For roads greater than 1km in length, the centerline spacing between tests shall not exceed 100m. The depth of subgrade tested shall be from 0 to 1.0m below design subgrade level. The lowest CBR recorded in this depth range shall be the CBR value recorded at that test location. The design CBR for each uniform pavement design shall be the 10%ile CBR value; that is the value exceeded by 90% of the test results.	No
Soaked CBR	NZS 4402: NZ Standard Compaction	Minimum of three representative samples per uniform design length or per kilometre for road lengths greater than 1km. Three tests to be undertaken for each sample.	Yes
Sub Base Layer Test			
Clegg Hammer	Clegg Impact value for fourth blow.	20m intervals on both sides of the road taken 300mm in from the edge of the carriageway. For 2 lane roads, centreline tests shall also be taken	No
Top Basecourse Layer Tests			
Clegg Hammer	Clegg Impact value for fourth blow.	20m intervals on both sides of the road taken 300mm in from the edge of the carriageway. For 2 lane roads, centreline tests shall also be taken	No
Total Voids	NZS 4407 : Test 4.2.2	5 random test locations per 200m length of road.	Yes
Benkleman Beam	TNZ T/1 Specification	20m intervals on both sides of the road taken 300mm in from the edge of the carriageway.	Yes
Falling Weight Deflectometer	Manufacturers Specification	25m intervals on alternate sides of the road taken 300mm in from the edge of the carriageway (40 tests/centreline km).	Yes

SCHEDULE OF TESTING

PAVEMENT DESIGN CHART AND SCHEDULE OF TESTING

No.	Revisions	Date
Designed	M WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

KAIPARA DISTRICT

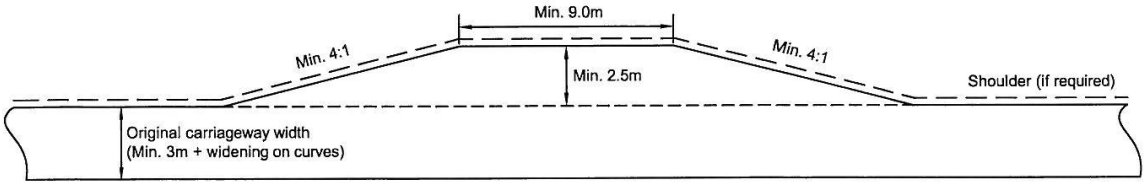
KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

Drawing S03
Revision 0
Scale N.T.S.

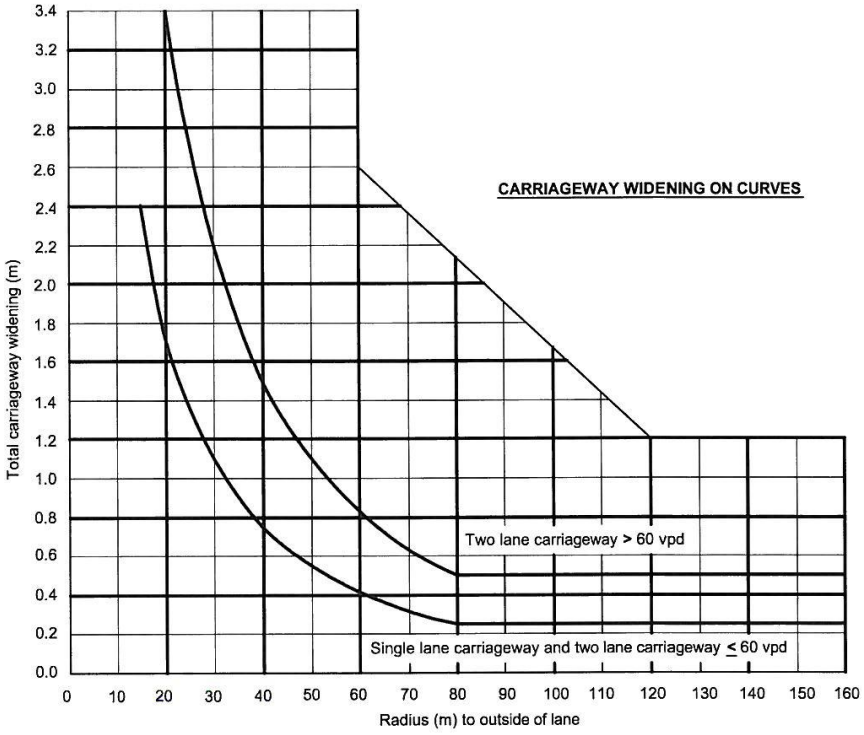
ORIGINAL SIZE mm A4

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S03-R2.dwg , Plotted By Anniversita Pilapil at 2/10/2009 1:16:40 p.m. Scale 1:46.82

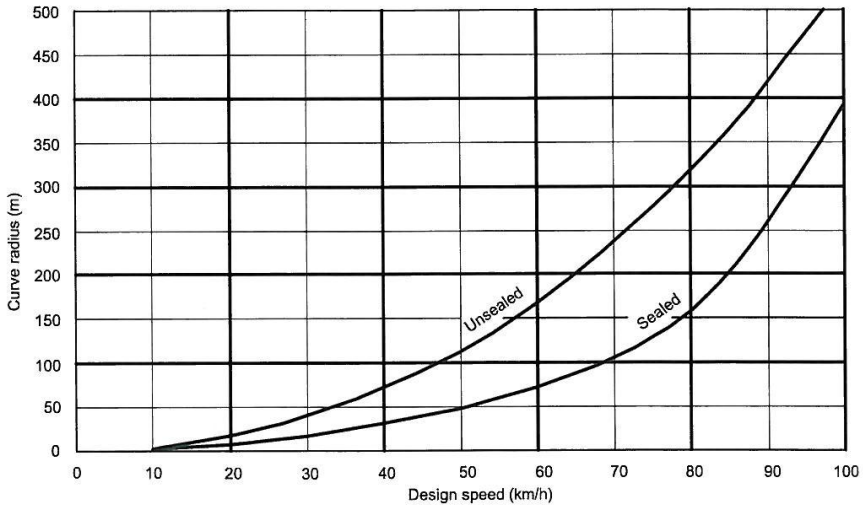
PASSING BAY



CARRIAGEWAY WIDENING ON CURVES



MINIMUM RADIUS FOR 6% SUPERELEVATION



PASSING BAY DETAILS, CARRIAGEWAY WIDENING AND CURVE RADIUS GUIDELINES

No.	Revisions	Date
Designed	M WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

KAIPARA DISTRICT
Kaipara te Oranganui - Two Oceans Two Harbours

KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARD 2009

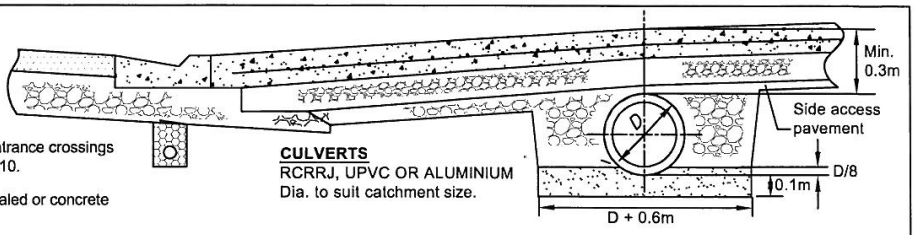
Drawing S04
Revision 0
Scale N.T.S.

ORIGINAL SIZE: mm A4

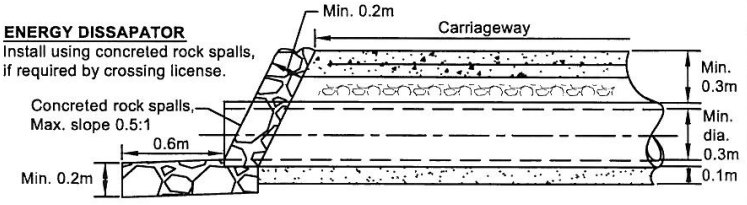
T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S04-R1.dwg , Plotted By Anniversita Pilapil at 28/09/2009 4:58:59 p.m. Scale 1:46.82

NOTES (Urban)

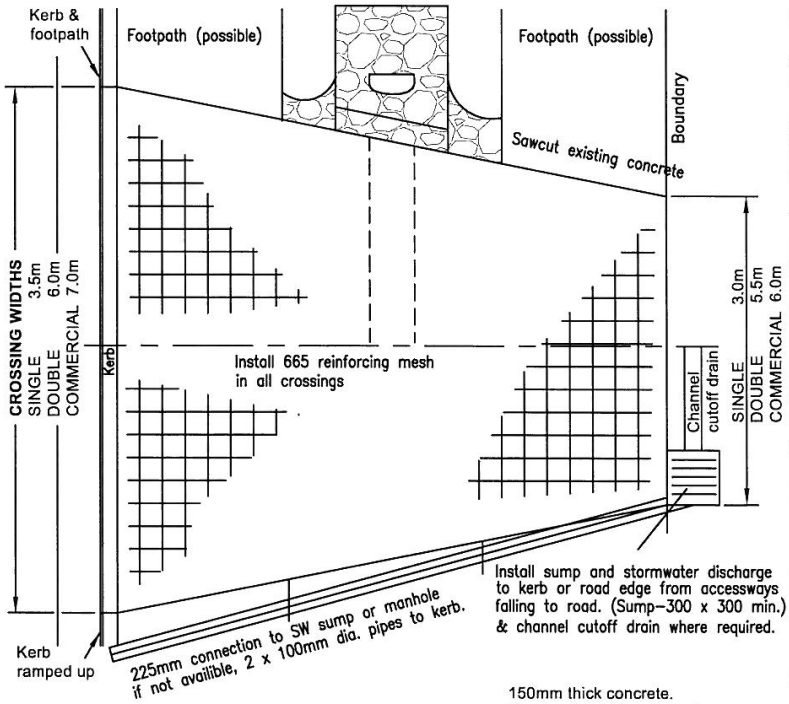
1. Sight distance requirements for entrance crossings are to comply with KDC drawing S10.
2. The crossing/driveway shall be sealed or concrete from the carriageway edge.
3. All crossings require Council inspection and a min. CBR of 15, prior to pouring concrete.
4. Ground to be compacted before pouring. Low or soft ground to be made good with compacted basecourse.
5. For single dwelling crossing only, min. 50mm of GAP25/40 and 665 mesh.
   All others use min. 100mm, of compacted GAP40 basecourse and 665 mesh prior to pouring concrete.
6. See KDC drawing S12 for kerb details.
7. Commercial, curves and tangent point intersection channel to be reinforced with 3-D12.
8. Crossing concrete to be 30MPa at 28 days.
9. Footpath concrete to be not less than 100mm thick, ordinary grade 17.5 MPa at 28 days, with constuction joints at 3.5m centres.
10. Slope shall be varied from those shown to suit existing footpaths.
11. Footpath width does not include kerbs.
12. In all cases the kerb level is to be below the adjacent property, flood level by min. 100mm.
13. If no footpath,allowance shall be made for such with a 3% crossfall to the kerb as part of any property vehicle access.

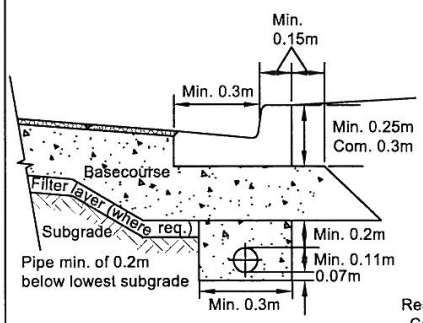


CULVERTS
RCRRJ, UPVC OR ALUMINIUM
Dia. to suit catchment size.

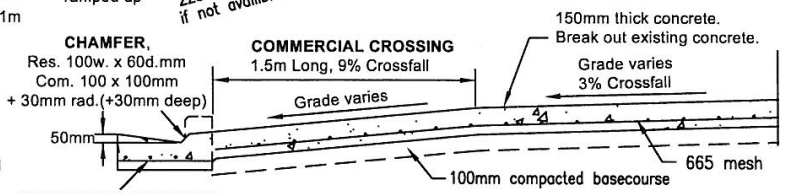


ENERGY DISSAPATOR
Install using concreted rock spalls, if required by crossing license.
Concreted rock spalls, Max. slope 0.5:1



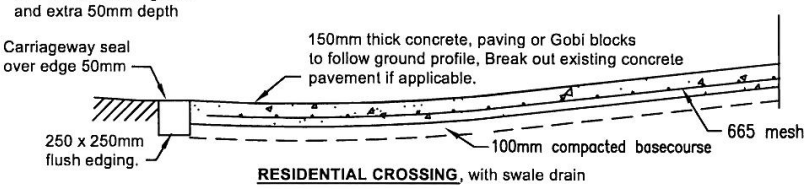


Subsoil drain pipe,
110mm dia slotted PVC or polyethylene with filter sock or unsocked pipe if filter fabric placed to trench perimeter, with an 300mm overlap.



COMMERCIAL CROSSING
3 of D12 reinforcing rods and extra 50mm depth

RESIDENTIAL & COMMERCIAL CROSSING (with kerb)



RESIDENTIAL CROSSING, with swale drain

URBAN VEHICLE CROSSING ROADS WITH KERB AND CHANNEL TYPE

No.	Revisions	Date
Designed	M WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

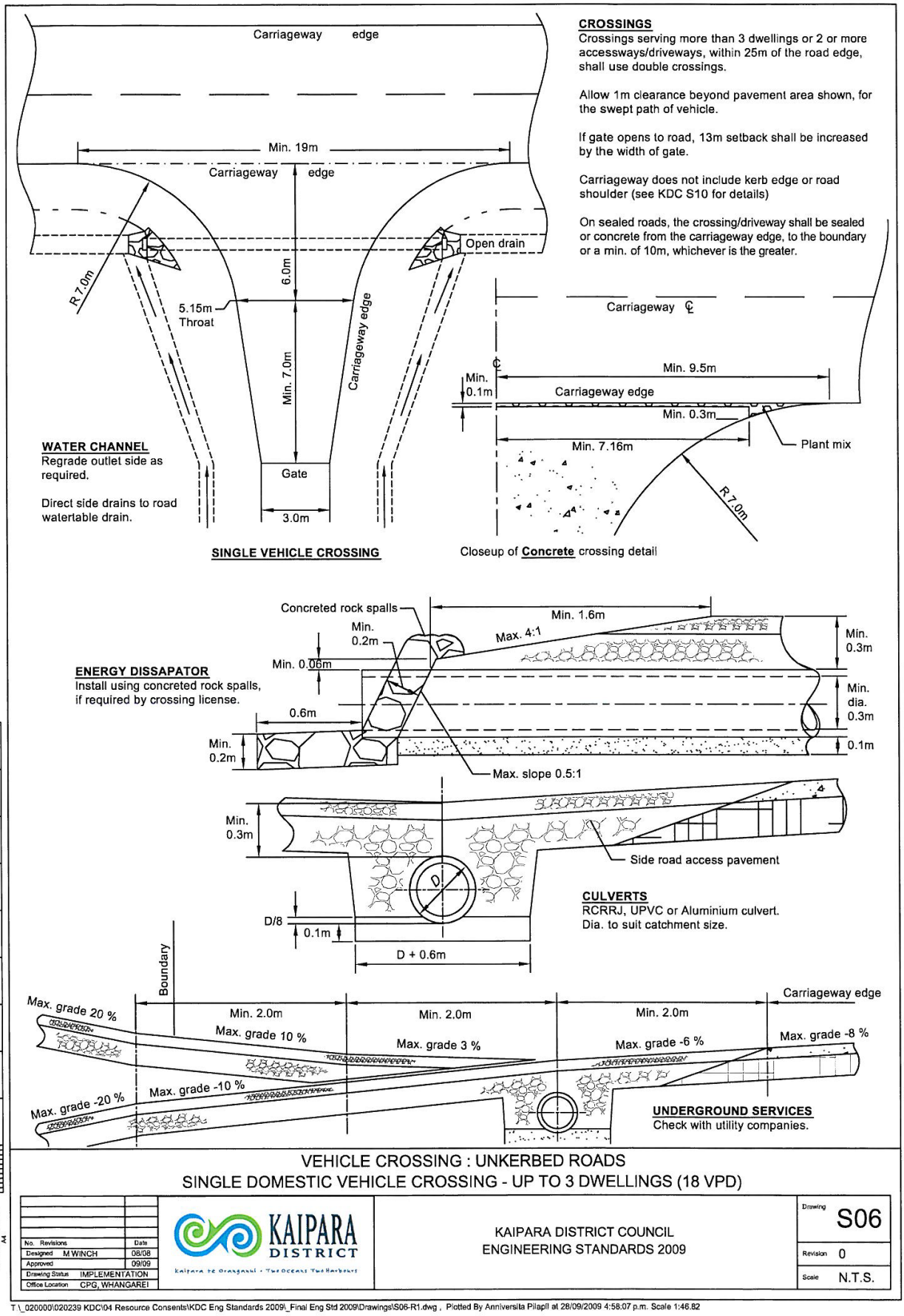
KAIPARA DISTRICT
Kaipara te Oranganui • Two Oceans Two Harbours

KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

Drawing S05
Revision 0
Scale N.T.S.

ORIGINAL SIZE mm A4

T _020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S05.dwg , Plotted By Anniversita Piiapii at 28/09/2009 4:56:34 p.m. Scale 1:46.82



VEHICLE CROSSING : UNKERBED ROADS
SINGLE DOMESTIC VEHICLE CROSSING - UP TO 3 DWELLINGS (18 VPD)

No.	Revisions	Date
Designed	M WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

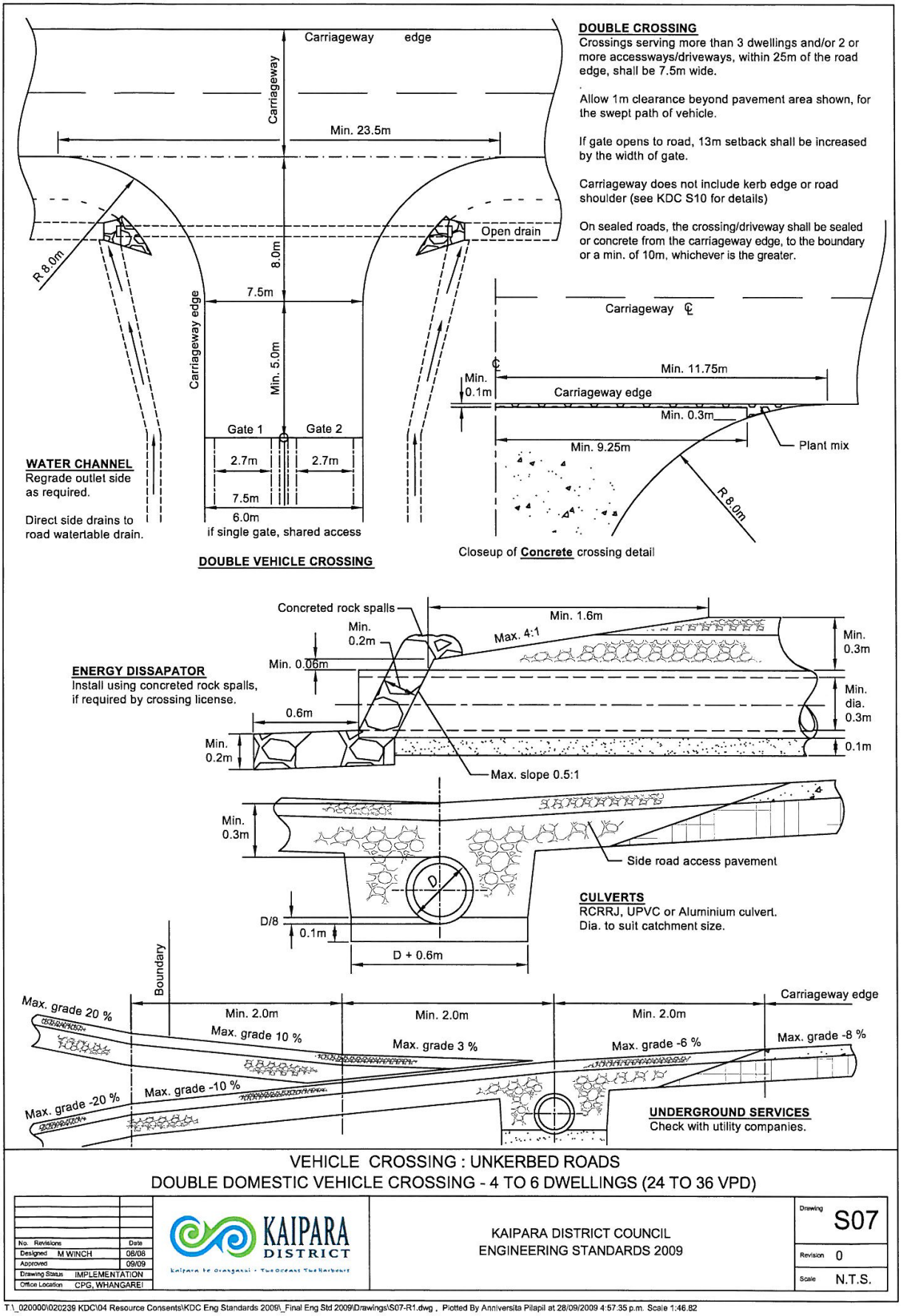
KAIPARA DISTRICT
Kaipara te Oranganui - Two Oceans Two Harbours

KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

Drawing S06
Revision 0
Scale N.T.S.

ORIGINAL SIZE mm A4

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S06-R1.dwg , Plotted By Anniversita Pilapil at 28/09/2009 4:58:07 p.m. Scale 1:46.82



VEHICLE CROSSING : UNKERBED ROADS

DOUBLE DOMESTIC VEHICLE CROSSING - 4 TO 6 DWELLINGS (24 TO 36 VPD)

No.	Revisions	Date
Designed	M WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

KAIPARA DISTRICT

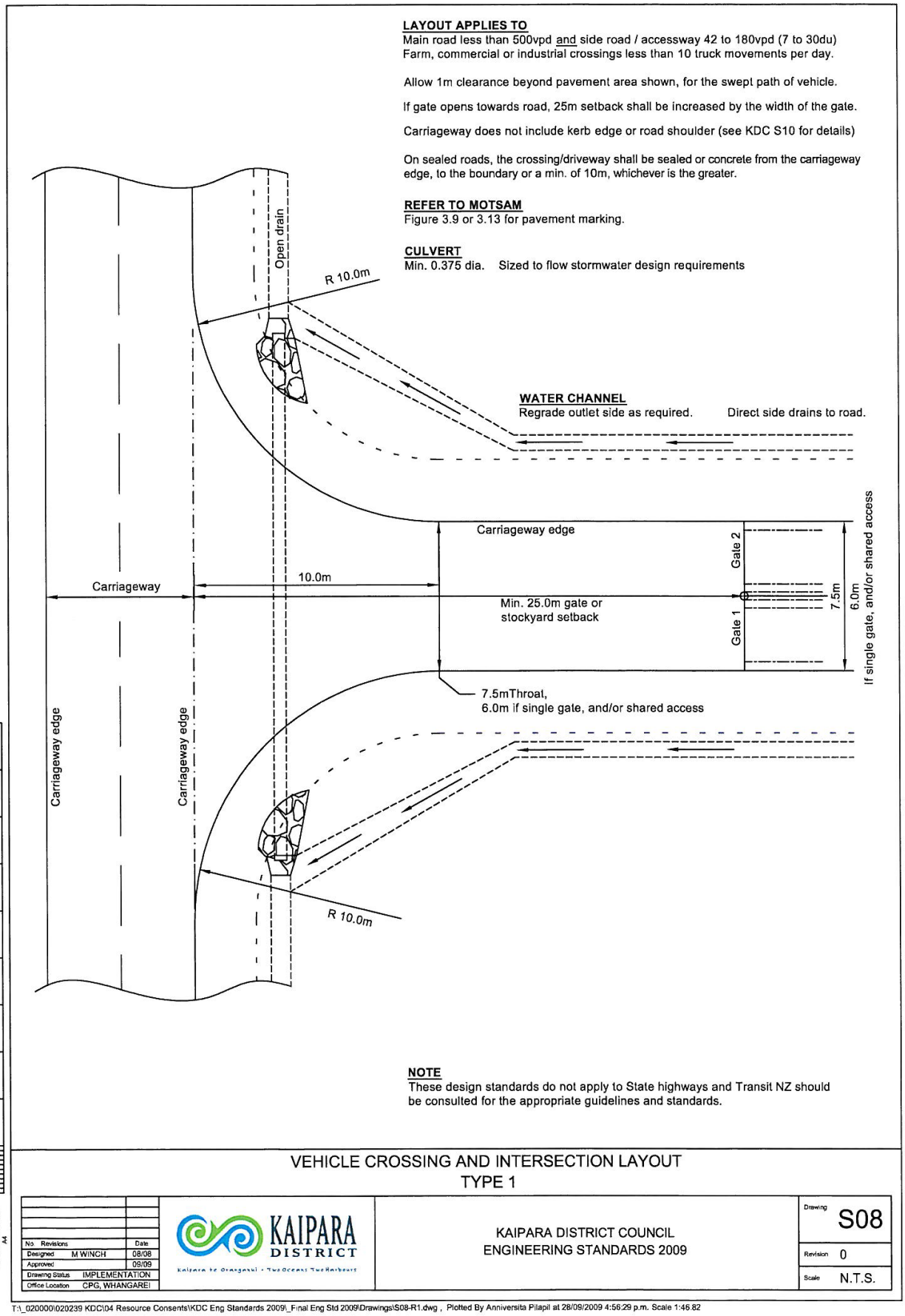
Kaipara te Oranganui · Two Oceans Two Harbours

