Far North District Council
Te Kaunihera o Tai Tokerau ki te Raki

HE ARA TĀMATA
CREATING GREAT PLACES
Supporting our people

Engineering Standards

Version 0.5

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Document Control

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0.1	For internal FNDC Working Group Review	FNDC	Dec 2020	FNDC	Dec 2020	Dec 2020
0.2	For Practitioners, Northland Reginal Council, Far North Waters, Northland Transport Alliance, FNDC internal, Disability Action Group Review (Working Draft)	FNDC	Feb 2021	FNDC	Feb 2021	Feb 2021
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0.5	For Public Notification: Reference to the Far North District Plan.	FNDC	April 2022	FNDC	April 2022	April 2022

Document Revision

The Far North District Councils Engineering Standards shall be reviewed to align with the District Plan. If you identify any issues with this document, or any areas where improvements can be made, please contact Councils Engineering Team Leader – Infrastructure and Asset Management Department.

The ES 2022 has been significantly updated since the 2009 version. This 2022 version has been developed from the Whangārei District Council Engineering Standards together with other changes incorporating input from Council staff and practitioners.

Council acknowledges input into the ES from the following:

a. Hamilton City Council,
b. Whangārei District Council,
c. Kaipara District Council,
d. New Zealand Transport Agency,
e. The New Zealand Fire Service,
f. Historic Places Trust, and
g. Network Utility Operators,
h. Wellington City Council

Chapter 1: General

1.1. Introduction

1.1.1. The Engineering Standards

The Far North District Council (FNDC) Engineering Standards (ES) sets out the processes and standards that are expected to be followed and met whenever any development project or Engineering work is undertaken within the District. The ES recognises that the District Council and other network operators will become the owners and operators of roads and other infrastructure, which are created and vested in the land development process.

It is important that the District Council and the community has confidence that the infrastructure and associated systems are competently designed and constructed in a manner which ensures that they are fit for purpose and can be expected to last well into the future.

The ES is the District Council's minimum acceptable technical specification.

1.1.2. Scope

Any person undertaking infrastructure design or construction within the Far North District whether:

a. The District Council's capital and/or operational works contracts or professional services agreements,

b. Development works regardless of whether the infrastructure will be vested in the District Council or remain in private ownership, or

c. Any other form of infrastructure development that will connect to the District Council's existing infrastructure network,

shall use the ES as the means of designing, constructing, testing and signing off the works.

If, for any reason, the ES requirements cannot be met or a design or method of construction outside the ES is more desirable, an Alternative Design (1.5.1.2 Alternative Designs) can be proposed.

The District Council acknowledges that the development of some infrastructure is not covered by the specific requirements in the ES.

Examples of such infrastructure are:

d. Water reservoirs,

e. Bulk water mains,

f. Trunk sewers,

g. Structures, (such as buildings, bridges, and retaining/palisade walls) and

h. Traffic signals.

These works shall be undertaken on a Specific Design basis involving the District Council's engineers and asset managers, relevant codes and standards and in accordance with accepted industry practice.

1.1.3. Overview

This section:

a. Introduces the philosophy and scope of the ES,

b. Provides referencing and definitions for the ES,

c. Identifies statutory requirements,

d. Describes the engineering design approval process, and

e. Provides generic guidance across all infrastructure groups for:

    i. As-Built Plans,

    ii. Working in the Transport Corridor,

    iii. Temporary traffic management, and

    iv. General forms and checklists for developments.

1.1.4. Reference Documents

The following documents are referenced in this Chapter:

Note it is the responsibility of the Developer to ensure the most up to date referenced document is sourced.

1.1.4.1 Statutory

Building Act 2004

Government Roading Powers Act 1989

Health and Safety at Work Act 2015

Local Government Acts 2002 and 1974

New Zealand Building Code

NRC Regional Plans

Operative District Plan and District Plan Map

Public Works Act 1981

Resource Management Act 1991

1.1.4.2 New Zealand Standards

NZS 4121: 2001 Design for Access and Mobility, Buildings and Associated Abilities

AS/NZS 1100.501:2002 - Technical drawing- Structural engineering drawing

NZS/AS 1100.301:1985 - Technical drawing- Architectural drawing

NZS/AS 110.301 Supplement 1:1986 – Technical drawing – Architectural drawing – Architectural drawings

NZS 3604:2011 - Timber-framed buildings

NZS 4229:2013 - Concrete masonry buildings not requiring specific engineering design

NZS 4402.2.2:1986 – Methods of testing soils for civil engineering purposes – Soil Classification tests – Test 2.2 Determination of the liquid limit

NZS 4402.2.6:1986 – Methods of testing soils for civil engineering purposes – Soil Classification tests – Test 2.6 Determination of the linear shrinkage

SNZ PAS 4509:2008 - New Zealand Fire Service firefighting water supplies code of practice

1.1.4.3 District Council Documents

Quality Assurance / Quality Control Manual 2022 - Vested Assets - Inspection and Handover Procedures.

FNDC Specification for Registered and Licensed Contractors for Waste & Drainage

Residential/Commercial water, wastewater, and stormwater application form

Road Assessment and Maintenance (RAMM) Data Collection Form

1.1.4.4 Other Referenced Documents

ENZ Practice Note 01: Guidelines on Producer Statements - January 2014

ENZ Practice Note 02: Peer Review –Version 2, April 2018

ENZ Producer Statement – PS1 Design

ENZ Producer Statement – PS2 Design Review

ENZ Producer Statement – PS4 Construction Review

MfE - Users' Guide national Environmental Standard for assessing and Managing Contaminants in Soil to Protect Human Health 2012

New Zealand Asset Metadata Standards, August 2017

NZ Utilities Advisory Group: National Code of Practice for Utility Operators' Access to Transport Corridors - Updated Version 2, July 2019

Waka Kotahi- Code of Practice for Temporary Traffic Management

Waka Kotahi Manual of traffic signs and markings (MOTSAM), August 2010

Waka Kotahi Road safety audit (RSA) procedures for projects, May 2013

Waka Kotahi– Traffic Control Devices Manual (TCD Manual) (2008)

Water New Zealand; New Zealand Gravity Pipe Inspection Manual Fourth Edition, 2019

WorkSafe NZ – Health and Safety in Design: An Introduction, August 2018

1.2. Statutory Requirements

1.2.1. General

The Developer is responsible for obtaining all necessary consents, providing for the protection of other property from damage resulting from the development and complying with all statutes, regulations, by-laws, national, district and regional planning documents and subsequent revisions, amendments, and updates at the time of consent application, including, but not limited to:

- Building Act 2004
- Ministry of Business, Innovation and Employment (MBIE)
- Electricity Act 1992
- Health and Safety at Work Act 2015
- Fencing Act 1978

- Land Drainage Act 1908
- Land Transfer Act 2017
- Land Transport Management Act 2003
- Local Government Act 1974
- Local Government Act 2002
- New Zealand Building Code
- Health (Drinking Water) Act 2007
- Plumbers, Gasfitters and Drainlayers Act 2006
- Public Works Act 1981
- Resource Management Act 1991
- Telecommunications Act 2001
- Government Roading Powers Act 1989
- Transport Management Act 2003
- Water services Act 2021
- Water Supplies Protection Regulations 1961
- Reserves Act 1997
- Regional Plan for Northland
- Regional Coastal Plan for Northland
- NZ Coastal Policy Statement
- FNDC Operative District Plan
- FNDC Control of earthworks Bylaw 2019
- FNDC Land Drainage Bylaw 2019
- FNDC Wastewater Drainage Bylaw 2018
- FNDC The Control of On-site Wastewater Disposal Systems Bylaw 2010
- FNDC The Control of Vehicle Crossings Bylaw 2010
- FNDC Trade Waste Bylaw 2009
- FNDC Water Supply Bylaw 2009

1.2.2. Relationship with the District Plan

Where a resource consent is required under the District Plan compliance with the ES will be specified in consent conditions that require infrastructure or other such engineering works.

1.3. Abbreviations and Definitions

In the ES, the following abbreviations have been used;

AADT	Annual average daily traffic
AC	Asphaltic Concrete
ADT	Average Daily Traffic
ADWF	Average Dry Weather Flow (l/s)
AEP	Annual Exceedance Probability (refer to definitions below)
ARI	Average Recurrence Interval
BMF	Blue metal fines
CAR	Corridor Access Request
CC	Climate Change
CDP	Catchment Drainage Plan – historical documents title, may still be in use
CMEngNZ	Charted Member of Engineering NZ
CMP	Stormwater Catchment Management Plan or historical Catchment Drainage Plans
CN	Curve Number
CPEng	Charted Professional Engineer
DN	Nominal Diameter
EDA	Engineering Design Approval
ES	Engineering Standards (this document)
EDV	Extended Detention Volume
HIRDS	High Intensity Rainfall Design System in the form of software produced by NIWA
ISO	International Standards Organisation
LDEngS	Survey and Spatial Plus NZ Certified Land Development Engineer
MOTSAM	Manual of traffic signs and markings, as published by the Waka Kotahi
MPD	Maximum Probable Development
NRC	Northland Regional Council
NZBC	New Zealand Building Code
NZGD	New Zealand Geotechnical Database

NZS	New Zealand Standard, as published by the Standards New Zealand (SNZ)
NZTA	Waka Kotahi - New Zealand Transport Agency (Previously LTSA and LTNZ)
OD	Outside diameter
OLFP	Overland Flow Path
OMM	Operation Maintenance Manual
ONRC	One Network Road Classification
PDWF	Peak Dry Weather Flow (l/s)
PE 100	Polyethylene type 100
PE 80B	Polyethylene type 80B
PF	Peak Flows
PN	Pressure nominal
PPM	Parts per Million
PWL	Permanent Water level
RMA	Resource Management Act
RoW	Right of Way (refer to definitions below)
RTS	Road and Traffic Standards (Published by the LTSA)
SCADA	Supervisory, Control and Data Acquisition
SMP	Stormwater Management Plan
SN	Stiffness number
SQEP	Suitably Qualified and Experienced Person(s)
SSA	Site Specific Assessment
TMP	Traffic Management Plan
TSS	Total Suspended Solids
vpd	Vehicles per day
FNDC	Far North District Council

In the ES, unless inconsistent with the context, the following definitions shall apply.

Access (Low Volume)	Refer to Access (Road) below and Table 3-2.

Access (Road)	Roads not classified as arterial or collector, whose major function is to provide access to properties rather than provide routes for other traffic. See Table 3-2. Includes RoWs, vehicle crossings over a road, access lots and any private land area for the purpose of access
Accessway	Provides access to a specific destination
Alternative Design	Alternative design is considered a design proposal deviating from the ES.
Annual Exceedance Probability (AEP)	The probability of exceedance of an event (generally a rainfall or flood) within a period of one year (e.g. 1% AEP is equivalent to 1 in 100 year storm).
Approved	FNDC approval in writing
Arterial Road	Major roads with high traffic volumes or a significant component of through traffic. These include major roads into and through the District, and roads serving significant areas of development. Existing arterial roads are shown on District Plan Maps.
Attenuation	Temporary storing stormwater for a period with a controlled release to lessen the intensity/severity/effects of runoff to a defined value, generally to peak flows at pre-development level or lower.
Average Recurrence Interval (ARI)	The average, or expected, value of the periods between exceedances of a given rainfall total accumulated over a given duration. Refer to Annual Exceedance Probability above.
Brownfield Development	Occurs on land that has already been developed and therefore has existing infrastructure.
Catchment/Catchment Area	The area over which surface water run-off will tend to flow under gravity towards a common point.
Carriageway Width	The road width normally traversed or occupied by vehicles. See **Sheet 2**
Collector Road	Roads that collect traffic from specific areas, or link important roads or major traffic generators. Existing collector roads are shown on District Plan Maps.
Commercial and Industrial Area	As defined in the District Plan (FNDC should be consulted beforehand to determine the standard that will be applied to a particular area if there is any doubt).

Community Sewerage System	A wastewater reticulation, treatment and disposal system, that serves two or more properties. This applies irrespective of whether or not it is maintained by FNDC.
Consent Holder	See Developer
Contractor	The company engaged to undertake the physical works
Curve Number	An empirical parameter used in hydrology for predicting direct runoff or infiltration from rainfall excess. The run-off curve number is based on the area's hydrologic soil group, land use, surface treatment, gradient and hydrologic condition.
Cycleway	Part of the road carriageway (between kerb lines) which is legally only for cyclists. Either a painted cycle lane or a protected cycle lane with associated paint and signs.
Defects Liability Period	The period required by FNDC, after the completion of the works, for which the Developer is responsible for repairing defects that may arise during this period, due to faulty materials and/or workmanship. FNDC will normally require a bond to cover any necessary works. See Section 1.7.3.1 Defects Liability Period.
Design/Technical Review	A review of a specific part of an overall design or report by a suitably qualified and experienced professional. Refer to document ENZ Practice Note 02: Peer Review. The review can be done internally with FNDC or externally. External reviews must be accompanied by a PS2- Design Review and associated documentation. Also see Peer Review.
Detention (hydraulic)	Temporarily detained water which enters a dry pond or tank, before being released slowly.
Developer	In relation to resource consents, is the applicant, owner, Trust, Company, person(s), or organisation or legal entity who have been granted consent to undertake the activities applied for.
Developer's Representative	See Section 1.4.1 Developer's Representative
District Plan	The operative and proposed plans for the District and any combination of them applicable to resource consent applications.
Drain	A pipe or channel that conveys sewage or stormwater flow. Drainage has a corresponding meaning.

Earthworks	Any modification to the shape of the land surface, removal of soil, excavation, infilling or re-contouring, including construction of any road, track, landing, overland flow paths, open drains and streams.
Engineering Design Approval	Any works that impact on council owned assets and/or proposed assets to be vested to FNDC will require an EDA.
EDA Certificate of Completion (EDA CoC)	Any completion of works requires the developer to apply for an EDA Certificate of Completion from FNDC.
Footpath	The part of a road that is laid out or constructed primarily for pedestrians. It shall not include the associated edging and kerb.
Geo-Professional	A chartered professional engineer (CPEng) with a practice field in geotechnical engineering or an engineering geologist (PEngGeol), with recognised qualifications and experience in geotechnical engineering, and land development.
Good Ground	Is defined in NZS 3604:2011, and in NZS 4229:2013: as 'any rock or soil capable of withstanding an ultimate bearing capacity of 300kPa (i.e. an allowable bearing pressure of 100kPa using a factor of safety of 3), but excludes: a. Potentially compressible ground such as topsoil, soft soils such as clay which can be moulded easily in the fingers, and uncompacted loose gravel which contains obvious voids b. Expansive soils being those that have a liquid limit of more than 50% when tested in accordance with NZS 4402 Test 2.2 and a linear shrinkage of more than 15% when tested from the liquid limit in accordance with NZS 4402 Test 2.6, and c. Any ground which could foreseeably experience movement of 25 mm or greater for any one or a combination of land instability, ground creep, subsidence, seasonal shrinking and swelling, frost heave, changing ground water level, erosion, dissolution of soil in water, and effects of tree roots'
Gradient	The slope of a surface or object off horizontal generally described either as a percentage or as a ratio i.e. 1:4 is equivalent to 25% or 250 mm/m
Greenfield Development	Developments done on land that has not previously been developed.
Ground	The surface of the earth and below, whether soil or rock
Heavy Vehicle	Any vehicle exceeding 3500kg gross laden weight

Household Unit (hu)	A single self-contained household unit used principally for residential activities, whether by one or more persons, including accessory buildings. Where more than one kitchen facility is provided on the site, there shall be deemed to be more than one household unit
Household Unit Equivalent (HUE)	A measured 'unit of demand' relating to a development and used in calculating its development contributions.
Hydraulic	The static and dynamic behaviour of fluids.
Hydrology	The study of the movement, distribution, and quality of water.
Invert	The bottom of a pipe, channel or cesspit.
Legal Width for Roads (road reserve)	For public roads, the width of the strip of land that has been declared road in accordance with Section 114 of the Public Works Act 1981.
	For private roads, private ways or easements (rights-of-way), the width of the strip of land over which the public, shared owners or landowners with dominant tenement are legally entitled to pass without the specific approval of any one landowner.
Licensed Contractor (Water Supply)	As defined in FNDC Specification for Registered and Licensed Contractors for Water Supply Note that only FNDC or its agent can make connections to a live drinking water network.
Licensed Contractor (Wastewater & Stormwater)	As defined in FNDC Specification for Registered and Licensed Contractors for Waste & Drainage Department
Manhole	A chamber which provides access from the surface to an underground service.
Maximum Probable Development	MPD represent a maximum impervious area for an allowable land use by District and Regional Plans. It is used in for hydrological/ hydraulics modelling scenarios.
Means of Compliance	A method by which the requirements of the standard may be complied with.
Modified Rational Method	A method to calculate the hydrograph from an empirical rational formula. Q = CIA, where Q = flow /discharge, C = dimensionless run-off coefficient representing land cover, I = rainfall intensity, A = catchment area, where uniform rainfall intensity applied over a catchment area. There is no 'loss method' associated with the Modified Rational Method. The underlying assumption is that the peak intensity is maintained for a long enough duration to reach peak flow at the outlet of the catchment.
Network Utility Operator	Has the same meaning as given to it by Section 166 of the Resource Management Act 1991.
Outlet	The discharge point of a catchment associated with a fluid conveyance system for both a gravity or pumped fluid system.
Overland Flow Path	A path taken by stormwater run-off as a surface flow concentrates. An OLFP may act as either primary or secondary stormwater conveyance system.

Owner	Includes an owner of land, whether beneficially or as trustee, and their agent or attorney, and a mortgagee acting in exercise of power of sale. It also includes the Crown, the Public Trustee, and any person, local authority, board or other body or authority however designated, constituted or appointed, having power to dispose of the land or interest therein by way of sale.
Pavement	The layer(s) of a road or access structure above the subgrade, incorporating sub-base and/or basecourse crushed granular material whether chemically stabilised or not, or rigid material (such as concrete), but excluding any seal coat. See **Sheet 2** and **Sheet 3.**
Peak Flow (Q)	The maximum rate of surface flow at a point in catchment for given period of runoff and a rainfall. It could be determined using various hydrological modelling software or by Modified Rational Method using basic- formula Q = CIA, where Q = discharge, C = run-off coefficient, I = rainfall intensity, A = drainage area
Peer Review	An overall review of a design or report by a suitably qualified and experienced professional. Refer to ENZ Practice Note 02: Peer Review . Also see Design/Technical Review.
Primary Stormwater System	The stormwater system comprising of pipes, watercourses, and other elements of built and natural drainage, that convey the flow of stormwater within the catchment for more frequent storm events and provide a primary protection from flooding to surrounding properties. Which may be owned by FNDC or controlled by easements and Local Government Act.
Principal Watermains	All water reticulation 100 mm inside diameter or greater, including associated valves.
Private Road	Any roadway, place or arcade laid out within FNDC on private land intended for the use of the public
Private Way/Private Accessway	A road or passage over private land that is not open or intended to be open to general public use. Also see District Plan definitions
Private Stormwater	Any part of the stormwater system that is privately owned and includes on drainage from a private land to a receiving environment or up to the point of service connection with the public stormwater network, and includes pipes, gutters, downpipes, catchpits, swales, subsoil drains, stormwater treatment devices, rainwater tanks and any stormwater management device or redundant stormwater system.

Public Stormwater	Public stormwater network includes: Any stormwater pipe, channel, watercourse, land drainage or treatment facility, vested in or under the control of FNDC. Any stormwater drain, drain, land drainage work or treatment facility declared by FNDC to be a public drain under Section 462 of the Local Government Act 1974. The stormwater assets of other public entities such as Transport, Kiwi Rail, and the NZ Transport Agency are not considered "public" in the context of this document. They may be owned by a public entity but are not "public" assets in a context of stormwater services being accessible to anyone.
Receiving Environment	A water body, river, stream, lake or sea where a catchment runoff discharges.
Registered Contractor (Water Supply)	As defined in FNDC Specification for Registered and Licensed Contractors for Water Supply Note that only FNDC or its agent can make connections to a live drinking water network.
Registered Contractor (Wastewater & Stormwater)	As defined in FNDC Specification for Registered and Licensed Contractors for Waste & Drainage Department
Regulatory Review	As defined in ENZ Practice Note 02: Peer Review -Version 2, April 2018
Retention (hydrology)	A volume of stormwater reaming in a wetland, pond or tank after detained water was released, the retained water may infiltrate ground, evaporates and be used by living organisms.
Rider Main	Water reticulation less than 100 mm inside diameter, including associated valves, that serves more than one property
Right of Way (ROW)	A ROW is a private access
Rising Main	Pressure reticulation between a pumping station and a non pressurised junction or termination, including another pumping station, manhole, reservoir or treatment system
Road or Street	Road means, subject to Sections 43(1), 51(1), 54(1) & 55(1b) of the Government Roading Powers Act 1989, any road as defined in Section 315(1) of the Local Government Act 1974, and roading has a corresponding meaning

Run-off Coefficient (C)	Used to estimate the amount of rainfall run-off that will occur off any given surface. See Table 4-3Rainfall runoff curves are used to describe rainfall losses. The curves used in TP108 and methods developed by the US National Resource Conservation Service, previously known as Soil Conservation Service (SCS). Curve numbers (CN) were determined based on the hydrological soil group, cover type, soil treatment, hydrological condition and antecedent ground condition. Values from the summary sheets in USDA Soil Conservation Service TR-55 and TP108 have been adopted for typical Northland soils encountered in the Far North District. Table 4-3 below sets out the typical values to be applied. For more detailed information refer to the original tables in USDA Soil Conservation Service TR-55 or Table 2-2 of TP108. Runoff Coefficients (C) represents the proportion of rainfall resulting in physical runoff for calculation of flow. The values given in E1 of the NZ Building Code are considered low for Northland conditions during significant rainfall events. The FNDC has adopted figures developed from the formula C= CN/ (200-CN) from TP108. These values are listed side by side in Table 4-3 below. The (Rational Method) runoff coefficients in Table 4-3 are for peak flow rate and may be modified for slope as discussed in NZ Building Code Clause E1. The variability of soils within the Far North District and wider Northland, are borne out by changes in runoff characteristics in addition to that caused by vegetation cover. The four hydrologic soil groups are: D Very low permeability such as clay (e.g. Northland Allochthon/Onerahi Chaos) C Low permeability such as loam (e.g. Maunu and Glenbervie volcanics) B Medium permeability, coastal wind-blown sands (e.g. Ruakaka and Waipu coastal sands) A High permeability such as fractured rock and deeply bedded scoria deposits. Soil type A is not usually encountered at surface levels and typically is only used for discharge to ground solutions by deep infiltration. Soil type A should not be used for the calculation of surface runoff. Table 4-3.
Rural Area	As defined in the District Plan
Safety in Design	Refers to the Health and Safety by Design concept of managing health and safety risks throughout the lifecycle of structures, plant, substance or other products as presented by WorkSafe NZ guidelines and framework (WorkSafe NZ Health and Safety by Design: An Introduction, August 2018).
Secondary Stormwater System	The path taken by stormwater runoff in excess of the primary design flow, (e.g. in excess of 20% AEP). The secondary stormwater system is comprised mostly of OLFP, and watercourses. The secondary system is vital for flood protection of surrounding properties.

Service Lane	Has the meaning given in Section 315 of the Local Government Act 1974
Specific Design	A design that requires analysis, and/or calculation, as required by a method referenced in the ES, or outside of the scope of methods used in the ES. Specific Designs shall be prepared by a SQEP in accordance with sound and accepted engineering practice and principles and shall meet the objectives set out in the ES and/or the District Plan. The design shall comply with New Zealand Standard specifications and/or other nationally recognised procedures and systems. All specific designs must be accompanied by a PS1 Design and a PS4 Construction Review. FNDC may require a PS2 Design Review to be provided.
Standard Design Vehicle	See **Sheet 26** for details
Stable Ground	Land that in the opinion of a suitably qualified and experienced Geo-Professional is in a state which is unlikely to settle, slip, erode or otherwise move, allowing for a suitable factor of safety to the detriment of superimposed buildings, services, roads or property.
Stormwater	Rainwater that turns into runoff and flows via primary and secondary stormwater systems into a receiving environment.
Stormwater Treatment Pond	A permanent pond, wetland or dry detention basin, designed to control peak stormwater flows and provide water quality treatment (see also Attenuation)
Sub-base	The material between the subgrade and basecourse aggregate
Subgrade	The top 1 m layer of the road formation below the pavement. It includes any stabilisation, granular or non-granular material of a lower standard than quarry run aggregate
Suitably Qualified and Experienced Person	FNDC requires that the engineering, including other technical aspects of infrastructure, environmental land development projects that need an engineering design approval and a consent from FNDC shall be undertaken, supervised and certified by a SQEP. Generally the required level of competency and qualifications corresponds with the scale and type of the project and the overall risk (Refer to Section 1.5.1.3 Risk Based Assessment Framework)
Surcharge	A pipe running in excess of its gravity flow condition, above full and under a degree of pressure.
Survey Plan	As described in Section 2 of the Resource Management Act 1991.

Swale	A planted or just grassed channel for conveying stormwater generally at low, non-eroding velocities and provide water quality treatment and amenity.
Transport Corridor	For the purpose of the ES, includes all Road or Street as defined above and includes all land from boundary to boundary (including the Berm and Carriageway).
Tree Dripline	The area defined by the outermost circumference of a tree canopy where water drips from and onto the ground
Urban Area	As defined in the District Plan
Vehicle Crossing	A trafficable pavement created over a public road corridor in order to connect FNDC's formed road to the boundary of private property.
Watercourse	A watercourse is part of the stormwater system and is a natural or man-made open channel where water collects and flows. It can be a river, stream, drainage channel, culvert or pipe that replaces a natural open channel etc.

1.4. General Engineering Requirements

The FNDC will undertake a review of a development application prior to issue of a resource consent, in order to establish suitable engineering consent conditions.

Typically, Engineering Approval consists of three phases:

a. Post-consent engineering design approval (pre-construction),

b. Works commencement, inspection, and testing (during construction), and

c. Works completion and acceptance (post-construction).

The following sections detail the expectations of the District Council and the information submission requirements for Engineering Design Approval (EDA).

Any works, whether they require land use; subdivision; building consent, that impact on FNDC owned assets and/or include installation of new assets to be vested to FNDC, will require an EDA.

1.4.1. Developer's Representative

The Developer shall nominate a SQEP in accordance with Section 1.5.1.3 Risk Based Assessment Framework. This shall be submitted in writing to FNDC.

Should the appointed SQEP(s) change during the various phases of the work, FNDC shall be notified in writing of the change, and provided with the contact details of the new SQEP.

The SQEP is to provide the following:

a. Compliance with Section 1.2 Statutory Requirements

b. All correspondence, investigations, calculations, design, construction work and supervision, certification of completed works, and provision of As-Built Plans of the approved works. See Section 1.4.4 Quality Assurance and Quality Control, Section 1.5.3.3 Investigation, Design and Certification and Section 1.7.2 As-Built Plans, Asset Information Schedules, Operation and Maintenance Manuals,

c. Ensure that SQEP is covered by professional indemnity insurance to the value of at least $1,000,000. See Section 1.4.3 Insurance, and

d. Ensure that the Developer's contractors hold adequate insurance cover for their activities, provide evidence of such insurance cover prior to commencement of work on the development, and maintain this cover throughout the works. See Section 1.4.3 Insurance.

All FNDC correspondence relating to the conditions of consent shall be with the nominated SQEP.

1.4.2. Cost of the Work and District Council Contributions

The Developer shall pay all development contributions and other fees and charges set by the District Council.

The Developer is responsible for all construction and associated costs of the development unless otherwise agreed in writing with the District Council.

In certain circumstances the District Council may contribute towards the cost of work in terms of an applicable policy, or as negotiated, with the basis and timing of payment of such agreements confirmed in writing by the District Council prior to commencing work. Generally, such contributions would only cover the provision of services greater than required for the immediate proposal and is entirely at the discretion of the District Council.

1.4.3. Insurance

Where work is carried out on a public road or reserve, on a FNDC asset, or on land not owned by the Developer, the Developer shall ensure that the following insurance is in place prior to commencing work:

a. Public Liability Insurance in the name of the Developer for an amount of not less than $2,000,000.

Note: For developments where the value of work on public land or FNDC asset is low, FNDC may reduce the required value of the Public Liability Insurance to relate to the risk, but not less than 200% of the value of this work.

Note: The policy shall cover all insurable risks normally applicable to land development work until the end of the maintenance period. Such risks may include flooding due to burst watermains, property damage due to land slips, or contamination of natural water due to overflowing sewerage reticulation, and similar

b. The Developer's SQEP(s) shall separately be covered by suitable current Professional Indemnity Insurance of not less than $1,000,000.

Note: This Professional Indemnity Insurance shall cover all aspects of the works for which the professional is responsible. See Section 1.4.1 Developer's Representative and Section 1.5.1.3 Risk Based Assessment Framework.

The Developer shall ensure that its contractors also hold insurance cover adequate to cover their activities and these requirements**,** provide evidence of suitable insurance cover prior to the commencement of the work, and ensure that this insurance cover is maintained for the duration of the works.

Note: Only a Tier 1 SQEP certifying site suitability for onsite wastewater disposal as per Table 1-4 shall be separately covered by a suitable current Professional Indemnity Insurance of not less than $200,000.

1.4.4. Quality Assurance and Quality Control

The *QA/QC Manual 2022* sets out the minimum Quality Assurance/Quality Control requirements for developments incorporating assets that will be vested to the District Council upon completion of the works. The Developer's Representative shall be responsible for the provision of inspection and testing services unless the ES requires the supervision and certification to be undertaken by a SQEP. The Developer's Representative shall however retain overall responsibility for ensuring that all inspection and testing services are completed in accordance with the District Council's approved Inspection and Testing Plan as per Section 1.6.3 Inspection and Testing Plan (ITP).

1.5. Design

1.5.1. General

1.5.1.1 Design Statement

All designs submitted to the District Council shall be accompanied by a Design Statement (see Section 1.5.3.3.5 Design Statements and Engineering Plans).

1.5.1.2 Alternative Designs

The District Council supports and encourages innovation and designs which add value. Alternative Designs may be submitted provided that the Alternative Design meets or exceeds the ES and in particular the policies and performance standards that are set out in the respective infrastructure sections. The Alternative Design provided shall be described in the Design Statement and include all relevant supporting information to enable review and assessment by the District Council.

Where a Designer identifies a product that is not currently approved (refer to Councils Approved Materials Lists), an application shall be made to the District Council for the item to be considered. Application and discussions for alternative products should occur at an early stage in the design process.

Approval of an Alternative Design or product will be at the sole discretion of the District Council's engineers and asset managers in accordance with their delegation, policies and performances standards. Such approval does not confer approval in general nor in principle to any design criteria, construction technique or material forming part of the design. Any such approval should be obtained as part of the resource consent and/or EDA process well in advance of committing to construction, and to allow specific consent conditions to address the alternative, if any.

Any approval is based on the information provided and shall not relieve the Developer of the responsibility for compliance with District Council standards, established principles and carrying out the work in accordance with the industry best practice.

All alternative means of compliance shall be specifically set out in a separate "Schedule of Alternative Means of Compliance" with description of proposed departures from the ES and alternatives. All other aspects of the design shall comply fully with the requirements of the District Plan and relevant standards.

Any Alternative design must provide sufficient information, similar to that required by Specific Design.

1.5.1.3 Risk Based Assessment Framework

The FNDC requires that the engineering, including other technical aspects of infrastructure, environmental land development projects that need an engineering design and a consent from FNDC, including Resource Consent, Engineering Design Approval, Building consent or any other approval related to the proposed works, shall be undertaken, supervised and certified by 'Suitably Qualified and Experienced Persons' (SQEP).

Design work, and assessments required for resource consents and engineering design approval shall at a minimum be reviewed and certified by SQEP in accordance with, Table 1-1, Table 1-2, Table 1-3, and Table 1-4 and as set out in the ES. SQEP can undertake work on designs and assessments classified above their Tier level, but the work must be reviewed and certified by a SQEP in accordance with these tables, before submitting to FNDC for approval.

The level of competency and qualifications required from SQEP shall generally correspond with the scale and type of project and the overall risk. It is considered that the level of complexity varies under different environments, processes, and with each asset type. There are certain aspects of development designs that will require a higher level of expertise even when the development is of a small scale.

A cascading system of responsibility is listed below to identify the minimum qualifications/experience required to certify the work or development component that is being addressed:

a. **Tier 1:** Work can be certified by an experienced person within a suitable field of practice.

b. **Tier 2**: Work can be certified by a professional holding a NZQA Level 6 academic qualification or equivalent in an applicable field of engineering and accredited with one of the following: REA, LDEngS, RPSurv, CMEngNZ (Engineering Technician).

c. **Tier 3:** Work can be certified by a professional holding a NZQA Level 7 academic qualification or equivalent in an applicable field of engineering and accredited with one of the following: REA, LDEngS, RPSurv, CMEngNZ, CMEngNZ (PEngGeol), CMEngNZ (Engineering Technologist).

d. **Tier 4**: Work can be certified by a Charted Professional Engineer (CPEng) accredited with the Charted Professional Council (CPEC).

Note: All designs that fall outside the scope of the simplified methods in the ES shall be certified by a Tier 4 SQEP.

If there is any doubt as to the required/permitted level of SQEP involvement in any consent application, please contact FNDC for clarification.

Regardless of what Tier the SQEP may be, all work and supporting documentation must be in accordance with the ES or follow the Specific Design requirements for alternative methods. Work requiring Specific Design shall be accompanied by detailed calculations, analysis, and reports and submitted to FNDC for approval.

SQEP shall be covered by Professional Indemnity Insurance in accordance with Section 1.4.3 Insurance.

While compliance with this Section (1.5.1.3 Risk Based Assessment Framework) is required by the ES, it does not diminish the responsibility of any professional to exercise their professional/engineering judgement and devise appropriate solutions.

Figure 1-1 sets out the manner in which the ES will be used when considering engineering works associated with resource consents and outlines FNDC's and a SQEP involvement in various aspects of development.

Figure 1-1 Performance Standards and Design Requirements

Engineering Standards

Performance Standards and Design Requirements

Assets to Vest in the District Council	Assets to be Retained in Private Ownership with Impact on Public Assets	Assets to be Retained in Private Ownership
Includes roads, public reticulation, reserves	Includes stormwater management, vehicle crossings	Includes private roads/ RoWs, private sewerage disposal schemes, private parking areas
• Conditions of consent identifying assets to vest. • Approval of EDA with relevant Producer Statement (PS1 Design). • Inspection and Test Plan in accordance with Section 1.6.3. • Inspections and testing in accordance with Inspection and Test Plan. • Final inspection undertaken in accordance with QA/QC Manual 2022. • Relevant Producer Statement (PS4 Construction Review), documentation and as-built information provided. • Maintenance bond secured (where necessary). • Asset vests to FNDC	• Conditions of consent identifying assets to be retained in private ownership with any ongoing maintenance requirements. • Approval of EDA with relevant Producer Statement (PS1 Design). • Schedule of required inspections by FNDC included in plan approval. • Inspections undertaken in accordance with Schedule. • Final inspection undertaken by FNDC with Developer. • Relevant Producer Statement (PS4 Construction Review), documentation and as-built information provided.	• Conditions of consent identifying assets to be retained in private ownership with any on-going maintenance requirements. • Approval of EDA with relevant Producer Statement (PS1 Design). • FNDC notified of inspections/testing for optional observation. • Relevant Producer Statement documentation (PS4 Construction Review) and as-built information provided. • Works completed

Note: If there is any doubt as to the required/permitted level of SQEP involvement in any consent application or EDA, please contact FNDC for clarification.

Table 1-1 Site Suitability (Geotechnical and Natural Hazards) Aspects that Require a SQEP

	Complexity of Site Suitability	
	Low risk or not identified in a hazard zone	*Medium/High Risk or identified within a hazard zone or unmapped in terms on land instability* ***(note 'risk' is in the context of all hazards)***
Geotechnical Assessment Report	Tier 3 (CMEngNZ, CMEngNZ (PEngGeol), CMEngNZ (Engineering Technologist) or REA)	Tier 4 Geo-Professional (including PEngGeol)
Report on other identified hazards, excluding flooding (e.g. Coastal erosion, mine zones, aggressive ground conditions)	Tier 3 (CMEngNZ, CMEngNZ (PEngGeol), CMEngNZ (Engineering Technologist) or REA)	Tier 4 Geo-Professional (including PEngGeol)
Flood Hazard and Coastal Flood Hazard Assessment	Tier 3	Tier 4
Geotechnical Design Report *(This includes all elements listed in Section* 2.4.1 Geotechnical Design Report *except for the Erosion and Sediment Control Plan, see SQEP requirements below)*	Tier 3* (CMEngNZ, CMEngNZ (PEngGeol), CMEngNZ (Engineering Technologist) or REA)	Tier 4 Geo-Professional (including PEngGeol)
Erosion and Sediment Control Plan	Tier 1	Tier 4*
Geotechnical Completion Report	Tier 4 Geo-Professional (including PEngGeol)	Tier 4 Geo-Professional (including PEngGeol)

	Complexity of Site Suitability	
	Low risk or not identified in a hazard zone	*Medium/High Risk or identified within a hazard zone or unmapped in terms on land instability* ***(note 'risk' is in the context of all hazards)***
Contaminated Site Validation Report	Suitably qualified and experienced Environmental Scientist or Engineer with relevant experience in the type of contamination and management. (See page 16 and 17 of Users' Guide National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health 2012 for further guidance)	

1. * This may require a higher level of sign off, dependent on complexity of works. i.e. Tier 4 Geo-Professional or a PS2 Design Review.

Table 1-2 Road and Access Aspects that Require a SQEP

	Complexity of the Development			
	Low complexity AND small subdivisions (Typically 0-2 Dwellings)	*Low complexity AND small to medium developments (Typically 3-8 Dwellings)*	*Low complexity AND medium to large developments (Typically 9-29 Dwellings)*	*Medium to high complexity AND/OR large developments (Typically 30+ Dwellings)*
All Design & Access Statements as per Section 3.2.2.2 Design and Access Statements for vested roads.	Tier 1	Tier 1	Tier 2	Tier 4
Integrated Transportation Assessment As required under the District Plan Rules.	Tier 1			
Roadway Design for Private Accessways: • Geometric Design • Horizontal & Vertical Alignment • Cut/Fill Batters	Tier 1	Tier 1	Tier 2	Tier 4

	Complexity of the Development			
	Low complexity AND small subdivisions (Typically 0-2 Dwellings)	*Low complexity AND small to medium developments (Typically 3-8 Dwellings)*	*Low complexity AND medium to large developments (Typically 9-29 Dwellings)*	*Medium to high complexity AND/OR large developments (Typically 30+ Dwellings)*
• Footpaths • Accessible Crossings • Cycle Facilities • Crossfall & Superelevation				
Roadway Design for Roads to Vest based on District Plan TRAN Table 10 - Transport Network Hierarchy: • Geometric Design • Horizontal & Vertical Alignment • Cut/Fill Batters • Footpaths • Accessible Crossings • Cycle Facilities • Crossfall & Superelevation	Tier 2 (Only if low volume and access roads)	Tier 3 (Only if Secondary Collector)	Tier 4 (For Primary Collector, Arterial, regional & National Roads)	Tier 4 (For Primary Collector, Arterial, regional & National Roads)

	Complexity of the Development			
	Low complexity AND small subdivisions (Typically 0-2 Dwellings)	*Low complexity AND small to medium developments (Typically 3-8 Dwellings)*	*Low complexity AND medium to large developments (Typically 9-29 Dwellings)*	*Medium to high complexity AND/OR large developments (Typically 30+ Dwellings)*
Intersection Design - Based on District Plan TRAN Table 10 - Transport Network Hierarchy For the intersection of two different classifications of roadway, qualification requirements will be based on the higher of the two roadway classifications.	Tier 2 (Only if low volume and access roads)	Tier 3 (Only if Secondary Collector)	Tier 4 (For Primary Collector, Arterial, regional & National Roads)	Tier 4 (For Primary Collector, Arterial, regional & National Roads)
Pavement Structural Design for Private Accessways	Tier 2	Tier 2	Tier 4	Tier 4
Pavement Structural Design for Roads to Vest	Tier 4			
Traffic Signal Design	Tier 3 (Suitably qualified and experienced Engineering Technologist)			
Lighting Design	Tier 1			
Traffic Signs & Line Markings	Tier 1			

Table 1-3 Stormwater Aspects that Require a SQEP

	Complexity of the Development		
	Low complexity AND small subdivisions (Typically 0-2 Dwellings)	*Low complexity AND medium to large developments (Typically 3-10 Dwellings)*	*Medium to high complexity AND/OR large developments (Typically >10 Dwellings)*
Stormwater Management Plan	Tier 2*	Tier 3*	Tier 4
Stormwater Mitigation Analysis	Tier 2*	Tier 3*	Tier 4
Stormwater Management Device Design: • Rainwater Re-use and/or Attenuation Tanks • Vegetated Swales • Bioretention Devices (including raingardens) • Pervious Paving (including porous or permeable paving) • Infiltration devices	Tier 3*		
Design details of ponds and constructed wetlands, including detention ponds, box culverts and major circular culverts sized ≥600 mm.	Tier 4		

	Complexity of the Development		
	Low complexity AND small subdivisions (Typically 0-2 Dwellings)	*Low complexity AND medium to large developments (Typically 3-10 Dwellings)*	*Medium to high complexity AND/OR large developments (Typically >10 Dwellings)*
OLFP Assessment (including conveyance of OLFP(s) from entry to exit through the development site).	Tier 2*	Tier 3*	Tier 4
Flood Hazard and Coastal Flood Hazard Assessment	Refer to Table 1-1		
Hydraulic calculations and gravity stormwater reticulation design requiring pipework including culverts.	Tier 2*	Tier 3*	Tier 3*

1. * This may require a higher level of sign off, dependent on complexity of works. i.e. Tier 4 or a PS2 Design Review.

Table 1-4 Water and Wastewater Aspects that Require a SQEP

	Complexity of the Development			
	0-6 Dwellings AND if extension is of the existing water or wastewater network.	*7-10 Dwellings, where design problems are well defined AND network sizing limited to 150 mm wastewater mains and 63 mm watermains. Pump stations are excluded.*	*>10 Dwellings, where design problems are well defined AND network sizing limited to 150 mm wastewater mains and 125 mm watermain. Pump stations are excluded.*	*40+ Dwellings or where design problems are complex and require broad spectrum or specialized engineering principles (includes work such as structural design, pump stations, process work or larger diameter pipework (225 mm and over)).*
Design Work (excluding those listed below)	Tier 1 (If detailed design work isn't required for service connections. The extension must be in accordance with the ES without any deviation or amendment to the standard ES design drawing solutions. The EDA application must show the intended extension in detail)	Tier 2 (If no specialist input is required, such as structural design that cannot be taken directly from FNDC ES standard design details i.e. requires Specific Design.)	Tier 3 (There may be simple structural designs required for network components such as narrow stream crossings or slightly deeper services that can be deduced from design catalogues.)	Tier 4
Gravity reticulation requiring pipework larger than 150mm ID	Tier 4			
Sewer pump stations and rising mains	Tier 4			

	Complexity of the Development			
	0-6 Dwellings AND if extension is of the existing water or wastewater network.	*7-10 Dwellings, where design problems are well defined AND network sizing limited to 150 mm wastewater mains and 63 mm watermains. Pump stations are excluded.*	*>10 Dwellings, where design problems are well defined AND network sizing limited to 150 mm wastewater mains and 125 mm watermain. Pump stations are excluded.*	*40+ Dwellings or where design problems are complex and require broad spectrum or specialized engineering principles (includes work such as structural design, pump stations, process work or larger diameter pipework (225 mm and over)).*
Suitability report for on-site disposal (using Appendix B ES-SEW1 or similar)	Tier 2 (Note: Tier 1 is suitable for 0-3 Dwellings)	Tier 3*	Tier 3*	Tier 4
Community wastewater treatment systems	Tier 4			
Siphons and retaining structures.	Tier 4			
Low Pressure Sewer Systems	Tier 4 (Pressure sewer design must be reviewed by the proprietary product supplier)			
Water Booster pump stations	Tier 4			
Reservoirs	Tier 4			

	Complexity of the Development			
	0-6 Dwellings AND if extension is of the existing water or wastewater network.	*7-10 Dwellings, where design problems are well defined AND network sizing limited to 150 mm wastewater mains and 63 mm watermains. Pump stations are excluded.*	*>10 Dwellings, where design problems are well defined AND network sizing limited to 150 mm wastewater mains and 125 mm watermain. Pump stations are excluded.*	*40+ Dwellings or where design problems are complex and require broad spectrum or specialized engineering principles (includes work such as structural design, pump stations, process work or larger diameter pipework (225 mm and over)).*
Pipe bridges and other structures	Tier 4			
Hydraulic design of reticulation	Tier 4			

1. * This may require a higher level of sign off, dependent on complexity of works. i.e. Tier 4 or a PS2 Design Review.

1.5.1.4 Review of Reports and Designs

The FNDC undertakes review of information submitted to the FNDC. Those reviews may take the form of one or more of the following:

a. Regulatory Review,

b. Design Review or Technical Review, or

c. Peer Review.

The Regulatory Review assesses the report or design for compliance with pertinent regulations, consent requirements and laws.

FNDC at its own discretion may arrange for external regulatory reviews as part of the approval process where FNDC staff do not have the necessary skills or capacity to assess.

Design or Technical Review checks assumptions, design method, arithmetical accuracy and conclusions drawn by the designer.

Peer Review involves a complete review of the overall proposal and design.

A full peer review may take place if, the proposal and supporting information appear to be deficient, or complex, or is an alternative design.

Regulatory, Technical/Design and Peer Reviews shall be undertaken generally as described by Engineering New Zealand (See ENZ Practice Note 02: Peer Review Version 2- April 2018).

All reviews will be undertaken by an independent specialist engaged by FNDC, at the Developer's cost, and as a part of the consent application.

1.5.2. Information Requirements - Resource Consent Applications

The following minimum level of engineering information (where applicable) is required to be provided with a Resource Consent Application:

a. A suitable site plan detailing the overall proposed development and showing existing contours in areas proposed for development (e.g. building site, access, effluent disposal area) and any overland flow paths, rivers, wetlands, water bores etc. which exist pre-development either in the subject property or in adjoining properties (where applicable),

b. Each proposed lot is to detail a building site, access route to the building site (taking into account natural hazards, emergency services) and an effluent disposal site (where applicable)

c. Site(s) that lie within the low instability hazard zone on the District Council GIS hazard mapping; visual assessment (site walk over) by a person experienced in geotechnical assessment. This assessment is to determine whether or not further geotechnical investigation is necessary i.e., local ground conditions do/do not qualify for a low instability rating. A professional statement will be required from this experienced person containing their recommendations and the fact that they are suitably experienced and qualified to make this assessment.

d. Site(s) that lie within the moderate and high risk instability zones on the District Council GIS hazard mapping, geotechnical assessment by a Geo-Professional. This assessment is to cover the areas proposed for development within the larger site (e.g. building site, access, effluent disposal site etc.). See Section 2.3 Geotechnical/ Hazard Assessment

e. Site(s) that lie outside of the District Council GIS hazard mapping, geotechnical assessment by a Geo-Professional. The content of the assessment will depend on whether the Geo-Professional considers the site(s) to be of low, moderate, or high instability. See Section 2.3 Geotechnical/ Hazard Assessment

f. Assessment of any other hazards affecting the site (flooding, coastal hazards, mine zones, tsunami zones etc.). In case of flooding and overland flow paths, an assessment of the extent and depth of the 1% AEP event shall be clearly shown on the plans. Development within the Coastal Hazard zones will require an assessment by a chartered professional engineer with competency in Coastal Hazard Engineering.

g. Traffic assessment. This may only be an assessment of entrance sight lines, but may involve a full report from a SQEP (traffic) depending on the proposal and the type of road accessing

h. In District Council reticulated areas, an assessment that shows that the existing infrastructure has sufficient capacity to support the development (sewer, water, stormwater) and consideration of elevation of each of the proposed lots to establish a service envelope where that lot is able to be serviced without the need for on-site pumping. Reference shall be made to any part of the lot that is outside the service envelope. This requirement does not cover development to be served by pressure sewers.

i. An outline of the proposals to provide electricity, telecommunications and gas networks.

j. For sites outside of the area of benefit of reticulated sewer, a completed on-site effluent assessment on form Appendix B ES-SEW1 to prove the ability of the site to effectively support disposal as per the NRC Regional Plan.

k. In reticulated area's an assessment of fire-fighting capability to provide compliance with SNZ PAS 4509:2008 showing:

   i. The position of nearest hydrant (existing or proposed) and distance to the existing or proposed dwelling site following a route along which a fire hose could be laid.

   ii. Flow/pressure available from hydrants compliant with standards and Section 6.2.4 Fire Service Requirements

Note: Hydrants shall be able to service all of the available buildable area shown in Living 1 & 2 and Business environments. Compliance with SNZ PAS 4509:2008 is required

   iii. Should any proposed house site be positioned sufficiently far away from a hydrant or other suitable water supply such that a fire fighting appliance has to use the access route, then, unless an alternative is agreed to in writing by the fire services region manager, this route shall be:

      - Capable of conveying a 20 tonne vehicle (maximum access gradients for fire appliance shall be considered)

- Capable of supporting a 20 tonne vehicle, and
- Formed to a minimum width as specified in Table 3-16: Minimum Width Requirements – Private Accessways for 2-4 lots.

l. In non-reticulated area's an assessment of fire-fighting capability to provide compliance with SNZ PAS 4509:2008 showing:

   i. Proposed method of providing fire-fighting water supply (tanks/dam/river etc.). Refer to SNZ PAS 4509:2008 for requirements.

   ii. An access complying with the requirements of SNZ PAS 4509:2008 unless an alternative is agreed to in writing by the fire services regional manager.

m. Existing services (private and public) on the land in question have been located and plotted

n. Any roads, accessways, entrances (existing and proposed) comply with the minimum requirements of the ES.

o. Parking and maneuvering, accessible parking etc. demonstrated as achievable

p. Proof that any consents necessary from NRC have been applied for/obtained.

Depending on the complexity of any consent application, it may be necessary to produce full engineering construction drawings, calculations etc. for certain/all aspects of the proposal prior to consent approval being obtained so that appropriate conditions of consent can be applied. This would particularly apply in terrain which is unstable/steep/flood prone etc. and where Alternative or Specific Designs are proposed.

Note: It is recommended that the Developer/SQEP have a pre-lodgment meeting with FNDC to determine the level of information/design necessary.

1.5.3. Detailed Design/Approval

The Developer shall provide sufficient information in support of their proposal and engage SQEP who will liaise with FNDC staff throughout the EDA process and provide the following:

a. Clear interpretation and presentation of the Resource Consent, engineering design and other relevant details prepared by SQEP,

b. Engineering design drawings, calculations, and reports,

c. Overseeing the physical works and certifying that the work has been completed to the required standards, and in accordance with the approved EDA, and

d. as-built plans and associated documentation.

Note: Consultation with FNDC asset management teams on all infrastructure design and landscaping proposals at an early stage of the development is encouraged.

1.5.3.2 Engineering Plan Approvals for Construction

The following **minimum** level of engineering information is expected to be provided for EDA prior to construction, (where applicable):

a. Full Engineering Drawings with all calculations, investigations, analyses, reports etc., drawn in accordance with AS/NZS 1100.501:2002, NZS/AS 1100.301 Supplement 1:1986, and NZS/AS 1100.301:1985 and the ES. See Appendix G Drawing Standards.

b. Completion of the supporting information Appendix J Checklist for Supporting Information.

c. Drawings submitted for approval shall include the FNDC's resource consent (if applicable), property legal description, and the Developer's name.

d. Complex and/or specialist designs are to be peer reviewed and a PS2 Design Review submitted with application.

e. It is recommended that a pre-lodgement meeting be held to determine the necessary detail for Engineering Drawings.

f. Any proposed changes to existing FNDC assets are to be clearly identified (e.g. abandonment, removal, upgrading and relocation).

1.5.3.3 Investigation, Design and Certification

1.5.3.3.1. General Requirements

All specialist investigation, calculations, design, supervision and certification of the works described in the ES shall be carried out by or under the control of person(s) who is a SQEP. SQEP shall sign off technical documentation as per Section 1.5.1.3 Risk Based Assessment Framework.

1.5.3.3.2. Design

Designs may either conform to the ES, or be an Alternative Design (Section 1.5.1.2 Alternative Designs) as appropriate to a specific situation.

Note: Designers are reminded of their responsibilities to apply Safety in Design *principles, particularly where the requirements of the Building Act 2004 and NZ Building Code may be more onerous than that required under the ES and the District Plan.*

1.5.3.3.3. Design Life

The design life of assets shall be 100 years unless otherwise stated in the ES.

1.5.3.3.4. Certification

Design Stage

All works requiring design by a SQEP require certification in the form of a producer statement (design), PS1 Design. Specific Design and complex works may also need a PS2 Design Review.

Post Construction

Producer statements (construction) are required for all completed works that are covered by a producer statement (design) PS1 Design and shall be certified by a SQEP. PS4 Construction Review may be used for this purpose, or other form approved by the FNDC.

1.5.3.3.5. Design Statements and Engineering Plans

All Engineering Drawings shall be accompanied by a Design Statement which describes the proposed infrastructure and its relationship to the ES. Alternative Designs and any departure from the ES shall be described in the Design Statement.

Table 1-5 contains details on the Engineering Drawings required to be submitted.

The Design Statement and Engineering Drawings shall be supported by the information summarised in Table 1-6.

Approval of Engineering documentation (plans, statements, drawings, calculations and reports) is required before construction commences.

The FNDC may reject applications with incomplete design documentation.

Note: Staged submission of detailed Engineering Drawings may be considered where an overall preliminary documentation is provided with the initial application and is included in the resource consent conditions.

Note: Unless specifically stated otherwise, the approval of drawings does not supersede the requirements or obligations of the ES.

1.5.3.3.6. EDA Process

EDA is subject to the payment for assessment, approval, and inspection fees. The approved plans shall be always kept on site during construction of the works.

The FNDC will endeavour to process plans within 10 working days, however larger or more complex applications may take up to 20 Working Days.

Once EDA is granted, it does not constitute a right of access onto FNDC or a third-party property to undertake works. A right of access must be obtained from the affected party in writing before works commence.

1.5.3.3.7. Request for Further Information

Prior to approval of EDA being issued, FNDC may require further information to be submitted with results in necessity to amend drawings and reports.

The final engineering documentation (statements, drawings, calculations, and reports) shall then be compiled by the Developer for EDA.

1.5.3.3.8. Changes to Approved Plans

It may also be necessary for an approved EDA to be amended due to unforeseen site conditions.

The approved plans may only be amended after consultation with the District Council.

In all cases the changes shall be documented, and the amendments shown on the plans submitted for further approval.

1.5.3.3.9. Variations to Approved Engineering Documentation

Where changes to the approved engineering documentation are required, the Developer shall not proceed until the District Council grants written approval to the variation.

Approval shall only be given once plans and/or calculations/details are submitted to the District Council.

The Developer/contractor shall be aware that, any works constructed without approvals may not be accepted by the District Council.

1.5.3.4 Content of Design Submission

Engineering Plans that are submitted for the District Council's approval shall include detailed information in accordance with Table 1-5: Engineering Plan Requirements Table 1-5.

In addition to the Engineering Plans the information presented in Table 1-6 is required prior to, during and after construction.

An erosion and sedimentation control plan is required for all developments where runoff from a construction site can enter into either a District Council stormwater pipe or open watercourse.

A health and safety plan is required if any works are in the public area i.e. roads, parks etc.

Table 1-5: Engineering Plan Requirements

Type	Plan View	Long Sections	Other
Site Locality	• Major street names • Legal descriptions of the site and adjacent properties • Overall extent of the works • Relationship with works or services adjacent to the site • Clear identification of existing works that will be modified, removed or abandoned • Proposed house sites and access routes		• Other major features that assist locating the site • Effluent disposal sites (if applicable). • Location of services in berms and accessways in relation to other services and site boundaries
Geotechnical	• Positions of tests • Areas of noted instability (slip scarps, unstable ground etc.) on or adjacent to the site • Proposed works required to mitigate the effects of geotechnical issues		
Earthworks Scheme Plan	• Original contours • Final contours • Overland drainage pattern • Cuts and fills • Batter slopes • Erosion and Sediment Control proposals		

Type	Plan View	Long Sections	Other
Transportation	• Horizontal alignment of kerb and channel including traffic facilities • Horizontal alignment of footpaths • Horizontal alignment of cycleways • Location of vehicle crossings where known • Parking arrangements • Locations of ducts and other below ground features • Location, type and colour of street light columns (may be separate plan) • Traffic signal details • Location of landscaping areas and street trees; landscape plans to include underground services and street lighting • Location of all street furniture • Location of any reserves • Location and type of any stormwater treatment and detention device	• Existing ground levels at minimum of 15m intervals • Proposed final centre line levels • Cuts and fills • Grades • Vertical curve information • Location of catch pits • Location of intersecting roads	Cross Sections • Proposed road • Existing ground contour extending at least 3.0m into adjacent land Road Marking and Signage • Location and types of signage • Location and alignment of all road markings Construction Details, including • Road pavements • Kerb & Channel, side drainage • Footpaths, cycleways • Vehicle access crossings • Proposed planting Details of information signs shall include the full layout, including sign text and colours (all road markings and signs to comply with Waka Kotahi TCD Manual and/or MOTSAM as applicable)

Type	Plan View	Long Sections	Other
Stormwater	• Horizontal alignment of all pipelines relative to property boundaries or kerb lines as appropriate and tie-in to existing services • Location of all pipes and nodes (manholes, inles, outlets, catchpits, etc.) • Location of all stormwater treatment devices • Location of any watercourse • Position of all property connections relative to property boundaries and the depth at the property boundary • Secondary network to 1% AEP (+ CC 20%) with easements where required • Site plan showing property boundaries finished land level contours (maximum one metre interval), catchment and sub-catchment boundaries used in stormwater flow calculations together with label annotations providing a reference to the stormwater runoff calculations. (Preferably show the stormwater network on the same drawing as well.) • Construction plan details for stormwater treatment and detention devices: plan view to include contours at minimum 0.5 metre interval and elevation view to show water levels	• Existing ground levels • Proposed ground levels • Pipe material, size, class, length, depth, inverts and grade • Location and depth of existing and proposed pipelines, cables and ducts crossing the alignment • Invert levels of all pipelines connecting to a manhole • Inlet, outlet and hydraulic information for all treatment and detention devices	Construction Details, including • Open drains and watercourses • Inlet/outlet structures, including scour protection, protective screens, etc. • Stormwater treatment and/or attenuation devices

Type	Plan View	Long Sections	Other
Wastewater	• Horizontal alignment of all pipelines relative to property boundaries or kerb lines and tie-in to existing services • Location of all manholes and other access structures • Location of all structures (including pump stations, rising mains, air valves, odour control facilities etc.) • Position of all property connections relative to property boundaries • Show finished land level contours (not greater than 1.0m intervals – include RL labels on contours)	• Existing ground levels • Proposed ground levels • Pipe material, size, class, length, depth, inverts and grade • Location and depth of existing and proposed pipelines, cables and ducts crossing the alignment • Invert levels of all pipelines connecting to a manhole	• Pump Station (including Rising Main and Overflow) • Show all relevant details to enable the design to be audited and the structure constructed • Construction drawing of pump station structure • Rising main plan and long section • Water and electrical services to the pump station • Show the provision for pump station overflow in both plan and elevation views • Make and model of all pumps, valves and associated pump station equipment • Pipeline details including thrust blocks, special connections, pipeline bridges etc.

Type	Plan View	Long Sections	Other
Water	• Horizontal alignment of all pipelines relative to face of kerb (or boundary as appropriate) and tie-in to existing services • Location of all valves, bends and tees • Location of all hydrants and building sites to be provided with fire protection • Pipe material, size, length and class • Position of all property connections relative to property boundaries and the depth at the property boundary • Position of meters and boxes, backflow devices, etc. • Location of all flushing valves	• Existing and proposed pipelines, cables and ducts crossing the alignment • Pipe depths where it is planned for the pipeline to be at a different depth to that specified in the ES. Long sections are required for pipelines of 250 NB and larger.	Construction Details • Details of connection into existing reticulation and other special connections • Special details, including pump stations, reservoirs • Pipeline details including thrust blocks, pipeline bridges etc. • The make and model of all pumps, valves and other equipment • Nominal static pressure at the connection point and at the lowest point in the works, design pressure and maximum design pressure.
Landscaping	Landscaping plan with plant locations for reserve areas, including stormwater and recreational reserves.		
Staging	Where the development is likely to be constructed in stages; • a plan showing the pattern and chronology of the land development The staging shall have been included as part of the resource consent application process and in the consent conditions.		
Utility Services	The depth and location of existing and proposed electricity and telecommunications, (including gas services where applicable).		

Table 1-6: Supporting Documentation for Approval

Type	Prior to Construction Commencing	During Construction	After Construction
Geotechnical Information	• Geotechnical Design Report • Earthworks and Fill Design Report	• Site Supervision	• Geotechnical Completion Report • Site Contamination Validation Report • Statement of Professional Opinion • Final contour plan identifying areas of fill
Transportation	• Road pavement design calculations including results of preliminary soil testing. • Approval for sub-soil drainage discharge (if appropriate) • Signal Plans including design, traffic modelling and peer review • Pre-Construction Road Safety Audit (RSA) or RSA Exemption	• Site Supervision	• Producer Statement • As-built information • Post Construction RSA
Stormwater	• Detailed catchment runoff calculations including each sub-catchment input factors used in the calculations • Detailed pipeline flow capacity analysis. • For stormwater treatment and detention devices, detailed analysis demonstrating the design performance in respect of stormwater quantity and quality as appropriate • Proposed operations and maintenance manuals for stormwater treatment and detention devices • Proposed landscaping plan for stormwater treatment and detention devices, landscape plans to include any services and access requirements for future maintenance	• Site Supervision	• CCTV Inspection and Report • Final operations and maintenance manuals for stormwater treatment and detention devices • As-Built Plans

Type	Prior to Construction Commencing	During Construction	After Construction
Wastewater	• Wastewater flow estimates supported by the estimates of population equivalents for each catchment together with catchment boundaries and catchment areas • Pipe flow calculations showing pipe capacity and flow velocity for average dry weather flow, peak daily flow and peak wet weather flow • Pump station calculations justifying the selection of wet well size, pump selection and rising main hydraulics.	• Site Supervision	• CCTV Inspection and Report • As-Built Plans
Water	• Fire flow calculation	• Site Supervision	• As-Built Plans
Landscaping	• Statement of design intent and design objectives • Planting schedule • Existing tree and vegetation plan • Maintenance schedule for weeding and replacement planting during Defects Liability Period	• Site Supervision	• As-Built Plans

1.6. Construction Process

1.6.1. General

For Developments:

a. No construction works shall commence on any development until all necessary approvals (resource consent, engineering design approval, building consent, etc.) have been obtained.

b. The Developer has advised Council of contact details of the Developer's Representative (Section 1.4.1 Developer's Representative)

c. The Developer has confirmed appropriate insurance is in place (Section 1.4.3 Insurance)

d. Any District Council contribution toward the cost of work, or other specific approval has been approved in writing.

e. A Construction Management Plan has been approved by Council in accordance with Section 1.6.2 Construction Management Plan.

f. An Inspection & Testing Plan has been approved by Council in accordance with Section 1.6.3 Inspection and Testing Plan (ITP).

The Developer's Representative shall give the District Council 24 hours' notice of the intention to commence construction work and advise the District Council in writing; the name, address, and contact details of all contractors who will be carrying out work on the development.

Note: Any works undertaken prior to the final approval of EDA will be at the Developer's risk. The District Council may reject such work, or request that the works be exposed and/or tested for compliance/suitability

Dependent on the size or complexity of the development, a pre-construction meeting may be required (see Section 1.6.4 Pre – Construction Meeting).

1.6.2. Construction Management Plan

The Developer's Representative shall submit a Construction Management Plan, where required by the resource consent conditions, and receive written District Council approval prior to commencing work on site. The plan shall include the following, (where applicable):

a. Details of when and how proposed works will be carried out,

b. All Particular Hazardous Work (Notifiable work),

c. A project execution plan, as applicable for complex projects,

d. Principal contractor and, sub-contractors,

e. Names and telephone numbers of contract and supervisory staff,

f. Starting date, working days, hours of work, and estimated completion date,

g. Temporary Traffic Management Plan (TTMP),

h. Health and Safety plan,

i. Dust and sedimentation control,

j. Confirmation of all insurances, and

k. Contingency and Emergency procedures

1.6.3. Inspection and Testing Plan (ITP)

The Developer’s Representative and SQEP are to prepare an Inspection and Testing Plan (ITP) identifying the following items:

a. Element of work,
b. Tests and checks required,
c. Quality requirements,
d. Frequency of testing,
e. Contractor's responsibility,
f. Developers Representative and SQEP’s responsibilities, and
g. Asset data recording requirements

Refer to Section 1.6.5.4 Site Inspections and Section 1.6.5.5 Testing for the content requirements of an ITP.

The ITP shall be approved in writing by the District Council prior to the commencement of work on site.

1.6.4. Pre – Construction Meeting

Following ITP approval, a pre-construction meeting with the District Council shall be held prior to the commencement of work. The Developer’s Representative and SQEP, contractor's representative, any relevant specialist consultants and District Council’s representative shall attend the meeting.

Where construction proceeds in stages, a separate pre-construction meeting shall be held for each stage.

Items to be considered at this meeting will include but not be limited to the following:

a. The District Council's construction requirements.
b. The process for monitoring compliance and auditing (ITP plan).
c. Management of environmental impacts and significant issues, including NRC Consents (if applicable).
d. Commissioning and decommissioning requirements of existing infrastructure and facilities (where applicable).
e. Erosion & Sediment Control measures

The District Council may require the Developer to undertake specific work prior to the pre-construction meeting to clarify the extent of works and highlight potential construction issues. Such work may include set-out of roads, investigations etc.

If the pre-construction meeting highlights any issues that may result in the works not being able to comply with the requirements of the EDA and other consents, then FNDC may require a design amendment. Design amendments shall be in accordance with Section 1.5.3.3.8 Changes to Approved Plans

1.6.5. Site Works, Site Inspections and Approvals

1.6.5.1 Health and Safety

All work carried out on District Council assets or public land shall strictly comply with the District Councils health and safety policies and procedures.

Where the District Council is not the Principal (e.g. work is carried out by a Developer), all contractors working on public land and/or on District Council assets are required to complete/comply with the following requirements of the Policy:

a. Be SiteWise approved with a score minimum of 50% in the first year of registration, moving to 75% and above in the subsequent years.

b. Ensure they can meet the minimum Health and Safety requirements outlined under the Health & Safety at Work Act (2015) and its relevant regulations and standards,

c. Provide a copy of their Site-Specific Safety Plan for the project including identifying any site-specific hazards associated with the project, and

d. Comply with all Traffic Management requirements, including providing a traffic management plan in a format that is consistent with Waka Kotahi Code of Practice for Temporary Traffic Management where work will be carried out within a road.

No work on District Council assets or on any public land shall proceed before the above has been complied with and approved by the District Council. The District Council may refuse to allow a contractor to carry out work on District Council assets or on public land where in the opinion of the District Council the contractors may not comply with all Health and Safety requirements.

In the case of work being carried out on private land that requires work in the District Council Road Reserve (e.g. vehicle crossing, water connection etc.), the Developer/contractor shall apply for a Corridor Access Request (CAR) and submit a Traffic Management Plan for approval **before** any work may take place in the public area.

Note: It is important to note that approval of EDA does not constitute a right of access onto District Council land to undertake works. Separate approval is required from the District Council before access can be allowed and works commence to ensure health and safety obligations are met.

1.6.5.2 Noise and Hours of Work

Noise resulting from any activity shall comply with the noise rules of the District Plan.

Unless otherwise stated in the District Plan, construction work shall be restricted to the hours of 7.00am to 7.00pm Monday to Friday and 7.30am to 6.00pm on Saturdays and exclude Sundays and public holidays, unless otherwise approved all work shall be undertaken during daylight. (For the purpose of this section daylight is defined as the period commencing at the official time of sunrise and ending at the official time of sunset).

Operating hours for emergency work and necessary maintenance work shall be at the discretion of the District Council.

1.6.5.3 Registered Contractors and Licensed Contractors

For some infrastructure services, the District Council maintains a list of contractors that are permitted to construct or work on District Council assets, or assets that will be vested to the District Council. Contractors on such a list may be either Registered Contractors or Licensed Contractors, both of which are defined in Section 1.3 Abbreviations and Definitions.

1.6.5.4 Site Inspections

Where assets are to vest, the Developer's Representative shall notify the District Council 24 hours prior to requiring site inspections. The District Council will confirm the minimum required inspections at EDA stage, but the critical points for which inspections will always be required are;

a. Completed earthworks and prepared subgrade,

b. Verification of construction to approved plans on-site prior to backfilling piped services, and similar,

c. Finished basecourse prior to the commencement of sealing,

d. Prior to pouring any concrete,

e. On completion of any service connections/disconnections prior to backfilling, and

f. At completion of all works when As-Built Plans have been submitted and the site left neat and tidy.

Note: The District Council may inspect any incomplete District Council approved works during daylight hours

As described in Section 1.5.1.3 Risk Based Assessment Framework, works that are to remain in private ownership, and which have no impact on FNDC assets, may be inspected/tested by a SQEP. The FNDC is still to be informed 24 hours in advance of when such inspections/tests taking place so that a FNDC officer may observe if so desired.

All works that impact on FNDC assets, may require FNDC representative to be present when inspections/testing take place. FNDC will not undertake such inspections/testing unless the Developers Representative responsible for the works is present.

Full documentation related to such tests, measurements and outcomes of inspections shall be provided to the FNDC, along with a producer statement (construction) PS4 Construction Review. Producer statements without the test results etc. will not be acceptable.

Note: In most situations images shall be provided to further back up the documentation.

1.6.5.5 Testing

All inspecting and testing for developments incorporating assets that will be vested to FNDC upon completion of the work shall be undertaken in accordance the QA/QC Manual 2022 and relevant standards applicable to the type of inspection or test being undertaken.

Inspecting and testing shall be fit for purpose and may include as necessary:

a. Material testing,

b. Fill compaction testing,

c. CBR testing of road subgrade,

d. Nuclear Densometer testing of compaction of road construction layers,

e. Clegg Hammer testing of pavement,

f. Confirmation of pavement depth (using lift pegs, string lines etc.),

g. Pressure testing of pipelines,

h. PE pipe weld testing, including: Calibration Certificate/Welders Registration, Joint tensile testing,

i. Welding data-log records,

j. CCTV inspection of all wastewater and stormwater pipelines.

k. Disinfection testing of water mains,

l. Hydrant flow testing,

m. Tracer Cable/Detection Tape testing,

n. Testing of manholes and other pipeline components, and

o. Other testing as directed by Council, including Benkelman Beam tests.

The Developer shall pre-test all works before requesting an inspection by the FNDC.

If the work does not meet the standard when inspected by the FNDC, then a fee will be charged for the second and any subsequent visit to re-measure or retest the work.

Relevant sections of the ES set Specific testing requirements for each asset group. Subsequent work dependent on a satisfactory test result shall not proceed until compliance has been achieved.

1.6.5.6 Colour of Pipes and Ducts

Pipelines and ducts installed shall comply with the requirements of the Network Utility Operator. To identify in-ground services, pipes with the external colours in Table 1-7 shall be used for the relevant services. Other services shall not use pipes with these colours (including the colour of stripes on pipes, and particular requirements for detection tapes identifying District Council services).

The internal colour of wastewater and stormwater pipes shall be suitable for video inspection (black will not be approved).

Any pipes laid not complying with these colours will need prior approval from the District Council (in writing), and will shall be clearly marked with a detection tape that identifies the service.

Table 1-7: Pipe Colours

Pipe Use	Colour
Sewer - Gravity	White (For pressure pipelines refer to Section 5.2.5 Approved Materials)
Sewer - Pressure	Black with white stripes
Stormwater	Grey
Potable Water	Blue
Non-Potable Water	Lilac
Gas	Yellow
Power	Orange
Telecommunications	Green

1.6.5.7 Connection to Existing Services

Upon successful testing of the reticulation, and written approval to connect to District Council owned services, the Developer shall arrange for the connection to be made. The connection shall only be made by FNDC/ FNDC agent (Water) or Licensed Contractor (Wastewater and Stormwater).

A District Council representative shall inspect connections prior to backfilling.

Where a connection shall be made within a property not owned by the Developer, it is the Developer's responsibility to obtain a right of access approval in writing and provide a copy to the FNDC.

1.6.5.8 Protection and Remediation of Existing Trees, Services, and Roads

The Developer and/or contractor shall take every care to protect existing public trees, services, and private property from damage as a result of its operations. To this end:

a. Excavations, filling, accessways, and retaining structures, shall be outside affected tree root and drip line areas,

b. Flat steel tracked machines shall only be permitted to run on sealed road carriageways with prior District Council approval if appropriate protection is provided,

c. Ribbed steel-tracked machines shall only be permitted to run on sealed road carriageways if appropriate protection, such as rubber mats, is provided. Otherwise, rubber tyre or flat tracked machines are required, and

d. The contractor shall consult all Network Utility Operators as to the location of buried services and take appropriate action to protect those services.

The Developer/Contractor shall be liable for the repair of any damage caused by the works and shall satisfy the District Council that they have made the proper reinstate. The District Council or affected Network Utility Operator may issue a written instruction to repair any damage and if remedial work is not commenced within 48 hours of the written instruction (or sooner if the circumstances warrant it) and completed as soon as practicable, the District Council may carry out the work at the Developer's cost. This provision includes the removal of mud and debris from existing roads and drains, which may be required daily in the interest of traffic and pedestrian safety.

Developer(s) and contractor(s) shall hold appropriate insurance to cover themselves in the event of their operations damaging existing property and services and shall indemnify the District Council against any claims associated with the works, whether during or after construction. See 1.4.3 Insurance.

1.6.5.9 Soil Disturbance and Dust Control

The Developer is responsible for compliance with Northland Regional Council requirements and consents. See Section 2.2.1 Northland Regional Council Requirements.

1.6.5.10 Emergency Procedures

If during the course of construction, a situation arises which may endanger the security of public or private property or the operation of a public facility, the District Council may instruct the Developer or contractor to undertake such remedial measures as considered necessary to alleviate the danger and secure the site. Any such work or supply of materials will be at the Developer's expense.

Where the District Council has to carry out emergency work on behalf of the Developer, the cost of the work will be recovered from the Developer.

For development's the following shall apply:

a. Developers shall ensure that works are to a standard acceptable to the District Council.

Note: Developers are advised to retain the services of a suitable qualified or professional person(s) to certify works as per 1.5.1.3.Risk Based Assessment Framework

b. Developers shall carry out regular audits of the construction and maintain a record of these audits which will be submitted to the District Council on application for 224(c) or works acceptance

Note: In addition to the audits carried out by the Developer, the District Council may also audit the works.

Auditing requirements for types of works are covered in the various sections. The District Council may enter the work site at any time for auditing, inspecting or checking purposes. while following the requirements under the Health and Safety at Work Act 2015.

1.6.5.11 Standard Audits

The following are key milestones that the Developer shall notify to the District Council to enable any audit to be carried out if required:

a. Commencement of work,

b. Prepared earthworks and subsoil drainage prior to filling,

c. Completed earthworks and prepared subgrade,

d. Commencement of stormwater, wastewater (including pump stations) and or water reticulation,

e. Finished basecourse, and

f. Prior to commencement of carriageway surfacing

Note: Audits will be carried out within one working day of notification if practicable.

Work shall not proceed until the audit has been satisfactorily completed. When work has been interrupted or delayed, the District Council shall be notified before it is recommenced.

1.6.5.12 Quality of Work

For developments the following shall apply:

a. The Developer is responsible for ensuring that the engineering works constructed by their Contractors are carried out according to the approved EDA and best work practices.

b. The Developer is responsible for quality assurance.

c. General procedures/requirements and Quality Assurance forms are provided for use during construction; however, the District Council will accept Developers/Contractors/Agents own Quality Assurance forms that convey similar information.

1.6.5.13 Stopwork Notices

Any person carrying out works as part of any District Council approved development project shall cease such work, or part thereof, immediately upon receipt of a written Stopwork Notice issued by the District Council or an authorised agent.

The Developer may appeal to the District Council to set aside or amend a Stopwork Notice. A copy of the District Council's written decision on such application shall be recorded on the District Council's resource consent or project file.

Work may recommence when the District Council advises in writing.

1.6.6. Construction within Road Corridor

1.6.6.1 Corridor Access Requests

Any civil works, activity or intended occupancy of a transport corridor that will have a more than `minor' impact for users of a transport corridor requires a CAR approval from the Road Controlling Authority.

"More than minor effect" means an activity that disrupts or alters the normal safe use of the transport corridor for pedestrians, motorists or cyclists: or may affect traffic signal operations: or Council road maintenance activities or that of Utility companies: or restrict a planned event to be held by Public or Private Organisations including Sporting Bodies or others approved to occupy a section of transport corridor.

All excavation and trenching work carried out within the road corridor shall be carried out in accordance with the National Code of Practice for Utility Operators' Access to Transport Corridors -Updated Version 2, July 2019 compiled and published by the NZ Utilities Advisory Group.

Note: Fees may be applicable for applications from Utility Operators for access to the transport corridor within the Far North District in accordance with the National Code of Practice for Utility Operators' Access to Transport Corridors -Updated Version 2, July 2019. The latest schedule of charges is available from FNDC website along with the Corridor Access Request form.

In conjunction with the Corridor Access Request a Traffic Management Plan shall also be submitted for approval.

Where works are proposed that affect roads from an adjoining District Council or a State Highway, the Developer/Contractor shall obtain additional approvals from that authority.

1.6.6.2 Council Local Conditions

The Local Conditions apply to all Work Access Permits issued by FNDC in accordance with the National Code of Practice for Utility Operators' Access to Transport Corridors -Updated Version 2, July 2019.

Note: Local Conditions can be found via the Council's on-line CAR application

1.6.6.3 Traffic Management Plan (TMP)

A Traffic Management Plan shall be required for any works undertaken within the Transport Corridor for which a Corridor Access Request is required to be made to the Road Controlling Authority. Council may choose to randomly audit any site to which a TMP applies to ensure compliance with the TMP and the safety of all road users.

1.7. Completion of Works

The Developer shall apply for EDA Certificate of Completion (EDA CoC) upon completing the works, and the 224(c) Certificate if related to a subdivision consent, only when satisfied the work is finished to the required standard. This includes the submission of the complete and accurate As-Built Plans and asset data.

The following clauses relate to the requirements of the District Council post construction with respect to asset information, operation and maintenance manuals, bonds and the Defects Liability Period.

1.7.1. General

On completion of the works, the Developer shall provide the supporting information required by Table 1-6 and the following (where applicable):

a. Post-construction geotechnical reports and associated plans, including locations of filling, and limitations on development of the properties e.g. Appendix E ES-PO1,

b. Post-construction survey of attenuation and water quality ponds to demonstrate design volumes have been achieved,

c. As-Built Plans. See Section 1.7.2.2 As-Built Plans and Asset Data Formats.

d. Results of all testing, video inspection records of all wastewater and stormwater network,

e. Evidence that all works relating to the utilities not owned by FNDC have been completed to the satisfaction of the Network Utility Operator,

f. Certified design and completion certificates from the SQEP, PS1 Design and PS4 Construction Review,

g. Operation and maintenance manuals required by the District Council. See Section 1.7.2.4 Operation and Maintenance Manuals,

h. Asset information schedule. See Section 1.7.2.5 Asset Information Schedule,

i. RAMM information for public roading assets. See Section 1.7.2.3 RAMM Data Requirements, and

j. Any bonds in terms of Section 1.7.3.2 Bonds and Section 1.7.3.3 Uncompleted Works Bond are in place.

1.7.2. As-Built Plans, Asset Information Schedules, Operation and Maintenance Manuals

The requirements for As-Built Plans, Asset Information and Operation and Maintenance Manuals apply to the installation or modification of all District Council assets.

As-Built Plans, Asset Information Schedules, and Operation and Maintenance Manuals shall be provided on completion of construction work in compliance with the following sub-sections.

Written acceptance of the works (if required in accordance with FNDC QA/QC Manual 2022) shall be provided on completion of construction work in compliance.

1.7.2.1 Resource Consents

Asset Information Schedules, As-Built Plans and Operation and Maintenance Manuals shall be provided and accepted by FNDC before a section s224(c) certificate can be issued and/or a performance bond released.

Where a final on-site inspection has been carried out more than 3 months prior to a request to issue the Section 224 certificate, FNDC may re-inspect all works on-site to ensure all assets remain fit for purpose and have not been damaged, destroyed or otherwise adversely affected.

1.7.2.2 As-Built Plans and Asset Data Formats

As-Built Plans shall be provided in electronic formats, to the following requirements:

a. Drawing standards shall be as detailed in Appendix G Drawing Standards. Plans shall not include aerial photographs

b. A full set of approved construction plans updated to include As-Built information. This shall include all sheets whether or not they have been amended since the application, such as Index Sheets, Locality Plans, Earthworks, Long Sections, Cross Sections, Coordinate Sheets, Details etc.,

c. Long Sections are to be provided on As-Builts.

d. As-Built Plans shall include non-physical details such as the extent of overland flow paths,

e. All ‘Asset Information Schedule Requirements’ as per Appendix I Asset Attributes and the example in Appendix H Example As-Built Drawings

f. Specific requirements in the particular sections of the ES, and all plans required by the statutory consent authorities in the consent approval(s).

As-Built Documentation (including plans, schedules and OMM) shall:

g. Be adequately labelled and dated,

h. Reference the FNDC’s approved consents (EDA sub-division or contract number),

i. Include the name and contact details of the principal contractor that completed the work,

j. Show what has been constructed, including all approved changes and items removed or decommissioned,

k. Label roads with FNDC approved road names, and parcels with legal descriptions and house numbers (where available), and

l. Have accurate position and depth of all existing services exposed during construction works.

Refer to Appendix H Example As-Built Drawings for examples of appropriate As-Built Plans.

The SQEP shall certify the as-built plans and documentation, as appropriate.

Location and level data for plans and asset schedules shall be to the co-ordinates and level requirements of Appendix G Drawing Standards, to the following accuracy:

m. Levels (z ordinate) accurate to ±10mm

n. Locations (x, y co-ordinates) accurate to ±100mm.

1.7.2.3 RAMM Data Requirements

RAMM (Road Assessment and Maintenance Management) data is required as set out below for all roads or other assets such as car parks constructed or altered by Developers which shall be maintained by the District Council. RAMM data requirements are as set out in the District Council RAMM data forms. (Refer to the FNDC Roading Asset Manager for the Road Assessment and Maintenance (RAMM) Data Collection Sheet)

1.7.2.3.1. Resource Consents

The District Council assess RAMM data capture for the District Council maintained road(s) and parking assets.

Developers shall provide all information required to enable RAMM data capture, which includes:

a. All pavement details, including aggregate types, depths and sources of aggregate,

b. Typical sections and plan views,

c. Top surface and sealing data,

d. Dates that each pavement layer, surfacing etc. are constructed,

e. Details of all road signs,

f. Footpath construction details,

g. Streetlighting details,

h. Crossings, features and minor structures,

i. Details of subsurface drainage, geotextile layers, and all other buried features,

j. Information on all structures, including bridges, retaining structures etc.

Note that culverts with a watercourse area greater than 3.4 m^2 are regarded as bridges in terms of the Waka Kotahi bridge manual

k. For roads, accessways and access lots serving 5 or more lots or household units, which are intended to be named but not maintained by the District Council, the Developer shall supply the carriageway length, width, road name and street name blade, pole and fixing/mounting data only.

This information shall be available with the as-built data.

1.7.2.4 Operation and Maintenance Manuals

Operation and Maintenance Manuals shall be provided in .pdf format for all mechanical equipment and installations, including sewer pump stations, water supply booster pumps, actuated valves, air valves, odour control and treatment facilities, water quality treatment devices, stormwater attenuation and treatment assets, outlets, and similar, including As-Built Plans:

a. Equipment List, with make, model and serial numbers,

b. Equipment supplier details,

c. Pump curves, with design flow/head identified,

d. Electrical layout,

e. Control logic,

f. As-built levels of control switches,

g. Maintenance schedules, and

h. Technical Specifications.

1.7.2.5 Asset Information Schedule

Asset Information Schedules shall be provided as below. See example schedules in Appendix H Example As-Built Drawings.

Asset Information Schedules shall be provided in .pdf and .xlsx formats with the electronic version of the As-Built Plans.

The schedule shall consist of a full inventory list of all assets that have been constructed and all assets that have been removed, or decommissioned. The Asset Information Schedule shall be cross-referenced with the As-Built Plans using a simple sequential numbering system. Cross-reference numbers on As-Built Plans shall be underlined to distinguish them from other numbers. The Asset Information Schedule shall adhere to the relevant New Zealand Asset Data Standard (NZAMS) and include:

a. Component Type/Description,

b. Unit Type,

c. Installation Date,

d. Expected Life,

e. X and Y coordinates (in NZTM) for;

   i. Point asset – at the point,

   ii. Line assets - the ends, junctions and bends

   iii. Areas: at 20m centres and the perimeter, sufficient that the area can be drawn in GIS,

f. Public (District Council owned) or private, and

g. Asset specific information as per Appendix I Asset Attributes.

1.7.3. Contractual Matters

1.7.3.1 Defects Liability Period

The Developer shall be responsible for the performance of all works provided by the Developer that will become District Council assets.

The Defects Liability Period for bonded engineering works shall commence from the date that the final inspection is approved, or the date that the resource consent or EDA completion certificate is issued, whichever is the latter, and shall be for a minimum period of 12 months for all assets to be vested in the District Council.

Note: Resource consents and/ or EDA's related to landscape planting may require a Defect Liability Period and associated bond for a of up to 24 months, where FNDC considers it would be appropriate.

1.7.3.1.1. Remedying of Defects

The Developer shall remedy any defects and damage in the bonded works resulting from defective workmanship or materials that arise before the end of the Defects Liability Period. The District Council shall, during the Defects Liability Period or within 5 working days thereafter, give notice in writing to the Developer of any defects or damage to be remedied. The Developer shall remedy any such defects or damage within 5 working days of receipt of the District Council notice or within such other reasonable time agreed by the District Council.

If the Developer fails to carry out any work in the specified time frame, the District Council may, after giving 5 working days' further written notice to the Developer, direct others to undertake the work. The reasonable costs of the work undertaken by others shall be recoverable by the District Council from the Developer. As soon as practicable after the completion of the work the District Council shall notify the Developer of the work undertaken and the cost.

The taking of any action by the District Council under this clause shall not relieve the Developer of any of their obligations.

The Developer shall not be liable for fair wear and tear during the Defects Liability Period.

1.7.3.2 Bonds

The following is a summary of the District Councils Bond requirements. The relevant District Council policies shall be consulted to establish the full conditions for the bond;

a. The bond shall be an agreed cash deposit, or at the District Councils discretion where sound reasons for not providing a cash bond are demonstrated, a bank bond or guarantee from a New Zealand based Trading Bank or approved Insurer,

b. No interest will be paid on bond monies,

c. The bond amount shall be a minimum of 150% of the estimated value of the intended bonded engineering work, including GST, or as otherwise approved by the District Council,

d. Defects/maintenance bonds shall be a minimum of 5% of the estimated value of the intended bonded engineering work including GST, or as otherwise approved by the District Council. A defect/maintenance bond will only cover works for which there are no known pre-existing defects at the time of bonding. Any works with known defects will be assessed at full replacement value with the bond set at a minimum of 150% of the full estimated value of the works,

e. The Developer is responsible for providing all necessary documentation, and shall pay all processing fees, legal costs and disbursements relating to the bond,

f. The District Council may require the bond to be registered against the title(s) of the property,

g. The bond for outstanding or defect/maintenance work is refundable upon confirmation of final inspection and acceptance by the District Council following completion of the works, payment of all associated fees and administrative charges,

h. Bond refunds shall include GST when included in the bond value approved by the District Council.

The District Council's decision as to whether a bond will be requested and refunded is final.

1.7.3.3 Uncompleted Works Bond

The bonding of Uncompleted Works is generally not supported by this Council. Minor incomplete works such as footpaths or landscaping may be bonded upon special request. Release of Bonds will only occur once the work has been completed to the standards as required. Incomplete or poorly completed work may result in Council retaining the bond or calling in the Bank Guarantee.

1.7.3.4 Requirements for Final Completion

Prior to final acceptance at completion of the Defects Liability Period, the Developer shall satisfy all consent and EDA conditions to the satisfaction of FNDC including:

a. Berm grass to be mown,

b. Carriageways and footpaths swept, and surplus seal chip removed,

c. All catch-pits and piped disposal systems cleaned out,

d. Planted areas to be left in a state suitable for ongoing maintenance – including all plants healthy, depths of mulch as specified in plans, grass established, removal of all weeds and noxious vegetation from berms, reserves etc., any outstanding maintenance items completed,

e. All utility services to be complete and functioning correctly, and

f. Written approval from other Network Utility Operators as necessary.

1.7.3.5 Vesting and Easements

The Developer's Representative shall ensure that all the District Council requirements are satisfied prior to requesting the transfer of constructed assets to District Council ownership. (As required in accordance with FNDC QA/QC Manual 2022). See Section 1.4.4 Quality Assurance and Quality Control.

Roads, stormwater pipelines, land for overland flow paths, retention/attenuation ponds, water and wastewater infrastructure, park infrastructure and land shall be vested or protected by easements in favour of the District Council as specified in the conditions of resource consent, or as otherwise approved, at the Developer's expense.

Easements in favour of the District Council are required for all public reticulation located in private property regardless of sizing, except where the reticulation is contained within the side boundary restrictions, specified in the District Plan or as otherwise directed by resource consent conditions. Easements may be required for access to maintenance structures.

Unless otherwise specified, all assets shall vest in the District Council at the date of issuing of the Section 224 certification.

Chapter 2: Site Development Suitability (Geotechnical and Natural Hazards)

2.1. Introduction

The District Council has chosen to incorporate the geotechnical requirements of NZS 4404:2010 into the ES.

Specific requirements relating to geotechnical assessments, testing and earthworks, which shall be carried out in the Far North District, are referenced here.

2.1.1. Scope

This section sets out the District Council's requirements for the assessment and reporting of site suitability and for the design and control of earthworks. To meet these requirements the following shall be submitted, where relevant to the site:

a. Assessment of land stability and ground strength for the construction of roads and services and to ensure suitable platforms are available for buildings.

b. Design and control of earthworks.

c. Onsite wastewater disposal or storm water soakage

d. Assessment of other hazards that may affect the development

e. Effects from climate change

2.1.2. Objectives

The objectives of this section are to ensure that:

a. Geo-professionals are involved in the design of landform for development when earthworks are more than minor or when stability hazards are present,

b. The development takes account of any geotechnical or natural hazard limitation of the land,

c. The District Council's duties in relation to Section 106 of the Resource Management Act 1991 and Section 71 of the Building Act 2004 have been discharged, and

d. Adequate information is provided to inform future owners of the land of the land's limitations and any special conditions that may be implemented at building consent stage.

2.1.3. Reference Documents

The following documents are referenced in this Chapter.

Note it is the responsibility of the ES user to ensure the most up to date referenced document is sourced.

2.1.3.1 Statutory

Building Act 2004

Northland Regional Council Regional Plan

Operative District Plan

Resource Management Act 1991

Resource Management Regulations 2011

2.1.3.2 New Zealand Standards

NZS 3604:2011 - Timber-framed buildings

NZS 4229:2013 - Concrete masonry buildings not requiring specific engineering design

NZS 4404:2010 - Land development and subdivision engineering

NZS 4431:1989 - Code of practice for earth fill for residential purposes

2.1.3.3 District Council Documents

FNDC stormwater modelling

2.1.3.4 Regional Council Documents

Regional Policy Statement for Northland May 2016

Report - Coastal Flood Hazard Assessment for Northland Region 2019-2020

Report - Coastal Erosion Hazard Assessment for Selected Sites 2019-2020

NRC Natural Hazards

NRC Flood modelling

2.1.3.5 Other Referenced Documents

Auckland Council GD2016/005: Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region

ENZ Producer Statement – PS4 Construction Review

MBIE Rockfall: Design considerations for passive protection structures 2016

Ministry for the Environment Contaminated Land Management Guidelines No. 1: Reporting on contaminated sites in New Zealand (June 2021)

NZ Geotechnical Society Inc; Field Description of Soil and Rock, Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes December 2005

2.2. Consents and Approvals

2.2.1. Northland Regional Council Requirements

2.2.1.1 General Requirements

The Northland Regional Council (NRC) plays a significant role in the management of earthworks and supporting sediment control management through Northland Regional Plan. The Developer shall satisfy any NRC requirements applicable to their development activity in addition to the requirements in this Section.

Permitted Activities under the Northland Regional Plan may still require consent under the District Plan. The Developer shall refer to Northland Regional Plan and District Plan when determining consent and engineering design requirements applicable to their development activity.

2.2.1.2 Northland Regional Council Consents

The Developer shall assess their proposed development activity against the Northland Regional Plan pertaining to earthworks activities, and shall identify, in their development application to the District Council, any Northland Regional Council consents that may be required under those rules.

If a Northland Regional Council consent is required for earthworks, the Developer shall consult with FNDC to understand requirements required for earthworks prior to submitting the Northland Regional Council consent application.

The consent shall be obtained prior to application to FNDC for a development consent. This does not negate the requirement to obtain a FNDC resource consent for earthworks, if applicable.

2.2.2. District Council Requirements

2.2.2.1 Geotechnical Reporting Requirements

The Developer's geo-professional shall carry out the following functions and any other specific geotechnical functions described in the ES.

a. Desktop study to check regional and district plans and maps, records and requirements prior to commencing a geotechnical assessment,

b. Site inspection and required investigations of subsurface conditions (where required) to satisfy the requirements of this section,

c. Review drawings and specifications defining earthworks or other construction for the proposed development,

d. Report to the District Council on foundation and stability aspects of the proposed development,

e. Before construction, determine the extent of any further geo-professional services required to undertake the proposed development to the required standard,

f. Identify any work necessary to manage geotechnical risks during construction,

g. Determine the methods, locations and frequency of any geotechnical construction control testing required to ensure the final quality of earthworks,

h. Undertake regular inspection (if required) of the development earthworks during construction, and

i. Provide a Geotechnical Completion Report, in accordance with NZS 4431:1989 or other applicable specification, on the compliance of earthworks and the suitability of the development for its proposed use.

In carrying out these functions, reporting shall be provided to the District Council at the following stages of the development:

2.2.2.1.2. Resource Consent Application

A Geotechnical Assessment Report as per Section 2.3.3 Geotechnical Assessment Report shall be provided with an application for resource consent, which shall include any relevant information, guidance and recommendations that:

a. Relate to the geotechnical suitability of the land for the proposed development, or

b. Result from a site inspection and/or investigation undertaken in order to identify geotechnical hazards affecting the land, including any special ground conditions that may impact on the design, or,

c. Inform the design of future development earthworks, services, structures, etc., or

d. Identify information gaps or specific requirements for further geotechnical investigation needed prior to design or construction, or

e. Relate to the management of the geotechnical risk of the proposed development, or

f. Relate to the foundation and stability aspects of the proposed development.

The Developer shall also identify, assess, and provide any relevant information, guidance and recommendations for the mitigation of any other hazards (including but not limited to potential flooding, erosion, seismic, liquefaction, contaminated land, aggressive soil conditions, and rockfall), both within the site or on neighbouring land where it may affect the site. Assessment of other hazards shall be provided either as part of the Geotechnical Assessment Report or as stand-alone specialist reports as required.

2.2.2.1.3. District Council Consents

The Developer shall assess their proposed development against the District Plan and shall identify whether a District Council resource consent or building consent is required for the proposed development earthworks activities.

Any District Council resource consents that are required shall be obtained prior to application for Engineering Design Approval under the ES.

2.2.2.1.4. Engineering Design Approval

A Geotechnical Design Report and supporting information shall be submitted for Engineering Design Approval and shall include any relevant information, guidance and recommendations that:

a. Arise from geo-professional review of the Geotechnical Assessment Report, design or construction drawings and/or specifications for the proposed development, or

b. Identify information gaps or specific requirements for further geotechnical investigation prior to or during construction, or

c. Relate to management of geotechnical risk during construction, or

d. Specify the construction or compliance criteria of proposed earthworks, or

e. Identify methods, location and frequency of construction control tests, or,

f. Is required to be considered during construction of the design in order to mitigate the effects of natural hazards.

2.2.2.1.5. Completion of Works

After construction, any relevant information that:

a. Identifies information gaps or specific requirements for further geotechnical investigation, or

b. Documents construction inspections, test results and reliability/significance of geotechnical investigation undertaken, or

c. Assesses and documents the quality of the finished work, or

d. Otherwise substantiates and verifies the compliance of earthworks against these standards, the recommendations made in applicable reports by geo-professional(s), and any other applicable New Zealand Standards (e.g. NZS 4431:1989),

shall be provided to the District Council for their records along with the Geotechnical Completion Report (Section 2.6.1.1 Geotechnical Completion Report).

This information shall also include appropriate certification of the works in accordance with Section 1.5.3.3.4 Certification or equivalent approved form from NZS 4404:2010.

2.2.2.2 Reference Documents

Reference shall be made to the following District Council documents:

a. FNDC Coastal hazards,

b. FNDC Flood Modelling,

c. NRC Regional Policy Statement,

d. NRC Coastal Flood Hazard Zones for Select Northland Sites July 2015,

e. NRC Coastal Erosion Hazard Zone Assessment for Selected Northland Sites October 2014,

f. NRC Natural Hazards

g. NRC Flood modelling

h. Other relevant District Council documents available on Land Hazards page of the District Council website.

2.2.2.3 Historic Investigations

The District Council may have copies of geotechnical (or other) investigations completed in support of previous development proposals. Reports on adjacent sites may be available, subject to limitations on their use.

2.2.2.4 Hazard Mapping

The Developer shall obtain information from the District Council's GIS, NRC's GIS, NZGD and other available sources, regarding hazards and development limitations that may affect the proposed development, including:

a. Coastal Erosion and Instability,

b. Earth movements (including but not limited to rockfall, landslide and soil creep),

c. Mine zones,

d. Flood zones,

e. Contaminated sites,

f. Subsidence and Settlement

g. Acid sulphate soils

h. Proposed climate change

Where the proposed development site is outside of an area covered by available FNDC Hazard Maps and NRC Hazard Maps, an assessment shall be made, by a SQEP, as to which hazard(s) and to what level(s) are applicable to the site.

Hazards and other limitations that are applicable to the site shall be addressed in accordance with Section 2.3 Geotechnical/ Hazard Assessment.

Note: The mapped hazard zones are "high level" classifications and will need to be confirmed through site specific investigations.

2.2.2.5 Erosion, Sediment and Dust Control

The Developer shall be responsible for compliance with any Northland Regional Council and District Council permitted rules or consent requirements regarding erosion, sediment or dust control which may be applicable to the proposed development.

2.2.3. Heritage New Zealand

The Developer is responsible for liaison with Heritage New Zealand Pouhere Taonga (HNZ) and shall identify any additional authorities that may be required for the proposed development earthworks activities.

2.3. Geotechnical/ Hazard Assessment

2.3.1. Criteria for Assessment

Specific assessment of geotechnical or other hazards applicable to a site shall be undertaken by a SQEP, wherever:

a. Hazard mapping or other assessment (refer section 2.2.2.4 Hazard Mapping) has identified that geotechnical or other hazards are actually or potentially applicable to the site,

b. Assessment of land stability requires specialist expertise,

c. Earthworks for development requires planning and design to ensure that cut and/or fill batters remain stable and can support future imposed loads,

d. Weak, compressive or unstable ground may be present, or is identified on the site, (e.g. historical fill where the fill is not documented as having been completed to any published standard),

e. Assessment of ground for the design of foundations of buildings, roads, services and other infrastructure requires specialist expertise due to the presence of weak or unstable ground, or

f. 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.

2.3.2. Assessment Considerations

Geotechnical assessment of land development shall include the factors from section 2.3.1 of NZS 4404:2010, repeated here for convenience:

a. Preliminary site evaluation,
b. Identification of special features to be retained / protected,
c. Low impact design considerations,
d. Selection of the choice of landform,
e. Stability assessment, including stability and accessibility for building where new slopes are proposed,
f. Assessment of special soil types where applicable,
g. Setting of compaction standards for fill material,
h. Erosion, sediment and dust control,
i. Seismic considerations, or
j. Geothermal issues where applicable.

Geotechnical assessment, and assessment of other hazards, shall also include:

a. Review of the proposed development against any requirements or recommendations in the reference documents (Section 2.2.2.2 Reference Documents),
b. Assessment of the applicability and accuracy of any high level hazard zone mapping on/adjacent to the site, and,
c. The factors in this section where applicable.
d. Impact from increased impermeable surfaces
e. Waste water disposal fields

For future building development, ground conditions should be investigated, to the extent necessary at the particular stage of development, to ensure:

k. (for residential development) that a suitable building site is available for each lot where it is viable to construct foundations in accordance with NZS 3604:2011 or NZS 4229:2013, and
l. (for residential development), where foundations are not covered by NZS 3604:2011, any requirements for Specific Design of foundations have been identified for the building site, and
m. (for commercial development) that any limitations of the ground conditions relevant to the construction of commercial buildings have been identified.

Where geotechnical assessment is being undertaken for a site that is not mapped on the available FNDC Land Instability Maps, or covered by a District Council commissioned assessment report, then the geotechnical assessment shall consider the classification of the site in terms of Section 2.3.3.2 Low Stability Hazard, 2.3.3.3 Moderate Stability Hazard and Section 2.3.3.4 High Stability Hazard.

2.3.3. Geotechnical Assessment Report

2.3.3.1 General Requirements

The Geotechnical Assessment Report shall be submitted with the resource consent application, and shall:

a. Address the reporting requirements in Section 2.2.2.1 Geotechnical Reporting Requirements, and

b. Address the expected risks of the proposed development with regard to geotechnical hazards, earthworks and foundations, and

c. Make any specific recommendations that the geo-professional considers necessary in order to achieve the objectives in Section 2.1.2 Objectives.

Special requirements apply when the development land is or is likely to be subject to erosion, avulsion, alluvium, falling debris, subsidence, slippage, rotation, creep, or inundation from any source. In these situations, reference shall be made in the assessment report to the requirements of Section 106 of the Resource Management Act 1991.

Where the geotechnical assessment has been undertaken for a development that relies directly on the findings of the Geotechnical Assessment Report for subsequent building work (e.g. for a Land use development application), then reference in the Geotechnical Assessment Report shall also be made to the limitations contained in Section 71 of the Building Act 2004.

The Geotechnical Assessment Report may require peer review, refer to NZS 4404:2010 Section 2.3.2(g).

2.3.3.2 Low Stability Hazard

On this land erosion or land slippage is not apparent. However, sloping areas may be sufficiently sensitive to erosion or slippage that could occur due to inappropriate cutting, filling, and/or site disposal of stormwater and/or effluent wastewater and natural events (e.g. cyclonic short-term high intensity rainfall events). These slopes could also be subject to soil creep.

Where:

a. the result of a visual assessment in accordance with Section 1.5.2 Information Requirements - Resource Consent Applications indicates that a more detailed assessment of land currently mapped as Low Stability Hazard is appropriate, or

b. the land is not currently mapped on FNDC Land Instability Maps, then

Applications for development of this land should be accompanied by a brief geotechnical assessment report which summarises the results of a walk-over survey and a geological/geomorphological assessment (which describes how the particular landform has been formed, what it is made up of and what slope processes are, or are likely to be occurring) and provides an informed opinion on the suitability of the land for the intended purpose.

The geological/geomorphological assessment shall entail most or all of the following steps, and the brief report shall specifically address the expected effects of the subdivisional and/or building development on the land.

The Geotechnical Assessment Report of low risk land shall include:

c. Walk-over inspection of the site and the surrounding land,

d. Inspection of historical aerial photographs taken at various times to provide insight into the local geomorphology and evidence of any previous instability,

e. Review of geological data (maps, bulletins),

f. Any local information about stability/instability of the ground,

g. Any existing data about the soil and rock profile (look for nearby exposures) or perform some simple subsurface investigation,

h. Examination of the soil profile to confirm that if the soil is in -situ and not colluvium (slide debris),

i. Examination of the existing survey records for evidence of movement (slippage or erosion),

j. The geo-professional’s opinion as to the stability and suitability of the land for development (including an assessment of the effects of development such as excavation, filling, removal of vegetation, disposal of stormwater or effluent wastewater into or over the area),

k. Definite conclusions and recommendations on any development restrictions and further test requirements.

2.3.3.3 Moderate Stability Hazard

This land does not exhibit any evidence of any recent instability but does display ‘relic’ landslide geomorphology, or is sufficiently sloping to be potentially subject to instability due to either natural events (e.g. high intensity rainfall events or earthquake), or as a result of inappropriate cutting, filling, and/or site disposal of stormwater and/or effluent waste water.

Applications for development (such as excavation, filling, removal of vegetation, disposal of stormwater or domestic wastewater into or over the area) may be appropriate to proceed subject to consent conditions provided that a geotechnical assessment includes a stability assessment demonstrating that the proposed development will not accelerate, worsen or result in the land being subject to, or likely to be subject to, erosion or slippage, to the satisfaction of the District Council.

In addition to the low-risk land Geotechnical Assessment Report requirements the Geotechnical Assessment Report of moderate risk land shall include:

a. Topographic survey (if not already available) or slope profiles,

b. A description of the geology and geomorphology of the area, including comments on the areas surrounding the development site,

c. Definition of the nature and continuity of the strata over the whole area of land which is proposed to be developed (buildings, access and services) and to a depth below which slipping is most unlikely, by means of test pit and/or drilling and/or auguring (unless existing exposures are adequate),

d. Assessment of the relative strength and the sensitivity of the soil in each stratum in which, or interface on which, sliding is practicable,

e. Assessment of likely groundwater levels and piezo metric pressures in the strata during extreme infiltration conditions,

f. The geo-professional's opinion as to the stability and suitability of the land for development, including the stability of the whole slope (upon which the site may only form a part of) and the effects of the development (such as excavation, filling, removal of vegetation, disposal of stormwater or effluent wastewater into or over the area) on the whole slope,

g. Definite conclusions and recommendations on any development restrictions and further test requirements.

2.3.3.4 High Stability Hazard

This land exhibits evidence of recent or present slippage or erosion and/or is subject to processes such that slippage or erosion is considered likely to occur within the next 100 years. Development of this land presents an identifiable hazard to property and could also, in some circumstances, threaten life.

On, above and especially below this land, no subdivision, building or other development including excavation, filling, removal of vegetation, disposal of stormwater or domestic wastewater into or over the area should be occur unless a Geotechnical Assessment Report, including an appropriate and adequately detailed stability analysis, is produced to the satisfaction of the District Council.

The Geotechnical Assessment Report shall demonstrate that the proposed development area will not be subject to erosion, or slippage, or inundation by debris from upslope. It shall also show how the proposed development, through preventative works or other measures, will ensure that any structure will not become damaged by erosion or slippage arising on or off the site, and that development will not accelerate, or worsen, erosion or slippage.

In addition to the moderate risk land Geotechnical Assessment Report requirements the Geotechnical Assessment Report of high-risk land shall include:

a. Topographic Survey (if not already available),

b. A description of the geology and geomorphology of the area and immediate surrounding areas,

c. Definition of the nature and continuity of the strata over the whole area of land involved, and to a depth below which slipping is most likely, by means of test pits and/or continuous recovery core drilling (unless existing exposures are adequate),

d. Determination of the peak and residual shear strength parameters (either from laboratory tests or back analysis of relevant slope failures) and the sensitivity of the soil in each stratum in which, or interface on which, sliding is practicable,

e. Assessment of groundwater levels and piezometric pressures in the strata during extreme infiltration conditions,

f. Analysis of practicable failure mechanisms, relevant to the specific geology and geomorphology of the site using effective stresses,

g. The Geo-Professional's opinion as to the stability of the ground and the preventative (or remedial) measures to be incorporated in the development,

h. The Geo-Professional's opinion as to the stability and suitability of the land for development, including the stability of the whole slope (upon which the site may only form a part of), and the effects of the development (such as excavation, filling, removal of vegetation, disposal of stormwater or effluent waste water into or over the area) on the whole slope,

i. Definite conclusions and recommendations on any development restrictions and further test requirements, specifically addressing Section 106 of the Resource Management Act 1991.

Even with a thorough geotechnical report and a stability analysis, complete avoidance of all risk may not be practicable, and no guarantee of absolute safety should be expected. Site development works shall be carefully planned to ensure the development does not result in slippage or erosion.

2.3.3.5 Stabilisation Works

Where necessary, the Developer's geo-professional shall provide recommendations for any necessary works required to protect or restore the stability of the site during any particular stage of the development.

This may include earthworks (to reduce slope angles or place buttress fills), drainage works (trench drains, buttress or counterfort drains aligned down the true slope angle), retaining structures, erosion protection structures, and planting.

In particular, where cutting or embankments are proposed as part of development works, the geo-professional shall assess short- and long-term stability of these and provide specific recommendations to protect the stability of land that may be affected by the proposed cutting / embankments.

Where subsoil drainage is recommended as a stabilisation measure, design and future operation / maintenance shall be subject to Council's approval and may be subject to peer review at the cost of the developer.

2.3.3.6 Special Soil Types

Special soil types are known to exist in the Far North District.

The Developer's geo-professional shall assess the proposed development site for the presence of special soil types and provide specific advice and recommendations on appropriate measures for incorporating these soils into the proposed development.

Special soil types to be assessed include, but are not limited to:

a. Expansive soils,
b. Compressible soils,
c. Volcanic soils,
d. Soils subject to liquefaction,
e. Acidic soils,
f. Soils prone to dispersion,
g. Previous fill material, and
h. Peat ground

2.3.3.7 Seismic Considerations

An assessment shall be made of the potential for seismic events to increase slope stability risk, to affect the strength of foundations soils, or other effects on the proposed development site.

The Developer's geo-professional shall detail any specific recommendations or limitations on the proposed development with regard to the seismic assessment.

2.3.4. Assessment of Other Hazards

2.3.4.1 Coastal Hazards

Specific investigation and design shall be carried out for all coastal sites and particularly where potential development lies within coastal hazard notations including coastal erosion and coastal flooding.

Minimum floor levels in coastal areas shall consider storm surge, wave run-up, tsunami hazards, erosion potential and climate change effects (see section 4.3.10.7 Freeboard Requirements).

2.3.4.2 Aggressive Ground Conditions

For all sites containing waterlogged soils or with the potential to contain aggressive ground conditions (e.g. acid sulphate soils), the Developer shall engage a geo professional to carry out investigations of the site, assess and report on the following:

a. The potential for saturated or aggressive soil conditions on the site under consideration;

b. The risk of saturated or aggressive soil conditions impacting on proposed (future) built structures;

c. Specific conclusions, recommendations, and proposed mitigation to address the assessed risk.

The site-specific hazard assessment report shall be included with the consent application (see Section 1.5.2 Information Requirements - Resource Consent Applications).

Note: Many areas of coastal Northland are undergoing rapid expansion and development of rural and urban land uses. Accompanying such development are many soil related problems, including acid sulphate soils. The development of this land shall incorporate a full understanding of the problems associated with such soils.

Note: Acid sulphate soils are extremely acidic soil horizons or layers resulting from the aeration of soil materials that are rich in iron sulphites, primarily pyrite (FeS). When drainage or excavation brings oxygen into these previously water logged soils, the pyrite is oxidised to sulphuric acid.

Note: Whether or not a particular land use will contribute to any acidification hazard in an area by exposing acid sulphate soils will depend on the depth of soil disturbance and the depth of occurrence of acid sulphate soil materials. Therefore, the environmental risk associated with disturbing acid sulphate soils will depend on the type and depth of land use activity undertaken.

2.3.4.3 Flood Hazard

For all sites subject to, or potentially subject to flood hazard(s), the Developer shall engage a SQEP to undertake site specific assessment of the flood hazard and risk associated with the proposed development, and to report on the following:

a. Desktop review of flood hazard data available, e.g. from Council(s), survey data and owners or witnesses,

b. Assess the flood risk associated with the proposed development, considering (where applicable):

    a. upstream and downstream flooding,

    b. loss of floodplain storage,

    c. peak flow,

    d. flood extents and elevations,

    e. accessibility/escape during inundation,

c. Recommendations for mitigation of the identified risk, e.g. minimum floor levels, (see section 4.3.10.7 Freeboard Requirements), and

d. Assessment against section 106 of the Resource Management Act.

The site-specific flood assessment report shall be included with the consent application (see Section 1.5.2 Information Requirements - Resource Consent Applications).

2.3.4.4 Mine Subsidence Hazard

For all sites subject to, or potentially subject to mine subsidence hazards, the Developer shall engage a SQEP to undertake site specific assessment of the mine subsidence hazard and risk associated with the proposed development, and report on the following:

a. Desktop review of the mine subsidence hazard data available, e.g. from Council(s) mapping, third party reports, etc.;

b. Provide an evaluation of the ground conditions and potential severity of subsidence, and assess the appropriateness of proposed or future structures for the inferred level of hazard;

c. Assess the subsidence risk associated with the proposed development;

d. Provide clear recommendations for the proposed development, including mitigation measures for the subsidence hazard (where applicable); and,

e. Provide assessment against section 106 of the Resource Management Act.

The site specific mine subsidence hazard assessment report shall be included with the consent application (see Section 1.5.2 Information Requirements - Resource Consent Applications).

2.3.4.5 Rockfall

For all sites subject to, or potentially subject to rockfall, the Developer shall engage a SQEP to undertake site specific assessment of rockfall hazards and risks associated with the proposed development, and report on the following:

a. Desktop review of rockfall hazard data available, e.g. from Council(s), survey data and owners or witnesses,

b. Carry out a field investigation that assesses the site-specific nature of the rockfall source areas, run-out zone and past rockfall events.

For further guidance refer to MBIE Rockfall: Design considerations for passive protection structures 2016.

This site-specific rockfall hazard assessment report shall be included with the resource consent application, (see Section 1.5.2 Information Requirements - Resource Consent Applications).

2.3.5. Setting of Compaction Standards for Fill Material

Compaction of fill material shall be as per NZS 4431:1989 or an alternative specification by the Developer's geo-professional where NZS 4431:1989 is not applicable or suitable.

Where fill is proposed, the Developer's geo-professional shall confirm the recommended fill compaction standards and testing requirements, in the Geotechnical Assessment Report.

All documentation on the testing of the compacted soils shall be submitted with the Geotechnical Completion Report (Section 2.6.1.1 Geotechnical Completion Report).

2.3.6. Geotechnical Assessment Drawings

Drawings shall be submitted in support of the Geotechnical Assessment Report which shall include:

a. Site plan showing positions of borehole/test pit/penetrometer etc. areas of concern but not limited to e.g., slip scarps, unstable ground etc.,

b. Location of any adjoining land/river/ocean details which might affect the stability etc. of the subject land,

c. Concept layouts and/or details of any works proposed to mitigate the effects of any issues identified by the geotechnical assessment.

2.4. Geotechnical Design

2.4.1. Geotechnical Design Report

2.4.1.1 General Requirements

A Geotechnical Design Report shall inform the engineering design approval stage when earthworks are included in the design. The report shall be submitted to the District Council for approval prior to any earthworks taking place on the site.

The Geotechnical Design Report shall detail the Specific Design of any works recommended in the Geotechnical Assessment Report, and reference relevant information provided in that report (Section 2.2.2.1 Geotechnical Reporting Requirements).

The Geotechnical Design Report shall include (where relevant) but not be limited to:

a. A brief description of the site.

b. Regional Council and District Council resource consent requirements.

c. Reference to the key requirements of the Geotechnical Assessment Report.

d. Evaluation of the foundation design parameters for road and infrastructure/services design and, where applicable, for buildings included as part of the development.

e. Evaluation of earthworks requirements in terms of area, volume, earth working methods, disposal of unwanted excavated material and design and specification for earthworks control, dust and silt management.

f. Description of the type and methodology of fill to be used on the site as per 2.4.1.2 Specification for Fill Material, Placement and Compaction.

g. Identification of any work necessary to manage the risk of geotechnical issues during the construction process i.e. temporary stability of excavations, fills and haul roads.

h. If contamination of the site is found, provide a detailed assessment of the contamination and recommend a remedial action plan.

i. Erosion and Sediment Control Plan as per District Council and Regional Council guidelines.

j. Identification and recommendations for any remedial construction work to address potential erosion, seismic, liquefaction and other natural hazards within the site or on neighbouring land.

k. Recommendations for supervision and testing of earthworks to be undertaken during construction, including qualifications of the supervisor and/or accreditations of the testing laboratory.

2.4.1.2 Specification for Fill Material, Placement and Compaction

2.4.1.2.1. Fill Material

The Geotechnical Design Report shall:

a. Include the source of the imported material and demonstrate that the imported material comes from land that is not contaminated as defined in the Resource Management Regulations 2011.

b. Describe the fill material in engineering terms in accordance with NZ Geotechnical Society Inc; Field Description of Soil and Rock, Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes December 2005.

c. State what testing has been undertaken on the source material to prove it is fit for the design purpose. This shall include the type of test, what testing standards the testing has been carried out to, the number of tests undertaken, and the test results. This testing may consist of:

    i. NZ Standard Compaction Testing

    ii. Shear Vane Testing

    iii. Moisture Content Determination

    iv. Plasticity Index Testing

    v. Particle Size Distribution

    vi. California Bearing Ratio (CBR) Tests

d. Include details of any geosynthetics used in the design and drawing(s) showing where these shall be used, the type of geosynthetics and the function of the geosynthetic.

2.4.1.2.2. Compaction Criteria and Methodology

Details of the compaction methodology to be adopted for the placement of fill shall be presented in the Geotechnical Design Report together with the compaction acceptance criteria proposed for the works.

The acceptance criteria may be based on any combination of the following:

a. A target percentage of the maximum dry density of the compacted material,

b. A range of suitable moisture contents of the material,

c. A maximum air voids of the material, and

d. A maximum and minimum shear strength of the material.

The basis upon which the chosen criteria are selected shall be presented in the Geotechnical Design Report.

Note: Type of testing is dependent on the materials used for filling (i.e. granular or clay/cohesive fill). For Clay/cohesive fill air voids are important not just relying on shear vanes. The dry cohesive material can be hard (e.g. high shear strength), but air voids can control potential longer-term settlement.

2.4.1.2.3. End Product Specification

Where the desired compaction criteria of the placed and compacted fill are specified in the Geotechnical Design Report, the earthworks contractor should confirm the method of compaction they wish to adopt to achieve the targets specified by the SQEP.

A test area of fill material shall be placed to determine compaction characteristics and performance of the fill and prove the method of compaction chosen will achieve the desired end product. Samples of compacted fill shall be taken and tested in a laboratory or in-situ tests undertaken to analyse the compaction performance. The method determined by the trial shall then be used to provide the desired compaction performance across the remaining earthworks.

2.4.1.2.4. Frequency of Tests

During the earthworks, soil tests shall be undertaken on the placed fill to ensure that the necessary degree of compaction is being achieved. The methods of testing and frequency of tests shall be specified and included in the Geotechnical Design Report.

2.4.1.2.5. Site Supervision

The Geotechnical Design Report shall state the level of site supervision to be undertaken to ensure that the compaction of the material meets the earthworks specification.

2.4.1.3 Cuttings and Embankments

For cuttings and embankments formed as part of the earthworks, the Geotechnical Design Report shall include:

a. details of analytical methods used to determine slope stability including the engineering properties and relevant ground investigation information,

b. details of drainage required with respect to groundwater and surface run off, or to ensure stability,

c. settlement calculations and justified ground investigation data for embankments, and

d. details of any special measures to analyse slope or control settlements.

e. Include onsite assessment of soils

2.4.2. Geotechnical Design Drawings

2.4.2.1 Earthwork Design Drawings

Earthworks design drawings showing existing and proposed contours, areas of cut and fill, batter slopes, drainage details, etc. shall be provided as part of the Geotechnical Design Report and supporting information submitted for engineering design approval.

2.4.2.2 Erosion, Sediment and Dust Control

The SQEP shall prepare an Erosion and Sediment Control Plan (ESCP), with associated design drawings, which shall be provided as part of the Geotechnical Design Report and supporting information submitted for engineering design approval.

The ESCP shall be in accordance with Auckland Council GD2016/005.

2.5. Construction

2.5.1. General

During construction, site supervision and or testing shall be undertaken in accordance with the Geotechnical Assessment and/or Design Reports, which may require a suitability qualified geo-professional.

2.5.2. Tsunami Sirens

Where developments are located within a tsunami evacuation zone (as identified by the Northland Regional Council), and the sections are more than 400m from an existing tsunami siren, the Developer shall install tsunami sirens so that the entirety of each section is no more than 400m from a siren. Tsunami sirens shall be supplied and installed by Northpower.

Note: Tsunami evacuation zones can be found at *https://www.nrc.govt.nz/civildefence/tsunami-evacuation-zones/*

2.5.3. Erosion and Sediment Control Maintenance

Construction and ongoing maintenance of any erosion and sediment control devices shall be carried out by the Contractor as detailed in the approved Erosion and Sediment Control Plan.

2.6. Completion of Works

2.6.1. Reports

2.6.1.1 Geotechnical Completion Report

The Developer’s Geo-Professional shall submit a Geotechnical Completion Report as per NZS 4404:2010 Section 2.6. The report shall be accompanied by a statement of professional opinion on the suitability of land for building construction (NZS 4404:2010 Schedule 2A) and where applicable producer statement (PS4-Construction Review). If a development contains more than 10 lots, a matrix of geotechnical recommendations for each new lot should be attached to the Geotechnical Completion Report.

2.6.1.2 Contaminated Site Validation Report

When earthworks have been undertaken on potentially contaminated sites or a site known to be contaminated, a Contaminated Site Validation Report shall be prepared and submitted to the District Council.

As a minimum, this shall contain the data and all test results listed in the Contaminated Land Management Guidelines 2003).

A post construction Management and Monitoring Plan will form part of the Contaminated Site Validation Report that is required on completion of any remedial works undertaken.

2.6.2. Resource Consents

The Developer is responsible for completing any requirements under any Resource Consents that have been issued for the development.

Chapter 3: Transportation

3.1. Introduction

3.1.1. Scope

This Section sets out the requirements for the design and construction of future roads and infrastructure (including accessways) associated with land development, subdivision and road improvements/upgrades within the District.

The requirements shall apply to all such infrastructure whether to be vested in the District Council or retained in private ownership and whether initiated and undertaken by a Developer or by the District Council.

3.1.2. Objectives

The objectives of the Transport Network are to:

a. Provide and maintain a safe, efficient, accessible and sustainable transport network capable of ensuring the movement of people, vehicles and goods with operating speeds appropriate to the surrounding environment and with minimal effects on the environment and adjoining land uses.

b. Integrate land use and transport planning to ensure that land use activities, development and subdivision enhance and maintain the safety and efficiency of the transport network.

c. Provide suitable and sufficient vehicle crossings, access, parking, loading and maneuvering areas that contribute to, and do not detract from, the safe and efficient functioning of the transport network.

d. Ensure that transport network infrastructure (including other utility services) is designed and located in a manner which contributes to quality urban design outcomes.

e. Ensure future growth can be supported by the provision of appropriate transportation infrastructure.

3.1.3. Performance Outcomes

The Transport Network shall be designed to achieve the following:

a. The construction and maintenance of the network in accordance with the ES including the asset design lives.

b. The design and location of intersections and accessways to ensure that:

    i. Safety is provided.

    ii. Vehicle maneuvers are accommodated.

    iii. They are sufficiently separated so as not to adversely affect the free flow of traffic.

    iv. Intersections operate at Safe System Speeds (see Austroads Safe System Assessment Framework (2016 – AP-R509-16))

c. The design and location of vehicle crossings and associated access to protect amenity and ensure safe and efficient movement to and from sites for vehicles, pedestrians and cyclists by managing:

   i. Separation distances between vehicle crossings.

   ii. Separation distances from intersections.

   iii. Vehicle crossing sight distances.

   iv. The number of vehicle crossings per site.

d. The promotion and facilitation of walkability by requiring unused vehicle crossings to be reinstated to match the existing footpath and kerbing.

e. The promotion of walkability by ensuring the safe and efficient movement to and from sites for pedestrians and cyclists through the design and implementation of road and outdoor lighting to conform to align with National Guidelines for Crime Prevention through Environmental Design in New Zealand principles including:

   i. Maximising movement safety (especially after dark).

   ii. Considering lighting as being integral to the overall design philosophy.

   iii. Eliminating concealment spots or securing them by incorporating visibility aids as necessary.

   iv. Ensuring good visibility, sightlines and casual surveillance are provided.

f. The design and location of parking and loading areas and associated access to ensure safe movement within the site as well as safe ingress and egress of vehicles, pedestrians and cyclists by managing:

   i. Parking and loading space dimensions.

   ii. The location and identification of car parking and loading spaces.

   iii. Maneuvering space within the site.

   iv. Gradient.

   v. The construction standards of parking areas.

g. The improvement of pedestrian safety and walkability in proximity to commercial areas, schools and other community facilities by enhancing the standard of pedestrian networks.

h. The facilitation of cycle and pedestrian connectivity within new subdivisions and developments, and where appropriate, to existing developments.

i. Incorporate the Safe System Approach (see Austroads Safe System Assessment Framework (2016 – AP-R509-16)) ensuring roadway design encourages appropriate road use behaviour and safe speeds.

3.1.4. Functions and Hierarchy of a Transport Corridor

The Transport Network should be designed to achieve:

a. Shorter travel distances,

An increased number of alternative routes for all types of users,

b. Increased opportunity for interaction, and

c. Improved access to public transport, cycling and walking networks, and to destinations such as schools and public amenities.

Transport Corridors serve the following functions:

d. Movement (linking places with transportation infrastructure that provides for a range of transport modes and user groups to move people and goods),

e. Place Context (creating public spaces for people to interact, exercise and enjoy where appropriate), and

f. Utility Corridor (providing corridors that Network Utility Operators and others can utilise to service the area e.g. telecommunications, electricity, three waters and gas networks: street lighting and design elements within the berm including landscaping and street furniture).

The Transport Network hierarchy is defined in the District Plan.

3.1.5. Reference Documents

Details of documents referenced in this Section are as follows:

Note it is the responsibility of the Developer to ensure the most up to date referenced document is sourced.

3.1.5.1 New Zealand Standards

AS 1141.32:2019	Methods for sampling and testing aggregates - Weak particles (including clay lumps, soft and friable particles) in coarse aggregates
AS/NZS 1906.1:2017	Retroflective materials and devices for road traffic control purposes - Part 1: Retroflective Sheeting
AS/NZS 2890.1:2004	Parking Facilities Part 1: Off-street car parking
AS 2890.2:2018	Parking facilities, Part 2: Off-street commercial vehicle facilities
AS/NZS 3845.1:2015	Road safety barrier systems and devices
NZS 3109:1997	Concrete Construction
NZS 3116:2002	Concrete Segmental and Flagstone Paving
NZS 4121:2001	Design for access and mobility - Buildings and associated facilities
NZS 4402:1986	Test 2.8.1 - Subsidiary method by wet sieving
NZS 4402:1986	Test 2.8.2 - Subsidiary method by dry sieving
NZS 4402:1986	Test 4.1.1 – NZ standard compaction test

NZS 4402:1986	Test 4.1.3 - NZ vibrating hammer compaction test
NZS 4404:2010	Land development and subdivision infrastructure
NZS 4407:2015	Methods of sampling and testing road aggregates

3.1.5.2 NZTA Standards and Guidelines

Land Transport Rule	Traffic Control Devices 2004
Waka Kotahi	Code of Practice for Temporary Traffic Management
Waka Kotahi	Cycling Network Guidance
Waka Kotahi	Bridge Manual SP/M/022 Third edition, Amendment 3, 2018
Waka Kotahi	Manual of Traffic Signs and Markings (MOTSAM) - Part 1: Traffic Signs, 2010
Waka Kotahi	New Zealand Guide to Pavement Structural Design (2017)
Waka Kotahi	One Network Road Classification (ONRC)
Waka Kotahi	Pedestrian Network Guidance
Waka Kotahi	Pedestrian Planning and Design Guide (2009)
Waka Kotahi	Planning Policy Manual - Accessway Standards and Guidelines Appendix 5B (2007)
Waka Kotahi	Public Transport Design Guidance
Waka Kotahi	Research Report 453 Trips & Parking Related to Land Use (November 2011)
Waka Kotahi	Road Safety Audit Procedures for Projects Guideline (2013)
Waka Kotahi	RTS 13 Guidelines for Service Stations (1996)
Waka Kotahi	RTS 14 Guidelines for Facilities for Blind and Vision Impaired Pedestrians (2015)
Waka Kotahi	RTS 18 NZ On Road Tracking Curves for Heavy Vehicles (2007)
Waka Kotahi	Speed Management Guide (2016)
Waka Kotahi	Speed Management Guide - Volume 2: Toolbox – how to implement treatments and activities (2016)
Waka Kotahi	Stormwater Treatment Standard for State Highway Infrastructure (2010)
Waka Kotahi	Technical Advice Note for Tactile Installation TAN #20-20 (2020)
Waka Kotahi	Traffic Control Devices Manual (TCD Manual) (2008)
Waka Kotahi	Traffic Note 37 Revision 2 (2011)
Waka Kotahi	Traffic Note 56 Revision 1 (2011)

3.1.5.3 NZTA Specifications

Waka Kotahi	B/2 Construction of Unbound Granular Pavement Layers (2005)
Waka Kotahi	B/5 In-situ Stabilisation of Modified Pavement Layers (2008)
Waka Kotahi	F/1 Earthworks Construction (1997)
Waka Kotahi	F/2 Pipe Subsoil Drain Construction (2013)
Waka Kotahi	F/5 Corrugated Plastic Pipe Subsoil Drain Construction (2000)
Waka Kotahi	M/1 Bitumen for Pavements (2020)
Waka Kotahi	M/4 Basecourse Aggregate (2006)
Waka Kotahi	M/6 Sealing Chip (2019)
Waka Kotahi	M/7 Roadmarking Paints (2009)
Waka Kotahi	M/10 Dense Graded Asphalt (2020)
Waka Kotahi	M/13 Adhesion Agents (1989)
Waka Kotahi	M/14 Edge Marker Posts (2011)
Waka Kotahi	M/17 W-section Bridge Guardrail (1989)
Waka Kotahi	M/23 Road Safety Barrier Systems (2009)
Waka Kotahi	M/23 Appendix A: Permanent Road Safety Hardware (2021)
Waka Kotahi	P/3 First Coat Sealing (1995)
Waka Kotahi	P/4 Resealing (1995)
Waka Kotahi	P/12 Pavement Marking (2000)
Waka Kotahi	P/43 Specification for Traffic Signals (2020)
Waka Kotahi	T/1 Benkelman Beam Deflection Measurements (1977)
Waka Kotahi	T/10 Skid Resistance Investigation and Treatment Selection (2013)

3.1.5.4 Austroads Guides

	Effectiveness and Implementation of Raised Safety Platforms (2020 - AP-R642-20)
Guide to Road Design	Part 3: Geometric Design (2021 - AGRD03-16)
Guide to Road Design	Part 4: Intersections and Crossings - General (2021 - AGRD04-17)
Guide to Road Design	Part 4A: Unsignalised and Signalised Intersections (2021 - AGRD04A-17)
Guide to Road Design	Part 4B: Roundabouts (2021 - AGRD04B-15
Guide to Road Design	Part 4C: Interchanges (2015 - AGRD04C-15)

Guide to Road Design	Part 6A: Paths for Walking and Cycling (2021 - AGRD06A-17)
Guide to Pavement Technology	Part 2: Pavement Structural Design (2019 - AGTP02-17)
Guide to Pavement Technology	Part 5: Pavement Evaluation and Treatment Design (2019 -AGPT05-19)
Guide to Pavement Technology	Part 6: Unsealed Pavements (2009 – AGPT06-09)
Guide to Traffic Management	Part 8: Local Street Management (2020 - AGTM08-20)
Guide to Traffic Management	Part 10: Transport Control – Types of Devices (2020 - AGTM10-20)
	Safe System Assessment Framework (2016 – AP-R509-16)

3.1.5.5 Other Documents

Auckland Council	GD01 – Stormwater Management Devices in the Auckland Region (2017)
NZ	Building Act 2004
ENZ	Producer Statement – PS1 Design
ENZ	Producer Statement – PS4 Construction Review
Local Government	Acts 2002 and 1974
Ministry for the Environment's	National Guidelines for Crime Prevention Through Environmental Design in New Zealand (2005)
Northland Transportation Alliance	Design Manual - Street Lighting Version 1
NZ	Building Code
NZ Utilities Advisory Group:	National Code of Practice for Utility Operators' Access to Transport Corridors - Updated Version 2, July 2019Operative District Plan
Wellington Council	WSD for Stormwater: Treatment Device Guideline
FNDC	District Plan Maps
FNDC	Policy # 2125 – Road Naming and Property Numbering

Note: These are not exclusive and other standards, guidelines, and design responses may be used where appropriate, provided they meet the performance requirements of this Section.

3.2. Design

3.2.1. General

Roads and accessways shall be designed to the requirements and standards set out in Table 3-2 (Urban) and Table 3-3 (Rural). The standards shall apply equally to new works and to upgrading works.

Traffic management/calming facilities may be required in the road design to ensure that the design speed is achieved/controlled.

3.2.2. Designer Responsibilities

Refer also to Section 1.5.1 General.

3.2.2.1 Competency

All investigations, design, supervision and certification of the works covered by this Chapter shall be carried out by or under the control of a SQEP working within their area of competence.

The SQEP shall certify that the works through all stages until completion are in accordance with the requirements of section 1.5.1.3 Risk Based Assessment Framework.

3.2.2.2 Design and Access Statements

For all roadways that will vest with FNDC, a design and access statement shall be submitted with the application for EDA. For all roads which will be publicly vested, a Road Safety Audit (See Section 3.2.4 Safety Audit) or an approved exemption will be required.

Design shall be accompanied by a PS1 Design signed by a SQEP, which outlines how the applicable design standards have been applied. The PS1 Design shall cover all relevant aspects of Section 3.2 Design and specifically address the following:

a. Road dimensions and layout;

b. Link and place functions;

c. Connectivity and how it will be achieved for all road user types;

d. How safe and appropriate speeds will be achieved and managed through design (in accordance with the Waka Kotahi Speed Management Guide) and the design speed environment;

e. How any 'serious and critical' issues identified in the road safety audit have been addressed;

f. Parking, passing and loading provisions;

g. Criteria used in determining visibility distances and splays;

h. Safety barrier requirements and considerations that have been made for alternative treatments;

i. Impact on existing street features, including but not limited to street furniture, pedestrian refuge facilities, bus stops & shelters, for visual consistency and also potential increase in usage;

j. Any new parking restrictions that will be required in order for the proposed design to operate safely (e.g. no stopping).

3.2.2.3 Information to be Submitted

All design documentation to be submitted for EDA shall include site investigations, supporting information and calculations sufficient to demonstrate compliance with the design standards. In addition to the general requirements of Section 1.5.3 Detailed Design/Approval the information submitted for EDA shall include, but not be limited to:

a. Testing of the pavement subgrade (roads and accessways),

b. Assessment of traffic volumes and vehicle operating speeds,

c. Plan showing the hierarchy of the proposed roading network including adjacent roads taking into account projected growth predictions and predicted AADT's,

d. Pavement design – structural and surfacing,

e. Geometric design,

f. Drainage design,

g. Streetlighting,

h. Roadmarking and signage,

i. Speed management devices,

j. Utility service locations,

k. Vehicle crossing design,

l. Landscaping,

m. Delineation between public and private assets, and

n. Design and access statement

In addition, design drawings complying with the requirements of Appendix G Drawing Standards shall be submitted for approval together with specifications as necessary.

Any departures from the ES shall be noted and fully justified. Such assessment shall be carried out by a SQEP who is working within their competencies in accordance with the requirements of Section 1.5.1.3 Risk Based Assessment Framework. The SQEP shall identify the design standards used and certify that the design complies with the referenced standards.

3.2.3. Design Approval

Refer also to Section 1.5.3 Detailed Design/Approval.

3.2.4. Safety Audit

A Road Safety Audit, or exemption, is required for any improvement or renewal activity that involves vehicular traffic and/or walking and/or cycling as per the Road Safety Audit Standard for the Far North District. The audit should generally take place at project milestones including, but not limited to:

- Concept Stage (for large, complex projects) and/or,
- Scheme or preliminary design stage (part or pre-implementation) and/or,
- Detailed design stage (pre-implementation or implementation) and,

Pre-opening or post-construction stage (implementation or post-implementation).

The auditors shall be independent of the design team and shall use the procedures detailed in Waka Kotahi Road Safety Audit Procedures for Projects – Guidelines.

The objectives of the audit will be to identify potential safety problems for all road users affected by the proposed development, including the needs of pedestrians, cyclists and elderly/disabled users and to ensure that measures to eliminate or reduce the problems are fully considered.

Recommendations from the audit report shall be addressed and incorporated into the design as considered appropriate by the SQEP, safety auditor and FNDC prior to final FNDC approval.

3.2.5. Design Life

The minimum design life of roading assets shall be:

a. Pavements – 30 years,

b. Surface and ground water drainage systems - 100 years,

c. Stormwater treatment systems within a public road – 100 years and in accordance with Section 4.3.6 Design Life,

d. Bridges, major culverts and earth retaining structures on public roads - 100 years, and

e. Structures (including bridges) on private roads and accessways – in accordance with the Building Act 2004/ NZ Building Code requirements.

3.2.6. Road Classifications and Design Criteria

3.2.6.1 Road Classifications

Roads have been classified in terms of the Waka Kotahi's One Network Road Classification (ONRC). The following table lists the classifications and what broadly defines them. The District Plan Maps identify each roading network classification.

Table 3-1: Road Classifications

Classification	Average Daily Traffic (ADT)		Brief Descriptive
	Urban	Rural	
Access (Low Volume)	<200	<50	Access (Low Volume) are all other roads classed as low volume.
Access	<1,000	<200	Access includes all other roads. Significant numbers of pedestrians and cyclists. Low volume roads within this category will fall into the low volume subset above.
Secondary Collector	>1,000	>200	Roads that provide a secondary distributor/collector function, linking local areas of population and economic sites and may be the only route available to some places within the local area. Significant numbers of pedestrians and cyclists in urban areas.
Primary Collector	>3,000	>1,000	Roads that are locally important that provide a primary distributor/collector function, linking significant local economic areas or areas of population. In urban areas they may have moderate passenger transport movements and numbers of cyclists and pedestrians using the road.
Arterial	>5,000	>3,000	Roads that link regionally significant places, industries, ports or airports and may be the only route available to some places within the region. In urban areas they may have significant passenger transport movements and numbers of cyclists and pedestrians using the road.
Regional	>15,000	>10,000	Roads that connect regionally significant places, industries, ports or airports. They are also major connectors between regions.
National and National (High Volume)	>25,000 >35,000	>15,000 >20,000	Roads that connect major population centres, major ports or international airports and have high volumes of heavy commercial vehicles or general traffic.

3.2.6.2 Design Criteria

Roads shall be designed in accordance with the general requirements of Table 3-2, Table 3-3, Table 3-4 and the standard drawings. For the purpose of applying the criteria of Table 3-2, Table 3-3, and Table 3-4 the “urban” and “rural” definitions shall be as follows:

“Urban” shall include the following environments:

a. Residential Zone

b. Mixed Use Zone

c. Light Industrial Zone

d. Heavy Industrial Zone

“Rural” shall include the following environments:

e. Rural Production Zone

f. Rural Lifestyle

g. Settlement Zone

h. Mineral Extraction Overlay

i. Rural Residential allotments over 2000 m^2. Special considerations for lots between 2000 m^2 and 4000 m^2 can be found in Section 3.2.6.3 Rural Residential Zone Lots 2000-4000 m2.

"Recreation / Conservation environment" shall include the following zones:

j. Sport and Active Recreation Zone

k. Open Space Zone

l. Natural Open Space Zone

"Special" Areas shall include the following zones:

m. Ngawha Innovation special zone

n. Horticultural Processing Zone

o. Orongo Bay Zone Horticulture Zone

p. Carrington Estate Zone

q. Airport Zone

r. Maori Purpose Zone

s. Treaty Settlement Overlay

t. Qual Ridge Zone

u. Kauri Cliffs Zone

v. Russell Township Zone

*Note: * denotes a proposed environment/zone*

Likewise, where "urban" and "rural" references are made throughout this Transportation Section, the above definitions shall apply.

3.2.6.3 Rural Residential Zone Lots 2000-4000 m2

The Rural Residential zone provides an opportunity for people to enjoy a spacious living environment while being close to a settlement. The Rural Residential zone is located on the fringe of our settlements and provides a transition to the surrounding Rural Production and/or Horticulture zones. The Rural Residential zone does not anticipate community, commercial or industrial activities but does retain the ability to undertake farming activities. The Rural Residential zone is identified through smaller lot sizes of approximately 4,000m2 that are capable of providing for on-site infrastructure servicing. The zone is appealing for peri-urban living within a reasonable distance from a settlement. It may also identify where an urban centre may grow and where land may be re-zoned for urban development when demand requires it. Section 3.2.6.2 Design Criteria provides that lots over 2000m^2 shall be classified as rural in terms of road classification. For the purposes of the road corridor, special design consideration may be given to lot sizes between 2000 m^2 and 4000 m^2 to provide safe and appropriate facilities for all users. Table 3-5 shall be used as a guide in development of Low Volume Access and Access Roads in this environment

Table 3-2: Urban Road Design Criteria

Classifications	Average Daily Traffic (ADT) [1]	Minimum Legal Road Width[2]	Carriageway Requirements				Berm[5] Requirements	
			Overall Width[3]	Movement Lane Width[4]	On Street parking	Cyclists	Pedestrians	Utility Service Corridor
Low Volume Access	< 200	18.0m	8.25m	2 x 3.0m	1 x 2.25m	cycling shared in movement lane on road	2 x 1.8m wide footpath, both sides.	1.725m both sides
Access	200 - 1,000	20.0m	10.5m	2 x 3.0m	2 x 2.25m	cycling shared in movement lane on road	2 x 1.8m wide footpath, both sides	1.60m both sides
Secondary Collector	1,001 - 3,000	24.0m	14.0m	2 x 3.5m marked	2 x 2.0m	2 x 1.5m wide marked cycle lane, both sides on road	2 x 1.8m wide footpath, both sides	1.85m both sides
Primary Collector	3,001 - 5,000	25.0m	14.6m	2 x 3.5m marked	2 x 2.0m	2 x 1.8m wide marked cycle lane, both sides on road	2 x 1.8m wide footpath, both sides	2.05m both sides
Industrial	N/A	22.0m[6]	13.0m	2 x 3.5m marked	2 x 3.0m	See Note 6 below	2 x 1.8m wide footpath, both sides	1.35m both sides
Arterial	5,001 – 15,000	Specific Design						
Regional	15,001 – 25,000	Specific Design						
National	> 25,000	Specific Design						

1. ADT as defined in Trips & Parking Related to land Use Nov 2011" NZTA Research report 453
2. Full transport corridor width. May be increased to accommodate cycleways, drainage facilities, landscaping etc. Shall allow for future development.
3. Measured between kerb faces
4. Excludes shoulders and parking
5. Measured from the property boundary to the face of the kerb refer to sheet 29 for dimensions.

6. Cycling shared in movement lane unless ADT > 3,000 in which case cycling provisions to be agreed with District Council

Table 3-3: Rural Road Design Criteria

Classifications	Average Daily Traffic (ADT)[7]	Minimum Legal Road Width[8]	Carriageway Requirements					Berm Requirements
			Overall Width[9]	Movement Lane Width[100]	Unsealed Shoulder	Sealed Shoulder	Cyclists	Pedestrians[111]
Low Volume Access	<50	20.0m	7.0m	2 x 2.5m	2 x 0.5m	2 x 0.5m	shared in movement lane	shared on shoulder & berm
Access	50 - 200	20.0m	7.0m	2 x 2.5m	2 x 0.5m	2 x 0.5m	shared in movement lane	shared on shoulder & berm
Secondary Collector	201 – 1,000	20.0m	8.0m	2 x 3.0m	2 x 0.5m	2 x 0.5m	shared in movement lane	shared on shoulder & berm
Primary Collector	1,001 - 3,000	20.0m	11.0m	2 x 3.5m	2 x 0.5m	2 x 1.5m	on sealed shoulder	shared on shoulder & berm
Arterial	3,001 – 10,000	20.0m	12.0m	2 x 3.5m	2 x 0.5m	2 x 1.8m	on sealed shoulder	shared on shoulder & berm
Regional	10,001 - 15,000	Specific Design						
National	> 15,000	Specific Design						

7. ADT as defined in Trips & Parking Related to land Use Nov 2011" NZTA Research report 453
8. Full transport corridor width. May need to be increased to accommodate cycleways, drainage facilities, earthworks and the like. Shall allow for future development.
9. Measured between the outer extremities of the shoulders. May need to be increased to allow additional widening on horizontal curves and/or the provision of passing bays
10. Excludes shoulders
11. Dedicated (separate) pedestrian access generally not provided unless in built environment

Table 3-4 Rural Road Design Criteria – Unsealed Roads

Classification	Characteristics[12]	Minimum Legal Road Width[8]	Carriageway Requirements			
			Minimum Width	Maximum Width	Pavement Depth (mm)	Wearing Course (mm) nominal
Primary Collector	Band 3	20.0	6.0	8.0	250.0	100.0
Secondary Collector	Band 3	20.0	6.0	8.0	250.0	100.0
Access	Band 3	20.0	6.0	8.0	250.0	100.0
Low Volume	Band 3	20.0	6.0	8.0	250.0	100.0
Primary Collector	Band 2 Forestry	20.0	4.0	5.0	250.0	100.0
Secondary Collector	Band 2 Forestry	20.0	4.0	5.0	250.0	100.0
Access	Band 2 Forestry	20.0	4.0	5.0	250.0	100.0
Low Volume	Band 2 Forestry	20.0	4.0	5.0	250.0	100.0
Primary Collector	Band 2 Private Use	20.0	4.0	5.0	100.0	100.0
Secondary Collector	Band 2 Private Use	20.0	4.0	5.0	100.0	100.0
Access	Band 2 Private Use	20.0	4.0	5.0	100.0	100.0
Low Volume	Band 2 Private Use	20.0	3.0	4.0	100.0	100.0
Primary Collector	Band 1	20.0	3.0	4.0	100.0	No Wearing Course
Secondary Collector	Band 1	20.0	3.0	4.0	100.0	No Wearing Course
Access	Band 1	20.0	3.0	4.0	100.0	No Wearing Course

Classification	Characteristics[12]	Minimum Legal Road Width[8]	Carriageway Requirements			
			Minimum Width	Maximum Width	Pavement Depth (mm)	Wearing Course (mm) nominal
Low Volume	Band 1	20.0	3.0	4.0	100.0	No Wearing Course
Arterial		Specific Design				
Regional		Specific Design				
National		Specific Design				

12. Determination of the ONRC Band Number will be made in consultation with the FNDC

Table 3-5 Low Volume Access and Access Roads for Rural Zone Lots 2000-4000 m2

Classifications	Average Daily Traffic (ADT) [1]	Minimum Legal Road Width[2]	Carriageway Requirements				Berm[5] Requirements	
			Overall Width[3]	Movement Lane Width[4]	On Street parking	Cyclists	Pedestrians	Utility Service Corridor
Low Volume Access	<50	18.0	8.0	2 x 3.0	NA	cycling shared in movement lane on road	2 x 1.8 m wide footpath, both sides.	1.5 m both sides
Access	50 - 200	20.0	8.0	2 x 3.0	NA	cycling shared in movement lane on road	2 x 1.8 m wide footpath, both sides	1.5 m both sides

3.2.7. Geometric Design

3.2.7.1 General

Roads shall be designed to satisfy the requirements of Table 3-7 and the sub-sections following.

Table 3-6: Road Classification Designs

Classification	Design Speed (km/h)	Gradient[13] (%)	Maximum Superelevation (%)	Minimum Curve Radius (m)
Private accessway	-	up to 22.2[14]	-	8
Urban				
Low Volume Access	50	0.4 – 12.5	6	60
Access	50	0.4 – 12.5	6	60
Secondary Collector	50	0.4 – 10.0	6	80
Primary Collector	50	0.4 – 10.0	6	80
Arterial	Design speed to be match the intended posted speed	Specific Design[154]		
Regional		Specific Design[15]		
National		Specific Design[15]		
Industrial/Commercial Service Lane	-	0.4 – 10.0	-	To suit 18m semi-trailer unit
Rural				
Low Volume Access	Design speed to be match the intended posted speed	0.4 – 12.5	Specific Design[15]	
Access		0.4 – 12.5		
Secondary Collector		0.4 – 10.0		
Primary Collector		0.4 – 10.0		
Arterial		Specific Design[15]		
Regional				
National				

13. Where the gradient of a public road is steeper than 12.5% a resolution of the District Council is required (refer to Section 329 of the Local Government Act 1974/2002)
14. Refer to Sections 3.2.28.2 Urban Private Accessways and Section 3.2.28.3 Rural Private Accessways for specific gradient details.
15. Specific Design shall be to Austroads Guide to Road Design – Part 3: Geometric Design

3.2.7.2 Design Speed

The design speed of a road is the maximum speed that a vehicle can safely travel at on that road under perfect conditions. A Safe System Approach encourages appropriate road use behaviour and safe speeds. Many factors shall be considered and the Austroads Guide to Road Design - Part 3: Geometric Design provides suitable guidance for designing to a design speed. (NB: This Guide replaces that which was previously provided in the (separate) Austroads Urban and Rural Road Design Guides). Austroads Guide to Traffic Management – Part 8: Local Street Management and the Waka Kotahi Speed Management Guide also provides suitable guidance.

Traffic management facilities shall be included in the road design as necessary to ensure that the design speed environment is achieved.

3.2.7.3 Horizontal and Vertical Alignment

Horizontal and vertical alignment (including horizontal and vertical curves) shall be based on terrain and the design speed applicable to the road function.

The design speed of the vertical alignment shall not be less than that of the horizontal alignment. The design should provide for a consistent standard of alignment with no curve less than 10 km/hr lower than the 85th percentile operating speed at the site.

Reverse curves shall be separated by an adequate length of straight in metres being 0.7 times the posted speed limit.

Tracking curves (or demonstration of tracking by use of digital tracking software) may be required to show that vehicles can negotiate curves that are narrow in lane width or have a small radius. The vehicles chosen shall be appropriate to the type of vehicle that will use the road. Refer to RTS18 – NZ On-road Tracking Curves for Heavy Vehicles.

3.2.7.4 Curve Radius

The minimum centreline radius for roads shall be in accordance with Table 3-6.

3.2.7.5 Crossfall and Superelevation

The normal (minimum) crossfall for all sealed roads shall be 3%. Where existing features mean that this cannot be achieved the crossfall may vary between 2% and 4%. Single crossfall roads will be considered on urban access and low volume access roads where normal crossfall is unobtainable and shall have particular regard for stormwater management.

The crossfall for unsealed roads shall be 4%, with a range of 3-6% as it will hold water resulting in rutting and potholes if crossfall is< 3%.

Minor adjustments to kerb levels to provide an evenly sweeping kerb line are acceptable.

The maximum urban superelevation shall be 6%.

3.2.7.6 Widening on Curves

In some instances, (eg low horizontal curve radius where the passage of vehicles has the potential to reduce safety), movement lanes shall be assessed to determine the need for localized additional width. For a two lane road, curve widening should be omitted when the total widening is less than 0.5 m.

The Austroads Guide to Road Design - Part 3: Geometric Design has useful guidance on this. Table 3-7 (adapted from Austroads) provides acceptable data for use in design.

Table 3-7: Curve Widening per Lane for Design Vehicle

Curve Radius (m)	Widening per lane (m)	
	11.5m large rigid truck	18m semi-trailer
60	0.7	0.8
80	0.5	0.6
100	0.4	0.5
140	0.3	0.3
200	0.2	0.2
>400	-	-

3.2.7.7 Sight Distance

All roads shall be designed with sight distances that match the posted speed. Refer to **Sheet 4**.

Visibility splays and envelopes may require the road boundary to be set back in which case trees shall not be planted in the visibility splay. Sightlines outside the Transport Corridor will only be approved where the land between the sightline and the road reserve boundary, plus an additional 0.5 m beyond the sightline, is appropriately protected such that no development is permitted within the affected area and FNDC has the legal right to trim or remove vegetation within that area. Easements or covenants are acceptable land protection instruments in this regard.

3.2.8. Cut / Fill Batters

3.2.8.1 Urban Roads

Cut and fill batters for roads shall be constructed within the Transport Corridor and comply with the following criteria:

a. Maximum grade of 20% (1:5) starting at the road boundary. Where circumstances dictate a steeper grade is necessary, a geotechnical assessment of the slope shall be provided together with specific access design,

b. Any retaining wall designed to support the road or footpath shall be constructed within the Transport Corridor and will likely require a building consent, and

c. Where the District Council considers that the stability of any planned embankment is in doubt, a stability analysis of the slope under saturated conditions may be required.

3.2.8.2 Rural Roads

Rural batters for cuttings and embankments shall usually be constructed inside the Transport Corridor and comply with the following criteria:

a. Batters less than 750mm high shall be cut at 1V:4H and shall be top soiled and grassed,

b. Batters greater than 750mm high shall be cut at 1V:2H and shall be protected from face erosion by hydro-seeding or similar, and

c. Batters 5m high and above shall be assessed by a Geo-professional. In undertaking this check and determining the appropriate erosion protection the Geo-professional shall take into account:

i. The type of soils present in the cutting, and

ii. The degree of practicable erosion and its effect on long term stability, the safety of road users, and adjacent property owners

3.2.9. Intersections

3.2.9.1 General

Subject to the following provisions and the provisions of Section 0 Design Considerations, all intersections shall be designed in accordance with Austroads Guide to Road Design Part 4: Intersections and Crossings and Part 4A: Unsignalised and Signalised Intersections. All intersection designs shall take into consideration the Safe System Approach (see Austroads Safe System Assessment Framework (2016 – AP-R509-16)) including minimizing and modifying conflict points, reducing speed of vehicles, improving visibility and providing space and protection for pedestrians and bicyclists.

Generally, roads should intersect only with roads in the same class or those immediately above or below in classification. T-junctions are preferred to cross intersections particularly for access roads. The angle of intersection should be 90°, although a minimum angle of 70° can be used when justified by other constraints. Carriageway alignment may be offset within the road reserve to improve the intersection angle.

Intersections on curves, particularly on the inside of curves, other than large radius curves, shall be avoided. Multi-leg intersections may require control by roundabouts.

Design Considerations

The location and design of intersections shall take into account the minimum sight distances shown in **Sheet 4**.

The minimum permitted spacing between adjacent intersections on different categories of road is set out in Table 3-8. All distances are measured along the centreline of the major road between the centrelines of the intersecting roads.

Table 3-8: Minimum Intersection Spacing

	Access (including low volume)	Secondary Collector	Primary Collector	Arterial
Urban	30m	50m	100m	100m
Rural	75m	100m	150m	150m

The minimum kerb radius at urban intersections shall be:

a. 8m with corner splays of 4m to 6m for residential roads of collector class and below. A reduced kerb radius may be considered to enhance pedestrian facility in low speed environments subject to the approval of the District Council.

b. 13.5m with corner splays of 6m for arterial roads and in commercial/industrial areas.

c. Corner splays in higher than 50 km/hr. speed environments shall be subject to Specific Design to ensure safe visibility at intersections

Major industrial intersections shall be specifically designed for 18m semi-trailer units, and all urban intersections (access roads and above) designed for a minimum 11.5m large rigid truck, as defined by the 'RTS18' tracking curves referenced in Section 3.2.7.3 Horizontal and Vertical Alignment.

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Gradients within 30m of urban intersections shall be:

a. for access roads - less than 1 in 33 where practicable and not greater than 1 in 10, or

b. for collector and arterial roads - less than 1 in 50

3.2.9.2 Arterial Road Intersections

For intersections with arterial roads, the Engineering Plans shall show the sight distance provided at each intersection, plus the following information:

a. Design Speed,

b. Design Vehicle,

c. Distance from limit lines to viewpoint (LV),

d. Approach Sight Distance (ASD),

e. Safe Intersection Sight Distance (SISD), and

f. All radii

The SISD shall be determined with an object of height 0.6m.

Reference can also be made to Austroads Guides to Road Design Parts 4, 4A, and 4C.

3.2.10. Roundabouts

Roundabouts may be required at multi-leg intersections, intersections where Stop or Give Way controls do not provide adequate capacity or Level of Service, or to provide traffic calming.

Roundabouts shall be subject to specific approval by FNDC and shall be designed in accordance with Austroads Guide to Road Design Part 4B: Roundabouts. The size of a roundabout has a significant role in the performance for capacity, traffic safety and turning movements of vehicles and shall take into account the following key considerations:

a. Classification of intersecting roads,

b. Pedestrian and cyclist safety and accessibility,

c. Anticipated vehicle types,

d. Distribution of turning traffic,

e. Heavy vehicle access requirements, and

f. Landscaping.

Visibility is an important factor to ensure safety standards are met, Austroads Guide to Road Design Part 4B: Roundabouts, Criteria 1 and 2 for sight distance are both mandatory requirements. Achievement of Criteria 3 is desirable.

3.2.11. Traffic Signals

Traffic signal installations shall be subject to Specific Design, safety auditing and approval processes to the satisfaction and final approval of the FNDC. Developers are advised to consult with FNDC at an early stage to ascertain current requirements. (Note: the current standard is Waka Kotahi P/43 Specification for Traffic Signals– modified by current Far North District Council Regional Special Conditions).

3.2.12. Pavement Structural Design

3.2.12.1 General

Pavements shall be provided to all roads such that vehicle loads may be carried out without distress, in all weathers, for at least the design life with only normal routine maintenance and periodic re-surfacing.

Pavements (including carparks) shall be flexible granular pavements with thin surfacing layers. Where this is not sufficient or a more innovative solution can be implemented, prior approval from FNDC will be required in order to proceed with the design – refer to Section 1.5.1.2 Alternative Designs.

Pavements shall be designed for the specified design life, based on the subgrade strength, traffic loading and traffic growth. Design loads shall be determined from the known and/or predicted heavy vehicle usage of the road, with adequate justification provided.

3.2.12.2 Design

A sealed pavement design may be carried out by one of two methods:

3.2.12.2.1. Sealed Pavement – Specific Design

This method shall be used for all industrial roads and all arterial and collector classifications (both urban and rural). It may also be used for roads of lower classifications.

The design shall be in accordance with the Austroads Guide to Pavement Technology – Part 2: Pavement Structural Design and the Waka Kotahi – New Zealand Guide to Pavement Structural Design together with relevant Waka Kotahi pavement material standards. All roads with a design number of Equivalent Standard Axles (DESA) greater than 10,000^7 shall have a pavement design completed by a Chartered Professional Engineer (CPEng). Factors to be included in the design are:

a. Design Period - 30 years,

b. Trips generated per household per day – 10,

c. Annual Heavy Commercial Vehicle (HCV) growth factor - 3 % minimum unless otherwise specified by the District Council,

d. Load factor - the Presumptive ESA/HCV of 1.44 shall be used for design purposes unless otherwise specified by the District Council, and

e. % HCV - 5% urban access and collector roads; 7% urban arterial roads; 10% industrial and commercial; 9% all rural classifications.

Note: The above factors are the minimum values to be used for design purposes and the District Council may require site specific increased values where peer reviews indicate the need or where Council believe that circumstances exist where they can be justified.

The design report shall include the following information as a minimum:

f. Results of soils investigations,

g. Design assumptions and figures,

h. Material specifications,

i. Engineering drawings, and

j. QA measures for construction

3.2.12.2.2. Sealed Pavement – Default Design

This method may only be used for urban and rural access (including low volume) classifications. Using this design does not exempt the construction from any tests or compliance with any targets and does not provide any guarantee that the resulting pavement will comply with all testing requirements. Pavements shall comply with the depth and aggregate specified in the following table:

Table 3-9: Pavement Layer Thickness for Urban and Rural Classifications

Road Classification	Sub-base	Basecourse	Notes
Low Volume Urban Access (< 200 vpd)	200	110	max 5% HCV
Urban Access (200 – 1,000 vpd)	250	130	max 5% HCV
Rural Access & Low Volume Access (< 200 vpd)	220	120	max 9% HCV

These typical designs are based on an insitu subgrade having a soaked CBR of 5 for a minimum depth of 0.6m. If the insitu subgrade does not achieve this strength, then subgrade improvements may be undertaken in order to achieve the required design subgrade CBR value. Refer per Section 3.2.12.2.1 Subgrade Testing for method of determining the design CBR.

If a subgrade of 0.6m depth and a CBR of 5 is not practicable, a Specific Design will be required as per Section 3.2.12.2.1 Sealed Pavement – Specific Design.

3.2.12.2.3. Unsealed Pavement

Pavement designers shall engage with FNDC's asset engineers before developing and submitting a design for consideration in order to determine the classification of road. This ensures the design can follow the Centre of Excellence for unsealed roads process when determining the importance of the road and how the road is constructed, maintained and renewed. This process allows for an unsealed road to be easily adopted to the vested and maintained roads.

Subgrade shall be investigated and tested before a pavement design is developed using pavement investigation methodologies in Astroads Guide to Pavement Technology Part 5, (DCP investigation through test pit methodology). Where a subgrade CBR is determined to be less than 7, a layer will be constructed using a sub100 aggregate at a minimum of 2.5 times the nominal aggregate size (250 mm) laid over the subgrade and a GAP65 layer at a minimum 2.5 times nominal aggregate size (162.5 mm) over the sub100 or to a sufficient thickness determined from the Austroads Guide to Pavement Technology Part 6 design guide chart for cover over formation to overcome the CBR deficiency.

Where a subgrade CBR is less than 3, a subgrade should be designed as equal to a CBR of 3 but with the initial subgrade (formation) layer stabilised to a depth of 100-150 mm. Stabilisation requirements are to be determined by following Austroads methodology for determining Lime or cement content or a blend of both through appropriate laboratory investigation.

If the subbase layers are required and once these have been constructed, unsealed granular pavements shall comprise a minimum compacted thickness as per table 3-4 of gap graded 40 (GAP40) material with a minimum soaked CBR of 20. Wearing Course, where required from the Table 3-4 are Page green compliant wearing course of AP30 material 100 mm thick will be placed and compacted to complete the carriageway formation.

Crossfall is to be between 6-8% on straights and 8-12 % superelevation in corners. Transitions and geometry of crossfall and geometric design of the road are to follow Austroads design guidelines. The crown of the road will not be flat or graded flat under any circumstances.

3.2.12.3 Subgrade Testing

The support provided by the subgrade is one of the most important factors to be considered in determining pavement design thickness, composition and performance. The level of support as characterised by the subgrade strength is dependent on the soil type, density and moisture conditions at construction and during service.

Subgrades are inherently variable in nature and reflect the changes in topography, soil type, and drainage conditions that occur along an existing or proposed road alignment. Hence the selection of a subgrade design value requires adequate consideration of the degree of variability within a particular development section, and the quantity and quality of data on subgrade properties. Therefore, the frequency of testing is critical to gaining a good understanding of the true nature of the subgrade. As a minimum, testing should be at intervals of 'length + 50m / 100" or 5 whichever is greater in visually similar subgrade materials.

Where the extent of cut or fill is too great to make subgrade CBR testing feasible at the design stage, such testing shall be done on completion of earthworks and the pavement design amended accordingly and submitted to the District Council for re-approval.

Soaked CBR (laboratory test) values of the pavement subgrade shall be used, and the pavement designed for the estimated number of ESA loadings over the design life.

Unsoaked, or in-situ subgrade CBR tests in non-granular materials will be approved for private accessways serving no more than eight household units using a scala penetrometer testing from 0 to 1.0m below design subgrade level. **Sheet 5** shows the correlation between scala penetration and CBR values. Taking the average value of the inferred CBR from the scala test results is not appropriate. Determine the design CBR as follows:

a. For subgrade strengths that are constant or improve with depth, the design CBR shall be the 10th percentile of the results obtained over the – i.e. the value below which 10% of the test results fall (or the value exceeded by 90% of the test results.)

b. For any weak layers encountered up to 1.0m below the design subgrade level and/or when subgrade improvements are required, the design CBR shall be determined using the nomograph on **Sheet 5a**

3.2.12.4 Peer Review

All specific pavement designs are required to be peer reviewed by an independent specialist approved by the District Council at the Developer's cost. The peer review shall be submitted with the design documentation together with an explanation as to how the findings of the peer review have been addressed.

3.2.13. Road Surfacing

3.2.13.1 General

All new urban carriageways shall be surfaced with either a chip seal or asphaltic concrete. Permeable pavers will not be approved as a running surface for public roads. The use of concrete will require the specific approval of the District Council.

All new rural carriageways shall be surfaced with a chip seal unless specifically approved otherwise by the District Council through resource consent conditions.

All urban and rural private accessways shall be surfaced in accordance with the requirements of **Sheet 7**, **Sheet 8**, **Sheet 9** and **Sheet 10**.

Asphaltic concrete (type to be approved by the District Council) applied over a waterproofing chip seal shall be used on industrial roads, roundabouts, all cul-de-sac turning heads, off street carparking areas and any other site subject to high turning movements as determined by the District Council. On cul-de-sac heads, asphalt shall be applied until the carriageway becomes a constant width.

3.2.13.2 Chip Seal Surfacing

The first coat shall be a two-coat grade 3/5 chip seal. A second coat of chip seal shall be applied between 12 and 18 months later as part of the development cost. Other chip seal designs may be considered and approved by the District Council. For further details and requirements see Section 3.3.5.3 First Coat Chip Seal and 3.3.5.4 Second Coat Chip Seal and Resealing.

3.2.13.3 Asphaltic Concrete Surfacing

Asphaltic concrete may be used as an alternative surfacing to chip seal, however there are stricter requirements for pavement stiffness. Selection of an appropriate mix for industrial sites shall be agreed with the District Council. For further details and requirements see Section 3.3.5.2 Asphaltic Concrete (AC).

3.2.13.4 Permeable Paving

Generally permeable pavement (other than on unsealed road) is not acceptable for public roads. This type of pavement may be used for low traffic roads, pedestrian areas, carparks, private roads or similar; and shall be considered under Section 1.5.1.2 Alternative Designs.

3.2.14. Road Drainage

3.2.14.1 General

The new roads and new drainage on the existing road shall be designed on a basis of the following:

All roads shall be provided with facilities for the collection and disposal of both surface stormwater and ground water suitable to cater for a 1% AEP flood event,

a. Enabling Groundwater recharge through soakage systems,

b. Providing for stormwater treatment for Roads where ADT is >3000, industrial, arterial, (or otherwise where required by District Plan and Stormwater Network Discharge Consent) for improved quality of stormwater discharges into receiving environments.

c. Complying with Requirements of the Northland Regional Council,

d. Where practicable, OLFP for new roads constructed in Urban and industrial areas should be constructed at a lower level than adjoining land. The rural roads should be constructed at a higher level than surrounding land but should not obstruct OLFP,

e. Water discharged from adjoining land,

f. Public safety,

g. Minimising of future maintenance requirements,

h. Capacity of any existing piped network,

i. Cyclists,

j. Reduction of peak discharge rate, and

k. Compliance with _Chapter 4: Stormwater and Drainage of the ES including stormwater runoff design.

In urban areas stormwater runoff should be controlled by kerb and channel. (Section 4.2.4 Discharge to the Road Kerb details the limitations of kerb stormwater outlets). Alternative options may be considered and will require specific approval under Section 1.5.1.2 Alternative Designs

Note: Channels constructed from clay or concrete pavers will not be considered for approval.

The urban road drainage system shall include first flush treatment to meet or exceed Auckland Council GD01 – refer to Section 3.2.14.6 Catch-Pits for catch-pit design requirements. Where proprietary treatment devices are proposed, the type of device shall be pre-approved by the FNDC.

Design criteria for components of the drainage system are as follows:

3.2.14.2 Subsurface Drainage

Subsurface drains shall be provided on both sides of all urban roads for pavement drainage purposes except where it can be demonstrated to the satisfaction of the District Council that it is not necessary - e.g. low water table and natural ground with high permeability. Rural roads in cut will require subsurface drainage - see **Sheet 14**.

Subsurface drains shall discharge to a suitable component of the stormwater system.

Where natural groundwater levels are known to be high, an effective means of de-watering shall be submitted for approval at the design stage. Such means to identify whether the measures shall be temporary, or form part of the permanent subsurface drainage system.

3.2.14.3 Side Drains, Water Tables

Stormwater from rural roads shall be directed to the side drains network, comprising of side channels /inlet & outlets, pipes and inspections chambers. The side drains network shall be sized to cater for a 10% AEP rainfall event, without causing flood hazard. The side drains network shall be capable of keeping groundwater levels below the road subgrade and be located within the Transport Corridor. scour protection such as concrete, rock riprap, check dams, a combination thereof shall be provided for side drains, where flow velocities exceed specified values in Section 4.3.11.3 Open Channel Flows. All outlets shall include protection from scouring, and not create adverse impact on slope stability.

The stormwater discharges from the road shall not cause damage to the adjacent property. The discharge of concentrated stormwater shall be subject to the approval of the affected property owner(s).

Where physical constraints preclude the construction of side drains and/or the land is steep, unstable or prone to erosion, kerb & channel or similar shall be considered.

3.2.14.4 Swales

The use of swales for stormwater treatment will require the pre-approval from FNDC before proceeding with design details. Where such approval is granted, swales, and similar stormwater devices that rely on infiltration may be used to reduce peak discharge flows, and to provide stormwater treatment.

Swales should be located within the road corridor at one or both sides. Swales in the centre of the road may be installed with pre-approval from FNDC. Swales shall be designed with the following principles:

a. With a sufficient width to accommodate other related infrastructure including stormwater devices, utility services (if needed), plants and be accessible for maintenance,

b. Accommodate for safe crossings for vehicles and pedestrians, and

c. comply with the requirements of Section 4.3.20 Soakage Devices and Section 4.3.21 Stormwater Treatment and Detention Devices.

Where swales are used in urban areas the road edge shall have a flush concrete edge or kerb openings. Safety in Design principles shall be applied to prevent vehicles driving through them (e.g. barriers and bollards). The road edge shall be installed with 30 MPa concrete, 300 mm wide and 200 mm deep with the top surface matching the crossfall of the carriageway. See **Sheet 13**. Refer to Section 3.2.27 Vehicle Entrances for the requirements for vehicle crossings over swales.

Refer also to **Sheet 15** and **Sheet 16** for typical details that may be used in swale design and to the Waka Kotahi Stormwater Treatment Standard for State Highway Infrastructure, Auckland Council GD01, and Wellington Council WSD for Stormwater: Treatment Device Guideline for further guidance.

3.2.14.5 Kerb and Channel

Subject to the provisions of Section 3.2.14.4 Swales, kerb and channel at a minimum gradient of 0.4% shall be provided on both sides of the carriageway for all urban carriageways. See **Sheet 13**.

Heavy duty kerb & channel shall be used in all industrial roads and service lanes. See **Sheet 13**.

Mountable kerb and channel shall be used on traffic islands and may be used on service lanes. In all other cases, mountable kerb and channel may only be used with the specific approval of the District Council.

Kerb and channel shall be provided on the uphill side of all urban roads with single crossfall to collect the stormwater runoff from footpaths and berms.

For rural roads, kerb and channel shall be required where necessary to control stormwater runoff such as adjoining cut and fill batters to control potential scouring of channels and embankments.

3.2.14.6 Catch-Pits

Catch-pits shall be installed alongside including kerb and channels and shall be designed and constructed in accordance with the provisions of Section 4.3.18 Catch-Pits.

The location of catchpits shall be designed in a manner not to cause a nuisance flooding at the road, road intersections and pram and vehicle crossings.

Catch-pit grates shall be safe and pedestrian and cycle friendly. The grates shall either transverse to the channel direction or gaps to be in a wavy pattern in a direction of traffic Proprietary devices including 'super catch-pits' or back entry inlet catch-pits, shall be pre-approved by FNDC, and designed and installed in accordance with the manufacturer's specifications. All catch-pits shall be designed with allowance for partial blockage of the gratings. See **Sheet 34** for standard catch-pit details.

3.2.14.7 Secondary Flow Provisions

At all points where there is a risk of primary network blockage and/ or overflow into private property, provision shall be made for secondary flow paths, which need to be in public ownership or protected by an easement.

For more information on overland flow path requirements and design refer to Section 4.3.8.3 Secondary System Design Requirements – Overland Flow.

3.2.15. Parking and Maneuvering

3.2.15.1 On Road Parking

The transport corridor shall be designed to accommodate the parking requirements contained in Table 3-2.

Parking bay pavement shall be constructed to the same standard as the road unless agreed otherwise by the District Council. Crossfall requirements are the same as for the carriageway.

3.2.15.2 Off Road Parking

Where dedicated off-road carparking is required, the quantity and location shall be provided in accordance with the District Plan. The following requirements shall be met:

a. The layout dimensions shall conform to the details shown in AS/NZS 2890.1:2004. Mobility parking spaces shall be designed in accordance with NZS 4121:2001. Loading bay spaces shall comply with AS 2890.2:2002. Refer also to District Plan for layout dimensions.

b. Adequate provision shall be made for access between the road and parking area and for maneuvering within the site so that vehicles do not reverse out onto the road.

c. On-site maneuvering for cars and heavy goods vehicles shall comply with the vehicle tracking curves shown on **Sheet 26**, **Sheet 27** and **Sheet 28** as applicable. Maneuvering in and out of a parking/loading bay shall not require more than one reverse maneuver.

d. The gradient for off-street parking spaces, loading bays and associated maneuvering areas for all non-residential activities shall not be steeper than:

   i. 1 in 16 for surfaces at 90° to the angle of parking, or

   ii. 1 in 20 for surfaces parallel to the angle of parking.

e. Structural design shall comply with the requirements of Section 3.2.12 Pavement Structural Design, and construction (including testing) shall comply with the requirements of Section 3.3.3 Pavement Construction and Section 3.3.4 Pavement Testing- the same as for roads. Unless approved otherwise through the resource consent conditions, surfacing shall comply with the requirements of Section 3.3.5 Pavement Surfacing.

3.2.16. No Exit Roads and Cul-de-sac Heads

3.2.16.1 No Exit Roads

'No-exit' roads shall not be provided (especially in commercial and industrial areas) where through roads and connected networks can be designed. Where no-exit urban roads cannot be avoided, they should ensure connectivity for pedestrians and cyclists and have no-exit signage.

No-exit roads shall provide for road turning at the end of the road for an appropriate vehicle but in any event not less than an 11 m rigid truck.

3.2.16.2 Cul-de-sac Head Design

The design of cul-de-sac turning areas shall be in accordance with **Sheet 11** noting that in commercial and industrial areas the minimum radius shall be 15m to accommodate the turning movements of service vehicles.

Off-set turning heads shall be designed by offsetting the road carriageway crown to create symmetrical conditions, with the channel being designed accordingly.

If a central area is proposed for parking or planting, the layout shall be checked for access by heavy vehicles (11.5m rigid truck) using tracking curves. The minimum trafficable width shall be 5.5m.

Hammerhead or 'T' cul-de-sacs may be provided in urban areas only where a standard circular head is not practicable. The layout shall be subject to Specific Design with particular consideration of vehicle entry/exits. Compliance with Figure 3.4 in NZS 4404:2010 is an acceptable solution in residential areas.

The minimum channel gradient around turning heads shall be 0.5%. The maximum long or cross section slope in turning heads shall be 6%. Appropriate drainage shall be provided with a double catch-pit required at the low point.

3.2.17. Road Lighting

3.2.17.1 General

The FNDC recognises that the correct level of road lighting is important for the safety and well-being of the community and this section provides the guidelines to achieve the following elements of good lighting design:

a. Enable safe and convenient movement of vehicles, pedestrian and cyclists,

b. Minimise glare, spill lighting and sky glow,

c. Reduce likelihood of criminal activity at night using National Guidelines for Crime Prevention through Environmental Design in New Zealand principles,

d. Reduce energy consumption, and

e. Reduce maintenance cost.

All materials, design and installation of Road and Public Space lighting shall comply with the requirements of the Northland Transportation Alliance Design Manual - Street Lighting Version 1.

3.2.18. Traffic Signs and Line Markings

Road design shall incorporate signage, road-marking and the provision of traffic control devices (such as flush or raised medians, pedestrian refuges) appropriate to the place and link context. Access roads shall be designed to minimise the need for traffic signs and marking. Signs include Stop and Give-Way, directional arrows on islands, warning signs, delineation devices (edge marker posts) etc. Road-marking includes marking of intersections, centrelines, parking areas etc.

Road marking and traffic signs shall comply with the Land Transport Rule: Traffic Control Devices 2004 and associated Waka Kotahi Traffic Control Devices Manual.

Urban and rural roads shall be marked in accordance with Table 3-10 and Table 3-11.

Table 3-10: Road Marking - Urban

Type	Criteria	Delineation Posts	Centre line	Edge Line	RRPM's	Intersection Control
Low Volume Access	0 – 200 ADT	X	X	X	X	✓
Access	200 –1,000 ADT	X	✓	X	X	✓
Primary Collector	1,001 – 3,000 ADT	X	✓	May Be required	May Be required	✓
Secondary Collector	3,001 – 5,000 ADT	X	✓	May Be required	May Be required	✓
Arterial	5,001-15,000 ADT	X	✓	✓	✓	✓
Regional	15,001-25,000 ADT	X	✓	✓	✓	✓
National	>25,001 ADT	X	✓	✓	✓	✓
Service Lane		X	May Be required	X	X	✓

Table 3-11: Road Marking – Rural (Sealed)

Type	Criteria	Delineation Posts	Centre line	Edge Line	RRPM's	Intersection Control
Low Volume Access	0 – 50 ADT	X	X	Inside Curves	X	✓
Access	51 – 200 ADT	X	✓	Inside Curves	X	✓

Type	Criteria	Delineation Posts	Centre line	Edge Line	RRPM's	Intersection Control
Primary Collector	201 – 1500 ADT	✓	✓	✓	May be required	✓
Secondary Collector	1000 – 3000 ADT	✓	✓	✓	✓	✓
Arterial	3000 – 10,000 ADT	✓	✓	✓	✓	✓
Regional	10,001 – 15,000 ADT	✓	✓	✓	✓	✓
National	>15,001 ADT	✓	✓	✓	✓	✓

All signs on public roads shall have VIP standard or equivalent sheeting in accordance with AS/NZS 1906.1:2017. All other signs shall have Class 2 sheeting. The sign sheetings shall be designed to adhere fully to the backing for at least 10 years.

Sign supports on traffic islands shall be a recoverable or breakaway type.

3.2.19. Speed Management

Speed management is about achieving safe and appropriate speeds that reflect road function, design, safety and use. We need people and goods to move efficiently around our transport network; however, aligned to the Safe System approach (See Austroads Safe System Assessment Framework (2016 – AP-R509-16)) , we also need to see a reduction in deaths and serious injuries. The Speed Management Framework (see Waka Kotahi Speed Management Guide) provides a single assessment method for determining safe and appropriate speeds by aligning travelling speeds with road function.

Effective speed management treatments are likely to be a result of a combination of measures which include engineering and infrastructure improvements and may include traffic calming through a combination of the following methods:

- Vertical features
- Horizontal features
- Traffic management and control
- Traffic signs and road markings
- Zonal treatments

In order to achieve the desired design speed environment, traffic calming devices may be required within the transport corridor. The Waka Kotahi Speed Management Guide, Austroads Guide to Traffic Management and the Waka Kotahi Traffic Control Devices Manual should be used to guide development of these devices.

Traffic calming measures shall be designed so not to create adverse stormwater impacts on the road and adjacent properties.

3.2.19.1 Targeted Safe & Appropriate Design Speed

Table 3-12 indicates the targeted design speed by roadway classification. The appropriate design speed should be determined prior to commencement of engineering measures to achieve that design speed.

Table 3-12 Targeted Design Speed

	Classification	Appropriate Design Speed
Urban	Low Volume Access, Access, Industrial	30km/h operating speed (safe and appropriate)
	School Zones (within 500 m of a school active frontage)	30km/h
	Primary & Secondary Collector	40km/h
	Arterial, Regional	50km/h
UTE & Future Urban (Semi-rural)	Low Volume Access, Access Primary & Secondary Collector	40km/h
	School Zones (within 500 m of a school active frontage)	30km/h
	Arterial, Regional	60km/h
Rural	Low Volume Access, Access	40km/h
	School Zones (within 500 m of a school active frontage)	60km/h or lower
	Primary & Secondary Collector	60km/h
	Arterial, Regional	80km/h

3.2.19.2 Device Selection

The Waka Kotahi Speed Management Guide, Volume 2: Toolbox identifies possible treatments based on speed and the One Network Road Classification. The selection of speed management treatments shall be discussed with FNDC at an early stage in the design. Safety audits (refer to Section 3.2.4 Safety Audit) and public consultation may be necessary depending on the proposed treatment. Ultimately the use of any speed management measure shall be subject to the specific approval of the FNDC.

3.2.19.3 Electronic Variable Speed Limits

The FNDC operates a network of electronic variable speed messaging signs which are used at schools to improve safety for school children at the start and end of a school day. These devices are Intelligent Transportation System (ITS) devices and because they operate a legally enforceable speed limit, they require Specific Design to ensure that the layout complies in all respects to be enforceable. It is very important that any works that impact an existing electronic variable speed limit sign is advised to FNDC at an early stage.

Developers need to be aware of the following:

- The developer is responsible for upgrading any existing variable speed limit sign impacted by their works
- Any upgrading or alterations must comply with the relevant provisions of the Waka Kotahi Traffic Note 37 Revision 2 (40 km/h variable speed limit in school zones) or Traffic Note 56 Revision 1 (Active school warning signs).
- Specific Design is required to demonstrate compliance

- Safety audits (refer to Section 3.2.4 Safety Audit) may be required to ensure no hazards are introduced as a result of the works.

3.2.20. Bridges, Culverts and Other Structures

The Developer shall obtain all necessary resource consents (including NRC) and/or building consents required for bridges, culverts, underpasses (pedestrian or stock) and retaining structures.

For any development where a bridge is proposed, the bridge concept plan shall be discussed and agreed with FNDC before detailed design commences.

All bridges, major culverts, underpasses and retaining structures shall be designed in accordance with the Waka Kotahi Bridge Manual (SP/M/022) and the design shall be carried out by SQEP.

Note: Culverts, including multiple culverts, with a total watercourse area greater than 3.4 m^2 are regarded as 'major culverts' under the Waka Kotahi Bridge Manual. Some culverts may be considered dams, for Further details refer to Section 4.3.13.1 General Requirements for Culverts.

Appendix D of the Waka Kotahi Bridge Manual (SP/M/022) shall not be used for bridges on public roads, except with the specific approval of the FNDC.

3.2.20.1 Bridge and Culvert Design

Particular features that shall be considered/covered in the design shall include, but are not limited to:

a. All bridges and culverts shall be designed with a width to accommodate movement lanes, cycle, and pedestrian needs of the road, in accordance with the road classification given in Table 3-2, Table 3-3 and Table 3-4.

b. The design of the structure shall provide for the installation and fixing of all suitable barriers to cater for the needs of pedestrians, cyclists and vehicles, including the interaction between the various modes.

c. All culverts shall have anti-scour structures to protect batter slopes, berms, and carriageways.

d. Where passing above traffic lanes, bridges shall have a full clearance height of 5.2 m to allow over-dimension vehicles to operate without a permit.

e. All bridges and culverts shall be founded to resist settlement or scour. Abutments shall be designed to ensure bank stability and provide erosion or scour protection as applicable.

f. The use of the structure as a service corridor shall be included in the design. This shall include consultation with utility providers to ascertain their current and future needs.

g. The design shall include provision of any necessary access facilities to and within the structure to undertake inspection and maintenance activities.

3.2.20.2 Bridge and Culvert Hydraulic Design

Hydraulic design shall be carried out by SQEP in accordance with Chapter 4: Stormwater and Drainage.

The bridge or culvert shall be designed to achieve:

a. No adverse impact on existing upstream water levels during a 20% AEP (adjusted for climate change) flood event,

b. Able to pass a 1% (adjusted for climate change) AEP flood without damage to the road and watercourse structures, and

c. Obstructions and risk of blockage of the flows are minimised.

In terms of traffic serviceability, the bridge or culvert shall also achieve:

d. On roads carrying > 3000 vpd, no interruption to traffic during a 1% (plus climate change) AEP flood event, or

e. For roads carrying between 250 and 3000 vpd, no interruption to traffic during a 2% (plus climate change) AEP flood event, or

f. For roads carrying < 250 vpd, no interruption to traffic during a 10% (plus climate change) AEP flood event.

3.2.20.3 Bridges on Private Accessways

For bridges on private accessways serving up to eight household units, the design requirements of Appendix D of the Waka Kotahi Bridge Manual (SP/M/022) set minimum requirements and may be used, subject to the following conditions:

a. The accessway will not become a through route,

b. The accessway has a speed limit to 70 km/hr,

c. Use by logging trucks or similar is unlikely, and

d. No significant overloads are expected to occur, or the bridge can be bypassed.

Note that Appendix D of the Waka Kotahi Bridge Manual (SP/M/022) allows the replacement of the HN design load with 0.85 HN. The HO load need not be considered.

The level of side protection shall be appropriate to the situation. The minimum acceptable shall be the provision of kerbs and marking posts where the height above the watercourse is no more than 1.0 m.

3.2.21. Footpaths and Pedestrian Accessways

Pedestrians and cyclists shall be provided for in accordance with Table 3-2 and Table 3-3.

3.2.21.1 Urban Footpaths and Accessible Crossings

Pedestrians shall be provided for in accordance with Table 3-2 and Table 3-3.

3.2.21.2 Urban Footpaths and Accessible Crossings

Footpaths shall follow the guidelines outlined in the Waka Kotahi Pedestrian Network Guidance and conform with the following:

a. Footpaths shall be set back a minimum 1.2 m from the kerb unless physical constraints dictate otherwise and/or located in a cul-de-sac. See **Sheet 29**.

b. The minimum width shall be 1.8 m (not including kerb width where adjacent to kerb) and noting that in areas with high concentrations of pedestrians such as shopping areas, community facilities, schools etc. and where angled parking is provided adjacent to the footpath, Specific Design shall apply in consultation with the FNDC.

c. Footpaths shall have the minimum clear width of 1.5 m between or around obstructions such as power poles, lighting columns, transformers and the like.

d. Crossfall shall typically be 2% sloping towards the kerb and channel. Localised crossfall in the range of 1-3% may be approved where levels make the typical crossfall impracticable.

Crossfall in high pedestrian use areas such as shopping centres shall be 1% wherever practicable.

e. Longitudinal gradient shall conform to that of the road and shall not exceed 12.5%.

f. New footpaths shall be constructed in concrete unless specifically approved otherwise by the FNDC.

Accessible (pram and wheelchair) crossings shall be provided at all kerbed intersections and pedestrian crossings. Catch-pits shall not be located within the accessible crossing. The crossing entrance shall be connected to the footpaths and have a maximum gradient of 8.3% and shall not create break over angles that are unsafe for, or not traversable by mobility devices.

Construction details for footpaths and pram crossings are described further in Section 3.3.7 Footpaths, Cycleways and Vehicle Crossings and shown on **Sheet 12** and **Sheet 17** respectively.

All new footpath crossings shall consider the Safe System approach (see Austroads Safe System Assessment Framework (2016 – AP-R509-16)) and be designed to shorten crossing distances, reduce conflicts between pedestrians and motorists, increase visibility and encourage safe speeds.

3.2.21.3 Rural Footpaths

Footpaths shall be provided and constructed in the rural environments where required by resource consent conditions. These may be located adjacent to lot boundaries, separated from the carriageway by a watertable. They shall be constructed to the same standard as urban footpaths.

Where not specifically required by resource consent conditions, the berm shall be formed and grassed so that it is suitable for pedestrian use.

In any rural environment the provision of safety footpaths may be required because of the scale or type of development, and/or hazards from traffic.

3.2.21.4 Pedestrian Accessways

Pedestrian accessways may be provided to link one urban road to another (especially no-exit roads) in order to improve connectivity and/or where they would offer a significantly shorter walking route from a road to a reserve or shopping centre etc.

Such accessways shall be designed for user safety and comply with the following:

a. They shall be created as either an easement in gross in favour of FNDC or a separate lot and should be visible from end to end and preferably no greater than 2 properties long,

b. The minimum formed width shall be 5.0 m if also acting as a cycleway and constructed to a standard not less than that for footpaths. The minimum legal width shall be 1.0 m wider than the formed width,

c. Provision shall be made for stormwater services,

d. Where barriers are provided to prevent vehicular access, provision shall be made for mobility scooter and wheelchair access, and

e. Lighting conforming to accepted National Guidelines for Crime Prevention through Environmental Design in New Zealand principles shall be provided and shall ensure that glare does not encroach into adjacent residential properties but still effectively illuminates the accessway.

3.2.22. Facilities for Vision Impaired Pedestrians

Facilities for visually-impaired pedestrians (i.e. TGSI - tactile pavers) shall be installed in accordance with the Waka Kotahi RTS14: Guidelines for Facilities for Blind and Vision Impaired Pedestrians at:

a. Crossing points at arterial or collector roads, including pedestrian throat islands, refuge islands and median islands,

b. Signalised intersections and signalized pedestrian crossings,

c. Zebra crossings,

d. Bus stops, and

e. Other areas of high pedestrian activity such as shared zones, pedestrian malls, shopping centres.

Further installation guidance can be found in Waka Kotahi Technical Advice Note for Tactile Installation TAN #20-20.

3.2.23. Cycle Facilities

Cyclists are generally expected to share the movement lanes on roads. Where a shared off-road cycleway/footpath or a dedicated cycleway is required or where good design requires separation from the carriageway, the facilities shall be designed in accordance with the Austroads Guide to Road Design - Part 6A: Paths for Walking and Cycling and the Waka Kotahi Cycling Network Guidance.

Off-road facilities designed for use by cyclists and shared with pedestrians shall have a minimum width of 3.0 m unless specified otherwise by resource consent conditions. Off road cycle ways and/or shared paths shall have a maximum gradient of 12.5%, a minimum lateral clearance of 700 mm and a minimum overhead clearance of 2.5 m from any fixed object (including trees) and shall be surfaced with either concrete or asphaltic concrete.

On road cycle lanes shall be surfaced with either chip seal or asphaltic concrete and marked to the Waka Kotahi's Traffic Control Devices Manual requirements.

3.2.24. Berms

3.2.24.1 General

Berms shall be provided between the edge of the formed carriageway and the road legal boundary to accommodate footpaths, road signs, road lighting, underground services, landscaping, and grass areas.

Berms shall be of adequate width to:

a. Achieve safe clearances between the carriageway edge and any obstacle (minimum 600 mm urban and 1500 mm rural),

b. Allow running of utility services and placing of street lighting poles within the berm,

c. Provide adequate space between the road reserve boundary and the carriageway edge to enable residents to safely enter the road traffic,

d. Allow for efficient road edge and edge drain maintenance,

e. Allow for accessibility and effective operation and maintenance of stormwater assets,

f. Allow for adequate growth of plants/trees and ease of their ongoing maintenance, and

g. Allow for use of a lawnmower for general maintenance - narrow grass strips less than 0.60 m wide shall be avoided.

3.2.24.2 Urban Berms

Berm crossfall shall typically be 4%, however localised grass berm cross falls may range between 2% and 10% but shall be easily maintainable. Engineering design shall demonstrate that a standard vehicle crossing can be installed as shown on **Sheet 26** and in accordance with **Sheet 23** (breakover angles).

The berm crossfall shall slope towards the road.

Stormwater runoff from berms shall not concentrate, cause ponding, flooding or a nuisance to adjacent properties or adversely affect footpaths and compromise a safe usage.

Berms shall have compacted base with layer of topsoil from 100 mm to 300 mm deep and grassed. See Section 3.3.8 Berms for construction details.

3.2.24.3 Rural Berms

Where practicable, rural berms should be constructed to the same standard as urban berms. Provision shall be made for footpaths in accordance with Section 3.2.12.2 Design.

3.2.25. Trees and Landscaping

Landscaping including structures and street trees shall not compromise sight lines, underground services, or the safety of road users, cyclists and pedestrians.

Trees shall not be planted within 10 m of power poles, vehicle crossings, bus stops and pedestrian crossings. Clearances from lighting columns shall be in accordance with Northland Transportation Alliance Design Manual - Street Lighting Version 1.

The mature size of any tree or garden planting shall be assessed for each planting location and shall be in scale with the surrounding street environment. Plants located in the sight triangle of intersections, or other traffic or vehicle/pedestrian conflict areas should not exceed 450 mm in height when mature. Street trees shall be suitably located and have formative pruning to ensure optimal traffic sightline visibility from when they are first planted through to maturity.

All proposed berm planting and landscaping structures shall be shown on the engineering drawings submitted for approval and the design shall be in accordance with Chapter 7: Public Spaces and Landscape Development Works of the ES. The approval of FNDC will be required for all such plantings and structures. The Developer is encouraged to discuss landscape concepts with FNDC to ensure the suitability of the proposal and consistency with the ES. It is preferable for this process to take place prior to applying for resource consent.

Street trees and other planting are assets for the purposes of as-built information.

3.2.26. Road Names and Signs

Names for new roads (including private roads and accessways serving more than five lots), will be determined by the District Council in accordance with their Policy # 2125 – Road Naming and Property Numbering. The Developer shall submit three names to the District Council for approval in order of preference well in advance of the vesting of the road (or the creation of the title or easement for private accessways).

Road name signs shall be in accordance with Table 3-13below and comply with the details in Sheet 24 and Sheet 25.

Table 3-13: Road Name Signage

Parameter	Urban and Rural Arterial Roads	All Other Public Roads	Private Roads and Accessways
Blade Size	200mm	150mm	150mm
Background Colour	Blue	Blue	White
Letter Colour	White	White	Blue
Letter Height	150m	100mm	100mm
Letter Type	Transport	Transport	Transport

'No exit' supplementary blades shall be erected on all cul-de-sac and dead-end road signage.

'Private access' supplementary blades shall be erected on all private road and accessway signage.

The District Council logo shall only be placed on public road signage.

All signage shall be erected at intersections.

3.2.27. Vehicle Entrances

3.2.27.1 General

Where a site has frontage to more than one road, the vehicle entrance shall be onto the road that has the lower class in the roading hierarchy.

The number of vehicle crossings per allotment shall not exceed those shown in Table 3-14.

Table 3-14: Maximum Number of Vehicle Crossings per Allotment

Frontage (m)	Low Volume Access	Access	Secondary Collector	Primary Collector	Arterial	Regional	National
0 - 16	1	1	1	1	1	Specific Approval	
17 - 60	2	2	1	1	1		
61 -100	3	3	2	1	1		
>100	3	3	3	2	1		

Notes:

1. *The frontage measurement will only apply to the road front approved for gaining entrance*
2. *Paddock entrances in rural Environments, with less than 10 vehicle movements per month, are exempt from the provisions of this Table*
3. *This Table does not apply to service stations where they comply with the Waka Kotahi's Guidelines for Service Stations.*

The minimum distance of a vehicle entrance from an intersection is shown in Table 3-15. Distances are measured along the centreline of the frontage road from the centreline of the vehicle entrance to the edge of the carriageway of the intersecting road.

Table 3-15: Minimum Distance of Vehicle Crossing from Intersections

Intersecting Road Classification (distance in metres)					
Frontage Road	**National**	**Regional**	**Arterial**	**Primary and Secondary Collector**	**Access and Low Volume Access**
Speed Limit up to 50 km/hr.					
National	Specific Design				
Regional					
Arterial	70	70	70	55	35
Primary and Secondary Collector	40	40	40	40	20
Access and Low Volume Access	25	25	25	25	10
Speed Limit over 50 km/hr.					
National	Specific Design				
Regional					
Arterial	180	180	180	180	90
Primary and Secondary Collector	75	75	75	60	60
Access and Low Volume Access	75	75	75	60	60

The angle of vehicle entrances should be 90^{o}, although a minimum angle of 70^{o} can be used when justified by other constraints (as approved by the District Council). Vehicle crossings may not be situated within the curve radius at intersections.

Where access points are not clearly identifiable at the development stage, crossings shall be constructed at the building consent stage.

Entrance crossings shall be designed and constructed in such a manner that will control stormwater runoff entering or exiting a property from the road, and prevent stormwater and detritus, including gravel, dirt and other materials, migrating in flow direction. Vehicle crossings shall be designed for use by a standard design vehicle without grounding and shall comply with the breakover and departure angles specified on **Sheet 23**.

All crossings shall demonstrate that vehicles exiting them are able to do so without crossing the road centreline and/or tracking outside the crossing flares. This is particularly applicable to commercial crossings.

Crossing locations shall comply with the minimum sight distance requirements of **Sheet 4**. Sight lines shall be contained within the road reserve.

Construction of a vehicle crossing over water meters, fire hydrants, valve boxes, cess pit grates, or other stormwater assets shall be avoided, unless approved by the FNDC.

Specific Design shall be provided for the crossing of swales and/or infiltration devices used for stormwater management. The design shall demonstrate that maintenance access is available to ensure the operation of the swale and/or infiltration device will not be compromised in any way. An acceptable design option is shown on **Sheet 16**. Consent notices may be required to be registered on affected property titles where such crossings are not constructed at the time of subdivision.

Vehicle entrances on State Highways shall comply with the requirements of the Waka Kotahi and obtain their prior approval.

Note: Maintenance of a vehicle crossing is the ongoing responsibility of the property owner(s) served by it.

3.2.27.2 Urban Vehicle Crossings

A vehicle crossing shall be provided at the development stage between the kerb line and the road boundary at the entrance to all private accessways and service lanes, and at any other place where the location of the future driveway to a lot can be determined with reasonable certainty (e.g. panhandle shaped lots, corner lots).

Vehicle crossings in urban areas shall be constructed in concrete with surface finish to match the surfacing of the adjacent footpath.

Private accessways and driveways sloping up from the road shall have a stormwater system installed at the boundary as detailed on **Sheet 18**.

Vehicle crossings for individual lots and private accessways shall comply with the details on **Sheets 18** and **Sheet 19**.

3.2.27.3 Commercial and Industrial Crossings

All lots in areas zoned for commercial or industrial activity and all developments in other zones for commercial or industrial activities shall have an industrial standard crossing. Dimensions and construction details are provided in **Sheets 19** and **Sheet 22**.

3.2.27.4 Rural Vehicle Crossings

A vehicle crossing shall be provided at the development stage at the entrance to all private accessways and at any other place where the location of the future driveway to a lot can be determined with reasonable certainty (e.g. panhandle lots).

On sealed roads, vehicle crossings shall be sealed to the road boundary or for a minimum distance of 10 m from the edge of the carriageway (whichever is the greater) and to a standard not less than that of the adjoining road surface. Asphaltic concrete or concrete may be used as alternative to chip seal. Where the access slopes up from a sealed road the crossing shall be sealed a minimum distance of 10 m from the edge of the carriageway and designed to ensure debris does not get flushed onto the road creating a danger to cyclists and motorcyclists (e.g. initial negative gradient away from the road).

If the access slopes away from the road, an area not less than 3 m long shall be provided from the edge of the carriageway at a gradient not exceeding 3%.

The crossing shall not obstruct any drainage facilities within the berm. Where the drain is shallow and only carries low rain flow, the crossing may pass through the drain. Where the drain is of an unsuitable shape or carries significant rain flow the drain shall be piped under the crossing. Pipes and end treatments shall be sized appropriately for the catchment intercepted but shall be a minimum 300 mm diameter. Traversable culvert safety ends complying with Waka Kotahi Specification M/23 shall be constructed to minimize safety risk and eliminate culvert end snagging hazards.

Rural crossings shall be designed to accommodate the largest vehicle that is likely to access the site.

Vehicle crossings for individual lots and private accessways shall comply with the following:

Type 1A	A basic entrance with flares but no local widening as shown on **Sheet 21**
Type 1B	Shall be used for dairy tanker entrances and the like as shown on **Sheet 21**
Type 2	A basic entrance with some local widening as shown on **Sheet 21**

Type 3	The same as the Waka Kotahi 's 'Diagram D' standard (as described and shown in Appendix 5B of the Waka Kotahi Planning Policy Manual) except that 3 of the 4 tapers shall be 1:20 rather than 1:10 – those tapers being both tapers on the opposite road from the crossing and the taper for a vehicle decelerating to turn left into the entrance
Type 4	A right turn bay and/or full left turn lane marked out in accordance with the Waka Kotahi Manual of Traffic Signs and Markings for the operating speeds of non-turning vehicles as they approach the entrance.

Criteria for the entrance crossing types are given in Figure 3-1 and Figure 3-2. Note that these Figures **do not** apply to rural intersections. They relate only to private rural entrances including private accessways.

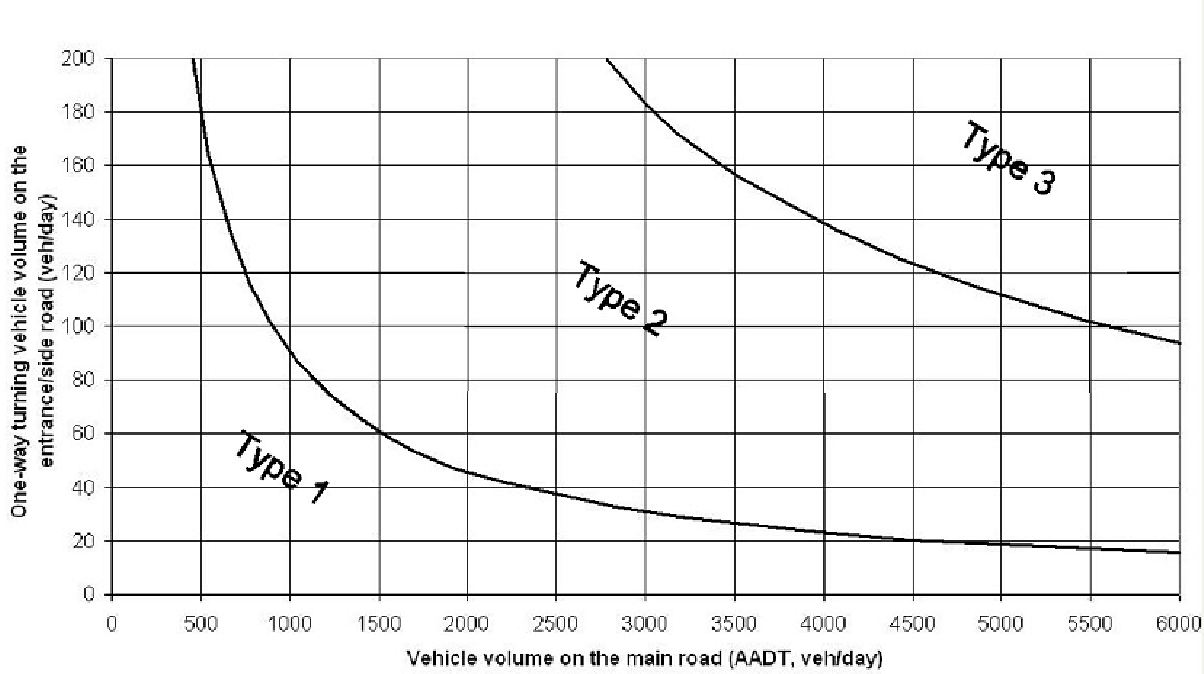


Figure 3-1: Criteria for Vehicle Entrance Types (Rural)

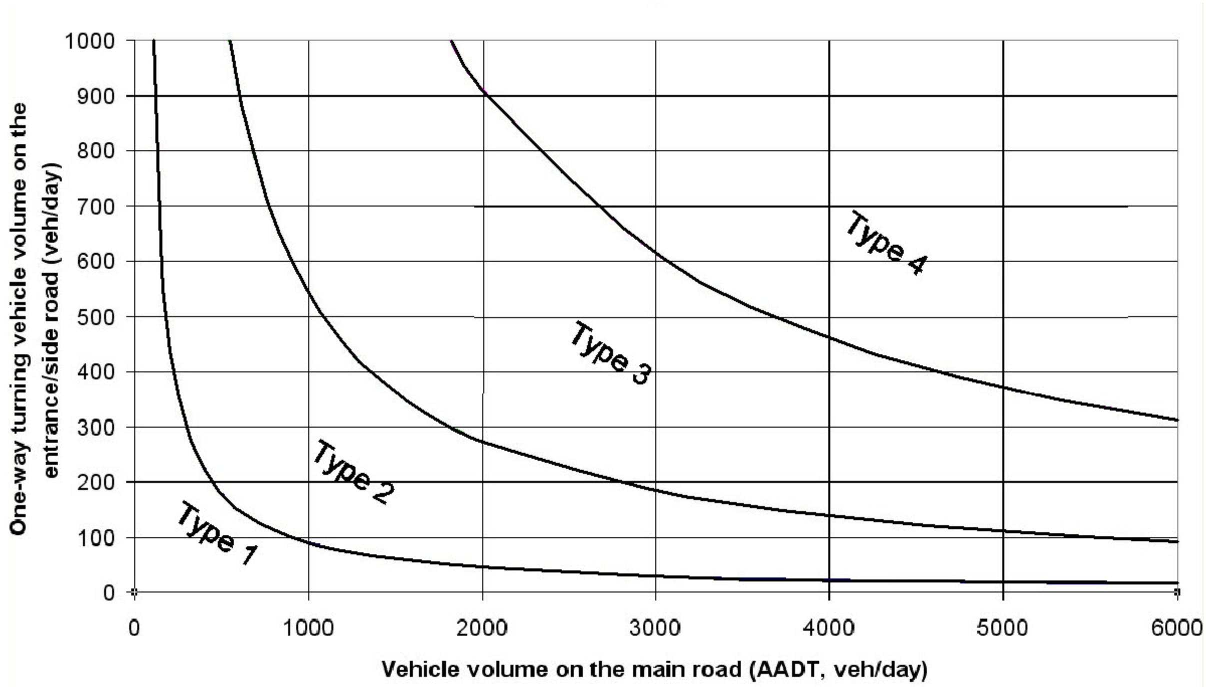


Figure 3-2: Criteria for Vehicle Entrance Types (Rural) - Extended

For Types 2 & 3 the criteria shall be applied separately to each direction of turn into the entrance crossing. It is acceptable for entrances to have different treatment types on each side of the main road provided the expected volumes of each turn have been assessed by a traffic engineering SQEP. With Types 2 & 3 treatments the left turn component applies to the widening on the same side of the main road and the right turn component applies to the widening on the opposite side of the main road.

3.2.28. Private Accessways

3.2.28.1 General

Vehicular accesses that serve eight or less lots or Household Units shall be private accessways, except where FNDC agrees that they become public road through resource consent conditions.

Unless approved otherwise through the resource consent conditions, private accessways serving more than eight lots or Household Units shall be formed to the requirements of the relevant road standard. minimum legal and carriageway widths shall conform to Table 3-16.

Table 3-16: Minimum Width Requirements – Private Accessways

Category	Criteria (Household Units)	Minimum Legal Width (m)	Minimum Carriageway Width (m)				Footpath Width (m)	Minimum Surfacing Requirement
			Unsealed Shoulder	Surfacing Width[17]	Total			
Urban								
A	2 - 4	4.0	-	1 x 3.0	3.0		-	Seal or Concrete
A(Alt)[1]	2 - 4	5.0	-	1 x 4.0	4.0		-	Seal or Concrete
B	5 - 8	6.0	-	1 x 4.5	4.5		1 x 0.95	Seal or Concrete
Rural								
C	2	4.0	2 x 0.25	1 x 3.0	3.5		-	Aggregate[18]
C(Alt) [16]	2	5.0	2 x 0.25	1 x 4.0	4.5		-	Aggregate[18]
D	3 - 5	6.0	2 x 0.25	1 x 4.0	4.5		-	Aggregate[18]
E	6 - 8	10.0	2 x 0.25	2 x 2.75	6.0		-	Seal

16. If a fire appliance has to use the private accessway, then the **alt** option will apply to the design of the private accessway. This decision will be made by the District Council after examining the available reticulation etc. (Refer to NZ Building Code C/AS1 Part 6: Fire Fighting – July 2014)
17. Private accessways in industrial/commercial developments shall be formed to service lane standards. See **Sheet 2**.
18. Refer to Section 3.2.27 Vehicle Entrances for instances where sealing is required for rural private accessways.

Where a private accessway serving more than eight household equivalents is gated, the gates shall be located far enough from the carriageway and provided with turning facilities to enable a standard design vehicle to enter the accessway and turn around, without passing the gates or affecting through traffic on the public road.

Where a public sewer pump station or fire hydrant is located within, or accessed via a private accessway, an adequate turning and parking area for service vehicles and fire appliances in the vicinity of the pump station or hydrant shall be provided and the access designed to take heavy vehicles. Refer to 5.2.10.4 Layout and Access and 6.2.9.2 Hydrant Locations for further details. The minimum carriageway width shall be 4.0m. See NZ Building Code C/AS1 Part 6.

Where a private accessway contains public water and/or sewer reticulation the legal width may shall be increased to accommodate the minimum clearances required by Sheet 30.

Easements in gross in favour of the District Council may be required to be created over accessways containing public utility services.

Provided the subgrade CBR (in-situ test) is not less than 7, the construction may be in accordance with **Sheet 7**, **Sheet 8**, **Sheet 9** and **Sheet 10**. Where the subgrade CBR is less than 7, the pavement shall be specifically designed by a SQEP.

3.2.28.2 Urban Private Accessways

The maximum gradient shall be:

a. 12.5% for the first 5 m from the road reserve boundary, and

b. 22.2% for the remainder.

The crossfall shall be 3%.

On accessways in excess of 100 m long and less than 4.5 m carriageway width, passing bays shall be provided at points of intervisibility (at approximate 50 m intervals). For such passing bays the carriageway width should be increased to 5.5 m over a 15 m length including 5 m tapers at each end.

Surface water from the accessway shall be collected in a catchpit and/or directed to a stormwater conveyance system with an approved outfall. Generally, kerb discharge or any discharge that may reach a road carriageway directly or indirectly will not be permitted. Where an accessway falls away from the road, stormwater control shall be provided to ensure that stormwater from the road via accessways does not concentrate onto a private property. See also Section 3.2.27 Vehicle Entrances. Stormwater attenuation and treatment shall comply with the requirements of Chapter 4: Stormwater and Drainage.

Private accessways shall comply with the construction requirements of Section 3.3.9 Private Accessways and the details on **Sheet 7** and **Sheet 8**.

3.2.28.3 Rural Private Accessways

The maximum gradient shall be:

a. 12.5% for the first 5 m from the road reserve boundary, and

b. 22.2% for the remainder.

The crossfall shall be 3% (sealed) or 6% (unsealed)

All accessways in the Rural Residential Rural Lifestyle and Rural Settlement shall be sealed. In other rural environments all accessways serving six household units or more shall be sealed and/or where the gradient exceeds 12.5%

On accessways more than 200 m long and less than 4.5 m carriageway width, passing bays shall be provided at points of intervisibility (at approximate 100 m intervals). For such passing bays the carriageway width should be increased to 5.5 m over a 15 m length including 5 m tapers at each end.

Where an unsealed accessway joins a sealed road, the accessway shall be sealed from the edge of the seal to at least the property boundary to prevent metal migrating onto the road. In addition, the provisions of Section 3.2.27 Vehicle Entrances shall apply for the crossings.

Surface water from the accessway shall not be permitted to concentrate onto any property which could be at risk of instability or erosion and shall comply with the requirements of Chapter 4: Stormwater and Drainage.

Similarly, surface water from the road reserve shall be prevented from flowing onto a private accessway in an uncontrolled manner.

On all side drains where the gradient is steeper than 6.7% scour protection such as concrete, rock riprap, check dams, a combination thereof or similar shall be provided. All outlets shall likewise be protected from scour and located to minimise the risk of slope instability.

Private accessways shall comply with the construction requirements of Section 3.3.9 Private Accessways and the details on **Sheet 9** and **Sheet 10**.

3.3. Construction

3.3.1. General

Road construction shall be carried out to the requirements and standards of the District Council approved drawings and specifications so as to achieve the intended design life. Where there is conflict between the approved documents and the ES, the ES shall take preference.

Road construction includes all associated construction within the Transport Corridor, together with private road and accessway construction, and applies equally to new works and to upgrading works.

3.3.2. Pavement Materials

These requirements apply to flexible pavements for public and private roads and for private accessways. For rigid pavements such as concrete refer to Austroads guides.

The design may utilise high strength materials (e.g. Waka Kotahi M/4 basecourse), or lower strength modified materials (e.g. lime or cement stabilised GAP 40 basecourse). The designer shall specify the material standards required by the design.

The Developer shall provide test data to confirm compliance with the specified material standards required for the design.

3.3.2.1 Granular Rock Fill Material (when used as a Subgrade Improvement Layer)

This material is a non-specific quarry aggregate suitable for use as a subgrade improvement layer. Lime rock is not acceptable as a granular fill.

This sub-base material shall have minimum soaked CBR of 20 and a nominal maximum size.

The material shall be suitably graded, moderate to highly weathered quarry rock with sufficient fines to aid compaction. A minimum of 10% by dry mass shall be unweathered (blue) material to ensure a level of durability.

The source of supply of all materials shall be nominated and the material shall be tested to ensure the CBR requirement can be achieved, and test results shall be provided. The material shall have the following properties:

a. A crushing resistance not less than 80 kN

b. Well graded with grading such that 100% of the material is less than 75mm maximum size with no more than 65% passing a 19.0mm sieve and 3% - 18% passing a 1.18mm sieve

c. A sand equivalent equal to or greater than a value of 20

Evidence of these properties will be required for approval by the District Council

3.3.2.2 Aggregate Pavement Layers

GAP aggregates shall comprise crushed aggregate and shall be free of all non-mineral matter. GAP 65 is a commonly used suitable sub-base material and lime stabilised GAP 40 a commonly used suitable basecourse material. Use of other complying materials is not precluded – e.g. Waka Kotahi M/4.

3.3.2.2.1. GAP Aggregates

GAP aggregates shall meet the material standards specified in Table 3-17 when tested in accordance with the specified test, and the grading limits defined in Table 3-18 when tested in accordance with NZS 4402:1986 Test 2.8.2 ‘Subsidiary Method by Dry Sieving’ or NZS 4402:1986 Test 2.8.1 ‘Standard Method by Wet Sieving’ where aggregates contain clay or other fine material causing aggregation of the particles and the shape control of Table 3-19.

Table 3-17: Materials Standards for GAP Aggregates

	Test	Standard
Crushing Resistance (kN)	NZS 4407:2015 Test 3.10	>110kN
Weathering Quality Index	NZS 4407:2015 Test 3.11	AA, AB, AC, BA, BB, CA or CB
Clay Index	NZS 4407:2015 Test 3.5	>3.5, <8.0
California Bearing Ratio	Compacted to NZS 4402:1988/1986 Test 4.1.3, Tested to NZS 4407:2015 Test 3.15	Not less than 40 %
Sand Equivalent	NZS 4407:2015 Test 3.6	Not less than 25 Not less than 40 when modified
Lime Reactivity (where applicable)	Tested by the Soaked CBR Test 3.15 of NZS 4407:2015 for 0% & 3% of lime (calcium oxide) by weight with NZ vibrating hammer compaction.	The soaked CBR of the 3% lime sample shall: Exceed the soaked CBR value of the 0% lime sample by more than 150% and Have a CBR value greater than 170%

Table 3-18: GAP Aggregate Grading Limits (Dry Sieving)

Test Sieve Aperture	Percentage Passing			
	TNZ M/4 (AP 40)	GAP 65	GAP 40	GAP 20
63.0 mm	-	100	-	-
37.5 mm	100	70-85	100	-
19.0 mm	66-81	46-68	63-81	100
9.5 mm	43-57	31-54	41-57	52-75
4.75 mm	28-43	20-41	26-43	31-55
2.36 mm	19-33	13-32	18-33	21-42
1.18 mm	12-25	9-23	11-25	13-31

Test Sieve Aperture	Percentage Passing			
	TNZ M/4 (AP 40)	GAP 65	GAP 40	GAP 20
600 micron	7-19	6-16	6-19	7-23
300 micron	3-14	3-12	3-14	5-16
150 micron	10 max	10 max	10 max	12 max
75 micron	7 max	6 max	7 max	8 max

Table 3-19: Aggregate Grading Shape Control

Fractions	Percentage of Material in Fraction			
	TNZ M/4 (AP 40)	GAP 65	GAP 40	PAP 20
37.5 – 9.5 mm	-	24-46	-	-
19.0 – 4.75 mm	28-48	15-37	27-49	-
9.5 – 2.36 mm	14-34	10-31	13-34	19-47
4.75 – 1.18 mm	7-27	7-25	7-28	8-35
2.36 mm – 600 micron	6-22	6-19	6-22	6-27
1.18 mm – 300 micron	5-19	5-16	5-19	3-21
600 – 150 micron	2-14	2-12	2-14	2-17

3.3.2.2.2. Equivalent Waka Kotahi M/4 AP40 Quality Basecourse Material

"Equivalent Waka Kotahi M/4 AP40 quality basecourse" must comply with all parts of the Waka Kotahi M/4 Specification except those requirements which are directly reduced by the allowance of the use of GAP 40 material as specified. These are as follows:

a. Crushing resistance can be as low as 120kN instead of 130kN;

b. Weathering quality index "CB" acceptable in addition to normal Waka Kotahi M/4 range;

c. Sand equivalent of GAP 40 aggregate prior to modification can be as low as 28 (modified must comply with Waka Kotahi M/4 requirement of 40);

d. Aggregate Grading Envelope & Shape Control prior to modification to comply with GAP 40 requirements specified in Table 3-18. The equivalent Waka Kotahi M/4 AP40 Quality Basecourse need not comply with Waka Kotahi M/4 grading requirements, however, after stabilisation the maximum particle size shall not be less than 26.5 mm.

Alternatively, material fully complying with the Waka Kotahi M/4 Specification may be used.

3.3.2.2.3. GAP 20 Running Course

The running course of an unsealed pavement shall consist of GAP 20 aggregate with the following properties:

a. A crushing resistance of 110kN to 230kN when tested in accordance with NZS 4407:2015 Test 3.10,

b. A clay index greater than 3.5 and less than 10.0 when tested in accordance with NZS 4407:2015 Test 3.5,

c. Meet the grading limits of Table 3-18.

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

3.3.3. Pavement Construction

3.3.3.1 Subgrade Layer

The subgrade may be fill or undisturbed material and shall be free of organic matter and other harmful material. It shall be constructed to meet the requirements of the pavement design and Waka Kotahi's Specification F/1 - Earthworks Construction. Wherever practicable, the natural in-situ material shall be used in construction of the subgrade by implementing compaction or other methods of modification to meet the required subgrade strength. Such methods of modification may include:

a. Lime or cement stabilization,

b. Use of geotextile fabrics and/or grids,

c. Drying and re-compaction of material,

d. Subgrade drainage improvements, or

e. A combination of the above.

Where the in-situ material is unsuitable to be used as subgrade, it shall be replaced by imported subgrade material fit for purpose and shall be subject to approval by FNDC before use – see Section 3.3.2.1 Granular Rock Fill Material (when used as a Subgrade Improvement Layer)

The subgrade material, whether in-situ or imported, shall be compacted to a depth of not less than 600 mm. It shall be placed in layers not exceeding 150 mm (compacted thickness) and as close as practicable to optimum moisture content. The material shall be compacted to the specified CBR value. Measurement of CBR value shall be by CBR in-situ tests or, in the case of non-cohesive material, by a suitable calibrated Scala Penetrometer test.

For cohesive soils, the Scala Penetrometer test may be used as a measure of uniformity. Irrespective of the CBR and Benkelman Beam results, the standard of compaction shall not be less than 95% of the optimum dry density of the material as specified in NZS 4402:1988/1986 Test 4.1.1 or Test 4.1.3.

Compaction shall cease if the material shows signs of excessive weaving or heaving and shall not recommence until the problem has been resolved.

The entire surface of the compacted subgrade shall be made smooth, firm and uniform, by blading, grading, and rolling, approximating the crossfall required on the final surface noting that:

f. The reduced level of any point shall be within the limits 0 mm above to 20 mm below the design level, as established by stringing.

g. The surface shall be finished so that all points are within 15 mm below a 3 m straight edge laid at any point on the surface.

See Section 3.3.4 Pavement Testing for testing requirements.

3.3.3.2 Recovered Material

Recovered material may be specified for use as the sub-base layer for the construction of a new pavement, subject to prior approval by the District Council.

Where recovered material shall be used and there is a shortfall, the recovered material shall be placed first, with the imported aggregate to make up the shortfall placed on top, subject to suitable depths of each being achievable for effective compaction.

Recovered road pavement for reuse shall have a grading curve within or close to (+/- 3% at any sieve size) the grading of the specified sub-base aggregate and meet the material standards of Table 3-17.

Recovered material with obvious clay intrusions shall not be used in the sub-base.

3.3.3.3 Sub-base Layer

The sub-base layer shall be spread, graded and compacted in accordance with Waka Kotahi Specification B/2 - Construction of Unbound Granular Pavement Layers to achieve a mean of 95% of maximum dry density and a minimum of 92% of MDD noting that:

a. No sub-base layer material shall be placed until the subgrade has been satisfactorily completed and approved by the FNDC,

b. The reduced level of any point on the surface of the sub-base layer shall be within the limits 10 mm above to 0 mm below the design level as established by stringing,

c. The surface shall be finished so that all points are within 15 mm below a 3 m straight edge laid at any point on the surface, and

d. Compaction of the sub-base shall be tested for acceptance as detailed in Section 3.3.4 Pavement Testing.

3.3.3.4 Basecourse Layer

The basecourse layer shall be spread, graded and compacted in accordance with Waka Kotahi Specification B/2 - Construction of Unbound Granular Pavement Layers to achieve a mean of 98% of maximum dry density and a minimum of 95% of MDD noting that:

a. No basecourse layer material shall be placed until all previous pavement layers have been satisfactorily completed and approved by the FNDC,

b. The reduced level of any point on the surface of the basecourse layer shall be within the limits 5 mm above to 5 mm below the designed or nominated level as established by stringing,

c. The surface shall be finished so that all points are within 10 mm below a 3 m straight edge laid at any point on the surface,

d. Compaction of the basecourse shall be tested for acceptance as detailed Section 3.3.4 Pavement Testing, and

e. The basecourse shall have a tight stone mosaic surface after sweeping and prior to sealing.

Cement or lime stabilized basecourse shall be placed and compacted in accordance with Waka Kotahi Specification B/5 – In situ Stabilisation of Modified Pavement Layers.

3.3.4. Pavement Testing

The pavement layers shall be tested with all test results to be provided to the District Council whose approval is required before construction of subsequent layers begins. Testing requirements are as follows:

3.3.4.1 Test Spacing

Compaction and material strength tests should be conducted at the locations and spacings shown in Table 3-20.

Table 3-20: Test Locations and Spacing

Carriageway Width	Location	Spacing
Less than or equal to 8.5m	at the kerbside wheel tracks	alternating sides, 10m between tests. (20m repetition of testing rows)
Greater than 8.5m	at centreline and kerbside wheel tracks	staggered across the road, 10m between tests. (30m repetition of testing rows)

The kerbside wheel tracks are assumed to be 0.5m from the edge of the channel or carriageway.

On small sites, there shall be a minimum of 10 tests carried out

3.3.4.2 Subgrade

Prior to sub-base construction, testing of the subgrade shall take place to confirm the design CBR (see Section 3.2.12.3 Subgrade Testing). If subgrade improvement measures have been carried out (such as replacement with pit sand, granular rock fill material or use of a stabilization agent), the materials shall be tested by scala penetrometer where a significant portion of the particles pass a 9.5mm sieve or by clegg hammer where granular rock is used.

The shape of the subgrade shall be measured by stringing.

3.3.4.3 Sub-base

The compaction of the sub-base shall be tested by nuclear densometer.

The thickness and shape shall be measured by stringing

3.3.4.4 Basecourse

The compaction of the basecourse shall be tested by nuclear densometer.

The thickness and shape shall be measured by stringing

Prior to sealing, clegg hammer and benkelman testing shall be carried out in the presence of a Council representative. (Note that benkelman beam testing is not mandatory on private accessways).

Such pavements shall not be sealed until all testing has been completed and test results submitted to and approved by the District Council. The pavement shall be sealed as soon as practicable after acceptance by the District Council, subject to suitable weather conditions.

Private roads and accessways may be sealed under instruction from the SQEP supervising the construction and will require a PS4 Construction Review to be provided to FNDC on completion.

3.3.4.5 Testing Methods and Parameters

For scala penetrometer testing, the CBR vs Penetration graph is shown on **Sheet 5**. The scala penetrometer should only be used when a significant portion of the particle size is less than 9.5mm.

Subgrade, sub-base and basecourse samples shall be tested by an IANZ accredited laboratory for their soaked CBR values.

Sub-base and basecourse compaction testing should be done using a calibrated nuclear densometer, measuring the compaction as a percentage of the maximum dry density of the material. Compliance values shall be as specified in Section 3.3.3.3 Sub-base Layer and Section 3.3.3.4 Basecourse Layer.

Clegg hammer testing shall be carried out on a surface that has no loose material, at testing intervals as specified in Table 3-20 and the minimum clegg impact value (CIV) shall be in accordance with Table 3-21.

Table 3-21: Minimum Clegg Impact Values

Accessway Type	Basecourse Clegg Values
For all roads to be sealed (public and private)	no value < 45
For all rural roads and vehicle crossings to remain unsealed (public and private, e.g. Dairy farms, forestry).	no value < 30
For private right of way relating to pavement formation from the road front boundary of a property inwards, requires a consistent pavement strength and compaction result (as per FNDC's ES).	no value < 45
For all commercial accessways to be sealed (*Shared ROW).*	no value < 45
For all private accessways to be sealed (*ROW & Joint Access Lot).*	no value < 45
For all private accessways to remain unsealed.	no value < 25
For all commercial vehicle crossings to be concreted & built as per ES.	no value < 30
For all residential vehicle crossings to be concreted & built with 665 Mesh.	no value < 15

Disclaimer: Roading Engineer / Inspector can make exceptions during winter months due to ground conditions, if all other inspection criteria is satisfactory

Benkelman beam deflections shall be carried out by an IANZ accredited organization and conform to the target deflections in Table 3-22.

No more than 10% of the test results shall exceed the 90th percentile and no single result shall exceed the maximum.

Readings shall be taken at the intervals specified in Table 3-20.

Table 3-22: Benkelman Beam Standards

Road Classification (Urban & Rural)	90th Percentile (mm)	Maximum (mm)
access roads	1.6	2.0
collector roads and commercial roads	1.4	1.8
arterial roads and all industrial roads and lanes	1.2	1.6

3.3.5. Pavement Surfacing

3.3.5.1 General

Acceptable surfacing options are as follows. For the mandatory use of asphaltic concrete refer to Section 3.2.13 Road Surfacing.

a. Hot laid asphaltic concrete laid over a waterproofing sealcoat

b. Chip seal

Other surfacing options include:

c. Concrete block pavers

d. Concrete

Limitations concerning their use are described in Section 3.3.5.6 Concrete Block Pavers, Section 3.3.5.7 Concrete and Section 3.3.5.8 Permeable Pavers.

If special sealing measures are required at an intersection, the special measures shall extend to a distance of 20m beyond the tangent points of the intersecting roads or accesses.

3.3.5.2 Asphaltic Concrete (AC)

Hot laid asphaltic concrete shall comply with and be constructed in accordance with Waka Kotahi M/10.

Prior to surfacing with AC a waterproofing sealcoat shall be laid. Where design traffic volumes in residential areas are less than 800 vpd a single coat grade 5 membrane seal shall be used with a residual bitumen application rate of 1.0 l/m^2. Where traffic volumes are higher and/or there are greater stresses, a waterproofing chip seal shall be applied to the prepared basecourse surface in accordance with Section 3.3.5.3 First Coat Chip Seal. The AC shall be placed no sooner than 14 days after the application of the waterproofing chip seal.

AC paving shall consist of the spraying of a tack coat with a quick breaking bituminous emulsion at an application rate of 0.3 l/m^2 and the spreading and rolling of the AC mix. The finished level shall be between 0 mm and 5 mm proud of the edge of the channel.

For urban access (including low volume) roads and no additional turning stresses, the default mix is Waka Kotahi M/10 DG10 with a minimum thickness of 30 mm.

For urban secondary collector roads, low stress intersections, cul-de-sac turning heads and public carparks, the default mix is Waka Kotahi M/10 AC20 with a minimum thickness of 35 mm.

For road classifications primary collector and above and for all commercial and industrial roads a specific mix design shall be submitted to and approved by the FNDC.

3.3.5.3 First Coat Chip Seal

A two coat chip seal shall be applied to the prepared basecourse surface but only when the ground temperature is not less than 10^{0}C.

The first layer shall consist of the spraying of 180/200 penetration grade bitumen. The bitumen shall be cut back to suit, include one part per hundred adhesion agent and be spread at a rate of 1.2 l/m^2 residual (measured at 15^{0}C).

The first layer chip shall comprise the spreading and rolling of a grade 3 chip at a spread rate of 75 m^2/m^3. It is essential that the spreading of the first chip layer is carefully controlled such that the chips are evenly spread and are no more than one layer thick over the entire surface.

The second layer shall consist of the spraying of 180/200 penetration grade bitumen. The bitumen shall be cut back to suit, include one part per hundred adhesion agent and be spread at a rate of 0.8 l/m^2 residual (measured at 15^{0}C).

The second layer chip shall comprise the spreading and rolling of a grade 5 chip at a spread rate of 150m^2/m^3.

For private accessways, the sealed surface may be a grade 4 chip with a grade 6 dry locking chip rolled in within 5 hours of the application of the grade 4 chip.

Seal binder, chip and adhesion agents shall be in accordance with Waka Kotahi Specifications M/1, M/6 and M/13 respectively and applied in accordance with Waka Kotahi P/3.

For both first and second coat chip seal, the bitumen application shall extend over the lip of the kerb and channel, but not by more than 25 mm. All catchpits, manhole lids, hydrant and valve boxes and the like shall be protected by paper prior to the spraying of bitumen.

Likewise, for both first and second coat chip seal where the new seal adjoins an existing sealed surface, the bitumen application shall extend 300 mm over the existing sealed surface.

3.3.5.4 Second Coat Chip Seal and Resealing

This treatment shall be applied on carriageways to produce a uniform texture on surfaces that have an existing seal coat.

Prior to resealing, all surface and pavement defects shall be repaired. The resealing shall not be applied until 28 days after asphalt patching or levelling of the surface has been completed, or any necessary basecourse repairs have been two coats sealed.

The second coat chip seal carried out between 12 and 18 months after the waterproofing first coat shall consist of the spraying of 180/200 penetration grade bitumen. The bitumen shall be cut back to suit, include one part per hundred adhesion agent and be spread at a rate of 1.3 l/m^2 residual (measured at 15^0C). The chip layer shall comprise the spreading and rolling of a grade 5 chip. If specified, a dry locking coat of grade 5 or 6 chip shall then be applied at a spread rate of 300 m^2/m^3.

3.3.5.5 Second Coat Seal Bond Removal of Surplus Chip

Sealed roads and private accessways shall be swept, and all surplus chip removed from grass berms, footpaths, channels and catch-pits prior to final acceptance by the FNDC.

3.3.5.6 Concrete Block Pavers

Design and material standards shall comply with NZS 3116:2002 and with the manufacturer's instructions. The pavers shall be readily available standard units and receive the prior approval of the FNDC. The design of the road shall be carried out by a suitably qualified person. Edges of the paved areas shall be adequately confined by concrete nibs.

Bedding course shall be in accordance with NZS 3116:2002.

When used in roads the basecourse surface shall be given a waterproof sealcoat in accordance with Section 3.3.5.2 Asphaltic Concrete (AC) before the bedding course and pavers are laid.

Pavers shall be laid to 5 mm above the edges of channels.

3.3.5.7 Concrete

Concrete shall be sourced from a special grade plant as defined in NZS 3109:1997.

The minimum concrete strength at 28 days shall be not less than:

a. 30 MPa for private ways, service lanes, parking bays, vehicle crossings, mountable kerb & channel and dished channels

b. 20 MPa for footpaths and standard kerb & channel

3.3.5.8 Permeable Pavers

Permeable pavers will not be approved as a running surface for public roads. For any other application within the transport corridor refer to Section 3.2.13.4 Permeable Paving.

3.3.5.9 Surface Tolerances and Finishing

The finished surface of all roads and accessways shall have no abrupt or abnormal deviations, and no areas shall pond water.

The surface shall be of uniform texture and satisfy density standards appropriate to the surfacing.

3.3.6. Kerb & Channel

Kerb and channel shall be placed on a well compacted layer (CBR > 15) of basecourse metal, the surface of which shall be smooth and uniform.

Kerb and channel may be either cast-in-situ or extruded and conform to the profiles of **Sheet 13**. The extrusion machine shall be operated to produce a well compacted mass of concrete which will maintain its shape without support after extrusion, and be free from surface pitting and trapped air. A mortar layer nominally 6 mm in thickness should be applied in conjunction with the laying of the kerb and channel and the top and face of the kerb and the channel surface floated over with a steel tool before the mortar has finally set.

Concrete used shall be ready mixed concrete from a certified plant and shall be not less than 20 MPa 28-day strength for standard kerb and channel and 30 MPa for mountable kerb and channel.

Contraction/expansion joints shall be formed at a maximum spacing of 3.0 m to a minimum depth of 40 mm. All cold joints shall be likewise sawcut. Should cracking occur adjacent to a saw cut, a minimum 1.5 m section of kerb and channel shall be removed and recast.

Channels shall not pond water (minimum gradient 1:200) and flow shall be maintained past all vehicle and accessible (pram) crossings.

Kerb blocks with cast-in-situ channels shall be the subject of Specific Design and the prior approval of the FNDC.

3.3.7. Footpaths, Cycleways and Vehicle Crossings

This section outlines the work required to construct, reinstate or repair footpaths, off road shared cycle paths and vehicle crossings.

3.3.7.1 Subgrade Preparation

The exposed subgrade shall be tested by using a Scala Penetrometer for compliance with a CBR value of not less than 10.

If the material fails this test then:

a. The existing subgrade shall be further compacted, to improve the CBR value, or

b. The unsuitable material shall be excavated, removed from site, replaced with suitable material, compacted up to subgrade level and re-tested.

The subgrade area, either existing or modified, shall be trimmed, shaped and compacted to provide uniform support for the basecourse.

3.3.7.2 Basecourse Layer

The basecourse layer shall be constructed of bedding sand and/or GAP metal depending on the surfacing and shall form a compacted pavement depth conforming to the relevant drawing Sheets.

For asphaltic concrete footpaths and cycle paths, the final basecourse surface shall have a tight stone mosaic surface, with no loose aggregate, suitable for the application of a tack coat and an asphalt layer.

3.3.7.3 Concrete Surfacing

Formwork shall comply with the requirements of NZS 3109:1997.

Concrete used shall be ready mixed concrete from a certified plant and shall be not less than 20 MPa 28 day strength for footpaths and cycle paths and 30 MPa for vehicle crossings. The concrete shall be placed so that the coarse aggregate does not separate from the fines, and it shall be thoroughly worked and consolidated into all parts of the formwork, so that no voids or cavities are left.

Strict attention shall be paid to adequate curing. Immediately after placement, concrete shall be protected from premature drying, excessively high or low temperatures and mechanical damage and shall be maintained with minimal moisture loss for the necessary curing period and hardening of the concrete. In hot dry weather this will involve the use of sprinklers. In cold or wet weather, concrete shall be protected from the elements during the curing period by covering with sheets of PVC or alternative approved material.

Footpaths and cycle paths shall be a minimum of 100 mm thickness and formed over not less than 50 mm compacted depth of fine granular material and shall be laid with construction joints at not more than 3.0 m intervals. See **Sheet 12**.

All final path and vehicle crossing surfaces shall be true to the lines and levels specified and 'broom' finished. Surfacing shall comply with D1/AS1 Table 2 of the NZ Building Code for acceptable wet slip resistance for sloping walking surfaces. The final surface shall not vary by more than 5 mm when checked with a 3 m straight edge. No finished surface shall hold water.

The use of coloured concrete exposed aggregate or patterned surfaces will require the specific approval of the FNDC.

3.3.7.4 Asphaltic Concrete Surfacing

AC footpaths and cycle paths shall be subject to the specific approval of the FNDC.

Footpaths, cycle paths and vehicle crossings shall be laid to the compacted basecourse and AC depths shown on the relevant drawing Sheets.

They shall be edged with either concrete, kerb blocks, brick pavers or timber edging. See **Sheet 12**.

The prepared basecourse surface shall be swept to remove all loose metal and debris prior to the application of a tack coat. The tack coat shall be applied to all surfaces where the asphalt material will be placed and at an application rate of 0.25 litres/m². The final surface shall be flush with the top of the edging and graded uniformly between. Depressions or irregularities that may cause water to pond will not be accepted in the finished surface.

All asphaltic concrete shall be laid in accordance with Waka Kotahi M/10, except that plant appropriate to the size of the area being surfaced shall be used.

3.3.7.5 Concrete Paver Surfacing

Concrete paver footpaths shall be subject to the specific approval of the FNDC.

They shall be laid to 5mm above the tops of channels and shall be edged with concrete.

3.3.8. Berms

On completion of all other works, the berms shall be prepared and spread with good quality topsoil to a lightly compacted depth of not less than 100 mm and not more than 300 mm. The topsoil shall be free of weeds, stones and other foreign matter and graded to kerb top and footpath edges, and shall be finished 15 mm high to allow for settlement except on the low side of the footpath where the topsoil shall be finished flush to prevent water ponding.

Berms will typically be grassed but may be landscaped if it is impracticable to maintain as grass. Any landscape planting design and implementation shall be in accordance with Chapter 7:Public Spaces and Landscape Development Works.

The berms shall be sown with a grass seed mixture the generic characteristics of which are such that the grass cover is low growing, with a robust and deep rooting system well suited to the soil conditions. An 80% grass strike shall be achieved within one month of sowing and the grassed areas shall be maintained free of excessive weed growth and shall be kept mown throughout the maintenance period and immediately before being taken over by the FNDC.

All poles, signposts, light standards, marker posts, electricity transformers, cast iron boxes, etc. set in grass berms shall be finished off with a concrete mowing strip 150 mm wide and 75 mm thick surrounding the base, flush with the finished ground level.

No grassed berms less than 300 mm in width shall be approved. Where mowing strips are required within 300 mm of hard stand areas (footpaths etc.) the gap shall be concreted and not grassed.

3.3.9. Private Accessways

Refer to Section 3.2.28 Private Accessways for the design requirements for private accessways, Section 3.3.5 Pavement Surfacing for surfacing requirements, and to **Sheet 7**, **Sheet 8**, **Sheet 9** and **Sheet 10** for construction details.

The subgrade CBR shall be tested for both the concrete and sealed options of **Sheet 7**, **Sheet 8**, **Sheet 9** and **Sheet 10** clegg testing carried out in accordance with Section 3.3.4.5 Testing Methods and Parameters.

The associated vehicle crossings shall comply with the requirements of Section 3.2.27 Vehicle Entrances and Section 3.3.7 Footpaths, Cycleways and Vehicle Crossings.

3.3.10. Reinstatement and Contractor Damage

Superfluous vehicle entrance crossings and the like along the road frontage of any development shall be removed and the ground reinstated to match existing features. Likewise any damage caused to any feature or service within the Transport Corridor as a consequence of the contractor's/Developer's actions shall be repaired at the contractor's/Developer's expense.

A photographic record of the existing road frontage should be taken before works commence to establish the existing condition of all such features. Refer to Section 1.6.5.8 Protection and Remediation of Existing Trees, Services, and Roads.

3.4. Completion of Works

3.4.1. General

Following completion of the work, a producer statement (construction) on PS4 Construction Review (or similar and approved), along with all testing, measuring etc. shall be supplied to FNDC for approval.

3.4.2. As-Built Information and RAMM Data

Refer to Chapter 1, Section 1.7.2 As-Built Plans, Asset Information Schedules, Operation and Maintenance Manuals for requirements.

3.4.3. Second Coat Seal Bond

The second coat chip seal required as a consequence of Section 3.3.5.4 Second Coat Chip Seal and Resealing shall require a bond in terms of Section 1.7.3.2 Bonds. The bond shall be released upon satisfactory completion of the works as determined by the FNDC.

Chapter 4: Stormwater and Drainage

4.1. Introduction

This section sets out requirements for the design and construction of stormwater systems for land development and subdivision. The ES provides high design standards to designers, with an understanding of the key design considerations, to support performance standards.

Stormwater systems and associated networks, convey flows, which frequently contain pollutants and nutrients. Additionally, they tend to increase the flow rate and the volume of water to receiving environments, such as watercourses (natural and modified), rivers, lakes, sea, and groundwater features. This can result in increased rates of erosion, land instability, habitat disturbance and degradation of habitat quality.

Managing the actual or potential effects, on receiving environments, must consider the hydro-ecology (ecological and hydrological processes) and include environmental, cultural, and social values, in the design of treatment (management) systems (e.g., wetlands) to mitigate these effects.

4.1.1. Stormwater System Description

A stormwater system's key objective is to protect people, their activities, properties, and environmental values. A stormwater system consists of:

a. A primary network designed to accommodate a specified design rainfall event appropriate for MPD approved by the District Plan,

b. A secondary network to service catchments for stormwater runoff that exceeds capacity of the primary network, including when there are blockages in the primary network, and

c. Processes and procedures used in Asset Management practices, flood modelling and risk management.

4.1.2. Objectives

The primary objective of the stormwater Chapter is to enable design and management of the stormwater system that will minimise flood damage and adverse effects on built and natural environments, people, property, and ecological systems.

This can be achieved by avoiding or mitigating the adverse quality and quantity effects of stormwater resulting from development and growth of human activities. As appropriate reference is made to best practice design and, management guidance, contained in existing reference guidance documents.

The stormwater system enables stormwater services to land. Regardless of whether the stormwater services are private or public, interaction between both shall be managed efficiently throughout collection, transport, treatment, attenuation, and discharge stages.

Design and operational objectives include, without limitations, the following:

a. Meeting FNDC Standards

b. Design for resilience

c. Compliance with environmental and Network Discharge Consent requirements

d. Safety in Design

e. Minimising flood hazards to people and properties

f. Minimising adverse environmental impacts

g. Minimising health and safety risk(s) for public and maintenance workers

h. Ensuring Māori freshwater values are identified and provided for

i. Minimising operational, maintenance and asset decommissioning risk(s)

j. Extended service life of stormwater assets with application of whole-of-life cycle cost

k. Practising and encouraging an integrated stormwater management approach

l. Delivering a public stormwater network that is fit for purpose and economical to operate and maintain

m. Maintain or improve water quality

n. Financial, environmental and community outcomes are achieved

o. Low impact design solutions, water sensitive systems and best practice design guidance should be used to meet these objectives.

4.1.3. Performance Standards

The design of the stormwater system shall achieve the objectives and provide for a stormwater system that is fit for purpose, given site constraints and takes into design guidance.

In brownfield developments FNDC may require a proposed development to connect into an existing public stormwater system if available, including where:

a. There is a public stormwater system with sufficient spare capacity available for connection: and,

b. The FNDC considers it is reasonable or practicable to require connection, or that it is a logical extension to the network required to provide connection: or,

c. The FNDC considers that there is a benefit, in terms of achieving the stormwater objectives of the engineering standards, or there is an environmental benefit to requiring connection.

New stormwater systems planned shall achieve the following minimum standards:

d. The stormwater system shall operate by gravity. Pumped public systems are not generally acceptable unless specific approval is obtained from FNDC Stormwater Manager before proceeding with design details (see Section 4.3.8.2 Primary System Design Requirements).

e. The primary stormwater system shall be capable of conveying 10% AEP design storm events without surcharge (see Section 4.3.9 Hydrological Design Criteria).

f. The secondary stormwater system shall be capable of conveying the 1% AEP storm event within a defined path and without causing undue risk or damage to persons or property.

g. The stormwater system shall not connect or be able to overflow to the wastewater network.

h. Development shall not increase peak discharge rates to receiving environment. An increase may be acceptable for large events where it is demonstrated that there are no adverse effects (including potential, future, or cumulative effects), on the environment or downstream properties as a result of the increase.

i. The stormwater system shall provide the required amount of treatment through the use of low impact design and sustainable solutions (See Sections 4.3.20 Soakage Devices and 4.3.21 Stormwater Treatment and Detention Devices

Where the existing stormwater network is affected by the development, the upgrades shall not increase risks to people or property flood hazards and no additional private properties shall be affected (i.e. new flood risks shall not extend onto previously unaffected property or increase flood risks to properties).

The design parameters and specific requirements for the performance standards listed above may differ by land use type, proposed solution (in the case of treatment and detention) and the catchment. Reference should be made to Section 4.1.5 Reference Documents and the following document hierarchy shall be applied:

j. The District Plan,

k. Relevant FNDC Flood modelling,

l. These standards, then

m. Auckland Council GD01 (the adopted design guideline for stormwater treatment and low impact design), and

n. Wellington Council WSD for Stormwater: Treatment Device Guideline.

Note: Any relevant national and or regional policies/plans take precedence over documents listed in this hierarchy.

4.1.4. Alteration to Existing Infrastructure

The connection of a new development, to the existing FNDC stormwater system, shall not negatively affect conveyance and operation of the network. All alterations of the existing stormwater network shall be paid for by the Developer unless otherwise agreed by FNDC.

4.1.5. Reference Documents

The following documents are referenced in this Chapter:

Note it is the responsibility of the ES user to ensure the most up to date referenced document is sourced.

4.1.5.1 Statutory

Building Act 2004

Local Government Acts 2002 and 1974

National Policy Statement for Freshwater Management 2020

New Zealand Building Code

NRC Regional Plans

Operative District Plan

Resource Management Act 1991

4.1.5.2 New Zealand Standards

AS 3996:2019 - Access covers and grates

AS/NZS 1254:2010 - PVC-U pipes and fittings for stormwater and surface water applications

AS/NZS 1260:2017 - PVC-U pipes and fittings for drain, waste and vent applications

AS/NZS 2566.2:2002 - Buried flexible pipelines - Installation

AS/NZS 3725:2007 - Design for installation of buried concrete pipes

AS/NZS 4058:2007 - Precast concrete pipes (pressure and non-pressure)

AS/NZS 5065:2005 -Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications

ISO 13953:2001 – Polyethylene (PE) pipes and fittings - Determination of the tensile strength and failure mode of test pieces from a butt-fused joint

NZS 3114:1987 - Specification for concrete surface finishes

NZS 4402:1988/1986 - Methods of testing soils for civil engineering purposes

4.1.5.3 District Council Documents

Approved Materials List - Wastewater and Stormwater (*To be provided by FNDC on request*)

Wastewater Drainage Bylaw 2018

FNDC Flood modelling

Quality Assurance / Quality Control Manual for Vested Assets - Inspection and Handover Procedures (2022)

4.1.5.4 Regional Council Documents

Regional Policy Statement for Northland May 2016

Report - Coastal Flood Hazard Assessment for Northland Region 2019-2020

4.1.5.5 Other Referenced Documents

Auckland Council TR2013/018: Hydraulic Energy Management: Inlet and Outlet Design for Treatment Devices (2013)

Auckland Council GD01 – Stormwater Management Devices in the Auckland Region (2017)

Auckland Council GD04 – Water Sensitive Design for Stormwater (2015)

Auckland Council GD007 – Stormwater Soakage and Groundwater Recharge in the Auckland Region (2021)

Auckland Regional Council TP108: Guidelines for Stormwater Runoff Modelling in the Auckland Region

Ministry for the Environment's National Guidelines for Crime Prevention Through Environmental Design in New Zealand (2005)

New Zealand Dam Safety Guidelines, 2015

New Zealand Fish Passage Guidelines (April 2018)

NIWA High Intensity Rainfall System

Waka Kotahi F2:2013 - Pipe subsoil drain construction

The Regional Infrastructure Technical Specification (RITS) 2018 (Waikato)

USDA Soil Conservation Service TR-55: Urban Hydrology for Small Watersheds

Water New Zealand; New Zealand Gravity Pipe Inspection Manual Fourth Edition, 2019

Wellington Council WSD for Stormwater: Treatment Device Guideline

4.1.6. Managing Effects of Land Use on Receiving Environments

Impervious surfaces and piped stormwater systems associated with development have an effect on catchment hydrology. Faster runoff, reduction in base flows and accelerated channel erosion and depositions alter the hydrology and adversely affect the quality of receiving environments. Flow and contaminant increases can have implications for the biodiversity of the aquatic biological community and post development maintenance requirements on systems such as piped networks, stormwater treatment devices, streams and channels.

To mitigate these effects developments are to achieve a hydrological regime where any impacts are managed and/or minimised.

Hydrological balance can be partly maintained by limiting the maximum rate of discharge and peak flood levels for post-development to that at pre-development levels and enabling infiltration to minimise impacts on base flow and ground water recharge.

Peak flow management can be achieved using detention storage, utilising extended duration, for the duration of a limited peak flow event. Therefore, in the absence of more detailed assessment of stream stability, the discharges from detention devices into a stormwater network shall be constrained to 80% of pre-development peak flow rate. These constraints may be relaxed, subject to detailed assessments and hydrological/hydraulic modelling of the catchment being provided.

4.1.7. Policy Requirements

The stormwater system for a development, including any upgrading of existing downstream systems where required, shall provide:

a. Formalised conveyance systems and/or storage or an alternative low impact system, including upgrades of the existing system servicing urban areas. This may include a catchment wide intervention where necessary to enable growth.

b. Retention and enhancement of existing natural and modified watercourses through open space areas, including parks and reserves.

c. Allowance for climate change effect (s).

For all land development works (including any changes in land use or coverage) the design of the stormwater system shall include the evaluation of stormwater runoff changes on upstream and downstream properties.

d. Upstream flood levels shall not be increased by any downstream development.

e. Downstream impacts from a development to be investigated shall include changes in flow peaks and patterns, flood water levels, contamination levels and erosion or silting effects, and effects on the capacity of the existing stormwater drainage system.

f. Where such impacts are considered detrimental by the FNDC, mitigation measures (e.g. peak flow attenuation, velocity control, contamination reduction approach) on or around the development site, or the upgrading of downstream stormwater systems may be required at the Developer's expense. The downstream effects need not be considered in detail if suitable mitigation measures, as identified in the ES, are implemented in the design of the development.

The piping of existing watercourses or open drains is not generally acceptable unless under specific circumstances. FNDC will consider, a risk to public safety as a driver, in any such proposal, but on a case-by-case basis and approve or otherwise, at its own discretion. See Specific Design.

4.1.8. Stormwater Management Hierarchy

Disposal of stormwater from developed land, must be considered to ensure that development and land- use change does not cause or contribute to adverse impacts upstream and downstream, such as increased flooding, erosion, habitat disturbance, or damage to infrastructure e.g., roads, channels and pipe bridges.

These potential impacts can be flow related (i.e. flooding or scour) and/or water quality related (e.g. suspended solids). Any proposed disposal system must therefore respond to downstream conditions, be this natural receiving environments or existing engineered infrastructure.

When selecting stormwater management solutions, the following hierarchy of key principles shall be adopted:

a. Retention for reuse,

b. Recharge base flow and ground water - Soakage techniques (subject to geotechnical conditions) see Section 4.3.3 Infiltration and Stability and Section 4.3.20 Soakage Devices),

Treatment, detention and controlled release to a piped stormwater system or watercourse.

Stormwater shall be managed as close to the point of origin as practicable, resulting in optimised collection and conveyance infrastructure.

4.2. Receiving Environment Requirements

4.2.1. Discharge into a Stream or Watercourse

All new and existing discharges to an existing FNDC owned and / or maintained watercourse(s) located within approximately 500 metres require specific approval from the Stormwater Manager before proceeding with design details and, if approved, FNDC shall apply appropriate conditions to the discharge.

Any stormwater discharge into a watercourse shall be controlled in a manner which does not create adverse environmental effects. In areas where reuse and soakage are not sufficient, and a watercourse is accessible, then the following requirements shall be met:

a. Suitable detention and treatment devices shall be designed, constructed, and maintained, and shall meet requirements of applicable Stormwater Catchment Management Plan . The Developer shall be responsible for installation, operations, and maintenance of the stormwater assets to provide best practice stormwater treatment efficiency at all times, until the public assets are vested in the FNDC.

b. In the absence of an approved CMP the Developer shall contact FNDC to discuss a site-specific Stormwater Management Plan (SMP) and requirements.

c. A suitable outlet and energy dissipating structure shall be constructed to mitigate risks of erosion. the watercourse protection structures shall be designed in accordance with **Sheet 35**, or an alternative specifically designed structure. Tail water conditions shall be taken into account in the design of discharges to watercourses.

d. The direction of the discharge shall be aligned with the natural downstream flow as far as practicable, to prevent erosion. In situations where there is risk of erosion to the banks, appropriate mitigation measures may be required.

e. No structure or items that would cause any obstructions can be placed in a watercourse, unless prior approval by Northland Regional Council.

f. Individual properties which border onto a watercourse shall discharge their stormwater in a dispersed manner, via an appropriate flow dispersal device (Section 4.2.5 Discharge to Land), to avoid and manage erosion.

Overland flow paths shall be maintained and provided, where necessary, in accordance with Section 4.3.8.3 Secondary System Design Requirements – Overland Flow to cater for events exceeding the capacity of the primary system and where there is a risk the primary drainage system could fail.

4.2.2. Discharge into the Public Stormwater Network

The Developer shall provide suitable stormwater detention and treatment prior to discharge into Council's stormwater network, unless otherwise directed by Council.

Prior to design approval, the Developer shall consult with Council to ascertain any capacity constraints in the existing downstream network:

- Where Council is unable to confirm downstream capacity, the Developer will be required to assess downstream network capacity and propose a discharge rate to Council for approval.
- Where known network capacity issues exist, Council may require discharge rates from the proposed development to be lower than would otherwise be required by the Engineering Standards.
- Detention and treatment systems shall comply with the requirements of this Engineering Standard, unless otherwise approved by Council.

Over land flow path shall be assessed, maintained and provided, as necessary, in accordance with Section 4.3.8.3 Secondary System Design Requirements – Overland Flow to cater for events exceeding the capacity of the primary system and occasions when the primary drainage system is blocked.

Outlet design and tail water level conditions shall be taken into account in the design of discharges to stormwater systems.

Where stormwater discharges to tidal waters, the design shall assume a tide level of Mean High Water Spring (MHWS) plus a storm surge of 0.35m (0.15m barometric adjustment and 0.2m of surge).

4.2.3. Discharge to a District Council Owned Reserve

This section applies to public stormwater infrastructure within recreation reserves or open spaces (Reserves).

For private stormwater infrastructure within FNDC owned Reserves refer to Chapter 7:Public Spaces and Landscape Development Works.

The Developer shall consult with FNDC as to the applicability of this section to other FNDC owned Reserves that may be affected by their proposed development.

In situations where a property borders onto a FNDC owned reserve and the flow of stormwater is in the direction of the reserve, it may be appropriate to discharge stormwater to the reserve provided that this does not adversely affect the amenity value or function of the reserve in any way or create any stability or flooding liability issues for the FNDC.

Stormwater discharge to a FNDC public network will require the Parks and Recreation Manager's approval.

Any proposed stormwater connection into a public reserve land shall be designed to public network standards and vested to FnDC.

For a new connection into a private stormwater network, including watercourse, pipe, pond or wetland, located within a Reserve and where such network is also operated by the Reserves Asset Team a specific approval from the Parks and Recreation Manager is required and considerations will be given as follows:

a. The design and construction shall be in accordance with an approved CMP. In the absence of an approved CMP the Developer shall contact FNDC to discuss a site-specific SMP and what measures are required.

b. A site-specific SMP shall be submitted for approval by FNDC.

c. A consultation on the SMP with other relevant landholders/affected parties may be required, subject to the District Plan and RMA.

d. Stormwater from all impervious areas on the development shall be mitigated on site to ensure that total runoff volumes and peak flow rates up to the 1% AEP event achieve the objectives (Section 4.1.2- Objectives) and performance standards (Section 4.1.3 Performance Standards).

e. The stormwater shall be discharged in a dispersed manner within the Reserve via an appropriate vegetated flow dispersal device (Section 4.2.5 Discharge to Land). If suitable vegetation does not already exist, this shall be planted according to a planting plan to be approved by the FNDC.

f. The receiving reserve area shall be well vegetated or grassed, not susceptible to erosion and have no geotechnical constraints. Where requested by FNDC, a report by a suitably qualified Geo-Professional shall be provided to support any application to discharge stormwater to a reserve area.

g. Alternatively, the stormwater discharge may be piped to an appropriate outfall point within the reserve subject to approval from FNDC.

h. The stormwater discharge shall not compromise any existing or planned structures or parks assets and shall not impede access or reduce the amenity value of the reserve.

i. An Overland flow to the reserve shall not create or exacerbate existing flooding or erosion problems.

j. Suitable detention and treatment devices shall be proposed, constructed and maintained in accordance with an~~y~~ approved CMP/SMP. The ownership of proposed stormwater devices shall be determined at the CMP/SMP stage to enable a planned vesting of the public assets.

k. The installed stormwater devices shall be operated and maintained by the Developer in the best practicable manner until the public assets are vested in the FNDC.

l. All NRC requirements and any District Plan requirements or resource consent conditions for the discharge of stormwater to land and water shall also be met.

m. Easements shall be provided over parts of private land, as necessary, for rights to drain and access to the assets for maintenance.

4.2.4. Discharge to the Road Kerb

Stormwater discharge from a private property to a road kerb outlet is an acceptable solution, only where alternatives are not available.

The use of kerbed roads for secondary (overland) flows is acceptable. All sites shall minimise discharges of stormwater flows onto roads.

4.2.5. Discharge to Land

Subject to the requirements of the NRC Regional Plans, discharge of stormwater from the development onto land is permitted provided that:

a. Flooding levels shall not be increased due to the development,

b. New Outlets to any low-lying areas shall be provided or existing outlets retained,

c. Dispersal of concentrated flow from the development shall be designed to occur at the shortest practicable distance and before a concentrated overland discharge to a neighbouring property occurs, and

d. An acceptable rate of dispersed discharge from stormwater runoff at the boundary is < 2 litres/sec/m (e.g. flow can be managed via dispersal swale or trench).

Note: For example, for a 12 litre/second discharge from attenuation or peak runoff shall provide a 6 m linear length of dispersal swale.

4.2.6. Discharge to the Marine Environment

Any new outfall or physical changes to existing outfalls in the Coastal Marine Areas may require a Resource Consent from the Northland Regional Council.

The following requirements shall be satisfied when discharge of stormwater is proposed onto a beach or a FNDC owned coastal reserve:

a. Regional Council resource consent shall be obtained (where required):

b. Compliance with the CMP or site-specific SMP for the catchment (if any):

c. Compliance with the NRC Regional Plans, and

In addition

d. The foreshore yard of private property shall form well vegetated buffer areas,

e. Where landowners have retaining or erosion control walls on the coastal edge, the landward side of the wall shall be used for wide dispersal of stormwater,

f. Where discharge through an outfall is the only alternative, the outfall shall be specifically designed to minimise beach erosion and adverse effects on beach amenities subject to specific approval of the FNDC, and

g. Where stormwater discharges to tidal waters, the design shall assume a tide level of Mean High Water Spring (MHWS) plus a storm surge of 0.35m (0.15m barometric adjustment and 0.2m of surge).

4.3. Design

4.3.1. Capacity and Future System Expansion

Primary and secondary stormwater networks within a development site shall provide capacity for safe conveyance of flows from the whole of the upstream catchment, including area outside of the development site, routed via the site. The Development shall extend the network (where appropriate) to a location at the upstream boundary of the development site.

As a minimum, stormwater systems shall convey both primary and secondary design flows from the upstream catchment(s) for mitigated Maximum Probable Development (MPD), for the design storms required by Section 4.3.9 Hydrological Design Criteria. In addition, FNDC may require the Developer to take account of unmitigated MPD flows from the potential development of the upstream catchment.

FNDC will work together with Developers and provide information on the capacity of the downstream stormwater network, where available. The Developer shall review and interpret available information in the context of the proposed development. If the stormwater network has inadequate capacity, FNDC will specify what approach would be acceptable (e.g. upgrading existing stormwater network, attenuation, detention, diversion or installation of a new SW network, as may be necessary).

In the event that FNDC is unable to provide current information on the capacity of the downstream stormwater network, then the Developer shall investigate, analyse, or carry out work necessary to provide relevant information and propose a solution to the issues found, if any. FNDC will review the Developer’s analysis and advise the preferred approach.

All information including Data files and informative reports resulting from the above shall be provided to FNDC for their review and records.

4.3.2. Increases to Impervious Surface

Where any development increases impervious surface, the development shall be assessed in accordance with Section 4.1.2 Objectives and Section 4.1.3 Performance Standards to determine the requirements, if any, for water quality and quantity controls.

Design of new development or alteration to existing development, resulting in increased impervious surface shall also comply with the NRC.

4.3.3. Infiltration and Stability

Soakage device design must be supported by a suitable geotechnical investigation and report confirming that those soils are suitable for soakage and land stability hazards are acceptable.

Soakage devices shall not be used in areas subject to moderate or high stability hazards.

Attenuation systems proposed within areas designated as moderate or high stability hazards shall protect against infiltration, e.g. by utilising sealed tanks or chambers.

Attenuation and/or treatment systems shall not be located within low stability hazard land adjacent to an area of moderate or high stability hazard without a specific engineering assessment of the impact of such a provision on the stability of the moderate/high hazard land.

Note: Stability hazard classifications may be shown on relevant Land Hazard Maps, or may have been classified as such by a site-specific Geotechnical Investigation.

4.3.4. Pre-Consent Applications

4.3.4.1 Catchment Management Plans

Where a CMP applies to the proposed development, the development proposal shall confirm which conditions are considered to apply to the development and demonstrate how these will be met.

The Developer shall account for catchment wide issues at the Land Use, Subdivision Resource Consent and EDA stages, including the potential implications of future development upstream, and the cumulative effects of land development on water quality, flooding downstream and erosion. The development proposal shall show how these potential effects will be addressed.

Developments within catchments with operative, consented CMPs that comply with the requirements of these plans, will not require separate resource consents for stormwater diversion and discharge from NRC.

Where an operative consented CMP is not in place, or the proposal is not consistent with an operative consented CMP, then:

a. The Developer shall prepare a site-specific SMP and agree with FNDC on the approach and obtain all necessary resource consents from NRC for the proposed site-specific SMP.

b. Where a NRC consent is required and where the developer's intention is to vest stormwater infrastructure assets or land to FNDC, or such proposal would impact FNDC stormwater network in any way, then the NRC application shall be in the name of FNDC and signed off by the Stormwater Manager.

c. The Developer shall consult with FNDC to understand requirements regarding stormwater management (e.g. flood hazard, treatment and disposal), prior to submitting the NRC consent application.

d. FNDC's Stormwater Manager shall review and accept NRC Resource Consent conditions before the consent being granted.

FNDC will advise whether the area of a development is covered by a CMP/CDP, and conditions associated with it. FNDC may require a site-specific SMP for a development site greater than 0.5 hectares and apply conditions/discharge constraints in addition to those imposed by NRC to safeguard elements of FNDC controlled downstream networks.

4.3.5. Post-Consent Engineering Design Approval

4.3.5.1 Content of Design Submission

In addition to the general requirements of Section 1.5.3 Detailed Design/Approval, the information submitted for EDA for stormwater works shall provide (as applicable) the following:

a. That the design is consistent with the general requirements for the whole of the catchment,

b. That stormwater quality and quantity requirements are adequately addressed,

c. That the proposed stormwater infrastructure is fit for purpose and provides the required level of service, including demonstration that non-surcharge and freeboard requirements have been met,

d. OLFP including 1% AEP flood level, flow path extent and easement requirements clearly shown on drawings, including floor level restrictions, if any,

e. Minimum floor levels and flood hazard (depth, velocity) for residences and escape routes within 1% AEP flood inundation areas on the site are available and shown on the drawings,

f. Scour protection designed for the range of events 1% AEP, 2% AEP, 20% AEP and 50% AEP and associated flows and velocities at outlets, watercourses and along OLFP's,

g. That the proposed stormwater system satisfies the objectives (Section 4.1.2 Objectives) and performance standards (Section 4.1.3 Performance Standards) in all other respects.

The EDA application shall also demonstrate that all effects onto the stormwater networks and/or other utility services, and neighbouring properties arising from the proposed works have been adequality mitigated, including:

h. Flow peaks (where approved) and frequency patterns,

i. Flood water levels, flood plain storage volumes,

j. Water quality,

k. Scouring and Erosion of both primary and secondary stormwater system, and

l. Overland flow paths.

Subject to the ground conditions and complexity of the proposed works a geotechnical report addressing ground stability will be required (e.g. pipe installations in weak soils for all pipes, in any soil type for pipes over 600 mm dia, all ponds, wetlands, inlets and outlets).

Operation and maintenance manuals for any water quantity and/or quality control structures shall be provided in a final form for approval before the asset being vested.

Any departures from the ES shall be noted and fully justified. Such assessment shall be carried out by a SQEP who is working within their competencies in accordance with the requirements of Section 1.5.1.3 Risk Based Assessment Framework. The SQEP shall identify the design standards used and certify that the design complies with the referenced standards.

The SQEP shall certify that the works through all stages until completion are in accordance with the requirements of Section 1.5.1.3 Risk Based Assessment Framework.

4.3.6. Design Life

All stormwater infrastructure assets to be vested to FNDC shall have a design life expectancy of at least 100 years.

Where components of the stormwater system, such as stormwater detention and treatment devices, require earlier renovation or replacement, it shall be considered as an Alternative Design (see Section 1.5.1.3 Risk Based Assessment Framework) and assessed as a departure from the ES, requiring specific approval by the Stormwater Manager. The proposed stormwater works shall document the asset renewal requirements for each component in the Operations and Maintenance Requirements, which shall be provided with EDA.

4.3.7. Approved Materials

Materials and products used for public stormwater infrastructure must comply with the relevant NZ standards and be from the FNDC Approved Materials List - Wastewater and Stormwater.

The use of material not listed in the FNDC Approved Materials List - Wastewater and Stormwater shall be considered an Alternative Design, refer to Section 1.5.1.2 Alternative Designs.

The FNDC Approved Materials List - Wastewater and Stormwater will be updated from time to time at the discretion of the FNDC.

4.3.8. System Design

4.3.8.1 General

The network design shall be in accordance with Table 4-1 below unless the approved CMP or site-specific SMP (see Section 4.3.4.1 Catchment Management Plans) allows different inputs.

Table 4-1: Minimum Design Summary

Criteria	Design Parameter	When required
Design calculations	Modified Rational method or TR-55 for catchment areas up to 8 ha (Rainfall intensity can be determined as a function of time of concentration Tc). For catchments greater than 8 ha refer to Section 4.3.9.2.1 Catchments Larger Than 8ha	Always.
Runoff coefficients	Pre-development runoff coefficients shall be based on expected imperviousness for the existing Land Use. Post-development runoff coefficients shall be based on allowable imperviousness based on the MPD by the District Plan. Refer to Table 4-3	Always.
Design Rainfall	Refer to Design Rainfall (Section 4.3.9.4 Design Rainfall and Section 4.3.9.5 Design Storm).	Current rainfall (i.e. not climate change adjusted) shall be used for the following: • Sizing temporary works where climate change is not relevant. • Determining pre-development stormwater runoff flows and volumes for use in combination with calculated post development flows to determine stormwater treatment (quantity and quality) requirements Climate change adjusted rainfall shall be used for the following: • Determining post-development stormwater runoff flows and volumes for stormwater infrastructure design.
Time of concentration	Calculated in accordance with Section 4.3.9.4 Design Rainfall.	Always.

Criteria	Design Parameter	When required
Flood Control (1% AEP event)	Detention required, limiting the post-development 1% AEP event flow rates to 80% of the pre-development 1% AEP event flow rates.	Where downstream flooding hazard has been identified. Where there is no CMP or site-specific SMP. 1. Refer to Flood Hazard Areas in the District Plan and any known downstream restrictions causing flooding.
Flow attenuation (Attenuation of the 50% and 20% AEP events)	Limit the post-development 50% and 20% AEP event flow rates to 80% of the pre-development flows through controlled attenuation and release.	Where there is no CMP or site-specific SMP. Catchment location dependent. Typically, always required in the upper catchment and sometimes not required where development site is located in proximity to the catchment outlet, discharging to a watercourse with sufficient network capacity, and where flow attenuation may worsen flooding hazards due to relative timing of peak flows. This is subject to assessment demonstrating no negative impacts would occur. If the proposed stormwater discharge is into a tidal zone, then no attenuation is required.
Volume	Limit pre-development volume runoff through reduced runoff by best practice and sub catchment management, where practicable (e.g. allowing infiltration and ground water recharge, enabling water reuse and diverting into wastewater system). If this cannot be achieved, mitigation within the receiving environment will be required, such as channel stabilisation.	When discharging directly into a natural stream or modified channel.

Criteria	Design Parameter	When required
Stormwater quality treatment	Stormwater management hierarchy (Section 4.1.8 Stormwater Management Hierarchy) • Provide treatment of the water quality flow or volume. • Managing at source where possible. • Designing for correct storm size. • Use a suite of water sensitive design devices, including pre-treatment where practical. • Design parameters shall be based on a selected device's effectiveness to remove pollutants and in accordance with GD01.	Always
Water quality Rainfall (WQS)	90th percentile of a 24-hour storm event (approx. 25 mm).	Always. Refer to Auckland Council GD01 for details
Water Quality Volume	Based on 90th percentile of a 24-hour storm event (approx. 25 mm).	When discharging directly into a natural stream or manmade channel.
Primary and Secondary Network Level of Service Requirements	As per Table 4-2 Secondary overflow as per Section 4.1.8 Stormwater Management Hierarchy).	Always. The primary system shall be designed to ensure gravity flow with capacity to accommodate the peak flows, without surcharge. The secondary system shall be designed for safe conveyance of 1% AEP.
Minimum Floor Levels	Freeboard requirements (Section 4.3.10.7 Freeboard Requirements)	Always.

Criteria	Design Parameter	When required
Whole-of-life	Shall demonstrate that the proposed system provides the most cost-effective whole-of-life outcome for FNDC. (e.g. providing an operation and maintenance manual)	Always.

The following shall be considered and where appropriate included in the design:

a. Quality and quantity requirements of any discharge,

b. How the roading stormwater design is integrated into the overall stormwater system,

c. The type and class of material proposed to be used,

d. System layouts and alignments including route selection, topographical and environmental aspects, easements, clearances from underground services and structures, provision for future extensions, location of secondary network and overland flow paths,

e. Hydraulic adequacy Section 4.3.10 Hydraulic Design, and

f. Where applicable, location of service connections.

The following documents provide general guidance in the design of pipes, culverts, detention and treatment devices and open channel hydraulics:

g. The NZ Building Code compliance document Clause E1 – Surface water (NZBC Clause E1).

h. Auckland Council GD01Stormwater Water Management Devices Design Guidelines Manual.

i. Wellington Council WSD for Stormwater: Treatment Device Guideline.

j. The Regional Infrastructure Technical Specification (RITS) 2018 (Waikato)

k. Auckland Council GD04

Note: NZBC Clause E1 provides guidance on runoff coefficients, which are not acceptable for the design of public infrastructure under the ES.

4.3.8.2 Primary System Design Requirements

A primary stormwater network within a development site shall be capable of serving the upstream catchment (Section 4.3.1 Capacity and Future System Expansion) and shall also mitigate impacts from the development on downstream, and adjoining properties, if any. The primary system design shall consider conditions of any approved CMP or site-specific SMP including:

a. The runoff characteristics of upstream areas shall be based on the development that is compatible with the MPD (under the District Plan) of the land at the time of engineering design.

b. The stormwater network shall be capable of serving the whole of the development site. Where the proposed primary network is to be connected to the public network, it shall, as a minimum, cater for the impervious surfaces constructed at the site, and/or within each new lot.

c. Each lot shall have a single stormwater connection, unless approved otherwise by the Stormwater Manager.

d. To cater for a Concentrated stormwater runoff from upstream and through the site, to protect downstream properties and people from nuisance and hazardous flooding.

e. the stormwater system shall be extended in accordance with Section 4.3.1 Capacity and Future System Expansion to the upstream boundary of the development site.

f. The preferred means of stormwater management shall be to adopt stormwater control measures that retain the pre-development catchment regime for ground recharge and runoff.

g. Where soakage, evapotranspiration and/or reuse cannot fully mitigate an increase in stormwater from a development, detention shall be provided to restrict the peak runoff from the site.

h. For the purposes of determining the increase in flow between pre and post- development reference shall be made to Table 4-1 and Section 4.3.9 Hydrological Design Criteria.

Proposed stormwater ponds or wetlands are generally an acceptable treatment approach, provided that:

i. The ponds or wetlands comply with the requirements of the NRC Regional Plans,

j. The ponds or wetlands, including associated lands shall be contained within its own land title(s) and it can be vested to FNDC for drainage purposes at no costs to FNDC, or can be retained in private ownership, subject to a specific approval by the Stormwater Manager.

k. The ponds or wetlands shall not be included in local purpose/Drainage reserves without specific prior approval from the Parks and Recreation Manager, and

l. The ponds or wetlands shall be designed in accordance with Auckland Council GD01, or an alternative design can be submitted to FNDC for consideration.

(Refer to Section 4.3.21.8 Constructed Ponds and Wetlands for additional requirements for constructed ponds and wetlands).

Note: Stormwater shall not be directly connected to ANY wastewater system.

4.3.8.2.2. Stormwater Pumping

FNDC considers that pumping of stormwater is rarely a practicable option because of the size of pumps and facility required, also power demand and continuity of supply issues.

The public stormwater pumping option is not generally acceptable. FNDC may consider a private stormwater pump to service a development.

Applications for pumping stormwater shall demonstrate, that all practicable alternatives have been investigated, and provide sufficient risk assessment and mitigation for pump malfunction and power outages.

4.3.8.2.3. Availability/Capacity of the Existing District Council Stormwater Reticulation

Where a development will result in an increase in stormwater flow, Developers shall investigate the availability of capacity in the existing stormwater system so the proposed additional flows can be managed. FNDC may require additional capacity to be provided in the existing or proposed system, if either system is critical for the long-term planning of growth. Additional capacity in the proposed system (if required) shall be at the Developer’s cost (see also Section 4.3.8.4 District Council Design Input).

4.3.8.3 Secondary System Design Requirements – Overland Flow

A Secondary stormwater network comprising of OLFP and watercourses may be under either public ownership or control.

The secondary network conveys excess runoff not catered for by the primary network.

The development proposal shall include a full analysis of OLFP. Engineering design shall include plans, long sections and cross sections showing water levels for a 1% AEP storm.

Where the secondary network is in private property, consideration to either vest the subject land to FNDC or provide an easement or otherwise record any limitations or public interests on the title shall be at the FNDC's discretion.

Consideration shall be given at the design stage to ensure that flow paths and watercourses shall be used as a basis for the design of the secondary network flow path and that restrictions, such as new diversions into adjacent properties and sharp turns, are not acceptable.

The design of secondary network shall include a ground stability and erosion assessment. Mitigation may include reduced flow velocities and/or reinforcing channel banks with suitable material. Ponding of the runoff on roads shall not cause hazards to traffic and/ or public, and the carriage ways shall be passable.

Where a secondary network is not available, the primary network shall be designed to provide an adequate conveyance to mitigate flood hazards. The design shall include an analysis of the effects of blockages of pipes and culverts. This is particularly important with smaller culvert sizes, or where there are grates on culvert inlets, and/or the culvert is in a location where it is likely to receive silt, vegetation or rubbish.

4.3.8.4 District Council Design Input

Notwithstanding the outcome of Specific Design, FNDC may require additional stormwater requirements including:

a. the diameters and classes of pipes to be used for all reticulation within the development,

connection points and reticulation alignment.

limit discharge rates and volumes from the development to the lesser of the existing runoff from the site at its pre-development levels, or any calculated limits, based on the capacity of the immediate downstream network.

4.3.9. Hydrological Design Criteria

4.3.9.1 System Design Event Probability (Recurrence Interval)

All new stormwater systems shall be designed for post-development flows based on climate change adjusted design storm for the Event Probabilities / Recurrence Intervals set out in Table 4-2 below unless specific approval has been obtained from the FNDC.

Table 4-2: Design Rainfall Event

1 **For primary design flows (all environments)**	**% AEP**	**ARI (years)**
a. Piped network no surcharge	50	1:2
b. Piped network allowing discharge within 0.3m of the lid level	20	1:5
2 **For secondary systems (all environments)**		
c. Overland flowpaths, watercoarse	1	1:100
3 **For flood protection (all environments)**		
d. All areas	1	1:100

The Climate Change allowance shall be an addition of 20% to NIWA rainfall intensity data for the design event.

Note: The current rainfall pattern (not adjusted for climate change) shall be used to determine detention requirements for brownfield developments where existing infrastructure may be considered, an 'existing use rights' and also for temporary works where climate change rainfall is not relevant.

4.3.9.2 Stormwater Flow Estimate

Rainfall runoff curves are used to describe rainfall losses. The curves used in TP108 and methods developed by the US National Resource Conservation Service, previously known as Soil Conservation Service (SCS). Curve numbers (CN) were determined based on the hydrological soil group, cover type, soil treatment, hydrological condition and antecedent ground condition.

Values from the summary sheets in USDA Soil Conservation Service TR-55 and TP108 have been adopted for typical Northland soils encountered in the Far North District. Table 4-3 below sets out the typical values to be applied. For more detailed information refer to the original tables in USDA Soil Conservation Service TR-55 or Table 2-2 of TP108.

Runoff Coefficients (C) represents the proportion of rainfall resulting in physical runoff for calculation of flow. The values given in E1 of the NZ Building Code are considered low for Northland conditions during significant rainfall events. The FNDC has adopted figures developed from the formula C= CN/ (200-CN) from TP108. These values are listed side by side in Table 4-3 below.

The (Rational Method) runoff coefficients in Table 4-3 are for peak flow rate and may be modified for slope as discussed in NZ Building Code Clause E1.

The variability of soils within the Far North District and wider Northland, are borne out by changes in runoff characteristics in addition to that caused by vegetation cover. The four hydrologic soil groups are:

D Very low permeability such as clay (e.g. Northland Allochthon/Onerahi Chaos)

C Low permeability such as loam (e.g. Maunu and Glenbervie volcanics)

B Medium permeability, coastal wind-blown sands (e.g. Ruakaka and Waipu coastal sands)

A High permeability such as fractured rock and deeply bedded scoria deposits.

Soil type A is not usually encountered at surface levels and typically is only used for discharge to ground solutions by deep infiltration. Soil type A should not be used for the calculation of surface runoff.

Table 4-3: Curve Numbers and C Values for Typical Far North District Conditions (CN - C)

Land Use	% impervious	Type B soils	Type C soils	Type D soils
Open space (lawns, parks etc.)				
Fair condition (grass cover 50-75%)		69 - 0.53	79 - 0.65	84 - 0.72
Good condition (grass cover >75%)		61 - 0.44	74 - 0.59	80 - 0.67
Impervious areas				
Paved parking lots, roofs, driveways, curbs, channels etc. (excluding right-of-way)		98 - 0.96	98 - 0.96	98 - 0.96
Roads and streets				
Paved: open ditches (incl right-of-way)		89 - 0.80	92 - 0.85	93 - 0.87
Unsealed/Gravel (incl right-of-way, accessway & parking areas)		85 - 0.74	89 - 0.80	91 - 0.83
Urban development				
Commercial and business	85	92 - 0.85	94 - 0.89	95 - 0.90
Industrial	72	88 - 0.79	91 - 0.83	93 - 0.87

Land Use	% impervious	Type B soils	Type C soils	Type D soils
Landscaped	0	70	75	80
Residential by average lot size				
500m² or less	65	85 - 0.74	90 - 0.82	92 - 0.85
1000m²	40	75 - 0.60	83 - 0.71	87 - 0.77
2000m²	25	70 - 0.54	80 - 0.67	85 - 0.74
4000m²	20	68 - 0.52	79 - 0.65	84 - 0.72
10,000m² (1 ha)	10	65 - 0.48	77 - 0.63	82 - 0.69
Rural development				
Pasture, grassland (m²)		61 - 0.44	74 - 0.59	80 - 0.67
Grass and bush		48 - 0.32	65 - 0.48	73 - 0.57
Trees and grass combination (orchards)		58 - 0.41	72 - 0.56	79 - 0.65
Forest		55 - 0.38	70 - 0.54	77 - 0.63

4.3.9.2.1. Catchments Larger Than 8ha

For larger catchments (greater than 8 ha), or where significant attenuation elements are incorporated, surface water runoff should be determined using an acceptable hydrological or hydraulic modelling technique or software.

a list of acceptable hydraulic modelling software can be found in FNDC Approved Materials List - Wastewater and Stormwater. Alternative modelling methods require FNDC specific approval.

A complete electronic copy of the hydrological/ hydraulic model shall be provided to FNDC at no charge. The model shall be accompanied with a report containing all underlying assumptions (e.g. land cover, losses, time of concentration, and sub-catchment areas, existing stormwater network) shall be clearly stated so that a full check of calculations is possible.

4.3.9.3 Time of Concentration

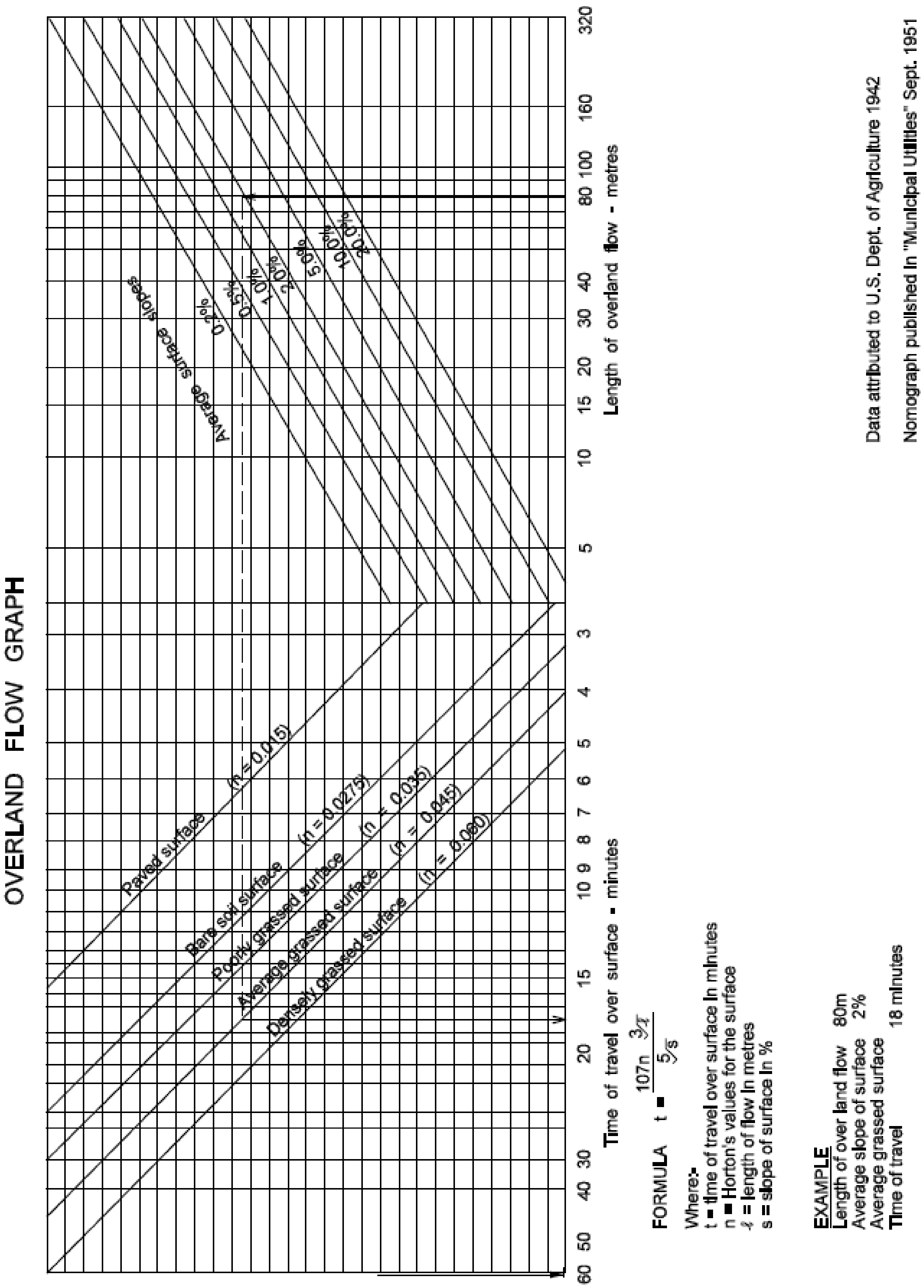
The time of concentration shall be determined as the 'time of entry' plus the 'time of flow' from the furthest point of the whole catchment to the point of discharge.

Time of entry to the system shall be calculated from Figure 4-1: Overland Flow Graph or an equivalent method.

Time of flow can be calculated from the velocity in pipes and channels.

Note: Since the time of concentration is not known initially, an iterative solution is necessary with time of concentration recalculated from the catchment flow calculation.

Figure 4-1: Overland Flow Graph



4.3.9.4 Design Rainfall

Acceptable sources for rainfall data for design within the Far North District are:

a. Rainfall depth data from NIWA High Intensity Rainfall System. In addition (where appropriate) other acceptable alternatives include analysis of a specific site based on information provided by verified research studies of particular soil or site conditions.

The current rainfall pattern (not adjusted for climate change) shall be used to determine detention requirements for brownfield developments where existing connections generate 'existing use rights' and also for temporary works where climate change rainfall is not relevant.

4.3.9.5 Design Storm

For analysis of rainfall events either the Modified Rational Method (variable duration, uniform profile), or a USDA Soil Conservation Service TR-55 type 1A storm profile (fixed duration, variable profile) are acceptable for determining peak flow and runoff volumes, subject to the criteria set out below.

The minimum duration of the design storm for the pre-developed flow consideration using Modified Rational Method shall be 60 minutes (all Environments). The post-developed design shall be tested for critical duration taking into account the effects of attenuation and detention on the discharge.

Note: This critical duration is unlikely to be the same as that used for the pre-development assessment.

The use of the Auckland Regional Council TP108 profile for estimation of pre-development peak runoff in the Far North District is not acceptable.

4.3.10. Hydraulic Design

4.3.10.1 Energy Loss through Structure

Energy loss is expressed as velocity head: He = kV2/2g (where k is the entrance loss coefficient and V is velocity).

The entrance loss coefficient table and energy loss coefficient graph in NZ Building Code E1 provide k values for flow through inlets and access chambers respectively (See Table 4-4).

For bends, see Table 4-5.

Table 4-4 Entrance Loss Coefficients

Design of Entrance		Entrance Loss Coefficients (k_e)
Pipe Culverts	Pipe projecting from fill - Square cut end	0.5
	Pipe projecting from fill- Socket end	0.2
	Headwall with or without wing walls- Square cut end	0.5
	Headwall with or without wing walls- Socket end	0.2
	Pipe mitred to conform with fill slope- Precast end	0.5
	Pipe mitred to conform with fill slope- Field cut end	0.7
Box culverts	No wing walls, headwall parallel to embankment - Square edge on three edges	0.5

	No wing walls, headwall parallel to embankment - Three edges rounded to 1/12 of barrel dimensions	0.2
	Wing walls at 30° to 75° to barrel- Square edge at crown	0.4
	Wing walls at 30° to 75° to barrel- Crown rounded to 1/12 of culvert height	0.2
	Wing walls at 10° to 30° to barrel- Square edge to crown	0.5
	Wing walls at 10° to 30° to barrel- Wing walls parallel (extension of sides) square edge at crown	0.7

4.3.10.2 Determination of Water Surface Profiles

Stormwater systems shall be designed by calculating or computer modelling backwater profiles from an appropriate outfall tail water level.

On steep gradients both inlet control and hydraulic grade line analysis shall be used, and the more severe relevant condition adopted for design purposes.

For pipe networks at manholes and other nodes, water levels computed at design flow shall not exceed finished ground level. Calculations shall also allow for existing and future MPD connections to function satisfactorily.

Table 4-5 Loss Coefficients for Bends

Bends		K
MH properly benched with radius of bend	1.5 x pipe diameter	0.5 to 1.0
Bend angle	90	0.90
	45	0.60
	22.5	0.25

4.3.10.3 Minimum Pipe Diameters

The following minimum pipe diameters shall apply:

a. Public stormwater main: 300mm.

b. Private / Lateral connection:100mm.

In no circumstances shall the pipe size be reduced on any downstream section.

4.3.10.4 Minimum Gradients and Flow Velocities in Pipes

Pipe gradients should be determined on the basis of a minimum velocity of 0.6 m/s for a 50% AEP design flow. This is to prevent silt deposition.

For velocities greater than 3.0 m/s Specific Design to resist pipe erosion is required.

Details shall be provided by a SQEP to demonstrate compliance with these design conditions.

4.3.10.5 Minimum Pipe Roughness

The minimum 'Colebrook-White' roughness coefficient shall be 0.06 for design of both Reinforced Concrete and uPVC pipes.

Alternatively, the minimum Manning's roughness coefficient shall be 0.011 for design of both Reinforced Concrete and uPVC pipes.

4.3.10.6 Pipe Surcharge

Pipelines shall not surcharge during the 20% AEP in any part of the design network

Surcharge in the proposed stormwater network may be approved under specific circumstances, subject to impacts on the existing network performance and risks, at the discretion of the Stormwater Manager.

4.3.10.7 Freeboard Requirements

Freeboard above the secondary flow level is required to cater for inaccuracies in flow estimation and practicable blockage/failure of the primary system.

The minimum freeboard above the calculated 1% AEP storm shall be:

a. 0.5 m for habitable building floors, and,

b. 0.3 m for commercial and industrial buildings,

Unless specific assessment demonstrates that a different freeboard is appropriate.

Minimum floor levels shall be identified for all lots within the area of the site where flood risks are for 1% AEP or lesser event. This assessment shall consider flooding caused by different sources including:

c. Rivers,

d. Tides,

e. Elevated groundwater, and

f. Surface water ponding.

Minimum floor levels in tidal areas shall be set by taking into consideration current information on natural hazards including storm surge, wave run-up tsunami, and sea level rise.

Development proposals shall demonstrate Safety in Design principles and may be required to provide for Escape routes from the flood hazardous areas/ properties within the development. The appropriate information shall be included in the engineering drawings.

The NRC Regional Policy Statement for Northland states that within the coastal environment:

- Any new habitable dwelling has a minimum floor level of 3.3 m above One Tree Point datum on the east coast and 4.3 m above One Tree Point Datum on the west coast.
- New non-habitable buildings will have a minimum floor level of 3.1 m above One Tree Point datum on the east coast and 4.1 m on the west coast.

However, specific assessment shall be carried out for **all sites** to determine the floor levels dependant on local conditions. Development proposals should include reference to the NRC Regional Policy Statement for Northland and NRC Coastal Flood Hazard Assessment for Northland Region Report .

4.3.11. Watercourses

4.3.11.1 General Requirements

Where watercourses become a receiving environment for a development site and become incorporated in the stormwater system the associated land may be vested to FNDC as a Drainage Reserve (Section 4.3.11.4 Drainage Reserves), protected by an easement or remain in private ownership. The watercourse area shall be of sufficient width to contain the design storm flow from 1% AEP.

Existing watercourses with natural character shall be retained and enhanced, where possible.

Where works in the bed or bank of a waterway occurs, the following should be considered to achieve a satisfactory solution:

a. Design to improve habitat and ecosystem function by designing naturalised channel(s) and banks e.g. mimic natural form and pattern.

b. Avoiding hard lining (e.g., with concrete) and straightening, in favour of natural channel meander, planting and the use of rocks in a complex matrix to increase channel complexity and shear strength.

c. Plant waterways to increase riparian vegetation diversity, density and quality.

d. Protect against scour and erosion using natural materials e.g. avoid concrete structures.

e. Create three dimensional habitats to enable fish and invertebrates to find their preferred velocity and habitat type(s).

f. Consider current and potential ecological values e.g. fish and insects present in the waterway and how their habitat could be improved.

The watercourse works shall be designed to achieve a satisfactory solution recognising:

g. flood protection,

h. Bank and bed stability,

i. The retention of the natural topography, morphology and ecological values,

j. Maintenance requirements such as access,

k. Fish passage requirements (See Section 4.3.14 Fish Passage)

l. Hydraulics; including Downstream effects of any works, and

m. Safety in Design considerations for the proposed works.

The piping of existing watercourses constructed channels or open drains is not generally acceptable. Watercourses may be piped if there are justifiable engineering or design considerations. ecological impacts must be considered, and a N orthland Regional Council approval obtained, where necessary. The EDA should be presented accordingly.

Where watercourses become a receiving environment for discharge from a development site, inevitably they become a part of the stormwater system and it may be vested to FNDC as a Drainage Reserve (Section 4.3.11.4 Drainage Reserves) or require an easement.

The watercourse shall be of sufficient width to contain the full design storm flow from a 1% AEP event plus 500 mm of freeboard. Where a watercourse is being naturalised, the design must ensure that there is no increased risk of erosion and/or scour and the ecological health of the watercourse is maintained or enhanced by the works.

riparian margins shall be provided each side of the watercourse and shall consider appropriate landscaping, bank stability and public safety.

If the constructed watercourse shall be in private property, discussions shall be held with FNDC to determine responsibility for maintenance. At a minimum the constructed watercourse shall be protected by an easement and constructed in compliance with **Sheet 36**, or an approved equivalent.

4.3.11.2 Natural Open Stream Systems

The development proposal shall demonstrate, in addition to requirements outlined in Section 4.3.11.1 General Requirements, that the watercourse:

a. Is suitable for a proposed discharge,

b. Has a maximum velocity in an unprotected open channel in accordance with Table 4-7, otherwise channel protection and mitigation may be required,

c. Is cleared of all weedy vegetation and replanted as per a landscape design approved by the FNDC,

d. Has had the consequences of any blockage assessed and adequate mitigation has been provided,

Has both site specific and catchment wide factors (e.g. removal of riparian vegetation), which may cause an increase in the water temperature and silt migration, mitigated by landscape design, where practicable.

Refer to Section 4.3.13 Culverts in Watercourses if a section of watercourse is proposed for piping (e.g. for road crossings).

Where unmodified watercourses, or formed channels, are to be incorporated in the stormwater network, they shall be located within a drainage reserve vested to FNDC or protected by an easement, of sufficient width to contain the catchment design flow.

4.3.11.3 Open Channel Flows

Open channel flow calculation shall generally be carried out as set out in NZ Building Code Clause E1 using the Manning's equation and corresponding roughness 'n'. The FNDC acceptable 'n' values are set out in Table 4-6.

Table 4-6: Manning's Values

Description	Manning's value 'n'
Open stream with straight uniform channel in earth & gravel in good condition	0.0225
Unlined channel in earth and gravel with some bends & in fair condition	0.025
Channel with rough stony bed or with weeds on earth bank & natural streams with clean straight banks	0.030
Winding natural streams with clean bed but with some pools & shoals	0.035
Winding natural streams with irregular cross sections & some obstruction with vegetation and debris	0.045
Irregular natural stream with obstruction from vegetation & debris	0.060
Very weedy irregular winding stream obstructed with significant overgrown vegetation & debris	0.100

Maximum velocities for open channels (including overland flow paths) shall be as set out in Table 4-7.

Table 4-7: Maximum Velocities in Channels (in all discharge conditions)

Description	Max velocity (m/s)
Earth channels – no bed vegetation	0.6
Fully vegetated channels (e.g. swales)	1.5
Rock spall lined channels	2.0
Fine sand, colloidal	0.4
Sany loam, noncolloidal	0.5
Silt loam, non collodial	0.6
Alluvial silts, noncollodial	0.6
Ordinary firm loam	0.8
Volcanic ash	0.8
Stiff clay, very colloidial	1.1
Alluvial silts, colloidal	1.1
Shales and hardpans	1.8
Fine gravel	0.8
Graded loam to cobbles, noncolloidal	1.1
Graded silts to cobbles, colloidal	1.2
Coarse gravel, noncolloidal	1.2
Cobbles and shingles	1.5

4.3.11.4 Drainage Reserves

Drainage Reserves include a land planned to be vested to FNDC for stormwater management purposes. Reserves can be formed over existing and constructed, watercourses, wetlands and ponding areas. Design for a drainage reserve shall consider the flowing inputs:

a. Provide for ease of maintenance and operation.

b. maximum and minimum terrain slopes shall be 1:5 and 1:50 respectively,

c. Formed and natural channels and dams may have slopes steeper than 1:5, subject to specific design,

d. A maintenance accessway from a public road which is at minimum 4 m wide and bear traffic loads for up to 8.2 tonne axle weight vehicle and include provision for turning vehicles where applicable,

Enable public cycle/foot paths and links with other reserves and traffic networks, where practicable, and

e. Be of sufficient width to contain the catchment design flow.

4.3.12. Outlets and Inlets

4.3.12.1 General

All culvert and pipeline inlets and outlets shall be provided with adequate wing walls, headwalls, aprons and scour protection for erosion control, fill retention around the pipeline, and pipeline support. Adequate energy dissipation shall be provided.

Open-ended manholes to serve as high flow inlets shall have adequate grates or scruffy domes installed.

Approved structures for use at the inlets and outlets of pipelines are shown on **Sheet 35**. Alternative structures shall be considered under Section 1.5.1.2 Alternative Designs.

With respect to health and safety, the following is required:

a. all inlets to the stormwater network greater than 375 mm diameter shall be fitted with a safety grille.

b. The inlet grille shall be provided for in the EDA.

c. The grille shall be vertical and have a clear opening of maximum 100 mm between bars.

Note that grilles are not required on manholes and will only be required at the inlet to a culvert in special circumstances as required by the FNDC.

d. Safety in Design principles shall be applied.

Outlets' or inlets' surrounding area shall be designed to maintain and/or enhance in-stream values. Outlet and inlets structures shall be constructed to not restrict the flows in the watercourse and to not form a barrier to fish passage.

4.3.12.2 Outlet Design

Outlet structures shall be designed in general accordance with Auckland Council TR2013/018, or Auckland Council GD01, whichever is most relevant to the outfall, and shall not adversely impact the flows in the receiving watercourse.

Outlet design shall ensure non-scouring velocities can be achieved at the point of discharge. Acceptable outlet velocities will depend on the channel soil conditions but should not exceed 2 m/s without specific provision for energy dissipation.

Where the proposed discharge to a watercourse represents more than 10% of the watercourse flow rate for an equivalent event, adequate energy dissipation shall be provided.

Outlet designs shall take into account, in addition to guidance contained in Auckland Council TR2013/018 and Auckland Council GD01, the following:

a. Alignment with a CMP or site-specific SMP,

b. Fit for purpose over the design life,

c. Watercourse levels and flow,

d. Extending outlet works below the water surface,

e. Safety in Design principles,

f. Achieving natural character, amenity, and aesthetics of the watercourse,

g. Appropriate planting and landscaping of indigenous species and

h. Retaining and enhancing remnant areas of indigenous watercourses' bank vegetation, where applicable.

4.3.12.3 Inlet Design

The inlet design shall take into account particular circumstances at each site using the following evaluation:

a. Direction of upstream flow,

b. Signs of erosion both lateral and down cutting,

c. Height of headwall,

d. General aesthetics,

e. Hydraulic efficiency, and

f. Fish passage.

Screens are required where flow from watercourse, detention and treatment systems enters into a piped network.

All screens shall be constructed from hot-dipped galvanised steel and the horizontal gap shall not exceed 100 mm. Specific Design is required to demonstrate requirements of Safety in Design, including the provision of access for maintenance and inspections. Screens shall be designed to be self-cleansing; to have the net flow area of minimum 2 times area of the pipe; and to withstand the loads from debris and hydraulic head. Where the consequences of a screen blockage are likely to be severe, a backup overflow bypass shall be provided allowing the flow to enter the stormwater system without causing hazards.

4.3.13. Culverts in Watercourses

4.3.13.1 General Requirements for Culverts

For the purposes of this document, a culvert is defined as any conduit that transfers the flows of a watercourse across a road or embankment and does not connect directly to a reticulated piped stormwater network. The design of culverts shall comply with this ES, as provided following:

If the culvert embankment can be considered a dam under the dam safety regulations (See NZ Dam Safety Guideline, 2015), the requirements of those regulations shall take precedence over those stated in this document. A structure is considered a dam where:

a. Vertical height from the downstream toe of the embankment to the top is more than 4 m, or

b. The total stored volume of fluid is more than 20,000 m^3, or

c. The contributing upstream catchment is more than 20 ha.

The culvert shall be designed to cater for the flows and water levels generated by the 1% AEP event without adversely affecting upstream or downstream property.

The headwater pond created by the culvert during the 1% AEP event shall have a depth not exceeding 3.0 m above the invert of the pipe and shall provide 500 mm freeboard to the edge of the seal of the road (or similar feature) at the top of the embankment. For cases where the approach velocity is greater than 2 m/s, the freeboard shall be at least 1.5 times the velocity head at the entrance.

The following general design criteria shall be applied to culverts:

d. Culverts shall be designed, such that the maximum velocity within the culvert generated by the 1% AEP event does not exceed 6.0 m/s. Higher velocities in culverts require approval from FNDC.

e. High outlet velocities are likely to cause scour and erosion of natural channels and reference shall be made to Auckland Council TR2013/018. Note that energy dissipation shall be required at far lower velocities than the maximum allowed within the conduit stated above.

f. Culverts shall be designed such that for the 50% AEP design storm, an absolute minimum velocity of 0.6 m/s and desired minimum of 1.0 m/s is achieved.

g. Culverts shall have a minimum internal diameter of 375 mm (for vehicle crossing standards refer to Chapter 3:Transportation).

h. A suitable transition structure is required at both the inlet and outlet to the proposed culvert which shall ensure that there is no scour or erosion in the watercourse, private property and/or the road formation.

i. A secondary flow path shall be kept unobstructed at all times. The secondary flow path design shall assume the total blockage of the culvert in cases where it is less than DN1,500, and 50% capacity. Reduction if the culvert is greater than or equal to DN1,500, unless demonstrated by specific FNDC approval that a lower blockage factor can be applied.

j. Allowance for 100% blockage of pipes greater than DN1,500 may be necessary in some circumstances. The risk of blockage resulting from the contributing catchment shall be assessed on a case-by-case basis (this includes situations where a safety grille or debris screen is used) to determine if specific culvert design (including consideration of a secondary inlet) is required.

k. For culverts whose inlets may be difficult to locate if submerged, green retro-reflective raised pavement markers shall be required to mark the presence of the culvert under the roadway. For all culverts associated with roads, markings shall be in accordance with Chapter 3:Transportation.

l. Safety in Design principles shall be demonstrated including provision of safety measures as required, e.g. a barrier along the culvert headwall.

m. Culverts under road fencing or barriers are to be designed to FNDC requirements.

n. Adequate provision shall be made for maintenance. This shall include, but not be limited to, access to inlet and outlet for inspection, debris removal and scour protection maintenance, and any other activities stated in the operation and maintenance manual.

o. Fish passage shall be provided for.

p. The need for debris screens shall be subject to specific design, considering the likelihood of debris flowing from the upstream catchment and any potential impact on the culvert.

q. Culverts shall be single barrelled unless Specific Design is approved by FNDC.

r. All culverts transferring flow across the road reserve, roadside drains and water table are owned and maintained by FNDC or Waka Kotahi. Note that culverts for private vehicle crossings (i.e. serving a private property) within the road reserve will be owned and maintained by the property owner.

s. For transportation requirements refer to Section 3.2.20 Bridges, Culverts and Other Structures for culvert design requirements in respect of roading and access-ways.

t. Culverts in watercourses shall be designed to cater for post-development events in Table 4-8.The effects and options of inlet and outlet tailwater controls shall be considered. All culverts shall be provided with adequate wingwalls, headwalls, aprons, scour protection, removable debris traps or pits to prevent scouring or blocking.

u. Where culverts are formed with multiple openings (e.g. pipes, arches) placed side-by-side, resulting in a culvert width greater than 6.0 m, the culvert is then defined as a bridge-culvert and shall be designed in accordance with the Section 3.2.20 Bridges, Culverts and Other Structures and best practice guidance for fish passage (refer to New Zealand Fish Passage Guidelines (April 2018)).

v. Where existing or proposed road culverts are discharging onto adjoining properties the culverts shall be extended to the road reserve boundary to enable continuous unrestricted pedestrian access.

w. Batter slopes shall be topsoiled and grassed or if necessary, hydroseeded.

It is usual for resource consents conditions to require that culvert construction in watercourses be accompanied by sediment control measures as set out in an Erosion and Sediment Control Plan. Refer to NRC Regional Plans.

4.3.13.2 Catchment Design Parameters

The following information shall be provided for culvert crossing design:

a. Catchment topography including main channel length, slope and area to drain through the culvert,

b. MPD based on land use description under the District Plan,

c. Any specific requirements from an applicable CMP or site-specific SMP, and

d. An assessment of the impacts on fish passage.

4.3.13.3 Culvert Design Rainfall Event

Culverts shall be designed as a minimum to accommodate storms as per Table 4-8. The design shall not cause any increase in upstream water levels that will cause flooding on neighbouring properties.

Table 4-8: Culvert – Design Rainfall Event

Design case	AEP year storm to pass without surcharge (design flow)	AEP year storm not overtopping structure (peak flow)
Driveway or private access-way	50%	NA
Pedestrian or cycleway walk	20%	10%
Local or Collector Road	20%	5%
Arterial roads and railways	5%	1%

4.3.14. Fish Passage

The Northland Regional Council should be contacted to determine the ecological value of the watercourse, when considering any watercourse disturbing activities.

In some cases, fish barriers will be desired because of their ability to prevent migration of pest fish. Where the Northland Regional Council does not identify this as an issue then fish passage through culverts in the watercourse shall be maintained. This is achieved by ensuring that the invert level is set below the stream bed level and the outlet is flooded at all times.

If a watercourse capacity is reduced, the velocity along the banks at base flow conditions shall be maintained at less than 0.3 m/s to allow for passage of indigenous fish and trout.

Where multi-barrel culverts shall be used for wide channels that have low flows but occasional high flow events, consideration shall be given to setting each barrel at a different level to allow base flows and ensure appropriate watercourse area at various flows.

The New Zealand Fish Passage Guidelines (April 2018), sets out recommended practice for the design of instream infrastructure to provide for fish passage. This should be used to inform the design of potential barriers to fish passage.

4.3.15. Piped System Layout

4.3.15.1 General

Stormwater pipes shall in general be located within the Transport Corridor, see Table 4-9.

The order and layout of pipes and other underground services shall be in accordance with **Sheet 29**. The minimum clearance between stormwater pipes and other services shall be in accordance with **Sheet 30**.

Table 4-9: Pipe Locations

Area	Location
Residential	Within the Transport Corridor and within the berm, at 2 m offset from the kerb except where the properties served are below road level.
Industrial	Within the Transport Corridor and within the berm, at 2 m offset from the kerb or alternatively in the front yard area with specific approval from FnDC.
Business	Within the Transport Corridor and within the berm, at 2 m offset from the kerb or alternatively in the rear service lane specific approval from FNDC. The major reticulation and trunk lines, however, shall be in the Transport Corridor (as for Residential Zones).
Other Areas	Within the Transport Corridor (as above) except where the properties served are below road level.
Private Property	If no other option is available, pipelines may be laid within private property. Where a pipeline is within a property, it is required to be parallel to the boundary and no more than 1.5 m from the boundary . No new private drains shall pass between one lot and another. If crossing of private property is unavoidable, those parts of the pipeline serving more than one lot shall be FNDC mains with service connections to the property boundaries.

The pipelines shall also meet the following requirements:

a. Where a stormwater pipeline changes location within a street, crossings of roads, railway corridor, and underground services shall, as far as practicable, be at an angle of 45 degrees or greater. Pipes shall be located and designed to minimise maintenance and crossing restoration.

b. The location of pipes shall be governed by topography. The pipe layout shall conform to the existing surface gradients as far as practicable to remove the need for deep installation due to gravity pipelines operating against the fall of the ground.

c. Any aerial pipes and pipe bridges shall be designed by a SQEP and considered an Alternative Design (See Section 1.5.1.2 Alternative Designs) and approval shall be at the discretion of the Stormwater Manager.

d. Pipes shall have a sealed joint, as per manufacturer specifications for various pipe materials and joint types.

e. Curved pipelines shall be considered an Alternative Design (Section 1.5.1.2 Alternative Designs) and approval shall be at the discretion of the Stormwater Manager.

f. Pipes shall not be installed within the tree drip line.

    i. Where pipe joints lie within 5 m of a tree with girth exceeding 0.5 m (as measured 1.0 m above the ground), pipe joints shall have root ingress protection.

4.3.15.2 Minimum Cover

All pipelines, other than those in private property, shall be specifically designed to support the likely loading in relation to the minimum cover to be provided in accordance with the terms of AS/NZS 3725:2007.

The minimum cover over pipes shall be:

a. 600 mm in berms and any other areas not subjected to traffic loading, or

b. 1000 mm under carriageways and trafficked areas.

Any pipelines that cannot achieve the minimum pipe cover requirements shall:

a. Be specifically designed by a SQEP to support the likely loading in relation to the actual cover to be provided, or,

b. Be provided with pipe protection in accordance with the reinforced concrete slab protection shown on **Sheet 32**.

4.3.15.3 Clearance from Structures

Pipes adjacent to existing buildings and structures shall be located clear of the 'zone of influence' of the building foundations. If this is cannot be avoided, a Specific Design shall be undertaken to address the following:

a. Protection of the pipeline through both construction and a lifetime period,

b. Long term maintenance access for the pipeline, and

c. Protection of the existing structure or building.

Any such proposals shall be considered an Alternative Design (Section 1.5.1.2 Alternative Designs). Approval shall be at the discretion of the Stormwater Manager.

Sufficient clearance for laying and access for maintenance is also required. Table 4-10 may be used as a guide for minimum clearances for mains laid in public streets.

Table 4-10: Minimum Clearance from Structures

Pipe Diameter DN (mm)	Clearance to Wall or Building (mm)	Public SW Mains within Private Property (mm)
<100	600	1000
100 – 150	1000	1400
200 – 300	1500	1900
375 +	1500 + 2 x diameter	1900 + 2x diameter

4.3.15.4 Steep Pipes

Where the pipeline grades are 1:3 or steeper, and pipes do not exceed 450 mm diameter, anchor blocks (bulkheads) shall be constructed in accordance with **Sheet 32** and shall have concrete bedding of 20 MPa. Specific Design by a SQEP is required where pipe diameters exceed 450 mm.

Bulkhead details shall be included in the drawings.

Bulkhead spacing shall be as per Table 4-11.

Table 4-11: Bulkhead Spacing

Grade %	Requirement	Spacing (S) (m)
15 - 35	Concrete Bulkhead	S = 100 / Grade (%)
> 35	Special Design	3.0

Where a pipeline shall be laid in soft ground (i.e. ground that is likely to settle, deflect and/or subside) FNDC may require specific engineering design including geotechnical investigations by a SQEP. The design requirements for Specific Design shall address pipe bedding and backfill in accordance with Section 4.3.16.7 Manholes Requiring Specific Design.

Note: Pipes laid to minimum grades will NOT be accepted in ground liable to settlement.

4.3.16. Manholes

4.3.16.1 General Requirements

Manholes shall be located:

a. On FNDC property or Transport Corridors whenever practicable. If located within the carriage way, manholes shall be located 2 m out from the kerb.

b. Out of hollows, dips or any area that may be subjected to inundation or identified as a secondary flow path.

c. Clear of all boundary lines by at least 1.5 m from the outer edge of the manhole chamber plus the height of any nearby retaining walls if they exist.

d. Clear of the zone of influence as per FNDC Wastewater Drainage Bylaw 2018.

Manholes are required at the following locations:

e. Intersection of pipes except for junctions between mains and lateral connections,

f. Changes of pipe size,

g. Changes of pipe direction, except where horizontal curves are approved,

h. Changes of pipe grade, except where vertical curves are approved,

i. Combined changes of pipe direction and grade, except where compound curves are approved,

j. Changes of pipe invert level,

k. Changes of pipe material, except for repair/maintenance locations, and

l. Permanent ends of a pipe.

For infill developments, manholes are not required at 150 mm branch connections onto 150 mm mains provided that:

m. a manhole exists on the main within 100 m of the connection point: and,

n. a manhole is provided on the branch upstream of the connection point: and,

o. the manhole is immediately within the boundary of the property being served or within 20 m of the connection point, whichever is the lesser.

4.3.16.2 Spacing

For reticulation pipes, the maximum distance between any two manholes shall be 120 m.

4.3.16.3 Allowable Deflection through Manholes

A maximum allowable deflection through a manhole for pipe sizes 150 to DN 225 is 90 degrees. The maximum allowable deflection for pipe sizes greater than DN 225 is 110 degrees.

4.3.16.4 Internal fall through Manholes

All manholes shall have a minimum drop of 50 mm plus 5 mm per 10 degrees of the angle of change of flow within the manhole and between inlet and outlet.

The construction tolerance for drop through the manhole shall be:

a. Constructed Manhole Drop = Manhole Drop (as calculated above) +/- 5 mm

b. Grading the channel shall be limited to falls through manholes of up to 150 mm.

4.3.16.5 Size of Manholes

Manholes shall be a minimum of 1050 mm diameter for depths of 1.2 m or more.

Where two or more incoming pipes are connected to the manhole, larger diameters shall be used.

Non-access chambers of 600 mm diameter are approved to be used for depths up to 1.2 m at the upstream end of public stormwater networks.

4.3.16.6 Materials and Parameters

Pre-cast concrete manholes with external flanged base are acceptable provided that:

a. They shall be installed in accordance with **Sheet 39**,

b. Manholes up to 2.4 m deep shall be constructed using a single riser with a pre-cast external flange base,

c. Manholes in excess of 2.4 m deep shall be constructed using a 2.4 m deep pre-cast riser with external flange base, and then completed to final ground level using no more than a single riser for manholes up to 4.0 m deep.

d. In no case shall a series of short risers be used,

e. The joints of all abutting units shall be sealed against the ingress of water,

f. The cover frame shall be set over the opening and adjusted to the correct height and slope using adjustment rings and mortar so as to conform to the surrounding surface,

g. The cover frame shall be held in place with concrete haunching in accordance with **Sheet 39**.

Manholes constructed and installed using alternative materials and methodologies shall be in accordance with FNDC Approved Materials List - Wastewater and Stormwater and installation details.

4.3.16.7 Manholes Requiring Specific Design

Any manhole with the following parameters shall be subject to Specific Design:

a. Depth greater than 4.0 m, or

b. If affected by the high-water table, or

c. Is bedded in suspected or proven aggressive grounds.

If the manhole is affected by the high-water table, the manhole shall include a factor of safety against flotation of 1.25.

4.3.16.8 Connections to Manholes

The invert of a lateral property connection to a manhole shall be at a level no lower than the average of the soffit levels of the main inlet and outlet pipes.

The invert of other lateral (pipeline) connections shall achieve the internal fall requirements of Section 4.3.16.4 Internal fall through Manholes. Maximum angle of deflection of lateral connection into the manhole main channel shall be 90 degrees.

External drops shall require Specific Design.

Cascades are only permitted under the following conditions:

a. Where the manhole is more than 2.0 m deep.

b. Where the cascade inlet pipe diameter will be a maximum of 300 mm.

c. Where the cascade will not discharge onto any steps or ladders.

d. Where the drop height will not exceed 1.0 m (from the invert of the cascade inlet pipe to the top of the benching within the manhole).

4.3.16.9 Covers

Watertight manhole covers with a minimum clear opening of 600 mm in diameter, complying with AS 3996:2019, and included on the FNDC Approved Materials List - Wastewater and Stormwater shall be used.

'Non-rock' covers shall be used on all State Highway and Level 2 roads (roads with average traffic of 10,000 or more vehicles per day).

Class D covers to AS 3996:2019 shall be used in the Transport Corridor, carriageway, commercial and industrial properties and all public areas.

Class B and **Class C** covers to AS 3996:2019 may only be used on residential properties.

Note: bolted down covers shall not be used.

4.3.16.10Manhole Steps

All manholes greater than 1.2 m in depth shall be provided with manhole step rungs. Step rungs shall be stainless steel. Encapsulated rungs with galvanized steel or a stainless-steel core shall be fully coated with an industrial grade PE or an approved alternative may be used. Approved products are as per the FNDC Approved Materials List - Wastewater and Stormwater .

Manhole steps shall be provided in accordance with **Sheet 39** and **Sheet 40**.

Manhole steps shall be provided at 300 mm centres vertically (refer **Sheet 39**). The top step shall not be more than 450 mm below the top of the top slab and the lowest step shall be no more than 375 mm above the bench, or such lower level if specified by manufacturers of proprietary manholes.

4.3.17. Connections

4.3.17.1 General Requirements

The lateral connection should be designed to suit the existing situation and any future development.

For connections to an open watercourse, resource consents from NRC may be required.

See Section 4.2.4 Discharge to the Road Kerb.

4.3.17.2 Lot Connections

Each lot within the subdivision shall be provided by a public or private stormwater connection to the primary or secondary system.

The following design requirements shall be met:

a. Stormwater management as per hierarchy in Section 4.1.8 Stormwater Management Hierarchy.

b. Where no other option is available, a kerb outlet can be considered under Specific Design, and it shall be installed at least 1.0 m clear of any vehicle crossing.

c. The preferred depth at the boundary, of a stormwater connection to a piped network, is 1.2 m (allowable range 0.9 m - 1.5 m) where practicable, subject to the following:

   i. The connection shall satisfy the pipe size, material, cover, depth and self-cleansing velocity requirements of the ES;

   ii. The connection shall be able to service the whole area of the lot; and,

   iii. The connection shall be able to convey the expected flow from the whole developable area.

d. To determine whether a connection can clearly serve the whole lot, the invert level should be calculated at grade of 1:80 from the pipe invert to the lot boundary and then at 1:100 to the furthest point within the lot. If after allowing for the pipeline diameter, the depth of soil cover over the pipeline is less than 0.5 m the final design shall be to the satisfaction of the FNDC.

e. Existing connections, if found on site, which may not be documented on FNDC records, may be reused subject to confirmation of existing asset condition.

f. A minimum connection diameter of 100 mm is required for each residential allotment, or

g. A minimum connection diameter of 150 mm is required for a commercial/industrial lot.

h. The connection shall be designed to service the property runoff.

Where discharge flow rate controls are applied, FNDC may approve alternative connection sizes.

All connections, which shall be made directly to the primary stormwater network, shall be designed using a factory manufactured ‘wye’ or ‘lunden-junction’ and shall be watertight.

Connections shall be sited clear of obstructions and known developments and accessible for maintenance.

Direct connection of branch pipelines to main pipelines is acceptable, provided:

i. Connection is via a suitable junction or saddle where the branch pipe diameter is not greater than half the main pipe diameter (see **Sheet 37**),

j. The distance between the pipeline connection and the closest inspection point is not greater than 25 m.

k. Connections shall be sealed with removable caps until required. The caps are to be painted green and have ‘SW’ painted/fixed onto the end cap.

4.3.18. Catch-Pits

The design of stormwater networks shall include catch-pits for public roads and other areas where nuisance flooding might be expected. The design proposal shall be based on the following principles:

a. Shall generally be in accordance with AS 3996:2019

b. Stormwater calculations shall allow for 50% blockage of the inlet grate.

c. Catch-pits are not generally considered as part of stormwater treatment, unless being fitted with filter bags. Any such proposal shall be considered an Alternative Design (See 1.5.1.2 Alternative Designs) and specific approval by the Stormwater Manager will be required.

d. Catch-pits shall be positioned so as not to adversely impact traffic, and flow in kerb and channel.

e. Catch-pits shall be fitted with removable grates, which allow maintenance while preventing accidental access, and that are suitable for crossing by bicycles.

f. Catch-pits shall be placed:

   i. at maximum 90 m intervals on roads,

   ii. where the location prevents primary flow from bypassing the catch-pit inlet, e.g. upstream of right of way crossings or pram crossings, at tangent points, and discharging overland, and,

   iii. to capture the design runoff flow from the identified contributing area, including adjacent road, paths and public or private land.

g. Catch-pit leads shall be at minimum pipe gradient of 1%, and minimum 225 mm diameter for a single catch-pit, and minimum 375 mm diameter for a double catch-pit,

h. Catch-pit leads up to 225 mm diameter and not more than 20 m in length may be saddled on to pipes 600 mm diameter and larger, without manholes,

i. Larger (double) catch-pits shall be placed at sags/low points, with the potential for ponding or for flow to escape channels.

Catch-pits on private access-ways shall be capable of accepting the flow from a proprietary catchment area. The minimum grate size shall be 300 x 300 mm. Where an access way is steep, or stormwater connections discharge onto the access-way, larger catch-pits or a cut off channel with a grate may be required. A minimum diameter for private catch-pit leads shall be 150 mm.

Refer to **Sheet 34**.

4.3.19. Subsoil Drains

All subsoil drains to provide land stability are considered private and should be self-contained within the individual property. Subsoil drains shall be installed to control groundwater levels, where required.

Refer to **Sheet 14**.

4.3.20. Soakage Devices

Soakage devices such as soak pits and soak holes may be considered for managing stormwater from roofs, parking areas, and roads.

The ability of the ground to accept stormwater can vary enormously within soakage areas, even within individual properties. Because of this, at least one percolation test shall be required for every soakage device that is constructed and this should be done where the device is likely to be placed.

Soakage devices (with storage) shall be utilised where infiltration test results exceed 150 mm/hr, as determined using the NZ Building Code E1 Method, and where other conditions (e.g. stability, groundwater) do not preclude their use. Infiltration rates may be determined using the test and calculation procedure set out in the worksheet in Appendix F Permeability Test Sheets.

(Design shall be subject to satisfactory percolation testing in accordance with Auckland Council guideline document GD2021/007: Stormwater Soakage and Groundwater Recharge in the Auckland Region).

Calculations of soakage device and storage volumes shall identify the most severe combination of rainfall and infiltration/discharge for a design rainfall event. The outputs shall then be used to determine the size of the infiltration vs storage requirements.

Soakage devices shall be accessible for maintenance and shall consider geotechnical conditions for the proposed location.

Soakage device proposal requires Specific Design as follows:

a. Permeable pavement and associated porous sub-base shall be specifically designed.

b. Specific engineering design is required for soakage device in soils with infiltration rates less than 150 mm/hr.

Specific matters to be considered in soakage system design include:

c. Soakage devices shall be designed for 20% AEP (+CC 20%) flows from impervious areas.

d. Capacity adequate for the maximum potential impermeable area and located in such a way to maximise the collection of site runoff.

e. Soakage devices shall be located away from overland flow paths.

f. Rate of infiltration determined through an infiltration test with an appropriate reduction factor (at least 0.25) applied to accommodate loss of performance over time.

g. Secondary flows shall be provided for the water which will follow during events that exceed the design capacity of the soakage device.

h. Confirmation that the soakage device will not create adverse effects on surrounding land and properties (e.g. stability, seepage, or flooding issues).

i. Pre-treatment device to minimise silt, litter and other pollutant ingress.

j. Access for maintenance.

Specific matters to be considered when determining location for soakage devices include:

k. Soakage devices shall not be located close to buildings or boundaries. A clearance of 3.0 m is required, but this can be reduced to 1.0 m for porous paving, or can be reduced to 1.5 m where the neighbouring property is required to have a 1.5 m setback to any new building. Setbacks to roadside boundaries shall be 0.5 m (to avoid fence footings). Further encroachment will require a Specific Design.

l. Soakage devices should not be located beside retaining walls. For walls less than 2.0 m high, the clearance shall not be less than a horizontal distance that is equal to the retaining wall height plus 1.5 m, unless a Specific Design is carried out. For walls higher than 2.0 m, a Specific Design shall always be carried out.

m. Soakage devices shall not be located within 2.0 m of public sanitary sewers or 1.0 m of private sewers.

n. Soakage devices shall not be positioned on unstable slopes (refer Section 4.3.3 Infiltration and Stability)

o. Soakage devices shall be positioned above the ‘winter’ high water table unless specifically approved to operate as predominately summer soakage devices. In the absence of specific field data, the position of the high-water table can be estimated from boreholes or test pit observations of soil colouration and wetness.

p. Soakage devices shall be servicing a single property.

A discharge permit may be required from the NRC.

4.3.21. Stormwater Treatment and Detention Devices

4.3.21.1 General

There are a number of treatment and detention options available. The preferred solution will either be identified in an approved Catchment Management Plan, site-specific Stormwater Management Plan, or for small sites through discussions with the FnDC.

The FNDC will assess a preferred approach based on the following considerations:

a. The lifecycle maintenance cost to the FnDC,

b. Land limitations such as location, available area, stability or ownership,

c. The performance of the device,

d. A level of optimisation of stormwater detention and treatment with the MPD, and,

e. Proposed engineering and landscape designs or works for treatment and detention solutions shall be approved at the sole discretion of FNDC.

Where proposed stormwater treatment and detention solutions may impact on the operation or maintenance of other FnDC assets, e.g. road, public reserves, and utility services, a specific approval from the affected asset owner Manager is also required.

Design shall generally follow the guidance provided in Auckland Council GD01. The specific requirements as set out in this Section take precedence over Auckland Council GD01. Additionally, where it can be explained to the satisfaction of FNDC that there is a benefit in an alternate design that meets or exceeds Auckland Council GD01, an appropriately selected and sized treatment option, it can be considered, when using the following industry guidelines; including but not limited to:

f. Wellington Council WSD for Stormwater: Treatment Device Guideline

g. The Regional Infrastructure Technical Specification (RITS) 2018 (Waikato)

If FnDC shall be ultimately responsible for maintenance the treatment or detention device shall be located on land owned by, or to be vested in FnDC.

The FnDC encourages early consultation between the Developer and FnDC to achieve mutually beneficial design outcomes. Of particular note FNDC seeks design outcomes that meet operational, environmental and amenity requirements.

4.3.21.2 Rainwater Tank for Water-Use

Rainwater tanks can provide a significant contribution to stormwater attenuation when they provide water supply for a domestic use.

Table 4-12 sets out the percentage reduction of the required attenuation volume attributable to the dwelling roof. The table is based on a water consumption of 250 litre/person/day.

Table 4-12: Percentage Reduction of Required Attenuation Volume

Roof Area (m^2)	Reduction of required Attenuation Volume (%)					
	Rainwater Tank Size (litres)					
	200	1,000	3,000	4,500	9,000	25,000
150	20	35	45	45	50	50
200	20	25	35	35	35	40
250	10	20	30	30	35	35
300	10	15	20	20	25	25
500	5	10	10	10	15	20

Note: Reduction figures relate only to the roof portion of the attenuation and do not include other impervious surfaces.

Where the rainwater tank attenuation shall be used to offset direct discharges from external impervious areas, once paved areas exceed 50-60% of the roof area, the incremental increase in roof runoff attenuation storage volume effectiveness becomes limited. Therefore, where the 'other' impervious areas exceed 120 m^2, a suitable, combined attenuation system shall also be provided.

For commercial and/or body corporate installations, the water use volume and its contribution to reduction of design discharge flow can be allowed. This shall be recorded on the title or as a land use consent condition.

If after some time attenuation can no longer be provided through water-use, the property owner will be obliged to provide an alternative attenuation system as required by the resource consent and before decommissioning the water-use system.

4.3.21.3 Proprietary Treatment Systems

The treatment of stormwater using proprietary systems is approved when:

a. The proprietary system meets or exceeds the minimum treatment requirements of Auckland Council GD01, and,

b. The proprietary system is on FNDC Approved Materials List - Wastewater and Stormwater, and

c. The proprietary system is installed in accordance with the supplier's specifications and/or recommendations.

Use of a proprietary system that is not a FnDC Approved Treatment System shall be considered an Alternative Design and, as such, the process in Section 1.5.1.2 Alternative Designs shall be followed.

The use of proprietary systems that require frequent replacement of treatment media will not be accepted as vested assets.

4.3.21.4 Swales

The design of swales shall be undertaken by a SQEP in accordance with design guidelines contained in Auckland Council GD01 / Wellington Council WSD for Stormwater: Treatment Device Guideline.

The design of swales shall ensure that they are able to convey the required design flows in a controlled manner, are not subject to ongoing erosion/scour and are able to be maintained in a safe and practicable manner with consideration given to traffic management.

Refer to Section 3.2.14.4 Swales for use of swales within the Transport Corridor as road pavement drainage controls.

4.3.21.5 Raingardens

The design of raingardens (often referred to as bio-retention) shall be undertaken by a SQEP in accordance with design guidelines contained in Auckland Council GD01 / Wellington Council WSD for Stormwater: Treatment Device Guideline.

The design of raingardens shall ensure that they can detain and treat the required water quality volume, can adequately drain between events through underdrainage and are able to be maintained in a safe and practicable manner with consideration given to traffic management.

Refer to Section 3.2.14.4 Swales for use of bio-retention within the Transport Corridor as road pavement drainage controls.

4.3.21.6 Underground Stormwater Storage

Typical specifications for underground stormwater are provided in Table 4-13. A gross pollutant trap may be required for protection and maintenance purposes.

Table 4-13: Proprietary Underground Storage Applications

Parameter	Application
Landuse	All land use types, all paved areas It shall sustain traffic loads, which are anticipated over the subject area.
Performance	Can provide retention (infiltration)and/or detention storage.
Sizing	Provide to achieve requirements of Section 4.1.3 Performance Standards and Table 4-1 as required. Consult manufacturer's guidance for detailed sizing information. The minimum cover depths will apply.

4.3.21.7 Catch-Pit Filter System

Table 4-14 summarises design requirements for typical catch-pit filter system (CFS) applications.

As systems are manufacturer specific, general specifications have been provided. Catch-pit filter systems require Specific Design.

Table 4-14: Catch-Pit Filter Application

Parameter	Application
Landuse	Heavy traffic paved areas, including shopping malls, schools, carparks, and roads

Parameter	Application
Catchment area	Less than 1 ha
Performance	Gross pollutant removal. Some course sediment removal. Can be part of a treatment train.
Sizing	Installed into a curb inlet or catch-pit and can be customized to meet specifications. High flows can bypass the filter. Drainage design should account for reduced inlet capacity.

4.3.21.8 Constructed Ponds and Wetlands

The design of constructed ponds and wetlands shall be undertaken by a SQEP in compliance with the design guidelines contained in Auckland Council GD01 and consideration of Wellington Council WSD for Stormwater: Treatment Device Guideline. Additionally, ponds and wetlands shall comply with the following minimum requirements:

a. Maximum permanent water depth is 1.5 m,

b. Maximum external slopes shall be 1v:4h,

c. Maximum internal slopes shall be 1v:4h,

d. The pond shall be contained within the legal boundaries of a drainage reserve,

e. Where ponds and wetlands are not fenced, safety benches are constructed around the full perimeter in accordance with section 4.3.21.9 Pond and Wetland Safety Requirements,

f. All weather, legal access to the drainage reserve from a road shall be provided for maintenance,

g. Vehicle/machinery access into the fore-bay of wet ponds, or the main bay of dry ponds, shall have a min width of 2.5 m and a max gradient of 35% (1/3),

h. Perimeter access and access to inlet and outlet structures for maintenance should be provided,

i. Safety in Design principles shall be applied,

j. A draft version of Operation Maintenance Manual shall be submitted to FNDC for acceptance at the resource consent stage and its final version at the asset vesting stage.

Specific approval is required from the Parks and Recreation Manager where a pond or wetland is proposed within a Local Purpose/Drainage Reserve.

In addition to Auckland Council GD01 the following should be considered:

k. That site levels and hydraulics provide for the overall proposed design integrates seamlessly with the existing or proposed network.

l. A safe maintenance access should be provided to allow for machinery operations.

m. That the wetland must be easily drained via gravity without any or only minor pumping (i.e. for the purposes of maintenance).

n. That underground services and other utilities may be located at the subject site. Developers should check with FNDC for locations of underground services in the area.

o. The design of the wetland should prevent velocities that result in resuspension of sediment and physical damage to wetland plants (e.g. flattening).

p. That any forebay should have a bund constructed to separate the forebay from the main wetland area. This could also be vegetated (with suitably selected wetland plants) and be arranged with a 1000 mm wide crest set to the PWL.

q. That design of inlets must consider potential for erosion from all design flows. The design should comply with Auckland Council GD01 or Auckland Council TR2013/018.

r. Outlet structures should allow for drawdown of the wetland volume for management and maintenance purposes. This is important when wetland plants are establishing. Lowering water levels to support robust and vigorous plant growth, may be required.

4.3.21.9 Pond and Wetland Safety Requirements

The following safety requirements shall be provided in addition to, or in preference to, the safety requirements in Auckland Council GD01/ Wellington Council WSD for Stormwater: Treatment Device Guideline:

a. Pond or wetland embankments can be considered a dam under the dam safety regulations (See NZ Dam Safety Guideline, 2015) the requirements of those regulations shall take precedence over those stated in this document. A structure is considered a dam where:

   - Vertical height from the downstream toe of the embankment to the top is more than 4 m, or
   - The total stored volume of fluid is more than 20,000 m^3, or
   - The contributing upstream catchment is more than 20 ha.

   i. The dam shall be designed to cater for the flows and water levels generated by the 1% AEP event without adversely affecting upstream or downstream property.

b. Safety in Design assessment shall consider impacts on the adjacent properties or the community in relation to the, National Guidelines for Crime Prevention through Environmental Design in New Zealand and particularly to Section 7.2.2 Crime Prevention through Environmental Design (CPTED).

c. Embankments shall be permanently planted if the slope is steeper than 1v:4h or as it may be otherwise advised by the FNDC.

d. A safety bench shall be provided around the PWL perimeter where water depth is greater than 0.9 m. The safety bench shall be between 0.3 m and 0.5 m below PLW and between 1.0 to 2 m wide

e. The main safety measure for constructed wetlands is a 2 m wide densely planted safety bench with a 1v:8h grade to a depth of 250 mm form the PWL. The slope of the internal banks below the safety bench must be no steeper than 1v:3h, to allow easier access from the wetland should someone fall in. At PWL a safety bench 2 m wide must be provided at a maximum slope of 1v:8h.

f. Safety benches are not required where fencing is applied as per g. below. Benches shall be stabilised with emergent wetland plants and wet seed mixes.

g. Any part of stormwater structures having either a vertical drop of 0.9 m or the ability to fall directly into standing water of depth greater than 0.9 m shall be fenced in 50% permeable format and otherwise compliant with the Building Act 2004.

Note: Fencing across overland flow paths requires Specific Design by a SQEP and approval by the FNDC.

4.3.21.10Planting and Aesthetic Requirements

Wetlands can support a diverse range of plant species. Plant selection is to consider the conditions at the site, including aspect, wind effects and changing water levels. Species should be selected from local sources.

The following shall be provided:

a. Planting plans shall be submitted to FNDC for approval.

b. Plant species allocations shall be specific to soil type and conditions, site topography and exposure, post-development groundwater table levels and alignment with local indigenous native plant species.

c. Plant species shall be indigenous to the Northland Region, and eco-sourced, if practicable, although native (non-invasive) New Zealand grasses are permitted. Perennial species, that don’t die back seasonally (e.g. raupo) are a requirement.

d. During the wetland plant establishment phase (first 3-6 months), water levels should be monitored and actively managed to support robust plant growth and to avoid the plants being submerged.

Plant selection should avoid those plants whose root structure will interfere with, damage or otherwise compromise, the integrity of any structural elements of the design e.g., root incursion in liner. In particular:

e. Woody vegetation and trees are not to be planted within 3.0 m of the slope of the toe of wetlands and ponds.

f. Planting shall be provided to shade those areas of the wetland with a sun exposure, to reduce thermal warming.

Aesthetic design elements shall be in keeping with local character. Developers are to consider:

g. Integrating planting into the wider environment such as streetscape and/or park setting so that the planting is seamless (where this is desired),

h. Extending the footpath into wetland area as a boardwalk, and

i. Making the wetland shape and edges aesthetically appealing

Landscaping shall:

j. Comply with engineering requirements and Safety in Design Principles,

k. Take into account landscaping design guidance contained in Auckland Council GD04,

l. Minimise ongoing maintenance,

m. Improve stormwater water quality discharge,

n. Retain existing bush areas and tree stands where practicable, and

o. Provide, where practicable, forage and habitats for native flora and fauna.

4.3.21.10.2. Planting Zones

In addition to the aesthetic appeal and ecological benefits, plants in and around detention and treatment devices contribute to the functional requirements such as trapping sediment and preventing scouring of the embankments.

The following planting zones (Table 4-15) define the planting regimes for any detention and treatment devices. While Table 4-15 is intended for wetlands it can be applied to other devices when considering plant tolerances to wet/damp roots and frequency of inundation.

Planting Zones are provided as a guide, the developer shall provide a landscape plan for consultation and approval by the FNDC.

Table 4-15: Planting Zones

Zone	Description
Wet Zone	This area is where the pond ground surface is capable of being permanently submerged and where the plant roots may be permanently waterlogged
Marginal Zone	This area is likely to be submerged or partially submerged in a 50% AEP return storm event
Lower Bank Zone	This is the planting zone between the Marginal Zone and Upper Bank Zone where plants may be occasionally submerged (in storm events more severe than the 50% AEP return period storm). Plants are able to withstand inundation for short periods of time
Upper Bank Zone	This planting zone is above the spillway level. Plants are able to sustain damp roots for periods but should not be fully inundated

4.3.21.10.3. Plant Sourcing and Grade

Plants shall be eco-sourced from the Northland Region where practicable, from reputable nursery stock with grades that minimise potential mortality rates. It is strictly prohibited to transplant vegetation from existing wetlands and other such environments.

Plant grades shall be of a suitable size to ensure vegetation establishes rapidly with minimum mortality rates and/or replacement requirements. Trees shall be a minimum grade of 1.5 m high.

4.3.21.10.4. Species Selection

Species shall be selected with regard to good conformation, healthy robust root systems and low maintenance. Species selection considerations shall include those listed in Section 7.2.6.6 Street Tree (and other Plant) Species Selection and:

a. Compliance with Section 3.2.7.7 Sight Distance in regard to sight distances where the treatment and detention device is within or near the Transport Corridor,

b. Engineering requirements, including improving post-treatment stormwater water quality,

c. Minimal leaf fall in autumn (which can reduce efficiency),

d. Ensuring no species that drop branches, debris, or may in any other way cause damming and/or unplanned flooding in and adjacent to watercourses (such as streams and spillways) are planted within 5.0 m of watercourses.

Where trees, shrubs and groundcovers shall be planted within a Transport Corridor, reference shall be made to Section 3.2.25 Trees and Landscaping.

4.3.21.10.5. Swales Planting

Swales are used for stormwater conveyance, primarily as roadside drains in areas without kerbs and channels. They are typically turfed or grassed to ensure rapid establishment and mitigate channel scouring. Grass should be maintained at heights between 50 mm and 150 mm, depending on engineering design parameters.

Where engineering requirements permit, *Carex virata* or *Carex geminata* may be planted in the Wet and Marginal Zones. No other groundcover, shrub or tree species are permitted in these Zones. These shall be planted with mulch rounds.

Table 4-16: Swale Planting - Velocity/Grade Matrix

Type	Grade	Velocity
Swale – Roll on Turfing	Less than 2%	Less than 1.5 m/s at 20% AEP flow
Swale – Vegetated (Carex grasses)	2-5%	Less than 2.0 m/s at 20% AEP flow
Swale – Rocks	Greater than 5%	2.0 m/s or greater at 20% AEP flow

Turfed swales shall be prepared, established and maintained as per the Section 7.3.7 Grassing, Sowing and Turfing. Both during and post-establishment, the height of the turf shall be consistently maintained at least fortnightly to the designed stormwater engineering requirements. Turf shall be of a drought- resistant hard-wearing rye-grass based variety.

Swales planted with Carex species shall be planted according to Section 7.3 Construction.

4.3.21.10.6. Bio-Filter Planting

Bio-filters (e.g. raingardens and tree pits) can be planted with a mix of FNDC approved groundcovers, shrubs and trees, as site conditions and engineering requirements permit.

4.3.21.11Maintenance Requirements

Access to wetlands and ponds shall be as follows:

a. A 4.0 m wide access driveway and platform (as applicable) with all-weather surface suitable for an 8.2 tonne axle weight vehicle, at a grade of less than 1:12 shall be provided,

b. Maintenance access shall be located within any perimeter safety fencing,

c. The excavator working platform shall be level and adjacent to the clean out area,

d. The excavator working platform shall be no higher than 2.0 m above the base of the clean out area, and

e. If the access path is greater than 50 m long, then a 3-point turning area for a 10-tonne rigid truck adjacent to device (in addition to the excavator working platform): shall be provided.

4.3.22. Building Over or Adjacent to Pipelines

a. The following is not permitted without the District Council's specific approval (refer to FNDC Wastewater Drainage Bylaw 2018):

a) Building over or within a horizontal distance of 2m measured from the outside of pipe:

b) Building within the zone of influence of the pipe:

c) Building within 2m horizontally of the outside of any maintenance structure (manholes, lampholes, maintenance shafts and sewer dead ends):

d) Driven piles shall not be installed closer than 5m from any pipe unless documentation is provided to the District Council's satisfaction showing that the proposed works will not damage the asset.

b. Refer to FNDC Wastewater Drainage Bylaw 2018 for dispensation procedures.

4.4. Construction

4.4.1. Pipeline Installation

The installation of pipelines shall be carried out in accordance with AS/NZS 2566.2:2002 (where applicable) and **Sheet 31** and **Sheet 32**.

4.4.2. Materials

Materials shall be in accordance with the requirements of Section 4.3.7 Approved Materials.

4.4.3. Pipe Installation by Trench

4.4.3.1 Pipe Embedment

Where a pipeline is to be constructed through areas with unsuitable foundations, such material shall be removed and replaced with approved material. Alternatively, other methods of construction may be carried out with approval from FNDC to ensure adequate foundation and side support is provided.

Pipe bedding and protection must be specified on the design drawings and shall be in accordance with **Sheet 31** and **Sheet 32,** AS/NZS 3725:2007, and the manufacturer's specifications.

The trench design shall be of sufficient width, and in accordance with **Sheet 31**, to allow pipes to be safely laid and all embedment material properly compacted.

Embedment and fill shall be installed so that not more than 15 m of pipes shall be left exposed in the open trench at any time.

The trench's subbase shall be able to support all expected design loads over the pipe. Geotechnical investigations and report by a SQEP are required for all pipes laid in known weak grounds and/or any pipe with a diameter greater than 600 mm.

A SQEP shall inspect and record the trench ground condition before embedment material is placed or pipes are laid.

Where pipelines have protruding projections such as sockets, flanges or couplings, a suitable recess shall be provided, in the supporting material, to ensure the pipeline is fully supported along the pipe barrels.

Pipes made of plastic materials shall be laid with product labelling uppermost in the trench.

All trenches over 1.5 m depth shall be secured from collapsing.

4.4.3.2 Tolerances

Pipes shall be accurately laid to the lines, levels and gradients shown on the approved drawings using pipe-laying laser equipment. The allowable tolerances are shown in Table 4-17.

Table 4-17 Tolerances

Alignment	Tolerance
Vertical Alignment	There shall be no steps at the junctions between successive pipe segments and no point in the pipeline shall be lower than any downstream point.
Horizontal Alignment	± 100 mm
Invert levels (IL)	± 50 mm, subject to the downstream IL being lower than upstream IL.

Gradient	50 mm from a straight line between the inverts of successive manholes.

Where the installed pipes exceed the tolerances in Table 4-17, FNDC may order the removal and relaying of any affected pipes.

4.4.3.3 Backfilling and Reinstatement

4.4.3.3.1. General

The trench or embankment fill material and trench reinstatement shall be as specified on the approved drawings and in accordance with **Sheet 31**.

Trench bedding and backfill material shall be compacted in layers to the designed ground level.

In public areas, backfilling shall be installed so that no more than 15 m of trench is open at any time.

Mechanical compaction of the backfill material directly above the pipe shall not be applied until sufficient cover is reached above the pipe to prevent damage to the pipe.

Displacement of the laid pipes during backfilling and compaction shall be prevented. Compaction or vibration equipment which can produce horizontal or vertical forces, which can cause damage or excessive distortion of the pipeline, shall not be used.

The Contractor shall reinstate trenches within seven days of backfill completion unless agreed otherwise by a SQEP. The surface level of the reinstated trench shall match the surrounding surface level.

Compaction test results shall be submitted to FNDC for approval, as applicable.

4.4.3.3.2. Backfill Materials

Selected material excavated from the trench may be used for backfilling trenches subject to SQEP approval.

In roads and paved areas, where material excavated from the trench cannot meet the compaction standards in Section 4.4.3.3.3 Compaction, imported granular material shall be used.

Surplus and unsuitable material from the excavation shall be appropriately disposed of.

4.4.3.3.3. Compaction

Within the Transport Corridor

Trenches in the Transport Corridor, or under private access or paved (vehicular) areas, shall be backfilled and compacted in layers of thickness commensurate with the compaction equipment to a density of at least 95% of the maximum dry density. Field compaction shall be tested as follows:

a. For cohesive soils - New Zealand standard compaction test, nuclear densometer and shear vane.

b. For non-cohesive soils - New Zealand standard compaction test, nuclear densometer or dynamic cone penetrometer (Scala Penetrometer).

Testing by other means shall be subject to the approved Inspection and Testing Plan or conditions of Engineering Design Approval.

Compaction testing of sub-base and base course shall be in accordance with requirements 3.3.4 Pavement Testing.

The SQEP shall specify a testing regime to verify the compaction effort meets the density specified to support the designed traffic loading.

The Contractor shall undertake tests in accordance with the approved Inspection and Testing Plan or conditions of the Engineering Design Approval, to demonstrate that the specified compaction standards have been achieved throughout.

Outside of the Transport Corridor

Trenches outside of roads or paved (vehicular) areas shall be backfilled and well compacted with mechanical equipment in layers not exceeding 300 mm thick to the specified finished ground level.

Under no circumstance shall the bearing capacity of the backfill material be less than that of the material prior to excavation, for the full depth of the trench. Scala Penetrometer tests may be used to establish the criteria for compliance, with a minimum of one test per 50 m of trench or 50 m^3 of trench backfill, whichever is greater.

Compaction testing of fill material shall be in accordance with NZS 4402:1988/1986. The Contractor shall undertake tests to demonstrate that the specified compaction standards have been achieved throughout.

4.4.4. Trenchless Construction

4.4.4.1 General

Trenchless technology may be preferable or required 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.

Trenchless construction shall only be used for applications in which the specified tolerance can be achieved.

Pipes used for trenchless installation shall have suitable mechanically restrained joints, specifically designed for trenchless application, which may include integral restraint, seal systems, or heat fusion welded joints.

Any trenchless technology and installation methodology shall be chosen to be compatible with achieving the required gravity pipe gradient.

4.4.4.2 Installation Methods

Trenchless installation methods for new pipes include

a. Horizontal directional drilling (HDD) (PVC with restraint joint/fusion welded PE):

b. Uncased auger boring/pilot bore micro-tunnelling/guided boring (PVC with restraint joint/fusion welded PE):

c. Pipe jacking (GRP/ reinforced concrete).

4.4.5. Joints

4.4.5.1 General

Specification of joints on gravity mains shall be as follows.

a. All pipes shall have flexible joints of an approved type, such as Rubber ringed joints:

b. Steel pipes shall be flexibly jointed (bolted unrestrained mechanical coupling 'denso' wrapped and sealed with approved outer wrapping or approved rubber ring):

c. Joints shall be provided adjacent to manholes to the requirements of AS/NZS 2566.2:2002 with the exception of PVC where proprietary connections may be used.

4.4.5.2 Rubber Ring Joints

Rubber ring joints shall be installed strictly in accordance with the manufacturer's instruction. Care should be taken to ensure that the rubber rings are located evenly around the joint with no twists in them. The pipe shall be pushed up firm and tight to the joints.

4.4.5.3 Welding PE Pipes

Butt or electrofusion welding of PE pipes shall be undertaken by a FNDC approved contractor using calibrated and data logged welding machines. Only employees of an approved contractor who have successfully completed a Water New Zealand approved welding course for polyethylene pipe, or re-fresher in the past two years, shall be permitted to physically undertake welding.

Prior to commencing work, the following shall be provided:

a. Copy of current calibration certificate(s) of the welding machine (not more than 12 months old)

b. Registration number of welder, and current certification (not more than 24 months old).

All welding of PE pipes shall be data logged.

Welding shall take place in a covered environment to avoid contamination of weld faces and prepared pipe.

For all electrofusion welds, including tapping saddles, a mechanical scraper with winding mechanism shall be used to ensure even finishing. Hand scraping of pipe ends, with the appropriate tools, will only be permitted if mechanical scraping is not practicable and with prior permission from the Distribution Engineer. Electrofusion welds shall be undertaken using clamps and the equipment correctly calibrated.

4.4.5.3.2. Butt Welded Jointing

In addition, welders may be required to carry out satisfactory test welds for each joint type and to stamp the welder's number on each joint. Butt welds shall be, at least, 90% of the tensile strength of the parent pipe material, when tested in accordance with ISO 13953:2001.

All internal weld beads shall be removed in an approved manner, to be smooth and flush with the pipe inner surface, without compromising the strength of the pipe joint.

4.4.6. Manholes

4.4.6.1 Channels and Benching

A semi-circular channel shall be formed in the concrete floor of the manhole. Benching shall then rise vertically from the spring line of the pipe to the height of the soffit and then be sloped back at a gradient of 1:3 (refer **Sheet 39**). A U3 standard of finish as specified in NZS 3114:1987 shall be achieved.

The flow channel shall be formed so that it presents an evenly curved flow path through the manhole. The cross section of the flow channel shall be uniform.

Benching shall be floated to a dense, smooth hard surface using 3:1 sand cement mortar and a steel float. Side branches shall be similarly formed with a smooth bend into the main channel.

Use of pre-formed benched manhole bases from FNDC Approved Materials List - Wastewater and Stormwater is an acceptable alternative to formed in-situ benching.

4.4.6.2 Flexible Joints

All pipes, other than PE pipes, shall have a flexible joint adjacent to the manhole on all incoming and outgoing pipes not more than 600 mm away from the manhole wall. The upper part of the pipe inside the manhole shall be cut back to the wall, the reinforcement cut out and the ends plastered with a cement mortar to a neat finish. Where the pipe is cut using a power saw the ends of the steel reinforcement shall be protected from corrosion by the application of epoxy before rust has developed. Refer to **Sheet 39**.

4.4.6.3 PE Pipe Connections

PE pipe shall be connected to the manholes with sliding joints, as per **Sheet 33**.

4.4.6.4 Sealing of Manholes

Where precast manhole units are used, the joints of abutting units shall be sealed against ingress of water with an approved sealant and with epoxy mortar on the inside and outside of the joints.

Plastic manholes shall be sealed, where required, in accordance with the FNDC Approved Materials List - Wastewater and Stormwater.

4.4.6.5 Manhole Steps

The steps shall be bolted through the walls using properly formed and recessed bolt holes.

The step shall have a washer welded to it on the appropriate angle to seat flush against the inside of the manhole chamber.

Prior to tightening, BM100 shall be placed around the stainless-steel shank both inside and outside the manhole riser. After the steps have been tightened in place the outside recess which houses the nut shall be sealed with Expocrete 'UA' or acceptable equivalent in accordance with the manufacturer's directions. Plastering of the recess will not be approved. The sealant shall be applied at least 48 hours before the manhole risers are required for construction.

4.4.6.6 Concrete

All concrete used for manufacturing manholes shall have a minimum crushing strength of 20.0 MPa at 28 days, unless otherwise specified or detailed by FNDC.

4.4.7. Connections

Connections will preferably be made into manholes.

Direct connection of a minor pipeline into a major pipeline shall be in accordance with the following:

a. The minor pipe diameter shall not be greater than half of the major pipe diameter:

b. Connection is made via a suitable prefabricated junction or saddle:

c. The distance between the pipeline connection and the closest inspection point shall not exceed 25 m:

d. Saddling of catch-pit leads into primary lines is permitted provided that the connection is made at 45º or less to the direction of primary flow:

e. Saddling of double catch-pits is not permitted:

f. Connections shall be sealed with removable caps until required.

g. Connection/cap and locations, and depths to invert shall be accurately measured and shown on As-Built Plans in accordance with the requirements of Section 1.7.2 As-Built Plans, Asset Information Schedules, Operation and Maintenance Manuals:

h. The cap position shall be marked with a wooden stake (100 x 50 mm) with green ‘SW’ painted/fixed onto the stake and extending from the invert of the connection to a minimum of 600 mm above ground level.

i. Connections shall be constructed as per **Sheet 37**.

j. All connections to FNDC piped network or work on FNDC piped network shall be undertaken by a Licensed Contractor.

4.4.8. Catch-Pits

The connection of the lead into the catch-pit shall be constructed as detailed in **Sheet 34**.

4.4.9. Outlets

The Developer shall be responsible for the structural integrity and maintenance of the bank stabilisation/erosion protection structures and for any erosion control works that become necessary to preserve the integrity and stability of the stream, river, channel or water course and/or to control erosion until the structure is vested to FNDC.

4.4.10. Stormwater Treatment and Detention Devices

Planting, protection, site preparation, spacing, and mulching shall be in accordance with the Parks and Recreation Specification.

4.5. Completion of Works

4.5.1. Testing and Inspections for Pipelines

A pipelines pressure test shall not normally be required however FNDC reserves the right to require a low-pressure air test of the pipes.

4.5.1.1 Low Pressure Air Test

a. Introduce air to the pipeline till a pressure of 300 mm of water is reached. (This shall be measured by a manometer such as a 'U' tube, connected to the system):

b. Wait until the air temperature is uniform (indicated by the pressure remaining steady):

c. Disconnect the air supply:

d. Measure pressure drop after five minutes:

e. The pipeline/manhole is acceptable if the pressure drop does not exceed 50 mm.

4.5.1.2 Inspections

The Developer/Contractor shall ensure that any progress inspections and associated approvals are granted before continuing with the installation. Failure to follow this process may result in the Developer/Contractor removing items or excavating a competed work to allow inspection. The progress inspections include:

a. Set out:

b. Excavation and bedding:

c. Backfill:

d. Pre-pour Form and Reinforcing:

e. Pre-Cover Installation:

f. Water Tightness:

4.5.2. Manholes

Manholes shall be visually inspected to ensure the standard of construction and finishing is acceptable.

4.5.3. CCTV Inspections

4.5.3.1 General Requirements

CCTV inspection shall be carried out on every new system to vest in Council. The timing of CCTV inspection shall be determined by FNDC.

CCTV inspections and deliverables shall be in accordance with The New Zealand Gravity Pipe Inspection Manual, Fourth Edition.

All defects shall be remedied to the satisfaction of FNDC. Where defects are found and repaired the section of pipe shall be inspected to ensure that there are no further problems.

CCTV inspection shall be carried out for all existing stormwater pipes before and after the construction works, which may affect the pipes by either directly interfering with the network or indirectly by using machinery and/ or plant at the site which may impose heavy loads and vibrations onto the stormwater network.

CCTV inspection shall be carried out in dry weather and where there is no flow which may affect the quality of video and still images

If there are pipe blockages and debris found the contractor shall apply to FnDC to flush the pipe with water prior to the CCTV being completed.

The CCTV camera shall travel upstream.

CCTV maps with log sheets (showing the pipe GIS identification references, still images of critical locations with distances form the stat node, and indication of defects types and severity) shall be submitted to the FNDC.

4.5.3.2 Deliverables

The following deliverables are required:

a. As-built plans and/or FNDC GIS maps for existing assets, showing pipes and nodes being inspected.

b. Computer generated log sheets showing the pipe identification references for new and existing assets; still images of critical distances from the starting node; and indication of defect types and severity.

c. CCTV inspection record in digital video format.

d. CCTV footage shall also be referenced to the node unique numbers and shown on As-Built Plans and/or FnDC GIS maps.

e. Still images shall be in a source file and a PDF format.

f. CCTV inspection summary sheets in a PDF digital format.

4.5.3.3 Header Information Required

Refer to FNDC QA/QC Manual 2022 for CCTV header information requirements.

Chapter 5: Wastewater

5.1. Introduction

5.1.1. Wastewater System Description

Wastewater systems are required to collect and convey wastewater for subsequent treatment and disposal. This section covers the design and construction requirements for wastewater systems that are:

a. Gravity and/or pumped (including Pressure Sewer) reticulation networks to be vested to FNDC.

b. Private reticulation systems that discharge into a FNDC reticulation system.

c. Private wastewater networks and on-site treatment and disposal systems.

FNDC require a proposed development to connect to a public wastewater system if:

d. There is a public wastewater system with sufficient spare capacity available for connection: and

e. FNDC considers that it is reasonable or practicable to require connection: or

f. FNDC considers that there is a benefit to the operation of the public wastewater system, or there is an environmental benefit to require connection.

Alternative reticulation systems such as solids free systems or vacuum systems shall require FNDC's specific approval, in particular the approval of applicable design and construction requirements.

Where a connection to the public system is not available, or where a public system does not exist, an alternative system shall be provided. This shall consist of wastewater on-site treatment and disposal, either individual or communal in nature. Such systems shall be subject to separate resource consent approvals and shall obtain any necessary NRC consents prior to lodging the consent application to the FnDC.

5.1.2. Objectives

a. To provide each property or household unit, a connection to an environmentally sustainable public wastewater system, which produces no objectionable odours, does not overflow, adversely affect receiving environments, and is affordable.

b. To ensure for properties where a public reticulation system is not available, that wastewater is collected, treated and disposed of in a way which is consistent with relevant building and discharge consents.

c. To ensure where properties connect to a sewer network (public or private), that the network meets the FNDC's performance standards.

d. The wastewater network shall be cost efficient over its design life while accounting for environmental and community impacts through integrated three waters management and water reuse.

5.1.3. Performance Standards

New wastewater systems shall achieve the following minimum standards:

a. Designed to meet the minimum design life requirement (Refer to Section 5.2.4 Design Life), taking into account internal and external pressure loadings, soil conditions and wastewater characteristics.

b. Minimise the potential for stormwater ingress and wastewater egress through the use of industry best practice for design and construction.

c. Ensure that the performance of the existing wastewater system is not adversely affected by connection of the proposed system.

d. Ensure that the proposed system does not surcharge at the peak design wet weather flow and is designed not to overflow.

e. Provide flow buffering storage only where specifically approved by FNDC for the purpose of balancing flows in the existing network. Storage, if approved by FNDC, shall clear within 24 hours, or such lesser time as required to prevent sewage turning septic.

f. Reticulation pipelines shall be designed to be self-cleaning.

g. Designed to service the entire catchment area and any future extension of the system.

h. SQEPs shall adopt best practice to ensure a system with lowest whole of life cost.

5.1.4. Reference Documents

The following documents are referenced in this Chapter:

Note it is the responsibility of the ES user to ensure the most up to date referenced document is sourced.

5.1.4.1 Statutory

Building Act 2004

New Zealand Building Code

NRC Regional Plans

Wastewater Drainage Bylaw 2018.

FNDC Trade Waste Bylaw 2009

5.1.4.2 New Zealand Standards

AS 1579:2001 - Arc-welded steel pipes and fittings for water and wastewater

AS 2129:2000 - Flanges for pipes, valves and fittings

AS 3996:2019 - Access covers and grates

AS/NZS 1260:2017 - PVC-U pipes and fittings for drain, waste and vent applications

AS/NZS 1547:2012 - On-site domestic wastewater management

AS/NZS 2280:2020 - Ductile iron pipes and fittings

AS/NZS 2566.2:2002 - Buried flexible pipelines - Installation

AS/NZS 2638.1:2011 – Gate valves for waterwork purposes – Part 1: Metal seated

AS/NZS 2638.2:2011 - Gate valves for waterworks purposes - Part 2: Resilient seated

AS/NZS 2980:2018 - Qualification of welders for fusion welding steels – Additional requirements for Australia and New Zealand

AS/NZS 3725:2007 - Design for installation of buried concrete pipes

AS/NZS 4058:2007 - Precast concrete pipes (pressure and non-pressure)

AS/NZS 4087:2011 - Metallic flanges for waterworks purposes

AS/NZS 4130:2018 - Polyethylene (PE) pipes for pressure applications

AS/NZS 4158:2003 - Thermal-bonded polymeric coatings on valves and fittings for water industry purposes

AS/NZS 4671:2019 - Steel for the reinforcement of concrete

AS/NZS 4998:2009 - Bolted unrestrained mechanical couplings for waterworks purposes

AS/NZS 5065:2005 - Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications

BS EN 1124 Series: Pipes and fittings of longitudinally welded stainless-steel pipes with spigot and socket for wastewater systems

ISO 13953:2001 – Polyethylene (PE) pipes and fittings - Determination of the tensile strength and failure mode of test pieces from a butt-fused joint

NZS 3114:1987 - Specification for concrete surface finishes

NZS 4402:1988/1986 - Methods of testing soils for civil engineering purposes

NZS 4442:1988 - Welded steel pipes and fittings for water, sewage and medium pressure gas

5.1.4.3 District Council Documents

Approved Materials List - Wastewater and Stormwater *(To be provided by FNDC on request)*

FNDC Connect-to-our-water-network Commercial and Residential Water and Wastewater Connection Application Forms

Wastewater Drainage Bylaw 2018.

FNDC Trade Waste Bylaw 2009

Quality Assurance / Quality Control Manual for Vested Assets - Inspection and Handover Procedures (2022)

5.1.4.4 Other Referenced Documents

Water New Zealand; New Zealand Gravity Pipe Inspection Manual Fourth Edition, 2019

Water Services Association of Australia, WSA 02-2014 - Gravity Sewerage Code of Australia Version 3.1

Water Services Association of Australia, WSA 04-2005 - Sewage Pumping Station Code of Australia Version 2.1

Water Services Association of Australia, WSA 07-2007 - Pressure Sewerage Code of Australia Version 1.1

5.1.5. Private Wastewater Provision

5.1.5.1 General

Properties not served by a FNDC owned and operated, public wastewater system shall be provided with either:

a. Reticulation, and a communal treatment and disposal system: or

b. An individual on-site treatment and disposal system.

All private wastewater systems shall comply with the NRC Regional Plans (or any amendments as applicable) either as permitted activity or by resource consent.

A Site Specific Assessment (SSA) to determine the suitability of waste water disposal to land shall be carried out by a SQEP using Appendix B ES-SEW1 in accordance with the Site-and-Soil Evaluation Procedures of AS/NZS 1547:2012 (or any amendments as applicable). The assessment shall be submitted to FNDC with the resource consent application.

In particular, the SSA shall demonstrate compliance with the permitted activity rules of the NRC Regional Plans (or any amendments as applicable) for each lot, and demonstrate for each lot that:

c. The site is suitable for the disposal system proposed.

d. Adequate disposal and reserve area is available.

If the outcome of the SSA is that the activity is not permitted under the regional rules, then consent from the NRC will be required to accompany the consent application to the FNDC.

The SSA shall reference the following:

e. The NRC Hazard Plans, and,

f. FNDC's GIS system when submitting designs for on-site effluent systems. In particular, the following GIS layers shall be referenced in the investigation:

   i. Land Resources Aquifers at risk:

   ii. Land resources Streams:

   iii. Hazards Effluent on slope stability:

   iv. Hazards Effluent suitability:

   v. Pressure sewer Location of area of benefit.

5.1.5.2 Council taking over Private Systems

The FNDC may agree to take over responsibility for the ownership, management and operation of a private wastewater system (in whole or in part) provided that:

a. The system serves a minimum of 16 lots,

b. The system meets the design and construction standards as described in this Chapter,

c. Adequate provision was made for ongoing maintenance and operation of the system during private ownership,

d. Certified as-built drawings, asset schedules and operation and maintenance manuals are provided (in accordance with the requirements of the ES), and

e. All necessary NRC consents have been obtained and shall be transferred to the FNDC.

Existing private systems will not be accepted to vest in FNDC unless it is proven that all parts of the system have been designed and constructed in accordance with the ES and referenced Bylaws and policies.

5.1.5.3 Individual On-Site Treatment and Disposal

On-site wastewater treatment and disposal systems require:

a. Net lot size in excess of 2,000 m²,

b. A SSA that determines that effluent can be disposed of to the site, in compliance with the NRC Regional Plans (or any amendments as applicable) permitted activity rules, and

c. Adequate provision for ongoing maintenance and operation of the proposed system.

Note: Approval of an on-site wastewater treatment and disposal systems will be determined by FNDC during the consenting phase of a development application.

5.1.5.4 Private Treatment and Disposal

Where site size, ground conditions, topography, etc. limit the ability for individual on-site effluent treatment and disposal, communal systems shall be considered.

These systems may be solids free sewer systems such as septic tank effluent drainage (either septic tank effluent gravity or pump systems, or combination), which discharge to a central treatment area.

The following shall be considered when a private system is proposed:

a. A resource consent from NRC may be required,

b. Whether to have the system made public,

If the system is kept private, the requirements include:

c. A formal legal agreement between all land owners in which each is individually and severally responsible for the maintenance and performance of the system and ongoing ownership of the disposal area. This agreement shall:

   i. Require each landowner to be a member,

   ii. Ensure that obligation under the agreement is transferred to a new owner(s) if the property is on-sold: and,

   iii. Identify the share of the land disposal area that is allocated to each owner, and restrict owners from exceeding this share.

d. A contract with an approved company is entered into on an ongoing basis to attend to the specified maintenance and any equipment failure,

e. A comprehensive management plan is supplied and approved by the FNDC.

If it is proposed to have the system become a public asset, the Developer shall engage with FNDC at an early stage in order for FNDC to consider the proposal. FNDC’s specific approval of the design and construction requirements is required to be included in the resource consent conditions.

5.1.6. Upgrading of Existing Wastewater Systems

Connection of a proposed development to an existing wastewater system (public or private) shall not compromise the performance standards of the existing system.

Alteration of the existing wastewater network to achieve the required performance standards shall be at no cost to FNDC.

Should the relocation of a FNDC main be approved as part of Resource Consent or Building Consent application, a management plan shall be submitted to FNDC for approval **before** any works commence. This management plan is to include the construction methodology, assessment of risks and contingency plans for the proposed works.

5.1.7. Connection to Existing Wastewater Scheme

All lots within the 'Area of Benefit' of a sewerage scheme shall be provided with a connection to the FnDC system unless FNDC confirms in writing that a connection is unwarranted, unavailable or unsuitable.

Where properties are adjacent to an area of benefit, FNDC may approve a connection or require that a connection to the system be provided. Refer to Section 5.2.8 Connections for connection details.

5.1.8. Recycled Water

The provision of any recycled water (treated wastewater) system whether public or private shall be subject to specific FNDC approval.

Early consultation with FNDC will be required to determine the acceptability of a proposed recycled water system, and to assess appropriate consent conditions.

Reticulation of recycled water will require careful consideration of backflow prevention issues, metering, pipe materials and colours.

5.2. Design

5.2.1. Engineering Design approval

5.2.1.1 Content of Design Submission

In addition to the general requirements of Section 1.5.3 Detailed Design/Approval, the information submitted for EDA of wastewater designs shall provide (as applicable) the following:

a. That the existing wastewater system that the development proposes to connect to has adequate capacity to serve the proposed development, including treatment capacity and consent to discharge.

b. That the minimum performance standards of the existing wastewater system will not be compromised by the proposed connection.

And EDA application shall also include details of:

a. Pipe sizes, materials, and layout of the reticulation, (including the existing reticulation).

b. Hydraulic design, including providing adequate capacity and self-cleaning velocity.

c. Service connection locations to serve the buildable area where a gravity reticulation system is proposed.

d. Engineering design of pump stations, rising mains and pressure sewer systems (including all calculations).

e. The replacement requirements of system components that have asset lives shorter than the required design life of the system (e.g. pumps, valves, etc.).

Any departures from the ES shall be noted and fully justified. Such assessment shall be carried out by a SQEP who is working within their competencies in accordance with the requirements of Section 1.5.1.3 Risk Based Assessment Framework and Table 1-4.The SQEP shall identify the design standards used and certify that the design complies with the referenced standards.

The SQEP shall certify that the works through all stages until completion are in accordance with the requirements of Section 1.5.1.3 Risk Based Assessment Framework and Table 1-4.

5.2.1.2 Design Drawings and Specifications

Design drawings complying with the requirements of Section 1.5.3.3.5 Design Statements and Engineering Plans and Appendix G Drawing Standards shall be provided for approval.

5.2.2. Design Criteria

5.2.2.1 General Requirements

The FNDC may specify the diameters and classes of pipes to be used for all reticulation within the development and specify connection points and reticulation alignment.

The FNDC will provide (on request) for design purposes, details held by FNDC of the existing wastewater reticulation. Where necessary, and at the Developer's expense, FNDC may investigate the capacity of the downstream wastewater reticulation and treatment facilities to determine their adequacy.

Design shall consider domestic wastewater, industrial wastewater, and for gravity reticulation, wet weather peaking factors.

Design shall consider the hydraulic adequacy of the network including the specified levels of service, the ultimate service area of the system and impact on the existing network.

All reticulated systems shall have adequate capacity to convey the design flow without surcharging.

Reticulation shall be designed, detailed, constructed and tested to ensure that there is no infiltration at commissioning, and to minimise infiltration/ex-filtration over the life of the system.

The use of sealed maintenance and inspection structures as an alternative to the conventional maintenance structures described in the ES, will require specific approval by the FNDC.

Note: Design flow requirements in this section are for reticulated sewers – for onsite systems, design flows are based on AS/NZS 1547.

5.2.2.2 Residential Flows

Table 5-1 shows the minimum inflows to be provided for (depending on the source of the water supply) for various uses related to people based activities. The flows are average daily dry weather flows (ADWF).

Table 5-1: Design Inflows for Residential Type Activities (Reticulated Sewers only)

Source		Wastewater Flow Allowances (litres / person / day)	
		Tank Supply	Reticulated / Bore Supply
Household		140	200
Hotels / Motels	Guests and resident staff	140	200
	Other Non-resident	30	40
Community Halls	Banqueting	20	30
	Meetings	10	15
Marae	Day only	40	40
	Day / Sleep over	140	140
Restaurant / Bar / Café	Dinner	30	30
	Lunch	25	25
	Bar patron	20	20
Schools	Pupils plus staff	30	40
Camping Grounds	Fully serviced	100	130
	Recreation areas	50	65
Retirement Home	Residents	200	220
	Day staff	40	50
Hospital / Rest Home		220	250

Where a particular activity is known (such as development in a holiday area), figures specific to the activity shall be used.

Where particular activities are not known or are not being specifically designed for in accordance with Table 5-1, then a default flow of 200 litres/person/day shall be used.

Table 5-2: Peaking Factors to be applied to ADWF Flows

Factor	Gravity Sewer Reticulation
Dry weather peak daily flow	2.5 x ADWF
Peak wet weather flow (PWWF)	5 x ADWF

Additionally:

a. Number of people per Household Unit = 4.0

b. Number of Household Units per gross hectare = 15

These factors are the default figures where there is no additional information available and shall be applied to the default flow figure. The FNDC may consider alternative parameters where these are supported by existing data.

5.2.2.3 Industrial / Commercial Flows

Wastewater system design for any commercial or industrial development, or development that includes future commercial or industrial lots, shall be undertaken by a SQEP.

The SQEP's proposed design assumptions, and parameters for the estimation of design wastewater flows, require Specific Approval prior to consent so that these can be included in appropriate conditions of Consent.

For commercial/industrial development of individual lots, specific assessment shall be carried out by a SQEP for the wastewater flows generated by the proposed industry. Where these flows are exceeded or differ from any parameters referenced in the development consent, specific approval to connect is required from the FNDC.

Provision for liquid trade waste and 'wet' industries shall be considered and provided for by the design.

Provision for trade waste shall be made by arrangement with FNDC and shall be subject to the provisions of the FNDC Trade Waste Bylaw 2009.

When assessing the ultimate development flows from a wider area, the flow rates in Table 5-3 (Business Dry Weather Flows) may be used as a design basis. The sensitivity of the pipe sizes and capacity of reticulation components shall be determined to ensure sufficient capacity is available in the event of heavier than-expected flows.

Table 5-3: Design Dry Weather Flow Rates (Business)

Minimum Design Flows	Flow Rates (litres/sec/ha)
Light water usage	0.4
Medium water usage	0.7
Heavy water usage	1.3

Note: These flows include both sanitary wastewater and trade wastes, and include peaking factors, and includes Business 1-4, Marsden Point Port and Airport Environments. Allowance shall be made for inflow/infiltration in wet weather.

5.2.2.4 Hydraulic Design

Unless the catchment is likely to exceed 250 Household Units, and where no industrial or commercial flow, or flow from a pumping station is involved, 150 mm diameter gravity pipes laid within the limits of Table 5-5 (Minimum Grades for Wastewater Pipes) will be adequate without specific hydraulic design.

Where a catchment does not comply with the above criteria, a specific hydraulic design shall be carried out.

Hydraulic design shall be based on either the Colebrook-White formula or the Manning formula. Material coefficients for pipes up to DN 300 are given in Table 5-4. These values take into account joints, slime, debris etc. and apply for pipes up to DN 300.

Pipes exceeding DN 300 require Specific Design by a SQEP.

Table 5-4: Coefficients for Gravity Lines

Material	Colebrook-White K *(mm)*	Manning
PVC	0.6	0.011
PE	0.6	0.011
Cement lining (DI & steel, concrete)	1.5	0.012
PP	0.6	0.011

5.2.2.5 Minimum Grades for Self-cleaning

The minimum allowable self-cleansing velocity in pipelines is 0.6 m/s and shall be calculated using peak dry weather flow.

Minimum pipeline gradients are specified in Table 5-5 below. The Developer shall demonstrate that the design can achieve self-cleansing velocities regardless of the selected pipeline gradient.

Table 5-5: Minimum Grades for Gravity Wastewater Pipes

Pipe Size	Location	Minimum Grade (%)	Minimum Grade (Ratio)
Connections and Permanent Ends of Reticulation			
DN 100	Property connection	1.65	1:60
DN 150	Property connection	1.20	1:83
DN 150, 225 & 300	Permanent upstream ends of reticulation with 10 or less residential lots connected	1.00	1:100
Wastewater Pipes – Reticulation with more than 10 Residential Lots (except PE pipelines and pipes installed by trenchless methods)			
DN 150	Recommended minimum grade	0.67	1:150
	Absolute minimum grade	0.55	1:180
DN 225		0.33	1:300
DN 300		0.25	1:400
PE Pipes and Pipes Installed by Trenchless Methods			
All sizes	To suit installation method, but not less than	1.65	1:60

5.2.2.6 Steep Pipeline Grades

Where the pipeline grades are greater than 1:3, and pipes do not exceed 450 mm diameter, anchor and/or anti-scour blocks shall be constructed in accordance with **Sheet 32**. Specific Design by a SQEP is required where pipe diameters exceed 450 mm.

On gradients flatter than above where scour is a problem, stabilisation of the trench backfill is required.

5.2.2.7 Maximum Velocity for Gravity Lines

The maximum design velocity for peak wet weather flow is 2.5 m/s. Where a steep grade that will cause a velocity greater than the maximum allowed is unavoidable refer to guidance in the WSA 02-2014 (or any amendments as applicable) for precautions and design procedures. The FNDC's specific approval will be required where this velocity limit cannot be met.

5.2.2.8 Structural Design for Installation of buried Pipes

5.2.2.8.1. Design Guidance

AS/NZS Standards provide methods and data for calculating the working loads on buried pipes due to:

a. The materials covering the pipes:

b. Superimposed loads.

Pipelines shall be designed in accordance with guidance in the applicable AS/NZS standards and as outlined in the following sections.

5.2.2.8.2. PE And PVC Pipes

AS/NZS 2566.2:2002, including the commentary provides the method to assess the pipe selection and embedment method for buried flexible pipelines.

5.2.2.8.3. Concrete Pipes

AS/NZS 3725:2007 provides the basis for determining the vertical working load on concrete pipes under a range of installation conditions. The standard relates these loads to the loads applied to pipes so that the appropriate 'strength class' of pipe can be selected to suit the 'pipe support' method chosen for the particular field application.

The minimum pipe support design shall be 'H' (H1 and H2).

For definitions refer to AS/NZS 3725:2007.

5.2.3. Piped System Layout

5.2.3.1 General Requirements

In general pipes shall be located in road berms, but they may be located in public reserves or on private property (see Section 5.2.3.2 Reticulation on Private Property).

Easements in favour of FNDC are required for all public wastewater systems and/or components that are located in private property. This includes easements over proposed systems and components located in property owned by third parties.

The order and layout of pipes and other underground services shall be in accordance with **Sheet 29.** The minimum clearance between wastewater pipes and other services shall be in accordance with **Sheet 30**.

In addition, pipelines and pipe system layouts shall meet the following requirements:

a. Pipelines should have a straight horizontal and vertical alignment between maintenance structures. The FNDC's specific approval is required for curved pipeline alignments, and for changes in pipeline gradient that do not occur at a maintenance structure.

b. Where a wastewater pipeline changes location within a street, crossings of roads, railway lines, and underground services shall, as far as practicable, be at an angle of 45 degrees or greater. Pipes shall be located and designed to minimise maintenance and crossing restoration.

c. Valves and fittings on pressure pipelines shall not be located under the formation of a (public or private) road or vehicle access, and the FNDC's specific approval is required to locate pipelines under the formation.

d. In steep terrain, the location of pipes shall be governed by topography. The pipe layout shall conform to the existing surface gradients as far as practicable to remove the need for deep installation due to gravity pipelines operating against the fall of the ground.

5.2.3.2 Reticulation on Private Property

Location of FNDC owned reticulation within private property, or down right of ways or private roads, requires specific approval from the Wastewater Manager.

Approval of public reticulation located in private property or right of ways will depend upon:

a. The number and length of connections required: and/or

b. The requirement to provide a service connection to the lots.

If approved:

a. The pipeline shall be parallel to the boundary and no more than 1.5 m from the boundary,

b. An easement in favour of FNDC over the private property, right of way or private access is required,

c. Pressure sewer mains shall be laid in a duct, and

d. The required minimum clearances from other services (refer **Sheet 30**) and future buildings shall apply.

The FNDC may require the legal width of an access to be greater than the minimum specified in Section 3.2.28 Private Accessways in order to ensure minimum clearances from other services are provided.

5.2.3.3 Minimum Cover

All pipelines, other than those in private property, shall be specifically designed to support the likely loading in relation to the minimum cover to be provided in accordance with the terms of AS/NZS 3725:2007.

The minimum cover over pipes shall be:

a. 600 mm in berms and areas not subjected to traffic loading, or

b. 900 mm under carriageways and trafficked areas.

Any pipelines that cannot achieve the minimum pipe cover requirements shall:

a. Be specifically designed by a SQEP to support the likely loading in relation to the actual cover to be provided, or,

b. Be provided with pipe protection in accordance with the reinforced concrete slab protection shown on **Sheet 32**.

Note: For pipelines in private property the depth of cover is dealt with under the Building Act 2004.

5.2.3.4 Clearance from Structures

Pipes adjacent to existing buildings and structures shall be located clear of the 'zone of influence' of the building foundations. If this is cannot be avoided, a Specific Design shall be undertaken to address the following:

a. Protection of the pipeline through both construction and a lifetime period,

b. Long term maintenance access for the pipeline, and

c. Protection of the existing structure or building.

Any such proposals shall be considered an Alternative Design (Section 1.5.1.2 Alternative Designs). Approval shall be at the discretion of the Wastewater Manager.

Sufficient clearance (a minimum offset of 2 m from any building or structure) for laying and access for maintenance is also required.

5.2.3.5 Aerial Pipes and Pipe Bridges

Any such proposals shall be designed by a SQEP and considered an Alternative Design (See Section 1.5.1.2 Alternative Designs) and approval shall be at the discretion of the Wastewater Manager.

If approved by FNDC, the following Specific Design requirements shall be satisfied:

a. Pipe bridges shall be specifically designed for the particular environment.

b. The underside of the pipe bridge structure shall be a minimum of 300 mm above the 1% AEP (+ CC 20%) flood levels.

c. Where existing bridges are not above the 1% AEP flood levels, the pipe shall be located on the downstream side of the bridge.

d. Piles shall be concrete unless specifically approved by the FNDC.

e. Pipelines across existing bridges shall be Grade 304 Stainless Steel with an approved corrosion protection coating, if required.

5.2.3.6 Inverted Siphons

Inverted siphon systems shall only be proposed when other alternatives have been exhausted. Any such proposals shall be considered an Alternative Design (See Section 1.5.1.2 Alternative Designs) and approval shall be at the discretion of the Wastewater Manager.

Approval shall be subject to the following design criteria being met:

a. Size the pipes to ensure peak daily velocities of at least 0.6 m/s:

b. The maximum pipeline slopes shall be 45° and 22.5° on the downward and upward legs respectively, with manholes placed to make cleaning easier:

c. Provide isolation valves to help with maintenance flushing unless these are demonstrated as not necessary:

d. Design for potential differential settlement between the manhole and the siphon piping when in difficult bedding conditions:

e. Surround piping with concrete when crossing watercourses that are periodically dredged or are prone to scour:

f. Siphons are not installed on any lateral.

5.2.4. Design Life

All elements of wastewater systems to be vested to FNDC shall have a design life expectancy of at least 100 years.

Where components of the wastewater system, such as pumps, valves, and control equipment, require earlier renovation or replacement, it shall be considered an Alternative Design (see Section 1.5.1.2 Alternative Designs) and assessed as a departure from the ES, requiring specific approval by the Wastewater Manager. The proposed wastewater works shall document the asset renewal requirements for each component in the Operations and Maintenance Requirements, which shall be provided with EDA.

5.2.5. Approved Materials

Materials and products used on wastewater networks shall be in accordance with the FNDC Approved Materials List – Wastewater and Stormwater.

The use of material not described in the FNDC Approved Materials List – Wastewater and Stormwater shall be considered Alternative Designs, refer to Section 1.5.1.2 Alternative Designs

The FNDC Approved Materials List – Wastewater and Stormwater will be updated from time to time at the discretion of FNDC.

PE pipes for gravity sewer application shall be black outer with white or brown inner lining. Blue pipes or black pipes with a blue stripe shall **NOT** be used for sewer pipelines.

5.2.6. Ventilation and Odour Control

In urban developments, pipes shall be adequately ventilated within private property. However, there are some situations where vent shafts may be required such as:

a. At pumping stations:

b. At manholes where pumping stations discharge to a gravity pipe: and

c. At entrances and exits to inverted siphons.

In such situations vent shafts shall be installed as per the requirements of WSA 02-2014, and WSA 04-2005 (or any amendments as applicable).

Where a vent shaft is required, the Developer shall assess the potential for odours, and the effects of odours on adjacent dwellings. All ventilation and odour control assessment and design shall be undertaken by a SQEP. The assessment shall include calculations to quantify odour generating potential, and demonstrate how odour generation will be mitigated. The SQEP shall liaise closely with FNDC on proposed ventilation and odour control measures.

Either forced ventilation or passive odour control is acceptable provided it is demonstrated that the proposed odour mitigation system will prevent offensive or objectionable odours from causing an adverse effect to adjacent property.

Where fan forced ventilation is proposed for pump station wet wells, it shall provide a minimum of four air changes per hour, and the vent discharge shall be a minimum of 3.6 m high.

5.2.7. Manholes and Inspection Chambers

5.2.7.1 General Requirements

Maintenance structures shall be provided for access and maintenance of the network, including water jetting and CTTV inspections. Preference will be given to structures that will minimise the potential for infiltration. Types of maintenance structures considered are:

a. Manhole,

b. Inspection chamber / mini-manhole (minimum diameter 600 mm), and

c. Rodding eye.

Maintenance structures shall be located:

a. On FNDC property or Transport Corridors whenever practicable. If located within the carriage way, manholes shall be located 2 m out from the kerb.

b. Out of hollows, dips or any area that may be subjected to inundation or identified as a secondary flow path.

c. Clear of all boundary lines by at least 2 m from the outer edge of the manhole chamber plus the height of any nearby retaining walls if they exist.

d. Clear of the zone of influence as per FNDC Wastewater Drainage Bylaw 2018.

e. In areas that are foreseeably safe to access for the long term.

f. Flush with the adjacent ground level, subject to specific requirements (below) in flood areas.

If maintenance structures shall be located in areas subject to flooding, all components shall be watertight, tied or fixed together, and covers shall be set 300 mm above the 1% AEP flood level.

Maintenance structures are required at locations in accordance with Table 5-6 below:

Table 5-6: Maintenance Structure Requirements

Maintenance Structure Locations	Acceptable Option		
	Manhole	Inspection Chamber (IC)	Rodding Eye (RE)
Intersection of pipes except for junctions between mains and lateral connections	Yes	No	No
Changes of pipe grade, except where vertical curves are permitted	Yes	For DN150 pipe only using pre-fabricated vertical bend	No
Change of pipe grade at different invert level	Yes	No	No

Maintenance Structure Locations	Acceptable Option		
	Manhole	Inspection Chamber (IC)	Rodding Eye (RE)
Changes of pipe invert level			
Changes of pipe size	Yes	No	No
Changes in horizontal direction Combined changes of pipe direction and grade, except where compound curves are permitted	Yes	Use prefabricated units or bends, max 33° deflection	No
Changes of pipe material, except for repair/maintenance locations	Yes	No	No
Upstream permanent ends of reticulation	Yes	Yes	Yes
Discharge of a pressure main into a gravity pipe	Yes	No	No

5.2.7.1.2. Additional Requirements for Manholes and Inspection Chambers

For infill developments (subject to the restrictions in Section 5.2.8.3 Connection to Trunk and Interceptor Pipelines), manholes are not required at 150 mm branch connections onto 150 mm mains provided that:

a. a manhole exists on the main within 100 m of the connection point: and,

b. an 'off-line' manhole is provided on the branch upstream of the connection point: and,

c. the 'off-line' manhole is immediately within the boundary of the property being served or within 20 m of the connection point, whichever is the lesser.

Where public manholes are located on private property, the provisions of Section 5.2.3.2 Reticulation on Private Property shall apply.

Manholes are the only option where personnel entry is required.

Inspection chambers 600mm diameter are only permitted for depths not exceeding 1.2m to invert.

5.2.7.1.3. Additional Requirements for Rodding Eyes

Rodding eyes shall be provided at the end of 100 mm diameter laterals of lengths up to 25 m. For lateral lengths exceeding 25 m, normal requirements apply (i.e. terminating manhole or inspection chamber).

A single lot connection may be made to a rodding eye if required at the terminal end of a lateral.

5.2.7.2 Spacing

Maximum spacing shall be as follows:

a. The maximum distance between any two consecutive maintenance structures shall be 120 m.

b. Where a combination of manholes and inspection chambers are used on the same pipeline, the maximum spacing between consecutive manholes shall not exceed 400 m irrespective of the number of maintenance shafts between the manholes

5.2.7.3 Allowable Deflection through Manholes

A maximum allowable deflection through a manhole for pipe sizes DN 150 to DN 225 is 90 degrees. The maximum allowable deflection for pipe sizes greater than DN 225 is 110 degrees.

5.2.7.4 Internal Fall through Manholes

The minimum internal fall through a manhole joining main inlet and outlet pipes with the same diameter shall comply with Table 5-7 :

Table 5-7: Fall Through Manholes

Deflection Angle at Manhole	Minimum Internal Fall (mm)
0 - 45	50
>45 - 90	80

Where pipe sizes change at the manhole, the soffit of the inlet pipe should be at least as high as the soffit of the outlet pipe.

Where the minimum internal fall specified above cannot be achieved, e.g. on gradient constrained pipelines, then Specific Design is required.

To avoid excessively deep channels within manholes, steep grades (> 7%) shall be 'graded-out' at the design phase.

Where this is not practicable the following precautions shall be taken:

a. The steep grade of an inlet pipe shall be continuous through the manhole,

b. The minimum depth to invert of the manhole shall be 1.5 m for DN 150 and DN 225 pipes,

c. The minimum depth to invert of the manhole shall be 2.0 m for DN 300 pipes,

d. Change of direction at the manhole is not to exceed 45°,

e. No drop junctions or verticals shall be incorporated in the manhole,

f. Inside radius of channel in the manhole shall be greater than 6 times the pipe diameter, and

g. Benching shall be taken to 150 mm above the top of the inlet pipe.

Note: For further guidance on handling steep grades, see WSA 02-2014.

Grading the channel shall be limited to a maximum fall through the manhole of 150 mm.

Where grading the channel cannot be achieved, then a drop connection shall be provided in accordance with section 5.2.7.8 Connections to Manholes.

5.2.7.5 Size of Manholes

Manholes shall be a minimum of 1050 mm diameter for depths of 1.2 m or more.

5.2.7.6 Materials and Parameters

Pre-cast concrete manholes with external flanged base are acceptable provided that:

a. They shall be installed in accordance with **Sheet 39**,

b. Manholes up to 2.4 m deep shall be constructed using a single riser with a pre-cast external flange base:

c. Manholes in excess of 2.4 m deep shall be constructed using a 2.4 m deep pre-cast riser with external flange base, and then completed to final ground level using no more than a single riser for manholes up to 5.0 m deep.

d. In no case shall a series of short risers be used:

e. The joints of all abutting units shall be sealed against ingress of water:

f. The cover frame shall be set over the opening and adjusted to the correct height and slope using adjustment rings and mortar so as to conform to the surrounding surface:

g. The cover frame shall be held in place with concrete haunching in accordance with **Sheet 39**.

Manholes constructed and installed using alternative materials and methodologies shall be in accordance with FNDC Approved Materials List - Wastewater and Stormwater and installation details.

The receiving manhole for discharge from a pressure main into a gravity pipe shall be corrosion resistant and be assessed for ventilation/odour requirements (refer to Section 5.2.6 Ventilation and Odour Control).

5.2.7.7 Manholes Requiring Specific Design

Any manhole with the following parameters shall be subject to Specific Design:

a. Depth greater than 5.0 m, or

b. If affected by the high-water table, or

c. Is bedded in suspected or proven aggressive grounds.

If the manhole is affected by the high-water table, the manhole shall include a factor of safety against flotation of 1.25.

5.2.7.8 Connections to Manholes

The invert of a lateral property connection shall connect to the manhole at a level no lower than the average of the soffit levels of the main inlet and outlet pipes.

The invert of other lateral (pipeline) connections shall achieve the internal fall requirements of Section 5.2.7.4 Internal Fall through Manholes. Maximum angle of deflection of lateral connection into the manhole main channel shall be 90 degrees.

Drop connections at manholes shall be designed as follows:

a. The drop connection shall be constructed as detailed in **Sheet 39**,

b. Internal drop connections shall only be constructed in a 1200 mm or greater diameter manhole,

c. External drops will not be approved,

d. The minimum height for drop connections shall be 600 mm, and

e. Only one drop connection per manhole is permitted.

5.2.7.9 Covers

Watertight manhole covers with a minimum clear opening of 600 mm in diameter, complying with AS 3996:2019, and included on the FNDC Approved Materials List - Wastewater and Stormwater shall be used.

'Non-rock' covers shall be used on all State Highway and Level 2 roads (roads with greater than 10,000 vehicles per day).

Hinged covers shall be used in all other areas and shall be oriented with the lid folding flat in the direction of traffic flow.

Class D covers to AS 3996:2019 shall be used in the Transport Corridor, carriageway, commercial and industrial properties and all public areas.

Class B and **Class C** covers to AS 3996:2019 shall only be used on residential properties.

Note: bolted down covers shall not be used.

5.2.7.10 Manhole Steps

All manholes deeper than 1.2 m shall be provided with manhole step rungs that are in accordance with **Sheet 40**. Encapsulated rungs with galvanized steel or stainless-steel core shall be fully coated with industrial grade PE or an approved alternative may be used. Approved products are as per the FnDC Approved Materials List- Waste Water and Stormwater.

Manhole steps shall be provided in accordance with **Sheet 39** and **Sheet 40**.

Manhole steps shall be provided at 300 mm centres vertically. The top step shall not be more than 450 mm below the top of the top slab, and the lowest step shall be not more than 375 mm above the bench, or such lower level if specified by manufacturers of proprietary manholes.

The manhole steps shall be located over the downstream pipe.

5.2.8. Connections

5.2.8.1 General Requirements

Before connecting to the public wastewater system, the FNDC's Public Utility connection process as per FNDC Connect-to-our-water-network Commercial and Residential Water and Wastewater Connection Application Forms shall be completed by the Developer and the FNDC's approval obtained. This applies to all:

a. New service connections and disconnections from private property:

b. Connections of new wastewater reticulation to the existing public wastewater system:

c. Connections where trade waste will be discharged, and compliance with the FNDC Trade Waste Bylaw 2009 is required.

The lateral connection shall be designed to suit the existing situation and any future development.

The lateral shall be positioned so that the private section of the connection with each lot can be constructed in accordance with the Building Act 2004. This should be at the lowest location in the lot.

Lateral connections may be made to any maintenance structure, or at any point along a main using a proprietary junction, subject to the requirements of Section 5.2.7.8 Connections to Manholes.

Lot connections shall be made directly to the maintenance structure where practicable.

5.2.8.2 Design Criteria

The following design requirements shall be met:

a. The minimum sizes of lateral connections shall be in accordance with Table 5-8.

b. Each connection shall be capable of serving the whole of the lot by gravity, allowing for minimum pipe gradients within the lot (see Table 5-5), and allowing for depth required for gully traps.

c. The standard depth of a new connection at the boundary is 1.2 m (range 0.9 - 1.5 m).

d. Where the depth of a connection at the boundary is deeper than 1.2 m, the service pipe shall be extended into the property on grade, or by use of a ramped riser, to the extent that its terminal end is no deeper than 1.2 m.

e. Where practicable, connections should be made directly to manholes.

f. Connections which shall be made directly to the line shall be designed using a prefabricated ‘wye’ or ‘lunden-junction’ and shall be watertight.

g. Connections should enter each lot from the road frontage. Where a property has no road frontage, pipes shall be located within that property's legal access (right of way).

h. Where practicable:

   i. Private pipes shall not cross property boundaries

   ii. Existing private connections crossing boundaries shall be replaced by a public connection.

Table 5-8: Minimum Pipe Sizes for Property Connections

Pipe	Minimum Size ID *(mm)*
Connection serving 1 household unit, UNLESS FNDC requires a larger size connection to be provided. Connection to in-fill development, serving up to 3 household units, via an inspection chamber (subject to FNDC specific approval).	DN 100
Connection serving more than 1 household unit Connection serving commercial and industrial lots	DN 150

Pipe size shall not be reduced on any downstream section.

Note: See FNDC Wastewater Bylaw 2009 for details of points of discharge with a range of property ownerships and public and private sewer locations.

5.2.8.3 Connection to Trunk and Interceptor Pipelines

Connections to wastewater trunk pipelines shall be at manholes.

A reticulated pipe connection to a wastewater interceptor shall only be designed in conjunction with FNDC. No individual lot connections are permitted into an interceptor.

5.2.8.4 Connections to Deep Lines

Where an existing or proposed wastewater pipe is more than 5.0 m deep to the top of the pipe, or where required by the ground conditions, a manhole shall be constructed on the shallower line. This should be 5 m from the deep line and ramped down to it.

5.2.9. Building Over or Adjacent to Pipelines

The following is not permitted without the FNDC's specific approval (refer to Wastewater Drainage Bylaw 2018):

a. Building over or within a horizontal distance of 2 m outside of the pipe:

b. Building within the zone of influence of the pipe:

c. Building within 2 m horizontally of the outside of any maintenance structure (manholes, lampholes, maintenance shafts and sewer dead ends):

d. Driven piles shall not be installed closer than 5 m from any pipe unless documentation is provided to the FNDC's satisfaction showing that the proposed works will not damage the asset.

5.2.10. Pump Stations

5.2.10.1 General Requirements

The design of public pump stations and components require Specific Design and FNDC's specific approval, and shall meet the following requirements:

a. Pump stations shall be provided with all-weather vehicle access and provision for parking and manoeuvring of maintenance vehicles:

b. Public pump stations and associated vehicular access shall be located within a separate lot vested in FNDC and shall not be located where they may adversely affect pedestrian or vehicular traffic.

c. Temporary pump stations may be located within an easement registered in favour of FNDC, rather than a separate lot.

d. Valve and pump station lids shall be kept clear of carriageways, footpaths and driveway locations.

e. Modular/Package pump stations shall be constructed of GRP or PE that comply with the ES, unless site conditions or Specific Design requirements preclude their use.

f. Pump station bases shall be used in accordance with FNDC Approved Materials List - Wastewater and Stormwater.

g. Electrical and control systems shall comply with the FNDC Briefing Document – EES 1.

h. Fencing around the pump station may be required.

i. The floor of the pumping station shall be set at such a level below the inlet pipe so that the inlet pipe will not surcharge during the normal pump operation cycle, which includes standby pump operation.

Note: Pump stations serving less than six household equivalents shall not be taken over by the FNDC.

Note: Pump stations in a gravity reticulation system, shall only be approved if it is demonstrated that a gravity connection is not practicable, and that the pump station is the most practicable option.

5.2.10.2 Design Criteria

Pump stations shall meet the following criteria (refer to **Sheet 42** and **Sheet 43**):

a. Consist of an underground pump well, a separate valve chamber that can drain into the pump chamber, emergency storage, a water supply and electrical control cabinet.

b. Designed for all imposed loads, including floatation.

c. Designed to ensure that no stormwater enters either through the wall or the roof and lid.

d. Lids and the electrical control cabinet shall be a minimum of 150 mm above the adjacent ground level, with the surrounding ground graded away from the station.

e. Located free of secondary flow paths for 1% AEP flood level, and the pump station lid levels shall be provided with a minimum freeboard of 300 mm above the estimated 1% AEP flood level.

f. The bottom of the control cabinet shall be provided with a minimum freeboard of 450 mm above the estimated 1% AEP flood level.

g. Pump wet well, valve chambers and storage chambers shall have sealed, lockable lids and safety grills that are in accordance with FNDC Approved Materials List - Wastewater and Stormwater, and can be readily opened by one person. Openings shall be a minimum of 900 x 900 mm.

h. All lifting chains, guide rails, fittings, connections, nuts, bolts etc. in the pump station shall be 304 stainless steel.

i. Pump chamber pipe work shall be stainless steel (316) or fiberglass.

j. Concrete in pump stations shall be suitable for sewer pump stations, and shall be lined with an epoxy or similar lining. The concrete strength, admixtures and lining specification shall be supplied in the design submission.

k. Pump impellors shall be hard iron. Impellor types shall be;

   i. For rising main diameters of 90 mm or greater - an Open Self Cleansing channel impeller. Shredded single or multichannel impellers shall be capable of passing a 75 mm diameter solid.

   ii. For rising main diameters of less than 90 mm - grinder cutter pumps shall be used.

l. The pumping system shall:

i. Have a minimum of two pumps (duty and standby) in all pump stations, with automatic changeover of the pumps if the duty pump blocks or breaks down,

ii. Each pump shall be capable of discharging the design peak wet weather flow rate from the catchment

iii. Include sufficient well volume to operate under normal conditions without surcharge to the incoming wastewater network

m. Access to pump stations shall be suitable for vehicles with a lifting gantry to install or remove pumps and equipment.

n. Float cables and lifting chains shall have hook plates.

o. Non-return and isolating valves for each pump shall be located in the valve chamber. The isolating valve shall be a resilient seated gate valve complying with AS/NZS 2638.2:2011 (anticlockwise closing) installed downstream of the non-return valve. Non-return valves shall be ball-valves with full-bore opening or swing check valves with external handles.

p. The capacity of the wet-well between start and stop levels shall be such as to limit pump starts to no more than fifteen per hour.

q. Pump Stations shall have emergency storage in case of mechanical or electrical failure or blockage of the pumps or rising main. The storage shall be located at such a level as to prevent overflow from any manholes, gully traps, pump station lids or any other outlet from the system. Storage tanks shall be provided with a lockable, hinged, watertight lid with a minimum opening of 900 x 900 mm, and able to be opened by one person by hand.

r. Pump stations and rising mains shall be designed to provide for the peak wet weather flow from the ultimate catchment development, without utilising the required emergency storage capacity.

s. Variable speed drive is required for pumps over 5kW.

t. Shielded power supply cables are required on all pumps exceeding 5 kW.

u. All pump stations shall be reviewed for the potential for odours in accordance with Section 5.2.6 Ventilation and Odour Control.

v. The electrical supply shall be underground.

w. Lighting shall be provided to illuminate the control cabinet. A 10A single phase power socket shall be provided in the cabinet with RCD protection.

x. Suitable low maintenance landscaping may be required on the pump station site around the wet well area.

y. Fencing may be required where the pump station is exposed to traffic etc.

z. An Operating and Maintenance Manual shall be provided that covers all aspects of the design and operation of the stations including:

i. Design calculations, including pipe and fitting head-loss assumptions and pump curves

ii. A plan of the design catchment

iii. As-Built Plans including circuit diagrams and switch locations

iv. Pump details, pump duty information, float switch levels

v. Contingency measures for emergency overflows

vi. Operation and maintenance procedures

vii. Other relevant data and information.

viii. Guarantees and warrantees

aa. Pump stations shall be tested and commissioned in the presence of a FNDC representative strictly in accordance with the FNDC QA/QC Manual 2022.

5.2.10.3 Sizing

5.2.10.3.1. Pump Station Sizing

Pump stations shall provide pumping velocities in the rising main in the range 0.6 to 2.5 m/s.

Where practicable, the rising main should be sized, and the pump controlled, such that the volume of the rising main is pumped at least once each day, preferably each pump cycle. If there is insufficient inflow into the pump station to achieve this, then odour measures (see Section 5.2.6 Ventilation and Odour Control) shall be incorporated into the design unless the results of a ventilation and odour control assessment demonstrate that these are not required.

Where the pump station discharges into a common pressurised main that is used by other pump stations, variation in head conditions caused by the operation of the other stations shall be taken into account. Supporting information shall be provided to demonstrate satisfactory operation of the network for all pumping scenarios.

A pump station design shall document the effluent volumes and associated pump requirements for the fully developed catchment and at commencement of operation.

The calculation of flow shall follow the design criteria in Section 5.2.2 Design Criteria. These projections will be described as

a. Average Dry Weather Flow:

b. Peak Dry Weather Flow:

c. Peak Wet Weather Flow:

d. Peak Daily Flow.

If the station catchment shall be fed by other pumping stations, then these flows shall be calculated for the direct gravity catchment as well as the direct plus contributing catchment.

All calculations shall be submitted in the EDA and all assumptions, design variables etc. shall be clearly documented.

5.2.10.3.2. Flow Meter Sizing

Pump stations with an ultimate design flow of 10 l/s or greater shall be provided with magnetic flow meters on the rising main, connected to FNDC's telemetry system. The system shall record instantaneous flow and totalised flows.

The flow meter shall be from FNDC Approved Materials List - Wastewater and Stormwater potted for IP68 which is required to be factory 'Finger printed' and appropriately sized for the rising main.

The pump station design shall ensure the flow meter is fully charged during non-pump operation.

The transmitter shall be located in the cabinet with analogue and digital information connected to the FNDC's telemetry system.

Where the meter is positioned within the designated site and free of roading or concrete cover then the meter may be buried or otherwise housed within a 1050 mm manhole with 400 mm clear of the invert of the meter. Both installation types are to connect to the cabinet by ducting. Where buried the end of the duct shall be sealed to prevent ingress of soil and moisture.

5.2.10.4 Layout and Access

The site layout shall comply with **Sheet 41**.

The alignment of the pump station shall be set out with reference to permanent land transfer pegs or temporary boundary marks, placed by the licensed cadastral surveyor responsible for the final land transfer pegging.

The site design shall include a paved all-weather access road, with a minimum width of 3.5 m, and have provision for parking and manoeuvring of maintenance vehicles. The centre line of the parking space shall be no greater than 4.0 m in plan from the distal pump and no greater than a 0.5 m difference in elevation between the parking area and lid elevation.

Where the access way is longer than 30 m, a turning point for a light commercial vehicle shall be provided at the well. The gradient of the access way shall not exceed 1 in 6, and all turning radii comply with light truck tracking curves.

The control cabinet shall be located with the switch gear facing the wet well and placed no closer than 2.5 m to any well or valve chamber lids and no further than 5.0 m. This is to provide safe working room between an open lid and the cabinet.

The above ground structures, including but not limited to control cabinet, odour control and RPZ, shall be positioned such that any 'out of control' vehicles leaving surrounding public roadways are unlikely to damage these structures. Protection such as guardrail or posts and rails may be required.

An area of 5.0 x 5.0 m shall be available to accommodate an odour biofilter, either at the time of construction or in the future.

5.2.10.5 Wet Well

5.2.10.5.1. