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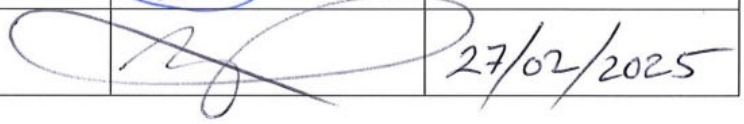
ENGINEERING STANDARDS
FOR LAND DEVELOPMENT

DOCUMENT CONTROL

Edition No.	Reason for amendment	Date
Fifth	Document Control added 1.20.2.2 – New Hold Point for water lateral 1.11 – Restriction of noxious plants clarified 1.14 – Engineering drawing requirements updated 1.29 – As-built requirements updated 1.31 – Clarification of bond restriction on service connection 3.24 – Street Tree and berm grassing requirements updated 3.5.21.1 – Requirement for turning heads in subdivisions specified 3.5.21.2 – Bus route requirements for subdivision clarified 3.8.8 – Machine laid Kerb and Channel requirements specified 3.25.3 – Street lighting lamp requirements clarified 3.26 – Requirements for stock underpass added 5.9.1.0 – Addition of material specification for live watermain cut in 5.18.2 – Fire hydrant location clarified 6.3.1 – Treatment requirements clarified 6.7 – Rain garden requirements updated 6.7.1.2 – Dam guideline appendix introduced Minor Formatting changes	Effective March 2025

AUTHORISATION

	Name	Signature	Date
Prepared by	Tyler da Silva Development Manager		27.02.2025
Authorised by	Stuart Cartwright Chief Engineer		27/02/2025

CONTACT US

We are committed to continually improving these standards to enhance infrastructure quality and efficiency in land development across Palmerston North. We encourage you to share your suggestions and insights at **ESLD.Suggestions@pncc.govt.nz** to help inform future updates and ensure the standards meet the needs of our community and industry.

TABLE OF CONTENTS

1 GENERAL REQUIREMENTS

1.1 INTRODUCTION

The Engineering Standards for Land Development (the Standards) state the technical standards necessary to comply with the objectives and policies set out in Palmerston North City Council's (PNCC's) District plan. The PNCC Engineering Standards and the District Plan contain all the relevant criteria to ensure Developers provide all the information necessary when seeking engineering approval for land development.

The Standards have been compiled to ensure that a high degree of uniformity, consistency and effective operational management is maintained in all development projects, not only during the construction but for the long term. The criteria contained within the Standards have been compiled from the proven and established publications which are used extensively in engineering works throughout New Zealand.

The intent of the Standards is to provide efficiencies for all parties involved throughout the development process. These efficiencies include:

- Ensuring the resource consent application is correct when presented to Council.
- Minimising both Developer and Council resource time by ensuring design standards have been met.
- Ensuring that all discussions and negotiations between parties are positive throughout the development process.

The design standards and procedures detailed in the Standards must be used for all development work. However, there will be circumstances where alternative methods could be used and to this end the Standards reflect where this may be possible, and the Standards should be read in conjunction with NZS 4404:2010.

The following criteria apply to the Standards:

1.1.1 Mandatory Standards

Mandatory Standards are those considered essential for the overall design and construction objectives. *Mandatory Standards* are indicated by the use of the word 'must'.

1.1.2 Advisory Standards

Advisory Standards are important but do allow some flexibility to accommodate genuine identified constraints within the development. *Advisory Standards* are identified by the use of the word 'should'. Approval is required from the Manager in the first instance if the Developer wishes to adopt alternative criteria. The Manager reserves the right to not approve such requests.

1.1.3 Permissive Standards

Any other criteria not included in either mandatory or advisory standards. This is identified by the use of the word 'may'. Prior approval is not required.

The Developer is required to complete a design check list prior to presenting all engineering documents to Council. This will enable Council management to rapidly ascertain whether all requirements of the Standards have been met. Refer Appendix 1 and 2.

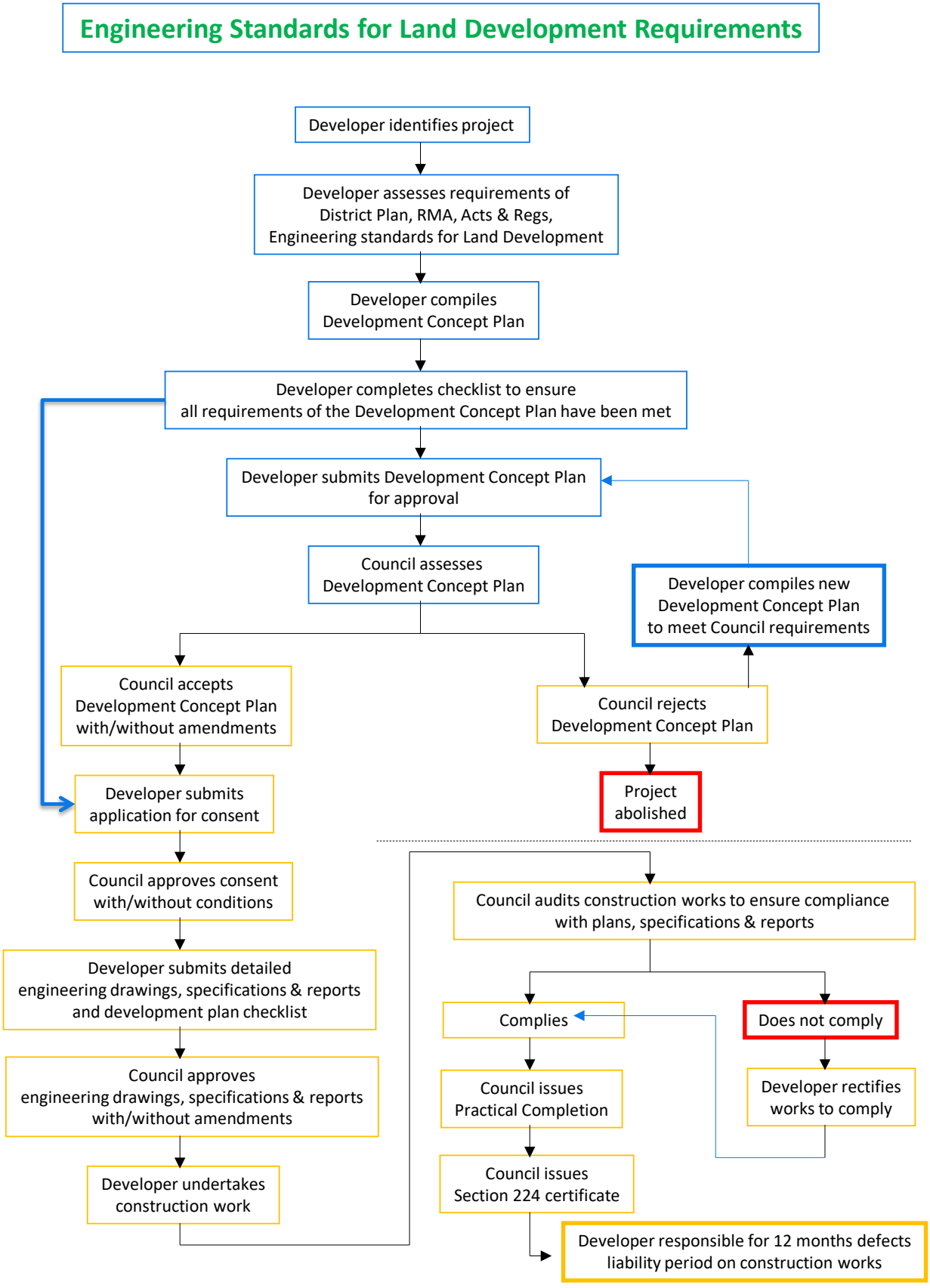
The Manager has the authority to deviate from any of the conditions identified in the Standards providing it is in the interests of all parties.

1.1.4 **Document Control**

The Engineering Standards for Land Development will be updated from time to time. The most up-to-date version will be available online at www.pncc.govt.nz. It is the Developers responsibility to ensure that they keep up-to-date with such amendments. All copies of the document are numbered for this purpose.

This document is: Fifth Edition, Effective March 2025

LAND DEVELOPMENT PROCESS ELEMENTS



1.2 INTERPRETATION

Unless the context specifies otherwise:

Access	Includes Right of Ways, access lots and any private land area for the purpose of access
Approved	Shall mean approved by the Chief Engineer and their representative
Council	Shall mean the Palmerston North City Council
Development Concept Plan	Shall mean a formal plan and documentation identifying the extent of the proposed development with sufficient information to allow Council to assess the feasibility or otherwise of the proposal. Council approval is required prior to any further advancement of the project.
Engineering Approval	Shall mean ALL plans, specifications and reports for development works are approved by the Chief Engineer and that construction works can proceed.
Geotechnical Specialist	A chartered professional engineer (CPEng) or an engineering geologist with recognised qualifications and experience in geotechnical engineering, and experience related to land development
HSW Act 2015	Shall mean the Health and Safety at Work Act 2015
Land Stability Guidelines	Shall mean the Palmerston North City Councils policy document “Development of land which is, or is likely to be, subject to erosion or slippage” (The Tonkin & Taylor Report, August 2005)
Manager	The Chief Engineer or such persons duly authorised to act on his behalf.
Developers Technical Representative	The person or persons appointed by the developer in accordance with Clause 1.3.
Regional Council	Shall mean the Manawatu-Wanganui Regional Council trading as Horizons.mw
Recognised Coordinate System	New Zealand Transverse Mercator 2000 (NZTM2000). Vertical levels in terms of New Zealand Vertical Datum 2016 - NZVD2016 Vertical Datum.
Rural	Any development on land zoned for that purpose under the District Plan

Rural Residential	Any development on the land identified as Rural Zone in the District Plan and to which the Rural Residential Overlay applies.
Services	Shall mean and include water, wastewater, stormwater, power, gas, telecommunications /data, whether below, on or above ground.
Developer	Shall mean the person/company responsible for the land to be subdivided
Waka Kotahi	New Zealand Transport Agency
Subdivision Consent	Shall have the same meaning as set out in the section 87(b) of the Resource Management Act 1991.
Urban	Means any land zoned Residential, Business, Industrial, Institutional and Recreational.

1.3 DEVELOPERS TECHNICAL REPRESENTATIVE

(i) The Developers Technical Representative must have experience acceptable to Council in subdivision development/construction work. The Developers Technical Representative must be a licensed surveyor or a NZ Chartered Professional Engineer or a person with experience and qualifications acceptable by Council.

(ii) The Developers Technical Representative will be responsible for:

(iii) Coordinating with all Network Utilities companies (Refer Clause 1.11)

(iv) All compliances with the requirements of the Resource Management Act 1991 (Refer Clause 1.5)

(v) The preparation of Engineering drawings and Specifications in accordance with the Engineering Standards for Land Development.

(vi) Obtaining all consents and approvals (Refer Clause 1.9)

(vii) Construction Monitoring (Refer Clause 1.20)

(viii) Provide interpreted test results to the Manager indicating that completed work has met the requirements of the Engineering Standards for Land Development.

(ix) Consultation with Council management

(x) Preparation of “As-Built” plans, list of assets to be vested with the Council including their values and final documentation to be submitted . (Refer Clause 1.28, Appendix 11)

(xi) Final Inspection (Refer Clause 1.30)

(xii) Completing the requirements of Clause 1.31, 1.32, and 1.33

1.4 REQUIRED ENGINEERING STANDARDS FOR ZONE AREAS

All proposed developments must comply with these Standards and the zoning requirements outlined in the District Plan.

1.5 RESOURCE MANAGEMENT ACT 1991

The effects of the provisions of the Resource Management Act 1991 on the subdivision and neighbours must be considered and taken into account when the engineering plans are being prepared. In particular, the effects of dust, vegetation, material stockpiles, stormwater runoff and noise are to be addressed to the satisfaction of both the Regional and City Council.

1.6 BUILDING ACT

All design and construction associated with the Building Act 2004 is to be adhered to at all times unless the Standards specify conditions additional to the requirements of the Building Act 2004. The Standards must take precedence over the Building Act 2004 where such situations should arise.

1.7 APPLICATION FOR CONSENT

1.7.1 Pre-Application Meeting

Whether or not a Development Concept Plan has been approved, it is recommended that the Developer discuss proposed subdivision plans with Council at a Pre-Application Meeting prior to formal lodgement.

Refer to district plan requirements. And website content.

1.8 DEVELOPMENT CONSENT

As part of the consent approval, Council may require services to be relocated, increased in size or altered in any other way. Where the alteration is required as direct result of the subdivision development, the Developer will be responsible for all costs associated with the alteration including design, consultation and physical works. Where, at the discretion of the Manager, services are to be altered to align with the development work but not as a result of the development itself, then Council will fund such works.

1.8.1 Connection of services

Connection of new works to the existing water supply reticulation must be carried out by a Council approved contractor. Connections to live wastewater and stormwater drainage systems must be carried out by an approved person under the supervisions of the appropriate Council staff.

The Developers technical Representative must give the Manager at least 48 hours notice of the intention to connect to any existing water, wastewater or stormwater reticulation. Such connection will be permitted only after the new reticulation has passed its necessary tests.

1.8.2 Design Review

At the Managers discretion, a peer review of any design or technical report may be required prior to granting a consent. The Manager must select, or approve, the reviewer. The Developer is responsible for all costs associated with the review.

1.9 OTHER CONSENTS

1.9.1 Consents under the Resource Management Act

The Developer, when lodging a consent application must formally advise, if any discharge and/or water consent(s) under Section 88 and schedule 4 of the Resource Management Act 1991 have been granted or have been applied for. A copy of the consent approval forms part of the consent application process and must be forwarded to Council on receipt. Approval will not be issued until the approval advice has been received.

1.9.2 Consents under Horizons Regional Council

Where consent are required from regional council no consent or approval under these Standards will be issued until written advice is received from Horizons that where required all consents in relation to the development required by it have been obtained.

Under the Resource Management Act, resource consents may be required for the following activities;

(a) The damming of natural water during construction work (water permit). The Developer is responsible for both obtaining and adhering to the conditions of this consent including all costs.

(b) The permanent use, damming or diversion of natural water as a consequence of the development (water permit). The Developer is responsible for both obtaining and adhering to the conditions of this consent including all costs. Once the development has completed defects liability, the name of the consent holder is to be amended to Palmerston North City Council.

(c) The discharge of stormwater or other contaminants into water, into air or onto land (discharge permit). The Developer is responsible for both obtaining and adhering to the conditions of this consent including all costs. Once the developer has completed defects liability, the name of the consent holder is to be amended to Palmerston North City Council.

(d) The disturbance of land or clearance of vegetation (land use consent). The Developer is responsible for both obtaining and adhering to the conditions of this consent including all costs.

(e) The disturbance of the bed of a river, lake or artificial watercourse (land use consent). The Developer is responsible for both obtaining and adhering to the conditions of this consent, including all costs.

The advice of Regional Council should be sought on all activities involving waterways, vegetation clearance, or disturbance of land or the beds of rivers, at the earliest stage of planning the subdivision.

1.10 GREENFIELD RESERVES DEVELOPMENT CRITERIA

Council plans a network of reserves under the categories outlined in its Parks Asset Management Plan and contained in the following below.

What we provide	Purpose
Local Reserves	This activity includes: Suburb, Neighbourhood, Small Neighbourhood, Esplanade Reserves, Ecological Reserves, Special Character Reserves. They provide open space in suburban centres and neighbourhood areas and improve the ability for people to move around the city.
City Wide Reserves	City Wide Reserves service a large area and are described as 'destination facilities due to their unique nature. They contain several amenity aspects not found in Neighbourhood reserves, such as native bush remnants, water features, paddling pools, and large play areas.
Sports fields	Sports fields provide unique spaces for the community to take part in recreational activities with a variety of surfaces for different sports/activities.

Decisions on the location, size and connections between the various reserve types extend beyond the needs of the immediate area covered in any particular subdivision proposal and include:

- the surrounding networks of reserves,
- other activities of Council with particular emphasis on stormwater reserves, active transport route planning and community development,
- specifics of the location's geography,
- biodiversity preservation or enhancement opportunities and
- historical or cultural opportunities

Where a structure plan is in place for an area many of the reserve matters will have been considered upfront. However, there can be many changes in the circumstances between a plan change structure plan and the implementation through subdivision development.

This makes it an imperative that the Developer discusses the proposed subdivision with the Parks division at the earliest possible opportunity.

The Council parks planners will make an assessment based on the following tables:

GENERAL CRITERIA

General Criteria	Benchmark
Minimum threshold of reserves in area unit	A minimum of 2% of total residential land area.
Level of access and visibility	Reserves must have at least two access points each. Including one which suitable for maintenance vehicles if required.
Disabled access	Topography of reserve must enable disabled access where possible. Exceptions will be where geographic features desirable for walkways, ecology, historic or cultural reasons take priority.

In addition to the criteria above there are three distinct types of 'local' reserve provision in any given wider area. Suburb Reserves, Neighbourhood Reserve, and Walkway Reserves. The following tables set out the requirements to meet the levels of service established for each reserve type.

SUBURB RESERVES CRITERIA:

Suburb Reserves are larger in size than neighbourhood reserves and provide more facilities such as sports fields, toilets and more play facilities. Existing suburb reserves range from 11,000m2 to 65,000m2.

Each suburb needs a well-located large reserve catering for a wide range of ages.

Suburb Reserve Criteria	Benchmark
Reserve Size and proportionality	1. 1.5 - 3.0 ha 2. Width a minimum of 90 m (may be reduced if clustered with other reserves at discretion of Parks Activities Manager - Parks.
Walkable distance and distribution	3. 1 km to 1. 5 km catchment
Land and drainage	4. Retention of the topsoil on the site present prior to development works being undertaken or 300 mm of approved topsoil if reinstated if changes to levels are required due to surrounding subdivision work. 5. Reserve to be provided free from noxious plants as defined in the Horizons Regional Pest Management Plan

Suburb Reserve Criteria	Benchmark
	6. Reserve to be free from ponds and watercourses that negatively impact the reserve capacity and development.
Topography	*7.* Minimum of 70% of reserve area must be flat (camber of no more than 7 degrees).
Level of access, safety, and openness	*8.* At least one of the two required access points is to be road frontage of not less than 100 continuous metres onto a road. *9.* All other access points are to be at least 5 metres in width, no longer than 40 metres in length, and preferably provide a straight line access with clear visibility to a road or another reserve. *10.* At least one access point suitable for vehicle access for maintenance vehicles and possible onsite car parking for the reserve.
Quality of reserves (trees/ /links/function & variety)	*11.* A variety of recreational choice based on other recreation opportunities in the area. *12.* Linkages to walkways and/or active transport routes. *13.* Retention of any mature vegetation, particularly trees, that are of value to the reserve development.
Non-exclusivity	*14.* Unrestricted public access to a reserve at all times.

NEIGHBOURHOOD RESERVES:

Neighbourhood Reserves are smaller than as suburb reserves and are intended to cater for the surrounding neighbourhood community.

Neighbourhood reserves generally provide facilities such as playgrounds (senior and Junior), open space, amenity planting, seating, and rubbish bins.

Quantitative Criteria	Benchmark
Reserve size and proportionality	*1.* A desired reserve size of 4,500 m2 with a minimum reserve size of 3,500 m2 as an exception e.g. where located adjacent to another open space type such as a walkway or stormwater reserve..

Quantitative Criteria	Benchmark
Walkable distance and distribution of reserve	2. Subdivision type: a. Standalone traditional residential lots urban over 500 m 2 - A maximum walking distance of 500 metres from reasonable access to a reserve taking into account major barriers to access such as major roads, railway lines and water courses. b. Medium or multiunit density housing area: A maximum walking distance of 400 metres from reasonable access to a reserve taking into account major barriers to access such as major roads, railway lines and water courses.
Land and drainage	3. Retention of the topsoil on the site present prior to development works being undertaken or 300 mm of approved topsoil if reinstated if changes to levels are required due to surrounding subdivision work. 4. Reserve to be provided free from noxious plants. 5. Reserve to be free from ponds and watercourses that negatively impact the reserve capacity and development.
Topography	6. Minimum of 60% of reserve area must be flat (camber of no more than 7 degrees).
Level of access, safety, and openness	7. At least one of the required two access points is to be road frontage of not less than 40 continuous metres onto a road no more major than a 'collector road' (as defined by the District Plan). 8. All other access points are to be at least 5 metres in width, no longer than 40 metres in length, and preferably provide a straight line access with clear visibility to a road or another reserve.
Quality of reserves (trees/ /links/function & variety)	9. A variety of recreational choice based on other recreation opportunities in the area. 10. Linkages to walkways and/or active transport routes. 11. Retention of any mature vegetation, particularly trees, that are of value to the reserve development.
Non-exclusivity	12. Unrestricted public access to a reserve at all times.

WALKWAY RESERVES:

A high proportion of walkways take advantage of the need for stormwater management and land that topography is unattractive to incorporate into residential section development. They form networks and often have an overlap with active transport planning.

Criteria	Benchmark
Topography and Land	*1.* Interesting topography avoiding flat, straight walkway provision where possible. *2.* Often connecting to viewpoints, or geographic features that form destinations in their own right e.g. rivers, streams or sites of significance to the community. *3.* Walkways that maximise the enjoyment of natural physical environment while providing suitable lateral gradient for construction of walkway.
Level of access, safety, links and openness	*4.* Road frontage sufficient for identifying entry points and signage *5.* Consideration of opportunities to create loops within the network of common walking distances e.g. 30-minute walks. *6.* Links provided to neighbourhood and other reserves to provide shortest, safest route to and from reserves and to join with other walkways.
Quality of reserves (trees/equipment/links/function & variety)	*7.* Vegetation cover with any plantings to be consulted with Council Parks staff to ensure appropriate species and location (refer Aokautere planting and design guidelines as an example). *8.* Reserves to be free of noxious weeds (refer to pest management strategy from Horizons Regional Council).
Non-exclusivity	*9.* Unrestricted public access to a reserve at all times.

1.11 NETWORK UTILITIES

Prior to making application for consent, the Developer must forward all subdivision proposals to all public utility providers. This will enable each provider to design and allow for their utilities to be installed with the minimum delay and ensure no interference to the final surfacing of carriageways and footpaths and formations of berms.

Provision must be made for the installation of suitable ducts within the development area if an authority is unable to install its services at the time of initial construction. In Urban areas and Rural Residential areas, all services are to be underground. Where a proposed development fronts a road reserve with existing overhead power and telecommunication services, these services are to be installed underground as part of the development at the Developers cost.

1.12 ENGINEERING DRAWINGS, SPECIFICATIONS AND REPORTS

The Developer must provide a complete set of detailed engineering drawings, specifications and reports. The drawings, specifications and reports should include the following:

1.12.1 Earthworks

(i) Assessment of suitability of land for development in its natural state.

(ii) Assurance that all earthworks are of acceptable design conforming to meeting all requirements of the NZS 4404:2010.and PNCC Engineering Standards for Land Development

(iii) That all identified allotments have sufficient area for building.

(iv) Assurance that no proposed works will have a detrimental effect on the stability of any land both within and adjacent to the development.

(v) Any natural land surfaces within the development that are considered to be unstable are identified and excluded.

1.12.2 Roadworks

(i) Earthworks including effects on any/all lot(s).

(ii) Fill construction: include fill material requirements.

(iii) Pavement Construction: include design detailing within the Pavement Design Report. Also indicate the design CBR and subgrade improvement layers if weak subgrade CBR is encountered. Report and drawings to indicate the type of subgrade test to be utilised and the relevant targets.

(iv) Kerb and channel: confirm the strength of concrete.

(v) Surfacing.

(vi) Footpath construction.

(vii) Treatment of areas outside carriageway.

(viii) Traffic Services including but not limited to road marking, traffic signs and street name plates.

(ix) Street lighting plan

(x) Streetscape including feature walls

(xi) Walkways and Cycleways

1.12.3 Drains

(i) Layout and details of stormwater drains, subsoil drains, sumps and ancillary work. Details of backfill materials requirements.

(ii) Layout and details of wastewater drains and ancillary work. Details of backfill materials requirements.

1.12.4 Water Supply

(i) Layout and details of watermains and ancillary work (backflow preventers, fire mains, etc). Details of backfill materials requirements.

1.12.5 Gas Reticulation

(i) Layout and details of gas mains and ancillary work.

1.12.6 **Power Reticulation**

(i) Layout and details of power cables, ancillary work and street lighting.

1.12.7 **Telecommunications network**

(i) Layout and details of telephone cables and ancillary work.

1.12.8 **Miscellaneous**

(i) Not limited to e.g 'Any associated structure, pumps, special manholes, penstocks, retaining walls, bridges'.

1.12.9 **General**

(i) The drawings must provide a design report and show sufficient details and levels to allow the Manager to accurately ascertain the feasibility of the design in all areas and to allow contractors to confidently construct the project. Specifications must provide sufficient details to both support the engineering drawings and additional detail to ensure the design and construction criteria comply with the Standards.

(ii) Where land is developed in stages, each stage must include a plan showing how the particular stage relates to the block as a whole and to other stages providing all related information from previous stages that will be relevant for the given stage as well. At least one plan of the area encompassed by the works, which may be a roading or service plan, must clearly define the boundaries or limits of the subdivision.

Storm water reticulation drawings must include catchment area limits and actual areas must be noted on the drawings. Catchment design details are to be included in the documentation for approval. The catchment plan forms part of the submitted stormwater management plan.

1.12.10 **Services**

(i) All network utility services are to be located as shown on Standard Drawing 1.2, except where an alternative location has been approved by the manager.

(ii) All services must be shown on a separate sheet with adequate details and flow directions.

1.12.11 **Development of Existing Residential Allotments**

(i) Where any existing occupied or single residential allotment is subdivided into one or more additional allotment(s), new wastewater, water supply and storm water services are to be provided for each new lot from the council point of supply. Extension of existing allotment services must not be permitted. Where existing services are provided to a vacant allotment, all copper, ceramic and asbestos cement materials are to be replaced. The manager will require evidence of materials servicing existing allotments prior to subdivision approval.

(ii) Access to all new allotments must be in accordance with clauses 3.10.2, 3.18 and 3.19.

1.12.12 **Subdivision and Servicing of Properties with existing multiple Dwelling Units**

(i) Where it is proposed to subdivide a section on which there are existing multiple dwelling units and the proposed subdivision meets all requirements with regard to areas, frontage etc. and structural requirements with regard to party walls, the use of existing services will be permitted provided that:

(ii) All shared underground services are covered by suitable easements.

(iii) Additional manholes or inspection chambers are constructed in the shared length of wastewater and storm water to facilitate maintenance.

(iv) All services including access, water supply, wastewater and stormwater may require upgrading at the discretion of the Manager.

1.13 DRAUGHTING STANDARDS- ENGINEERING DRAWINGS

Engineering drawings are to be provided an electronic format compatible with the latest version of AutoCAD and must be in either a .DXF or .DWG file and ESRI Shapefile.

Details of roading, wastewater drainage, stormwater drainage, water supply, gas, power, telecommunications and miscellaneous infrastructure must be shown on separate drawings.

Engineering drawings must contain the subdivision number and ensure datums meet PNCC requirements. PNCC datum requirements are:

Horizontal: NZTM2000

Vertical: NZVD2016. Council's standard symbols must be used. Refer Standard Drawing 1.1.

The following scales must be used:

Plans	1 in 500
	1 in 250
Long Sections	1 in 500 Horizontal
	1 in 50 Vertical
Cross Sections	1 in 100
	1 in 50
Details	As required

All plans must be produced with the following requirements.

- North orientation must be at top of plan
- Cross sections to commence at lower station value at bottom left hand corner.

Long sections and plan layout to commence at lower station value on left hand side of plan. Long section to be partnered on the same sheet as the associated plan where possible.

1.14 APPROVAL OF ENGINEERING DRAWINGS AND SPECIFICATIONS

NO CONSTRUCTION WORK INCLUDING EARTHWORKS IS TO PROCEED UNTIL ENGINEERING APPROVAL HAS BEEN PROVIDED.

Council approval of engineering drawings and specifications will be provided in writing following the satisfactory correction or amendment of any required detail. Assessment of drawings and specifications will be completed within twenty working days of initial receipt provided that any corrections or amendments are made immediately on receipt of same.

All approvals will be expiring if construction work has not commenced within one year of the date of the Manager's approval. The Developer is not to proceed with any works until all plans and specifications have been resubmitted to the Manager for approval and approval with any amendments has been given.

1.15 VARIATIONS

Any alterations to works in progress resulting in a variation from the approved drawings and specifications must be notified to the Manager in writing prior to the commencement of these works. Such works must not be commenced without approval from the Manager.

1.16 HOURS OF WORK

The hours of work in residential, commercial and industrial subdivisions must be:

Weekdays	6.30am- 8.00pm
Saturdays	7.30am- 6.00pm
Sundays/ Public Holidays	No Work

The Manager's approval must be obtained before any work outside of these hours.

There is no limitation on the hours of work in Rural or Rural Residential subdivisions unless there is specific requirement.

Where the hours of work stipulated within the Resource Consent conditions vary from those listed above, the Resource Consent condition shall take precedence.

1.17 WORKS IN ROADS OR ROAD RESERVES

1.17.1 Road Opening Permits

The developer and contractor are required to apply to Council's Corridor Access Manager for road opening permits where existing roads or road reserves are affected by the proposed development works.

1.17.2 Traffic Management Plans

An approved Traffic Management Plan is required prior to the commencement of any works in an existing road or road reserve. Contractors to allow sufficient time for review and approval of TMPs in their programs. Any delays caused due to late submission cannot be held against PNCC.

1.17.3 Development adjacent to existing infrastructure

Where a development is proposed adjacent to existing infrastructure (whether an existing road and/or services), and the completed development will generate additional demand on the existing infrastructure beyond its design capacity, then it will be required to be upgraded in accordance with the Standards. The Developer must meet the full cost of the required upgrade works.

1.17.4 Feature Walls

All structures including entrance walls to be incorporated into the proposed development must not be located within road reserve. The developer must be responsible for the on-going maintenance of any structure following completion of the defects liability period.

1.18 NAMING OF DEVELOPMENTS

The naming of all proposed developments other than approved suburban/rural names must be at the discretion of the Manager.

For naming of streets refer to the "Street Naming Guidelines" and "Street Naming and Numbering Policy"on the PNCC website.

1.19 INSURANCE

The developer will ensure that the following insurance cover is obtained prior to commencement of any works within existing road reserves and that cover remains current until the defects liability period has expired.

Public Liability	**$2,000,000**
Professional Indemnity	$5,000,000

Motor Vehicle/ Plant Insurance	For all vehicles and for plant over $50,000
Contract Works Insurance	80% of the value of the works

Evidence is to be provided to the Corridor Access Manager that insurance cover outlined above has been obtained and will form part of the consent process.

1.20 CONSTRUCTION MONITORING

1.20.1 The Developer's Technical Representative

The Developer's Technical Representative is responsible for construction monitoring (inspection). The level of "Construction Monitoring" must be one of the five levels of construction monitoring as defined by the Engineering New Zealand.

The level of construction monitoring must be calculated for each subdivision. Certain phases of construction may require additional or constant monitoring. The level will usually be CM3 or CM4 and will be specified on the Subdivision Consent.

1.20.2 Council Hold Point Inspections

The Developers Technical Representative must be fully satisfied that Council's requirements have been complied with pre-identified quality assurance hold points with relevant data support prior to requesting any inspections. Recovery of costs will be sought by Council should any inspection request be made for uncompleted works.

The Council may consider undertaking an inspection via live video phone call. Video inspections may be recorded for Council records.

Council inspections are required at the following points:

1.20.2.1 Roading

(i) Completion of earthworks, including compliant test results.

(ii) Completion of subgrade preparation for road pavement including compliant test results

(iii) Completion of kerb & channel, vehicle access ways and footpaths preparation.

(iv) Completion of subbase pavement layer, including compliant test results.

(v) Completion of basecourse pavement layer, including compliant test results

(vi) Surface prior to any bituminous related work (membrane seal, first coat and second coat, and asphalt) , including compliant Degree of Saturation.

1.20.2.2 **Water supply**

(i) Prior to backfilling of trenches

(ii) Inspection of typical water lateral and toby prior to backfilling

(iii) Prior to connect to live main:

a. Pressure testing

b. Free Available Chlorine test

(iv) Flow testing

(v) Inspection of the final backfill layer, including compliant test results for each backfill layer.

1.20.2.3 **Wastewater**

(i) Prior to backfilling of trenches

(ii) Inspection of manholes for compliant haunching prior to pressure testing

(iii) Alignment and grade checks

(iv) CCTV Inspection

(v) Pressure testing prior to connection to live mains

(vi) Inspection of the final backfill layer, including compliant test results for each backfill layer.

1.20.2.4 **Stormwater**

(i) Prior to backfilling of trenches

(ii) Inspection of manholes for compliant haunching prior to pressure testing,

(iii) Alignment and grade checks

(iv) CCTV Inspection

(v) Pressure testing prior to connection to live mains

(vi) Inspection of the final backfill layer, including compliant test results for each backfill layer.

1.20.3 **Notice Prior to an Inspection**

The Developers Technical Representative must give at least one full working day notice to Council prior to an inspection. Requests for inspections from Contractors and/or Sub Contractors will not be considered.

The Manager reserves the right to make inspections at any time.

1.20.4 **Health and Safety Act**

The Developer must ensure that the requirements of the HSW Act 2015 are met.

1.21 EMERGENCY PROCEDURE

If during the course of construction, any situation that arises whereby the security of public or private property or the operation of any public facility is endangered, in the opinion of the Manager, endangered; the Contractor may be directed to carry out such remedial measures as are considered necessary by the Manager to remove the danger. Any work directed must be carried out immediately at the Developers expense.

1.22 SAMPLES FOR TESTING

The Manager must be able to take samples of materials at any time for testing. All samples taken must be fair average sample of bulk material or of the article which it represents. Samples taken from bulk must be obtained by the recognised sampling procedure and tested by an I.A.N.Z registered laboratory. Sampling and testing is to be carried out at the developers cost.

1.23 SAMPLE TESTING REQUIREMENTS

The Developer is responsible for ensuring all tests required in the Standards are carried out by an I.A.N.Z registered laboratory. Records of results of all tests are to be kept and provided to the Manager in accordance with the Standards or made available at any time to the Manager on request.

1.24 TEMPORARY FENCING

Temporary fencing must always be provided for and erected by the Developer at all entrances to the development site and all danger areas within the development site to protect the general public at all times. All fencing is to comply with the HSW Act 2015 and amendments. Appropriate warning signage must be erected. Use of barbed wire is not permitted.

1.25 DAMAGE

The Developer must make good any damage to any infrastructure within existing road reserves, survey markers, or private property, which is caused as a result of the development. This includes, but is not limited to road pavement, kerb & channel, footpaths, vehicle access ways, street and traffic signs, power poles, cabinets, fire hydrants, water valves, water manifolds, manholes. Repair work must be completed by the

Developer at the Developers cost. Remedial works must be undertaken within 24 hours of damage occurring. Where damage has occurred to any network utility services or pavement that has an immediate adverse impact on surrounding residents it must be repaired immediately.

Any damage of open/closed drains, roadways, footpaths, driveways, properties and temporary ponds must be cleared forthwith by the Developer at the Developers cost.

Failure to comply with Clause 1.26 will result in the Manager arranging remedial works. Completion of remedial works by Council, including any management time in organising this, will be a cost to the Developer.

1.26 TRENCHING

The excavation, installation and backfilling of trenches must be in accordance with NZS/AS3725.

Compaction tests must be carried out on all service trenches within the development. The Developers Technical Representative must retain all compaction testing records and provide certification of the tests to the Manager.

1.27 STOCKPILE SITES

The Developer must not utilise locations for any stockpile site for any equipment, plant, materials and soils outside the designated development area unless approved by the Manager. The Developer must ensure that any stockpile site used within the development area does not impact adversely on the adjacent neighbourhood.

1.28 "AS BUILT" DRAWINGS

Prior to practical completion, the Developer must amend all drawings and necessary documents to represent the true 'As Built'. The amendments must be made in both AutoCAD and in the GIS Shapefiles. AutoCAD files shall be compatible with the latest version of AutoCAD, in either a DXF or DWG file.. For GIS Shapefile templates refer to the Appendix 11 and PNCC website.

The following files need to be supplied:

(i) Vector PDF file
(ii) DXF or DWG file, including CTB file
(iii) Coordinates in XLS format
(iv) GIS Shapefile

The 'As Built' information to be shown on the drawings is specified in (i) – (xi) below.

All coordinates must be:

(i) shown in terms of NZTM2000 coordinates

(ii) to two decimal places

(iii) provided in .xls or .dbf format

All levels must be:

(i) to NZVD2016

(ii) to three decimal places. See Standard Drawing 1.1 for details of Councils standard draughting symbols, GIS point codes and line types.

Mark-ups and amendments to As-built plans must be made in red.

(i) The size and type of all wastewater, storm water and water supply pipes. Position, related to a side boundary, and depth of invert at inlet and outlet and longitudinal grade, related to ground level at the marker (northing and easting), of all wastewater and storm water laterals.

(ii) The coordinated position of the centre of the cover of all manholes. Levels of the cover and inverts of each inlet and outlet of all manholes. The coordinated position of all fire hydrants, swabbing points, valves, tees and bends.

(iii) The position, related to a side boundary, of all manifolds.

(iv) The coordinated position of the centre of the kerb behind each sump.

(v) The coordinated position of the road centreline after line making has been completed identifying start/finish and tangent points including centre points of each intersection.

(vi) The extent of all fill areas.

(vii) The depths and types of Pavement formation.

(viii) Where appropriate, any restriction limiting building on any part of the lot must be shown on either the wastewater or stormwater plan.

(ix) The position of grass berms, gardens, rain gardens and all street trees to be vested, including data to show species and date planted.

(x) Vehicle crossings and car parks

(xi) An “As-built” plan must be submitted for earthworks in accordance with section 2.7

The Developer is responsible for the accuracy of the information given on the ‘As Built’ plans and for any extra costs which may arise as a result of incorrect information shown.

1.29 CCTV INSPECTION REQUIREMENTS FOR COUNCIL APPROVAL

1.29.1 Engaging a CCTV Provider

The Consent Holder’s Representative shall be responsible for engaging a CCTV provider which is acceptable to Council. The agreed/nominated CCTV provider shall undertake the CCTV inspection for the development as and when required.

1.29.2 Responsibilities of All Parties

The Consent Holder's Representative is responsible for ensuring the required CCTV inspections for the development are completed and submitted to Council for acceptance. The Consent Holder's Representative is also responsible for the on-site coordination of the Contractor and CCTV Provider. Council accepts no liability for the CCTV Provider or the coordination and timing of inspection requirements.

1.29.3 Cleaning

Prior to the CCTV inspections being undertaken pipes are to be fully cleaned to remove all foreign matter, including all debris. This may involve either several passes of jetting equipment or the use of several different cleansing techniques to ensure that all debris is removed from the pipeline.

1.29.4 Water Flow in Pipe

A nominal flow of water is required in the pipe invert during the CCTV inspection to provide visual confirmation of the absence of significant dips. The water flow shall not be such as to inhibit the CCTV equipment from completing a thorough inspection of the pipeline.

1.29.5 Submission Requirements

The CCTV provider is required to provide the following as part of the submission:

- An electronic copy (A3) as-built drawing of the pipe layout and manhole positions labelled to correspond with the information on the CCTV video.
- Video inspection files recorded in an mpeg2 programme stream (PS) format, with a variable bit rate of 5 Mbps or higher or alternative video inspection files provided in MP4 video format, with an H.264 codec and a bit rate of 5 Mbps or higher. Inspection videos must be named with a unique file name to link them to the report data.
- A report outlining the condition of each pipe and highlighting damage requiring repair and follow standards set out in the New Zealand Pipe Inspection Manual.
- Inspections and report to be delivered on either a memory stick or external Hard Drive due to large file size.

1.29.6 CCTV Footage Requirements

The CCTV video files shall include the following text information:

a) Screen header information shown for a minimum of 10 seconds showing:

1. Name of main Contractor.
2. Name of CCTV Contractor.
3. Name of Client.
4. Date of inspection.
5. Resource Consent Number or Council Contract Number.
6. Upstream manhole number.

7. Setup Manhole number.
8. Downstream manhole number.
9. Pipe Diameter in millimetres.
10. Pipe Material e.g. UPVC.
11. Pipe use e.g. Stormwater.

b) Continuous header information located on screen so as not to impede the view of the pipe showing:

12. Upstream manhole number
13. Downstream manhole number
14. Distance along pipe
15. Inclinometer

Figure 1 Example of Continuous Header Information Position

1.29.7 Unacceptable Footage

The video will be deemed unacceptable and rejected due to any of the following issues:

16. Camera out of focus.
17. Insufficient / excessive lighting.
18. Fog or steam in the pipe.
19. Condensation or grease on the lens.
20. Temporary discharge of water down the pipe.
21. Debris or spider webs over the lens due to insufficient cleaning.
22. Camera moving too fast or too slow through the pipe.

1.29.8 Condition Assessment Reports

The Consent Holder's Representative is responsible for obtaining a condition assessment report of the CCTV footage and providing this to council for review.

The result of the condition assessment report will inform remedial works required on the network.

1.30 PRACTICAL COMPLETION INSPECTION

Prior to practical completion being issued and Council receipt of the 'As Built' plans, a practical completion inspection must be undertaken between the Developer's Technical Representative and the Manager.

The practical completion inspection must include a review of all test results, visual assessment, and CCTV survey of all sewer and storm water supply systems that are to become public drains.

Any damage or faults identified either in a practical completion inspection or previous inspections must be made good before issue of practical completion (refer Clause 1.32 and 1.33)

1.31 BONDS

Section 222(1) of the Resource Management Act 1991 provides the developer with the opportunity to cover the cost of completion of works with a bond. Consideration will be given to the execution of a bond relating to works that have not been completed due to it being out of season or else beyond control of the Developer. Any bond for the completion of such works will be at Council's discretion. Water and sewer connections may not be bonded.

When applying for approval for such a consideration, the Developer must supply an accurate estimate of the value of the work to be completed and an estimate of the time needed for final completion. The Manager will make arrangements for the Councils solicitor to prepare the Bond at the Developers expense as security for the carrying out and completing the works. A cash deposit or an approved indemnifier or both will be required for an amount calculated using the Bonds Plus Factor Table below.

The date for the release of the bond and the date for Council if necessary to commence completion of the works will be by agreement between the Manager and the Developer however it will not exceed a timeframe of six months.

Bonds Plus Factor Table			
Est. cost of bonded works	Plus Factor	Technical Representative	**Total**
Any work less than $5,000.00	25%	N/A	**25%**
Any work $5,000.00 to $10,000.00	25%	10%	**35%**
Any work greater $10,000.00	**50%**	**15%**	**65%**

1.32 ACCEPTANCE OR APPROVAL OF WORKS

Prior to the issue of Acceptance of Works, the Developer must supply to Council:

(i) A Completion Report which includes all Quality Assurance (QA) test records required under this Standard including but not limited to:

a. Subgrade testing (for both earthworks, pavement and service trenching)

b. Compaction testing for all earthworks, service trenches and pavement construction.

c. As-Built levels or string lines for all constructed pavement layers, including subgrade layer.

d. Source and production property test results for fill, backfill, subbase, basecourse, sealing and AC aggregate.

e. Concrete strength confirmation for any concrete works carried out

f. Benkelman Beam test results for roads and accessways

g. After the completion of the bituminous layer the contractor must submit a detailed spay sheet for review and approval.

h. Compaction and binder testing for all AC related work

i. Pressure tests for all water, wastewater and stormwater services

j. Flow testing of watermains

k. CCTV inspection results for stormwater and wastewater gravity lines

l. Backflow prevention device commissioning report

m. Pump station commissioning report (where required)

n. PE pipe weld logs and testing

And any other quality assurance testing specific to the work as required (e.g. soakage test results where on-site stormwater disposal is proposed)

(ii) "As-Built" drawings as detailed in clause 1.28.

(iii) An Operating and Maintenance Manual where mechanical assets are vested to Council e.g. Pump Station

(iv) A certificate regarding earth fills and compaction. Refer Appendix 4.

(v) A certificate regarding water main disinfection after completion of water main construction. Refer to the Appendix 5.

(vi) Certification that the construction works have been monitored in accordance with the clause 1.21 and have been carried out in accordance with sound engineering practice. Refer Appendix 6.

(vii) Formal advice from all network utility providers acknowledging that all works have been completed.

(viii) The bond agreement for completion of subdivision work (if any) to cover any uncompleted work has been signed by all parties (see clause 1.31).

(ix) CCTV records of sewer and stormwater pipelines in DVD standard format.

(x) Schedule of assets of vested assets to PNCC (refer to the Appendix 12)

1.33 MAINTENANCE OF WORKS

Notwithstanding that the notice to the Manager has been issued, the developer must be responsible for completing maintenance of the engineering works until such time as the Council has been advised that the Survey Plan has been deposited.

The Developer must be responsible for any defects prior to release of the survey plan. The Developer is responsible for any defect of the development for a period of 24-month defects period from date of acceptance of works or later date where the infrastructure is covered by a bond.

Developer required to inspect the road two months prior to the end of defects period and identify any maintenance requirements to the Council before release of responsibility.

For any chip seal surfacing the developer is responsible for implementing a designed second coat chip-seal surface 12 months or at the following next summer sealing period from date of practical completion inclusive of any pre-seal repairs requirements.

Failure to comply with Clause 1.26 will result in the Manager arranging remedial works. Completion of remedial works by Council, including any management time in organising this, will be a cost to the Developer.

1.34 DEVELOPMENT AND FINANCIAL CONTRIBUTIONS

1.34.1 To Council

Any or all Development or Financial contributions relating to engineering works required to be paid by the Developer to Council will be set out in the Subdivision Consent. The instances where contributions are required are set out in the Long Term Plan (LTP). The time for payment will be set out in the Subdivision consent.

1.34.2 From Council

Payment to the Developer for any financial contribution relation to engineering works required by Council will be by separate agreement outside of the Subdivision Consent.

1.35 ARBITRATION

In the event of a dispute between the Developer and Council over any engineering activity associated with the development, a meeting between both parties is to occur no later than 10 working days to resolve the conflict. The contents of the Engineering Standards for Land Development must take precedence in all decisions. Where the Standards do not provide a solution to the dispute, the Manager must decide the final outcome of the dispute.

1.36 PRECEDENCE

Where conflict arises between documents associated with the development the Engineering Standards for Land Development must take precedence unless agreement can be reached between both parties.

2 LAND SUITABILITY AND EARTHWORKS

2.1 INTRODUCTION

This section provides standards for the management of earthworks, excavation, soil disturbance and sedimentation and addresses the following:

- Assessment of suitability of land for development in its natural state.
- Ensuring that subsequent earthworks/remediation works are of appropriate design and are carried out in accordance with relevant standards
- Confirming that the finished landform is suitable for development and that each lot provides a safe adequate area for building, access and effluent disposal.
- No earthworks associated with the development must be undertaken which will have a detrimental effect on the stability of any land.
- All natural land surfaces considered to be unstable must be identified and no build areas and appropriately located building platforms must be utilised to ensure the avoidance of subsidence and other natural hazards.

The purpose of the earthworks standards is to provide guidance to the Developer involved in vegetation removal, excavation, recontouring of land and the preparation of sites for development involving any land disturbance works. The standards are designed to ensure that any disruption associated with earthworks is minimised, that soil loss and sedimentation are controlled to avoid adverse off-site effects, that development sites are safe and stable, and that finished landscapes are rehabilitated. Poorly managed earthworks and development can result in soil loss, erosion and instability.

2.2 OBJECTIVES

All earthworks and land disturbance activities in the Palmerston North City area, regardless of the scale and size of the activity, compliance with permitted activity standards and conditions, or resource consent conditions, should be consistent with the following objectives:

a) Low impact design – where possible, a low impact approach to earthworks is preferred;

b) The extent and scale of disruption should be minimised – significant works should be staged, to minimise the total area of exposed soils at any point in time. Every effort should be made to minimise disturbance of existing vegetation;

c) Maintain natural drainage – where practicable, retain existing natural contours and features, such as gullies, streams and wetland areas. Avoiding disturbance of these areas can help to reduce the potential for excessive soil loss, erosion, sedimentation and inundation.

d) Topsoil stripping - All topsoil must be stripped from the earthwork areas with the stripped area being kept to the practical minimum at any one time. Topsoil should be stockpiled and used in the rehabilitation of the site;

e) Unsuitable material - All unsuitable material uncovered during stripping or earthworks must be excavated. Unsuitable material is generally described as any material having a California Bearing Ratio (Scala or equivalent) (CBR) inferred value of three or less;

f) Compaction - all fill areas must be re-worked and compacted in accordance with the appropriate design relevant to soil conditions and geology.

g) Protect steep slopes – Steep slopes must be protected to reduce erosion and sedimentation.

h) Stabilise exposed areas rapidly – Exposed areas must be stabilised as soon as practicable. Vegetated ground cover is the most effective form of erosion control. Keep machinery off areas that have been stabilised;

i) The protection and where possible enhancement of watercourses.

j) Install perimeter controls - Install diversion drains, silt fences and earth bunds to divert clean water runoff away from worked areas and keep separate from sediment prone water.

k) Soil loss - All practicable measures should be undertaken to minimise soil loss, erosion and sedimentation from exposed surfaces;

2.3 STANDARDS

The following Standards and Codes of Practice are referred to in Part 2 of the Engineering Standards for Land Development. The design, materials and method of construction must comply with the Standards and Codes of Practice applicable.

The Standards used must incorporate the latest amendments. Standards superseding those listed and the latest version must automatically apply.

NZS 4402 Methods of Testing Soils for Civil Engineering Purposes

NZS 4404:2010 Land Development and Subdivision Infrastructure

NZS 4431 Code of Practice for Earth Fill for Residential Development

2.4 LAND SUITABILITY

The determination of suitability of land for subdivision requires that the land be assessed in each of the following categories:

(i) Landform – Risk of erosion and slippage

(ii) Location – Flood prone or swampy land

(iii) Bearing capacity and settlement in areas of building foundations

(iv) The presence of Hazardous Activities and Industries (HAIL)

(v) Liquefaction under earthquake loading

Each of these areas must be addressed and evidence provided prior to consent approval.

The Developer must provide a preliminary report as to suitability of land for building construction as part of the development concept plan approval process. This report must be prepared by a geotechnical specialist to provide a professional opinion that suitable building sites, access and effluent disposal areas, if appropriate, will be available in the completed subdivision.

2.4.1 Geo-Professionals

Where, in the opinion of the Manager, concern is expressed over the suitability of any land included in a subdivision development proposal, the Manager will require and independent investigation and report(s) (Peer Review) from a suitably qualified person or persons. The cost of this additional assessment will be the responsibility of the Developer.

These Standards provide information for professionals involved in designing and constructing a land development project and require geotechnical expertise in projects where land stability could be an issue.

Geotechnical assessment must only be undertaken by a geo-professional. A geo-professional is a chartered engineer (CPEng), or an engineering geologist, with recognised qualifications and experience in geotechnical engineering and experience related to land development.

A geotechnical assessment must be undertaken where any of the following apply:

a) The assessment of land stability requires specialist expertise;

b) The construction of earthworks associated with any batters remain stable and that fill material is placed in such a way that it remains stable and can support the future loads imposed on it;

c) There is historical fill which has not been undertaken in accordance with any Standard or where natural slopes, banks or batters are involved;

d) The assessment of ground for the foundations of buildings, roads, services, and other infrastructure requires specialist expertise as weak ground may require special design;

e) The wide range of soil types, physical conditions and environmental factors applying in different areas make it difficult to specify precise or prescriptive requirements for land stability assessment or earthworks.

A geo-professional needs to be involved in the choice of final land form. This decision depends on many factors which may be specific to the development. These include the relationship with surrounding landscapes, the size of the development, the proposed and existing roading patterns, the preservation of natural features, wahi tapu, and other historic and archaeological sites, the land stability and underlying structural geology, the function and purpose of the development and the potential for flooding, and erosion and other natural hazards and events including earthquakes. The aim is to also give guidance on the identification of and assessment of the order of importance of the above factors which will vary from project to project.

2.4.2 Landform

Council has adopted, as policy, a report prepared by Tokin & Taylor Ltd entitled, "Development of Land which is, or is likely to be, Subject to erosion or slippage."

All development proposals that contain land with slopes in excess of 10 degrees will require assessment under this policy. A copy of this policy can be found in Appendix 3.

This report sets out geotechnical investigation and reporting requirements for developments within the city and rural areas; however, it should be noted that criteria in this report apply only to erosion or slippage.

The Tonkin & Taylor report identifies development criteria appropriate to the various levels of apparent potential for slippage and erosion on any particular site. This is intended to ensure that unnecessary investigation and reporting is not required on sites with slopes less than 10 degrees.

2.4.3 Location

The District Plan identifies areas of flood prone land. All localised low spots, swampy areas, springs or seepage, floodways and overland flow paths within and surrounding the proposed development area must be highlighted and methods of drainage of flood protection proposed.

2.4.4 Foundation Conditions

An area on each lot with adequate bearing capacity for the proposed structures (residential/industrial) must be identified, and any required rectification works (filling/excavation/compaction) proposed.

Similarly, areas designated for roads, pipelines, service corridors and underground structures must be shown to have adequate bearing capacity for their purpose.

Consideration and prevention and preventative design where necessary must also be given to the likelihood of settlement beneath foundations and services as listed above, including settlement under both static and seismic loads.

2.4.5 Hazardous Activities and Industries List and Chemical Contamination

The National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (1 January 2012) establishes provisions for identifying and rectifying areas of chemical contamination. Site investigations may be required depending on whether the site has been identified as a HAIL site.

A design proposal for remediation or containment must be submitted and approved prior to consent approval.

2.4.6 Earthquake Loading

Consideration must be given to the effects of an earthquake on earthfills, slopes and liquefiable ground, and these effects must be taken into account in the design and construction of any development.

2.5 EARTHWORKS

During construction, the following Standards must be complied with:

NZS 4431 Code of Practice for Earthfill for Residential Development

2.5.1 Fill Areas

Requirements relating to the compaction of fill for all subdivision lots are:

For residential lots, requirements for compaction may be limited, with the approval of the Manager to those areas on which buildings are likely to be sited. Such permission should not normally be withheld unless the extent of the filling in relation to the original topography is such that stability of the building site may be affected.

Previously filled areas must be tested in accordance with the NZS 4431 and a report complied and forwarded to the Manager. Any previously filled areas which prove unsatisfactory must be excavated and reconstructed as prescribed in this section.

Where the proposed development adjoins an establishment subdivision, the proposed surface level of the new allotments must be similar or lower than the existing surface level of the existing subdivision.

2.5.2 Detailed Investigation and Testing

Where soils are intended to form the in-site base for stable fills, or where they are intended for use as fill material or where they are intended to be permanently exposed in batters or to remain as permanent slopes or cuts, then the standard test methods outlined in NZS 4431 Section 11 “Test Methods” must be used to determine the stability of such soils.

Sufficient investigation work must be undertaken to:

(i) Classify the soil strata and structure by field and visual methods;

(ii) Establish the extent and variation in depths of the principal soil types involved, and

(iii) Determine natural ground water levels.

Further sampling and testing on the representative soil types must be carried out, as required, to determine the relevant soil test properties necessary to properly assess the strata over the site.

2.6 SAMPLING AND TESTING

2.6.1 Areas of Soft Soil

Where it is intended to leave particular soft soil under any depth of fill, liquid and plastic limit tests, natural moisture content tests, consolidation and shear strength sensitivity tests must be carried out in accordance with NZS 4402 Methods of Testing Soils for Civil Engineering Purposes.

2.6.2 Areas Covered by Deep Fill

Areas which are to be covered by deep fill must require liquid and plastic limit tests, natural moisture content tests on the fill material, where this data indicates the likelihood of slumping or settlement, consolidation and shear strength and sensitivity characteristics must be assessed in accordance with NZS 4402

2.6.3 Alterations to Natural Surface or Sub-Surface Drainage

Where an area is to have its natural surface or sub-surface drainage extensively altered or reversed the liquid limit and plastic limit along with natural moisture content, shrinkage and swelling characteristics, organic characteristics, organic content and the position of the natural water table must be determined by test methods outlined in NZS 4402.

2.6.4 Fill Materials

Areas from which material for permanent fills are to be obtained must be tested for natural moisture content and compaction characteristics (optimum moisture content maximum dry density). Where materials indicate plasticity the liquid limits and plastic limits must be determined. Such tests are to be carried out in accordance with NZS 4402.

2.6.5 Compaction Standards

The following percentages of maximum densities as determined by NZS 4402 Test 4.1.1 must apply;

(i) Within 0.6 m of the street subgrade and extending to the outer edges of the footpaths etc. the densities must not be less than 95% of those given by New Zealand Standard Compaction Test (Test 4.1.1).

(ii) Within 1 m (vertical measurement) of the finished surface of all fill areas and within 3 m (horizontal measurement) of all batter boundaries of unenclosed fills, the densities must not be less than 95% of that given by the NZS Compaction Test (Test 4.1.1)

(iii) Below 1 m (vertical measurement) of the finished surface except within 3 m of the boundaries, the densities must be not less than 95% of that given by the NZS Compaction Test (Test 4.1.1).

(iv) Increased percentages may be required in certain cases where directed by the Manager.

(v) Where the slope of a fill batter precludes the use of normal compaction equipment, the Manager will have to approve compaction method proposed by the Technical Representative.

2.6.6 Slope Design

Cut and fill batter slopes are to be specially designed in accordance with the Land Stability Guidelines.

For cut and fill batter slopes within the road reserve, refer to clause 3.5.21 of the Engineering Standards for Land Development.

2.6.7 Drainage

Stormwater runoff must be designed to ensure full and effective control and discharge is maintained at all times.

Where overland flow exists from an existing adjacent development, the flow must be intercepted on the common boundary and managed so that it is directed into the approved stormwater system.

2.7 CERTIFICATION

On completion of the earthworks, a geotechnical completion report being Appendix 4- "Schedule 2A – Statement of Professional Opinion as to Suitability of Land for Building Construction" (NZS 4404:2010 – Land Development and Subdivision Engineering) must be provided by the Developer.

An "As-Built" plan must be submitted which shows the finished ground levels, the extent and depth of all fills, the position, type and size of all sub-soil drains and their outlets and any areas of low density fill or fill that does not comply with the specifications agreed during design and consent

3 ROADING

3.1 INTRODUCTION

Council's objectives with regard to street design are set out in the current Street Design Manual.

Council's aim is to encourage subdivision layouts in which the function of each street is clearly expressed by its location and alignment and its relation to other streets within the subdivision and on the wider network.

The Developer must provide for roads and associated infrastructure including footpaths, cycle ways and pedestrian access ways, vehicle crossings, drainage, traffic and street signage, street furniture, street lighting, roadmarking and street landscaping, including street trees, which are to be all incorporated into the development project and must be specifically designed and constructed to cope with the volumes and loadings of traffic and provide a functional and safe environment for the users of the development over the design life.

3.2 STANDARDS AND SPECIFICATIONS

The following standards and specifications must be used for the design and construction of the proposed road network within the development project.

The standards used must incorporate the latest amendments. Standards superseding those listed and the latest version must automatically apply.

Bracketed figures indicate the Transit New Zealand document reference number.

NZS 2890	Off-street Parking Facilities
NZS 3104	Specification for Concrete Production
NZS 3109	Concrete Construction
NZS 4121	Design for Access and Mobility – Buildings and Associated Facilities
NZS 1428.4.1	Design for Access and Mobility – Means to Assist the Orientation of people with Vision Impairment - Tactile Ground Surface Indicators
NZS 4402	Methods of Testing Soils for Civil Engineering Purposes
NZS 4404:2010	Land Development and Subdivision Infrastructure
NZS 4407	Methods of sampling and Testing Road Aggregates
AS/NZS 1158	Lighting for Roads and Public Spaces
RTS 6	Guidelines for Visibility at Driveways
NZTA B/05	Specification for In-Situ Stabilisation of Modified Pavement Layers
NZTA F/01	Specification for Earthworks Construction
NZTA F/2	Specification for Pipe Subsoil Drain Construction

NZTA F/03	Specification for Pipe Culvert Construction
NZTA F/6	Specification for Geotextile Wrapped Aggregate Subsoil Drain Construction
NZTA F/07	Specification for Geotextiles
NZTA M/01	Specification for Performance Graded Asphalt Binder
NZTA M/04	Basecourse Aggregate
NZTA M/06	Specification for Sealing Chip
NZTA M/07	Specification for Road Marking Paints
NZTA M/10	Specification for Dense Graded and Stone Mastic Asphalts (Asphaltic Concrete)
NZTA M/30	Specification and Guidelines for Road Lighting DesignNZTA
NZTA P/03	Specification for First Coat Sealing
NZTA P/09	Construction of Asphaltic Concrete Paving
NZTA P/12	Specification for Pavement Marking
NZTA T/1	Standard Test Procedure for Benkelman Beam Deflection Measurements
NZTA	Bridge Manual (SP/M/022)
NZTA	Guidelines for Highway Landscaping (SP/M/020)
NZTA	Manual of Traffic Signs and Markings, Parts 1 and 2 (MOTSAM1 and MOTSAM2)
Austroads	Guide to the Structural Design of Road Pavements including NZ Supplement (AP-G17/04)
Austroads	Guide to Stabilisation in Roadworks including New Zealand cover note (AP-60/90)
Austroads	Guide to the Traffic Engineering Practice Part 14, including NZ supplements (SP/M/025)
Austroads	Guide to Road Design Parts 1-8
Austroads	Guide to Traffic Management Part 8: Local Area Traffic Management
NZTA	State Highway Geometric Design Manual
Austroads	Guide to Pavement Technology
NZTA	Cycle Network and Route Planning Guide
NZTA	Pedestrian Planning and Design Guide
PNCC	Street Design Manual
NZTA	Traffic Control Devices Manual (all parts)
NZTA	Road Safety Audit Procedures for Projects
PNCC	Tree Policy
NZTA	Chipsealing in NZ (2005) Handbook
NZTA	RTS 14 Guideline for facilities for blind and vision impaired pedestrians

3.3 CARRIAGEWAY WIDTHS

3.3.1 General

The Street Design Manual and Palmerston North City Council District Plan describe the roading hierarchy which classifies the existing proposed roading network.

Table 3.1 of this Standard provides a guide for minimum criteria that is to be used in defining road classifications for proposed development. Council may require development design to exceed the criteria outlined in Table 3.1. The Developer would be advised of any changes to Table 3.1 and the reasons why when the Development Concept Plan was submitted.

Where a proposed development involves or requires an extension of the primary road network, design and construction must be to the same or better standard as that required for that part of the network. It is advisable that the Developer discuss proposals with the Manager prior to the preparation of the Development Concept Plan.

On primary roads and roads with a design speed of greater than 80km/h, the pavement width must be such that all left hand vehicle turning movements exiting from properties must be restricted to the left hand side of the road centreline.

3.3.2 Roading Network

The hierarchical classification of subdivision streets forming part of the roading network will be determined by the criteria in the District Plan and Table 3.1.

To ensure Council's objectives are met, the following Estimated Dwelling Units in Catchment (EDUC) and Estimated Personnel Employed (EPE) design factors must be used to determine the hierarchical classification of proposed streets within a subdivision.

3.3.3 Estimated Dwelling Units In Catchment (EDUC)

For the design of Residential Streets an assessment must be made of the total possible number of dwelling units in the "catchment".

The definition of "catchment" must be deemed to include all such household units, the traffic from which could reasonably be assigned to that part of the street having regard to its distance and time of travel. Special consideration must be given to specific traffic generators such as schools, shopping areas, parks for organised sport, and the like.

In addition to catchment considerations, regard must also be given to the intended character and function of each street in determining its appropriate carriageway width.

3.3.4 Vehicles Per Day (VPD)

For design purposes allow ten vehicle movements per day per residential lot or Rural/Rural Residential Lot. Specific assessment is to be undertaken to determine vehicles per day for commercial and industrial developments.

3.3.5 Estimated Personnel Employed (EPE)

For the design of Arterial and Local Industrial Streets, an assessment must be made of the possible maximum number of persons who could be employed in the industrial subdivision with the due regard to the zoning of the industrial area.

Table 3 1 Street Classification and Street Width

Road Classification	Street Design Manual Classification	No. of units served	Typical Traffic Volumes	Minimum Road Reserve Width (m)	Minimum: Footpath no & width (m)	Minimum: Grass Berm (m)	Minimum: Cyclists[1]	Minimum: Traffic	Minimum: Parking[2] & Kerb Extension[3]	Minimum: Min Carriageway width (m)	Max Vehicle Crossing Requirements (m)
Arterial											
State Highway	All	All scenario		Subject to specific design in collaboration with the Council and NZTA with AUSTROADS and State Highway Geometric Design as a guide							-
Arterial (except for State Highway)	All	All scenario		Subject to specific design in collaboration with the Council with AUSTROADS and State Highway Geometric Design as a guide							-
Residential											
Cul-de-sac & ROW (Private)	Residential/ Private	<6 EDUC <100m length	<60	Refer to Section 3.19.4							6[4]
Road, Cul-de-sac & ROW (Private)	Residential/ Private	7-10 EDUC <100m	60-100	Subject to specific design in collaboration with the Council with NZS 4404 as a guide							6[4]
Cul-de-sac/ Local Road	Residential	11-19 EDUC <100m	100-200	15.5	2 x 1.8	2 x 1.9m	shared with traffic	2 x 3.0m	1 x 2.1m		
Local Road	Residential	20-200 EDUC	0-3000	15.5	2 x 1.8	2 x 1.9m	shared with traffic	2 x 3.0m	1 x 2.1m		
Collector Road	Residential	All scenario	3000-10000	19.1	2 x 2.5	2 x 1.5m	2 x 1.5m	2 x 3.0m	1 x 2.1m		
Rural											
Cul-de-sac & ROW	Rural	20 EDUC <300m length	<200	Refer to Section 3.19.6							
ROW	Rural	1-5 EDUC <100m length	<60	Refer to Section 3.19.6							
Local & Collector Road	Rural	All scenario	3000-10000	18.6	None	2 x 4	Sealed Shoulder	2 x 3.5 + 2 x 1.8m sealed shoulder	None	10.6	6
Industrial											
Cul-de-sac & ROW	Industrial	1-4 Lots	<200	Refer to Section 3.19.5							
Local Road (cul-de-sac)	Industrial	All scenario <300m length	<3000	16[1*]	2 x 1.8	2 x 1.5	shared with traffic	2 x 3.5	2 x 2.1m		8
Local & Collector Road	Industrial	All scenario	3000-10000	18.7[2*]	2 x 1.8	2 x 1.5	2 x 1.5m	2 x 3.5	2 x 2.1m		8
Commercial											
Cul-de-sac & ROW	Commercial	1-4 Lots	<200	Refer to Section 3.19.5							
Service Lanes & Accessways	Commercial	<300 EPE <100m length	<200	13	1 x 1.8	Not required	shared with traffic	2 x 3.5m	1 or 2 x 2.1m	11.2	
Local Road	Commercial	<150 EPE <300m length	<200	16.2	2 x 2.5	Optional 1.2m green Strip	shared with traffic	2 x 3.5m	2 x 2.1m	11.2	
Local Road	Commercial	150-450 EPE	<3000	16.2	2 x 2.5	Shared with parking	shared with traffic	2 x 3.5m	2 x 2.1m	11.2	6
Collector Road	Commercial	All scenario	3000-10000	19.2	2 x 2.5	Shared with parking	2 x 1.5m	2 x 3.5m	2 x 2.1m	14.2	6

Key:

[1*] Acceptable design to achieve minimum road width is to provide a footpath on one side of the road.

[2*] Acceptable design to achieve minimum road width is to provide parking on only one side of the road.

[1] Cycle facilities shall be selected and designed in accordance with Austroads Guide to the Traffic Engineering Practice Part 14, including NZ supplements (SP/M/025). The above figures are typical widths of on-road cycle facilities. Allow for clear space if the cycle lanes are located adjacent to angled parkings. If an off-road cycle facility is warranted, the facility shall be subject to the Manager's approval and designed in collaboration with the Council.

[2] Figures quoted are minimum for parallel parking. Refer to Figure 3.1 for alternative angled parking arrangements.

[3] Kerb extensions with suitable planting and grass berm can be placed in between parking spaces to enhance the landscaping of the street

[4] The District Plan has a requirement for minimum width of access/ vehicle crossing as summarised in Table 3.2 below:

Table 3 2 Minimum width of access

Number of Dwellings	Minimum Width of Access (driveway/right-of-way)	Vehicle Crossing Width
1	3	3
2-3	3.5	3.5
4-6	5	5

Notes:

Approval of a different width crossing is at the Manager's discretion.

EDUC Estimated dwelling units in catchment

EPE Estimated personnel employed

3.4 ROAD RESERVES

3.4.1 Reserve widths

The minimum widths must be as shown in Table 3.1. In the event of there being insufficient width in the berm to locate all services, the Manager may approve some services to be laid under the sealed carriageway.

3.4.2 When a proposed road falls under the roading cross sections specified in the Palmerston North City Council District Plan, these specifications take precedence and must be adhered to as a priority over the engineering standards.

3.4.3 **No Exit Roads/ Cul-de-sac**

To ensure positive traffic functions within subdivisions, cul-de-sacs must serve a maximum of:

(i) 20 dwellings with a maximum length of 100m* in urban areas; and

(ii) 25 dwellings with a maximum length of 300m* in rural areas.

*measured from the mouth of the road to the end of the cul-de-sac

No Exit Roads and Cul-de-sacs must allow for pedestrian connectivity (Refer to Section 3.15).

3.5 GEOMETRIC DESIGN OF CARRIAGEWAYS

3.5.1 **Longitudinal Gradients**

(i)	Maximum grade for Arterial roads	10.0%	(1 in 10)
(ii)	Maximum grade for all other roads	12.5%	(1 in 8)
(iii)	Minimum Grade	0.3%	(1 in 300)

In difficult situations, and for short lengths of streets not exceeding 50m, gradients outside these limits may be approved. However, the developer must refer any such requests to the Manager during the preliminary design stage.

3.5.2 **Design Speeds**

The Design Speed is the speed used to determine geometric elements of a road such as sight distance, stopping sight distance, curve radii, super elevation, curve widening, traffic lane width and friction demand for the road. The design speed that is adopted provides a margin (typically 10 km/hr) over the proposed speed limit and should not be less than the 85th percentile of the speed distribution for a particular geometric element within a given speed environment.

All roads must be designed in accordance with Austroads Guide to Road Design: Part 3 Geometric Design. The following design speeds must be used.

Table 3 3 Design Speeds

Road Type		Environment			
		Rural			Urban
		Terrain			All
		Flat	Rolling	Mountainous	
Two Lane	Local Road [1]	80	60	40[2]	50
	Collector	100	80	60	60
	Arterial	120	110	100	70
Dual Carriageway		Subject to specific design			

Notes:

1 Local Road – Low volume roads where AADT is less than 200vpd.

2 Requires approval from the Manager

- Source: Transit Draft State Highway Geometric Design Manual 2004 (refer to source document for terrain definitions)
- The Developer must ensure that the alignment is designed to the speed identified in Table 3.3.
- The Manager may require a design speed that exceeds the values listed in Table 3.3 to allow for future growth.

3.5.3 Variance of Design Speed in Successive Elements

The variance of design speed in two successive geometric elements must provide sufficient time and distance for a driver to observe, react and adjust the vehicle speeds and ensure a smooth driving experience and is not to exceed the following:

(i) 10km/hr for reverse curves tangent to curves

(ii) 5km/hr for compound curves

(iii) downgrade exceeding 3.5.1 requirements requires specific design in accordance with Austroads Guide to Road Design Part 3: Geometric Design and will be subject to the manager's approval.

Alternatively, variance in design speeds can be determined using the methods outlined in Austroads Guide to Road Design Part 3: Geometric Design.

3.5.4 Vertical Curves

3.5.4.1 Maximum grade change without a vertical curve

The maximum grade change in the longitudinal alignment without a vertical curve is summarised in Table 3.4 below.

Table 3.4 Maximum Grade Change without a Vertical Curve

Design Speed (km/h)	Grade Change (%)
40	1.0
50	0.9
60	0.8
70	0.7
80	0.6
90	0.5
100	0.4
110	0.3
120	0.2

3.5.5 Sag and crest vertical curves

The design of the crest and sag vertical curves must be in accordance with Austroads Guide to Road Design Part 3: Geometric Design for all roads within the urban area as defined in the District Plan.

The curve length can be determined using the formula below:

L= K x A

Where:

L= Length of Vertical Curve

K = is the length of vertical curve in meters for 1% change in grade

A = algebraic difference in gradient (expressed in percentage)

Table 3.5 is to be used in the design of the sag vertical curves in addition to Austroads criteria.

Table 3.6 is to be used in the design of crest vertical curves in addition to Austroads criteria.

In calculating the vehicle (light and heavy) stopping distance a minimum reaction time of 2.0 seconds must be used for 70kph or less and 2.5 seconds for greater than 70kph (design speed).

The design and installation of traffic signage and road pavement markings must be in accordance with NZTA Manual of Traffic Signage and Markings (MOTSAM).

Table 3.5 Sag Vertical Curves

K = Length of Vertical Curve in metres for 1% change in grade

Design Speed (km/h)	Comfort Considerations		Headlight Considerations (C = 150)		Headlight Manoeuvre Time (secs)
	General Design a = 0.5 g	Special Cases a = 0.10 g	Sight Distance m	K	
40	3	1			
50	4	2	50	17	3.6
60	6	3	65	28	3.9
70	8	4	85	48	4.4
80	10	6	105	74	4.7

Note:

C = the sight line constant which for a mounting height of 750 mm and zero elevation gives a value of C = 150.

Any design speed lower than 50km/h shall meet the design requirements of 50 km/h as a minimum

Table 3.6 Lengths of Crest Curves – Sight Distance Criterion for Change of Grade A%, Length of Curve L = KA

				Overtaking Provision h1 = 1.15, h2 = 1.15 C = 920			
				Establishment		Continuation	
Design Speed (km/h)	Stopping Sight Distance (m)	K h1=1.15 h2=0.2, C=461 Note (a)	K h1=1.15 h2=0 C=230 Note (b)	Sight Distance (m)	K	Sight Distance (m)	K
50	50	5.4	10.8	350	133	165	29
60	65	9.2	18.4	450	220	205	46
70	85	15.7	31.4	570	353	245	65
80	105	23.9	47.6	700	532	320	111

Notes:

- Normal minimum sight distance. However, values aimed at in design should be between values in this column and those for zero object height
- In cases where zero object height may be considered appropriate e.g. At intersections, values in this column apply.

3.5.6 Horizontal Curves

The design of horizontal curves must be in accordance with Austroads Guide to Road Design Part 3: Geometric for all roads as defined on the District Plan. NZTA State Highway Geometric Design Manual must be used for all roads within the rural area as defined in the District Plan.

Table 3.6 is to be used in addition to Austroads for widening on urban curves.

Table 3.7 Widening on Curves

Radius (m)	Curve Widening per lane (m)	
	Rigid Truck or Bus	Articulated Vehicle
30	1.03	Specific Design
40	0.82	
50	0.71	
60	0.59	
70	0.52	1.31
80	0.46	1.16
90	0.41	1.03
100	0.36	0.90
120	0.32	0.80
140	0.28	0.71
160	0.24	0.62
180		0.53
200		0.45
250		0.37
300		0.30
350		0.26
400		0.22

Total widening must be applied equally to the two shoulders of the carriageway.

Any extra widening must apply to both the carriageway and the street reserve, to preserve the minimum distance between kerb and boundary.

Kerbs, where possible, must be at the same level on both sides of the street. In special circumstances the left hand and right hand kerb line may be better graded individually in conjunction with centreline levels, footpath levels and boundary levels. Kerbs may differ from each other in level, provided the following standard design tolerances are not exceeded.

3.5.7 Coordination between Horizontal and Vertical Curves

The horizontal and vertical geometry must be coordinated to ensure that drivers can anticipate, observe and react to changes in road geometry, ensure a smooth driving experience, tie in with the natural landform and allow adequate distance for drivers to detect hazards on the road. The coordination of horizontal geometry must be designed in accordance with Austroads Guide to Road Design Part 3 Geometric Design.

3.5.8 Superelevation

Superelevation is determined using the following equation:

$$e_1 = \frac{V^2 e_{max}}{127R(e_{max} + f_{max})}$$

Where:

R =curve of the radius (m)

V = vehicle speed (km/hr)

e_{max} =maximum superelevation (m/m)
The general maximum superelevation for all new roads is 6% except in hilly or mountainous terrain or in places where there are site constraints, the maximum superelevation is up to 10% subject to the Managers approval.

f_{max} =maximum coefficient of side friction (Table 3.7)

The corresponding coefficient of side friction is calculated from:

$$f_1 = \frac{V^2}{127R} - e_{1\,\text{rounded}}$$

Table 3.8 Maximum Coefficient of Side Friction Factor, f_{max}

Operating Speed (km/hr)	f_{max}	
	Cars	Trucks
40	0.30	-
50	0.30	0.21
60	0.24	0.17
70	0.19	0.14
80	0.16	0.13
90	0.13	0.11
100	0.12	0.12
110	0.12	0.12
120	0.11	0.11
130	0.11	-

The maximum rate of rotation is 2.5%. Except in hilly or mountainous terrain or places where there are site constraints, the maximum rate of rotation is 3.5% subject to the Manager's approval.

Table 3.9 Kerb Line Levels

Width of Carriageway	Maximum Difference in Kerb Line Level
7 m	130 mm
8 m	150 mm
9 m	160 mm
11 m	175 mm
11.5 m	175 mm
12.5 m	200 mm
13 m	200 mm

The Developer must ensure that the design of horizontal alignment will not create adverse driving conditions. Caution must be given to the use of negative camber to ensure vehicle operation is not hindered in anyway.

3.5.9 Intersections

Design of intersections must be in accordance with Austroads Guide to Road Design Part 4, 4A, 4B and 4C or relevant NZ Transport Agency standards such as MOTSAM/TCD Manual and State Highway Geometric Design Manual.

All intersections will be subject to specific review. The following matters provide guidance in achieving acceptable outcome. All designs must be consistent with the road hierarchy and intended use of the road.

3.5.10 Structure Plans

Larger subdivisions require a structure plan that establishes a road hierarchy and promotes a "connected and efficient road network for all users". The principles of the structure plan should be observed when developing the road hierarchy, layout, widths and junction arrangements.

3.5.11 Angle of Connecting Roads

The angle of connecting roads at intersections must be 90˚. However, a minimum angle of 70˚ may be used only when justified by other constraints and with the approval from the Manager.

3.5.12 Intersection Approaches

No intersection will be formed with more than four approach arms converging.

3.5.13 Intersection Spacing

Intersection spacing must be in accordance with the District Plan Rule 20.3.9.1

3.5.14 Corner Splay

At intersections with all urban Primary and industrial streets the minimum corner splay must be 9m. At all other urban intersections, the minimum corner splay must be 6m. Refer Standard Drawing 3.1.

3.5.15 Rural/rural Residential Intersections

The design of rural/rural residential intersections is also to incorporate details outlined in Standard Drawing 3.3. The design of urban intersections is to incorporate Standard Drawings 3.1 and 3.2.

3.5.16 Road Connection

Where a new road is connected to an existing road or street, the pavement of the existing road is to be upgraded to a similar standard to the new road unless it is already to the required standard. In all cases the existing sealed surface is to be resurfaced with a similar surface to the new works over the full extent of the intersection work area.

Where a proposed road or access intersects a State Highway, the Developer must forward the design to the Waka Kotahi approval and conditions, including the approved design, must be provided to the Council and will form part of the consent approval process.

3.5.17 Signs and Markings

Chevron boards to NZTA Manual of Traffic Signs and Markings (MOTSAM) must be installed at the head of all intersections in rural areas.

The design of traffic signs, installation and road markings at intersections must be in accordance with the NZTA Manual of Traffic Signs and Markings (MOTSAM) or the Traffic Control Device Manual.

3.5.18 Radii of Kerbs at Intersections

The minimum radius for kerbs is shown in Table 3.9 below. Refer to Standard Drawing 3.1.

Table 3.10 Radii of Kerbs at Intersections

	Local - Residential	Local – Industrial /Commercial	Collector Primary/ Secondary	Arterial
Local Road- Residential	4-6m*	4-6m*	4-6m*	10.5m
Local Road- Industrial/Commercial	13.5m	13.5m	13.5m	13.5m
Collector – Primary/Secondary	4.6*	13.5m	10.5m	10.5m
Arterial	Specific Design			

* The selection of kerb radius ranges from 4-6m and is selected based on the road geometry, design speed and types of traffic turning into the intersection.

3.5.19 Kerb Crossing

Provision must be made in the kerb for the installation of vehicle and mobility crossings. The positions of each crossing must be detailed on the engineering plans submitted for engineering approval. Refer to Section 3.10 for construction specifications.

3.5.20 Camber

The pavement camber on straight alignment regardless of terrain must be 1 in 33 or (3%).

Reductions to 1 in 50 (2%) may be considered by the Manager for complex intersection design.

The developer must give due consideration to the use of negative camber in 50kph areas to ensure vehicle operation is not hindered in anyway.

3.5.21 Cul-de-Sac Heads

Cul-de-Sac heads must have minimum 10m radius turning area in residential areas. In commercial /industrial zones the radius must be 15m. Refer Standard Drawing 3.6. No parking is permitted anywhere within the total turning area of the Cul-de-Sac unless it has been specifically designed to allow parking.

Where there are greater than 10 allotments serviced off the Cul-de-Sac head, the Cul-de-Sac must be in accordance with Standard Drawing 3.6.1.

Off centre Cul-de-Sac heads must be designed by offsetting the road carriageway crown to create symmetrical conditions with the kerb return. Refer to Standard Drawing 3.6.

Any alternative arrangement proposed must fully demonstrate the ability to accommodate turning manoeuvres of an 8m rigid truck for refuse and recycling collection services.

The minimum longitudinal grade of kerb and channel in Cul-de-Sac heads must be 1 in 300. Where grades are less than 1 in 200, sumps are to be placed either at the neck of the Cul-de-Sac on both sides of the carriageway or a double sump at the end of the Cul-de-Sac.

3.5.21.1 Cul-de-Sac Turning Area Requirements for Subdivisions

To ensure adequate turning space at the termination of public roads, all residential subdivisions must include cul-de-sac turning areas in roading concept plans. These must achieve a minimum turning radius of 10.5 meters at all public road endpoints and apply to both single-stage and multi-stage developments.

For single-stage developments, turning areas are required at each road termination point within the development boundary. The turning head must be situated within the road reserve and vested in council. In cases where additional stages are intended but consent is not sought or granted the turning area requirement applies.

For multi-stage developments, where consent is sought and granted for all stages, the cul-de-sac turning area must still physically meet council engineering standards. However, the turning area may be positioned within the balance lot as a temporary solution, remaining on private land until the road is extended. In this instance, appropriate consent notices are required, specifying that

the private landowner is responsible for keeping the temporary turning area accessible and maintained until future stages are constructed. This approach provides safe turning and traffic maneuvering while accommodating the staged layout for the subdivision.

Alternative arrangements may be proposed to the council's transport team during the resource consent process. These alternatives will be subject to council discretion.

3.5.21.2 Cul-de-Sac Turning Area Requirements for Buses

Prior to submission to PNCC of designs for collector/arterial routes Horizons input shall be sought by the applicant to confirm the requirements for bus routes, bus stops and bus turning areas. Where required, approval from Horizons for the design must be obtained and provided to PNCC to support the design approval.

3.5.22 Cut and Fill Batters

Earth slopes beyond the road boundary into the adjacent properties must be at a maximum grade of 1:6. Cut and fill batters steeper than 1:6 require approval from the Manager. Refer to Standard Drawing 3.9.

Cut batters must be specifically designed in accordance with the Council's Land Stability Guidelines. Where cut and fill batter heights exceed 4.0 meters, the Manager must require either the flattening of the slope to allow drive access or the batters to be incorporated within the road reserve.

In undulating and hilly country, the reserve width must be extended as necessary to incorporate 1.0m beyond the toe of fill batters and the top of cut batters.

3.6 STRUCTURAL DESIGN AND TESTING OF PAVEMENTS

3.6.1 General

Pavement rehabilitations and green field pavement construction shall be designed for a 25 year design traffic loading.

All pavements must be designed in accordance with the Austroads Guide to Pavement Technology – Part 2: Pavement Structural Design (2017) and the NZTA Guide to Pavement Evaluation and Treatment Design in order of precedence. The pavement design shall be submitted to the Manager for approval.

3.6.2 Materials

3.6.2.1 Basecourse

Unbound granular basecourse materials shall comply with the requirements of NZTA M/4. Marginal material that does not fully comply with the requirements of NZTA M/4 can be used for stabilised basecourse or areas with low traffic, however, these materials must be approved by the Manager on a case-by-case basis. The Manager may approve materials that do not fully comply with the specifications; however, these materials must be from a proven source both in

performance and durability. The maximum dry density (MDD) report must be a part of the production properties. The compaction lift thickness of AP40 material shall not be less than 100mm and no greater than 200mm.

Basecourse source properties shall be sampled and tested at least at the rate of one sample for every 10,000 m3 or per year. Basecourse production properties shall be sampled and tested at least at the rate of one sample for every 1,000 m3 or per year. At the start of a project the lab reports cannot be over than 6 months old.

3.6.2.2 Sub-base

Subbase materials shall comprise AP65 free from clay, all organic matter, and other deleterious materials. It must have a soaked CBR of not less than 40% when compacted in the laboratory in accordance with NZS 4402 Test 4.1.3. The aggregate must be well graded with a particle size distribution that falls within the following limits:

Table 3.11 **Particle Size Distribution of AP65 Subbase**

Sieve Size (mm)	Lower Limit	Upper Limit
63	100	100
37.5	80	90
19	50	70
9.5	30	55
4.75	20	40
2.36	15	30
1.18	10	22
0.6	6	18
0.3	4	14
0.15	2	10
0.075	0	7

The subbase materials must also comply with the following criteria:

- Crushing Resistance (minimum) 100kN
- Weathering Resistance CA or better
- Sand Equivalent (minimum) 25
- Plasticity Index < 10
- MDD report

In each of the aggregate fractions between the 63.0mm and 4.75mm sieves, not less than 60% by weight shall have 2 or more broken faces.

The maximum dry density (MDD) report must be a part of the production properties. The compaction lift thickness of AP65 material shall not be less than 100mm and no greater than 200mm.

Alternative subbase material shall be reviewed and approved by Manager on a case-by-case basis.

Subbase source properties shall be sampled and tested at least at the rate of one sample for every 10,000 m3 or per year. Subbase production shall be sampled and tested at least at the rate of one sample for every 1,000 m3 or per year. At the start of a project the lab reports cannot be over than 6 months old.

The lift thickness of AP65 material shall not be less than 170mm and greater than 250 mm to comply with the requirements of NZTA B/2.

3.6.2.3 Fill for roading

Materials used in fill for roading shall conform to the requirements of NTZA F/1. The soaked CBR of the fill to be used should be at least 8. The fill must satisfy the current subgrade compatibility requirements of NZTA M3 notes. Material shall be placed in layers not exceeding 250 mm in thickness. The maximum dry density (MDD) and particle size distribution (PSD) properties needs to be provided for an approval at the start of the project or change of materials.

3.6.3 Pavement Design

3.6.3.1 Pavement loading

The traffic loading for pavement rehabilitations shall be determined from traffic counts undertaken within a year of the pavement design. The proposed traffic loading for new developments shall be submitted by the Developer and reviewed by the Manager. The minimum growth rate to be applied to the traffic loading is 1.5% per annum. The design traffic in terms of Equivalent Standard Axles (ESA's) and/or Design Number of Heavy Vehicle Axle Groups (N_{DT}) as appropriate, shall be determined from Austroads Guide to Pavement Technology – Part 2: Pavement Structural Design (2017). The designer shall select a Traffic Load Distribution (TLD) from an NZTA Weigh in Motion (WIM) site which has similar heavy traffic characteristics as the site being designed

3.6.3.2 Testing for Pavement Rehabilitation

The pavement shall be assessed in accordance with the New Zealand Guide to Pavement Evaluation and Treatment Design to identify potential causes of failure and isolate areas that require treatment for existing pavements.

Test pits shall be undertaken at a minimum frequency of one test every 100m within each lane (staggered between lanes) or a minimum of three tests for pavement sections less than 200m. The locations of the test pit shall be determined to generally cover the range of pavement conditions within the site. The test pit investigation and reporting shall be IANZ accredited in accordance with the document Field Description of Soil and Rock (2005).

Scala penetrometer and shear vane testing shall be undertaken at the surface of the subgrade to determine the inferred CBR value and peak/remoulded strength of the cohesive subgrade,

respectively. The representative subgrade strength adopted for designs shall generally coincide with the 10th percentile strength condition. Pavement layer materials (including the subgrade) shall be retained for further testing if required. Additional tests such as laboratory soaked CBR, particle size distribution, plasticity index can be undertaken to provide additional information regarding the engineering properties of the pavement materials if required. The design CBR must be shown on the typical pavement drawings.

A subgrade improvement design must be included in case weak subgrade is encountered during construction.

3.6.3.3 Testing for Greenfields Pavements on Engineered Fill

Soaked CBR Testing shall be undertaken for engineered fill for Greenfields pavement cut sections. The soaked CBR for engineered fill shall not be less than 4%. A minimum of three tests shall be undertaken for each type of material.

The design CBR must be shown on the typical pavement drawings.

A subgrade improvement design must be included in case weak subgrade is encountered during construction

3.6.3.4 Pavement Drainage and Subsoils

In areas where sub-surface soils are not free draining, allowance must be made for subgrade drainage. This must take the form of:

- An under-channel drain which must consist of an approved filter smooth bore drainpipe 100mm nominal diameter in a trench backfilled with an approved free draining filter material. The conduit shall have a grade not less than 1 in 100 to discharge into the catch pit.
- The filter material shall be either NZTA F/2 material with a filter sock around the conduit or NZTA F/6 material with a geotextile wrapping around the trench.

The subsoil drain must be installed immediately behind the back of the kerb, no subsoils will be accepted within the roadway. The drains must drain by gravity into the road sumps such that the drain invert is above the sump outlet pipe soffit level. The compaction of filter material shall be undertaken in accordance with NZTA F/2 and F/6 2013 (refer to sections 6 and 9). Refer to Standard Drawing 3.5.

In residential streets batter drains must be constructed where the topography is likely to cause ground surface water to concentrate on the street berms. Batter drains must be as for above and must normally be constructed 50mm outside the street reserve boundary.

3.6.3.5 Geotextiles in Pavement

The granular pavement shall be designed to comply with the requirements of Austroads Guide to Pavement Technology – Part 2: Pavement Structural Design (2017). A geotextile fabric cloth must be placed at the interface between subgrade and granular subbase layer where the subgrade CBR

< 4%. A geogrid must also be placed at the subgrade and subbase interface for subgrade CBR's <2%.

3.7 PAVEMENT CONSTRUCTION AND TESTING

3.7.1 Subgrade Construction and Acceptance

Subgrades must be constructed to the requirements of Part 2- Land Suitability and Earthworks of these Standards and drained in accordance with Clause 3.6.3.4 The subgrades must also be constructed in accordance with NZTA F/1.

The subgrade must be constructed to the same cross section profile as the finished pavement surface.

Testing by means of proof rolling (with an appropriate static steel drum roller), and/or Benkelman Beam deflections testing, and Scala penetrometer testing should be undertaken on the subgrade prior to subbase placement to validate the design assumptions. Testing must also include the subgrade levels. PNCC must inspect the subgrade and approve the subgrade test results provided by the Technical Representative prior to construction of subbase.

Once the subgrade is approved it must not be left exposed for a period longer than 2 days or to inclement weather or should the subgrade be exposed for longer than this period or if weather conditions or traffic deteriorate the subgrade surface or depth, the Developer is to advise the Manager who will further inspect the pavement. Preparation of the subbase/basecourse is not to proceed until approval has been given.

3.7.2 Unbound Granular Pavement Construction and Testing

The unbound granular pavement must be constructed in accordance with the approved design and NZTA B/2.

Compaction testing of the pavement layers shall be carried out on the surface of the subbase and basecourse layers using a Nuclear Densometer (NDM) in accordance with NZTA B/2. The compaction requirements shall be met if the mean and minimum compaction values of the tests taken comply with the values in Table 3.12. Minimum of 5 NDM tests per lot or 1000m^2 (a lot can't exceed 1000 m^2).

Table 3.12 Mean and Minimum Value of Pavement Layer Compaction as Percentage of Maximum Dry Density

Values	Sub-base Pavement Layer	Basecourse Pavement Layer
Mean Value	>95	>98
Minimum Value	>92	>95

The Maximum Dry Density shall be determined for each layer at a minimum frequency of one Maximum Dry Density test per 5,000m^2 of material laid. If the aggregate source, face at the source,

or processing method is changed then a new Maximum Dry Density shall be determined, and the Manager informed.

The Developer shall be responsible for carrying out laboratory tests according to NZS 4402:1986, Test 4.1.3 to determine the maximum laboratory dry density at the optimum water content (OWC) of the aggregate used. The Solid Density of the aggregate tested shall be determined according to NZS 4407:1991, Test 3.7. The tests shall be undertaken on material that is representative of that used in construction and a grading for the material tested shall be supplied with the results.

Material used for blinding/running course layer as a preventative protection layer prior to sealing and this must not exceed 5mm in compacted depth. The surface must be swept clean by mechanical broom to expose a clean prior to sealing stone mosaic surface with no ravelling prior to sealing.

No cake layer will be accepted due to addition of fines or being lower than the design levels and making the difference with more material.

The pavement degree of saturation shall be less than 80% prior to sealing. The degree of saturation shall be determined by NDM methods at a minimum frequency of five tests per 1000m^2. DOS testing results will not be accepted if moisture of the basecourse layer changes between testing and sealing by means of precipitation or external moisture.

The Developer must not proceed with any surfacing on the road pavement until approval from the Manager has been obtained.

All development having option of a chip seal design will be required to have second coat chip seal after a year and/or within the next following reseal summer season (October to March).

The maximum allowable pavement deflections outlined in Table 3.13 must be adhered to for completed basecourse layers in Flexible Pavements. Benkelman Beam Testing must be carried out in accordance with NZTA T/1 on top of the basecourse. The Benkelman Beam tests shall be undertaken at a frequency of 1 every 10m staggered between wheel paths in each lane. The 90th percentile deflections of all tests must comply with the deflections appropriate to the road type. In addition, no individual tests must give deflections greater than 10% above the specified values.

Table 3.13 90th Percentile Benkelman Beam Deflection Standards

Road Type	Maximum Allowable Deflection for Chipseal	Maximum Allowable Deflection for Asphalt Concrete
Arterial	1.00 mm	1 mm
Collector	1.20 mm	1 mm
Local	1.40 mm	1 mm
Residential ROW (up to 6 lots)	1.60 mm	1 mm
Rural Residential	1.60 mm	1 mm
Rural	1.60 mm	1 mm
Industrial/Commercial	1.00 mm	1 mm

3.7.3 Trench Backfill Reinstatement of Pavement layers on top of trenches

The trench backfill shall be undertaken in accordance with the standard drawing 1.3

The granular backfill materials should be compacted in accordance with plan Dr. 1.3 where each layer compacted shall be checke for compliance with the clegg hammer.

Where the Clegg Hammer is to be used then it shall be the Standard Australian Digital model with a 4.5 kg compaction hammer, using a drop height of 450 mm. Testing is carried out on a surface that has no loose material (removed by scuffing with stiff hand-brooming). The device is held in place by foot and steadied in a vertical position with the knees. The maximum Clegg Impact Value (CIV) at the end of the 4th blow is the recorded value. The on-site CBR value shall be taken as 0.07 $(CIV)^2$ If a Clegg Hammer test gives a sub-standard result, five further tests will be taken close-by. If any further tests fail to reach the compacted limit required, the area will be reworked at the Contractor's expense until a satisfactory test result is achieved.

Testing should be done every 10 m of trench length with a minimum 3 results.

Table 3.14 Clegg Hammer Compliance Values

	CIV	Equivalent CBR
Subbase	25	40
Basecourse	35	80

3.7.4 Stabilisation Treatments

Where the pavement design involves stabilisation of one or more of the layers, or the inclusion of Geotextiles or Geogrids the Developer must provide a construction specification for this work for approval by the Manager. The construction of stabilised pavement layers shall be undertaken in accordance with NZTA B/5 for in-situ stabilised layers of modified pavement layers, and NZTA B/6 for in-situ stabilisation of bound subbase layers. All site work must be undertaken in strict accordance with the approved specification for the treatment selected to ensure the material properties are achieved.

The Developer shall provide Indirect Tensile Strength (ITS) test results with the source aggregate material and approved binder dosage to show a suitable reactivity has been achieved prior to the construction of the pavement layer. The MDD and OMC of the stabilised material shall also be provided by the Developer.

The Developer should allow sufficient time for Modified basecourse and Stabilised Subbase layers to cure for 3 and 7 days respectively without any construction or heavy vehicles movement over the layer.

Strict attention must be made to the quality control of stabilization operations and the following factors controlled to ensure uniformity and acceptability of the treated layer.

(i) Uniformity of the material to be stabilised

(ii) Quantity and distribution of the stabiliser

(iii) Thickness of the processed layer

(iv) Degree of pulverisation

(v) Mixing

(vi) Water content

(vii) Compacted density

(viii) Quality of the stabilised material

(ix) Surface finish

(x) Integrity of geotextiles/geogrids

Stabilisation is to be designed and constructed in accordance with Austroads Guide to Pavement Technology, NZTA B/5 or B/6, and the manufacturer's specifications.

3.7.5 Surfacing

3.7.5.1 Membrane Seal /Prime coat seal

A membrane seal will be the first layer to be constructed on the new basecourse layer. The membrane seal shall be designed in accordance with Chipsealing in New Zealand (2005) handbook. The membrane seal design shall be submitted 5 Working Days prior to the construction date to the Council's Chief Engineer for review and approval. Bitumen associated with sealing work must comply with the requirements of NZTA M/1. Sealing chips used must comply with NZTA M/6. Work associated with applying the membrane seal must be in accordance with NZTA Specifications P/3.

The binder must be applied only to a clean, dry stone mosaic surface and during warm, dry, settled weather conditions. Prior to the binder application, the basecourse layer will have to conform to the maximum Degree of Saturation (DOS) of 80%. If precipitation occurs after the DOS test and prior to the application of the binder, a new set of DOS tests will be required. All roadside furniture, kerb and channels, manhole and service covers will be protected against bitumen stains.

After the approval has been provided to continue with the membrane seal, the surfacing must take place within two working days. Should sealing of the basecourse surface exceed this period and/or inclement weather has affected the surface, no sealing work is to proceed until further approval has been obtained.

If a membrane seal is to be constructed without an asphalt overlay or a chip seal, then the developer must ensure that the membrane seal layer is not damaged through construction activities. The membrane seal shall be inspected prior to the construction of the next layer to check if the pavement waterproofing is maintained.

3.7.5.2 Chipsealing

A chipseal layer will be constructed on top of a membrane seal or existing surface. The chipseal shall be designed in accordance with the Chipsealing in Zealand (2005) handbook. The chipseal design shall be submitted 5 Working Days prior to the construction date to the Council's Chief Engineer for review and approval. Bitumen associated with sealing work must comply with the requirements of NZTA M/1. Sealing chips used must comply with NZTA M/6. Work associated with applying first and second coat seals must be in accordance with NZTA Specifications P/3 and P/4 respectively.

The binder must be applied only to a clean, dry surface and during warm, dry, settled weather conditions. All roadside furniture, kerb and channels, manhole and service covers will be protected against bitumen stains. Prior to sealing, a strip 600mm wide adjacent to each channel or seal edge must be sprayed with an approved ground sterilising weed killer at the manufacturer's recommended rate of application. Sufficient time should be allowed for the weeds to die-off prior to sealing.

After the approval has been provided to continue with the chipseal, the surfacing must take place within two working days. Should sealing of the surface exceed this period, no sealing work is to proceed until further approval has been obtained.

Chipseal longitudinal construction joints should be planned that the joint does not fall inside the wheel track but preferably under the new line markings.

The Developer should allow for a second coat seal at the end of the nominated defects period which is two years. Any defects that may have occurred will be remediated by the Developer prior to the application of the second coat seal.

3.7.5.3 **Asphalt Surfacing**

Asphaltic layers shall be constructed on a membrane seal or a underlaying surfacing layer. Asphalt layers shall be designed, tested, and constructed in accordance with the latest revision of NZTA M/10. Bitumen associated with asphalt work must comply with the requirements of NZTA M/1A. The asphalt mix design (JMF) shall be submitted ten working days prior to the construction date to the Council's Chief Engineer for review and approval.

Asphalt coring is the preferred method of testing voids (compaction) and layer thickness. Alternative testing can be used if approved by the Council's Chief Engineer. Asphalt testing requirements shall be undertaken in accordance with NZTA M/10.

A minimum of two-week curing period is required for chipseal with kerosene cutback agent prior to applying an asphalt surface. Two week curing requirements can be waived if emulsion-based bitumen is used for sealing.

After the approval has been provided to continue with the asphalt surfacing, the surfacing must take place within two working days. Should sealing of the surface exceed this period, no sealing work is to proceed until further approval has been obtained.

Asphalt surfacing longitudinal construction joints should be planned that the joint does not fall inside the wheel track but preferably under the new line markings. Asphalt surfacing finished ride quality will be govern by NZTA specification requirements.

The finished surface must comply with the skid resistance requirements of NZTA T/10.

The 100m rolling average pavement roughness undertaken on the surface shall not be greater than 70 counts per km and no single value shall exceed 80 counts per km.

Table 3.15 Surfacing Type

The following surfacing types are required on new roads and R.O.Ws.

Road Type	Chipseal	Asphalt
Arterial – State Highway	✓	✓
Arterial – Other	✓	✓
ROW (Residential, Rural, Industrial, Commercial)	✗	✓
Cul-de-sac (Residential, Rural, Industrial, Commercial)	✗	✓
– Road (Private)	✗	✓
Local Road (Residential, Rural, Industrial, Commercial)	✓	✓
Collector Road (Residential, Rural, Industrial, Commercial)	✓	✓
Commercial – Service Lanes	✗	✓
Commercial – Accessways	✗	✓
Concrete or Cobble Stone	Descretion of the Manager	

3.8 CONSTRUCTION OF KERB AND CHANNEL

3.8.1 General

Kerb and channel must be provided on both sides of all proposed carriageways in both the urban areas and may be provided in rural residential areas. Refer to Standard Drawings 3.10 and 3.10.1. Mountable kerbs may be approved for street islands and lightly trafficked precincts. Dished channel may be used in areas such as parking area and right of ways.

All kerb and channel must be machine poured (slip formed). The exposed face of the kerb and channel must be clean and smooth. Kerb and channel must be laid in the one operation. The cement content of the kerb mix must be between 260-280kgs per cubic metre.

Kerb and channel, mountable kerbs and dished channel are to be constructed on a subbase layer minimum 200mm compacted to a mean density of 95% maximum dry density (MDD) and a minimum of 92%. Contraction joints are to be placed at a maximum spacing of 4 metres and are to include the full profile of the kerb and channel. Joints to be formed as soon as possible to prevent cracking of the kerb. Cracked kerb will be removed and re-instated on developers cost.

Kerb and channel, mountable kerb and dished channel tolerances are as follows:

(i) **Horizontal :**

Maximum +/- 20mm over the total length however must not exceed +/- 5mm over a 10m length.

(ii) **Vertical:**

Maximum +/- 12mm over total length however must not exceed +/- 3mm over a 10metre length.

The minimum gradient of all kerb and channel, mountable kerb and dished channel must be no less than 1 in 300. The Developer must replace any section where water ponding depth exceeds 3mm over a one metre length.

A 100 mm diameter nominal connection from the allotment boundary to the kerb must be provided for stormwater disposal from urban residential allotments. Refer to Standard Drawing 3.11. This is not required if approved alternative systems are in place. To avoid unnecessary joints, outlets should be incorporated at the time of the kerb construction. The kerb outlet and reinforcement need to be added on the same day of kerb construction to minimise kerb discoloration and cracking. Reinforcement to be 300m long.The following identifications must be stamped on the top of the kerb directly above the respective laterals. Refer to the Standart Drawing (will be designed and attached) size to be confirmed.

‘L’ for a wastewater lateral;

‘T’ for a water service connection;

‘X’ for a stormwater lateral

3.8.2 Dished Channel

Where necessary in parking areas, right of ways and other areas approved by the Manager, a 600mm wide dished channel (reinforced) must be constructed. Refer to Standard Drawings 3.5.

3.8.3 Sumps

Street sumps must be provided as outlined in Section 6 Stormwater Drainage of the standards.

Openings must be sized and oriented to provide for the safety of pedestrians and cyclists. Cycle-friendly sump grates must be used, with bars transverse to the side channel direction.

3.8.4 Concrete

All concrete, unless otherwise specified by the Manager, must comply with NZS 3104 and must attain an in situ strength of 20 MPa at 28 days.

The Developer need to supply test results of all concrete placed per day. Concrete not meeting the requirements will be removed and re-instated on developer’s cost.

3.8.5 Curing

All concrete must be cured in accordance with NZS 3109.

3.8.6 Swales

Swales should be used wherever appropriate in Rural/Rural Residential areas to allow for infiltration to reduce peak discharge flows and to provide stormwater treatment. They can be located either in the berm area or in the centre of the road and must be of sufficient width to accommodate services, plant growth and maintenance. Swales must be designed by a suitably qualified person experienced in the design of swale drains. Typical details that may be used in swale design are shown in NZS4404:2010, figures 3.6(A) to 3.6(C).

Reference also needs to be made to the PNCC Street Design Manual for design practice.

3.8.7 Water sensitive design

Section 6 of the Engineering Standards outlines a range of water sensitive design options for storm water management which may be used within the road reserve. These devices are used at the discretion of the Manager.

3.8.8 Machine Laid Kerb and Channel

To ensure strength, durability, and a high-quality finish, all concrete used in slip-form kerb and channel construction must meet a minimum batch plant mix strength of 35 MPa, achieving an onsite output of at least 20 MPa. The concrete must retain its shape and present a smooth, even surface free of air pockets.

The slip-form machine used should be capable of producing well-compacted concrete without trapped air. It should only be used on curves with a radius of 5 meters or more; for tighter curves, specified formwork is required.

Methods should be in place to produce a clean, smooth, and even surface on all exposed concrete faces. The final surface finish, whether machine-laid or hand-laid, must be consistent in color, texture, and shape across the entire kerb and channel.

Before beginning slip-form construction, the contractor must verify the subbase level relative to the kerb and channel string lines. This check prevents the slip-form machine from bottoming out or bouncing, which could lead to surface imperfections such as fluttering in the concrete profile.

Slip-form kerb and channel that does not meet the requirement for a smooth, even surface free of air pockets may be subject to core sampling, at the developer's expense, to verify concrete strength compliance. Any remedial work needed to bring the finished concrete up to standard will not be the responsibility of the council.

3.9 FOOTPATHS

3.9.1 General

A footpath must be provided on both sides of all proposed carriageways in all urban and industrial areas unless otherwise agreed by the Manager. The footpath must generally follow the gradient of the adjacent kerb. A footpath must also be provided on one side in business and industrial accesses to rear lots.

3.9.2 Construction

All footpaths must be in accordance with the widths specified in Table 3.1, measured from kerb face where set adjacent to the kerb. Footpaths must be constructed with a crossfall of 2%. Refer to Standard Drawing 3.12.

Footpaths must be constructed to the following materials and standards.

20MPa 100mm thick concrete laid on 100mm minimum compacted AP 40 material foundation to a mean density of 95% maximum dry density (MDD) and a minimum of 92% MDD as specified in NZS 4402 test 4.1.1. NDM is the means of verification for compaction and density for all granular pavements prior to sealing. Clegg Hummer tests can be undertaken on the footpath subbase material at the discretion of the engineer. A minimum CIV of 25 must be met for the footpath subbase and needs to be correlated with an NDM test.

Other materials including Asphaltic Concrete, Pavers and Limestone (Rural/Rural Residential areas only) may be accepted with the approval of the Manager.

All footpath surfaces are to be even and non-slip. Concrete edges are to be properly formed, equal distance out from behind the kerb and edges are to be properly formed with 8 mm rounding edging tool to all exposed edges. Construction joints in concrete footpaths must be provided at no more than 3.0m intervals.

The finished surface level to have a single 2% crossfall and footpath must be similar to surrounding ground level to ensure no ponding of water.

Footpath must be connected and accessible by wheeled pedestrians. Dish or V-channels across the footpath must be avoided or, if necessary, designed to be traversable (Refer to NZS 4121).

3.9.3 Low level Paths

Where the level of the berm is lower than the kerb and channel, a dish channel is to be placed along the lower side of the footpath (Refer to clause 3.9.2). Sumps must be provided at no more than 100 metre spacing. Refer to Standard Drawing 3.12 and 3.13.

3.9.4 Testing

The Manager may require core samples of the finished footpath.

Samples are to be taken at centres of not less than 100m. Should these tests indicate insufficient concrete depths and/or concrete strength is less than 20MPa then the path must be removed and replaced. Where tests identify compliance with the Standards, Council will pay the cost of the test

and the remedial work. The Developer must pay for all costs if the footpath does not comply with the Standard.

3.10 CROSSINGS

3.10.1 Mobility (Pram) Crossings

Mobility crossings to be designed according to NZTA RTS 14 Guidelines for facilitates blind and vision impaired pedestrians.

Mobility crossings must be provided in the kerb line at all intersections and at the end of all walkways and cycleways. Where a walkway/cycleway exits onto a street, a mobility crossing must be constructed at the kerb on both sides of the carriageway in an alignment similar to the walkway/cycleway. Refer to Standard Drawings 3.1, 3.1.1A, 3.1.1B, 3.1.2 & 3.25. The crossing entrance must be connected to the footpath as shown in the standard drawing and must be of similar construction to the adjacent footpath.

The position of mobility crossings must be identified in the design plans forwarded for engineering approval. Sumps must be placed so as to reduce the flow of stormwater as much as possible in the channel at the crossing entrance.

Provide tactile warning pavers or tactile ground surface indicators (TGSI) for vision-impaired pedestrians on public footpaths at all pedestrian crossing kerb cut-downs. Specify tactile types, preferably pavers, which will achieve the 20 year operational life of the contrast between the path surface and the tactile.

3.10.2 Vehicle Crossings

The following construction criteria must apply to the following vehicle crossings.

Table 3.16 Vehicle crossing Construction Criteria

Vehicle Crossing Type	Minimum 28 Day Strength	Thickness	Reinforcement
Residential	20MPa	150mm	1/665 HRC
Commercial	25MPa	200mm	1/665 HRC
Industrial	30MPa	300mm	1/665 HRC

Residential

Concrete crossings must be constructed between the kerb line and the boundary to all urban and rural residential allotments. This must include at the entrance to all accessways to rear lots and service lanes and at any other place where the location of a future driveway to a lot can be determined with certainty. Refer to Standard Drawings 3.13 to 3.20 inclusive.

Where possible for access to front lots in greenfield subdivisions, vehicle crossings should be located a 1.5m from the boundary to allow alignment with future garages which have a 1.5m separation requirement from boundaries. This will not be possible in all cases and for rear lots. However future garage location should be considered by the designer.

All vehicle crossing locations approved under a resource consent application for greenfield subdivisions must be considered "existing infrastructure" and included in building consent applications in the correct location and width. In some cases, the width and location will not be feasible to alter due to other infrastructure in the road reserve such as rain gardens or street trees.

Rural

For all rural developments, vehicle crossings must be constructed between the carriageway and road boundary. Refer to Standard Drawings 3.22 and 3.23. Sight boards may be required at the discretion of the Manager.

All existing crossings within a new development must be upgraded to Council standards. Culvert sizing may require specific design but must not be of a smaller nominal diameter than 300mm. All culverts to be RCRRJ pipes with standard headwalls. Refer to Standard Drawings 3.4, 3.4.1 and 6.6.

3.11 COMMERCIAL SERVICE LANES

Commercial allotments must have fully formed service lanes to facilitate the delivery of supplies. Service lanes must consist of a minimum 4.0m wide, 25mm thick asphaltic concrete surface with drainage facilities as required. Refer to Standard Drawing 3.24. Footpath must be provided on one side where access is provided to more than one lot.

3.12 INDUSTRIAL SERVICE LANES

Industrial service lanes must be a minimum width of 6.0m and must be constructed to the same standards as required in the Engineering Standards for the Land Development for industrial streets adjacent to the service lane. Footpath must be provided on one side where access is provided to more than one lot.

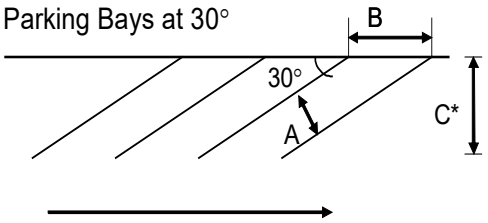
3.13 PARKING BAYS

Parking bays must be constructed to the same standard as for the adjoining street.

New or upgraded parking areas must be in accordance with Figure 3.1.

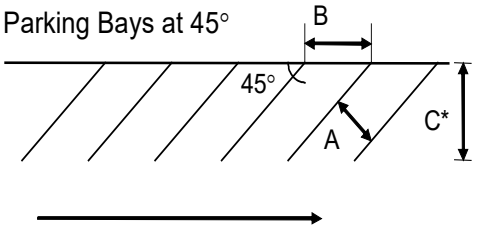
Figure 3.1 Car Park Dimensions

Parking Bays at 30°



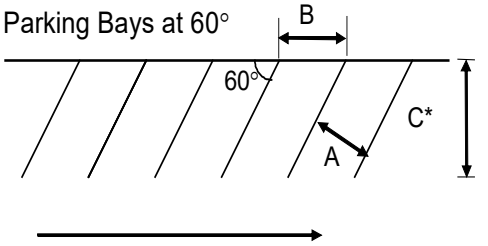
User Class	A	B	C1	C2	C3	Aisle Width
1	2.1	4.2	4.4	4.1	4.5	3.1
2	2.3	4.6	4.4	4.1	4.7	3.0
3	2.5	5.0	4.4	4.1	4.9	2.9
4	3.6	6.4	4.4	4.1	5.5	2.9

Parking Bays at 45°



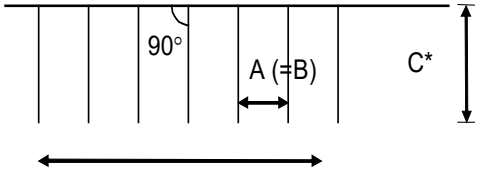
User Class	A	B	C1	C2	C3	Aisle Width
1	2.4	3.4	5.2	4.8	5.5	3.9
2	2.5	3.5	5.2	4.8	5.6	3.7
3	2.6	3.7	5.2	4.8	5.7	3.5
4	3.6	5.1	5.2	4.8	6.1	3.3

Parking Bays at 60°



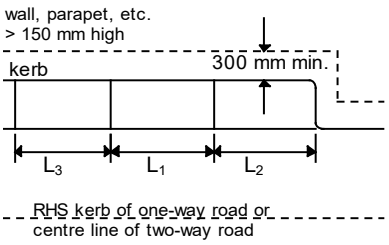
User Class	A	B	C1	C2	C3	Aisle Width
1	2.4	2.8	5.7	5.1	5.9	4.9
2	2.5	2.9	5.7	5.1	6.0	4.6
3	2.6	3.0	5.7	5.1	6.0	4.3
4	3.6	4.2	5.7	5.1	6.3	4.0

Parking Bays at 90°



User Class	A	B	C1	C2	C3	Aisle Width
1	2.4	2.4	5.4	4.8	5.4	6.2
2	2.5	2.5	5.4	4.8	5.4	5.8
3	2.6	2.6	5.4	4.8	5.4	5.4
4	3.6	3.6	5.4	4.8	5.4	5.0

Parallel Parking Bays



User Class	A	B	L1	L2	L3	Aisle Width
1, 2, 3	2.1	2.1				
4	3.6	3.6				
All			6.3	6.6	5.4	3.0
All			6.1	6.4	5.4	3.3
All			5.9	6.2	5.4	3.6

User Class is defined as:

(a) for all day parking, such as tenant, employee and commuter parking;

(b) for medium-term parking, such as long-term town centre parking, motels, airport visitors, sports and entertainment centres;

(c) for short-term and goods or children loading parking, such as short-term town centre parking, hospitals and medical centres.

(d) Accessible parking for people with disabilities.

Dimension C is selected as follows

C1 Where parking is to a wall or high kerb not allowing any overhang;

C2 Where parking is a low kerb which allows 600mm overhang;

C3 Where parking is controlled by wheel stops installed at right angles to the direction of parking, or where the ends of parking spaces form a sawtooth pattern;

Dimension L is selected as follows:

L1 Space length for consecutive parallel parking spaces;

L2 Space length for obstructed end spaces;

L3 Space length for unobstructed end spaces;

Aisle width dimensions are for one-way aisles

For parking bays at 90˚ with two-way aisles, aisle width should not be less than 5.5meters.

For Parallel parking bays with two-way aisles, aisles widths should be at least 3 metres wider than for one way aisles.

Car park area must include provision for pedestrian movement. This will be assessed on case by case basis.

3.14 HARDSTAND AREAS

Hardstand areas must be constructed to the same standard as for the adjoining street.

All weather hardstand areas must have an approved retained edge.

Minimum dimensions for hardstand areas must be 5.2m wide by 5.4m long this does not include manoeuvring and turning area.

Alternative formations may be approved at the discretion of the Manager.

3.15 PEDESTRIAN/ CYCLE ACCESSWAYS

An accessway is a passage way that provides the public with a convenient route for pedestrians and/or cyclist from any road, service lane, or reserve to another, or to any public place or to any railway station, or from one public place to another public place, or from one part of any road, service lane, or reserve to another part of that same road, service lane, or reserve.

Pedestrian and/or cycle accessways should be designed in accordance with NZTA's Pedestrian Planning and Design Guide. Particular care needs to be taken:

(i) where cyclists join the shared route to ensure that they can do so safely and without conflict with pedestrians; e.g. cycle access ramps may be required,

(ii) where the shared route ends, to ensure that cyclists do not continue to use a route intended for pedestrians only; e.g. by way of signs and/or markings,

(iii) where one route crosses another pedestrian, cyclists or shared-use route

(iv) to ensure adequate forward visibility for cyclists who are generally moving more quickly than pedestrians and

(v) to provide adequate signage to indicate the shared cycle/pedestrian facility.

(vi) accessways should also be designed using Crime Prevention Through Environmental Design and should:

(vii) be conspicuous - Have good sight lines for passive surveillance from vehicular traffic, neighbouring properties and other road users. Fences adjacent to accessways should be less than 1.2m.

(viii) provide a direct route

(ix) well lit (in accordance with AS/NZS 1158.3.1)

(x) be aesthetically pleasing using low maintenance surfacing

(xi) be designed to ensure high levels of community use

A single removable bollard placed centrally must be erected at all intersections with public footpaths and streets. Refer to Standard Drawing 3.25.

Minimum pavement width for accessways must be 3.0 metres. The minimum width does not include stormwater channels. The footpath pavement construction of accessways must be as required for footpaths. Refer to Clause 3.9.

Provision must be made for the collection and disposal of all stormwater from the paved surface so that the water is not discharged across any paved surface or into the adjoining lots.

3.16 CYCLE FACILITIES

Cycle facilities must be selected according to Figure 4-1: Guide to Choice of Facility Type for Cyclists in Urban Areas from NZ Supplement to Austroads Part 14: Bicycles and designed according to MOTSAM, Traffic Control Devices Manual. If off-street cycle paths are warranted, specific design must be undertaken in collaboration with the Council and is subject to the Manager's approval. The typical width for cycle lanes must be provided in accordance with Table 3.1.

Cyclists require a high level of protection when adjacent to parking. Cyclists face a risk of being undetected by reversing vehicles. Therefore, cycle facilities/ lanes located adjacent to parallel (0^o) angled parking spaces require clear space between the parked vehicles and cycle lanes, and the clear space must be provided in accordance with Table 3.13 below.

Table 3 17 Clear Space between Parked Vehicles and Cycle Lanes

Parking Angle	0^o	45^o	60^o	90^o
Minimum Spacing	1.0	2.0	2.5	3.0

Zero degrees parking: Cycle lanes next to parking should not use a "buffer strip" as suggested in GTEP Part 14 (Section 9.6.1.2) to separate cyclists from parked cars. Any extra width should be provided in the cycle lane.

Lower values for clear space (based on NZ Supplement to GTEP Part 14: Bicycles) can be adopted in low speed environments (85^{th} Percentile speed of 40 km/h and below) and when it is not possible to achieve a wider cycle lane, subject to approval of the Manager.

3.17 BUS BAYS

Where the Council identifies a requirement for Bus Bay(s) these must be constructed by the Developer in accordance with Standard Drawing 3.26 at location (s) to be determined by the Manager. The construction of these areas must be to a minimum design EDA of 2×10^6. Design plans and documentation are to be forwarded to Council as part of the engineering approval process.

Bus turning areas reference

3.18 RURAL/RURAL RESIDENTIAL

3.18.1 General

All roads must be designed in accordance with NZTA State Highway Geometric Design Manual and Austroads Guide to Pavement Technology Part 2: Pavement Structural Design. Refer to Standard Drawings 3.9 and 3.9.1.

3.18.2 Culverts

All culverts must be designed for the catchment area it serves in accordance with Section 6 – Stormwater Drainage of the Engineering Standards for Land Development.

The minimum nominal internal diameter for any road culvert is 375mm and vehicle crossing is 300 mm. All culverts must extend an approved distance beyond the toe of the filling of the road construction and headwalls are to be built. Refer to Standard Drawing 3.7.

Vehicle crossing culverts are to have the certified slope ends similar to NZTA specifications if drain is less than 1000mm in depth. Drains deeper than 1000mm must be subject to specific design.

3.18.3 Intersections

Refer to Standard Drawing 3.3.

3.18.4 Kerb and Channel

Kerb and Channel in rural or rural/residential developments is required in the following circumstances:

(i) Where longitudinal vertical gradients exceed 1:10 kerb and channel will be required for stormwater control. This requirement also applies to right-of-ways.
(ii) Where the road or accessway is adjacent to a cutting or embankment

3.18.5 Rural Road Drainage

Roadside drains in profile must conform to Standard Drawings 3.7 and 3.8. The grade must be no flatter than 0.2% (1 in 500) and must be directed by enclosed piping into existing water courses or approved soak manholes. Enclosed piping is to extend to the bed of the existing water course, with a suitable rock mattress extending over the total stream bed in front of the outlet and sufficiently up the opposite bank to eliminate scouring. If possible, drains should discharge through a suitably sized RCRRJ pipe at the culvert headwall. Refer to Standard Drawing 3.7. Also refer to Clause 6.4 and 6.5.

3.18.6 Lighting

A flag light must be provided at the intersection of a proposed road and the intersecting road. The column and luminaire must be located so that both the intersection is identified by approaching traffic and that the traffic conflict area is illuminated. Refer Standard Drawing 3.3.

Lighting must not exceed an output greater than 16,000 lm and must be mounted at a height not less than 7 metres. Refer AS/NZS 1158.

3.18.7 Turning Areas

Turning areas must comply with section 3.5.21.1

A minimum 10 metre radius turning area must be constructed in all situations. In rural roads in turning heads may be a chip seal on approval of the manager depending on the number of lots served. In urban areas AC thickness requirements shall be in accordance with NZTA M/10. A minimum AC thickness of 30 mm requires the asphalt type to be DG7. A minimum thickness of 35mm allows the use of DG7 or DG10.

Any alternative arrangement proposed must fully demonstrate the ability to accommodate turning manoeuvres of an 8m rigid truck for refuse and recycling collection services.

3.19 ACCESS TO REAR LOTS

3.19.1 General

All accessways to rear lots except those rear lots mentioned in Clause 3.19.2 and 3.19.3 must be constructed and serviced for the full length of the access.

3.19.2 In areas previously subdivided for residential purposes.

Construction of a new accessway formation is not required if only one or two lots are to use an existing accessway and the accessway is acceptable in the opinion of the Manager. Where no accessway exists refer to Clause 3.19.1.

3.19.3 In all Rural/ Rural Residential Subdivisions:

Construction of the access way formation is generally not required if only one lot is to use the access and the access is acceptable in the opinion of the Manager, unless this is in a location where no other alternative is possible. In some instances the terrain will dictate the need for an engineered access.

The access must be wide enough at the street boundary to allow for the positioning of letter and milk boxes and vehicle passing. Passing bays must be constructed at the road boundary and as a minimum every 100 metres for accessways exceeding 100 metres in length for pavement widths less than 5.0 metres. The visibility between passing opportunities from bay to bay is required. Passing Bays must be constructed with a minimum width of 5.5 metres, over a length 15 metres.

Vehicle crossings must be provided between the boundary and the carriageway. Refer to Clause 3.10.2.

3.19.4 Residential

(i) For 2-3 Lots

Formed Asphaltic surface carriageway meeting the width, passing and queuing standards of PNCC District Plan Section 20E Table (viii) Turning heads are not required in the common area where it can be shown that an adequate turning area is available within each lot. Refer to Standard Drawing 3.27 (For examples of shared accessway refer to Standard Drawing 3.27.1).

Turning area must be as per Clause 3.14 Hardstand Areas.

(ii) For 4-6 lots

Formed Asphaltic surface carriageway meeting the width, passing and queuing standards of PNCC District Plan Section 20E Table (viii). A maximum 3-point turning area in the common area must be provided of a size and in a location approved by the Manager. Refer to Standard Drawing 3.28.

(iii) For 7 lots and over

Refer to the current District Plan Section 20E Table (viii) and Table 3.1.

3.19.5 Commercial and Industrial

(i) For 1-4 Lots

Formed Asphaltic surface carriageway meeting the width, passing and queuing standards of PNCC District Plan Section 20E Table (viii). Manoeuvring and turning areas for all vehicles are to be incorporated within each lot. Refer to Standard Drawing 3.24.

(ii) For 5 Lots and Over

Specific design is required to the approval of the Manager.

3.19.6 Rural/ Rural Residential

(i) For 1 Lot

Access dimensions must meet width, passing and queuing standards of PNCC District Plan Section 20E Table (viii). Refer to Table 3.15 and Standard Drawing 3.29. Sight rails may be required at the entrance Refer to Standard Drawing 3.4.

(ii) For 2-4 Lots

Access dimensions must meet width, passing and queuing standards of PNCC District Plan Section 20E Table (viii). Refer to Table 3.15 and Standard Drawing 3.29. Services must be laid as required. Sight rails may be required at the entrance. Refer to Standard Drawing 3.4.

(iii) For 5 Lots to 20 lots

Design/ construction requirements to be in accordance with Table 3.1- Street Classification and Street Width. Refer to Standard Drawing 3.9

The above minimum standards for residential, business, industrial, rural residential and rural are to apply for the total length of the access.

3.19.7 **Internal Access To Building Platforms**

Where required by the Manager, access through an individual allotment to a building platform must be designed to comply with these standards.

3.20 DISTRICT PLAN ACCESS STANDARDS

Refer to the Operative District Plan for updated access requirements.

(a) Position and Construction

All vehicle crossings and intersections shall be positioned and constructed in accordance with instructions and specifications of, and to the satisfaction of, the road controlling authority.

Waka Kotahi is the road controlling authority for State Highway 3, 54, 56 and 57 within the Palmerston North City Boundaries, and retains control of the location, design and construction standards of crossing places and road intersections within these state highways. Waka Kotahi will not allow the construction of any vehicle crossing or intersection if its location and use would be unsafe for vehicles using the highway. No crossing place or intersection onto a state highway will be permitted unless:

- The location and number of crossing places and intersections are determined so as to minimize the number of intersections, promote safe access to the state highway, and avoid or minimize adverse effects on the safe and efficient operation of the state highway;
- The property does not have reasonably practicable alternative legal access to some other road.

The Palmerston North City Council is the road controlling authority for all other roads in the Palmerston North City area, which are not state highways. Palmerston North City Council retains control of the location, design and construction standards of crossing places and road intersections (where these are not to state highways).

NOTE TO PLAN USERS:

Notwithstanding this rule; the Council, as Road Controlling Authority, requires the permission of the Roading Manger, Palmerston North City Council, for any work to construct a vehicle crossing or intersection on all roads other than state highways; and Waka Kotahi permission is required for any work to construct a vehicle crossing or intersection with a state highway.

(b) Access on to Arterial, Collector and Local Roads

Any access to a site or an activity on a Arterial or Collector Road (as defined in Appendix 20A must be provided in accordance with the following standards:

(i) Vehicles cannot reverse onto or off that road from any access to a loading or parking area, except where access is to a residential dwelling and the posted speed limit is less than 100km/hr;

(ii) Site access must be formed to a maximum of 6 metres in width. This rule does not apply to Collector Roads in the Residential and Industrial Zones;

(iii) The minimum spacing and site distances between successive accesses and between accesses and intersections must be as detailed in District Plan section R20.4.2 (vi).

(iv) The minimum spacing and sight distances between successive intersections must be as shown in Table 3.14 and measured in accordance with Figure 3.2.

Table 3 18 Minimum Intersection spacing

Posted Speed (km/h)	Minimum Distance between successive:	Minimum Sight Distance at:
	Inter-sections (d)	Inter-sections
100	800	280
80	800	220
70	400	160
60	200	160
50	150	130

Note 1: Minimum distances between successive intersections are conservative. Minimum spacing requirements can be discussed with Council prior to design submission. Further guidance can be found from Austroads Guide to Road Design Part 4: Intersections and Crossings General.

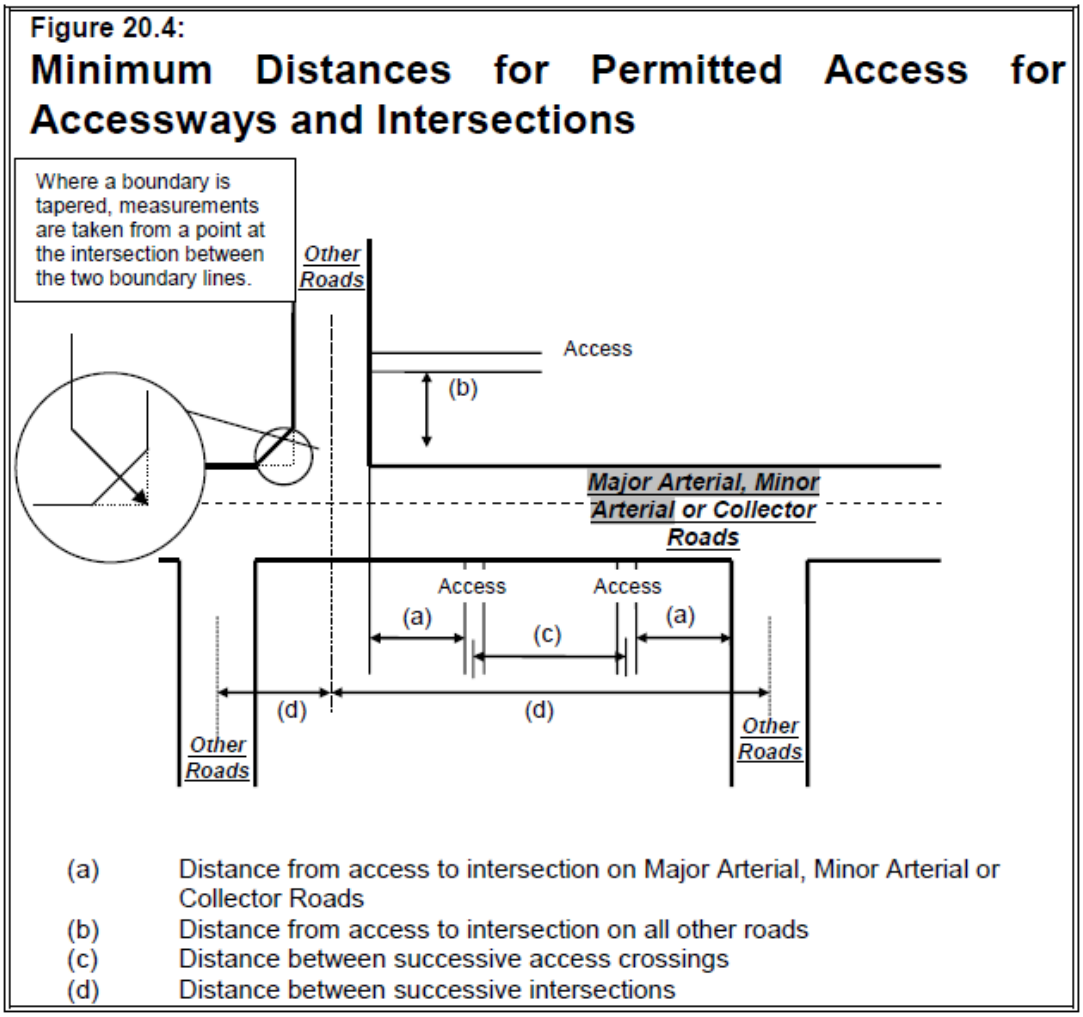
Note 2: Minimum Sight Distance at intersections are conservative. Values are derived from Austroads Guides to Road Design Part 4A: Unsignalised and Signalised Intersections Table 3.6.

NOTES TO PLAN USERS:

(i) Where the posted speed limit differs on the two roads, the standards for the higher speed limit must apply.

(ii) Any part of a road which forms part of the State Highway network is also subject to the requirements of that road controlling authority Waka Kotahi.

Figure 3.2 Minimum Distances for Permitted Access on Arterial and Principal Roads



(c) Access Standards in the Rural Zone

Any access to a site or an activity not covered by rules (b) above, and which is located in the Rural Zone, must be provided in accordance with the following standards:

(i) Vehicles cannot reverse onto or off that road from any access to a loading or parking area;

(ii) Site access must be formed to a maximum of 6 metres in width;

(iii) No vehicle crossing must be located within a minimum distance of 10m from an intersection, measured in accordance with Figure 3.2, being:

The minimum sight distances at intersections and accesses must be recorded as in Table 3.14 measured in accordance with Figure 3.3.

(d) Access Standards in Zones other than the Rural Zone

Any access to a site or an activity not covered by the rules (b) and (c) above, and which is located in any zone other than the Rural Zone, must be provided in accordance with the following standards:

(i) There must be no vehicle access across a Pedestrian Street (as identified in Appendix 20A of the District Plan);

(ii) Where the site or activity is located in a residential Zone and used for residential purposes:

  (i) One standard crossing of 3 metres width may be provided

  (ii) No vehicle crossing must be located within 8 metres of an intersection, measured in accordance with Figure 3.2.

(iii) Where the site or activity is located in an Industrial Zone

  (a) Where a site has frontage to one road, one-two way crossing of not more than 8 metres in width, must be provided;

  (b) Where a site has frontage to more than one road, one crossing of not more than 8 metres in width may be provided to each road. The minimum is one two-way crossing of not more than 8 metres in width to one road;

  (c) Where a site has a frontage length of more than 30 metres to a road, it may have two crossings of not more than 8 metres wide each to that road. As a minimum, one two-way crossing of not more than 8 metres in width must be provided to the road;

  (d) No vehicle crossing must be located within 20 metres of an intersection, measured in accordance with Figure 3.2;

  (e) The minimum distance between access crossings and an intersection with a Arterial or Collector Road must be as recorded in the Table 3.14 measured in accordance with Figure 3.2. NOTE TO PLAN USERS:

(iv) Where the site or activity is located in a Fringe Business Zone:

  (a) Where a site or Multiple Retail Development has frontage to one road, one two-way crossing, of not more than 6 metres in width must be provided;

  (b) Where a site or Multiple Retail Development has frontage to more than one road, one crossing of not more than 6 metres in width may be provided to each road. The minimum is one two-way crossing of not more than 6 metres in width must be provided to the road;

  (c) Where a site has a frontage length of more than 30 metres to a road, it may have two crossings of not more than 6 metres in width each to that road. As a minimum, one two-way crossing of not more than 6 metres in width must be provided to the road;

(d) No vehicle crossing must be located within 20 metres of an intersection, measured in accordance with Figure 3.2;

(e) The minimum distance between access crossings and an intersection with a Arterial, or Collector Road must be as recorded in the Table 3.14 measured in accordance with Figure 3.2.

(v) Where the site or activity is not covered by standards (i), (ii), (iii) or (iv) above:

(a) Where a site has frontage to one road, one two-way crossing, of not more than 6 metres in width must be provided;

(b) Where a site has frontage to more than one road, one crossing, of not more than 6 metres in width may be provided to each road (access from a dedicated service lane must be deemed to form one standard crossing). The minimum is one two-way crossing of not more than 6 metres in width to one road;

(c) Where a site has a frontage length of more than 30 metres to a road, it may have two crossings of not more than 6 metres in width each to that road. As a minimum, one two-way crossing of not more than 6 metres in width must be provided to the road;

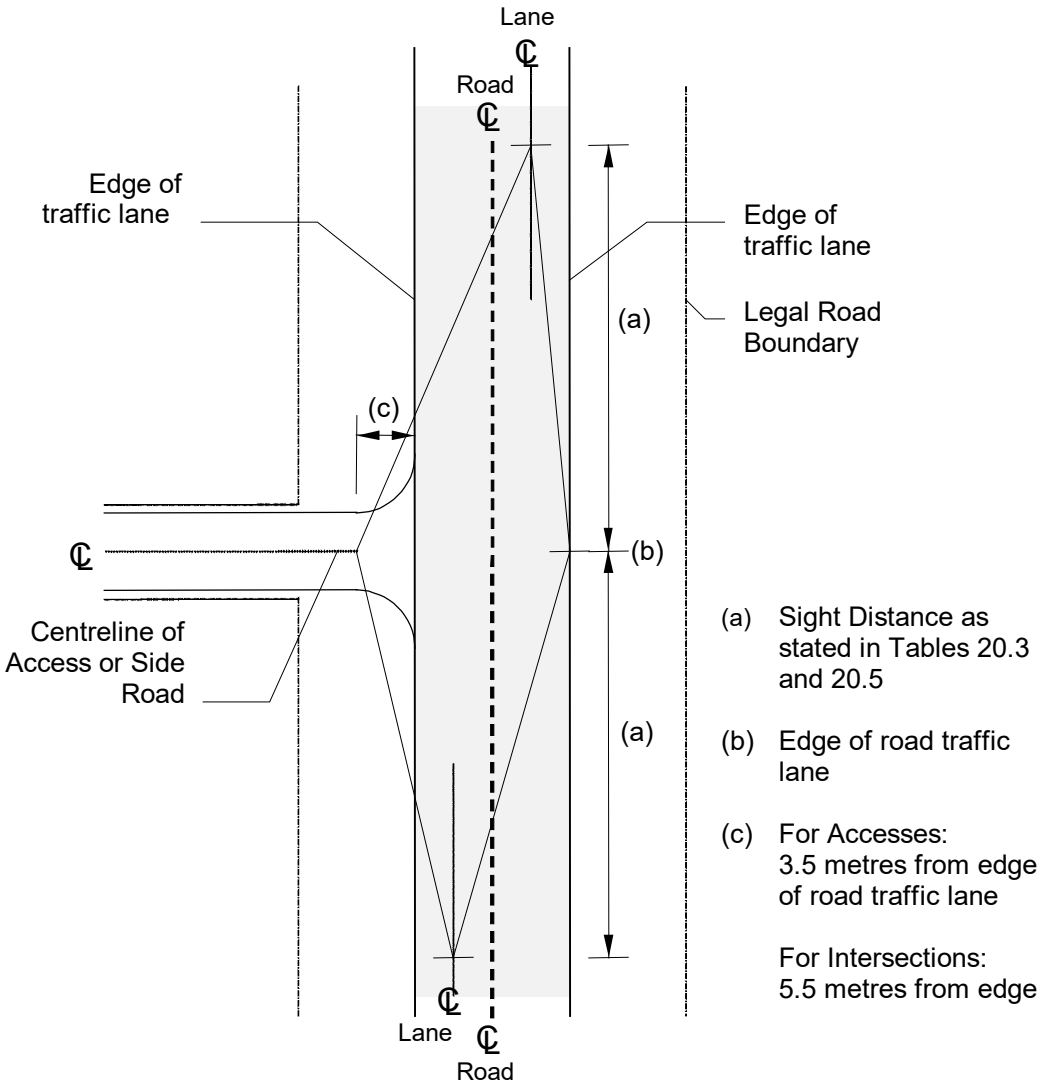
(d) No vehicle crossing must be located within 8 metres of an intersection, measured in accordance with Figure 3.2;

(e) The minimum distance between access crossings and an intersection with a Arterial or Collector Road must be as recorded in the third column of Table 3.14 (entitled "Other Roads (b)"), measured in accordance with Figure 3.2.

NOTE FOR PLAN USERS:

For the purposes of interpreting this Rule, vehicle crossing widths are measured at the property boundary.

Figure 3.3 Sight Distance Measurement Diagram



Note:
Sight distances shall be measured to and from a height of 1.15 metres above the existing road surface and the proposed surface level of the side road or access

3.21 BRIDGES AND CULVERTS

All appropriate building and resource consents must be obtained.

Design is to be in accordance with the NZTA Bridge Manual.

3.22 TRAFFIC CONTROL AND CALMING DEVICES

All proposed traffic control and calming devices with and adjacent to the proposed development including, for example, intersection controls, roadmarking, chicanes and speed humps must be at the discretion of the Manager.

Council may request specific traffic control and calming devices be included in the development.

Any traffic control or calming device approved by the Manager must be designed in accordance with the respective Austroads Guides and meet all regulatory requirements.

The Developer is responsible for all costs associated with any traffic control or calming device.

All signs and markings are to comply with MOTSAM and/or the Traffic Control Devices Manual. Signs and markings are to be shown on the Engineering Plans submitted to Council.

3.23 RETAINING WALLS

All appropriate building and resource consents must be obtained.

3.24 STREETSCAPING

3.24.1 Introduction

Council's objectives with regard to street design are set out in the current Street Design Manual.

Council's aim is to encourage subdivision layouts in which the function of each street is clearly expressed by its location and alignment and its relation to other streets within the subdivision and on the wider network.

The Developer must provide for roads and associated infrastructure including footpaths, cycle ways and pedestrian access ways, vehicle crossings, drainage, traffic and street signage, street furniture, street lighting, roadmarking and street landscaping, including street trees, which are to be all incorporated into the development project and must be specifically designed and constructed to cope with the volumes and loadings of traffic and provide a functional and safe environment for the users of the development over the design life.

3.24.2 STANDARDS AND SPECIFICATIONS

The following standards and specifications must be used for the design and construction of the proposed road network within the development project.

The standards used must incorporate the latest amendments. Standards superseding those listed and the latest version must automatically apply.

Bracketed figures indicate the NZTA document reference number.

NZS 2890	Off-street Parking Facilities
NZS 3104	Specification for Concrete Production
NZS 3109	Concrete Construction
NZS 4121	Design for Access and Mobility – Buildings and Associated Facilities
NZS 1428	Design for Access and Mobility – Means to Assist the Orientation of people with Vision Impairment - Tactile Ground Surface Indicators
NZS 4402	Methods of Testing Soils for Civil Engineering Purposes
NZS 4404:2010	Land Development and Subdivision Infrastructure
NZS 4407	Methods of sampling and Testing Road Aggregates
AS/NZS 1158	Road lighting
RTS 6	Guidelines for Visibility at Driveways
NZTA M/01	Roading Bitumens
NZTA M/04	Basecourse Aggregate
NZTA M/06	Sealing Chip
NZTA M/10	Asphaltic Concrete
NZTA P/03	First Coat Sealing
NZTA P/09	Construction of Asphaltic Concrete Paving
NZTA	Bridge Manual (SP/M/022)
NZTA	Guidelines for Highway Landscaping (SP/M/020)
NZTA	Manual of Traffic Signs and Markings, Parts 1 and 2 (MOTSAM1 and MOTSAM2)
Austroads	Guide to the Structural Design of Road Pavements including NZ Supplement (AP-G17/04)
Austroads	Guide to Stabilisation in Roadworks including New Zealand cover note (AP-60/90)
Austroads	Guide to the Traffic Engineering Practice Part 14, including NZ supplements (SP/M/025)
Austroads	Guide to Road Design Parts 1-8
Austroads	Guide to Traffic Management Part 8: Local Area Traffic Management
NZTA	State Highway Geometric Design Manual
Austroads	Guide to Pavement Technology
NZTA	Cycle Network and Route Planning Guide
NZTA	Pedestrian Planning and Design Guide
PNCC	Street Design Manual

NZTA Traffic Control Devices Manual (all parts)

PNCC Vegetation Framework 2016

3.24.3 STREETSCAPING (RESIDENTIAL)

3.24.3.1 General

As part of the development engineering approval process, the Developer must design and construct the following streetscape works:

(i) Berms; OR alternatively berms may be constructed as a Water Sensitive Design (WSD) as described in Section 6.7
(ii) Grassing of Berms
(iii) Median Strips
(iv) Street Nameplates
(v) Street Lighting (as outlined in Section 3.25)
(vi) Street trees

As part of the development engineering approval process, the Developer has the option to design and construct further variations to the Berms with the following streetscape works:

(i) Gardens
(ii) Raised gardens
(iii) Street Furniture
(iv) Bollards

The Developer must meet the full cost of gardens and street furniture and bollards associated with the proposed development.

Additionally the developer must design and construct all street scape elements required under relevant district plan and consent conditions for any granted resource consents.

Requirements for Compulsory Streetscape Works

3.24.3.2 Berms

The berms must be clear of all foreign debris including construction material, concrete, timber and large stones to a depth of 500mm.

Table 3.1 provides the minimum width for a berm. Section 3.24.6 provides further berm width criteria for tree selection.

NOTE: Berms physically separated from footpaths, such as placing berms at a lower level to footpaths, will assist avoidance of footpath damage from tree roots.

Standard Drawing 1.2 provides the required position of services within the berm. The minimum 750 mm depth for service lines must be strictly adhered to. At these depths any current or future planting can be installed with minimal impact on the services.

3.24.3.3 Grassing of Berms

Grassing of berms is the minimum requirement for berms. Alternatives to grassing are described as WSD (Section 6.7); Gardens (Section 3.24.7) and Raised Gardens (Section 3.24.8).

The Developer must provide and place good quality clean topsoil which and is:

(i) Free from stones, weeds, turf and any other foreign materials to all berm areas and median strips to be grassed.
(ii) Sufficiently aerated to allow for drainage downwards through the berm area.
(iii) Level, after settling, with the surrounding concrete works.
(iv) A minimum depth of topsoil of 100mm

Grassing

Topsoil must be left for a period of 3 months before sowing. Any unwanted grasses or weeds must be sprayed off prior to sowing.

Berms must be sown with grass seed mixture conforming to the following proportions: turf type fescue mix (low mowing requirement); at 50 grams per m^2; or an equivalent grass mix approved by Councils Parks Operations Manager.

The grass berm shall maintain at least 90% sward cover, no weeds, with an even level surface for a 6 month period. The grass shall be maintained to an even height.

3.24.3.4 Median Strips

Median strips must be constructed in accordance with Standard Drawing 3.10.1. The width of the median must be not less than 800mm.

Top soiling and grass requirements are to be the same as for grassed berms. Median strips less than 800mm in width are to be concreted. Median strips where heavy traffic is expected must be concreted.

3.24.3.5 Street Nameplates

The Developer must provide street nameplates. Product details and installation must be in accordance with Palmerston North City Councils Policy for Roading Signage.

Street Naming and Numbering Policy and Street Naming Guidelines can be found on PNCC website: Street naming and numbering policy (pncc.govt.nz)

3.24.3.6 Street Trees

General

For street trees in green field subdivisions the Council will carry out street tree planting on behalf of the Developer. A payment to Council will be required for tree planting once the development

has been completed (i.e. after all construction is finished); and for ongoing maintenance for a three-year establishment period. The payment will be a minimum based on an average of provision of one tree per 30m of road frontage; but final tree numbers planted will depend on practicality of planting and any design detail required by the Resource Consent or District Plan if relevant.

Planting of street trees by Council will not occur until 80% of the homes in the development have been completed. Planting of trees by Developers is subject to prior approval by Council.

The selection and placement of street trees must be undertaken so as to ensure surrounding utilities and infrastructure are not damaged and to enable the safe passage of pedestrians and vehicles.

Tree species selection, maturity, position in the berm and tree planting methodology must be approved by the Manager of Parks and Reserves or their representative who shall also supervise all street tree planting.

Tree Selection

Tree selection shall comply with the following maximum mature height based on the berm width.

Table 3.19 Maximum mature height based on the berm width

Berm Width	Mature Tree Height
< 1.2 m	No Trees
1.2 to 2m	4m
2 to 3m	6m
> 3 m	>6m

Trees purchased by the developer must come from a reputable tree nursery and be of a consistent size and quality, free of pests and diseases. All trees shall be approved by the Parks Operations Manager prior to planting.

Positioning in the berm

The location of the trees shall be determined by the designer taking into account separation from other services and compliance with the following requirements:

(i) Minimum of 1 tree for every 2 properties within the development and no less than 1 tree every 30 metres of road frontage

(ii) Off-set i.e. located on the opposite of the road from the streetlight

(iii) Ensure the mature tree will not obstruct road signs, pedestrian crossings and power poles

(iv) Meet the following minimum separation distances from infrastructure

- 10m - traffic lights and intersections3m - vehicle crossings and bus-stops

- 2m - Stormwater drain
- 1.5m - Stormwater and wastewater laterals
- 3m – water and wastewater mains, gas and & fibre optic cables
- 1m – Telecommunications cables 0.7m - footpath and kerb

(v) On streets with West-East orientation street trees will only be planted on the northern side of the road.

(vi) On Streets with a North South orientation the trees will alternate on either side of the road at the 30 m spacing (60 m apart on each side of the road)

Where the above separation distances cannot be achieved then the tree shall be planted with root barriers installed to a depth of 600mm, in accordance with the Standard Drawing 3.31 and 3.31.1.

Tree Planting Requirements

Planting must be undertaken between 1 April and 30 September.

Planting is to be supervised by the Parks Operations Manager. The Contractor shall give the Manager not less than five days notice of dates upon which planting will commence.

Tree Maintenance

The developer shall be responsible for ensuring that street trees and any other trees planted by the developer are maintained for a period of 24 months. The maintenance obligations shall include the following:

- Watering of the trees
- Weed control for 1m radius around the trees
- Replacement of trees which are diseased or damaged (advise Council of any replacements)

The Council will maintain trees planted by Council, in accordance with the provisions of 3.24.3.1

Requirements for Optional Streetscape Works

The following optional streetscape works are minimum requirements. Where practical WSD are the preferred practise.

3.24.3.7 Gardens

Garden Design plans must be submitted for approval as part of the consent process. These plans must be in accordance with the principles of the PNCC Vegetation Framework (2016).

Detailed planting plans must be submitted and approved by council prior to planting.

The Developer must meet the full cost of gardens associated with the proposed development.

Construction

All gardens located within grass areas must be surrounded by a 20MPa concrete mowing strip of 200mm wide with a minimum depth of 150mm. Gardens at ground level must be excavated to a depth of 400mm, be free from all foreign materials that are removed at the Developers cost.

Plant selection & layout

The plants and their arrangement in the garden must support low maintenance.

All species chosen must be perennial in nature with an expected life of 7 to 15 years.

All shrubs must allow for clear sight lines for road users. Plants at the time of maturity shall not exceed 600mm in height when positioned at intersections, vehicle crossings or on an inside bend of a roadway.

Plant must be positioned to limit mature plant growth extending beyond the garden edge.

Plant quality

Plants shall be purchased from a reputable plant nursery, be well formed and of typical habit for the species. All plants shall be vigorous with strong root systems and free of all pests and diseases.

Plants will be a consistent size and quality for each garden.

Garden planting technique

Planting must be carried out from 1 April to 30 September or a watering system installed to ensure optimum plant establishment.

At the time of planting, a slow release fertiliser shall be applied at the rate recommended by the manufacturer, and the entire garden bed shall be covered by an organic mulch, approved by the Parks Operations Manager, to an average depth of 75-100mm.

Garden maintenance

Should the Developer wish to install gardens prior to the commencement of building construction, the Developer must be responsible for the maintenance of the gardens until building construction has been completed for the entire development.

3.24.3.8 Raised Gardens

Raised garden design plans must be submitted for approval as part of the consent process.

Raised gardens must be constructed of permanent materials and of a material type in keeping with other structural developments within the development. Garden walls must have a maximum height of 450mm. As for ground level gardens, those located within grass areas must be surrounded by a 20MPa concrete mowing strip of 200mm wide and 150mm depth.

Raised gardens structures within 40 metres of intersections, between vehicle crossings or on an inside bend of a subdivision road must not exceed 300mm in height and the total height from base of structure to top of mature vegetation must not exceed 600mm.

3.24.3.9 **Street Furniture**

Street furniture design must be submitted for engineering approval as part of the consent process.

The Developer must meet the full cost of street furniture associated with the proposed development.

Street furniture must be designed so as not to obstruct visibility for vehicles, cyclists or pedestrians.

3.24.3.10 **Bollards**

A bollard layout plan must be submitted for engineering approval as part of the consent process. Bollards must be supplied and installed in accordance with Standard Drawing 3.34.

3.25 STREET LIGHTING

The Developer must provide and pay for the design and installation of street lights in accordance with:

(i) AS/NZS 1158 Lighting for Roads and Public Spaces- Part 0: Introduction

(ii) AS/NZS 1158 Lighting for Roads and Public Spaces-Part:1.1: Vehicular Traffic (Category V) lighting-Performance and Design Requirements

(iii) AS/NZS 1158 Road Lighting- Part 1.3: Vehicular Traffic (Category V) lighting- Guide to Design, Installation, Operation and Maintenance

(iv) AS/NZS 1158 Lighting for Roads and Public Spaces- Part 2: Computer Procedures for the calculation of Light Technical Parameters for Category V and Category P Lighting.

(v) AS/NZS 1158 Lighting for Roads and Public Spaces- Part 3.1: Pedestrian Area (Category P) Lighting- Performance and Design Requirements.

(vi) AS/NZS 1158 Lighting for Roads and Public Spaces- Part 6: Luminaires

Street Lighting must form part of the engineering approval process.

The following streetlight columns/luminaries must only be used in any development.

3.25.1 **Column Specifics:**

(i) CSP Pacific Columns

(ii) Spunlite Poles Columns

(iii) Schreder Columns

(iv) Kendelier Columns

(v) Windsor Heritage Columns

(vi) Gess Columns

(vii) Steelgal Columns

(viii) Ibex Columns

(ix) Vicole Columns

All street light columns must be backfilled with approved granular backfill as per the street light column's manufacturer's specification. Excavated material must not be used. "Rhino Lining", (or equivalent) coating must be applied in accordance with manufactures instructions to the exterior of all columns and is to extend 100mm above ground level.

3.25.2 **Design Criteria:**

All street lighting designs and calculations are to be sighted and approved by Council prior to the installation of the street lighting. LED street lighting must be used in all new subdivisions/ development,

3.25.3 **Lamp Specifics:**

Only the highest efficacy LED luminaires are allowed.

(i) **Approved models**:
   a. **RAZO-S-20**: 20 LEDs, 17W-40W
   b. **RAZO-M-42**: 42 LEDs, 40W-70W
   c. **RAZO-M-60**: 60 LEDs, 80W-110W
   d. **RAZO-M-72**: 72 LEDs, 120W-140W

(ii) **Lumen Output** (at 4000K):
   a. RAZO-S-20: 2100 - 5400 lumens
   b. RAZO-M-42: 7200 - 9600 lumens
   c. RAZO-M-60: 12000 - 15000 lumens
   d. RAZO-M-72: 16100 - 18000 lumens

(iii) **Color Temperature Options**:
   a. 2700K, 3000K, 4000K

(iv) **Control Compatibility**:
   a. NFC programmable DALI2 LED driver

3.25.4 **NEMA socket for wireless control integration Luminaire Specifics:**

The luminaires are to meet the AS/NZS 1158.6 standard and are to be included and certified by the Auckland Transport Certification Board and the Waka Kotahi M30 Standard.

Only IP65+ ingress protection ratings are allowed. Each new light must have NB-IOT light controller NEMA unit. This is a smart unit which allows PNCC to remotely monitor and control the streetlight.

3.25.5 **Earthing:**

All steel street light columns must have a separate driven earth.

The following fusing/earthing system must only be used in any development:

SL3 Street Lighting Cut Outs 25A, 240V AC

3.26 STOCK UNDERPASS

To construct a stock underpass under a council road, the landowner is required to enter into an agreement with the council that will be lodged against their land title which details the conditions relating to installing this private structure within the road reserve. The agreement must include:

(i) Acceptance by the landowner of all fees and charges associated with council or their engaged services for inspections of this structure that complies with NZTA bridge inspection requirements.
(ii) 2 yearly general inspections and 6 yearly detailed inspections.
(iii) Acceptance by the landowner of all maintenance costs required for structural compliance which may result from the above inspections.
(iv) Acceptance by the landowner that if the adjoining property is sold and that the structure is no longer required to service access, then the landowner at their cost will remove the structure at their cost and that full reinstatement of the road corridor and pavement structure is met to the satisfaction of council.

The following are required to be submitted to council by all applicants applying to construct a stock underpass:

- Building consent application including structural details
- Plan view of proposed installation location
- Drainage plan
- Road pavement design plan
- QA details on install processes
- Traffic management plan

4 WASTEWATER DRAINAGE

4.1 INTRODUCTION

This section sets out standards and design criteria for wastewater drainage in land development. It does not cover the design of trunk mains. Particular emphasis is placed in this section on measures to prevent stormwater inflow and ground water infiltration into the wastewater drainage system.

4.2 OBJECTIVES

The objectives of the design are to ensure that the wastewater system is functional and complies with the requirements of the Council's wastewater systems. In principle the wastewater system must provide:

(a) A single gravity/pressure connection for each property;

(b) A level of service to the Council's customers in accordance with the Council levels of service;

(c) Minimal adverse environmental and community impact;

(d) Compliance with environmental requirements;

(e) Compliance with statutory OSH requirements;

(f) Adequate hydraulic capacity to service the full catchment;

(g) Long service life with minimal maintenance and least life-cycle cost;

(h) Zero level of pipeline infiltration on commissioning of pipes;

(i) The minimisation of pipeline infiltration/exfiltration over the life of the system;

(j) Resistance to entry of tree roots;

(k) Resistance to internal and external corrosion and chemical degradation;

(l) Structural strength to resist applied loads; and

(m) 'Whole of life' costs that are acceptable to the Council.

4.3 STANDARDS

The following Standards and Codes of Practice are referred to in this part. The design, materials and method of construction must comply with the Standards and Codes of Practice as applicable.

The Standards used must incorporate the latest amendments. Standards superseding those listed and the latest version must automatically apply.

AS/NZS 1260 PVC-U Pipes and Fittings for Drain, Waste and Vent Application

AS/NZS 1462 Methods of Test for Plastic Pipes and Fittings

AS/NZS 1546.1 On-site Domestic Wastewater Treatment Units – Septic Tanks

AS/NZS 4130 Polyethylene (PE) Pipes for Pressure Applications

BS2494 Specification. Materials for Elastomeric Joint Rings for Pipework and Pipelines

NZS 3107 Specification for Precast Concrete Drainage and Pressure Pipes

NZS 4402 Methods of Testing Soils for Civil Engineering Purposes

NZS 4404:2010 Land Development and Subdivision Infrastructure

NZS 4452 The Storage and Handling of Toxic Substances

NZS 7643 Code of Practice for the Installation of Unplasticised PVC Pipe Systems

NZS/AS 2033 Installation of Polyethylene Pipe Systems

AS/NZX 2566.1.: Buried Flexible Pipelines – Part 1: Structural design

AS/NZS 2566.2: Buried Flexible Pipelines-Part 2: Installation

NZS/AS 3725 Loads on Buried Concrete Pipes

WSA 02 2014 Gravity Sewer Code of Australia

WSA 04 2005 Sewerage Pumping Code of Australia

WSA 07 2007 Pressure Sewerage Code of Australia

PNCC Pressure Sewer Design Standards

4.4 GENRAL REQUIREMENTS

The wastewater drainage system must be designed to serve the entire area of the proposed development, and other such areas that the Manager considers will be ultimately served by the wastewater drainage system, whether it be by gravity or pumping. The system must have a design life of at least 100 years.

Where provision is to be made for drainage of other areas, the Developer must be responsible for the construction and costs through to the boundary of the development.

4.4.1 Design Life

All wastewater systems must be designed and constructed for an asset life of at least 100 years, unless otherwise specified in the Palmerston North Wastewater Asset Management Plan. Some components such as pumps, valves, and control equipment may require earlier renovation or replacement. Refer to WSA 02 for the classification of life expectancy for various components in conventional gravity systems. Refer to WSA 07 for the classification of life expectancy for various components in pressure sewer systems.

4.4.2 Structure Plan

The PNCC may provide a structure plan setting out certain information to be used in design, such as flows, sizing, upstream controls, recommended pipe layout, or particular requirements of the Council. Where a structure plan is not provided, the designer must determine this information by investigation using this Standard and engineering principles.

4.4.3 Layout

The Wastewater system layout must ensure the following:

Access to all parts of the reticulation for inspection and maintenance. Manholes, access points and access chambers must be provided to ensure access to pipelines by modern equipment for CCTV inspection, water jetting, root cutting and grouting. Pressure sewer on-property equipment owned by Council must be located to enable inspection and maintenance (refer PNCC Pressure Sewer Design Standards).

Safety of the wastewater system operators should be maximised.

The potential for infiltration and exfiltration must be minimised (e.g.: minimise the number of manholes and access points)

4.4.4 Future Development

Where further subdivision, upstream of the one under consideration, is provided for in the district or regional plan, Council may require wastewater infrastructure to be constructed to the upper limits of the subdivision to provide for the needs of this development.

Additionally, Council may require additional capacity to be provided in the wastewater system to cater for existing or future development upstream. Peak flows and cleansing velocities should be taken into account when designing for additional latent capacity.

4.5 SYSTEM DESIGN

4.5.1 Catchment Design

Pipes within any project area must be designed to be consistent with the optimum design for the entire catchment area and any future extension of the system must be accommodated. This may affect the pipe location, diameter, depth, and maintenance structure location and layout. Designers must adopt best practice to ensure a system with lowest life-cycle cost.

Pipes must be designed with sufficient capacity, and in the case of gravity systems, depth to cater for all existing and possible development of the catchment. Where future extension of the pipe is possible, it may be necessary to carry out preliminary designs for large areas of subdivided and un subdivided land. This design must use safety factors defined by the Council for hypothetical subdivision and service for layouts to determine the necessary depth and diameter for an extension.

4.5.2 Extent of Infrastructure

Where pipes are to be extended in the future, the ends of pipes must extend past the far boundary of the development by a distance equivalent to the depth to invert and be capped off, unless otherwise agreed to by the Council. This ensures that a future extension of the pipe does not require unnecessary excavation within lots or streetscapes already developed.

4.5.3 Topographical Considerations

In steep terrain the location of pipes is governed by topography. Gravity pipelines operating against natural fall create a need for deep installations which may require trenchless installation. The pipe layout must conform to natural fall as far as possible.

4.5.4 Geotechnical Considerations

The designer must take into account any geotechnical requirements determined under section 2 of this document.

4.5.5 Pressure Sewer Systems

Pressure sewer systems must be designed in accordance with the PNCC Pressure Sewer Design Standards.

4.6 FLOW REQUIREMENTS

The wastewater drainage system must be sized so as to convey the full wet weather flow including domestic wastewater, industrial wastewater, infiltration and direct ingress of stormwater without surcharging. The design must be based on the following criteria.

4.6.1 Residential Flow

Dry weather flow	DWF	250	litres/head/day
Wet weather flow	WWF	1000	litres/head/day (42 litres/head/hr)

Pipeline flows must be based on allowing 2.9 persons per residential unit for the fully developed subdivision, subject to a minimum of 26 persons per hectare.

NOTE: For small contributing catchments, pipeline flows can be significantly higher but, due to the requirement for a minimum pipe size of DN 150, such flows will not govern the design.

4.6.2 Business and Industrial Zones

Each development needs to be considered individually, with respect to employment and the likely mix between "wet" and "dry" sites. The current peak design flow for existing commercial and industrial developments range from 30 000 to 100,000 litres/hectare/day. A trade waste consent will be required for any business discharges that exceed domestic wastewater characteristics as defined in the current Trade Waste Bylaw.

4.7 HYDRAULIC DESIGN (GRAVITY SYSTEM)

4.7.1 Design

The hydraulic design of wastewater pipes should be based on either the Colebrook-White formula or the Manning formula.

The diameter and grade of the sewer must be selected to ensure

(i) that the pipeline has sufficient capacity to cope with peak wet weather flows.

(ii) that velocities are sufficient to prevent siltation.

(iii) that velocities are not high to cause scouring.

(iv) that the pipeline has been designed to cater for future extensions

Note: Section 4.13. refers to depth of wastewater mains to accommodate connections from all lots.

4.7.2 Minimum Gradients

Minimum gradients to allow for self-cleansing of wastewater pipes must be as follows; however, these gradients may be varied in accordance with individual pipe manufacturers flow velocity assessments.

Table 4.1 Minimum Gradient

Nominal Bore	Grade
100 mm	1 in 80
150 mm	1 in 150
190 mm	1 in 220
225 mm	1 in 260
300 mm	1 in 390

The pipeline within 100m of the upstream terminal manhole, or pipelines draining six or fewer allotments, must be laid at a grade of not less than 1:100.

4.7.3 Diameter

All sizes stated are nominal internal diameters.

No pipe intended to become a public wastewater drain must be less than 150 mm nominal diameter.

4.7.4 Loading

Diameters and gradients of pipes greater or equal to the loadings shown below may be adopted without specific design.

Table 4.2 Minimum Pipe Diameters

Gradient	Maximum number of dwelling units		
	150 mm nominal bore	190 mm nominal bore	225 mm nominal bore
1 in 100	320	600	970
1 in 120	300	540	890
1 in 150	280	500	800
1 in 200		450	710
1 in 260			600

4.7.5 Velocities

The minimum design velocity at full flow is 0.7 m/s to minimise sedimentation, and the maximum design velocity to prevent scour is 3.0 m/s.

4.8 HYDRAULIC DESIGN (PRESSURE SYSTEM)

4.8.1 General

Pressure sewer systems must be designed in accordance with the PNCC Pressure Sewer Design Standards.

4.9 STRUCTURAL DESIGN

4.9.1 Design

All pipelines must be designed in association with their bedding and backfill to have sufficient strength to safely support the loads normally imposed upon them, including construction loadings. The design must be in accordance with AS/NZS 2566.1, or AS/NZS 3725, including the structural design commentary AS/NZS 2566.1 Supplement 1. Details of the final design requirements must be shown on the drawings. All pipes and structures must be designed with adequate flexibility and special provisions to minimise risk of damage during earthquake.

4.9.2 External Forces

The external forces to be taken into account must include:

(a) Trench fill loadings (vertical and horizontal forces due to earth loadings);

(b) Surcharge;

(c) Groundwater;

(d) Dead weight of the pipe and the contained water;

(e) Other forces arising during installation;

(f) Traffic loads;

(g) Temperature (expansion/contraction).

The consequences of external forces on local supports of pipelines must also be considered.

4.9.3 Bedding

The type of bedding and class of pipe must be in accordance with the pipe laying tables and bedding diagrams in NZS/AS 3725 - Loads on Buried Concrete Pipes. Requirements for PVC pipes must be in accordance with NZS 7643 - Code of Practice for the Installation of Un-plasticised PVC Pipe Systems, and with the pipe manufacturer's guidelines. Under normal conditions compacted granular bedding must be used as shown in Standard Drawing 4.1. Bedding and trench details must be shown on the Engineering Plan.

Maximum and minimum permitted trench widths are shown on Standard Drawing 4.1.

4.9.4 Cover

Minimum cover above the crown of the pipeline must be as follows:

Table 4.3 Minimum Cover

Location	Minimum Cover (mm)
Roads, berms, accesses and parking areas	750*
All other areas	600

* During construction, pipework may require ramped metal protection

Where it is not possible to achieve minimum cover requirements, an approved protection system to the satisfaction of the Manager must be installed above the pipework.

When pipeline gradients exceed 20% (1 in 5), a cement bonded bedding and anti-scour blocks placed at 6.0 metre intervals midway along a pipe must be required. As shown in Standard Drawing 4.2.

4.10 PIPEWORK

Rubber ring jointed pipes that comply with the following standards are acceptable. (Latest version standards to apply.)

(i) Concrete pipes to NZ 3107

(ii) PVC pipes to AS/NZS 1260

(iii) PE pipes to AS/NZS 4130 (black with cream stripe)

(iv) Other pipe types, e.g. steel, may be considered for specific applications.

All pipework used in sewer reticulation must have flexible joints. Rubber rings complying with BS 2494 are acceptable.

4.10.1 Pipe Selection in Special Conditions

Pipeline materials and jointing systems must be selected and specified to ensure:

(a) Structural adequacy for the ground conditions and water temperature;
(b) Water quality considering the lining material;
(c) Compatibility with aggressive or contaminated ground;
(d) Suitability for the geotechnical conditions;
(e) Compliance with the Council's requirements.

4.11 INFILTRATION CONTROL

4.11.1 Mains, Laterals, Manholes and Pumping Stations

All wastewater drainage including mains, laterals, manholes and pumping stations must be constructed so as to prevent the inflow of stormwater, groundwater infiltration and any root penetration.

All joints in manhole structures must be sealed using appropriate sealing systems. No visible infiltration through manhole walls or floors will be permitted.

4.11.2 Abandoned Laterals, Mains and Other Structures

Existing laterals, mains and other structures that are abandoned during construction must be completely sealed off to prevent infiltration into the wastewater drainage system. Laterals must be sealed as close to the main as possible or as required by the Manager.

Where abandoned mains are located below properties and carriage ways Council can require to fully grout the mains to ensure that the surface stays intact during seismic events.

4.11.3 Uncompleted Pipework and Structures

While construction of a new wastewater drainage system is underway, the pipeline at the lower end must be effectively plugged to prevent ingress of stormwater into the main network from uncompleted pipework and structures.

4.12 PIPE LAYING AND TESTING

4.12.1 Pipeline Location

Wastewater pipelines must be sited in accordance with the standard position allocated by the Council. Refer Standard Drawing 1.2.

Pipes should be positioned as follows:

(a) Within the street to alignments set out in this standard

(b) Clear of carriageways and access points where possible; is preferred;

(c) Within public land with the permission of Council;

(d) Within reserves outside the 1 in 100-year flood area;

(e) Where possible, not within private property.

(f) Within private property parallel to front, rear, or side boundaries.

NOTE: It is Council's preference for public pipes to be contained within public land as far as possible. Where necessary for public pipes to enter private land, easements must be provided.

Wastewater drainage pipelines must not be laid in the same trench as stormwater drainage or water mains. Service pipes and services in access ways may be laid in a common trench provided the required clearances between services are maintained (Table 4.4).

Table 4.4 Clearances between wastewater pipe and other underground services

Utility (Existing service)	Minimum horizontal clearance for new pipe size ≤DN 300 (mm)	Minimum Vertical clearance[1] (mm)
Gas mains	300[2]	150
Telecommunication conduits and cables	300[2]	150
Electricity conduits and cables	500	225
Drains	300[2]	150
Water mains	1000[3]/600	500/750

NOTE –

(1) Vertical clearances apply when wastewater pipes and other underground services cross one another, except in the case of water mains when a vertical separation must always be maintained, even when the wastewater and watermain are parallel. The wastewater pipe should always be located below the watermain to minimise the possibility of backflow contamination in the event of a main break.

(2) Clearances can be further reduced by 150mm for distances up to 2m when passing installations such as poles, pits, and small structures, providing the structure is not destabilised in the process.

(3) When the wastewater pipe is at the minimum vertical clearance below the watermain (500mm) maintain a minimum horizontal clearance of 1000mm. This minimum horizontal clearance can be progressively reduced to 600mm as the vertical clearance increases to 750mm.

Pipelines over 300mm internal diameter are classified as trunk mains with connection permitted only at manholes. Where a trunk main passes along the frontage or through a subdivision, rider mains will be necessary to facilitate individual lot wastewater connection.

Public wastewater drainage pipes are to be laid in Council controlled land. Where this is unavoidable, pipelines must be sited so as not to reduce the building area available on the lot (that is, within the front, side or rear yard areas). Easements must be minimum 3 metre width and will be required for all wastewater reticulation pipelines and for all lateral connections serving other than the affected lot. Manhole structures must be placed centrally within the easement.

The Developer is to identify all drainage systems in the Development Concept Plan that are proposed to be located other than the road reserve.

4.12.2 Pipe Laying

All pipelines must be laid in accordance with the manufacturer's instructions, and to the appropriate standard.

NZS 7643: Code of practice for the installation of un-plasticised PVC pipe systems.

AS/NZS 2033: Installation of polyethylene pipe systems.

Backfill for pipes must be as shown on Standard Drawing 4.1.

Connections to the existing wastewater drainage system must be carried out by an approved person under the supervision of the appropriate Council staff. See Clause 1.9.1. In addition, all elements of a pressure sewer system must be installed by an approved person under the supervision of the appropriate Council staff.

4.12.3 Backfill and Compaction

No backfilling must be done prior to approval by the Council Engineer.

Bedding material grading must be as described in Table G.1 of AS/NZ 2566.2 for PVC pipes. If the excavated material cannot meet the specified grading, imported material must be used.

AS/NZ 2566.2

Table G1: Grading Limits for Acceptable Embedment Material

Sieve Size, mm	Mass of samples passing, percent
19.0	100
2.36	50 to 100
0.6	20 to 90
0.3	10 to 60
0.15	0 to 25
0.075	0 to 10[1]

Note:
1. For non-plastic fines otherwise <5%

The backfill material above the bedding under the Road Carriageway and Footpath, must be well graded AP65 granular material. Trench excavated material can be utilised for backfill in the berm area if it is free of organics and other deleterious material, be non-plastic, have a CBR greater than 8% and MDD must be provided prior to backfill.

Compaction equipment, the number of passes and the thickness of the layer to be compacted shall consider the material to be compacted and the underlying pipe. The compaction shall not cause any loading or pressure transfer to the pipe that could cause damage to the pipe or its alignment.

The backfill compaction shall achieve the following:

	Carriageway	Footpath	Berm
Trench Backfill	NDM test only	CIV 20	CIV 15

Note:
1. CIV is the Clegg Impact Value
2. Clegg hammer testing shall be undertaken by a suitably trained person utilising a calibrated Clegg Hammer

The compaction testing regime must be carried out as outlined below:

a. for Trenches in Carriageways or under Footpaths, tests at a rate of at least one test per layer of backfill per 15m of Trench with a minimum of two tests;
b. for Trenches in Berms, tests at a rate of at least one test per layer of backfill per 30m of Trench, with a minimum of two tests;
c. where the excavated area is greater than 0.5m2 and less than 5m2, tests at a rate of one test per backfill layer or, for larger excavations, one test per 5m2;
d. all test locations must be uniformly spaced in the pavement;

Also note that:

- Subject to satisfactory test results the above frequency of testing may be reduced with the prior agreement of the Manager;
- The Clegg hammer may be used for testing of trench backfill but not for the carriageway pavements layers (i.e. subbase and basecourse). Refer to the roading section for pavement testing.

Where the trenching is undertaken to install a new service in the road reserve Clegg Hammer test results shall be recorded and available for inspection as part of quality assurance and auditing undertaken by Council's Road Maintenance contractor. Where the trenching is a part of new subdivision the test results must be provided as part of the completion documentation.

4.12.4 Trenchless Technology

Trenchless technology may be preferable or required by Council as appropriate for alignments passing through or under:

(a) Environmentally sensitive areas;

(b) Built-up or congested areas to minimise disruption and reinstatement;

(c) Railway and major road crossings;

(d) Significant vegetation;

(e) Vehicle crossings.

Refer to NZS 4404:2010 for further guidance.

Further information on trenchless technologies may be found in 'Trenchless technology for installation of cables and pipelines' (Stein), 'Trenchless technology – Pipeline and utility design, construction, and renewal' (Najafi), and 'Guidelines for horizontal directional drilling, pipe bursting, micro-tunnelling and pipe jacking' (Australasian Society for Trenchless Technology).

4.12.5 Marking Tape or Pipe Detection Tap

Appropriate marking tape or detection tape must be installed at the top of the embedment zone, or tied to the pipe during horizontal directional drilling, to aid future location of the pipe. Refer to AS/NZS 2032 section 5.3.15 and figure 5.1.

4.12.6 Ends of Pipe

All sewers will terminate at a manhole or other alternative structure approved by Council. Approval may be granted to terminate the line at a blank plug if it is clear that construction of the upstream stage of the development is imminent.

4.12.7 Pipe Testing

4.12.7.1 General

All wastewater drainage mains and laterals must be tested for leakage and other defects. Air testing will generally be acceptable, although water testing may be required in certain circumstances or at the discretion of the Manager. Testing requirements for PVC pipes will be in accordance with AS/NZS 1462 Methods of test for plastic pipes and fittings.

Pressure testing must be carried witnessed by the Council unless approved otherwise by the Manager.

Pipe joints and end caps must be left exposed to facilitate observation. End caps at the property boundary must be fixed to the pipe. The Developer must provide all necessary testing equipment.

4.12.7.2 Air Testing of Gravity Lines

The test pressure must be 20kPa. For acceptance the pressure must not fall below 17kPa over a 10-minute period.

4.12.7.3 Water Testing

Where required, water testing will be in accordance with:

a) Concrete and Ceramic Pipes - NZS 4452

b) PVC Pipes - NZS 7643

4.12.7.4 Closed Circuit Television (CCTV) Inspection

All pipelines proposed to become public drains are to be CCTV surveyed after all other works have been completed. Refer to clause 1.30. CCTV inspections are to be undertaken in accordance with recommendations contained in the New Zealand Water and Wastes Association (NZWWA) Pipe Inspection Manual

4.13 MANHOLES & MAINTENANCE STRUCTURES

4.13.1 Location

Manholes or other approved maintenance structures are required on gravity pipelines at any or all of the following:

a) the head of the line, at changes of gradient

b) changes of direction

c) changes of pipe size

d) the junctions of all pipelines in excess of 100mm diameter

e) a spacing of up to 120m on straight lengths

f) the discharge of a pressure main into a gravity pipe

Manholes or other approved maintenance structures are required on pressure sewer pipelines in accordance with the PNCC Pressure Sewer Design Standards.

Manholes and other maintenance structures should be located clear of carriageways and access points where possible and generally a minimum clearance of 1.0m should be provided around maintenance structures and MH's. Refer to NZS 4404:2010 for a list of acceptable MH's, Maintenance Structures and Terminal Maintenance Shafts.

4.13.2 Construction

Manholes must be constructed using a precast concrete base and precast concrete manhole risers Manholes may be constructed from alternative materials i.e. PVC/PE or GRP subject to the approval of the Manager.

Flexible joints must be provided upstream and downstream of the manhole. Refer to Standard Drawing 4.3. A circular manhole with minimum internal diameter of 1050mm must be used for pipes up to 600mm diameter. Where manholes are more than 5.0m deep they must be specifically designed to incorporate an intermediate landing platform or grill in order to prevent a free fall of more than 3.0m. All manholes must have heavy duty lids fitted with heavy duty frames and covers.

Where different sizes of pipes are built into a manhole their soffits must be at the same level.

All concrete manholes will be haunched as shown on Standard Drawing 4.3.

Step irons must be used in manholes where depth to invert is less than 5.0 metres. Where the depth to invert is greater than 5.0 m then a ladder is required.

Landings must be specified in manholes where the depths to invert exceeds 5.0m. The level of the top of the landing must be at least 2 m above the haunching level.

The grade across the invert of a manhole must not be less than the general grade of the sewer. Where a wastewater pipeline changes direction, a minimum additional fall must be provided as follows:

Table 4.5 Minimum Additional Fall due to Change in Direction

Change of Direction	Additional Fall
5° - 15°	25 mm
15° - 60°	50 mm
60° - 90°	75 mm

The grade of the incoming pipes must be similar to the invert of the manhole. Drop manholes will only be approved in exceptional circumstances and at the discretion of the Manager.

All joints between precast sections including the joint with the concrete lid must be sealed with an approved flexible sealant.

4.13.3 Flotation

In areas of high water table, all MHs must be designed to provide a factor of safety against flotation of 1.25.

4.13.4 Testing

Water testing must be required on all manholes. The test must be over 24 hours continuously and the drop in water level must not exceed 10mm over a one hour period. Manholes are to be rectified where water loss exceeds 10mm per hour and retested.

4.14 LATERAL CONNECTIONS

4.14.1 General

Each lot of a residential, business and industrial subdivision must conform to the following:

All connections are to be and remain easily accessible for future maintenance:

An approved plug, or cap of appropriate material must be installed on any inspection pipe and on the last pipe of the lateral connection and securely fastened;

A 75mm x 50mm marker painted white must extend from the top of the pipe to at least 300mm above ground level at the point where each lateral terminates within each lot;

An "L" must be cut into either the face of the kerb at a position "square off" the end of the lateral or into the top of the nib directly above the lateral;

Connections are not permitted onto any rising main or trunk wastewater main or at any location outside of the wastewater service areas;

Front lots on each side of an access may be connected to the wastewater drainage system in the access, provided the necessary easements are granted;

Rear lots must be serviced by a connection terminating in the accessway to the lot and not at the road boundary;

Business and industrial lots must be provided with individual laterals appropriately sized and to the approval of the Manager.

4.14.2 Gravity Lateral Connections

Each lot of a residential, business and industrial subdivision connected to a gravity system must conform to the following:

Be served by a minimum 110mm OD lateral connection or larger connection if design warrants to the wastewater drainage system;

The connection must be provided terminating at a point of 1.0m inside the boundary of each lot and be at such a level that wastewater can be discharged to it by gravity from any part of the building area of the lot, allowing for 500mm cover. Where the public pipeline runs through subdivision lots, the end of the lateral connection to the lot must be at least 1.0m from the pipeline;

Connections must be located to be able to service the lowest practical point for a dwelling;

Where the length of a lateral connection exceeds 6m from the public main to the boundary, the first pipe off the wastewater main must be an inspection pipe.

Up to five residential lots, with a maximum potential of 35 persons, may be serviced by a single lateral of 110mm OD. This lateral must be laid in an access or other location approved by the Manager and must have an inspection chamber or manhole at each junction and at the head of the line. Separate 110mm OD laterals must be provided to each lot, with each lateral covered by an easement, if required. Pressure Sewer System Lateral Connections.

Each lot of a residential, business and industrial subdivision connected to a pressure sewer system must have a pressure sewer system lateral connection, including a boundary kit, that is in accordance with the PNCC Pressure Sewer Design Standards.

4.14.3 Inspection

The Manager reserves the right to require any connections to be opened for checking purposes at the time of Final Inspection. All laterals required in a development must be completed before the Final Inspection.

4.15 PUMP STATIONS

4.15.1 General requirements

This section does not apply to the pumping equipment and chamber that forms part of the On-Property Pressure Sewer System Equipment in a Pressure Sewer System. Instead see the PNCC Pressure Sewer Design Standards.

The Developer must include pumping station details in the Development Concept Plan. Pumping Station will only be considered by PNCC when it can be demonstrated that a gravity solution is not practical.

The design of the pumping station shall meet the following objectives:

a) Design for safe working environment and minimise the requirement for access to confined spaces

b) Eliminate dry weather overflow and minimise risk of wet weather overflow caused by extreme weather conditions

c) Design for realistic response time in terms of redundancy

d) Minimise the total lifecycle cost (operation, maintenance, renewal and disposal) of the facility

4.15.1.1 Submission requirement

4.15.1.1.1 Engineering plan approval

Developers shall submit Engineering Plan as part of the engineering approval process. The design of pumping stations shall be carried out by engineers who are qualified and competent in the relevant field of expertise. Designs shall be reviewed and approved by Chartered Professional Engineer before submitting to PNCC.

The design shall be carried out in conjunction with the standard drawing 4.6, showing the typical layout that is expected for a pumping station. It is expected that the core requirements shall remain unchanged with design outcomes establishing the pipe sizes, fall/grade changes, chamber sizes, wet well size and depth, and storage tank dimensions.

The Engineering Plan shall include:

a) Pump station design check sheet (Appendix 8)

b) Design drawings

c) Pump system curve

d) Control levels

4.15.1.1.2 Commissioning

Commissioning work shall proceed after the following documentation has been provided and accepted by the Manager:

a) Preliminary as-built drawings

b) Electrical certificate of compliance (CoC)

c) Signed-off pre-commissioning test results of structures and pipework

d) Functional Description

e) Draft Operations and Maintenance (O&M) Manual

f) Commissioning plan

g) Applicable construction quality control signed off by the manager

The developer's commissioning plan shall include, but is not limited to:

h) Testing of all control system inputs and outputs (I/O's)

i) Wet well level sensors and height adjustment

j) Alarm status

k) Pump control units

l) Data logginManagerg and analysis

m) Remote control and data transmission (RTU and PLC checks)

n) Pump flow rates

During commissioning:

o) The developer must undertake the complete testing, pre-commissioning and commissioning of the electrical and telemetry equipment installed, witnessed by Development Engineer.

p) The works will be commissioned by operating the installation and simulating failures of all sensed conditions and demonstrating that the control system operates in accordance with the specified requirements.

q) Advise the Development Engineer two weeks prior to the expected pre-commissioning date, and cooperate with the engineer or nominated representative to allow witnessing of the tests.

Any non-conformance with this standard shall be corrected and re-tested.

4.15.1.1.3 Handover documents

PNCC shall take over the pumping station when all of the below documentations are finalised and supplied:

a) Provide and permanently install inside the cabinet door a laminated copy of the Operation and Maintenance manual. The Maintenance manual must incorporate the Electrical Control Manual supplied by the Contractor.

b) Final Functional Description (FD) supplied separately to the O&M manual. Supply two copies of the PLC and other relevant control system document on flash drives to the Manager.

c) Two copies (one copy is required to be laminated on site) of the electrical circuit drawings, equipment specifications, manufacturers information, as installed settings and commissioning results. Note: All control drawings must be completed with identified control cables and control conductors.

d) A certificate of compliance for the electrical installation and proof for independent inspection

e) Reduced pressure zone back flow prevention valve test certificate

f) Consents and compliance monitoring reports or codes of compliance where relevant

g) Testing and commissioning records

h) As -built information which specified in section 1.29. Design drawing sets, as-built drawings and survey data. Include the Telemetry connections on the as built drawings. Drawings must be provided showing dimensional details including pump clearances. Such drawings should be CAD quality and must be available on digital format (on flash drives).

4.15.1.1.4 Guaranties

a) The developer must guarantee the whole of the electrical equipment for a period of one year and must supply warranties to this effect.

4.15.1.2 Design lifetime

Pumping station structure shall allow for the following minimum design life

Asset Type	Design life (years)
Wet wells and storage tanks	100
Mechanical Equipment and Plant	20- 25
Pipework	100

Asset Type	Design life (years)
Electrical equipment	25
Control system	15
Valves and meters	30

4.15.2 **Design requirements**

4.15.2.1 **Wet well**

4.15.2.1.1 General design requirements

a) The design shall ensure that the structure is not affected by settlement, seismic movement or flotation movement.

b) Materials and fitting shall be constructed with approved corrosion resistant material i.e. Stainless steel 316 and GRP.

c) The walls and ceiling of the wet well should be painted with a white high build epoxy paint to assist cleaning operations and maximize the effect of lighting or equal approved light-coloured corrosion protection coating.

4.15.2.1.2. Size

The size of the wet well shall be determined to meet the following criteria:

a) A minimum four (4) hour period of average dry weather flow of storage capacity above the high-level alarm level shall be provided, unless separate storage is used.

b) The operating volume of the wet well shall be set to limit the number of pump starts to less than 8 per hour or as otherwise specified by the pump manufacturer

c) Allow sufficient submergence of the pump intake to prevent air from entering the pump as specified by the pump manufacturer.

d) Pump clearances shall be sufficient to allow maintenance access, flow passage to the pump intake and for the pumps to be raised without touching walls of other pumps. The side clearance from the centre of the pumps to the well walls shall be minimum 0.8 times the external pump diameter at its widest section

4.15.2.1.3. Access hatch

a) The access hatch shall provide a full clear opening over the discharge pipe bend and up to the external dimensions of the installed pump set. Hatches shall be tested to comply with AS3996 class B.

b) All access hatches shall be fitted with a hinged safety grille underneath the lockable access hatch. Safety grill shall be tested to comply with AS3996 class A

c) Products such as Austral International Safety Cover and BTS Davit base 30038 are acceptable.

d) Davit base shall be installed in the vicinity of access hatches. The site-specific location shall be approved by asset owner.

e) Fixed ladders should be avoided as it creates areas with the potentials for build-up, which may get ragged up and be more of a hazard than they are of assistance.

4.15.2.1.4. Additional storage

Additional storage shall be provided where the minimum average dry weather flow (ADWF) for the ultimate catchment of 4 hours cannot be contained within the wet well. The emergency storage shall be maintained between the high-level alarm and the high-high level alarm, unless otherwise approved by the asset owner.

Underground storage shall be designed to prevent flotation when the chamber is empty.

4.15.2.1.5. Guide rails and lifting

a) Guide rails shall be 316 stainless steel to suit the standard dimensions for the pump pedestal . A double guide rail shall be supplied for each pump to allow free sliding and correct seating for the specific pump model.

b) All mounting brackets and fixtures shall be stainless steel grade 316. The spacing of mounting brackets shall be such as to avoid deflection in accordance with the manufacturer's specification.

c) Lifting chains shall be stainless steel grade 316 and installed for each pump.

4.15.2.2 PUMPING SYSTEM

4.15.2.2.1. Hydraulic design

The hydraulic design shall consider the following parameters:

a) Invert level of the incoming wastewater

b) Pumping station volume capacity

c) Internal diameter, length, route and materials of the rising main, including surge and fatigue analysis

d) Levels and profile of the rising main

e) Level of the rising main discharge point.

f) No negative grade on the rising mains.

The system design shall be based on the total pumping head with design flows anticipated at ultimate wet weather inflows and used to develop the system curve. In deriving the system curve the static head shall be based on pump duty start level at 150mm below the invert level of the incoming wastewater pipe.

In calculating the system head losses, the effects of all bends and fittings beyond the pump discharge bend shall be allowed for, together with the rising main friction losses.

4.15.2.2.2. Pump selection

a) Pump selection shall be within ±5% of the pump best efficiency point (BEP), unless otherwise approved by the asset owner.

b) The minimum overall pump efficiency shall not be less than 50%. Lower efficiency may be considered in the following exceptional circumstances and shall be discussed with and approved by the asset owner:

i. Where pumping stations are very small, or

ii. The pump curve is very flat thereby consuming less power at intermediate flows, or

iii. The anticipation of excessive impeller clogging, and the associated maintenance outweighs the energy saving costs of selecting a more efficient impeller type.

4.15.2.2.3. Pump discharge connection

Outlet pipework from the pumps to the first flange inside the outlet valve chamber shall have external corrosion protection to withstand H2S levels of up to 50 ppm with a high abrasion resistance rating in excess of 100 years. All internal pipe work for pump chamber and valve chamber must be stainless steel 316 or HDPE, with a minimum pressure rating of PN10, and any other component valve or fitting shall have a minimum pressure rating of PN16.

4.15.2.2.4. Valves

Valves and fittings shall have provision to allow them to be removed without the need to cut pipes by using flange adaptors or dismantling joints.

Non-return valves

Non-return valves must be swing check type with a rubberised steel disc, unless otherwise approved by the asset owner.

Isolation valves

Valves must be metal seated knife gate valve. This valve must have a non-rising, flanged and extension spindle, and a valve key which allows the operation of the valve from the top of the pumping station ground level. Isolation valves shall be installed on each pump discharge line downstream of the non-return valves.

Air release valves

Where possible, should avoid negative grades on rising mains. For long rising mains approved air valves must be installed at all high points on the rising mains. Refer to NZS4404:2010 for details.

4.15.2.2.5. Valve chamber and flow meter

Valve chambers shall be separate from the wet-well and to provide adequate working room around the valves.

a) The chamber shall be isolated from the wet well to prevent H2S gas collecting in the valve chamber.

b) The rising main must be metered with a magnetic flowmeter situated within the pumping station site.

c) Products such as ABB or Krohne Flowmeter are acceptable to PNCC's existing specifications, unless otherwise approved by the asset owner.

d) The valve chamber shall be self-draining to the wet well through a check valve, with a minimum fall to the outlet to be 1 in 40

e) There should be minimum 6 times upstream pipe diameter distance and minimum 2 times downstream pipe diameter distance from any fittings

4.15.2.3 Outlet system

4.15.2.3.1. Rising main

Rising mains shall be designed and constructed to the same standards as potable water* pressure mains. Rising mains in private properties must be avoided.

(*in relation to drinking water, means water that meets the requirements specified in the drinking-water standards)

The design criteria for sizing the pump discharge pipework is as follows:

(i) Pipework diameter must be equal to or larger than the sphere clearance of the pump. The minimum diameter is 100 mm.

(ii) Pipework velocities for both initial and future flows must be within the range of 1 m/s - 3 m/s.

(iii) Wherever possible, the rising main shall be designed on a positive gradient avoiding high and low points, therefore minimising the need for air release and scour valves.

(iv) Each discharge pipe must incorporate an isolating valve and a non-return valve located upstream of the isolating valve. Refer to Standard Drawing 4.6.1

4.15.3 Pumping station site

The pumping station must have its own free lot provided exclusively for the purpose of housing the station and all related structures and equipment. Where the access is a right-of-way shared with other lots the station site must be of sufficient size to provide a parking space for service vehicles that does not obstruct the right-of-way

It is important that the developer considers the serviceability of the pumping station site early in the design process. The pumping station general site layout shall have:

a) 24hour all-weather vehicle access, adequate parking and an adequate turning area within the pumping station boundary.

b) Adequate clearance around the wet well, inlet manhole, storage well and valve chambers to allow service vehicle access, lifting of equipment and parts and general serviceability of the pumping station.

c) The site access road shall comply with PNCC Engineering Standards for Land Development-Roading. Where required (typically at the end of a right-of-way) an adequate vehicle turning area shall be provided within the site. The access road shall have a load bearing sealed width of minimum 3.5m.

d) Both the vehicle access from the kerb to the boundary and internal access and the work maintenance area is to be concreted with 20Mpa, 150mm thick with one layer of 665 mesh placed centrally.

e) Dedicated underground mains power supply.

f) A freestanding weatherproof control cabinet to house electrical equipment as specified in the PNCC electrical and control standards.

g) A minimum 1.8m high fence, with 3.0m wide lockable security gate is required.

4.15.3.1 Telemetry

A telemetry link compatible with the Council's telemetry system must be installed to provide alarm and operational data to the Council's master unit. The transmitter unit must be capable

of operation from the supply provided in the cabinet. The range of data to be included in the telemetry system must be approved by the asset owner prior to installation. This needs to be referred to the PNCC asset owner for pump station electrical supply cabinet specifications.

4.15.3.2 On site service

Drainage

The site shall have adequate drainage and fall with minimum 1 in 40, to prevent standing or ponding water and prevent inflow into the station and cabinets. Overland drainage shall not affect neighbouring properties and may require a storm water system to be installed for discharge to a suitable location.

Water supply

A metered 25mm water supply with reduced pressure zone backflow preventer (RPZ) must be installed to allow for wash-down of the wet well and storage tank. The supply shall be fitted with a tap connection with ¾" BSP thread to allow fitting of a hose.

Lighting

Where considered an operational requirement or for safety reasons, site lighting may need to be required by asset owners

The position must be such as to provide adequate lighting over the wet well at a level that will not have obstructive and obtrusive effects. The lighting shall be adequately controlled to prevent annoyance to the adjacent properties. The light switch shall be situated inside the control cabinet.

4.15.4 Private pumping facility to gravity network (pump up)

Where development is approved to allow private pumping facilities, each residential lot must have its own pumping facility placed within the allotment.

The Manager must require that a consent notice be registered against the title of the property stating that a private pumping facility is required for connection to the public wastewater drainage system.

Where a private pumping facility is provided, a connection chamber must be provided at the head of the rising main that is to be approved by the Manager. Each connection must incorporate a boundary connection kit in accordance with Standard Drawing 4.10 of these standards located at the property boundary or other approved point of discharge.

4.16 ONSITE TREATMENT AND DISPOSAL

All onsite disposal systems must be specifically designed to suit the location. All designs must be in accordance with Horizons Regional Council's document 'On-site Wastewater Systems, Guidelines for the Manawatu-Wanganui Region'.

The Developer must advise of the requirements including initial design criteria and site suitability to use onsite disposal systems at the time of submitting the Development Concept Plan. Detailed design plans must be submitted for engineering approval. All systems will require the approval of the Manager.

4.17 PRESSURE SEWER

Pressure sewer design, construction and testing shall be in accordance with the Councils Pressure Sewer Design Standards and Pressure Sewer Policy (can be found on the PNCC Website).

5 WATER SUPPLY

5.1 INTRODUCTION

Part 5 sets out requirements for the design and construction of drinking water supply systems for land development and subdivision. It covers the design of both the localised reticulation system and the lager distribution network.

In addition to the requirements of this section of the Engineering Standards, water supply must meet the requirements of the following:

- Health Act
- Health (Drinking Water) Amendment Act 2007
- SNZ PAS 4509 The Code of Practice for Fire Fighting Water Supplies
- Palmerston North City Council Water Supply Development Plan
- Palmerston North City Council Water Supply Bylaw
- Palmerston North City Council Water Supply Mains Disinfection Code of Practice
- NZS 4404:2010 Land Development and Subdivision Engineering.
- Palmerston North City District Plan.
- Palmerston North City Council Water Supply Asset Management Plan

5.2 OBJECTIVES

The objectives of this section are to:

- Ensure that the water reticulation system is functional and that the required quality and quantity of water is supplied to all customers within the Councils designated water supply area, and that the Councils requirements are satisfied. In designing a water reticulation system, the designer must take into account:

    A. The Councils policies, customer charters, and contracts;
    B. The hydraulic adequacy of the system;
    C. The ability of the water system to maintain acceptable water quality;
    D. The structural strength of water system components to resist applied loads;
    E. The requirements of SNZ PAS 4509;
    F. Environmental requirements;
    G. The environmental and community impact of the works;
    H. The ‘fit-for-purpose’ service life for the system;
    I. Optimising the ‘whole-of-life’ cost; and
    J. Each component’s resistance to internal and external corrosion or degradation.

- The design must ensure an acceptable water supply for each property including fire flows, depending on Council's Water Supply Bylaw, Water Supply Asset Management Plan (AMP), any conditions of consent on Council's water take and any other relevant Council Policy by providing either:
    A. A water main allowing an appropriate point of supply to each property; or
    B. A service connection from the main for each property.

5.3 GENERAL REQUIREMENTS

Design and construction of the water system must be in accordance with NZS 4404:2010 except where modified by the provisions of these Standards and must be such that a water supply connection can be readily provided to each allotment.

The Developer must provide mains and services to each residential, business or industrial lot. Where new connections off an existing main are required, the Developer must pay for the application fee, physical construction, pressure test, disinfection (including lab test) cost for new connections, including backflow prevention facilities, valves, manifolds and meters if applicable. Where an existing water service passes through any new lot being created, the Developer must provide and pay for a new service located in a position approved by the Manager. Where any existing buildings are demolished or removed as a result of the development, the existing water tobies must be removed and the existing connections must be disconnected from the main at the developer's expense.

It is at the Manager's discretion whether the existing water connections and tobies (manifolds) are suitable for the development and the developer must meet the cost if any replacement is required.

Any existing water pipe (for example to a hose tap or detached building) crossing any proposed boundary between lots must be disconnected by the Developer.

The connection of new works to an existing water supply reticulation must be carried out by an approved waterworks contractor at the Developers cost. A list of the approved waterworks contractors is available from the Council.

5.3.1 Design Life

All water supply systems must be designed and constructed for an asset life of at least 100 years, except components such as backflow preventers, manifolds, pumps, metering, control valves, and control equipment may require earlier renovation or replacement.

5.3.2 Structure Plan

The Council may provide a structure plan setting out certain information to be used in design, such as flows, sizing, upstream controls, recommended pipe layout, or particular requirements of the Council. Where a structure plan is not provided, the designer must determine this information by investigation using this Standard and engineering principles.

5.3.3 Future Development

Where further subdivision, adjacent to the one under consideration, is provided for in the district or regional plan, the Council may require water supply infrastructure to cater for future development. Refer Clause 1.9.

5.3.4 Rural or Rural Residential Development

Generally Council will not provide a public water supply service to properties zoned as Rural and Rural-Residential in the District Plan.

5.3.5 Business and Industrial

In Industrial developments, a water connection is not required to be installed to each lot at the time of the development construction.

5.3.6 Metered Services

Refer to the Palmerston North City Council Water Supply Bylaw

Water meters must be approved by Council before installation.

5.4 STANDARDS

The following Standards and Codes of Practice are referred to in this part. The design, materials and method of construction must comply with these Standards and Codes as applicable.

The Standards used must incorporate the latest amendments. Standards superseding those listed and the latest version must automatically apply.

AS1628	Water Supply – Metallic Gate, Globe and Non-Return Valves
AS 1831	Ductile Cast Iron
AS 3571/AS 3572	Glass Filament Reinforced Thermosetting Plastics (GRP) Pipes – Polyester Based – Water Supply, Sewerage and Drainage Applications
AS/NZS 1477	PVC Pipes and Fittings for Pressure Applications
AS/NZS 2280	Ductile Iron Pipes and Fittings
AS/NZS 2566	Buried Flexible Pipelines – Structural Design and Installation
AS/NZS 4129	Fittings for Polyethylene (PE) Pipes for Pressure Applications
AS/NZS 4130	Polyethylene (PE) Pipes for Pressure Applications
AS/NZS 4131	Polyethylene (PE) Compounds for Pressure Pipes and Fittings
AS/NZS 4158	Thermal-bonded Polymeric Coatings on Valves and Fittings for Water Industry Purposes

AS/NZS 4765	Modified PVC (PVC-M) Pipes for Pressure Applications
AS/NZS ISO9001	Quality Management Systems - Requirements
BS 381 C	Specification for Colours for Identification, Coding and Special Purposes
SNZ PAS 4509	Code of Practice for Firefighting Water Supplies
NZS 4404:2010	Land Development and Subdivision Engineering
NZS 4442	Welded Steel Pipes and Fittings for Water, Sewage and Medium Pressure Gas
NZS 4501	Code of Practice for the Location Marking of Fire Hydrants
NZS 7643	Code of Practice for the Installation of Unplasticised PVC Pipe Systems
NZS/AS 2033	Installation of Polyethylene Pipe Systems
NZS/AS 2638	Gate Valves for Waterworks Purposes – Resilient – Seated
NZS/AS 4087	Metallic Flanges for Waterworks Purposes
NZS/BS 750	Specification for Underground Fire Hydrants and Surface Box Frames and Covers
WSA107	Tapping Bands
AS/NZS 4793	Mechanical Taping Bands for Water Works Purpose
AS/NZS 4411	Orientated PVC (PVC-O) Pipe for Pressure Application
NZS 4552	Underground Fire Hydrants
WSA 03	Water Supply Code of Australia – 1999 and 2002
AS/NZS 3500	Plumbing and drainage
AS/NZS 4020	Testing of products for use in contact with drinking water
AS/NZS 4020 - Part 1:2003	Testing of products for use in contact with drinking water - Water service

5.5 DESIGN REQUIREMENTS

Design and working delivery pressures including variations in pressure must be in accordance with the Council's promised Levels of Service set out in the current Water Supply Asset Management Plan (AMP) and any future changes indicated in the AMP.

Water mains must be designed with sufficient capacity to cater for all existing and predicted development within the area to be served and to meet the fire fighting water supply requirements of SNZ PAS 4509.

The water demand allowance in the subdivision must include provision for:

(a) Population targets

(b) The area to be serviced

(c) Individual properties proposed by the developer

Adjustment may be required to cater for the known performance (demand-based flows) of the existing parts of the water system.

The water demand for business and industrial areas or for irrigation must be analysed and specifically allowed for in the design. Assessed flows are to be to the approval of the Manager. Such uses constitute extraordinary supplies as defined in the Water Supply Bylaw 2015 and any amendments. The provision of initial or continuing supply is at Council's discretion. However, the minimum pipe size must be 150mm diameter.

Council may provide details of the working pressure or pressures at the point or points of connection to the existing reticulation, in which case these may be used for design guideline; however the impact as a result of future development and Council agreed Level of Service must be taken account. The Developer must provide calculations to demonstrate how the water main sizes as proposed on the engineering plan have been determined.

All pipe sizes are nominal diameter (DN). Internal diameter (ID) and outside diameter (OD) must be specified.

5.6 SYSTEM DESIGN

5.6.1 Network analysis

Where required by the Council, a network analysis of the system must be undertaken. The system must be analysed using a mathematical model of the network to ensure adequate water supply is available to all consumers connected to the system for all defined modes of operation. The analysis must include all elements within the system and must address all demand periods including peak demand, low demand flows, and fire flows.

The demand (for public water supply) for business and industrial areas or for irrigation must be analysed and specifically allowed for in the design. Assessed flows need the approval from Council. Such supplies are defined as extraordinary supplies in the Water Supply Bylaw. The provision of initial or continuing supply is at the Council's discretion.

5.6.2 Peak flows

The design parameters for PNCC water supply pipe sizing are:

Average day demand = 290l.day/person

Household occupancy rate = 2.9 person /household

Peak Day Demand (over a 12-month period) = Average Day Demand x PF

Unless specified otherwise by the Council:

(a) PF = 1.5 for populations over 10,000;
(b) PF = 2 for populations below 2,000.

Peak Hourly Demand = Average Hourly Demand (on peak day) x PF
(over a 24-hour period)
Unless specified otherwise by the Council:
(a) PF = 2 for populations over 10,000;
(b) PF = 5 for populations below 2,000.

5.6.3 Minimum water demand

The minimum peak domestic demand must be specified by the Council, or:
(a) Daily consumption of 250 L/p/day;
(b) Peaking factor of up to 5;
(c) Firefighting demands as specified in SNZ PAS 4509;

5.6.4 Pressure zones

There are 5 pressure zones in Palmerston North City namely:

- Main City zone.
- Main Aokautere zone (including Linton).
- Lower Aokautere zone (including Clifton Tce and Willliams Tce).
- Kelvin Grove (upper) zone.
- Kelvin Grove (lower) zone
- The extent of the pressure zones refers to the PNCC Water Supply Asset Management Plan.

5.6.5 Kelvin Grove Zones

The water sources for Kelvin Grove Zones are from two bore stations via bore pumps. There is no storage to compensate the demand fluctuation. To prevent from over working the bores, the peak water demand from an individual connection should not exceed 30 cubic metres per hour.

5.6.6 Design pressure

The design pressures are the limiting pressures for operation of a pipeline system including any allowance for variation of usage in the future.

The current minimum design pressure at the point of supply (at peak flow rate) is 350kPa .

Unless otherwise specified by the Council design pressure must be between 350 kPa and 800 kPa (35 m to 80 m).

5.7 SYSTEM LAYOUT

Water mains are usually located in the road. A principal water main of not less than nominal internal diameter (DN) 100mm, fitted with fire hydrants, must be laid on one side of all public roads and no-exit roads in every residential development. A 50mm NB rider must be laid along the road frontage of all lots not fronted by the principal main. A 50mm NB rider main must also be provided for service connections where the principal main is DN 250 or larger. Rider mains must be supplied from the principal main at both ends. The principal mains serving commercial and industrial areas must be at least DN 150 laid on both sides of the road. This requirement may be relaxed in short no-exit roads as long as firefighting coverage and capacity meet the requirements set in this document.

For the general location of the water mains and rider mains refer to Standard Drawing 5.1. Water mains and rider mains must be located 450mm behind the kerb face unless approved by Manager.

Water supply pipelines must not be laid in the same trench as wastewater drainage or stormwater drainage nor pass through manholes. The trench may be widened to accommodate gas. Service pipes and services in accesses may be laid in a common trench provided the required clearances between services are maintained.

Network layouts must be established in accordance with Council practice. Interconnected ring systems should be provided when feasible.

Water mains should:

A. Be aligned parallel to property boundaries;
B. Not traverse steep gradients if possible;
C. Be located to maintain adequate clearance from structures and other infrastructure;
D. No building is allowed over the Council owned water mains

5.7.1 Mains layout

In determining the general layout of mains, the following factors must be considered:

(a) Main location to allow easy access for repairs and maintenance;
(b) Whether system security, maintenance of water quality, and ability to clean meet operational requirements,
(c) Location of valves for shut-off areas and zone boundaries (see NZS 4404:2010, Section 6.3.14);
(d) Avoidance of dead ends by use of looped mains or rider mains;
(e) Provision of dual or alternate feeds to minimise service risk;
(f) Principal mains laid in cul-de-sacs must be carried through the adjoining lot or lots by way of easements or access ways and must be connected to a principal water main in another street. The minimum size of such through mains must be DN100. In addition, principal mains in cul-de-sacs must be ring-mained within the cul-de-sac length with a water main of DN50 or greater;
(g) Dead end mains must only be used for servicing up to six rear residential lots;
(h) Principal and rider mains must be laid after the placement of kerb and channel. 450 mm behind the face of the kerb, unless approved by the Manager;

(i) Where the alignment is governed by the street boundary, the water mains must be laid with reference to permanent land transfer pegs or temporary boundary marks placed by the registered surveyor responsible for the final land transfer pegging;

(j) The alignment of water mains may be governed by a kerb line only when the setting out of the kerb line with reference to the land transfer pegs is verified and confirmed by the surveyor;

(k) All water mains must generally be laid in straight lines. When water mains are laid on curves, the degree of deflection at joints must not exceed the manufacturer's recommendation;

(l) Laying tolerances for both horizontal and vertical alignment must be no more than 50 mm on straight streets, and up to 100 mm on curves. The Developer must rectify any tolerances exceeding the maximum allowable to the satisfaction of the Manager. For pipes installed by directional drilling, cover and alignment must be plus 100mm of that used for pipes installed by open excavation;

Design layout refer to Standard Drawing 5.1 & 5.2

5.7.2 Water mains in private property

Water mains located within private property will require an appropriately sized and registered easement in accordance with the Council's requirements.

Note: An easement over private property is not the preferred option and may only be used as a temporary solution for landlocked subdivisions pending future permanent supply within a road. A typical situation where the Council may approve water mains in easements is a fire main in a right of way.

5.7.3 Water mains near trees

Locating water mains within the root zone of trees should be avoided if possible. Where this is not practicable, careful attention to pipe material selection is necessary to minimise risk of pipe failure due to root growth. Extreme caution needs to be taken to avoid any damage to the trees.

5.7.4 Shared trenching

Where shared trenching is approved by the Council and utility service owners, a detailed design must be submitted for approval by those parties and must include with the details set out in NZS 4404:2010.

Where approved by the Council and utility service owners, shared trenching may also be used for property service connections.

5.7.5 Rider mains and duplicate mains

A rider main must be laid along the road frontage of all lots not fronted by a principal main. Rider mains must have a maximum length of 200m and must service up to a maximum of 20 dwelling units. Minimum 350kPa working pressure must be maintained at all times. The Developer must consider a larger diameter rider main take-off from the principal main on the boundaries of staged development with future development sites to compensate for pressure loss.

Valves must be installed in locations as shown on Standard Drawings 5.1 and 5.2.

Duplicate mains are required in the following cases:

(a) Arterial roads or roads with a central dividing island;
(b) Roads with split elevation;
(c) Roads with rail or tram lines;
(d) Urban centres;
(e) Parallel to large distribution mains that are not available for service connections;
(f) Commercial and industrial areas nominated by the Council;
(g) Where required by SNZ PAS 4509.

5.7.6 Trunk mains

Pipelines over DN200 are classified as trunk mains. Connections will only be permitted with the approval by the Council. Where a trunk main passes along the frontage of or through a subdivision, an additional principal or rider main must be installed to allow individual lot connections.

5.7.7 Crossings

Water main crossings of roads, railway lines, and underground services must, as far as practicable, be at right angles. Mains should be located and designed to minimise maintenance and crossing restoration. The Council may require extra mechanical protection for the pipes or different pipe materials to minimise the need for future maintenance.

5.7.8 Crossings of waterways or reserves

All crossings of waterways or reserves must be specific designs to suit the Council's requirement. Crossings must, as far as practicable, be at right angles to the waterway or reserve. Reference should be made to the Council to establish whether it prefers elevated crossings or below waterway invert crossings. When the pipeline is placed under the invert level of a waterway it may require mechanical protection by concrete encasement or steel or other acceptable pipe duct. Different pipeline materials may need to be used for the crossing.

5.8 CLEARANCES

Details refer to NZS 4404:2010 Clause 6.3.9 and Table 6.4 and 6.5.

5.9 MATERIALS

All parts of the water supply system in contact with drinking water must be designed using components and materials that comply with AS/NZS 4020.

5.9.1 Standard and minimum pipe sizes, pressure class and, design pressure

5.9.1.1 Standard pipe sizes

The principal main must be standardised as DN 100, 150, 200, 250, 300, 375, 450, 525, 575, or 600 mm nominal diameter only. When larger pipes are required the exact diameter will be determined by the Council.

5.9.1.2 Minimum pipe sizes

Minimum pipe diameters must be as follows, where DN is the nominal pipe diameter:

(a) DN50 for rider mains in residential zones;

(b) DN 100 for residential zones;

(c) DN 150 for industrial or commercial zones.

The Council may also specify minimum pipe diameters for other identified areas such as CBDs.

5.9.1.3 Pipe PN class (Pressure rating)

Pipe PN class is selected on the basis of the design pressure (head) calculated for the various sections of the reticulation network. This may be varied by specific operational requirements specified by the Council.

5.9.1.4 Design pressure

The design pressure (head) for the mains must be based on NZS 4404 Clause 6.3.10.3.1.

5.9.2 Minimum PN for pipes and fittings

The minimum pipe PN to be used for water reticulation mains must be PN 12. The minimum fitting PN must be PN 16. Designers must verify the Council's minimum requirement before specifying the required pipe PN.

5.9.3 Principal mains and rider mains

The following pipes must be used for principal mains and rider mains and comply with the relevant New Zealand or Australian Standards:

a. PE 80 Type B (Medium density PE) AS/NZS4130

b. PE 100 (High Performance PE) AS/NZS4130

c. Ductile Iron pipe AS/NZS2280

Other pipes may be acceptable for particular applications however this needs to be agreed by the Council:

a. MPVC AS/NZS4765 (Series 1 or Series 2 sizes)

b. PVC-O Pipes and fittings – AS4401

c. Other materials, epoxy coated e.g. concrete lined steel pipe meeting relevant standards

Pipes of differing compositions must not be mixed within a common pipe length, (i.e. valve to valve).

5.9.4 Medium Density Polyethylene (MDPE) Pipe

Medium density polyethylene pipe and fittings must comply with AS/NZS 4130 (Series 1) and AS/NZS 4131 in all respects. Pressure rating will be PE80 PN12.5 SDR 11 or greater.

All MDPE pipe must be coloured blue.

5.9.5 PVC Pipe

Modified PVC (mPVC) pipe must comply with AS/NZS4765 Series 1 or Series 2 in all respects. The minimum pressure rating must be PN12. The pipe must have the following identification: Size (DN) Pressure rating Manufacturer Year, month, and day of manufacture Blue in colour.

5.9.6 PVC-O Pipe

Orientated unplasticised poly (vinyl chloride) (PVC-O) pipe must comply with AS 4441 Series 2 in all respects. The minimum pressure rating must be PN12.5. The pipe must have the following identification: Size (DN), Pressure rating, Manufacturer, Year, Month and Day of manufacture, Blue in colour.

5.9.7 Pipe fittings

Ductile Iron

All ductile iron fittings must be manufactured to AS/NZS 2280. All ductile iron fittings must be nylon coated inside and outside. Nuts and bolts must be made from 316 Stainless Steel. A nickel or molybdenium based antigalling lubricant must be used.

“Gibault” Type Joints

Must be either cast iron from an approved manufacturer with a thermally bonded coating to AS/NZS 4158 Part 1, and be fitted with approved rubber rings and 316 Stainless steel engineered nuts and bolts, or Viking Johnson couplings or Victualic Joints maxifit couplers. All buried bolted joints, Gibaults etc. must be either wrapped in two layers of Denso Tape or nylon coated. The Manager may approve other types.

5.9.8 Service valves

Valves DN >25 must be AVK or Hawle valves, resilient seated, Nylon coated with minimum class PN16. In-line valves must be the same diameter as the reticulation main. All valves must comply with AS/NZS2638.

Sluice Valves

Must comply with AS/NZS2638. They must be standard waterworks pattern, double flanged or double spigot with non-rising spindle. All sluice valves must be anti-clockwise closing and have a 16 Bar pressure rating. If flanged valves are used then flanges must be to AS/NZS4087 Table D. All bolts and washers to be 316 stainless steel. The valves must be flanged when laid next or in close proximity to other cast iron or ductile iron fittings. All sluice valves must be resilient seated. All surfaces of the body of the valve (inside and out) must be nylon coated or have a similar thermally bonded coating system in accordance with AS/NZS 4158 Part 1. The manufacture of the body must be from ductile iron, conforming to AS1831.

Gate and Manifold Valves

All valves used in 50mm NB rider mains must constructed as per AS1628. Valves in 50mm mains and service connections must be manifold valves. Gate valves must be forged brass to BS5154:1991 with a non-rising stem and be of approved manufacture. Manifold valves must be Gunmetal or dezincification resistant brass to BS 1400-LG2 approved manufacture, (Davies Shepard, Aquaflo or other types as approved by the Manager).

5.9.9 Fire Hydrants

Must comply with NZS/BS 750 and be of the tall pattern, screw down type. They must be clockwise closing, nylon coated, blue in colour, resilient seated and the valve face must be nitrile rubber coated. Frost plugs must not be fitted, or alternatively the plug must not be free draining. All bolts are to be 316 stainless steel.

The sealing cup washer must be of polyurethane (or nitrile rubber for high performance hydrants), and the gland seal must be either of braided PTFE yarn or a minimum of two captive ‘O’ sealing rings.

Valve body and bonnet components must have a thermally bonded coating system in accordance with NZS/AS 4158 Part 1.

The screwed outlet must be fabricated of LG2 gunmetal and secured to the body of the hydrant by at least two bolts.

Surface Boxes and Underblocks

Hydrant, valve and toby surface boxes and underblocks must be of a pattern approved by the Council. Toby boxes must be Draper (or other types as approved by the Manager) universal heavy-duty surface box with “water” embossed in a blue lid. A strip of metal must be attached to the underside of the lid and attached to the box by galvanised chain. The top of hydrant boxes must be painted yellow and the top of valve painted white. Carriageway marking of fire hydrants to comply with NZS 4501. - (see Standard Drawings 5.4 and 5.5). Hydrant boxes must be CI heavy duty type with minimum opening dimensions of 220mm x 380mm. The CI box lid must comply with the NZ Fire Service Code of Practice for fire fighting supplies and NZS/BS 750.

Valve and Hydrant Markers

Valves and hydrant markers must meet the requirements of Standard Drawing 5.4 and 5.5

5.9.10 Service connections

Domestic service connection pipes must be blue or predominantly blue PE 80 of minimum size 20mm NB DN25 PN12.5 AS/NZS 4130. The size of the pipes must depend on the pressure available in the water main and the water demand of the property connected.

Only approved water supply fittings and pipe inserts must be used and jointing must be carried out in accordance with the manufacturer's instructions.

Appropriate PTFE tape or Loctite 567 or 592 must be used with threaded joints to ensure leak free connection.

For new connections to live public watermains, electrofusion parts must be avoided due to the risk of compromising the welds with residual water within the mains. Mechanical fittings must be used for all connections from new developments to live watermains.

5.9.11 Tapping band and ferrules

A tapping band, ferrule and flow preventer must be used for each connection to either a principal or rider main up to 100mm diameter. For connections to mains exceeding 100mm diameter, a gibault joint with 50mm vertical take-off and 90 degree bend must be used.

Tapping bands must be manufactured to WSA107.2001 from D/R copper alloy and must comply with the following:

- Bolts and nuts must be manufactured from D/R copper alloy or 316 Stainless Steel;
- Bolts must be positioned such that the nut is tightened from the top;
- Bands must have a nitrile rubber sealing ring, secured in a recess rated to 12 Bar;
- Tapped hold must have a standard BSP thread.

5.10 PREVENTION OF BACKFLOW

Developers must meet the backflow prevention requirements set out in the PNCC Water Supply Bylaw and Water Supply Bylaw Administration Manual . This will in most cases require backflow prevention at the boundary.

Non-testable double check valves are required for domestic users. Testable double check valves or RPZs may be required for commercial and industrial sites at the Councils's discretion on the basis of the levels of potential risk.

Drinking water supply systems must be designed and equipped to prevent backflow. The location and operation of hydrants, air valves, and scours must ensure no non-potable external water enters the system through negative pressure.

Some properties may require further backflow prevention within the property boundary under the New Zealand Building Code Clause G12 Water Supply specifies the definitions of the hazard levels and examples. Where there are discrepancies between the levels of backflow prevention stipulated, the highest level of protection indicated must be installed.

Backflow prevention should be located as close to the boundary as practicable, with no take-offs between the point of supply and the backflow preventer.

Only backflow preventer from the PNCC approved product list may be installed.

5.11 FIRE FLOWS

The water reticulation system must be designed to comply with SNZ PAS 4509 and Palmesrston North City Council level of service for the firefighting water supply.

5.11.1 Fire protection services

Many commercial and industrial developments require installation of special fire protection services. While it is the responsibility of the site owner to provide these fire services, the developer must design the water reticulation system to meet the required demands, pressure and in some cases storage where these are known in advance. The Council maintains a minimum pressure at the PoS according to the Levels of Service specified in the PNCC Water Supply Asset Management Plan. This pressure should be used for design.

The developers may need to provide the firefighting storage and the firefighting flowrate over and above the Council Level of Service for commercial and industrial users.

5.12 ALTERNATIVE WATER SUPPLY

The existence of alternative water supplies such as bores, rainwater tanks and piped irrigation supplies is to be notified.

5.13 RAINWATER TANKS

For details refer to 6.7.1.5. Rainwater Tanks of the Standards.

The water from rainwater tank is only allowed for non-potable uses such as toilet flushing and watering the garden. No connection is allowed between the Rainwater Tank water and potable water.

5.14 STRUCTURAL DESIGN

For details refer to NZS 4404:2010 clause 6.3.12.

5.15 CONSTRUCTION

5.15.1 Embedment

Refer to Standard Drawing 5.6 for pipe laying details.

Minimum pipe cover

Cover over pipelines must conform with Table 5.3. Cover must be measured from the finished ground surface level of the development.

Table 5.3 Cover Required over Pipelines

Item	Cover
Mains under carriageways	1000mm – 1500mm
Mains under berms and footpaths	750mm – 1000mm
Rider mains under carriageway and berms	750mm – 1000mm
Hydrant spindles	75mm – 225mm
Valve spindles	75mm – 400mm
Service pipes under carriageways	750 mm – 1000mm
Service pipes under berms and footpaths	600mm – 750mm
Service pipes at street boundary	300mm
Other areas	600mm

Where the Council does not have specific requirements, the minimum covers as described in AS/NZS 2566.2 may be used.

Trench width

Trench widths must conform to the following table but may be widened to accommodate gas and telecommunications. Refer to Standard Drawing 5.6 for trench details.

Table 5.2 Width of Trenches

Nominal Pipe Diameter	Trench Widths
20 mm - 100 mm	D + 300 mm
150 mm - 200 mm	D + 300 mm
250 mm - 300 mm	D + 300 mm

Detector tapes

All pipes must have approved metallic detector/warning marked "Buried Water Line Below", laid 150mm to 250mm below the finished ground surface immediately above the pipe/service line continuously throughout the length of the entire pipe. The letter should be at least 40mm height in size and the repeat spacing should be less than 4.0metres length.

5.15.2 **Pipeline restraint**

Anchorage must be provided at bends, tees, reducers, valves, and dead ends where necessary.

For details of the thrust blocks, anchor blocks and constrained joint water mains refer to NZS 4404:2010 clause 6.3.12.11.

All thrust block design and positioning must be approved by the Council prior to pouring of concrete. The design and positioning of the thrust blocks must include the following:

- the location of the block does not impede water main fittings
- the thickness of the inner face of the block must be greater than the diameter of the fittings
- concrete strength must be minimum 17.5kPa after 28 days
- block must bear against undisturbed ground
- protective membrane is to be placed between the pipe surface and concrete to deter abrasive damage.

Refer to Standard Drawing 5.6.1

When a watermain has to traverse gradients steeper than 20%, an anti-scour/slip structure needs to be designed and approved by the Manager or their representative prior to installation .

Note: In-line valves, especially those DN 100 or larger, should be anchored to ensure stability under operational conditions. See Standard Drawings 5.4, 5.5, 5.6.1 and 5.7 for details.

5.15.3 Pipe laying and joining

Bedding and trench details for all pipelines must be in accordance with the relevant Standards and the manufacturers recommendations.

PE watermains and ridermains

- All Ridermains must be 50mm diameter (NB) and must be jointed using mechanical fittings conforming to AS/NZS 4129.
- Watermains 100mm diameter and larger must be jointed using Butt Welding or Electrofusion technique. Both these techniques require appropriately trained/certified personnel approved by the Council.
- PE watermains must be installed in accordance with AS 2033 – Installation of Polyethylene Pipe System and AS/NZS 2566.2

PVC watermains

- Solvent (glued) joints are **not** permitted.
- PVC watermains must be installed in accordance with "AS/NZS 2566.2 - Buried Flexible Pipelines Part 2: Installation and AS/NZS 2032 – Installation of PVC Pipe Systems.

All pipes must be inspected prior to laying and defective pipes marked and removed from the site.

The internal bore of pipes and fittings must be inspected and foreign matter removed prior to laying. After laying, suitable temporary caps must be placed over all openings to avoid ingress of deleterious matter.

Joining pipes and fittings must be in accordance with the manufacture's instructions. A record of PE pipe welding and testing shall be kept and provided to the Manager. Joint lubricant is to be used where recommended.

5.15.4 Backfill and Compaction

No backfilling must be done prior to approval by the Manager .

Bediing material grading must be as described in Table G.1 of AS/NZ 2566.2 for PVC pipes. If the excavated material cannot meet the specified grading, imported material must be used.

AS/NZ 2566.2

Table G1: Grading Limits for Acceptable Embedment Material

Sieve Size, mm	Mass of samples passing, percent
19.0	100
2.36	50 to 100

0.6	20 to 90
0.3	10 to 60
0.15	0 to 25
0.075	0 to 10

Note:
1. For non-plastic fines otherwise <5%

The backfill material above the bedding under the Road Carriageway and Footpath, must be well graded AP65 granular material. Trench excavated material can be utilised for backfill in the berm area if it is free of organics and other deleterious material.

Compaction equipment, the number of passes and the thickness of the layer to be compacted shall consider the material to be compacted and the underlying pipe. The compaction shall not cause any loading or pressure transfer to the pipe that could cause damage to the pipe or its alignment.

Clegg hammer can be used for compaction verification of non-granular trench backfill material. NDM testing must be undertaken to verify Clegg compaction results. NDM is the only acceptable method for compaction testing and verification of granular backfill or pavement materials.

For non-granular trench backfill compaction shall achieve the following standard:

	Carriageway	Footpath	Berm
Trench Backfill	CIV 25	CIV 20	CIV 15

Note:
1. CIV is the Clegg Impact Value
2. Clegg hammer testing shall be undertaken by a suitably trained person utilising a calibrated Clegg Hammer

The compaction testing regime must be carried out as outlined below:

e. for Trenches in Carriageways or under Footpaths, tests at a rate of at least one test per layer of backfill per 15m of Trench with a minimum of two tests;
f. for Trenches in Berms, tests at a rate of at least one test per layer of backfill per 30m of Trench, with a minimum of two tests;
g. where the excavated area is greater than 0.5m2 and less than 5m2, tests at a rate of one test per backfill layer or, for larger excavations, one test per 5m2;
h. all test locations must be uniformly spaced in the pavement;

Also note that:

- Subject to satisfactory test results the above frequency of testing may be reduced with the prior agreement of the Manager;
- The Clegg hammer may be used for testing of trench backfill but not for the carriageway pavements layers (i.e. subbase and basecourse). Refer to the roading section for pavement testing.

5.15.5 Flow Testing of Pipes

The completed water supply reticulation must be flow tested by the Developer in the presence of the Manager or their representative. Where flows and/or pressures do not meet the approved design values, the Developer must undertake the necessary works to achieve the approved design criteria.

5.15.6 Pressure testing of pipes

All pipes and services must be tested by the developer in the presence of the Council engineer or their representative.

Pipe pressure testing must comply with the Palmerston North City Council Water Supply Mains Pressure Testing Code of Practice and must be carried out by an approved person.

Prior to Testing

(a) The pipeline must be sufficiently backfilled to ensure it does not move during the test;

(b) All thrusting must be completed. Thrust blocks must cure for minimum of seven days prior to testing;

(c) Test ends (valves, blank ends, etc.) must be securely anchored;

(d) All joints on fittings are to be uncovered and fully visible;

(e) The main must be filled with potable water at a steady rate;

(f) All air must be expelled as the main is filled and the mains allowed to stabilise prior to testing;

(g) The Developer must provide a minimum of 48 hours notice prior to the pressure test;

All leaks, weeps, drips, bursts and thrust block movements or failures must be made good by the Developer.

5.15.7 Disinfection and testing

Disinfection and testing must comply with the Palmerston North City Council Water Supply Mains Disinfection Code of Practice and must be carried out by an approved person.

The Developer must complete the prescribed form "Certificate of Cleanliness and Disinfection of Water Supply Mains" at Appendix 5.

Water sample must be taken according to the current Drinking Water New Zealand standard in presence of the Manager or its representative. Samples are to be tested for Free Available Chlorine (FAC), Ecoli and Total Coliforms. Testing must be completed by an iANZ accrediated laboratory. A copy of the results is to be provided to the Manager prior to any connection with the existing reticulated network.

5.15.8 Connection to existing reticulation

After any water main has been laid, tested and disinfected, it must be kept continually charged and remain under pressure until a permanent connection is made.

No connection must be made prior to the approval from the Manager . All connections to the existing reticulation must be made by the Council's Utility Maintenance Contractor or a contractor approved by the Council. At least 24 hours' water shut down notice should be given to all the affected properties. The water shut down should be made by the City Council staff on the cost of the developers. No property should be out of water supply for more than 8 hours.

5.15.9 Reinstatement

Reinstatement must comply with Palmerston North City Council Policy for Road Openings and Reinstatement. All compaction requirements must be met and the results submitted to the Manager .

5.16 RESERVOIRS AND PUMPING STATIONS

Where reservoirs or pumping stations are required, reference must be made to the Council for its specific requirements. WSA 03 contains design criteria for pumping stations and reservoirs.

5.17 VALVES

5.17.1 General

All valves on water mains must be flanged. All valves 100mm or larger must be strapped to a concrete anchor block as per Standard Drawing 5.4.

5.17.2 Siting valves

In addition to NZS 4404:2010 Clause 6.3.15.2, the Developers must consider:

(a) Valves must be sited to provide the control (such as flow, pressure, isolation, and diversion) required by the Council;
(b) Optimisation of the number and location of valves to meet the Council's operation and maintenance requirements, safe working, and to minimise the effect of a shutdown on the Council's customers.

(c) The maximum valve spacing on any water mains must not exceed 350 m. For valve arrangements see 5.17.3 and Table 5.4 of this document.

(d) Valves on branch mains must be located adjacent to the through water main. Where a road crossing is necessary immediately after the tee branch and there is no space available adjacent to the tee, a stop valve must be installed on the opposite side of the road.

(e) All valves are to be located behind the kerb and channel, unless at intersections. Sluice valves at intersection must be located opposite kerb tangent points.

For a general layout of valves refer to Standard Drawing 5.1.

5.17.3 Gate valves

All valves used in 50mm NB rider mains must be constructed as per AS 1628. Valves in mains ≤ 50 mm NB or and service connections must be manifold valves. Gate valves must be forged brass to BS 5154:1991 with a non-rising stem and be of approved manufacture. Manifold valves must be Gunmetal or dezincification resistant brass to BS 1400-LG2 approved manufacture, (Davies Shepard, Aquaflo or other types as approved by the Manager).

Valves must be anti-clockwise closing, unless otherwise specified by the Council. Gate valves DN ≤50 must be clockwise closing unless otherwise specified by the Council.

Buried gate valves must be operated from above ground and must be designed to facilitate the use of a standard key and bar. An extension spindle must be incorporated as necessary to ensure the top of the spindle is 350 mm below the finished surface level (FSL).

Valves DN ≥80 must be gate valves. In-line valves must be the same diameter as the reticulation main.

Valve spacing criteria

The number of property service connections in a shut-off area must be in accordance with table 5.4. When assessing property service numbers, unit title and strata title properties such as apartment buildings and multi-unit developments must be counted as multiple connections. All connections having an alternative supply may be excluded when assessing property service numbers. The overriding maximum spacing between in-line valves must be in accordance with table 5.4.

Table 5.4 – Valve spacing criteria

Water main size DN	Number of property service connections (nominal)	Maximum spacing (m)
50	15	100
100	30	200
150	40	300*

>=200	60	350
*** In rural areas, the maximum spacing is 500 m.**		

Branch mains

Stop valves must be located on branch mains adjacent to the through water main. Where a road crossing is necessary immediately after the tee branch and there is no space available adjacent to the tee, a stop valve must be installed on the opposite side of the road (see NZS 4404:2010 Figure 6.1 and Appendix B Drawings WS – 001 and WS – 002).

Pressure zone dividing valves

Pressure zone dividing valves and hydrants must be installed as per NZS 4404:2010.

Butterfly valves

Butterfly valves must only be used with the approval of the Council.

Note: Butterfly valves are not normally used in reticulation mains as they hinder swabbing operations, and the quick closing action can induce high surge pressures.

Pressure reducing valves

Pressure reducing valves (PRV) are outside the scope of this Standard. Refer to WSA 03.

Note: A PRV is used to reduce the pressure upstream of the PRV to a desired lower downstream pressure. The PRV works automatically to maintain the desired downstream pressure. Refer to WSA 03 for design criteria.

Air valves

For details refer to NZS4404:2010.

As required automatic air release valves must be located above ground level and inside a standard air valve box as per Standard Drawing 5.7. Surface or ground water must not be allowed to enter the air valve box.

Swab Inlets

Swab inlets must be provided on all principal watermains of DN100 or greater. The swab inlet must consist of a flanged tee and risers of the same diameter as the principal main and must be brought up to within 150mm of the finished surface. The riser must be sealed with a blank cap drilled to AS/NZS 4087 Table D. The swab inlets are to be located adjacent to the sluice valve at each end of the principal main. Swab inlets must be located within a standard valve box lid and surface box.

5.18 HYDRANTS

5.18.1 General

Hydrants are installed on reticulation mains for firefighting or operational purposes.

Operational purposes include mains flushing, chlorination, to allow the escape of air during charging, and the release of water during dewatering of the water main, where air valves and scours are not installed. For hydrant details refer to NZS 4404:2010.

Hydrants must be located in the berm area at mid-point of the adjacent lot frontage to avoid vehicle crossings.

Hydrants must be accessible for fire appliances. A fire hydrant is to be positioned at each intersection.

5.18.2 Hydrants for firefighting

In all cases the spacing of hydrants for firefighting must be in accordance with SNZ PAS 4509. In some cases of subdivision or land development a hydrant must be provided at the end of a ROW and/or private road to meet the requirement of 1 hydrant within 135m and 2 within 270m for all proposed lots.

The layout of fire hydrants is subject to the approval of the Fire & Emergency New Zealand (FENZ) who may require additional hydrants in areas where special fire risks call for a greater degree of protection. A sign off from FENZ may be required before the subdivision is approved by the Council.

5.18.3 Hydrant installation

Fire hydrants must not be fitted to reticulation mains DN <100 or to distribution or transfer mains without the prior written approval of the Council.

5.18.4 Hydrant at ends of mains

If a scour is not provided, a hydrant must be installed as close as possible to the end of every main DN ≥100, including temporary dead end for the staging or provision for future subdivisions. These dead ends should be avoided when possible, refer clause 5.7.1 and 5.19 for details

5.19 CONNECTIONS

In addition to meeting the requirements of NZS 4404:2010, developers must also comply with the requirements below. All connections to the existing reticulation must be made by a Council approved Contractor.

5.19.1 General

Services must be laid at right angles to the street boundary and located approximately midpoint of each lot. Corner residential lots with two dwelling units require a service from each street.

All service connections must be terminated with a manifold toby of the same nominal size as the service pipe.

A 'T' must be cut into either the face of the kerb at a position "square off" the connection or in the top of the nib directly above the connection.

Meter

An ordinary supply of water is not normally metered.

5.19.2 Point of Supply to Consumer

The point of supply to the consumer will be determined by the Council in accordance with Council policy on metering of supply and on water mains in private property. Unless required otherwise by the Manager, the following must occur as per the Palmerston North City Council Water Supply Bylaw.

5.19.3 Front Residential Lots

For front lots (or dwelling units with individual street frontage) the service connection must terminate at the street address frontage of the property with a 20mm manifold toby as shown in Figure 1 of the PNCC Water Supply Bylaw.

Manifold tobies must be located 150mm from the boundary with the road reserve.

A Council approved heavy duty universal surface box must be installed over the manifold and set flush with the final finished level of the surrounding ground.

Front lots on each side of an access must be serviced from the street.

Service connection location should avoid vehicle crossings where possible.

5.19.4 Rear Residential Lots

For Single Lot

The service connection must extend from the main to the head of the entrance strip. The manifold must be located at the street address frontage of the property in accordance with requirements for Front Residential Lots.

For 2-6 Lots

A service line must extend from the main to the centre of the last lot. The diameter of the service line must be as set out in Table 5.5. In situations where a proposed right of way is to remain in private ownership a master toby of similar diameter to the service line must be located at the street boundary in accordance with the requirements for Front Residential Lots as shown in Figure 2 of the PNCC Water Supply Bylaw 2015. 20mm service connections must be provided at the midpoint of each lot terminating with a manifold toby contained in a Council approved heavy duty universal surface box located immediately behind the access.

For 7 or more Lots

Service lines that serve more than six lots must be 'through' lines or ring lines.

Table 5.5 Service Connections

Nominal Internal Diameter of Service Pipe (mm)	Maximum Number of Single Dwelling Units
20	1
25	3
32	4
40	6

5.19.5 Construction

Tapping bands and ferrules on the water mains must be fitted when the mains are first laid. The ferrules must be tapped into the water main and the service pipe must be laid to the point of supply.

In Industrial and Commercial subdivisions it is normal to omit tapping bands and service connections until the specific requirements of the consumer are known. If the type of development is known at the time of subdivision and the water demand determined, then it is the Developer's responsibility to provide the water connection to the point of supply.

The Developer must lay the service connection to each allotment boundary and place a gate valve and toby box at the boundary. Service connections must be laid at right angles to the frontage.

The placement of services, gate valve and toby box must be carried out after the electric power or any other reticulation between the water main and the boundary has been laid.

Property service connections must conform with the sizes permitted by the Council.

Refer to drawings 5.8 and 5.9 for the method of connection (including tapping)..

The position of the property connection toby valve, meter, and backflow device must conform with the requirements of the Council as outlined in the PNCC Water Bylaw and Bylaw Administration Manual.

5.20 TERMINATION POINTS

For details refer to NZS 4404:2010 Clause 6.3.17.

6 STORMWATER DRAINAGE

6.1 INTRODUCTION

6.1.1 Stormwater System

The Developer must design and construct a stormwater system that complies with NZS 4404, Land Development and Subdivision Infrastructure, and this document. The 1993 Palmerston North City Council Stormwater Design Manual provides guidance on general methodology for sizing of reticulation systems. Where the Engineering Standards set a higher requirement (e.g. rain fall intensities and design storm) theses supersede the requirements of the Manual. The Three Waters Plan sets out the Palmerston North approach to stormwater management.

The implications of future development on adjoining land should be on the basis of replicating the pre-development hydrological regime. All stormwater systems shall provide for the management of stormwater runoff to ensure upstream flood levels are not increased by any downstream development and downstream impacts (changes in flow peaks and patterns, flood water levels, contamination levels, erosion or silting effects etc.) are determined to be less than minor. Mitigation measures may be required, such as peak flow attenuation, velocity control and treatment devices.

The Developer must give consideration to all available options to mitigate the risk of flooding in the event of exceptional rainfall intensity both within and downstream of the development. A catchment-based approach is required with consideration of changes in catchment hydrology, rainfall patters and flooding effects from climate change.

The Developer must design and construct all works in accordance with this document. The design requirements must also be read in conjunction with NZS 4404:2010, Land Development and Subdivision Infrastructure. Any areas not covered by these documents must be designed in consultation with Council officers.

The Developer must meet all costs of new stormwater systems. The Council may consider, at its discretion, contributing to proposed works in cases where additional capacity or extensions to the system are required to serve areas outside the site and its upstream catchment.

As part of any development proposal the Developer must identify areas with limited service, flood sensitivity, or other issues for which building restrictions may apply. The applicant must detail how these areas will be serviced.

The system design must identify and incorporate downstream improvements required as a result of the proposed works.

6.1.2 Resource Management Act 1991

Authorisation from the Regional Council will be required for stormwater discharge, unless the discharge is to an existing stormwater drainage system and meets any conditions which apply to the existing system. Refer to Clause 1.11.2

6.1.3 Bylaws

Authorisation is required pursuant to the stormwater Drainage Bylaw to connect to the public stormwater drainage network.

The Bylaw also regulates to restrict contamination and control modification of the public stormwater drainage network and adjacent environment.

Refer to the Stormwater Drainage Bylaw for details.

6.1.4 Objectives

The primary objective of a stormwater system is manage storm surface water run-off to minimise flood damage and adverse effects on the environment as outlined in the Three Waters Plan.

The Developer must apply an interdisciplinary approach to stormwater management that will ensure:

a) Compliance with the Engineering Standards for Land Development;

b) Adopts water-sensitive design approaches, unless proven to be inappropriate;

c) Improves the quality of the stormwater runoff entering the receiving environment;

d) Reduces stormwater runoff volumes and peak flow rates;

e) Where possible, utilises natural systems and improves biodiversity by preserving and enhancing the integrity of ecological and biological systems of the environment;

f) Avoids adverse environmental and community health and safety effects;

g) Avoids potential adverse effects to aquatic ecosystems;

h) Complies with environmental requirements;

i) Provides adequate system capacity to service the fully developed catchment;

j) Ensures a long service life;

k) Identifies and incorporates downstream improvements required as a result of the proposed works;

l) Is economically efficient, taking into account maintenance and life-cycle costs;

m) Ensures stormwater management devices are fit for purpose, taking into account local characteristics;

n) Where possible, minimises the need to collection and conveyance.

6.2 GENERAL REQUIREMENTS

6.2.1 General requirements

Any natural watercourse that will require piping as a result of the development must be undertaken by and paid for by the Developer.

The stormwater system must have a design life of at least 80 years.

Where open watercourses are to form part of the land drainage system this must be determined at the Development Concept Plan approval stage. The Developer must submit sufficient engineering design to enable Council to evaluate the proposals.

All stormwater connections from developed lots must be capable of serving the whole of the building area of the lot.

Where necessary the developer must incorporate measures to minimise stormwater runoff from the site and utilise sustainable development practices. This approach should consider the use of Water Sensitive Urban Design (WSUD or WSD), the use of sustainable technologies such as rainwater harvesting and other Best Management Practices to reduce stormwater runoff volumes and peak flow rates, and improve the quality of stormwater runoff entering the receiving environment. In some instances, the impervious area may be limited if it is believed that further development may increase flooding risk within the catchment.

Some Best Management Practices to be considered for implementation include:

- Rainwater harvesting – The use of rainwater tanks for the collection of roof runoff for non-potable uses such as toilet flushing, clothes washing and garden watering.
- Bush revegetation.
- Permeable paving
- Rain gardens
- Swales and filter strips
- Biofiltration trenches
- Green roofs
- Detention practices such as wet ponds, wetlands and detention tanks
- Contaminant filters and separators such as sand filters and oil and grease separators
- Litter control
- Proprietary devices.

6.2.2 Stormwater Management Plan

A Stormwater Management Plan (SMP) may be required for development due to the change in land cover affecting the stormwater runoff characteristics (i.e., peak flows, volumes and frequency of runoff), or based on land use activities as required in the Stormwater Drainage Bylaw.

The SMP must identify any changes in runoff characteristics generated from the development or change in land use and propose measure to mitigate the effects where deemed necessary by Council. The SMP must be prepared by a suitably qualified stormwater design consultant, preferably with experience in Water Sensitive Design (WSD) concepts and elements.

The SMP must address the following:

I. A site-specific assessment of the likely changes in stormwater quantities created by the development/land use changes for the 2-year, 5-year, 10-year, 20-year and 50-year (including climate change) ARI events using the HIRDS database and nested design storm approach;
II. Scoping of all internal stormwater infrastructure and how it will interact with the exisiting drainage system;
III. Outline how the development will hydraulically relate to its surrounding environs, including assessment of overland flow paths and potential flood impacts;
IV. Outline how the stormwater management system will ensure that an y changes in runoff from the site will be addressed.

In some areas of the city the potential changes in runoff can be addressed through the use of WSD components focused on the following parameters:

a. Reduction in peak flow discharges by flow attenuation;
b. Reduction in discharge volumes by infiltration, soakage or other means appropriate for the site (i.e., the first 5 or 10m of daily rainfall runoff from impervious areas may need to be retained on site in certain circumstances);
c. The ability to use WSD to address stormwater runoff quality aspects (i.e., treatment of the “first flush”).

6.3 PROPRIETARY STORMWATER TREATMENT SYSTEMS

Proprietary, modular stormwater treatment systems have become readily available. They are used primarily for settleable solids, floatables, oil and grease from stormwater runoff. These should be installed wherever there is potential for undesirable materials to collect and cause unnecessary pollution.

For vehicle maintenance yards, commercial warehouse sites etc. where there is a high probability that contaminants and pollutants may discharge into natural watercourses, such a filtration system is essential.

6.3.1 Treatment Requirements

Where stormwater treatment is deemed necessary to treat a contaminant generating surface, treatment devices must be sized to treat the first flush in accordance with table 6.

Table 6.0 First Flush Requirements

Device type	First flush treatment requirement
Volume based treatment device	15mm of rainfall depth from the total area of high contaminant generating surface.
Flow based treatment device	5mm/hour of runoff from the total area of high contaminant generating surface.

Note: the depths above are based on rainfall analysis completed for Palmerston North

6.4 LAYOUT

The stormwater system layout must ensure the following:

- Access to all parts of the reticulation for inspection and maintenance. Manholes, access points and access chambers must be provided to ensure access to pipelines by modern equipment for CCTV inspection, water jetting, root cutting and grouting
- Safety of the stormwater system operators should be maximised
- The potential for infiltration and exfiltration must be minimised (e.g. minimise the number of manholes and access points)

6.5 STANDARDS

The following Standards and Codes of Practice are referred to in this part. The design, materials and method of construction must comply with these Standards and Codes as applicable.

The Standards used must incorporate the latest amendments. Standards superseding those listed and the latest version must automatically apply.

AS/NZS 1260 PVC-U Pipes and Fittings for Drain, Waste and Vent Application

AS/NZS 4130 Polyethylene (PE) Pipes for Pressure Applications

NZS 3107 Specification for Precast Concrete Drainage and Pressure Pipes

NZS 4404:2010 Land Development and Subdivision Infrastructure

NZS 4452	The Storage and Handling of Toxic Substances
NZS 7643	Code of Practice for the Installation of Unplasticised PVC Pipe Systems
NZS/AS 2033	Installation of Polyethylene Pipe Systems
NZS/AS 3725	Loads on Buried Concrete Pipes
NZSOLD 2015	New Zealand Dam Safety Guidelines

6.6 ENGINEERING DESIGN

In planning and designing a stormwater system, the developer or contractor must provide a Design and Process Assessment. The Design and Process Assessment must:

1. Provide an assessment of how the proposed stormwater management system is consistent with the Objectives of this Chapter;
2. Provide details of the design process including but not limited to:

6.6.1 Site Assessment

Undertake an initial site evaluation. Matters to consider include:

- Bio-physical characteristics;
- Geotechnical characteristics;
- Socio-cultural characteristics;
- Identification of areas with limited service, flood sensitivity, or other issues for which building restrictions may apply;
- Topographical features

6.6.2 Project objectives

The need to be clear about what is being designed for is important to informing decisions on the type of device and maintenance approach that is appropriate in a given context.

Clear and measurable project objectives (consistent with the Stormwater Objectives of this Chapter) should be developed at the early stages of the design process.

6.6.3 An inter-disciplinary design approach

Stormwater Management can provide an opportunity to deliver multiple benefits that meet both stormwater management objectives and other outcomes that are of importance to Palmerston North (e.g. quality urban environments, biodiversity, green space, traffic calming etc.). Application of WSD principles requires an inter-disciplinary approach to planning and design because analysis and decision making needs to be informed by a wide range of topics (e.g. hydrology, urban design, civil engineering etc.).

The design and process assessment should provide details of how an inter-disciplinary approach has been adopted and how these are reflected through the project objectives and anticipated outcomes.

6.6.4 Stormwater management solution

Problems with the operation and maintenance of a device can occur when it is inappropriate for a given location or is undersized for its purpose. The respective position of the various components in the treatment train is an important consideration in ensuring the sustained effectiveness of the system.

The proper design and position of a stormwater solution (e.g. product or device) within the stormwater treatment train is important. It is critical to select a device or product that is:

- Consistent with the achievement of the objectives of this Chapter;
- Fit for purpose;
- Robust; and
- Effective for delivering the project objectives over its design life.

The design and process assessment should provide details of how the stormwater management solution achieves the above requirements.

6.6.5 An integrated design approach

Those who will become responsible for the ongoing operation and maintenance of stormwater solutions must be involved in the design process. This is critical to informing the development of a practical design that will enable ease of maintenance and develop ownership for ensuring the solution performs as it was intended.

The design and process assessment should provide details of how an integrated design approach has been adopted and how these are reflected through the project objectives and anticipated outcomes.

6.6.6 Design for maintenance

Maintenance of devices must be considered early in the design process. This will assist in the identification of features that will facilitate the ease and efficiency of ongoing operation and maintenance of solutions. Elements to consider in the design for the maintenance and operation of the systems include:

- Access;
- Vegetation;
- Mulch;
- Sediment;
- Mechanical components;
- Vandalism;
- Safety.

The design and process assessment should provide details of how the stormwater management solution achieves the above requirements.

6.7 WATER-SENSITIVE DESIGN

Water-sensitive Design (WSD) is an approach to land development and stormwater management that includes both an interdisciplinary planning and design process and a suite of structural techniques that utilise natural systems for stormwater management. WSD aims to use natural processes such as vegetation and soil media to provide stormwater management solutions as well as adding value to urban environments. The main principles of low impact design are reducing stormwater generation by reducing impervious areas, minimising site disturbance, and avoiding discharge of contaminants.

In general, stormwater should be managed as close to the point of origin as possible to minimise collection and conveyance. Benefits include limiting discharges of silt, suspended solids, and other pollutants into receiving waters, and protecting and enhancing natural waterways.

Effective implementation of WSD principles typically requires more planning and design input than piped stormwater systems. Aspects in the design process requiring specific consideration include provision of secondary flow paths, land requirements, and provision for effective operation and maintenance. WSD is a type of stormwater system that aims to minimise environmental impacts by:

a) Reducing peak flow discharges by flow attenuation;
b) Eliminating or reducing discharges by infiltration or soakage;
c) Improving water quality by filtration;
d) Installing detention devices for beneficial reuse.

Application of WSD principles requires an inter-disciplinary approach to planning and design because analysis and decision making needs to be informed by a wide range of disciplines and topics (e.g. hydrology, geology, ecology, botany, network infrastructure, landscape, community values etc.).

WSD can provide an opportunity to deliver multiple benefits that meet both stormwater management objectives and other outcomes that are of importance to the city. This is recognised in the Palmerston North Three Waters Plan, 2018/21. The Three Waters Plan recognises that:

1. *Intensification of development in the existing urban area and more urban development on the fringe of the city will require a more sustainable response to growth to maintain the current levels of service;*
2. *Low-impact urban design and water reuse lessens impacts from the urban area on the Manawatu River and other waterways;*

6.7.1 Design Devices

The types of low impact design devices that could be considered for use include:

a) Detention ponds;
b) Wetlands;
c) Vegetated swales;
d) Rain gardens;
e) Rainwater tanks;
f) Soakage pits and soak holes;
g) Filter strips;
h) Infiltration trenches/basins;
i) Permeable paving;
j) Green roofs;
k) Tree pits.

6.7.1.1 Detention ponds

Stormwater ponds are an accepted method of improving stormwater quality and reducing peak downstream flow rates to replicate the pre-development hydrological regime.

Detention ponds can be of the 'dry' or 'wet' type and can be 'on-line' or 'off-line'. The type of pond required should be discussed with PNCC at an early stage.

Specific matters to be considered in pond design include:

a) Side slope stability;
b) Mustow ledges or batters for safety;
c) Ease of access and maintenance including mowing and silt clean out;
d) Shape and contour for amenity and habitat value;
e) Effectiveness of inlet and outlet structures;
f) Overflow design and scour protection;
g) Fish passage;
h) Pest control (for example mosquitoes and blue-green algae);
i) Species to be planted;
j) Potential effect on downstream aquatic ecology and habitat;
k) Maintenance requirements

lf PNCC is to be responsible for pond maintenance it must be located on land owned by, or to be vested in, the PNCC or protected by an appropriate easement and maintenance vehicle access must be provided

Any stormwater detention ponds must be multi-purpose to provide additional amenity t the development and encourage basic maintenance to keep it in a suitable state. It should be an integrated feature of the subdivision, and landscaping design with be required.

Detention pond must be designed by a suitably qualified engineer and submitted for approval prior to subdivision consent. The operation and performance of the detention ponds must be assessed in conjunction with the upstream and downstream stormwater network, and include all elements of the proposed development.

6.7.1.2 Dams

Stormwater attenuation designs which incorporate a water retention structure which is defined as a "Dam" under the Building Act 2004 must adhere to the guidance provided in PNCC Dam guidelines 2024 found in the ESLD Appendices.

A dam as defined in the Building Act (2004):

(a) means an artificial barrier, and its appurtenant structures, that

i. is constructed to hold back water or other fluid under constant pressure so as to form a reservoir; and

ii. is used for the storage, control, or diversion of water or other fluid.

(b) includes

i. a flood control dam; and

ii. a natural feature that has been significantly modified to function as a dam; and

iii. a canal; but

(c) does not include a stopbank designed to control floodwaters.

The purpose of appendix # is to provide high level guidance in relation to the design and construction of embankment dams (constructed from earthfill materials) that do not meet the threshold for classification as a 'large dam'. This guidance is not intended to be exhaustive and given that conditions related to each dam site differ, a suitably qualified professionals in relation to such works must be engaged by the developer. Direction is provided to reference documentation commonly used within the dam industry that, when applied by a suitably qualified professional, forms the basis for substantiating an alternative solution for dam design in relation to the Building Regulations 1992 (Building Code).

6.7.1.3 Wetlands

Constructed wetlands can be designed to provide flood protection, flow attenuation, water quality improvement, recreational and landscape amenity, and provision for wildlife habitat.

Specific matters to be considered in wetland design include:

- Catchment area greater than 1 ha;
- Size calculated to achieve water quality volume;
- Forebay to capture coarse sediments;
- Depth not to exceed 1 m;

- Sufficient hydraulic capacity for flood flows;
- Sufficient detention time for sediment retention;
- Species to be planted.

If PNCC is to be responsible for wetlands maintenance it must be located on land owned by, or to be vested in PNCC or protected by an appropriate easement.

6.7.1.4 Vegetated Swales

Vegetated swales are stormwater channels that are often located alongside roads or in reserves. While their primary function is conveyance, filtration through the vegetation provides some water quality treatment.

Specific matters to be considered in swale design include:

a) Catchment area not greater than 4 ha;
b) Longitudinal slope 1% - 5%;
c) Slopes flatter than 1% may require underdrains;
d) Slopes greater than 5% may require check dams to reduce effective gradient to less than 5%;
e) Capacity for a 1O% AEP event;
f) Velocity not greater than 1 .5 m/s in a 10% AEP event unless erosion protection is provided;
g) Grass length 50 mm - 100 mm;
h) Species to be Planted

An option for swales with very flat longitudinal slopes and high water tables is a wetland swale.

6.7.1.5 Rain Gardens

Rain gardens are engineered bioretention systems designed to use the natural ability of flora and soils to reduce stormwater volumes, peak flows, and contamination loads. Rain gardens also provide value through attractive design and planting. Specific matters to be considered in rain garden design include:

a) System designed to manage a 10% AEP event without significant scour or erosion;
b) Overland flow paths to accommodate flows in excess of the design storm;
c) Entry and overflow positions to restrict short circuiting;

d) Geotextile on side walls;

e) An underdrain with a minimum of 50 mm gravel cover;

f) Pavement design in vicinity of device;

g) Soil composition;

h) A ponding area;

i) Species to be planted;

j) Access for maintenance.

k) The back edge of a rain garden, where it meets a footpath must have a raised lip to prevent falls. Separation of 500mm is preferential to a rain garden immediately joining a footpath.

Refer to the Appendix 13 for Rain Garden design manual (with permission from the Christchurch Council adapted for PNCC).

Soil composition and species to be planted are to be approved by the Palmerston North City Council Parks Operations Manager for local conditions.

6.7.1.6 **Rainwater Tanks**

Rainwater tanks can be designed to harvest water for non-potable uses such as toilet flushing and watering the garden. This can significantly reduce the demand on the potable water supply from PNCC. Where required by PNCC rainwater tanks can be configured to provide peak flow attenuation, to reduce stream channel erosion and the load on the stormwater system, with or without reuse.

Specific matters to be considered in rainwater tank design include:

a) Capacity: Typically 2,000 L - 5,000 L for domestic reuse and 6,000 L - 9,000 L for a dual reuse and attenuation;

b) Primary screening to keep out leaves and other coarse debris;

c) First-flush diverters to collect first 0.4 mm for slow release to ground through a small chamber;

d) Backflow prevention;

e) Low level mains top-up valve;

f) Overflow outlet;

g) Gravity or pumped;

h) Tight-fitting cover;

i) Cool location;

j) Aesthetics and convenience.

k) Dead storage volume to allow for sediment accumulation at the bottom of the tank.

6.7.1.7 Soakage Devices

Soakage devices such as soak pits and soak holes, filter strips, infiltration trenches/ basins, permeable paving, green roofs, and tree pits can also be considered for managing stormwater from roofs, parking areas, and roads in rural subdivisions. Soakage devices within the residential area are not supported by council and require discretionary approval from the stormwater service manager.

Specific matters to be considered in soakage system design include:

a) Capacity adequate for a 1O% AEP event;

b) Rate of soakage determined through a soakage test with an appropriate reduction factor (at least 0.5) applied to accommodate loss of performance over time;

c) Capacity to accommodate the maximum potential impermeable area;

d) Overland flow paths to accommodate flows in excess of the design storm;

e) Confirmation that the soakage system will not have an adverse effect on surrounding land and properties from land stability, seepage, or overland flow issues;

f) Soakage system to be located above static groundwater level;

g) (S) Pre-treatment device to minimise silt ingress may be required;

h) Interception of hydrocarbons;

i) Access for maintenance.

j) Where steps are not installed for access, rip-rap or suitable material must be inserted into the chamber to a minimum level of 1.2m from access point.

k) Necessary building consent must be obtained where required for soakage devices

For guidance on disposal using soakage on individual lots refer to NZBC clause E1A/M1.

PNCC may require a geotechnical assessment to be carried out by an appropriately qualified geo-professional to determine the suitability of soil and groundwater characteristics for any proposed soakage system.

A discharge permit may be required from the Regional Council for discharge to soakage.

6.8 OPEN WATERCOURSES

Natural watercourses must be retained and must be located in public or designated reserves. If piping is preferred, this must be approved by the manager.

In order to pipe an open watercourse, at a minimum the following is required:

1. An engineering assessment to determine the required pipe size and the effects this work will have on the catchment.
2. Preservation of an overland flowpath to prevent increased risk of flooding.
3. Engineering drawings for the works that meet Council standards. Drawings must include the designated overland flowpath, the easement (refer item 5 below), and be supported by the hydraulic calculations for the pipe sizing.
4. Physical works be undertaken by a Council-approved contractor.
5. An easement over the pipe (width is dependent on the size of pipe required) to allow Council to replace and maintain as required.

Improvement works where necessary must be carried out in natural watercourses to mitigate the effect of the development. This includes water quality considerations and treatment prior to discharge into open watercourses.

The Developer must provide protection works at all piped outlets into natural watercourses as a result of the development. The Developer must provide design details as part of the engineering approval process.

6.9 HYDRAULIC DESIGN OF PIPELINES

6.9.1 Hydraulic Design

The primary net work shall be designed for the 10% AEP event.

All sizes stated are nominal internal diameters. No pipe intended to become a public stormwater drain must be less than 300mm diameter.

The hydraulic design of stormwater pipelines must be based on approved engineering design practice. The hydraulic characteristics of the selected pipeline material must comply with the manufacturer's recommendations. The minimum and maximum design velocity for all pipework must be 0.7 metres per second and 3.0 metres per second respectively.

The minimum gradients for respective pipe sizes must be as follows:

Table 6.1 Self Cleansing Gradients

Nominal Pipe Diameter	Minimum Allowable Gradient
150 mm	1 in 150
225 mm	1 in 260
300 mm	1 in 390
375 mm	1 in 525
450 mm	1 in 650
525 mm	1 in 800
600 mm	1 in 900

Where a section of the stormwater reticulation carries flow from a watercourse or open drain, regard must be had in the selection of pipe size and its level in relation to the stream, to the depth of water in the stream and the head losses at the entry of the pipe.

The outlet of all stormwater reticulation discharging to a natural watercourse must be at bed level. Provision must be made in the design to reduce flow velocities at the point of discharge to non-scour levels. The outlet reticulation must be fully piped from the last stormwater collection structure or manhole to the outlet. Where the outlet is likely to be drowned, the hydraulic gradients used in the design of the stormwater system must take this into account.

Where the outlet receives the flow from catchments larger than 1ha then an approved stormwater treatment device must be installed of the gross pollutant type or similar Best Management Practice devices as approved by the Engineer.

6.9.2 Climate Change

Stormwater systems must be designed to include the effects of climate change. Rainfall intensities and depths shall be site specific and obtained from the NIWA HIRDS database with an adjustment to account for climate change. Unless otherwise advised, the RCP 6.0 for 2081-2100 model shall be used.

6.10 STRUCTURAL DESIGN

6.10.1 Design

All pipelines must be designed in association with their bedding and backfill to have sufficient strength to safely support the loads that will be imposed, including the loading from heavy construction traffic and equipment. The design must comply with NZS/AS 3725: Loads on Buried Concrete Pipes including the pipe manufacturer's guidelines, and NZS 7643, Code of Practice for the Installation of Unplasticised PVC Pipe Systems including pipe manufacturer's guidelines.

6.10.2 Bedding

Refer Clause 4.8.3

Maximum and minimum permitted trench widths are as follows:

Pipe Type	Minimum Width	Maximum Width
Concrete	Dia + 400mm	Dia + 600mm
uPVC	Dia + 200mm	Dia + 400mm

6.10.3 Cover

The minimum cover above the crown of the pipe must be as follows:

Table 6.2 Minimum Cover

Location	Minimum Cover (mm)
Roads, berms, accesses and parking areas	750*
All other areas	600

* During construction, pipework may require ramped metal protection.

The manufacturers cover specification must be used where it is greater than the minimum stipulated in Table 6.2.

Where it is not possible to achieve minimum cover requirements, an approved protection system to the satisfaction of the Manager must be installed above the pipework.

Where pipeline gradients exceed 20% (1 in 5), cement bonded bedding and anti-scour blocks placed at 6.0 metre intervals and located midway along the pipe must be required.

6.11 PIPEWORK

The following rubber ring jointed pipework has been approved by the Manager for use on stormwater reticulation that will become public drains including lateral connections beneath road reserves.

(i) Concrete pipes to NZS 4058 - 2007.

(ii) PVC Pipes to AS/NZS 1260.

(iii) Other pipe types, e.g. steel, may be considered for specific applications.

(iv) PE pipes to AS/NZS 4130.

6.12 PIPE LAYING AND TESTING

6.12.1 Pipeline Location

Stormwater reticulation must be located within the road reserves as shown on Standard Drawing 1.2.

Stormwater reticulation must not be laid in the same trench as wastewater drainage or water mains. Service pipes and services in accesses may be laid in a common trench provided the required clearances between services are maintained.

Public stormwater drainage pipes are to be laid in Council controlled land. Where this is unavoidable, pipelines must be sited so as not to reduce the building area available on the lot (that is, within the front, side or rear yard areas). Easements must be minimum 3 metre width and will be required for all wastewater reticulation pipelines and for all lateral connections serving other than the affected lot. Manhole structures must be placed centrally within the easement.

The Developer is to identify all drainage systems in the Development Concept Plan that are proposed to be located other than the road reserve.

6.12.2 Pipe Laying

All pipelines must be laid in accordance with the relevant standards and manufacturer's instructions.

Backfill for pipes must be as shown on Standard Drawing 4.1.

Connections to the existing stormwater drainage system must be carried out by an approved person under the supervision of the appropriate Council staff. Refer Clause 1.9.1.

All pipes must have an approved flexible sealed joint.

6.12.3 Backfill and Compaction

No backfilling must be done prior to approval by the Council Engineer.

Bedding material grading must be as described in Table G.1 of AS/NZ 2566.2 for PVC pipes. If the excavated material cannot meet the specified grading, imported material must be used.

AS/NZ 2566.2

Table G1: Grading Limits for Acceptable Embedment Material

Sieve Size, mm	Mass of samples passing, percent
19.0	100
2.36	50 to 100
0.6	20 to 90
0.3	10 to 60
0.15	0 to 25
0.075	0 to 10[1]

Note:
1. For non-plastic fines otherwise <5%

The backfill material above the bedding under the Road Carriageway and Footpath, must be well graded AP65 granular material. Trench excavated material can be utilised for backfill in the berm area if it is free of organics and other deleterious material.

Compaction equipment, the number of passes and the thickness of the layer to be compacted shall consider the material to be compacted and the underlying pipe. The compaction shall not cause any loading or pressure transfer to the pipe that could cause damage to the pipe or its alignment.

The backfill compaction shall achieve the following:

	Carriageway	Footpath	Berm
Trench Backfill	CIV 25	CIV 20	CIV 15

Note:
1. CIV is the Clegg Impact Value
2. Clegg hammer testing shall be undertaken by a suitably trained person utilising a calibrated Clegg Hammer

The compaction testing regime must be carried out as outlined below:

i. for Trenches in Carriageways or under Footpaths, tests at a rate of at least one test per layer of backfill per 15m of Trench with a minimum of two tests;
j. for Trenches in Berms, tests at a rate of at least one test per layer of backfill per 30m of Trench, with a minimum of two tests;
k. where the excavated area is greater than 0.5m2 and less than 5m2, tests at a rate of one test per backfill layer or, for larger excavations, one test per 5m2;
l. all test locations must be uniformly spaced in the pavement;

Also note that:

- Subject to satisfactory test results the above frequency of testing may be reduced with the prior agreement of the Manager;
- The Clegg hammer may be used for testing of trench backfill but not for the carriageway pavements layers (i.e. subbase and basecourse). Refer to the roading section for pavement testing;

6.12.4 Pipe Testing

Pressure testing of stormwater drainage pipelines must be at the discretion of the Manager. Pressure testing must be carried out in accordance with the methods set out for Wastewater Drainage Systems. Refer Clause 4.12.7.

6.13 SUMPS

6.13.1 Construction

Sumps must be constructed in accordance with Standard Drawing 6.3. Precast sumps of similar design may be used at the discretion of the Manager. The Manager may require the installation of approved pollutant filters within the sumps in specific circumstances or in catchments smaller than 1ha where there is direct discharge into an open water course.

6.13.2 Location

Sumps must be located:

(i) At intervals of not greater than 100m where channel gradients do not exceed 1%. This spacing must be reduced on steeper grades to a maximum of 70m at gradients of 5%. At gradients in excess of 5%, double sumps must be constructed at 70m intervals.

(ii) At the upstream tangent point of street intersections where the grade continues round or past the intersection. Refer Standard Drawing 3.2.

(iii) At changes of channel cross fall where water would flow onto the street surface.

(iv) At channel low points.

(v) Double sumps must be constructed at low points where the length of channel drained exceeds 100m, (e.g. at vertical curves and cul-de-sac bulbs) The sumps must be interconnected with a 200mm minimum diameter pipe. Only one outlet must be provided for.

6.13.3 Subgrade Drains

Provision must be made in all sumps for the connection of subgrade drains. These drains must be connected into the sumps such that the drain invert is not lower than the outlet pipe soffit. Refer Standard Drawing 6.3. Refer Clause 3.6.6.

6.13.4 Connection

All connections must be a minimum 200mm diameter and must join to the drainage system at a manhole.

Double sump leads shall be minimum 300mm diameter.

6.14 CULVERTS

Culvert design must comply with normal hydraulic design principles and the nominal diameter for any culvert or pipe to be vested in the Council must be a minimum of 375mm for road culverts and 300mm for entranceway culverts.

All culverts vesting in council must include vested access points incorporated into the road reserve for maintenance.

Due consideration must be given to the effects of culvert design including profiles of watercourses, hydraulic profiles and scour. Where exit velocities are likely to cause erosion or scour, energy dissipaters must be included in the design and bank protection provided where necessary. All design details are to be submitted for Engineering approval. Culvert design shall be completed by a Suitably Qualified Engineer and submitted for Engineering approval.

Culvert inlets and outlets under carriageways must have headwalls as detailed in Standard Drawing 6.6 and suitable handrails/fences are to be provided where depths of inlets and outlets exceed 1000mm. Culverts under property accessways must have NZTA approved sloped ends where the drain depth does not exceed 1000mm. Standard headwalls are to be used where drains exceed 1000mm in depth.

6.15 PIPE INLETS AND OUTLETS

The inlet and outlet to all culverts and piped systems must be provided with wing walls, headwalls, aprons, grills and detritus traps, contaminant filters or separators to prevent erosion, scour, blockage or unauthorised or accidental access. Wing walls and headwalls must be constructed to a level that will not allow material

from the bank to erode. Permanent access must be provided to all pipe inlet and outlets on private property. Entrance gates and vehicle crossings must be provided to allow access for maintenance vehicles in areas outside the road reserve. Where it is proposed to discharge a stormwater system into a water way which is subject to the back water flood effects of the Manawatu River and other streams, an approved flap gate must be fitted to the headwall of the outfall structure and, in certain circumstances, an approved screw-down penstock may be required in a special manhole sited close to the outfall.

6.16 MANHOLES

6.16.1 Location

Manholes are required on pipelines at:

- the head of the line,
- changes of gradient,
- changes of direction,
- changes of pipe size,
- junctions of all pipes in excess of 100mm diameter,
- spacings of not more than 100m on straight lengths.
- optional hinged manhole lids can be used where surcharge risk is identified (refer Dr. 3.32)

6.16.2 Construction

Manholes must be constructed in accordance with the details shown on Standard Drawing 6.1, 6.2 and 6.8. Cast in situ manholes are generally not permitted. Flexible joints must be provided upstream and downstream of the manhole. Refer to Standard Drawing 6.8. A circular manhole with internal diameter of 1050mm must be used for pipes up to 600mm but this will depend on the number of lines at the manhole. Manholes with internal diameter greater than 1050mm must be used to accommodate an excessive number of pipes or larger size pipes. All manholes must have heavy duty lids fitted with heavy duty frames and covers. Where manholes are more than 5.0m deep they must be specifically designed and must incorporate an intermediate landing platform or grill in order to prevent a free fall of more than 3.0 metres.

Where different sizes of pipe are built into a manhole, they must be positioned such that their hydraulic gradients are at the same level.

All manholes must be haunched as shown on Standard Drawing 6.8.

Pipelines of diameter 300mm or less must be provided with additional fall at manholes as following:

Table 6.3 Additional fall

Change of Direction	Additional Fall
5° - 15°	25 mm
15° - 75°	50 mm
75° - 90°	75 mm

6.16.3 **Specials**

Manholes on pipelines of 1200mm diameter and above may be constructed using intake bosses that may also be used in conjunction with bends. Any manhole or bend so specified must be constructed by the pipe manufacturer. See Standard Drawing 6.2.

6.16.4 **Drop connections**

Drop connections must be avoided where possible. Where connections into manholes are at a height > 1m above the invert, the connection must be made via a drop structure. Drop inlets may be avoided by grading to the base of the manhole where possible.

6.16.5 **Connections to manholes < 2 meters**

All connections to manholes under 2 meters deep must be at the base of the manhole. Pipes 300mm diameter or less may discharge over existing benching.

6.17 LATERAL CONNECTION

Each lot of a residential, business and industrial subdivision must comply with the following unless levels require a direct connection to the stormwater system or to an approved soakway system:

(i) Each front residential lot must have a 110mm OD lateral, grading from 1m inside the property boundary to the kerb and channel. However, front lots on each side of an access may be drained to the stormwater drainage system in the access provided the necessary easements are granted.

(ii) Corner residential lots must be provided with two such stormwater connections, one to each frontage.

(iii) Rear lots with a common access must be serviced by a connection located in the main body of the lot and not at the road boundary.

(iv) Single rear residential lots must be serviced by a 110mm OD lateral.

(v) Provided necessary easements are granted, two or more rear residential lots must have appropriately sized lateral connections as determined by the Clause E1 Surface Water of the New Zealand Building Code with a minimum of 110mm OD. Where the size is determined to be 160mm OD or more this must be connected directly to the stormwater system and terminate in a manhole. See Standard Drawing 6.8 Inspection chambers are required at the junction. See Standard Drawing

6.9. Where no stormwater system is available a suitable design detail must be submitted for engineering approval.

(vi) Lateral connections to sumps are not permitted.

(vii) All laterals connected directly to a main must have an inspection cleaning eye located at the boundary.

(viii) An approved plug, or cap of appropriate material must be installed on the last pipe of the lateral connection and securely fastened.

(ix) Where a lateral is connected to a stormwater disposal system, a 75mm x 50mm marker painted green must extend from the top of the pipe to at least 300mm above ground at a point where each lateral terminates.

(x) An 'X' must be cut into either the face of the kerb at a position "square off" the end of lateral or in the top of the nib directly above the lateral.

(xi) Business and industrial lots must be provided with individual, appropriately sized stormwater drainage connections, connected to the main stormwater system. Kerb and channel connections or soakways will not be permitted. In specific cases on site detention may be considered and/or an appropriate stormwater treatment devices (to be determined in conjunction with the Manager).

(xii) Soakways, raingardens, biofiltration trenches may be allowed for residential lots in those areas of the city which have the proven ability to effectively dispose of stormwater by soakage under all conditions of ground water level. Soakage tests will be required prior to subdivision consent. All proposals for onsite stormwater disposal by ground soakage must be supported by detailed calculation and drawings. Onsite disposal systems must be designed to have no adverse effects on ground stability or on downstream properties and must be constructed in accordance with requirements of the Building Act 2004. The developer must undertake detailed testing and calculations to determine that the proposed system is suitable for disposal from a 10% AEP event.

Secondary flow paths must be provided to cater for events exceeding the capacity of the primary system and on occasions when the primary system fails. Refer to Standard Drawing 6.7.

Inspection

The Manager may require any lateral connections to be opened for inspection. All laterals must be constructed prior to Final Inspection. Refer Clause 1.29.

6.18 INSPECTION AND HANDOVER REQUIREMENTS

A formal inspection with the developer or his representative and a representative from the Council must take place prior to the issue of a s224c certificate. Prior to the issue of the s224c certificate the following activities must be completed to Councils satisfaction.

(i) Pond(s) cleaned and desilted and sediment disposed of at an approved site.

(ii) Provision of an Operating and Maintenance Manual and other requirements as required by the consent conditions including a copy of the relevant Horizons Regional Council stormwater discharge consent if required.

6.19 DRAINAGE OF NEIGHBOURING LOTS

The Developer must ensure that the drainage of existing lots adjoining the subdivision is not adversely affected, and that the requirements of the Building Act 2004 are fulfilled.

6.20 DRAINAGE OF RURAL ROADS

The Developer must ensure that the design and construction of rural roads and adjoining lots does not adversely impact on natural drainage patterns.

Road stormwater must be discharged into streams and valleys with appropriate energy dissipation and scour protection structures. The stormwater flows must be conveyed to the outfall by means of approved pipelines. Channels and flumes will not be permitted.

6.21 HEADWALLS

Refer Standard Drawing 6.6

7 STANDARD DRAWING LIST

INDEX TABLE	
Drawing Number	Title
General	
1.1	Standard Symbols and GIS Codes
1.2	Standard Location of Services in Road Reserve (Sheet 1 of 2)
1.2.1	Standard Location of Services in Road Reserve (Sheet 2 of 2)
1.3	Trench Cross Section for Existing Roads and Footpaths
Roading	
3.1	Mobility Crossing and Corner Splay Details
3.1.1A	Mobility Crossing with Grass Frontage
3.1.1B	Mobility Crossing with No Grass Berm
3.1.2	Mobility Crossing Location
3.2	Intersection Detail
3.3	Rural / Rural Residential Road Intersection
3.4	Rural Road / Accessway Entrance – Edge Protection - Drain Depth >1m
3.4.1	Rural Road / Accessway Entrance – Edge Protection for Drain Depth <1m
3.5	Dish Channel and Subgrade Drainage
3.6	Minimum Cul-de-sac Head Design Standards for Urban / Industrial / Rural R.O.W
3.6.1	Cul de Sac Detail Servicing more than 10 Allotments
3.7	Rural Road - Typical Details
3.8	Rural Road - Open Drain Typical Details
3.9	Rural Road - Typical Cross Section
3.9.1	Urban / Rural Residential / Rural Road - Typical Cross Section
3.10	Standard 150mm Kerb and Channel Details
3.10.1	Kerbs for Traffic Islands, Roundabouts and Raised Medians
3.11	Stormwater to Kerb
3.11.1	Stormwater to Kerb - Multiple Outlets
3.12	Footpath Details
3.13	Maximum Breakover Angles for Vehicular Access to Property
3.14	Dish Vehicle Crossing (Hotmix Footpath)

INDEX TABLE	
Drawing Number	Title
3.15	Dish Vehicle Crossing (Berm and Footpath)
3.16	Dish Vehicle Crossing – Channel Detail
3.17	Dish Vehicle Crossing – Cross Sections
3.18	Plate Vehicle Crossing
3.19	Plate Vehicle Crossing – Channel Detail
3.19.1	Build Up-Vehicle Crossing
3.20	Paved Vehicle Crossing (For Existing Paved Areas Only)
3.21	Repair of Vehicle Crossing – General Position
3.21.1A	Residential Vehicle Crossing Detail For the UFB Fibre Installation Reinstatement Requirements (Sheet 1 of 2)
3.21.1B	Residential Vehicle Crossing Detail For the UFB Fibre Installation Reinstatement Requirements (Sheet 2 of 2)
3.22	Rural Vehicle Crossing – One Lot
3.23	Rural Vehicle Crossing – 2 to 4 Lots
3.24	Business and Industrial Service Lane, and Access to Rear Lot – Typical Cross Section
3.25	Pedestrian / Cycleway Accessway – Barrier and Crossing
3.25.1	Pedestrian / Cycleway Accessway – Cross Section Details
3.26	Bus Bay Design
3.27	Residential Access to Rear Lots – One to Three Lots
3.27.1	Shared Access For Two to Three Lots
3.28	Residential Access to Rear Lots – Four to Six Lots
3.29	Rural - Access to Rear Lots
3.30	Steel Lighting Columns for Streets
3.31	Street Tree - Elevation
3.31.1	Street Tree - Plan and Detail
3.32	Stormwater & Sewer Access Chamber Lid Securing Details
3.33	Asphaltic Concrete Resurfacing – Cul de Sac Bowls
3.34	Screw Mounted Bollard
3.35	Greenfield Subdivision New Vehicle Crossing Cut-in Details

INDEX TABLE	
Drawing Number	Title
Wastewater	
4.1	Pipe Trenching Details – Wastewater and Stormwater
4.2	Anti-Scour Blocks for Steep Pipelines
4.3	Manhole - Wastewater
4.4	Internal Drop Manhole - Wastewater
4.4.1	Internal Drop Manhole for Pressure Sewer System Connection - Wastewater
4.5	Typical Inspection Chamber for 100mm Pipe, Wastewater
4.6	Standard Two Pump Station - Plan
4.6.1	Standard Two Pump Station - Elevation
4.7	Standard Pump Station Bypass
4.8	Alternate Rising Main Entry to Receiving Manhole
4.9	Typical Isolation Valve Detail
4.10	Trafficable Boundary Kit
4.10.1	Non-Trafficable Boundary Kit
4.11	Rodding Eye Detail
4.12	Pressure Sewer System Typical Boundary Kit Layout
4.13	Pressure Sewer System Flushing Point
4.14	Pressure Sewer System Valve Cover
4.15	Pressure Sewer System Typical On-Property Chamber Location

INDEX TABLE	
Drawing Number	Title
Water Supply	
5.1	Layout of Valves and Hydrants
5.2	Watermains in Cul de Sac Connected Principal Main
5.2.1	Watermains in R.O.W.
5.3	50mm Rider Main or R.O.W Service Connection
5.4	Sluice Valve and Marker Installation
5.5	Hydrant and Hydrant Marker Installation
5.5.1	Hydrant with Saddle Installation for HDPE Watermain
5.6	Watermain – Pipelaying Details
5.6.1	Watermain – Thrust Block Details
5.7	Details of Box to Cover Air Valves (50mm Ø)
5.8	20mm ID Water Service Connection and Manifold
5.9	25mm, 32mm & 40mm ID Service Connection and Valve
5.10	Scour Valve
5.11	Manifold Assembly at Boundary Box
5.11.1	Fire and Metered Service Connection
5.12	Commercial / Industrial Connection
5.13	Swab Inlet Detail
Stormwater	
6.1	Manhole for Large Dia. Pipes – 750mm to 1050mm
6.2	Manhole for Large Dia. Pipes – 1050mm Dia.Plus
6.3	Street Sump Details
6.3.1	Sump Details (Yard Sump and Footpath / Small Sump)
6.4	Standard Grate Details
6.5	Vehicle Crossing (Heavy Duty and Standard) Well-up Sump
6.6	Standard Headwall Detail
6.7	Standard Soak Pit Detail (Residential)
6.8	Manhole – Stormwater
6.9	Typical Inspection Chamber for 100mm Pipe, Stormwater

8 APPENDICES

Appendix 1 Developer checklist for Development Concept Plan

Appendix 2 Developer checklist for Engineering Drawings, Specifications and Reports

Appendix 3 Tonkin Taylor Report – Development of Land which is, or is likely to be, Subject to Erosion or Slippage. August 2005.

Appendix 4 Schedule 2A – Statement of Professional Opinion as to Suitability of Land for Building Construction. (NZS4404)

Appendix 5 Certificate of Cleanliness and Disinfection of Water Supply9Mains

Appendix 6 Statement of Completion by Developers Technical Representative.

Appendix 7 Engineering New Zealand Construction Monitoring Services

Appendix 8 Pump Station Design Check Sheet

Appendix 9 Approved Backflow Prevention Devices

Appendix 10 Backflow Prevention Device – Product Approval Application

Appendix 11 As Built Shapefile Templates

Appendix 12 (a-c) Schedule of Assets Sheets

Appendix 13 Rain Garden Design and Maintenance Manual (with permission from the Christchurch Council adapted for PNCC)

Appendix 14 PNCC Pipe Sizes