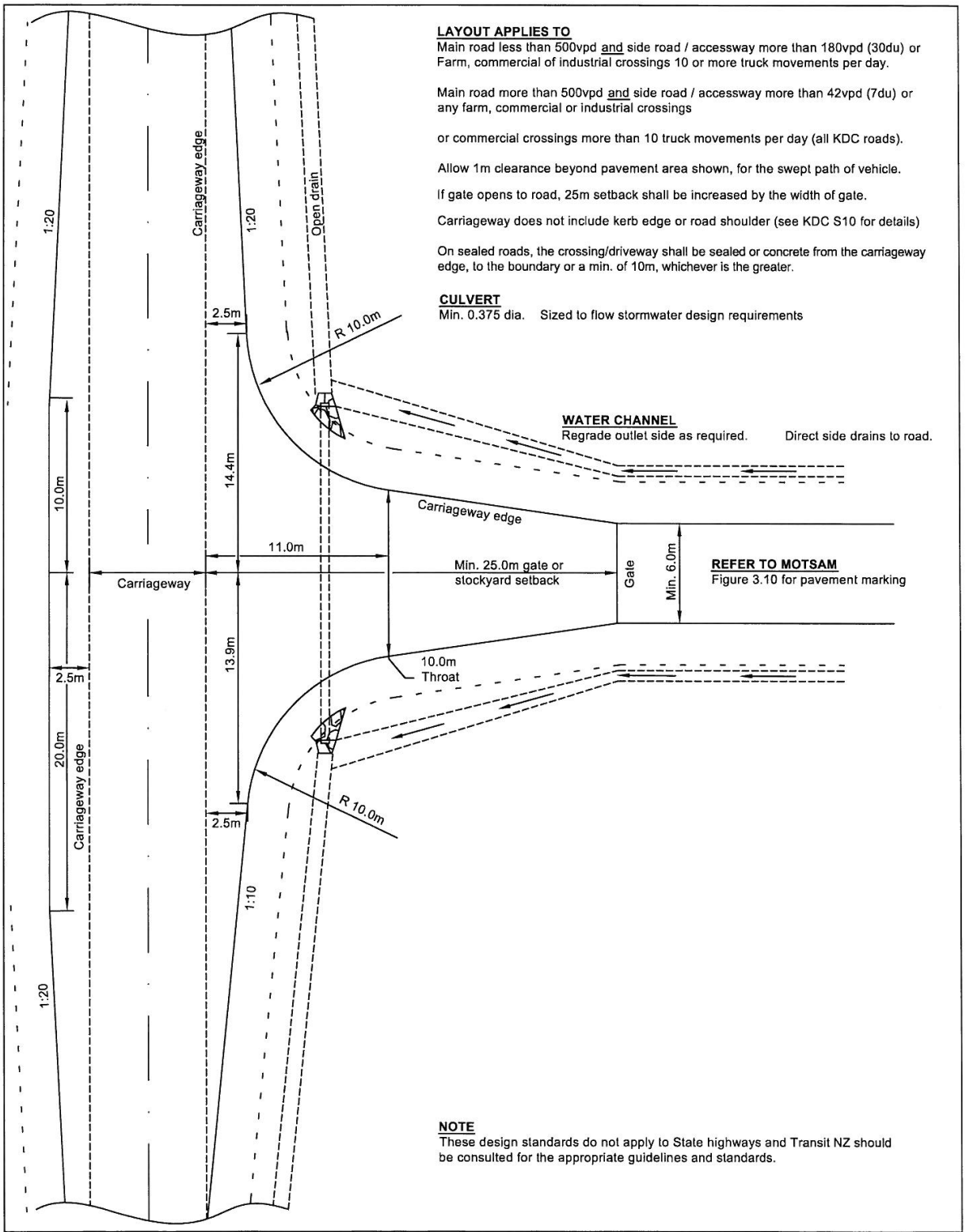
KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

Drawing S07
Revision 0
Scale N.T.S.

ORIGINAL SIZE mm A4 0 10 30 50 100

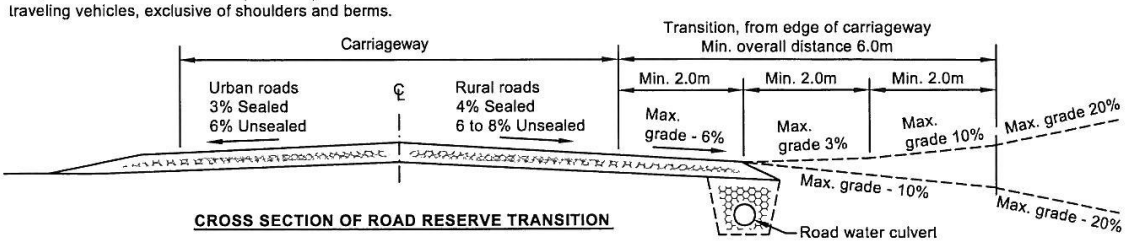
T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S07-R1.dwg , Plotted By Anniversita Pilapil at 28/09/2009 4:57:35 p.m. Scale 1:46.82


LAYOUT APPLIES TO
Main road less than 500vpd and side road / accessway 42 to 180vpd (7 to 30du)
Farm, commercial or industrial crossings less than 10 truck movements per day.
Allow 1m clearance beyond pavement area shown, for the swept path of vehicle.
If gate opens towards road, 25m setback shall be increased by the width of the gate.
Carriageway does not include kerb edge or road shoulder (see KDC S10 for details)
On sealed roads, the crossing/driveway shall be sealed or concrete from the carriageway edge, to the boundary or a min. of 10m, whichever is the greater.
REFER TO MOTSAM
Figure 3.9 or 3.13 for pavement marking.
CULVERT
Min. 0.375 dia. Sized to flow stormwater design requirements
Open drain
R 10.0m
WATER CHANNEL
Regrade outlet side as required.
Direct side drains to road.
Carriageway edge
Gate 2
Carriageway
10.0m
Min. 25.0m gate or stockyard setback
Gate 1
7.5m
6.0m
If single gate, and/or shared access
7.5mThroat,
6.0m if single gate, and/or shared access
Carriageway edge
Carriageway edge
R 10.0m
NOTE
These design standards do not apply to State highways and Transit NZ should be consulted for the appropriate guidelines and standards.
VEHICLE CROSSING AND INTERSECTION LAYOUT
TYPE 1
No. Revisions
Date
Designed M WINCH 08/08
Approved 09/09
Drawing Status IMPLEMENTATION
Office Location CPG, WHANGAREI
KAIPARA DISTRICT
KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009
Drawing S08
Revision 0
Scale N.T.S.
ORIGINAL SIZE mm A4
T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S08-R1.dwg , Plotted By Anniversita Pilapil at 28/09/2009 4:56:29 p.m. Scale 1:46.82

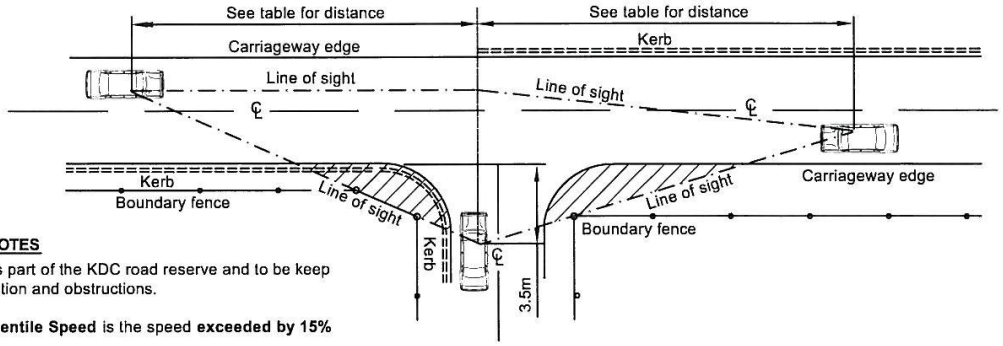

LAYOUT APPLIES TO
Main road less than 500vpd and side road / accessway more than 180vpd (30du) or Farm, commercial of industrial crossings 10 or more truck movements per day.
Main road more than 500vpd and side road / accessway more than 42vpd (7du) or any farm, commercial or industrial crossings
or commercial crossings more than 10 truck movements per day (all KDC roads).
Allow 1m clearance beyond pavement area shown, for the swept path of vehicle.
If gate opens to road, 25m setback shall be increased by the width of gate.
Carriageway does not include kerb edge or road shoulder (see KDC S10 for details)
On sealed roads, the crossing/driveway shall be sealed or concrete from the carriageway edge, to the boundary or a min. of 10m, whichever is the greater.
CULVERT
Min. 0.375 dia. Sized to flow stormwater design requirements
WATER CHANNEL
Regrade outlet side as required.
Direct side drains to road.
REFER TO MOTSAM
Figure 3.10 for pavement marking
NOTE
These design standards do not apply to State highways and Transit NZ should be consulted for the appropriate guidelines and standards.
1:20
Carriageway edge
1:20
Open drain
2.5m
R 10.0m
10.0m
14.4m
Carriageway edge
11.0m
Carriageway
Min. 25.0m gate or stockyard setback
Gate
Min. 6.0m
13.9m
10.0m Throat
2.5m
20.0m
Carriageway edge
R 10.0m
2.5m
1:10
1:20
VEHICLE CROSSING AND INTERSECTION
TYPE 2
No Revisions Date
Designed M WINCH 08/08
Approved 09/09
Drawing Status IMPLEMENTATION
Office Location CPG, WHANGAREI
KAIPARA DISTRICT
KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009
Drawing S09
Revision 0
Scale N.T.S.
ORIGINAL SIZE mm A4
T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S09-R1.dwg , Plotted By Anniversita Pilapil at 28/09/2009 4:55:57 p.m. Scale 1:46.82

CARRIAGEWAY DEFINITION

The portion of the road devoted particulary to the use of traveling vehicles, exclusive of shoulders and berms.



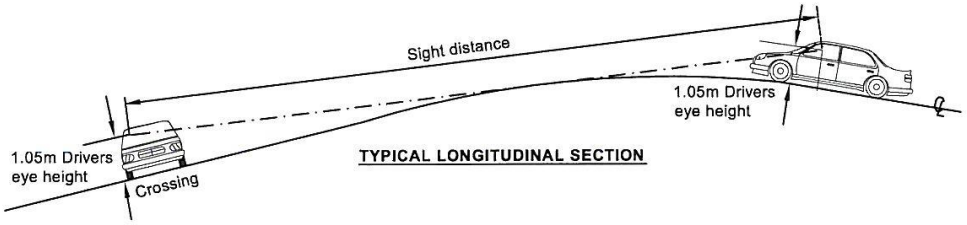
CROSS SECTION OF ROAD RESERVE TRANSITION



LINE OF SIGHT NOTES

1. Shaded area is part of the KDC road reserve and to be keep clear of vegetation and obstructions.
2. The **85th Percentile Speed** is the speed **exceeded by 15%** of drivers

PLAN OF TRAFFIC SIGHT LINES AT VEHICLE CROSSING



TYPICAL LONGITUDINAL SECTION

	85th Percentile speeds							
Road operating speed (km/h)	≤ 40	50	60	70	80	90	100	110
Minimum sight distance sealed (m)	40	45	65	85	105	130	160	200
Minimum sight distance unsealed (m)	45	65	85	115	145	185	230	

TABLE OF MINIMUM SIGHT DISTANCE

GENERAL NOTES

1. Refer to KDC drawings S10, S11, S13 (for swale details), and S05 to S09 for crossing layouts.
2. Crossings shall have a positive drain system which intercepts stormwater and directs it away from the road or into the road drainage system.
3. The crossing and driveway shall be sealed or concrete in accordance with clause 5.2.6.
4. Any superfluous entrance crossings along the property road frontage shall be removed and the site reinstated similar to their immediate surroundings.
5. The transition to road crossfall goes past the boundary, over a minimum lenght of 6m and the grade shall be less than 10% (10 to 1). Driveway grade shall be less than 20% (5 to1).
6. The road operating speed shall be measured at the approaching vehicle position on the road as shown in the drawings above.
7. Sight distances are to be increased for gradients in accordance with the current Austroads guide for "Intersections at Grade" .
8. A turning area shall be provided within the property.

VEHICLE CROSSING
SIGHT DISTANCE AND VERTICAL GEOMETRY STANDARDS

No.	Revisions	Date
Designed	M.WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

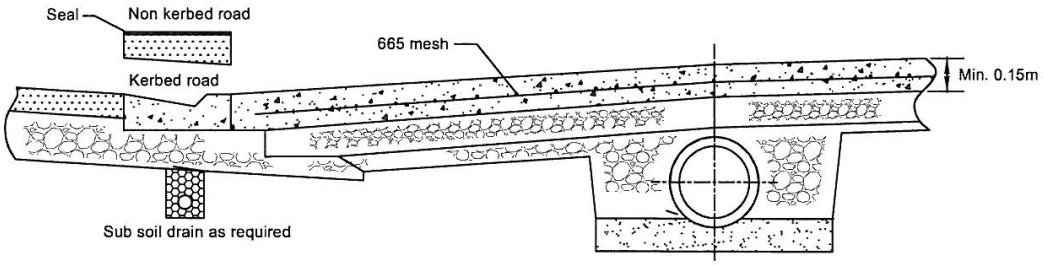
KAIPARA DISTRICT

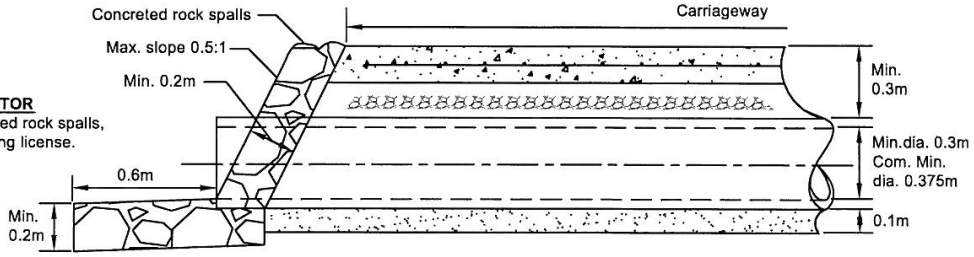
Kaipara te Oranganui • Two Oceans Two Harbours

KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

Drawing S10
Revision 0
Scale N.T.S

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S10.dwg , Plotted By Anniversita Pilapil at 28/09/2009 4:53:53 p.m. Scale 1.46.82





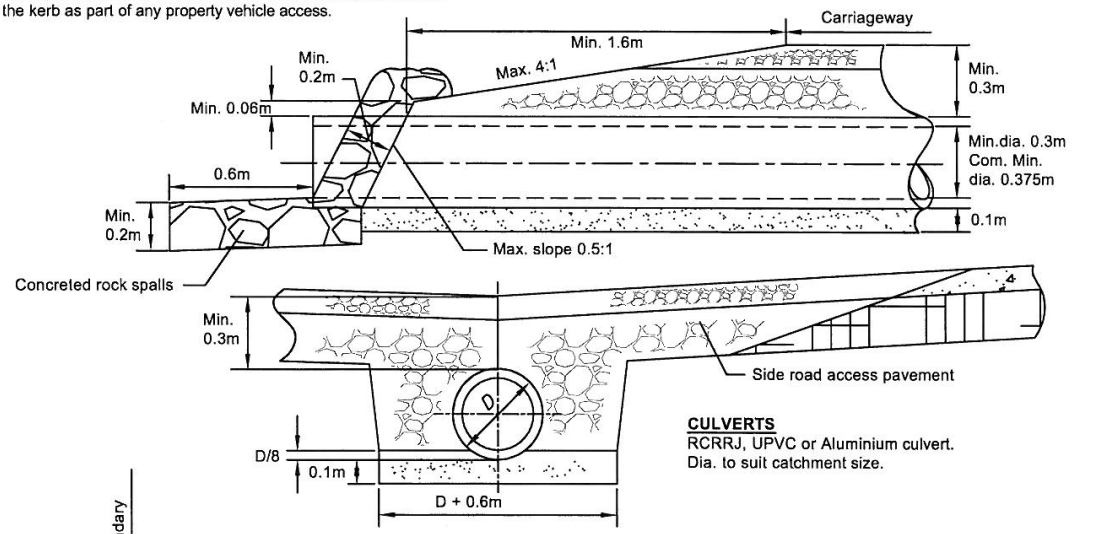
ENERGY DISSAPATOR
Install using concreted rock spalls, if required by crossing license.

NOTES

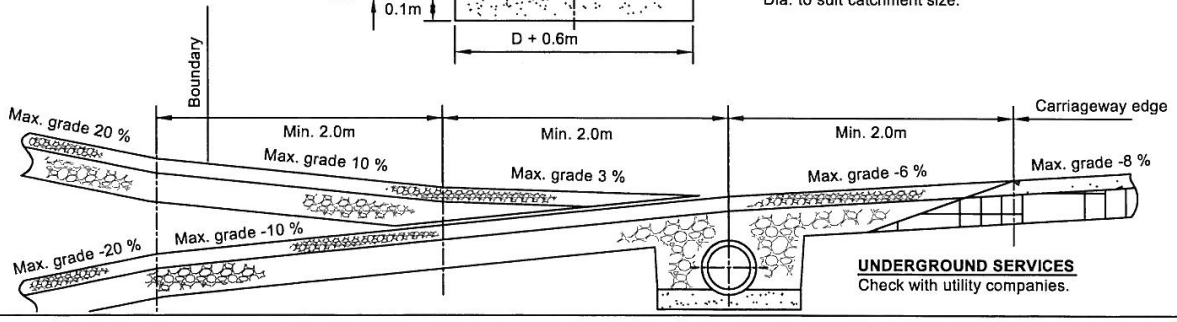
1. On sealed roads, the crossing/driveway shall be sealed or concrete from the carriageway edge.
2. All crossings require Council inspection and a MIN. CBR of 15, prior to pouring concrete.
3. Crossing concrete to be 30MPa at 28 days.
4. Ground to be compacted before pouring. Low or soft ground to be made good with a compacted Sub base layer as required.
5. Use a Min. 100mm, of compacted GAP40 basecourse and 665 mesh prior to pouring concrete. For urban, single dwelling crossing only, Min. 50mm of GAP25/40 and 665 mesh.

Urban

1. Slope shall be varied from those shown to suit existing footpaths.
2. If no footpath,allowance shall be made for such with a 3% crossfall to the kerb as part of any property vehicle access.



CULVERTS
RCRRJ, UPVC or Aluminium culvert.
Dia. to suit catchment size.



UNDERGROUND SERVICES
Check with utility companies.

VEHICLE CROSSING CROSS SECTIONS KERBED AND UNKERBED ROADS

No.	Revisions	Date
Designed	M WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

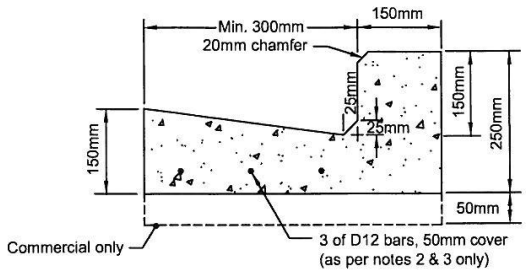
KAIPARA DISTRICT

KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

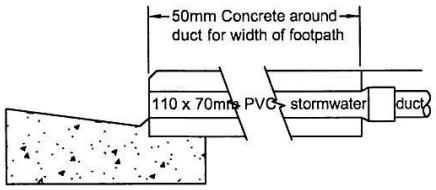
Drawing S11
Revision 0
Scale N.T.S.

ORIGINAL SIZE mm A4

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S11.dwg , Plotted By Anniversita Pilapil at 29/09/2009 10:00:20 a.m. Scale 1:46.82

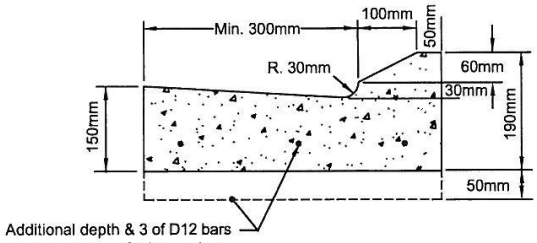


KERB AND CHANNEL

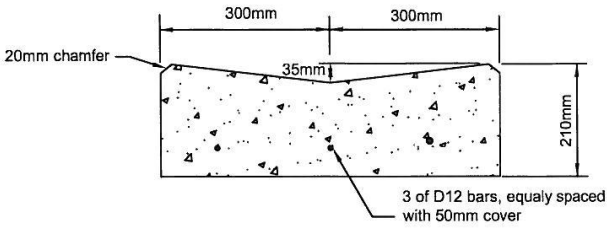


Note: Subject to adequate capcity for the catchment area

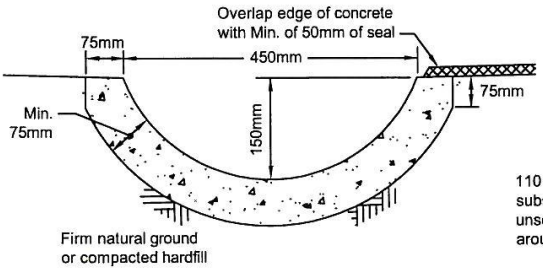
SECTION THROUGH STORMWATER DUCT AND KERB & CHANNEL



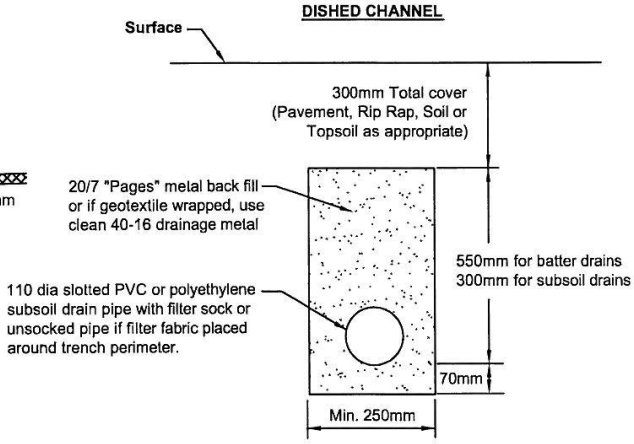
MOUNTABLE KERB AND CHANNEL



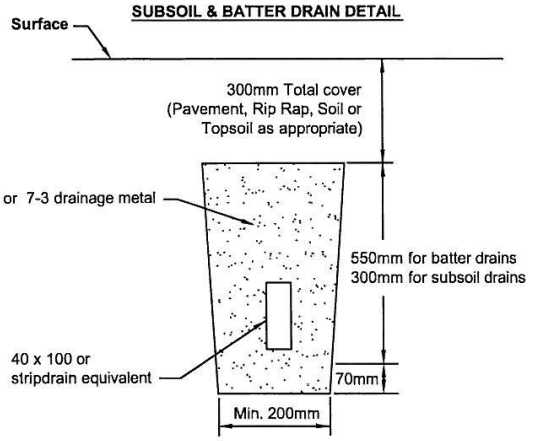
DISHED CHANNEL



CONCRETE LINED CHANNEL - RURAL



SUBSOIL & BATTER DRAIN DETAIL



STRIP DRAIN DETAIL

NOTES

1. Mountable kerbs are only to be used for service lanes, traffic islands and similar.
2. 3/D12 reinforcing bars to be placed around all curves, and intersections between tangent points.
3. Commercial crossings to be additional 50mm in depth as well as having 3-D12's equally spaced in the channel.
4. Concrete for Dished Channel, Pram Crossing and Mountable Kerb and Channel shall comply with NZS3109 and be 30MPa at 28 days.
5. Concrete for Concrete Lined Channel Rural and Kerb and Channel shall comply with NZS3109 and be 20MPa at 28 days.
6. Crack control joints to be formed at maximum of 3.5 metre intervals.
7. Profiles may be modified slightly to suit kerbing machine.
8. 300mm wide channels may be used for privateways and carparks.

KERB & CHANNEL, SUBSOIL & BATTER DRAIN DETAILS

No.	Revisions	Date
Designed	M WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

KAIPARA DISTRICT

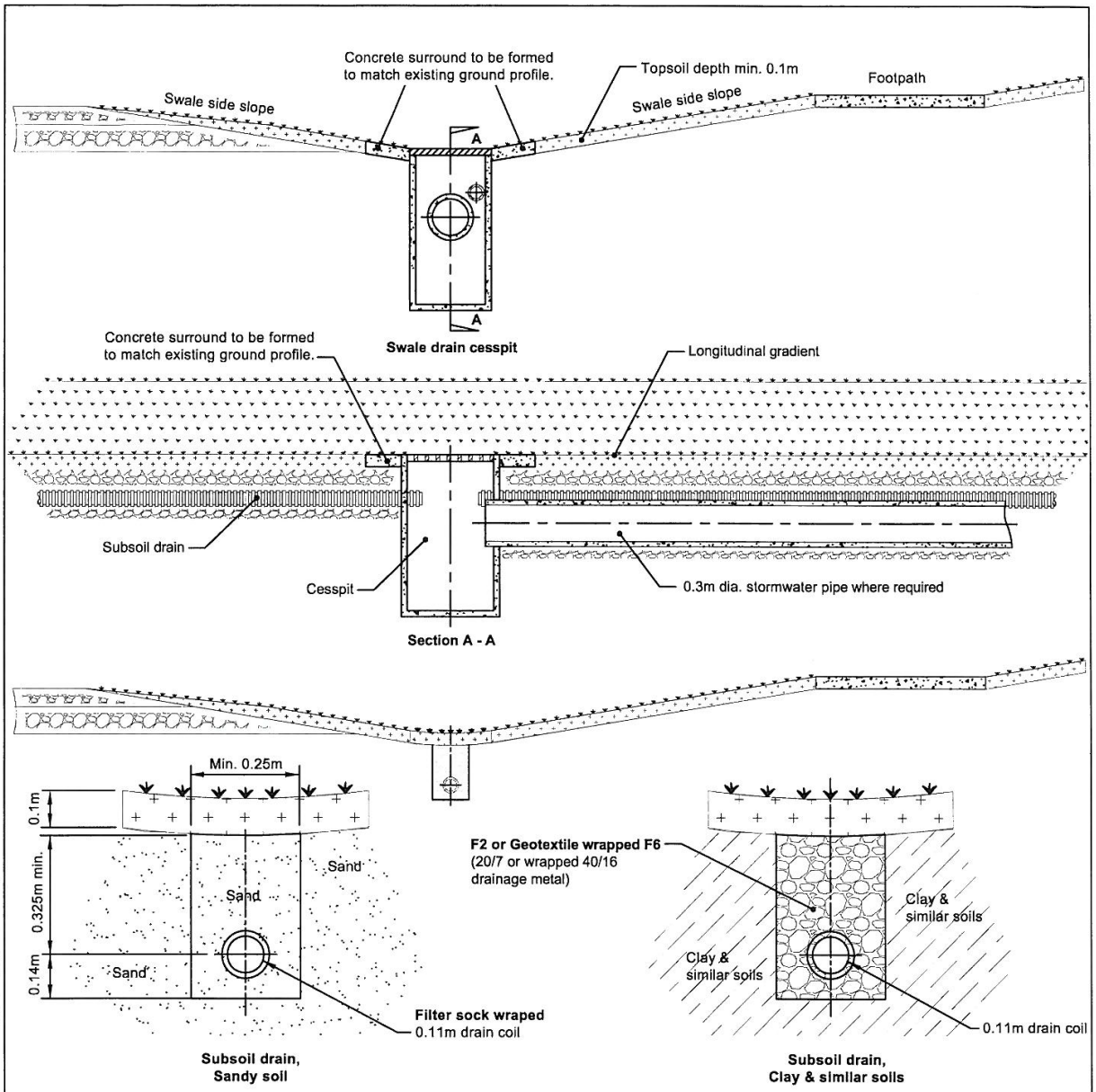
Kaipara te Oranganui • Two Oceans Two Harbours

KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

Drawing S12
Revision 0
Scale N.T.S.

ORIGINAL SIZE mm A4

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S12-R1.dwg , Plotted By Anniversita Pilapil at 29/09/2009 10:01:45 a.m. Scale 1:46.82



NOTES

1. Swale drain side slopes can vary from 20:1 to 6:1.
   Swale drains with vehicle crossings shall comply with the departure angle shown on KDC S17
2. Road reserve width may require increase to accommodate swale batters.
3. Vehicle crossings may require reduced swale side slopes.
4. Swale drain to be designed to limit max. velocities, refer to KDC Code of Practice clause 6.4.3.
5. Disposal soakage areas or outfalls subject to specific design.
6. Where cesspits are used they should be a max. of 100m apart.

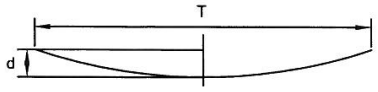
SWALE SHAPE & DESIGN DETAILS:

Cross section aera (A)

Top Width (T) = $\frac{1.5 \times A}{d}$

Hydraulic Radius (Hyd.r) = $\frac{T^2 \times d}{1.5 \times T^2 + 4 \times d^2}$

Where: T = 2.5m
d = 0.2m



SWALE DRAIN DESIGN

No.	Revisions	Date
Designed	M.WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

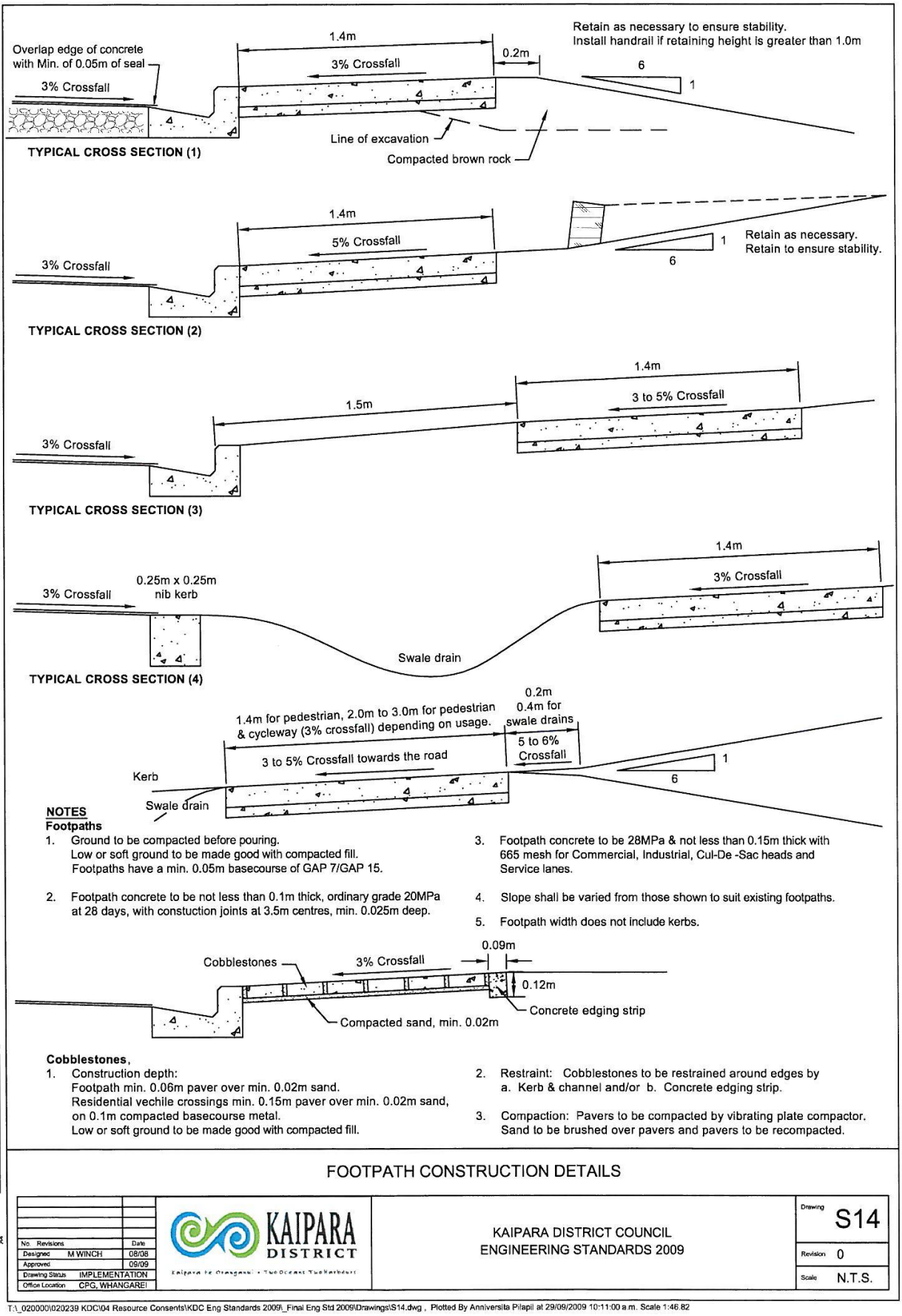
KAIPARA DISTRICT

KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

Drawing S13
Revision 0
Scale N.T.S.

ORIGINAL SIZE mm A4

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S13.dwg , Plotted By Anniversita Pilapil at 29/09/2009 10:02:54 a.m. Scale 1:46.82



NOTES

Footpaths

1. Ground to be compacted before pouring.
   Low or soft ground to be made good with compacted fill.
   Footpaths have a min. 0.05m basecourse of GAP 7/GAP 15.
2. Footpath concrete to be not less than 0.1m thick, ordinary grade 20MPa at 28 days, with constuction joints at 3.5m centres, min. 0.025m deep.
3. Footpath concrete to be 28MPa & not less than 0.15m thick with 665 mesh for Commercial, Industrial, Cul-De -Sac heads and Service lanes.
4. Slope shall be varied from those shown to suit existing footpaths.
5. Footpath width does not include kerbs.

Cobblestones,

1. Construction depth:
   Footpath min. 0.06m paver over min. 0.02m sand.
   Residential vechile crossings min. 0.15m paver over min. 0.02m sand, on 0.1m compacted basecourse metal.
   Low or soft ground to be made good with compacted fill.
2. Restraint: Cobblestones to be restrained around edges by a. Kerb & channel and/or b. Concrete edging strip.
3. Compaction: Pavers to be compacted by vibrating plate compactor. Sand to be brushed over pavers and pavers to be recompacted.

FOOTPATH CONSTRUCTION DETAILS

No.	Revisions	Date
Designed	M WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

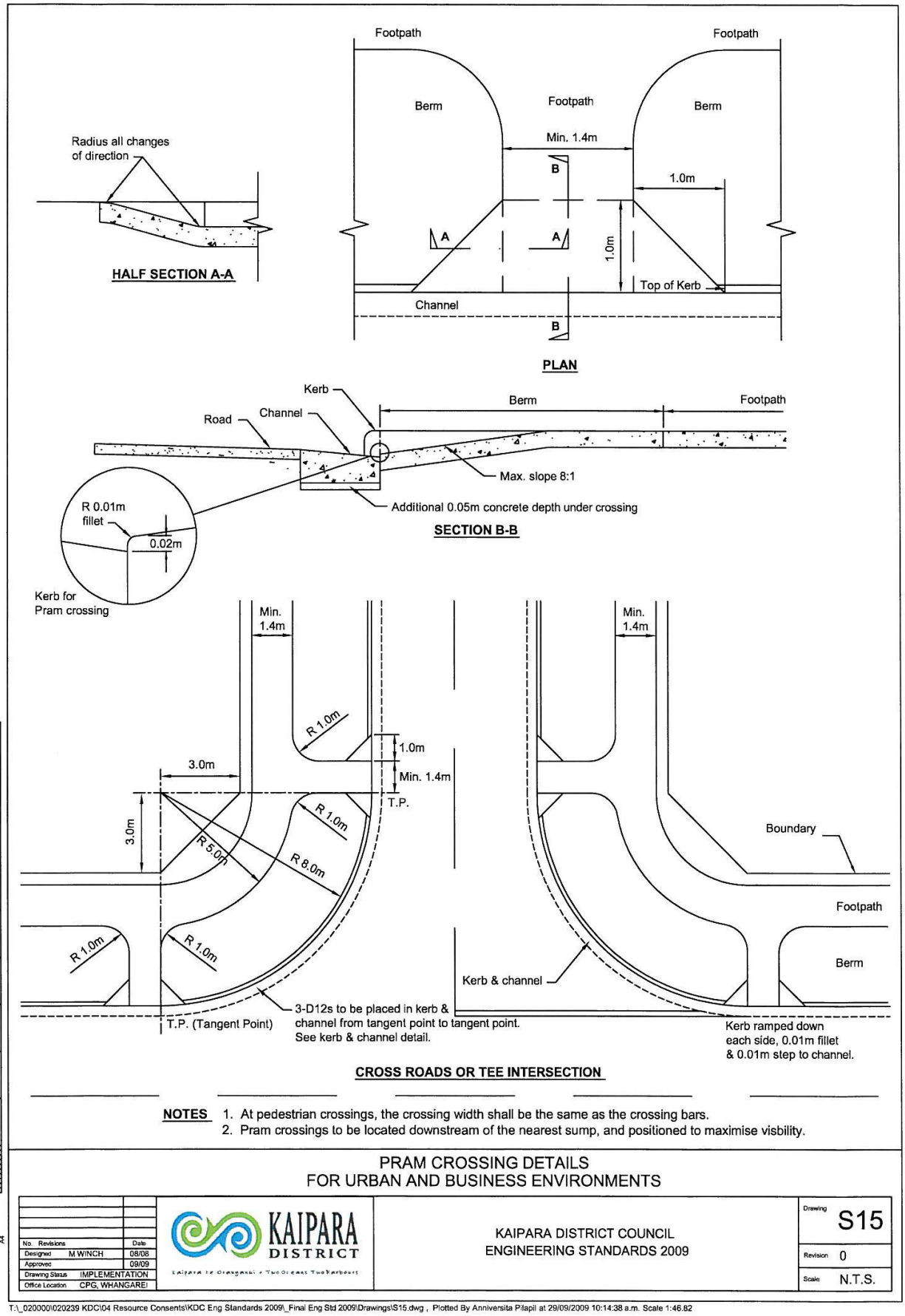
KAIPARA DISTRICT

KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

Drawing S14
Revision 0
Scale N.T.S.

ORIGINAL SIZE mm A4

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S14.dwg , Plotted By Anniversita Pilapil at 29/09/2009 10:11:00 a.m. Scale 1:46.82



NOTES
1. At pedestrian crossings, the crossing width shall be the same as the crossing bars.
2. Pram crossings to be located downstream of the nearest sump, and positioned to maximise visbility.

PRAM CROSSING DETAILS FOR URBAN AND BUSINESS ENVIRONMENTS

No.	Revisions	Date
Designed	M WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

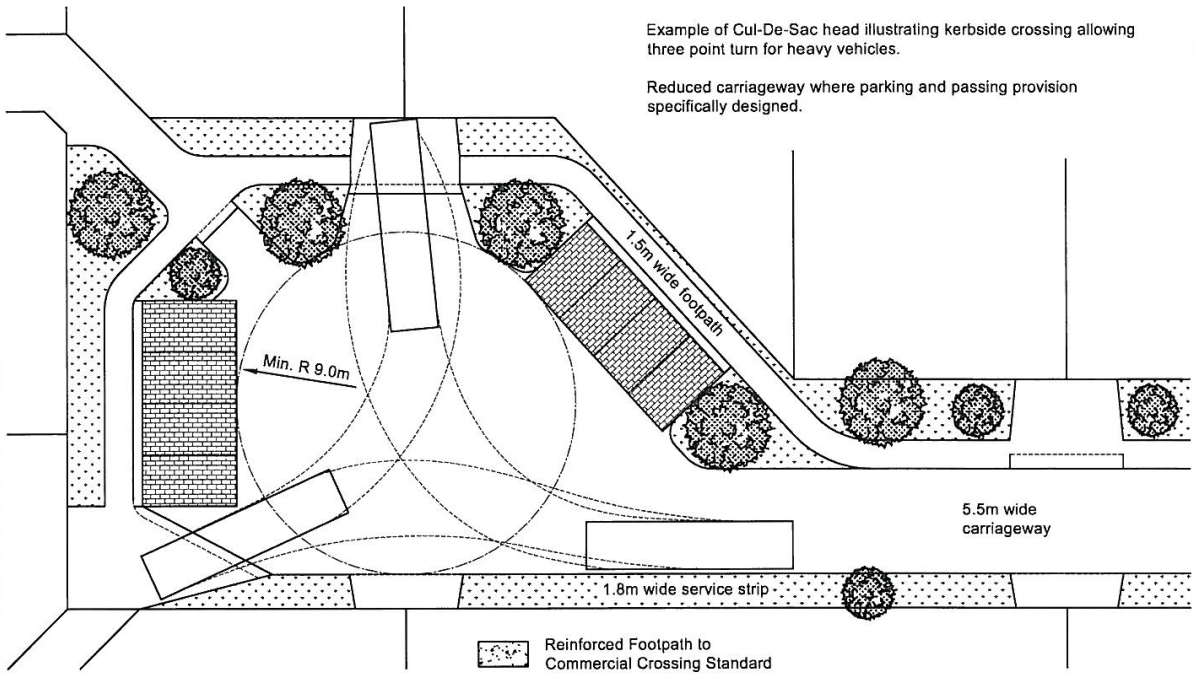
KAIPARA DISTRICT

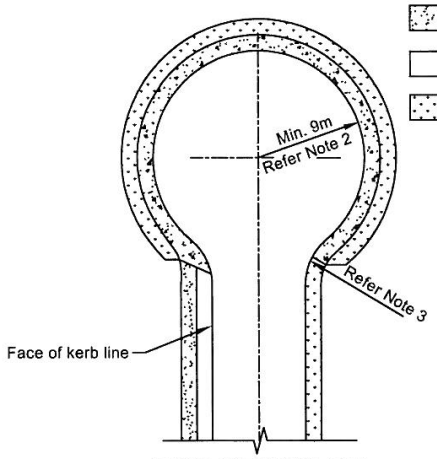
KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

Drawing S15
Revision 0
Scale N.T.S.

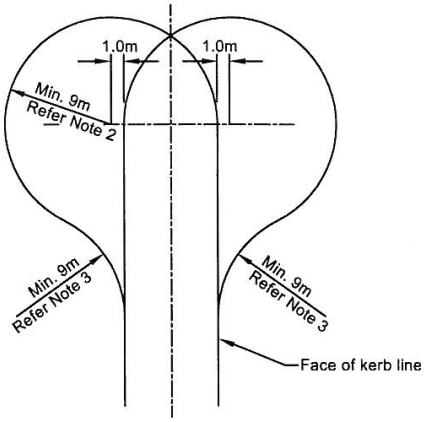
ORIGINAL SIZE mm A4

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S15.dwg , Plotted By Anniversita Pilapil at 29/09/2009 10:14:38 a.m. Scale 1:46.82





CIRCULAR TURNING AREA FOR CUL-DE-SAC



OFFSET CIRCULAR TURNING AREA FOR CUL-DE-SAC FOR RESIDENTIAL AREAS

NOTES

1. For All Environments, These dimensions are absolute minima. Kerb and shoulder support is not included.
2. Turning Radius 9 metres for Urban, 10m for Roads or Privateways longer than 100m and Rural areas, 15 metres for Industrial & Commercial areas.
3. Shoulder radius 8.0 metres for non-offset heads, 9.0 metres for offset heads. The "offset" dimensions apply for offsets from the road centreline of 2 metres or more.
4. Footpaths and berm widths as required for Urban Cul de sac (refer KDC S2 & S6).
5. Reinforced footpath to be 0.15m thick concrete with 665 mesh. Concrete strength to be 30 MPa at 28 days.
6. A central area may be provided for parking or planting. Where this is proposed, the layout shall be checked for access by heavy vehicles using tracking curves.
7. Hammerhead or "T" cul-de-sacs may be approved where a standard circular head is unsuitable. The layout is subject to specific design. Compliance with Figure 3.5 in NZS 4404:2004 is an acceptable solution in residential areas.
8. Where a cul de sac is formed, and it is intended that the road will be extended as part of a future stage in a development, the provision for turning at the end of the cul de sac shall be specifically considered. The design shall be subject to specific approval by the Roading Manager.

CUL - DE - SAC DETAILS

No.	Revisions	Date
Designed	M WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

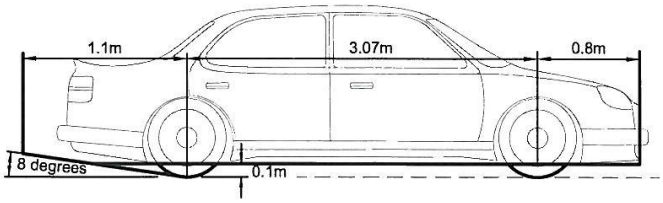
KAIPARA DISTRICT
Kaipara te Oranganui • Two Oceans Two Harbours

KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

Drawing S16
Revision 0
Scale N.T.S.

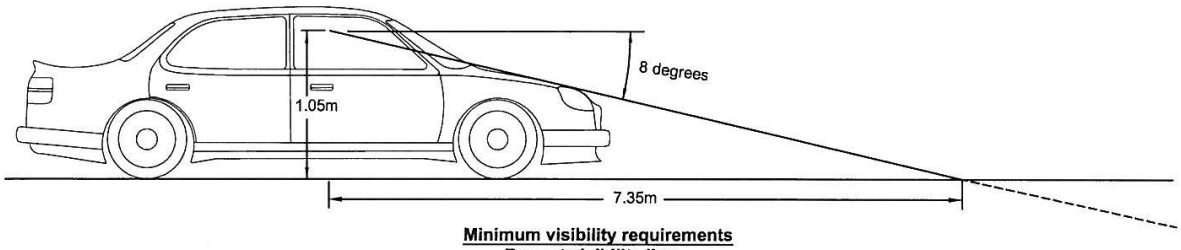
ORIGINAL SIZE mm A4

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S16-R1.dwg , Plotted By Anniversita Pilapil at 29/09/2009 9:00:49 a.m. Scale 1:46.82



Ground clearance template

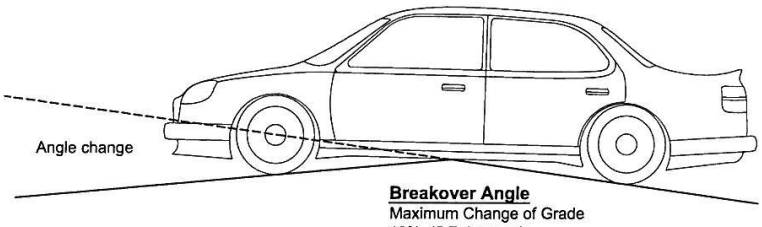
1. Prepare long section of driveway to natural scale and to the same scale as the template.
2. Move template back and forth along the plot, ensuring that the heavy line does not fall below the ground line.



Minimum visibility requirements

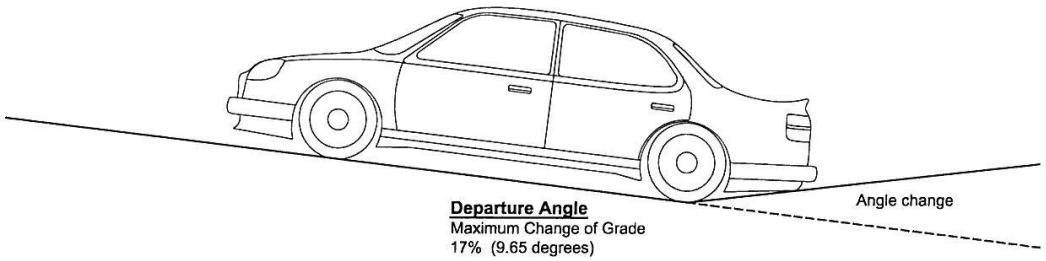
Bonnet visibility line

If angle change exceeds 10%, a vertical curve with minimum k > 1.0 m/% shall be provided



Breakover Angle

Maximum Change of Grade
10% (5.7 degrees)



Departure Angle

Maximum Change of Grade
17% (9.65 degrees)

Refer NZS 4404 Fig 3.9

ACCESS AND VEHICLE CROSSING
MINIMUM SERVICEABILITY REQUIREMENTS

No.	Revisions	Date
Designed	M WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

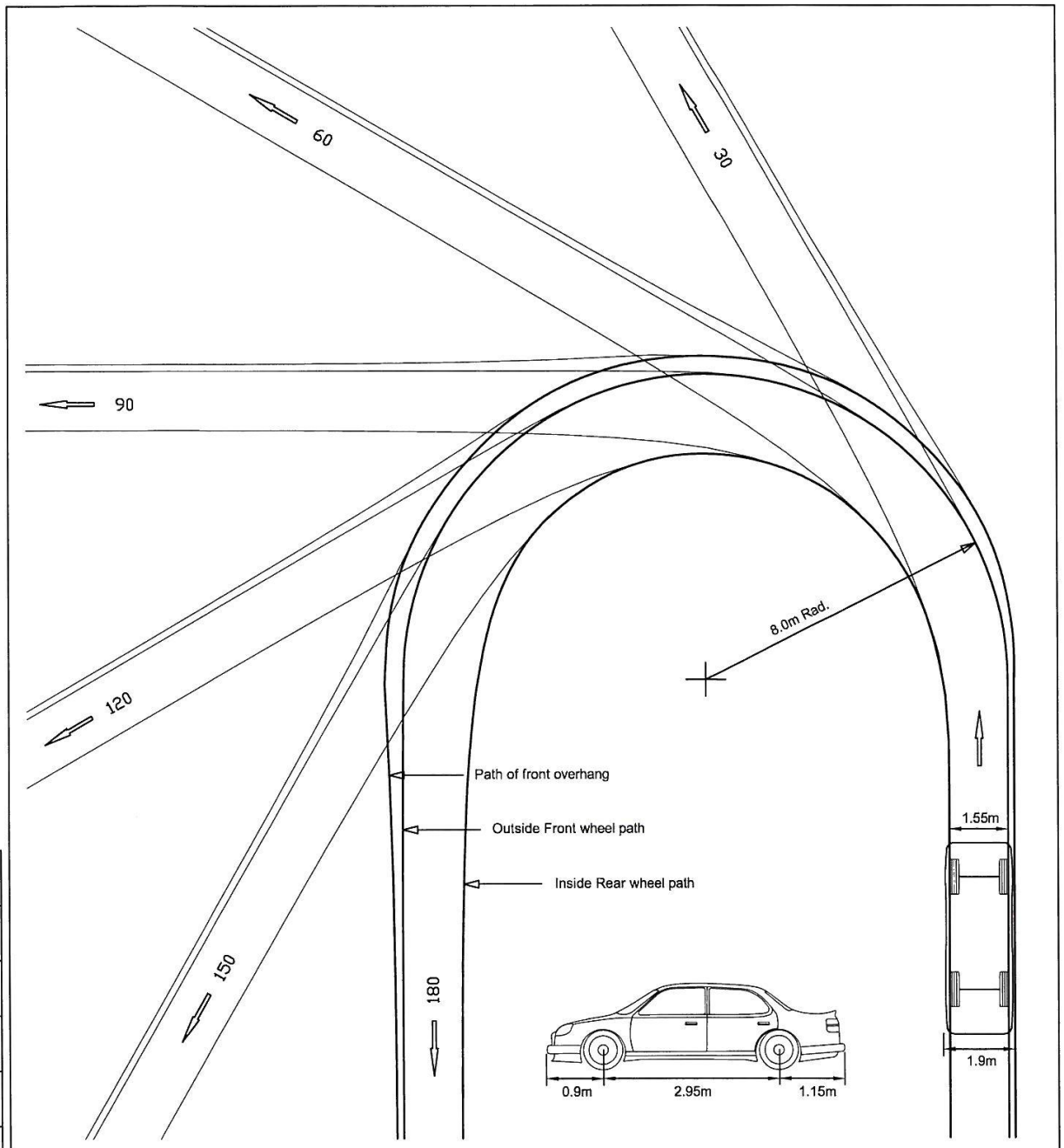
KAIPARA DISTRICT
Kaipara te Oranganui • Two Oceans Two Harbours

KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

Drawing S17
Revision 0
Scale N.T.S.

ORIGINAL SIZE mm A4 0 10 30 50 100

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S17.dwg , Plotted By Anniversita Pilapil at 29/09/2009 8:56:31 a.m. Scale 1:46.82



NOTES

1. Locate face of kerbs at least 0.6m clear of wheel paths
2. Allow 0.6m clearance outside path on both sides and ensure that this area is kept free of road furniture.

TRACKING CURVES
DESIGN CAR

No.	Revisions	Date
Designed	M WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

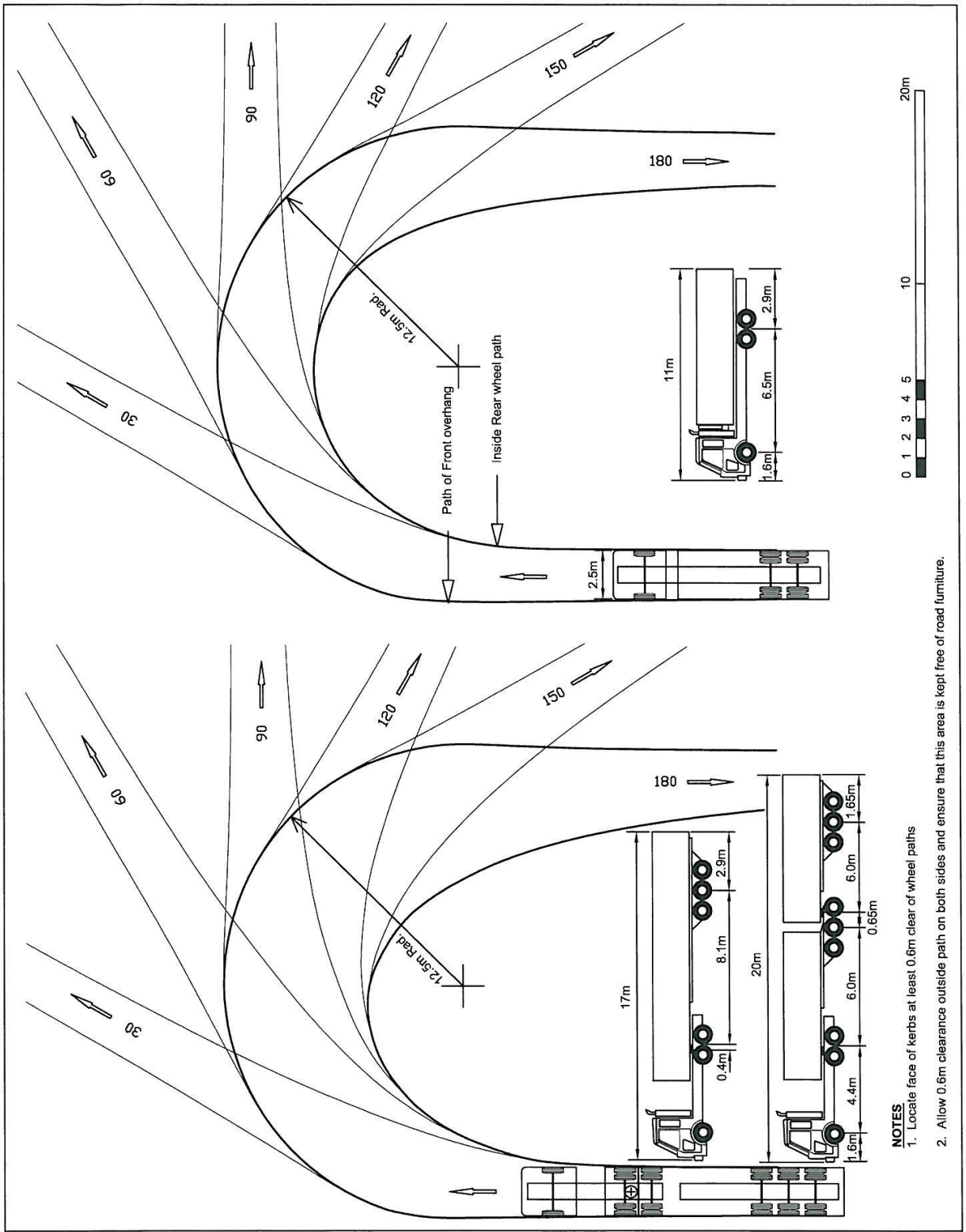
KAIPARA DISTRICT

KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

Drawing S18
Revision 0
Scale N.T.S.

ORIGINAL SIZE mm A4

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S18.dwg , Plotted By Anniversita Pilapil at 29/09/2009 8:59:20 a.m. Scale 1:46.82



NOTES
1. Locate face of kerbs at least 0.6m clear of wheel paths
2. Allow 0.6m clearance outside path on both sides and ensure that this area is kept free of road furniture.

TRUCK TRACKING CURVES
DESIGN TRUCKS

No.	Revisions	Date
Designed	M WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

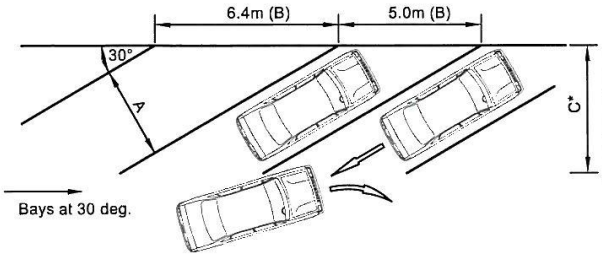
KAIPARA DISTRICT
Kaipara te Oranganui • Two Oceans Two Harbours

KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

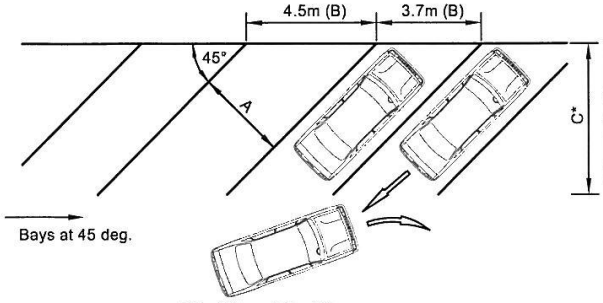
Drawing S19
Revision 0
Scale N.T.S.

ORIGINAL SIZE mm A4

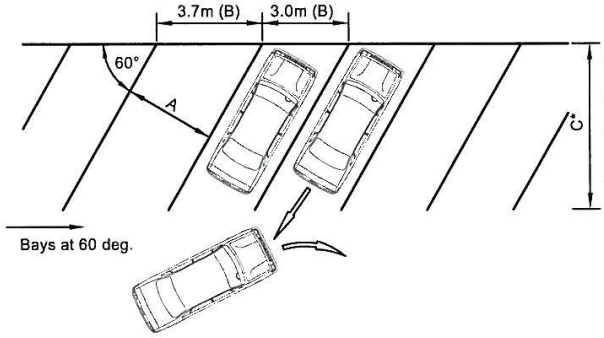
T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S19.dwg , Plotted By Anniversita Pilapil at 29/09/2009 8:59:02 a.m. Scale 1:46.82



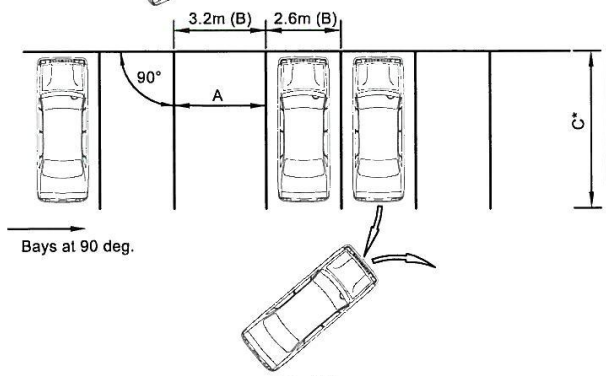
User class	A	B	C1	C2	Aisle width
1	2.5	5.0	4.4	4.1	2.9
2	3.2	6.4	4.4	4.1	2.9



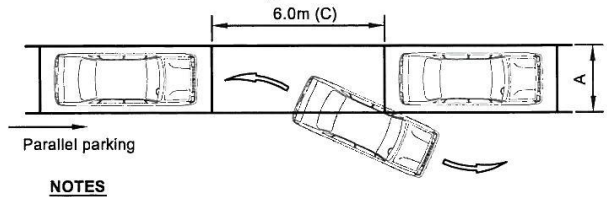
User class	A	B	C1	C2	Aisle width
1	2.6	3.7	5.2	4.8	3.5
2	3.2	4.5	5.2	4.8	3.3



User class	A	B	C1	C2	Aisle width
1	2.6	3.0	5.7	5.2	4.3
2	3.2	3.7	5.7	5.2	4.0



User class	A	B	C1	C2	Aisle width
1	2.6	2.6	5.4	4.8	6.2
2	3.2	3.2	5.4	4.8	5.8



User class	A	B	C1	C2	Aisle width
1	2.3	---	6.0	---	3.3

Dimensions in metres.

NOTES

User class 1: Standard.
User class 2: Disability parking.

C1: Where parking is to a wall or high kerb, not allowing any overhang.
C2: Where parking is to a low kerb which allows 0.6m overhang.

CAR PARKING LAYOUTS AND DIMENSIONS

No.	Revisions	Date
Designed	M WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

KAIPARA DISTRICT

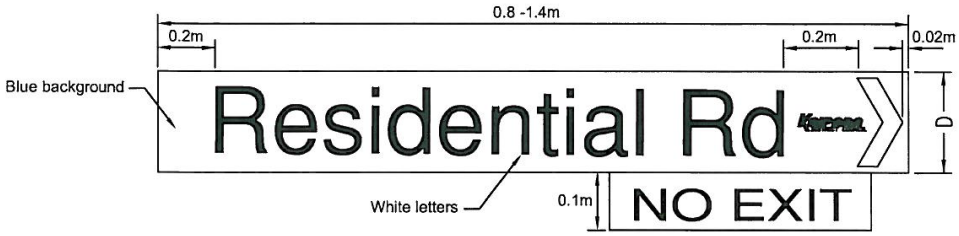
Kaipara te Oranganui • Two Oceans Two Harbours

KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

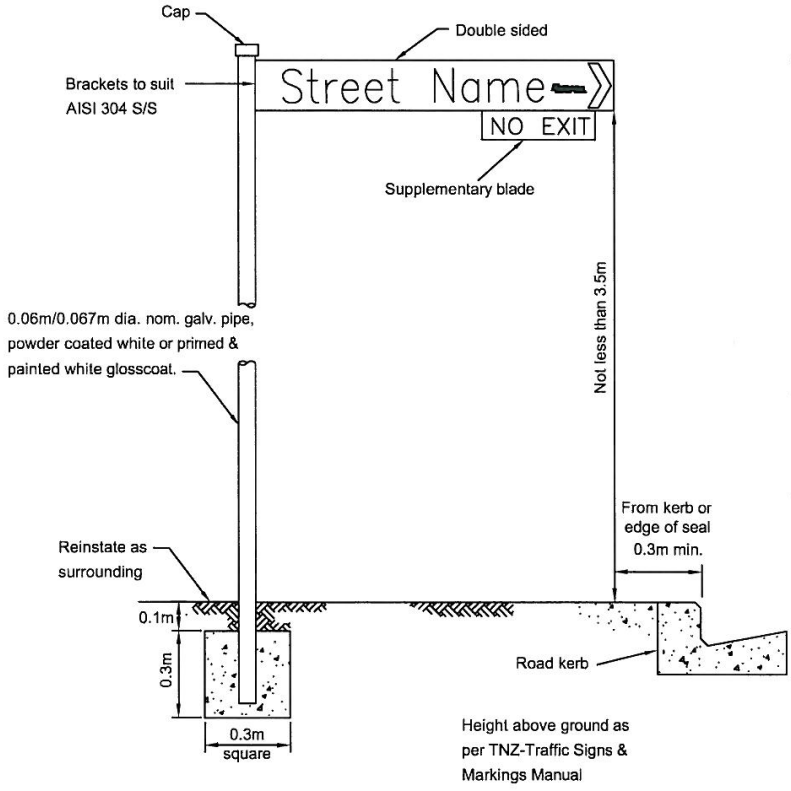
Drawing S20
Revision 0
Scale N.T.S.

ORIGINAL SIZE mm A4

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S20.dwg , Plotted By Anniversita Pilapil at 29/09/2009 8:58:41 a.m. Scale 1:46.82



BLADE SIZE: D	100 km/h – 0.25m 70 km/h – 0.2m 50km/h – 0.15m
BLADE TYPE:	"I" Section Aluminium Extrusion
CODE:	SNB 0.15m / 0.2m / 0.25m
LETTER STYLE:	Transport-Upper & lower case
LETTER HEIGHT:	0.15m/0.2m/0.25m
CONDENSED:	To Suit
SPACING:	To Suit
LOGO:	Kaipara District Council Logo
COLOUR:	E.C. film high intensity White Letters on Blue background
ARROW:	120° 0.15m blade - 0.04m wide 0.2m blade - 0.045m wide 0.25m blade - 0.05m wide



NOTES

1. When a road is to be vested in the Council the applicant shall submit 3 (three) preferred names in order of priority for Council approval.
2. The applicant is responsible for installation of necessary signage and road marking in accordance with the Transit New Zealand Manual of Traffic Signs and Markings for any access vested as road to be maintained by the Council.

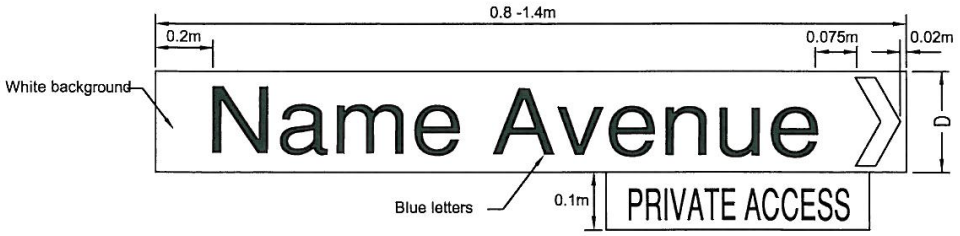
STANDARD STREET SIGN FOR PUBLIC ROADS

No. Revisions	Date	KAIPARA DISTRICT	KAIPARA DISTRICT COUNCIL ENGINEERING STANDARDS 2009
Designed M WINCH	08/08		
Approved	09/09		
Drawing Status IMPLEMENTATION			
Office Location CPG, WHANGAREI			

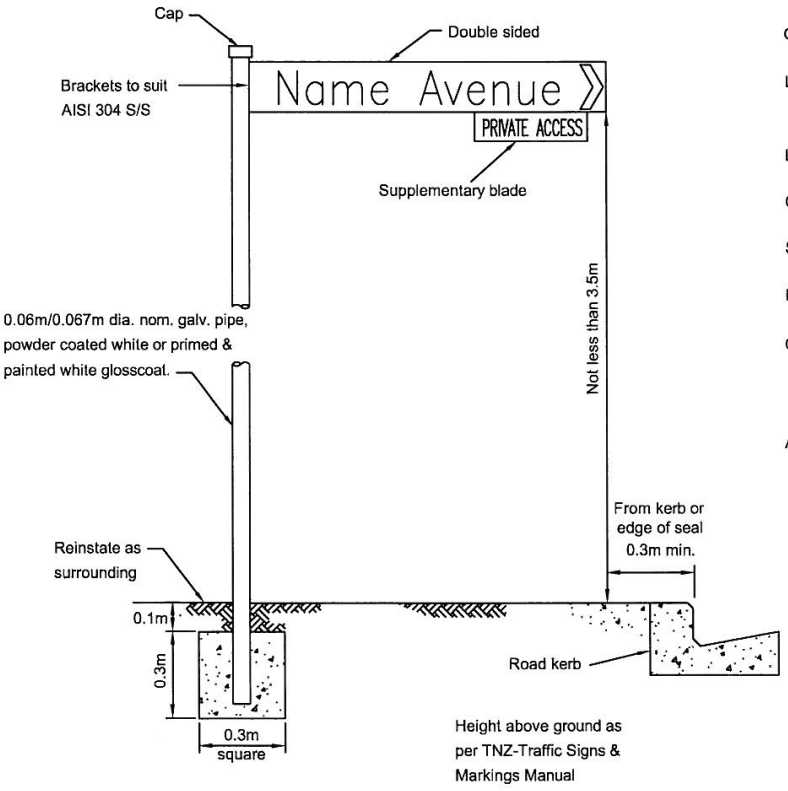
Drawing S21 | Revision 0 | Scale N.T.S.

ORIGINAL SIZE mm A4

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S21.dwg , Plotted By Anniversita Pilapil at 29/09/2009 8:57:52 a.m. Scale 1:46.82



BLADE SIZE: D	Over 50 km/h – 0.2m 50km/h -- 0.15m
BLADE TYPE:	"I" Section Aluminium Extrusion
CODE:	SNB 0.15m / 0.2m
LETTER STYLE:	Transport-Upper & lower case
LETTER HEIGHT:	0.1m / 0.15m
CONDENSED:	To Suit
SPACING:	To Suit
LOGO:	No Logo
COLOUR:	E.C. film high intensity Blue Letters on White background
ARROW:	120° 0.15m blade - 0.04m wide



NOTES

1. Rights of way, access lots, common areas and private roads do not require names.
   Where a name is preferred for any such accessway, the applicant shall submit 3 (three) names in order of priority for Council approval.
2. The applicant is responsible for installation of necessary signage and road marking in accordance with the Transit New Zealand Manual of Traffic Signs and Markings for any access vested as road to be maintained by the Council.

STANDARD ACCESS NAME SIGNS

No.	Revisions	Date
	Designed M WINCH	08/08
	Approved	09/09
	Drawing Status IMPLEMENTATION	
	Office Location CPG, WHANGAREI	

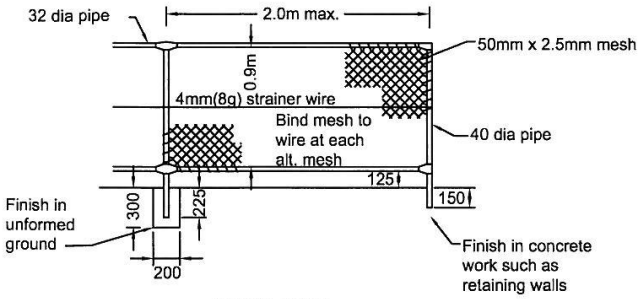
KAIPARA DISTRICT

KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

Drawing S22
Revision 0
Scale N.T.S.

ORIGINAL SIZE mm A4

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S22.dwg , Plotted By Anniversita Pilapil at 29/09/2009 8:57:36 a.m. Scale 1:46.82



TYPE 1 FENCE
WALKWAYS AND SIMILAR

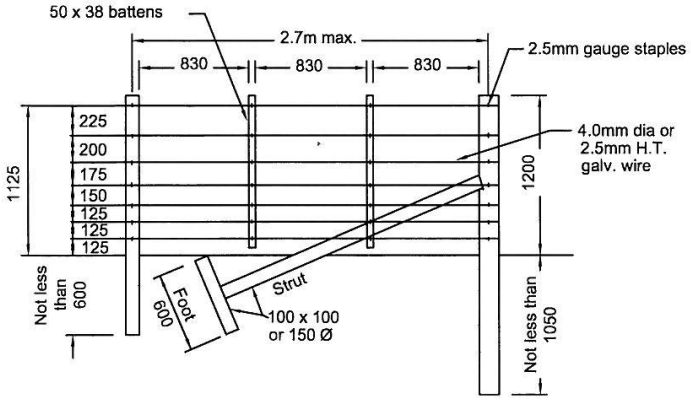
TYPE 4 FENCE

1. To be used for fencing bush covenants and areas where stock proofing is essential.
2. Details are to conform with a Type 2 fence with the exception that:

a) Posts shall not be more than 5.0m apart.

b) Battens shall be approx. 800mm apart (i.e. 5 battens between posts)

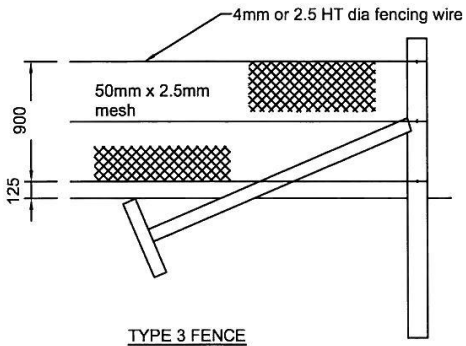
3. Posts and hollow areas subject to lifting from wire strain are to be securely footed and/or stayed.
4. Bush covenant fencing shall only have one access gate which is to be securely wired closed in two positions each end.



TYPE 2 FENCE
WALKWAYS AND SIMILAR

NOTES

1. TYPE 2, 3 and 4 FENCES to have concrete or wooden posts and struts, securely rammed.
2. Timber posts shall be treated to H4 specification.
3. Timber posts and struts to be 100 x 100 or 150 dia min.
4. Timber strainer posts to be 150 x 150 or 250 dia min.
5. Mesh to be tied to railings and standards with galvanised binder wire as shown (Not bag ties)
6. Fittings to be "Kee Klamp" or similar pattern.
7. All pipes, wire, mesh and staples to be galvanised.
8. GENERAL:
   Safety fencing, safety railing, alternative fencing, cycle barriers,and walkway surfacing shall be subject to specific design and approval otherwise specified.



TYPE 3 FENCE
WALKWAYS AND SIMILAR
(Posts, struts, and footings as per Type 2 fence.)

FENCE TYPES

No.	Revisions	Date
Designed	M WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

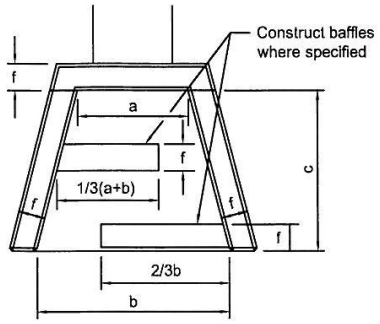
KAIPARA DISTRICT
Kaipara te Oranganui • Two Oceans Two Harbours

KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

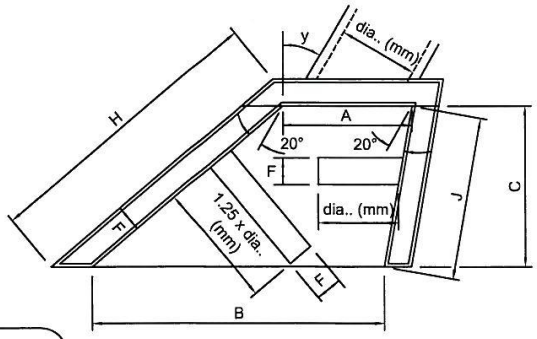
Drawing S23
Revision 0
Scale N.T.S.

ORIGINAL SIZE mm A4

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S23.dwg , Plotted By Anniversita Pilapil at 29/09/2009 9:26:28 a.m. Scale 1:46.82

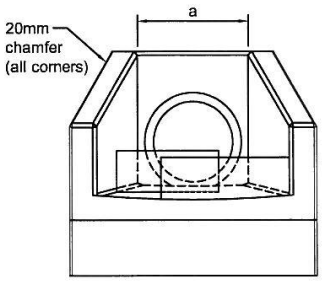


PLAN

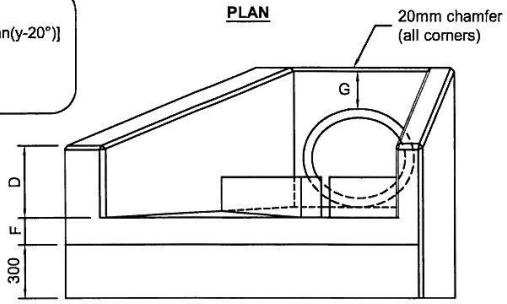


PLAN

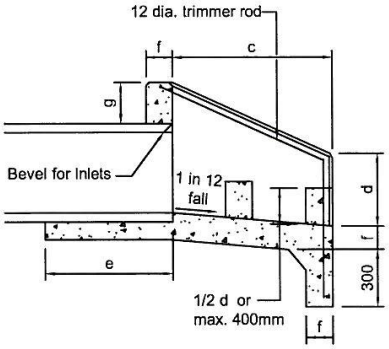
A	Sec y x (a)
B	C Tan (y+20°) + [A-C Tan(y-20°)]
H	C x Sec (y + 20°)
J	C x Sec (y - 20°)



END ELEVATION



END ELEVATION



SECTION

PRINCIPAL DIMENSIONS (mm)							
DIA. OF PIPE	a	b	c C	d D	e E	f F	g G
300	450	750	750	300	525	100	150
375	550	900	850	350	625	100	150
450	630	1100	900	400	725	150	230
525	700	1200	1000	450	825	150	230
600	800	1400	1100	550	900	150	230
750	1000	1700	1200	600	1050	150	300
900	1170	2000	1450	650	1225	150	300
1050	1380	2300	1700	750	1375	150	300
1200	1520	2600	2100	750	1550	150	450
1350	1680	2800	2400	750	1725	150	450

NOTES

1. Reinforce floors & walls with:
   - 150 - 375 665 mesh
   - 450 - 600 663 mesh or D10 rods at 250 crs.
   - 675 - 900 D12 rods at 250 crs.
   - 1050 - 1350 D12 rods at 150 crs.
2. All reinforcement shall be placed centrally in walls and floor,and shall be continuous between walls and floor.
3. Laps in Structural grade bars to be 300mm min.
4. There shall be at least 2 bars - whether mesh or M.S over the top of the pipe.
5. Concrete is to be ordinary grade (17.5MPa) in accordance with NZS 3109.
6. Baffles are to be constructed as shown when outlet velocities and soil conditions dictate, in extreme cases specific design may be required by the Council.
7. Inlet structures shall have reverse apron fall and no baffles.

INLET AND OUTLET STRUCTURES

No.	Revisions	Date
Designed	M WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

KAIPARA DISTRICT
Kaipara te Oranganui • Two Oceans Two Harbours

KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

Drawing S24
Revision 0
Scale N.T.S.

ORIGINAL SIZE mm A4

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S24.dwg , Plotted By Anniversita Pilapil at 29/09/2009 9:25:59 a.m. Scale 1:1.02

CONCRETE PIPES
(SUITABLE FOR ALL SITUATIONS)

PIPE SIZE (mm)	CLASS	MIN. COVER (mm)	MAX. COVER (m)
225	3 (Y)	300	3.0
	2 (X)	500	2.4
300	4 (Z)	300	-
	3 (Y)	400	3.0
	2 (X)	700	2.0
375	4 (Z)	300	-
	3 (Y)	400	3.0
	2 (X)	700	1.8
450	4 (Z)	300	-
	3 (Y)	400	3.0
	2 (X)	700	1.8
525	4 (Z)	300	-
	3 (Y)	400	3.0
	2 (X)	700	1.8
600	4 (Z)	300	-
	3 (Y)	400	3.0
	2 (X)	500	2.0
750	3 (Y)	300	3.0
	2 (X)	500	2.0
900	3 (Y)	-	3.0
1050	2 (X)	300	2.0
1200			

Note : Information obtained from Concrete Pipe Association of Australasia

ALUMINIUM PIPES
(ENTRANCE CROSSINGS - PRIVATE ROAD CULVERTS ONLY)

PIPE SIZE (mm)	MIN. COVER (mm)	MAX. COVER (m)
300	300	3.0
375	300	
450	300	
600	300	
750	375	
900	450	
1050	525	
1200	600	

Note : Information obtained from C.S.P Pacific

uPVC PIPES (ENTRANCE CROSSINGS - PRIVATE ROAD CULVERTS ONLY)
IPLEX TRANSIT - SPEC. CULVERTS

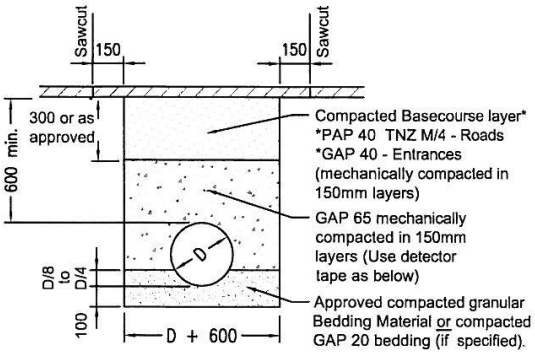
PIPE SIZE (mm)	MIN. COVER (mm)	MAX. COVER (m)
225 - 475	300	3.0

Note : Information obtained from IPLEX.

ALI-TUFF PIPES (1.6mm Gauge)

PIPE SIZE (mm)	MIN. COVER (mm)	MAX. COVER (m)
300 - 1200	600	Manufacturers Specification

Note : Information obtained from Richardson Pacific (NZ) Ltd.



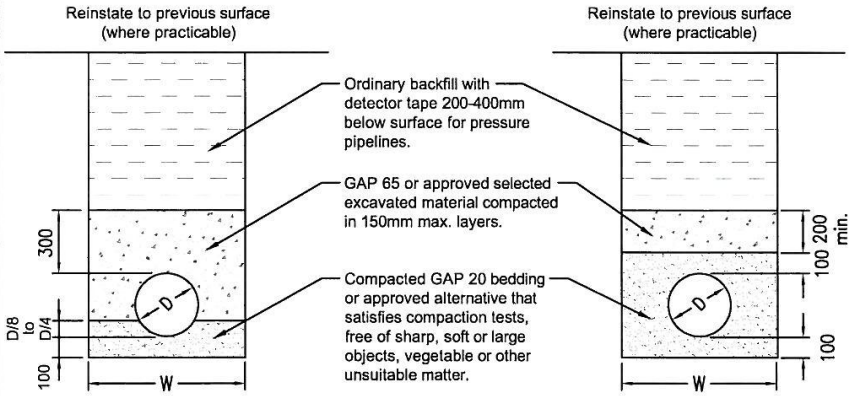
ADDITIONAL BACKFILL REQUIREMENTS UNDER CARRIAGEWAYS

All types of pipe except concrete (refer to concrete pipe chart)

BEDDING MATERIAL

Crushed aggregate with the following requirements:
Crushing resistance 110KN
Weathering resistance: AA, AB, AC, BA, BB, CA, CB
Clay index: B
Sand equivalent: 15

Grading: Sieve Size (mm)	19.0	2.36	0.60	0.30	0.15	0.075
% Mass Passing	100	100-50	90-20	60-10	25-0	10-0



ALUMINIUM, CONCRETE GALVANISED STEEL OR VITRIFIED CLAY PIPE
(Where specifically approved)

PVC & PE PIPE
(PVC not approved for water supply)

PE pipe bedding aggregate shall not exceed 5% of the Nominal pipe dia.

W	TYPE OF PIPE
D + 600	Aluminium
D + 600	Galvanised Steel
D + 450	Concrete
D + 450	Vitrified Clay
D + 400	uPVC & PE

Variations in **W** require additional design compensation.

NOTES

1. Concrete pipes to be RCRRJ "Class X" (or stronger) installed to Manufacturers requirements.
2. Aluminium pipes to be "Aluflo" or "Highflo" type design (or similar).
3. Ordinary backfill shall be free from stones or rocks greater than 150mm nominal diameter & compacted in 300mm layers.
4. Replace topsoil to original depth as necessary.
5. Existing sealed roadway excavations are to be resurfaced with 50mm of asphaltic concrete.
6. Privateway basecourse metalling within pipe trenches may be in accordance with the Privateway Standards.
7. Unsatisfactory trench material is to be undercut and replaced with compacted hardfill.
   In poor soils such as swamp/peat material and in rock the minimum depth of granular bedding material below the invert is to be 200mm or Specific design as necessary.
8. Trench width shall not exceed W at the pipe crown level.
9. Pipelines at 1:8 gradient or steeper shall have cement stabilised bedding and/or surrounds.
10. Pipelines at 1:3 gradient or steeper shall have 'weak mix' concrete bedding (10MPa). Large pipes will require Specific pipe design.
11. Concrete bedding shall be allowed to cure for 48 hours prior to backfilling.
12. Backfilling under carriageways may be with 'flowable fill' (low strength fly-ash concrete).
13. Granular bedding is to satisfy N.Z.S 7643 - Appendix B.
14. Minimum cover over pipes (unless specifically designed or protected in accordance with KDC S26), to the highest point or bell, of the outside of the pipe (or collar) in any area shall be :
    a) 300mm - if not subjected to traffic loading
    b) Ref. to above charts - under carriageways and trafficked areas.

CULVERT, BEDDING AND BACKFILL DETAILS

No.	Revisions	Date
Designed	M WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

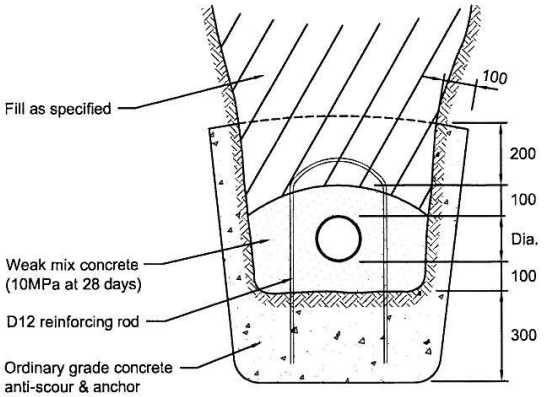
KAIPARA DISTRICT
Kaipara ki Oruawhata • Two Oceans Two Harbours

KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

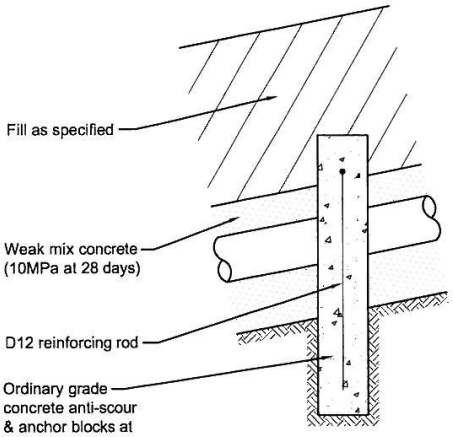
Drawing S25
Revision 0
Scale N.T.S.

ORIGINAL SIZE mm A4

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S25.dwg , Plotted By Anniversita Pilapil at 29/09/2009 9:25:39 a.m. Scale 1:46.82



SECTION



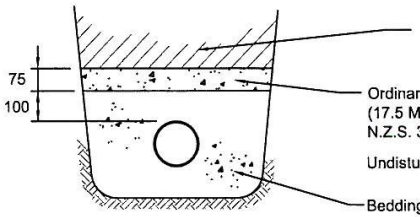
ELEVATION

STEEP PIPE DETAILS

(For pipeline gradients 1:3 or steeper)

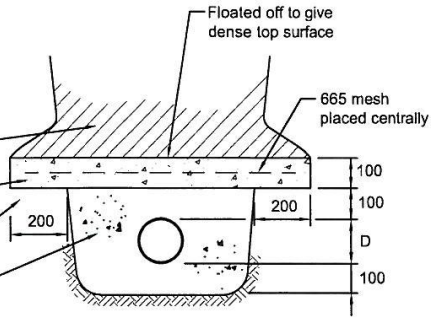
NOTES

1) Some variation is possible using aluminium plate cut off walls bolted to larger diameter pipes.
2) Larger diameter pipes will require Specific pier design to counter the downward component of water and pipe weight.



UNREINFORCED CONCRETE

SLAB PROTECTION



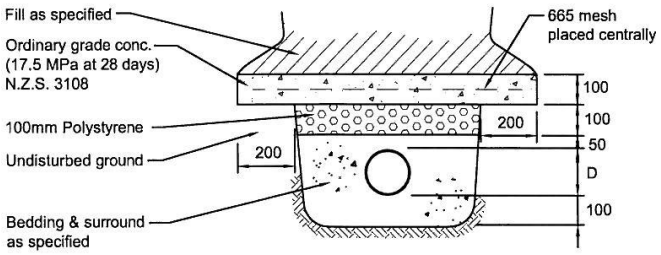
REINFORCED CONCRETE

SLAB PROTECTION

(Where additional loading or other requirements necessitate)

GENERAL NOTES

1. Weak mix concrete:
   - 1 part cement to 6 parts aggregate.
2. Cement stabilised bedding and back fill:
   - 1 part cement to 20 parts aggregate.
3. Allow 48 hours curing prior to back-filling for any concrete or stabilised material.



REINFORCED CONCRETE SLAB PROTECTION

FOR WATER PIPELINES

PIPE PROTECTION AND BULKHEAD DETAILS

No.	Revisions	Date
Designed	M WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

KAIPARA DISTRICT

Kaipara te Oranganui • Two Oceans Two Harbours

KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

Drawing S26

Revision 0

Scale N.T.S.

ORIGINAL SIZE mm A4

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S26.dwg , Plotted By Anniversita Pilapil at 29/09/2009 9:25:24 a.m.Scale 1:1

Sewer Reticulation

- Sewer Lines — DIAMETER & TYPE — SS SS SS
- Sewer Manholes — MH ID
- Pump Station — PS ID
- Maintenance Shaft — MS ID
- Terminal Maintenance Shaft — TMS ID

Stormwater Reticulation

- Stormwater Lines — DIAMETER & TYPE — SW SW SW
- Stormwater Manholes — MH ID
- Cesspit / Sump — CP ID
- Subsoil Drain
- Watercourse
- Limit of Catchment Area

Water Reticulation

- Water Lines — DIAMETER & TYPE — W W W
- Sluice & Peet Valve
  - Normally open — SV PV
  - Normally closed — SV PV
- Pressure Reducing Valve — PRV
- Air Valve — AV
- Non-Return Valve — NRV
- Bulk Meter — M
- Hydrant — H
- Multi Chamber — MC

ORIGINAL SIZE mm A4 (0, 10, 30, 50, 100)

STANDARD SYMBOLS

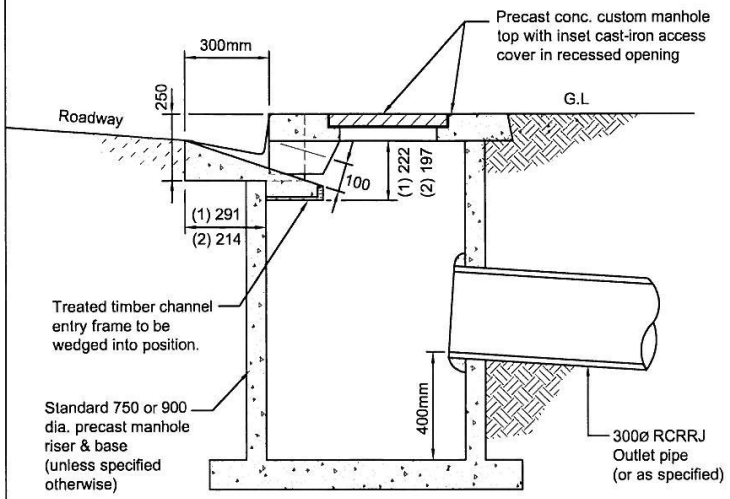
No.	Revisions	Date
Designed	M WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

KAIPARA DISTRICT

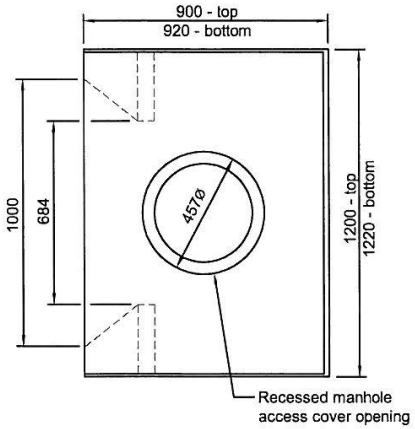
KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

Drawing S27
Revision 0
Scale N.T.S.

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S27.dwg , Plotted By Anniversita Pilapil at 29/09/2009 9:25:09 a m.Scale 1:112.49



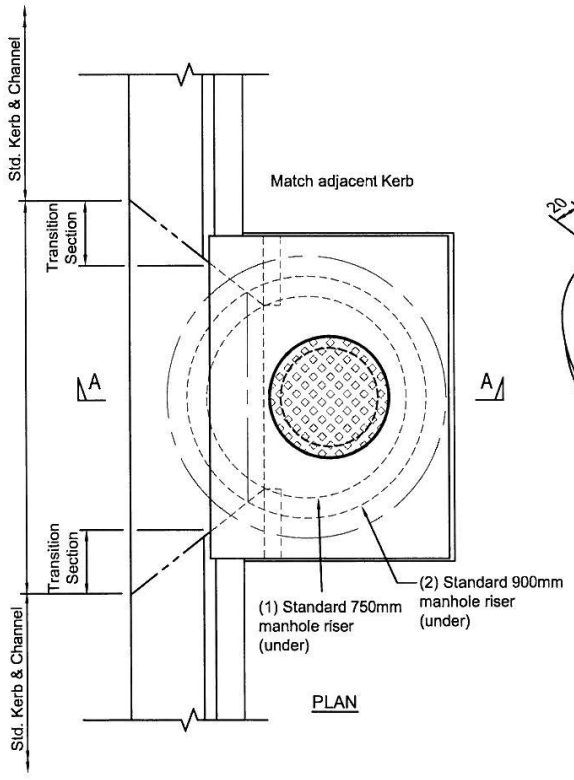
SECTIONAL ELEVATION A - A



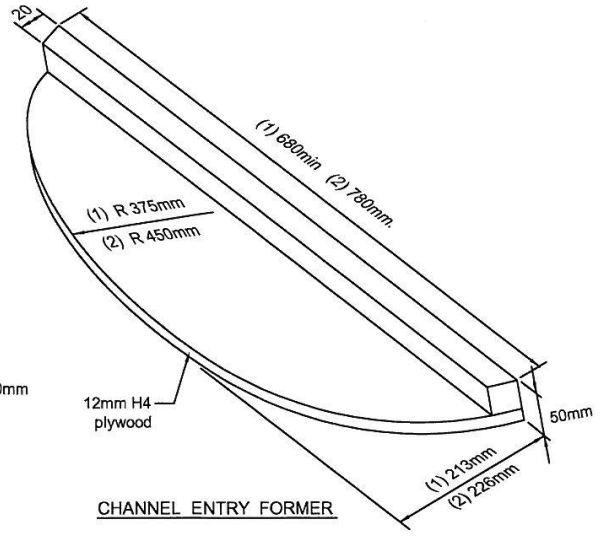
PLAN - MANHOLE TOP

NOTES:

1. Precast Catchpit shall be Humes type or approved equivalent.
2. Associated pipes to be as detailed or specified.



PLAN



CHANNEL ENTRY FORMER

CATCH PITS

No.	Revisions	Date
Designed	M WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

KAIPARA DISTRICT

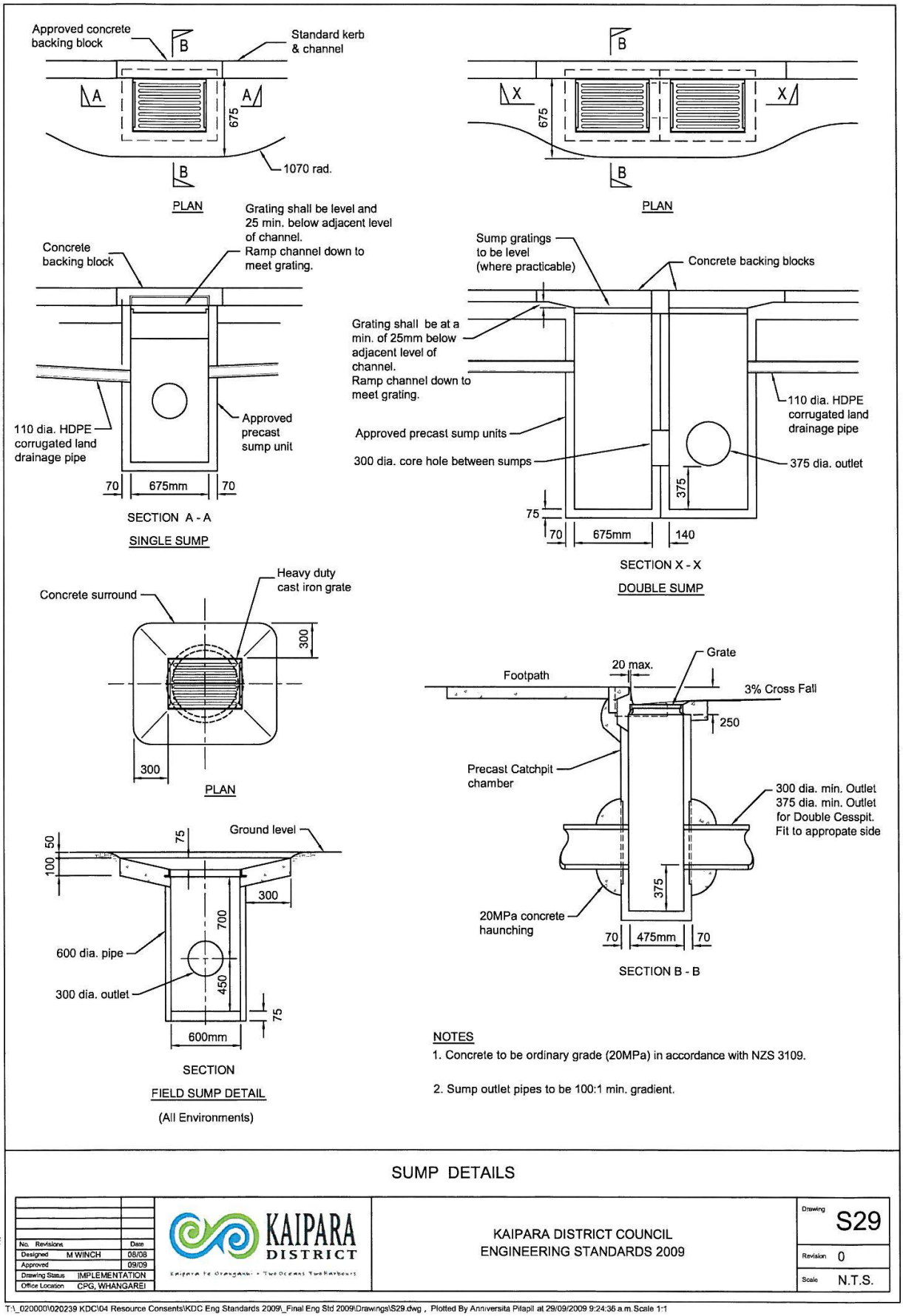
Kaipara te Oranganui - Two Oceans Two Harbours

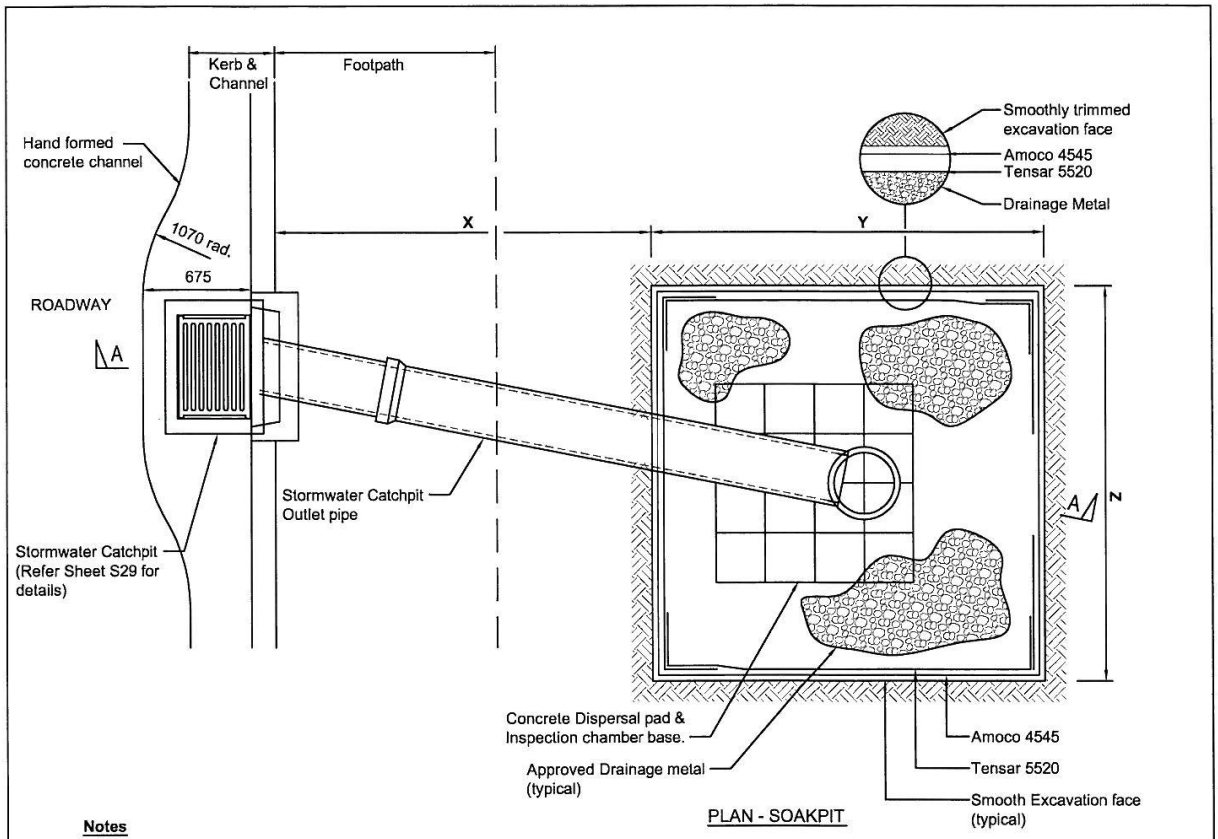
KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

Drawing S28
Revision 0
Scale N.T.S.

ORIGINAL SIZE mm A4

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S28.dwg , Plotted By Anniversita Pilapil at 29/09/2009 9:24:55 a.m.Scale 1:1

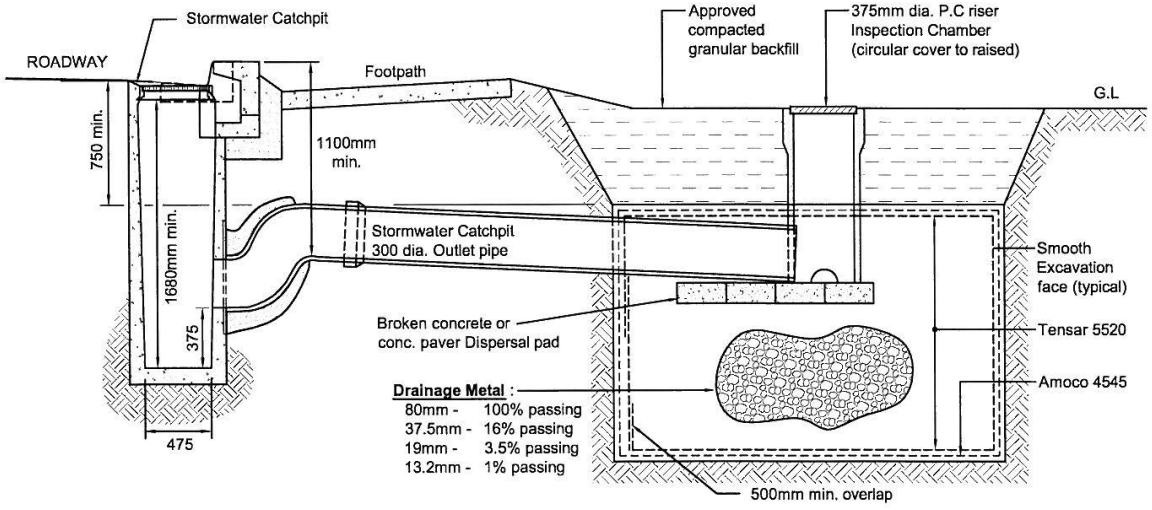

Approved concrete backing block
Standard kerb & channel
B
A
675
1070 rad.
PLAN
Grating shall be level and 25 min. below adjacent level of channel.
Ramp channel down to meet grating.
Concrete backing block
110 dia. HDPE corrugated land drainage pipe
Approved precast sump unit
70
675mm
70
SECTION A - A
SINGLE SUMP
X
PLAN
Sump gratings to be level (where practicable)
Concrete backing blocks
Grating shall be at a min. of 25mm below adjacent level of channel.
Ramp channel down to meet grating.
Approved precast sump units
300 dia. core hole between sumps
110 dia. HDPE corrugated land drainage pipe
375 dia. outlet
375
75
70
675mm
140
SECTION X - X
DOUBLE SUMP
Concrete surround
Heavy duty cast iron grate
300
300
PLAN
Ground level
75
50
100
300
700
600 dia. pipe
300 dia. outlet
450
75
600mm
SECTION
FIELD SUMP DETAIL
(All Environments)
Footpath
20 max.
Grate
3% Cross Fall
250
Precast Catchpit chamber
300 dia. min. Outlet
375 dia. min. Outlet
for Double Cesspit.
Fit to appropate side
375
20MPa concrete haunching
70
475mm
70
SECTION B - B
NOTES
1. Concrete to be ordinary grade (20MPa) in accordance with NZS 3109.
2. Sump outlet pipes to be 100:1 min. gradient.
SUMP DETAILS
No. Revisions
Date
Designed M WINCH 08/08
Approved 09/09
Drawing Status IMPLEMENTATION
Office Location CPG, WHANGAREI
KAIPARA DISTRICT
KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009
Drawing S29
Revision 0
Scale N.T.S.
ORIGINAL SIZE mm A4
T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S29.dwg , Plotted By Anniversita Pilapil at 29/09/2009 9:24:36 a.m. Scale 1:1



PLAN - SOAKPIT

Notes

1. " X, Y, Z " Dimensions to be determined by Council Engineer.
2. Alternative Soakpit designs allowed but are subject to Council Engineer's approval.
3. Concrete to be ordinary grade (20MPa) in accordance with NZS 3109.
4. Half syphon sump outlet pipes to be 1:100 min. gradient.



SECTIONAL ELEVATION A - A

STORMWATER SOAKPIT

No.	Revisions	Date
	Designed M.WINCH	08/08
	Approved	09/09
	Drawing Status IMPLEMENTATION	
	Office Location CPG, WHANGAREI	

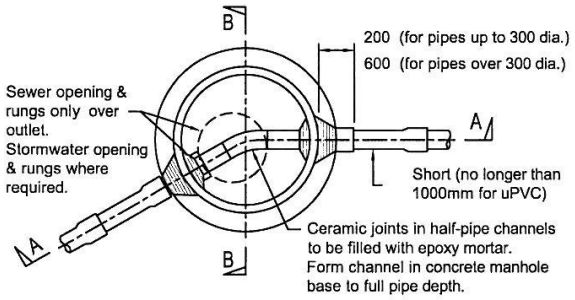
KAIPARA DISTRICT

KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

Drawing S30
Revision 0
Scale N.T.S.

ORIGINAL SIZE mm A4

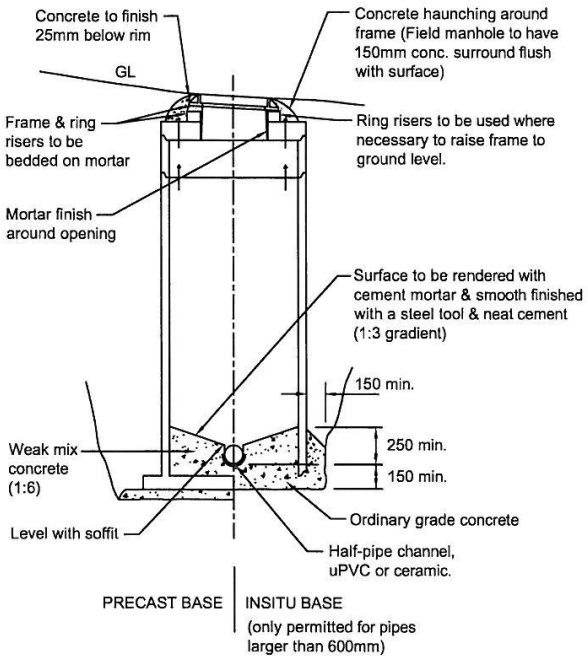
T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S30.dwg , Plotted By Anniversita Pilapil at 29/09/2009 9:24:14 a.m.Scale 1:1



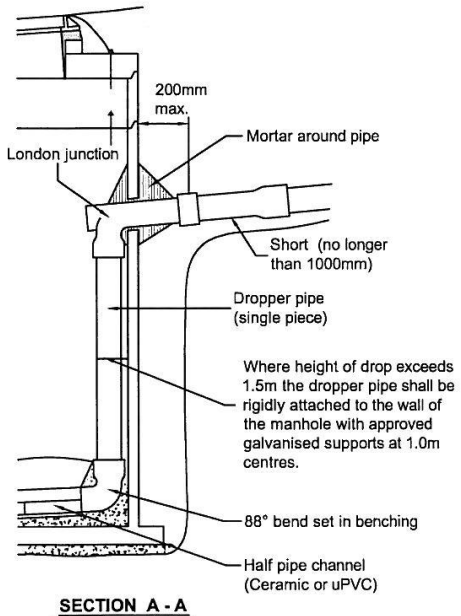
SECTION C - C

NOTES:

1. This detail is applicable for pipe diameters up to 600mm & for manhole depths up to 5.0m.
2. All steel fittings to be hot dip galvanised. Zinc coatings to be not less than 700g/m.
3. 150mm thick concrete lids with heavy-duty cast iron frames & covers to be used in driveways, carriageways & berms. 100mm thick concrete lids with light-duty cast iron frames & covers may be used elsewhere.
4. Precast manhole bases shall be used in all instances with minimum sized holes cut for pipe entry.
5. No additional thin plastering of benching or inverts is permitted.
6. All manhole covers are to be painted blue for stormwater & red for sewer.
7. All concrete to be 20MPa at 28 days unless specified as "weak mix".

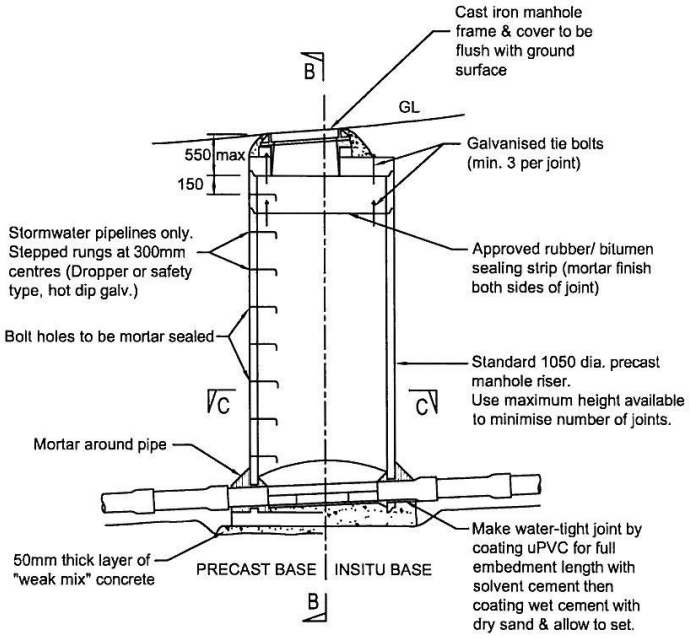


SECTION B - B



SECTION A - A
INTERNAL DROP

(This detail is applicable for pipe diameters up to 250mm & for manhole depths up to 5.0m)



SECTION A - A

STANDARD PRECAST MANHOLE
(SEWER & STORMWATER)

No.	Revisions	Date
Designed	M WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

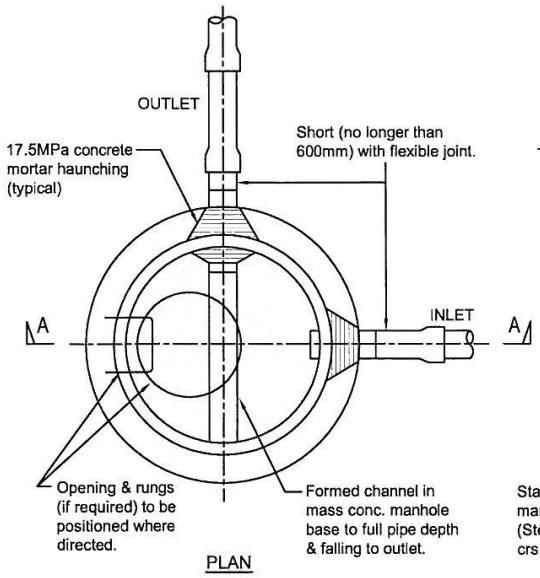
KAIPARA DISTRICT

KAIPARA DISTRICT COUNCIL
ENVIRONMENTAL ENGINEERING STANDARDS 2009

Drawing S31
Revision 0
Scale N.T.S.

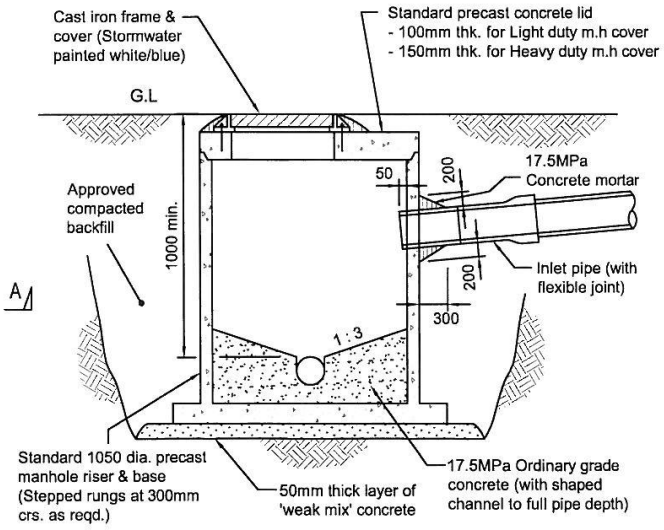
ORIGINAL SIZE: mm A4

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S31-R1.dwg , Plotted By Anniversita Pilapil at 2/10/2009 1:09:54 p.m. Scale 1:1

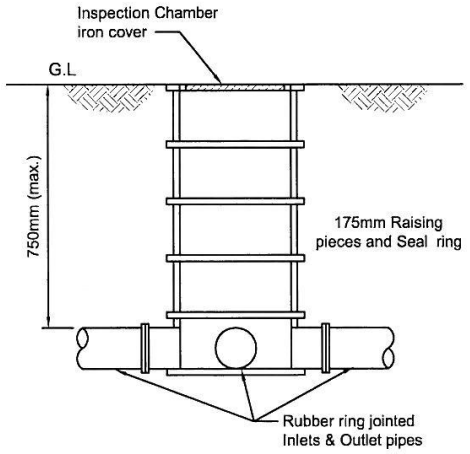


PLAN

DROP MANHOLE



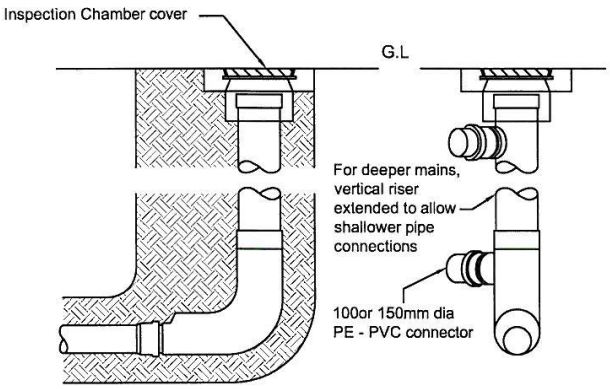
SECTIONAL ELEVATION A - A



Purpose-built proprietary Inspection Chamber
(e.g. 'Hepwith' polypropylene Inspection Chamber)

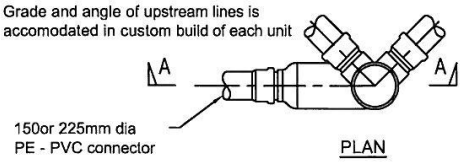
MINI MANHOLE /

INSPECTION CHAMBER



SECTIONAL ELEVATION A - A

FRONT VIEW



PLAN

WORMALL RODDING EYE

NOTES

1. Refer to KDC S31 for general manhole construction details.
2. If Drop manhole is to be used as an energy dissipating Outfall then choose outlet pipe size to be next standard diameter greater than design Di.
3. Manholes and Sumps located below MHSL to be constructed with Ball valve system.
4. All manhole covers are to be painted blue for stormwater & red for sewer.

DROP MANHOLE, WORMALL RODDING EYE & "MINI" MANHOLE DETAILS (STORMWATER OR SEWER)

No.	Revisions	Date
Designed	M WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

KAIPARA DISTRICT

Kaipara te Oranganui • Two Oceans Two Harbours

KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

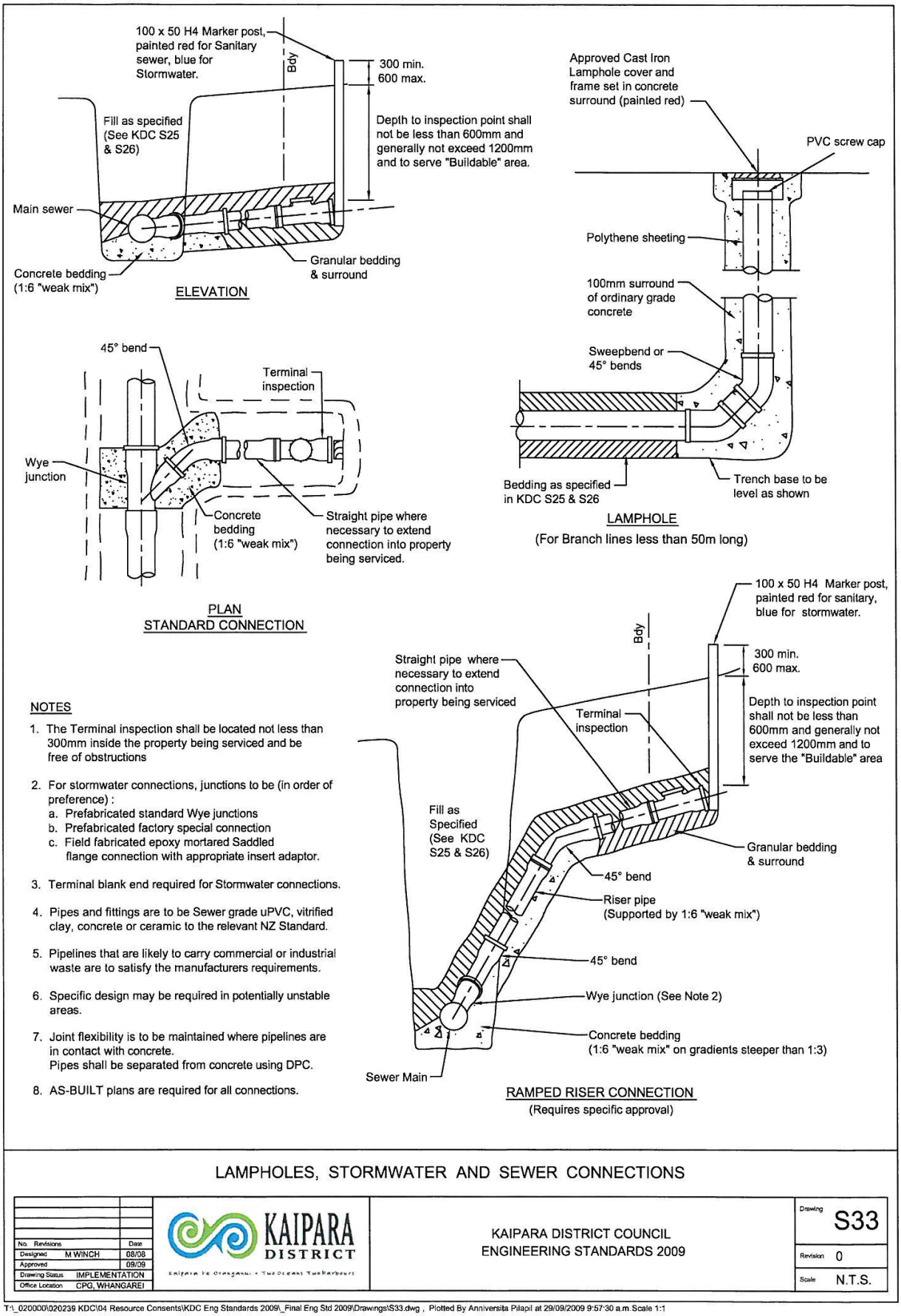
Drawing S32

Revision 0

Scale N.T.S.

ORIGINAL SIZE mm A4

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S32.dwg , Plotted By Anniversita Pilapil at 2/10/2009 1:14:06 p.m.Scale 1:47.17



NOTES

1. The Terminal inspection shall be located not less than 300mm inside the property being serviced and be free of obstructions
2. For stormwater connections, junctions to be (in order of preference) :
   a. Prefabricated standard Wye junctions
   b. Prefabricated factory special connection
   c. Field fabricated epoxy mortared Saddled flange connection with appropriate insert adaptor.
3. Terminal blank end required for Stormwater connections.
4. Pipes and fittings are to be Sewer grade uPVC, vitrified clay, concrete or ceramic to the relevant NZ Standard.
5. Pipelines that are likely to carry commercial or industrial waste are to satisfy the manufacturers requirements.
6. Specific design may be required in potentially unstable areas.
7. Joint flexibility is to be maintained where pipelines are in contact with concrete.
   Pipes shall be separated from concrete using DPC.
8. AS-BUILT plans are required for all connections.

ORIGINAL SIZE: mm A4

LAMPHOLES, STORMWATER AND SEWER CONNECTIONS

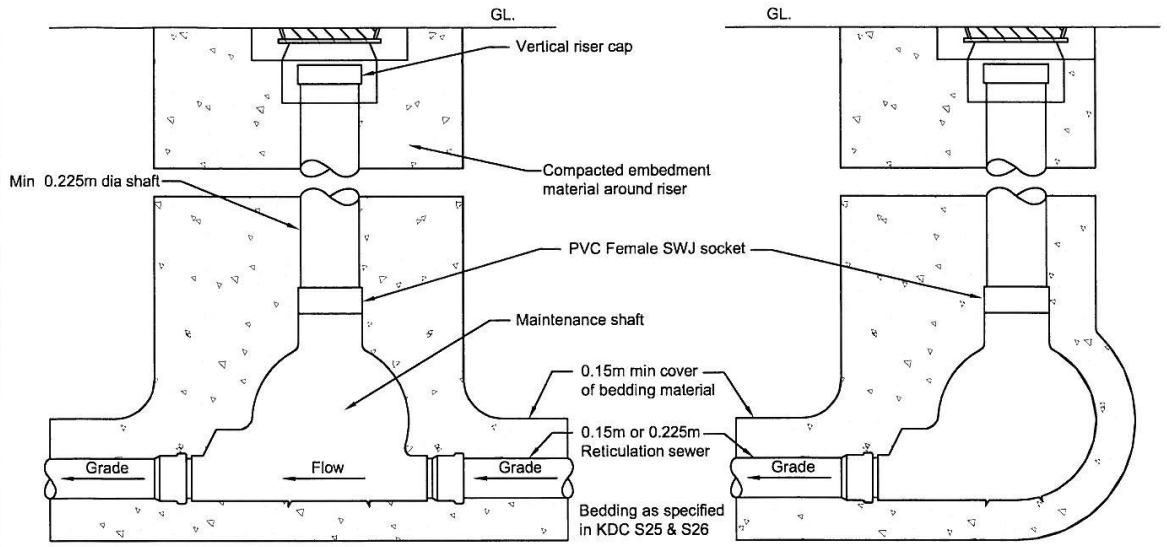
No.	Revisions	Date
Designed	M WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

KAIPARA DISTRICT

KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

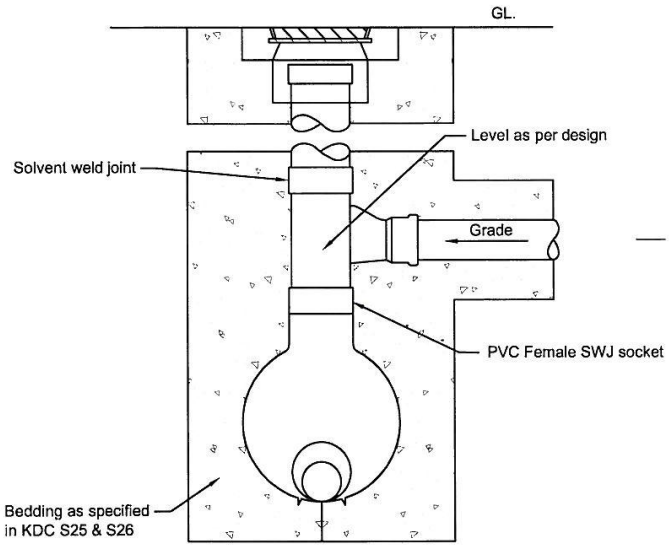
Drawing S33
Revision 0
Scale N.T.S.

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S33.dwg , Plotted By Anniversita Pilapil at 29/09/2009 9:57:30 a.m.Scale 1:1

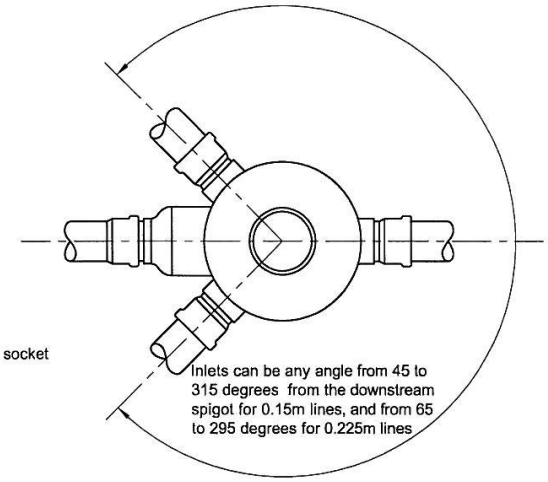


ELEVATION
INLINE (180 deg) MAINTENANCE SHAFT

ELEVATION
TERMINAL MAINTENANCE SHAFT



END ELEVATION
INCLUDING DROP JUNCTION



PLAN
STANDARD CONNECTION

NOTES

1. Bedding material shall comply with KDC standard specifications
2. All pipe joints shall comform with KDC standard specifications and the manufacturers recomendations
3. Poo-Pits are bedded into embedment material, no concrete cradle is required
4. Each product is made to order when specifying requirements, the upstream spigot can accomodate angle, grade and height from invert. The standard fall is 20mm but 10mm can be accomodated if required
5. Inlets can be any angle from 45 degrees from the downstream spigot for 0.15m lines, and 65 degrees for 0.225m lines
6. Drop juctions can be supplied either attached or as a seperate item
7. Vertical riser caps use a standard "Tee" key for locking and unlocking and comply with AS/NZS 1260
8. Connections can be supplied as spigots or sockets for PVC, or a lenght of Polyethylene pipe can be used when specified

ORIGINAL SIZE mm A4

WORMALL POO-PIT

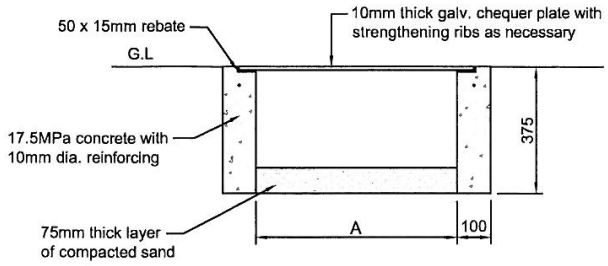
No.	Revisions	Date
Designed	M.WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

KAIPARA DISTRICT

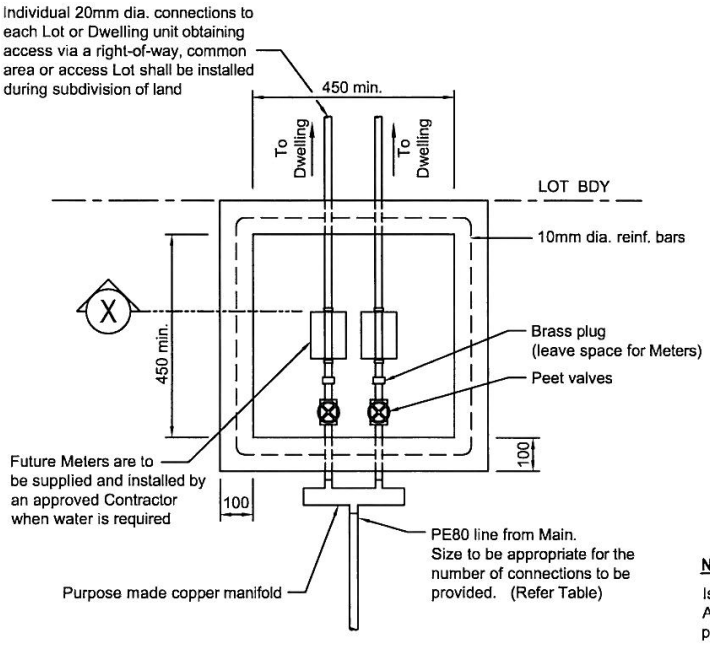
KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

Drawing S34
Revision 0
Scale N.T.S.

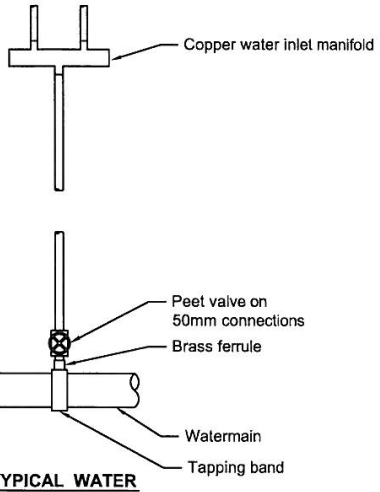
T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S34.dwg , Plotted By Anniversita Pilapil at 29/09/2009 9:56:41 a.m.Scale 1:1



SECTION X-X



PLAN

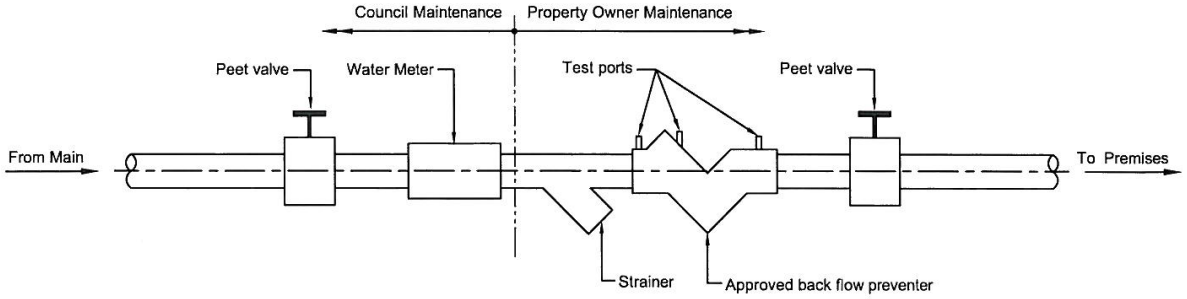


TYPICAL WATER CONNECTION DETAIL

NUMBER OF CONNECTIONS	WIDTH AT A	I.D SIZE OF CONNECTION FROM MAIN
1	450mm	20mm
2	600mm	25mm
3	750mm	32mm
4	900mm	50mm
5	1050mm	50mm

NOTE

Isolating Valves are required on all pipes less than 50mm dia. i.e AC pipes require a Tapping band and a Ball valve. uPVC and PE80 pipes require a self tapping band with an "In-built plug" valve.



METERED SUPPLY WITH DOUBLE CHECK VALVE BACK FLOW PREVENTER

MULTIPLE WATER CONNECTIONS & BACKFLOW PREVENTERS

No.	Revisions	Date
Designed	M WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

KAIPARA DISTRICT

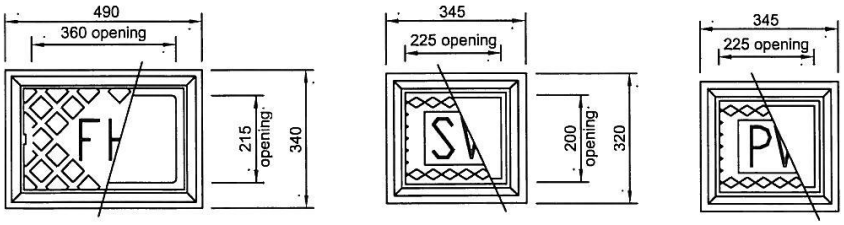
KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

Drawing S35
Revision 0
Scale N.T.S.

ORIGINAL SIZE mm A4

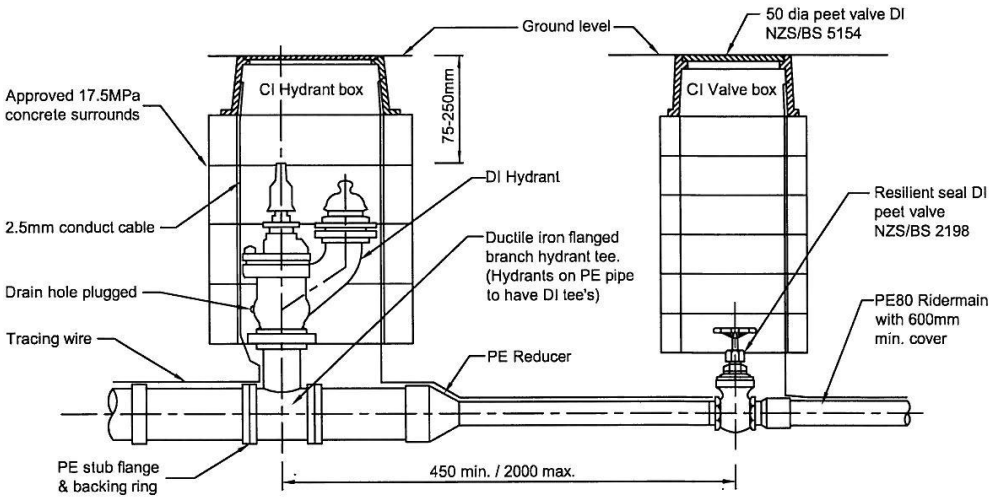
T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S35.dwg , Plotted By Anniversita Pilapil at 29/09/2009 9:55:21 a.m.Scale 1:1

"TALL TYPE" screw-down DI hydrant to NZS/BS 750. To close clockwise when viewed from above.



PLAN - CAST IRON HYDRANT BOX

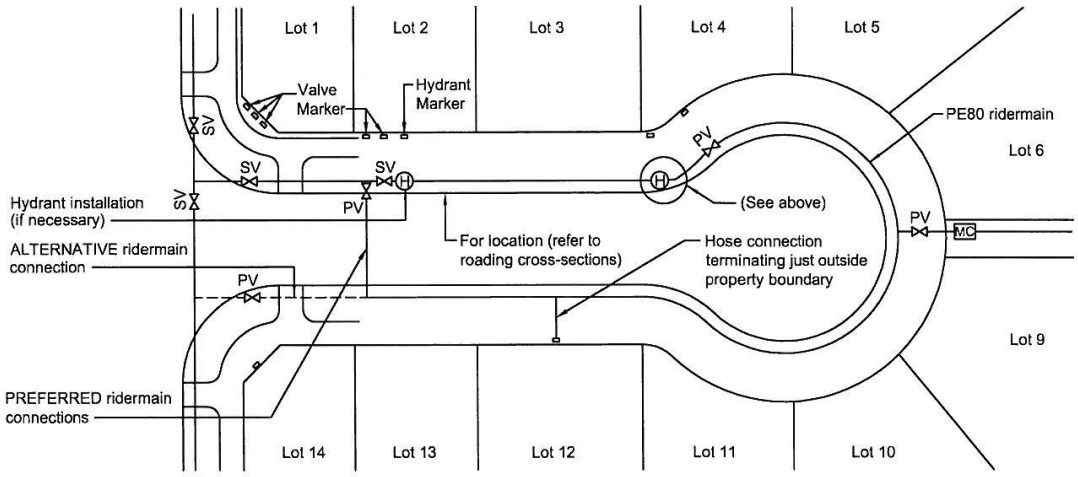
PLAN - CAST IRON VALVE BOX



ELEVATION

Notes

1. Deflection of joints is not to exceed the Manufacturers recommendation.
2. Where there are more than 15 connections from a rider main, an isolating peet valve should be provided in the middle of the rider main.
3. All underground bolts to be stainless steel and wrapped with denso tape, mastic and polytape.
4. Service connections to terminate just outside from boundary with an approved manifold, meter box (including base) and diaphragm valve including dual check valve.
5. Dimensions to be supplied with As-Builts.



WATER PIPELINE DETAILS

No.	Revisions	Date
Designed	M WINCH	08/08
Aprooved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

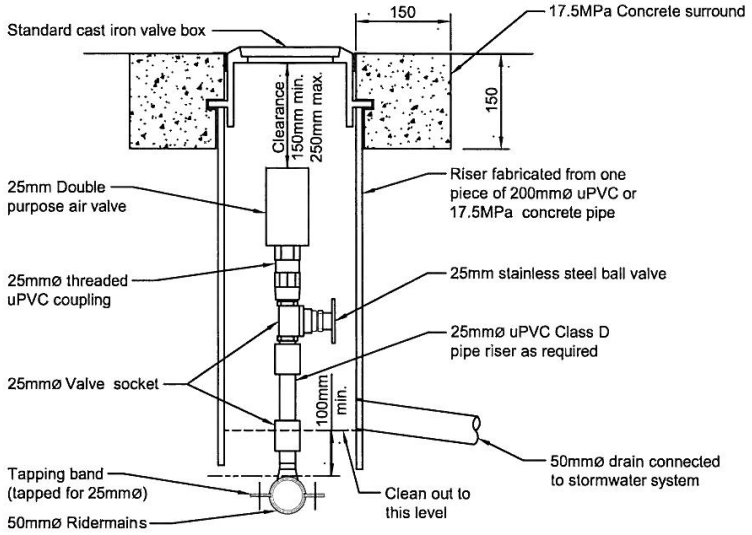
KAIPARA DISTRICT

KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

Drawing S36
Revision 0
Scale N.T.S.

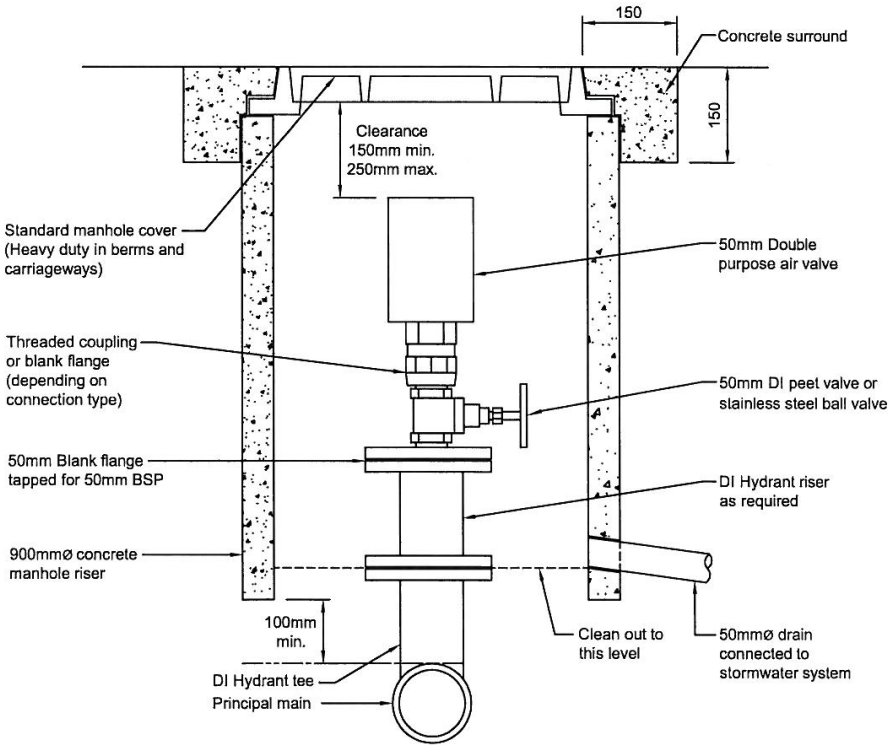
ORIGINAL SIZE mm A4

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S36.dwg , Plotted By Anniversita Pilapil at 29/09/2009 9:54:59 a.m.Scale 1:1



STANDARD AIR VALVE DETAIL FOR 50mmØ RIDER MAINS

NB: Underground bolts to be wrapped with DENSO tape



STANDARD AIR VALVE DETAIL FOR PRINCIPAL MAINS

NB: Underground bolts to be wrapped with DENSO tape

AIR VALVE DETAILS

No.	Revisions	Date
Designed	M WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

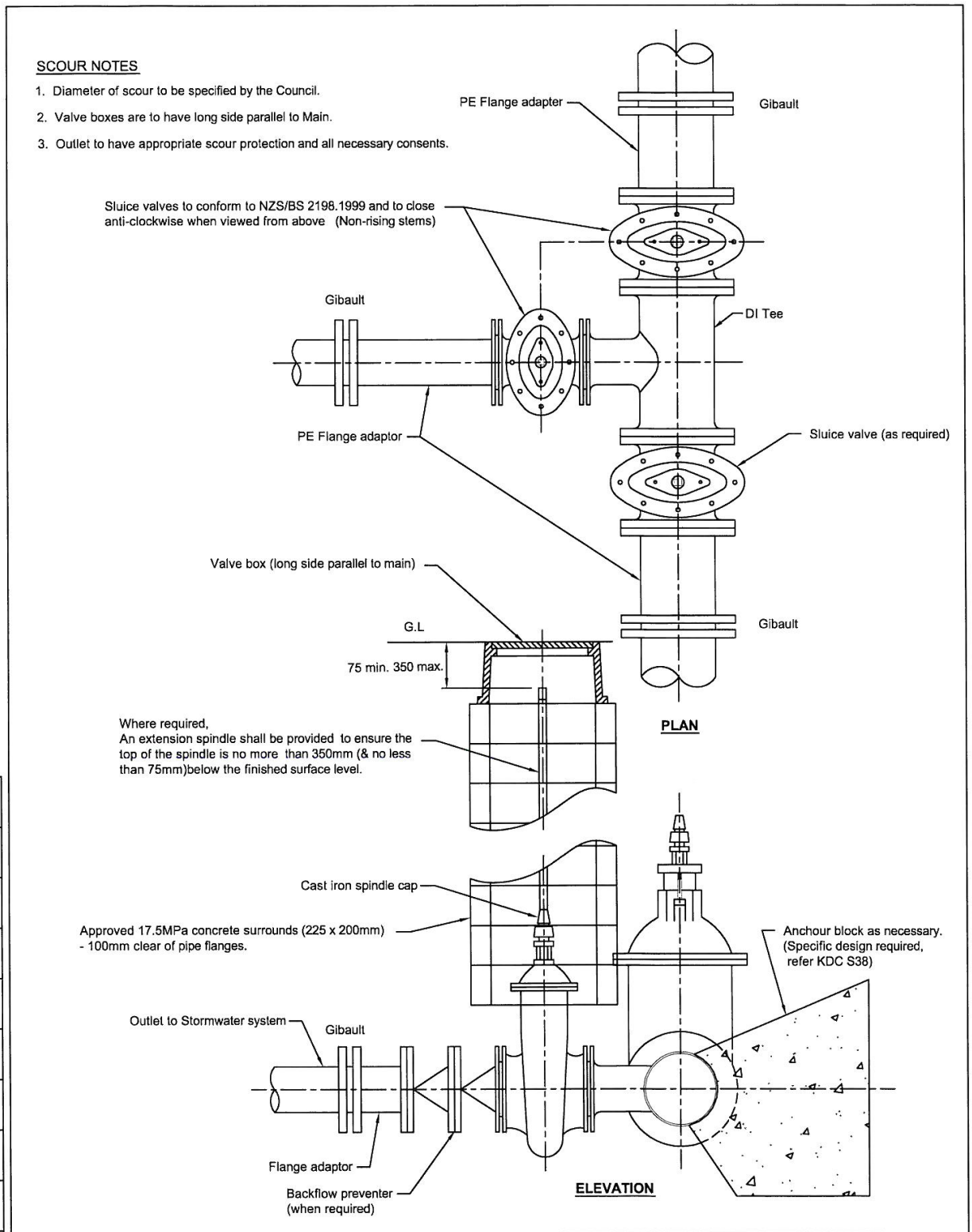
KAIPARA DISTRICT

KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

Drawing S37
Revision 0
Scale N.T.S.

ORIGINAL SIZE mm A4

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S37.dwg , Plotted By Anniversita Pilapil at 29/09/2009 9:50:03 a.m.Scale 1:1



GENERAL SCOUR VALVE
INSTALLATION DETAILS

No.	Revisions	Date
Designed	M.WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

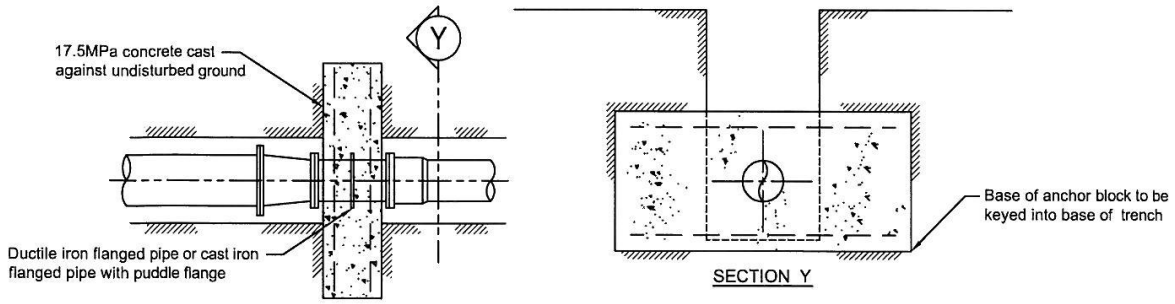
KAIPARA DISTRICT

KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

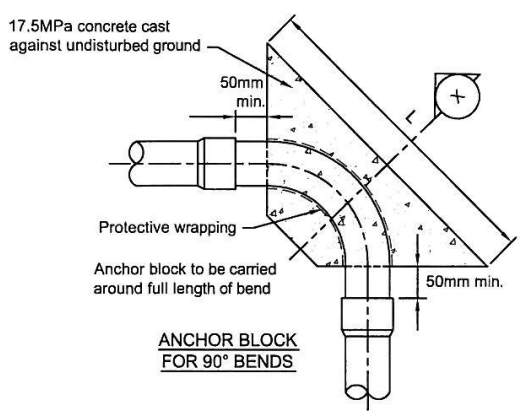
Drawing S38
Revision 0
Scale N.T.S.

ORIGINAL SIZE mm A4

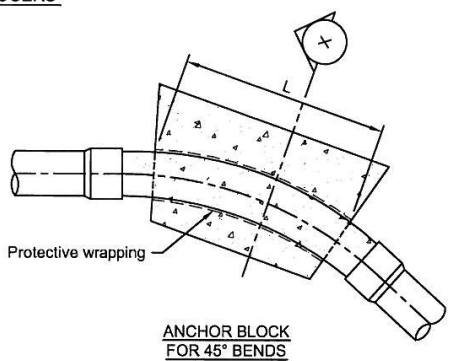
T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S38.dwg , Plotted By Anniversita Pilapil at 29/09/2009 9:53:26 a.m. Scale 1:1



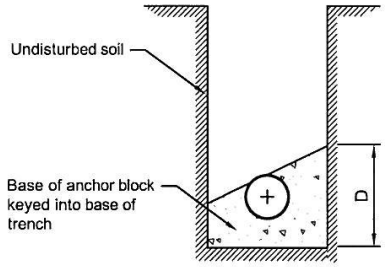
ANCHOR BLOCKS AT REDUCERS

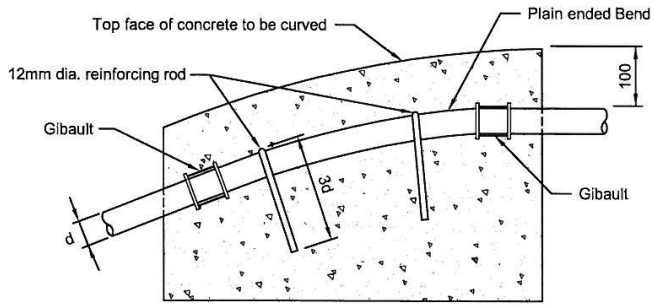


ANCHOR BLOCK FOR 90° BENDS



ANCHOR BLOCK FOR 45° BENDS





ANCHOR BLOCKS AT BENDS IN VERTICAL PLANE

Nom. Pipe Diameter	90° Bend L	90° Bend D	45° Bend L	45° Bend D	Tee or Closed End L	Tee or Closed End D	22.5° Bend L	22.5° Bend D	11.25° Bend L	11.25° Bend D
100	740	400	500	320	520	400	300	300	300	300
150	1340	460	700	470	870	500	500	340	300	300
200	1610	660	960	600	1150	650	740	400	490	300
250	2000	800	1250	700	1420	800	890	500	640	350
300	2330	1000	1560	800	1650	1000	1080	600	810	400

NOTES

1. Anchor block dimensions for firm soil conditions.
2. The dimensions to be increased or decreased for variation in soil conditions.
3. Allowable bearing stress used - 100kPa.
4. Internal pipe test pressure up to 1800kPa (18 Bar).
5. All underground bolts to be wrapped with denso tape.
6. Protective membrane to be bitumised paper, thin roofing felt or polythene film applied to a thickness of 2.5mm.
7. If an anchor block is to be supported by engineered fill material, it shall be specifically designed, taking into account all design actions, including the weight of the concrete, with allowance for safety factors.
8. Calculations for anchor blocks at reducers and vertical curves must be shown with Engineering drawings.

ANCHOR BLOCK AND INSTALLATION DETAILS

No.	Revisions	Date
Designed	M WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

KAIPARA DISTRICT

KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

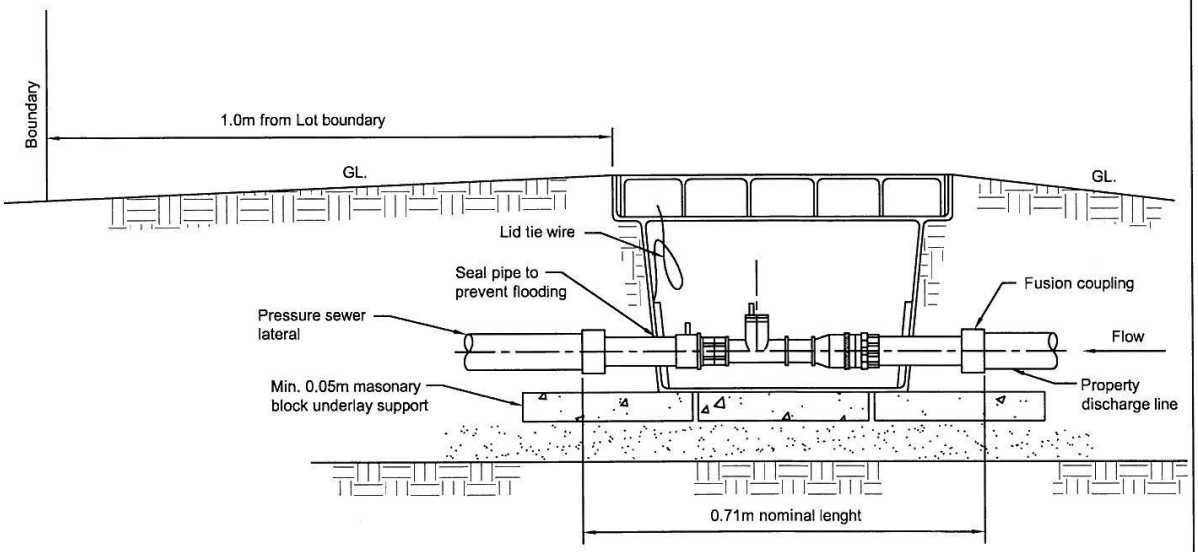
Drawing S39
Revision 0
Scale N.T.S.

ORIGINAL SIZE:mm A4

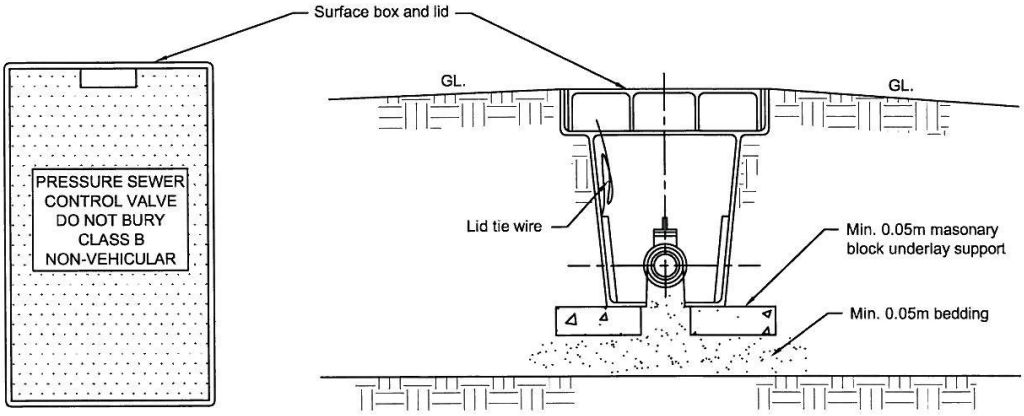
T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S39.dwg , Plotted By Anniversita Pilapil at 29/09/2009 9:47:10 a.m.Scale 1:1

NOTES:

1. All dimensions in meters unless otherwise specified
2. Use only approved components
3. Ensure that the lid of surface box is marked as shown. Where the warning/name plate is not cast or moulded into the lid, affix an engraved SS name plate using SS fasteners
4. Prepare bedding metal under box to specification
5. Install surface box slightly proud of surface so the GL. can be graded away from the lid
6. Test assembly and connecting pressure sewers hydrostatically after installation in accordance with the KDC code
7. All pressure pipework items to be PN 16



SIDE ELEVATION



PLAN

END ELEVATION

BOUNDARY CONNECTION KIT

No.	Revisions	Date
Designed	M.WINCH	08/08
Approved		09/09
Drawing Status	IMPLEMENTATION	
Office Location	CPG, WHANGAREI	

KAIPARA DISTRICT

KAIPARA DISTRICT COUNCIL
ENGINEERING STANDARDS 2009

Drawing S40
Revision 0
Scale N.T.S.

ORIGINAL SIZE mm A4

T:_020000\020239 KDC\04 Resource Consents\KDC Eng Standards 2009_Final Eng Std 2009\Drawings\S40.dwg , Plotted By Anniversita Pilapil at 29/09/2009 9:45:48 a.m.Scale 1:1

12. APPENDIX B

Mangawhai EcoCare Project
Pump Stations Communication Standard

Communication Standard Pump Stations

Mangawhai Ecocare Project

Customer:	**Water Infrastructure Group**
Document Number:	**225-310-FD-004**
Revision:	**V2.0**
Status:	**For Construction**
Date:	**04-08-2009**
Author:	**Bart Post / Ariel Racioppi**

McKay

Table of contents

Page

1 Introduction

The purpose of this document is to describe the standard for the interfacing between the Pump Stations and the Waste Water treatment Plant for the Mangawhai Ecocare Project.
The first part of the Ecocare project, comprising of the Waste Water Treatment Plant and ten Pump Stations, has been implemented. In the future more Pump Stations will be connected to the Treatment Plant. To avoid having multiple telemetry systems and communication standards in the system, this document can be used to design future Pump Stations in a way that the interfacing is compatible with the current Pump Stations.
The first part of this document describes the control and telemetry components used for the first stage. Part two deals with the minimal requirements regarding the telemetry interface of future pump stations.

McKay

2 System Overview first stage

The system overview in figure 1 shows the configuration of the first stage of the Ecocare project, the Waste Water Treatment Plant and ten Pump Stations.
Each pump station is controlled by two Altivar61 Variable Speed Drives (VSD) with "controller inside" (CI) and Ethernet cards. The CI cards control the pump station depending on the signals from the field like the analogue level and the level switches. They are working in a redundant configuration, which means that if one of the drives fails, the other drive is still capable of operating automatically.
Data buffering is achieved by using a Kingfisher RTU that communicates with the speed drives through a Modbus/TCP connection. The RTU works as a data concentrator/data buffer only and has no control function. From the RTU, the data is passed on to the WWTP by using a cellular modem that creates a Virtual Private Network (VPN) link to the router at the WWTP side. The cellular modems keep the VPN open all the time, so basically a Wide Area Network (WAN) is created between the pump stations and the WWTP.

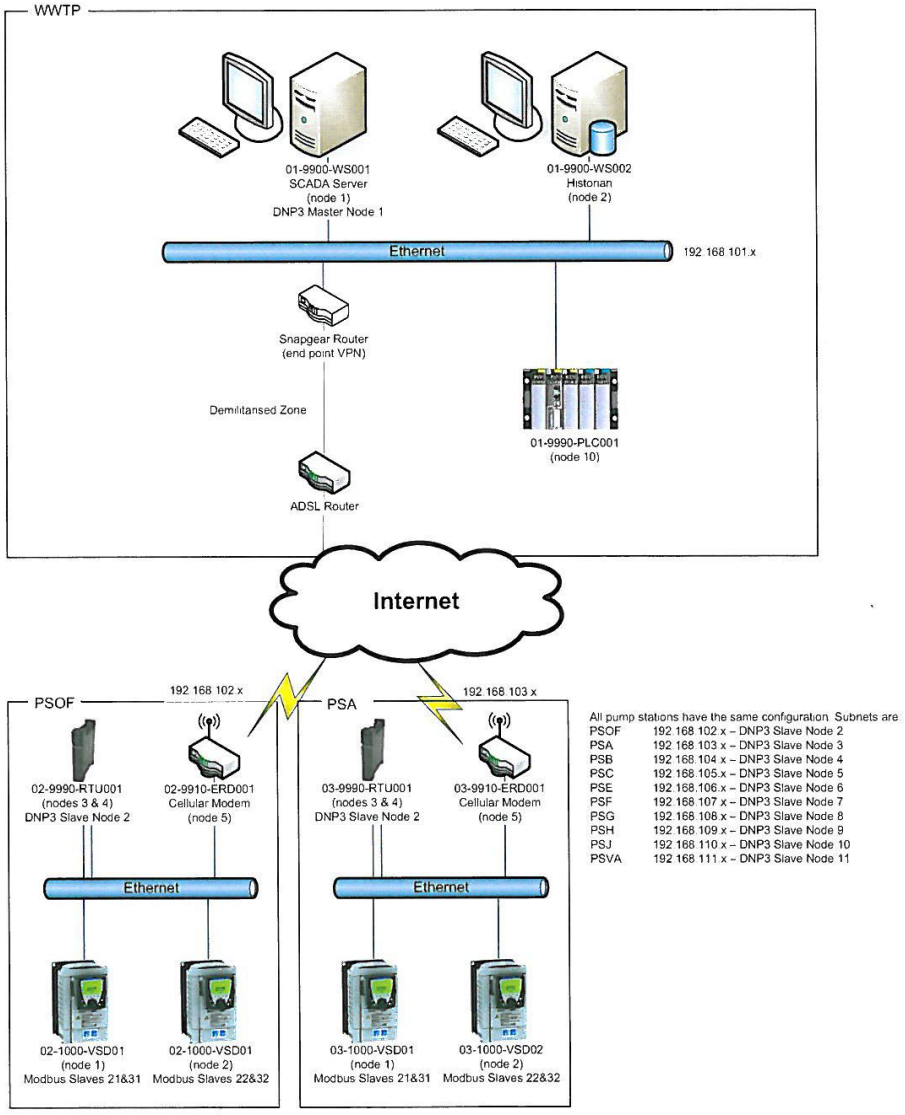


Figure 1; Control System Overview

3 Monitoring and control structure first stage

3.1 Control System

Each Pump Station is fitted with the following equipment:

- One cellular modem: allows the communication between the Waste Water Treatment Plant (WWTP) SCADA and the pump stations.
- One Ethernet Switch: allows the internal communication between Radio, Remote Terminal Unit (RTU) and VSD's
- One Remote Terminal Unit (RTU): acts as a buffer, data concentrator and communication gateway between the WWTP SCADA and the VSD's. The RTU is DNP3 slave node (with the SCADA being the Master) and a Modbus/TCP master node (with the VSD's being the slaves). There is no direct communication between the RTU and the PLC in the WWTP.
- Two Variable Speed Drives (VSD):

Each VSD has its own controller card that contains a wet well control program with configurable control algorithms required to monitor and control the individual pumps and share information with the other pump. The VSD's are connected together via a CANOpen Network that allows the VSD's to work together as one integrated unit or if the CANOpen Network is lost, the VSD's can operate as standalone devices. The system also allows for handling external signals like the contacts from the surge arrestor monitor or the circuit breaker of an independent device like a fan. Therefore there is no need for a PLC or IO on a RTU. All interfacing between the field and the controls is done through the IO on the VSD cards.

The control card in the VSD allows for several operating modes, but for this application there are only the following:

- Automatic; The pumps are controlled from the controller inside cards.
- Local Manual; by pressing the F4 function key on the drive's keypad, the drive can be controlled locally. This means that the pump can be started and stopped by pressing the start and stop buttons on the drive's keypad and that the speed can be controlled by the wheel on the drive. Pressing the F4 button again will take it out of manual mode.
- Remote Manual; when the drive is in remote (this is the normal situation) a pump can be started and its speed controlled from the SCADA at the WWTP site. This is done from the faceplate of each individual pump on the HMI screen.

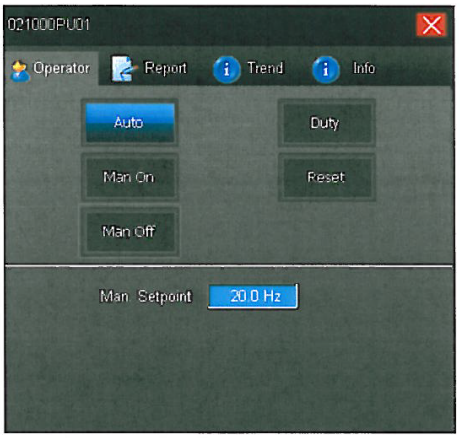


Figure 2; Faceplate for remote control of pump station pumps

When a VSD starts-up the drive will always be in remote.

The system controls in a duty / standby arrangement, whereby one VSD is the duty and the other is the standby. The duty status of the VSD's can be cycled between the VSD's or remain with one VSD. It's also possible to issue a remote command from the WWTP SCADA system to swap the duty and standby pumps (see faceplate above). When a fault is detected in the duty drive, the control is automatically handed over to the standby drive.
If a VSD has a fault, the operator can try to reset the VSD, both locally on the drive's keypad or remotely on the WWTP SCADA system (see faceplate above).

3.1.1 Control philosophy

The pumps are started and stopped in a duty/standby configuration dependant on the level in the wet well. (See figure Figure 3; Wet Well level limits) In the picture pump 1 is the duty pump and pump 2 the standby.
The duty pump starts at the "pump 1 start level" at the preconfigured "start speed". If the level keeps rising the speed is increased to the preconfigured "pump 1 limit level speed ", which is the maximum speed. If the level decreases and gets below the "pump 1 limit level" the speed will decrease until the level reaches the "pump 1 start level". The pump will keep pumping at the "start level speed" until the level gets below the "pump 1 low stop" setpoint.
If the level gets above the "pump 2 start level", it is assumed that the duty pump has a problem and this pump will be stopped and the standby pump will be started.
The "high" switch point provided by one of the two floating balls generates an extra "switch on" command for the duty pump. The speed is preconfigured at 50Hz. The pump will keep running for a preconfigured time.
The "HighHigh" switch point of the upper floating ball provides an alarm to the WWTP. This is the same level as the overflow level of the pump station.

For some pump stations, the mains power supply is not sufficient to run both pumps at the same time. Therefore an interlock has been put in place that prevents a pump from running if the other pump is running. This is a hardware interlock, so it will work in both local manual, remote manual and auto modes.

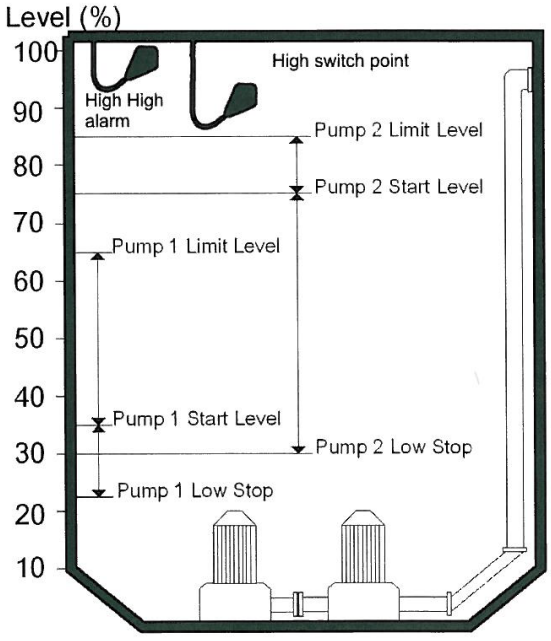


Figure 3; Wet Well level limits

A typical profile for this type of control is outlined below:

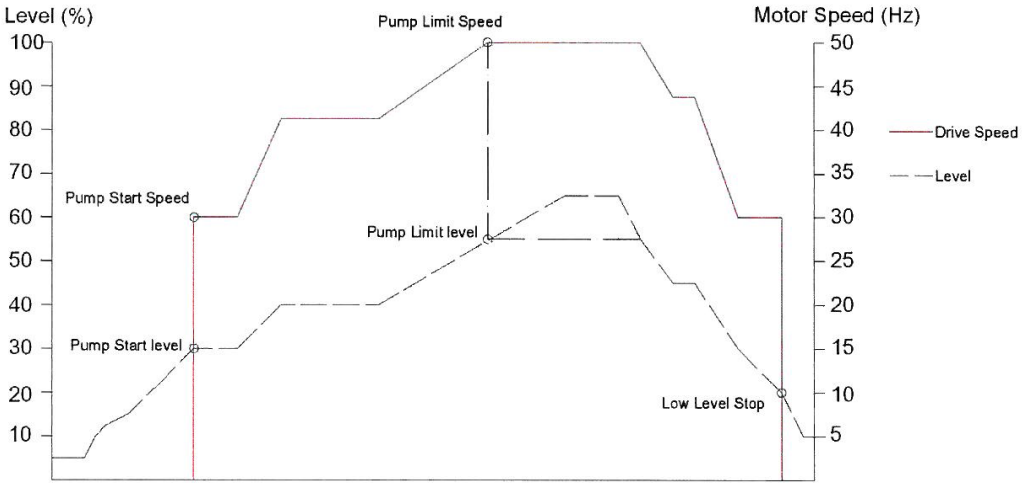


Figure 4; Typical pump profile

The wet well controller card in the VSD's comes with a number of features, of which only the following are used:

- **Pipe fill algorithm:**
  On initial start of the duty pump, the algorithm presets the speed to a configurable value (50Hz) (only on the drive itself) for a configurable time (30s). After the timer has expired, the normal control will take over. The mechanism is used for flushing the pipe.
- **Anti Jam:**
  The Anti Jam function is used to dislodge any product or detritus that may be attached to the pump impeller. It may also be used to clear a blocked pipe or valve. The anti Jam function works by rapidly accelerating and decelerating the pump for an adjustable amount of cycles. All speeds, acceleration, deceleration rates and times are adjustable depending on the pump station configuration. The trigger for this program is the motor current.
- **High Water:**
  If the Hi switch input is activated, the pump will run at a preconfigured speed ("Switch Speed") for a preconfigured time ("Switch Time") or until there is "no load current"
- **High High:**
  The High High switch will generate an alarm to indicate that the well overflows into the emergency storage.

The Wet Well Controller will respond to a fault condition in one of three ways, depending on the nature of the fault.

- **Warning:**
  Each alarm condition can be set up to give a warning message. The alarm will not trip the drive or stop the pump. The VSD's HMI will display a Flashing warning message on the status display which will also be shown on the HMI of the WWTP.
- **Trip:**
  This is a pump system fault that is considered too serious to allow the pump to continue operating. If the pump trips, then the pump will remain in fault until a reset is initiated. A relevant fault message will be displayed which will also be shown on the HMI of the WWTP.
- **Reset:**
  This is a pump system related fault that is expected to clear if the pump (system) shuts down temporarily. A relevant fault message will be displayed. The system will automatically reset a certain amount of times for each individual fault. The number of resets and the interval between resets can be configured. (3 resets, 1800sec interval)

The following protections are defined in the VSD:

- **Cavitation Protection: (Reset)**
  Cavitation protection is activated when the pump is running at high speed, but the current is low. When cavitation is detected, the pump will stop and display the status. The system will auto restart after 15min
- **Cycling protection: (Reset)**
  If the pump cycles between start and stop faster than at a configurable frequency, the cycling protection will be activated. Both the cycle time (3min) and the cycle count (4) can be configured.

3.1.2 Hardware I/O

Each VSD has the following hardware interface:

Analogue Well Level:	AI2
High Level switch:	CI_LI54
HighHigh Level switch:	CI_LI57
Surge Arrestor:	CI_LI58
Switchboard fan trip:	LI5
Control power:	LI3
Thermistor:	LI6

3.1.3 Alarms

The following alarms are defined in the VSD:
(For the description of the alarm handling procedure see the functional specification of the HMI)

Internal

Alarm	Category	Note
Power failure	Urgent	When both drives detect "line power failure"
VSD 1 Phase failure	Not urgent if one drive fails, otherwise urgent	
VSD 2 Phase failure	Not urgent if one drive fails, otherwise urgent	
VSD 1 Communication failure	Not Urgent	If the communication between VSD1 and the RTU fails
VSD 2 Communication failure	Not Urgent	If the communication between VSD2 and the RTU fails
VSD 1 Fault	Not urgent if one drive fails, otherwise urgent	Signal is parallel to the fault contact on the drive
VSD 2 Fault	Not urgent if one drive fails, otherwise urgent	Signal is parallel to the fault contact on the drive

External

Alarm	Category	Note
Level Transmitter Analogue Signal Fault	Urgent	Detects a failure in the 4-20 mA from the level transmitter. The signal is looped to both VSD's. If one of the VSD's detects a failure, the alarm will be activated
Level Switch High (fail safe)	Not Urgent	Digital input from a floating ball in the wet well
Level Switch High High (fail safe)	Urgent	Digital input from a floating ball in the wet well
Odour Fan Flow Switch Low (fail safe)	Not Urgent	Digital input from the flow switch detecting flow from the odour fan
Surge Arrestor Alarm	Not Urgent	Digital input from the surge arrestor, indicating that it is blown
Switchboard Ventilation Fan Tripped (fail safe)	Urgent	Digital input from the circuit breaker of the ventilation fan
Pump 1 Thermistor	Not urgent if one drive fails, otherwise urgent	Thermistor input of the VSD is activated
Pump 2 Thermistor	Not urgent if one drive fails, otherwise urgent	Thermistor input of the VSD is activated

Control power failure (fail safe)	Urgent	The radio, Ethernet switch, RTU and the controller and Ethernet cards of the VSD have a 24VDC power supply that's backed up by a battery. When the system swaps from power supply to batteries, this alarm is activated

3.2 Interfacing Pump Station / WWTP

The following data flows can be identified between pump stations and the WWTP:

- Dataflow A: event based updates of the status of the pump station
- Dataflow B: adhoc commands to the pump station (e.g.manual operation) and settings (e.g. level setpoints)
- Dataflow C: maintenance

3.2.1 Dataflow A; event based status updates

Dataflow A is the main stream of information that provides a status overview of the pump station at the WWTP including alarms and reporting data. Dataflow A uses DNP3, an event based protocol, specifically designed for telemetry to keep data throughput low.
Please refer to the DNP3 Profile (4.2.1) for more information.

3.2.2 Dataflow B; adhoc commands and settings

Dataflow B is used only when an operator at the WWTP wants to make changes to the operation or settings of a pump station. This dataflow uses DNP3 also.
Please refer to the DNP3 Profile (4.2.1) for more information.

3.2.3 Dataflow C; maintenance

Dataflow C is used when an operator or engineer wants to diagnose problems with the control equipment of the pump station. The Altivar VSD's for example, have an web server built in that can be browsed from the WWTP using an Internet Explorer. This dataflow can be any Ethernet based protocol as long as the firewalls allow it to be used.

4 Future pump stations

When new pump stations are going to be added to the the Ecocare Project, it is important that a similar communication system is used as the one described above. This means that all communication has to be based on DNP3/TCP and that the data formats have to be the same. Although the control structure of each pump station can be completely different from the structure implemented during the first stage, having a standard control system with standard components would be the preferred choice from a maintenance point of view. This chapter will describe the minimum requirements for communication and control equipment

4.1 Cellular modem

The preferred cellular modem is a NetComm NTC-790seu.(www.netcomm.com.au). Although alternative brands can be used, it is not recommended. The IPSec protocol which is used for the VPN can have incompatibility issues between modem and router. Additionally, the current Snapgear router, which is the other side of the VPN link, needs to be setup to accept communication from the new cellular modem. Having one brand will make that process easier.
Stage 1 is running on the Telecom XT network but the Netcomm modem can be fitted with an alternative sim card which makes the cellular link service provider independent.
The cellular modem needs a battery backup to keep the communication alive during an outage.

4.2 RTU

Basically any RTU that supports DNP3 can be used. For stage 1 the Kingfisher CP11 is configured as a data concentrator and buffer. All IO's are connected to the VSD's and communicated through the Modbus/TCP link between the drives and the RTU. When VSD's without control are implemented, there are several options to provide automatic control; the RTU can be fitted with IO-cards and the control can take place in the RTU. Alternatively a separate PLC can be installed that communicates with the RTU. The interfacing between the RTU and the SCADA system however is standardised and can't be changed.

4.2.1 DNP3 Profile

The following interface needs to be implemented between RTU and pump station

Digital Inputs

TYPE	DNP_OBJECT#	Description	Notes
DI	1	Fan Tripped	1
DI	2	Odour Fan Stopped	1
DI	3	High Level Reached	1
DI	4	High High Level Reached	1
DI	5	Surge Arrestor Fault	1
DI	6	Both Drives in NLP (No Line Primary)	1
DI	7	Comms Fault Drive 1	1
DI	8	Comms Fault Drive 2	1
DI	9	Drive 1 in NLP	1
DI	10	Drive 2 in NLP	1
DI	11	4-20 mA Loss	1
DI	12	Fault Drive 1	1, 2
DI	13	Fault Drive 2	1, 2
DI	14	PTC/Thermistor Drive 1	1
DI	15	PTC/Thermistor Drive 2	1
DI	16	24VDC Power Fault	1

Notes:
1) In all cases, "1" means alarm, "0" means normal
2) Any other fault from the drive

Analog Inputs / Outputs

TYPE	DNP_OBJECT#	Description	Notes
AI/AO_16	1	Duty Pump Start level	1

AI/AO_16	2	Duty Pump Start Speed	1
AI/AO_16	3	Duty Pump Limit Level	1
AI/AO_16	4	Duty Pump Limit Speed	1
AI/AO_16	5	Duty Pump High Stop	1
AI/AO_16	6	Duty Pump Stop Level	1
AI/AO_16	7	Standby Pump Start level	1
AI/AO_16	8	Standby Pump Start Speed	1
AI/AO_16	9	Standby Pump Limit Level	1
AI/AO_16	10	Standby Pump Limit Speed	1
AI/AO_16	12	Standby Pump Stop Level	1
AI/AO_16	25	Spare	
AI/AO_16	26	Spare	
AI/AO_16	27	Pump 1 Control Word	2
AI/AO_16	28	Pump 2 Control Word	2
AI/AO_16	29	Pump 1 Manual Speed	
AI/AO_16	30	Pump 2 Manual Speed	
AI_16	31	Pump 1 Pump Status Enum	3
AI_16	32	Pump 2 Pump Status Enum	3
AI_16	33	Wet Well Level	
AI_16	34	Pump 1 TotalCycles	4
AI_16	35	Pump 2 TotalCycles	4
AI_16	36	Pump 1 Duty Cycles	4
AI_16	37	Pump 2 Duty Cycles	4
AI_16	38	Pump 1 Status Word	5
AI_16	39	Pump 2 Status Word	5
AI_16	40	Pump 1 Motor Current	6
AI_16	41	Pump 2 Motor Current	6
AI_16	42	Pump 1 Drive Speed	6
AI_16	43	Pump 2 Drive Speed	6
AI_16	44	Pump 1 Altivar Status word	7
AI_16	45	Pump 2 Altivar Status word	7
AI_16	46	Pump 1 Altivar Logical Inputs	7
AI_16	47	Pump 2 Altivar Logical Inputs	7
AI_16	48	Pump 1 CI card Logical Inputs	7
AI_16	49	Pump 2 CI card Logical Inputs	7
AI_16	50	Pump 1 CI card Logical Outputs	7
AI_16	51	Pump 2 CI card Logical Outputs	7

Notes:

1) AI/AO16 means that the SCADA writes to the AO16 object, but reads from the AI16 object.
2) The Control Word layout is as follows:

BIT#	Description	Notes
1	Pump Inhibit	A
2		
3	Reset Status Fault	B
4	Set this Pump as Duty Pump	C
6		
7		
8	Manual Run	A
9		
10		
11		
12		
13		
14		
15		
16		

Notes:

a) Bits 1 and 8 work together:

Bit 1 and 8 Off: Automatic Mode
Bit 1 and 8 On: Manual Stopped
Bit 1 Off and 8 On: Manual Run

b) SCADA sets it to "1", RTU sets it to "0" when command has been applied.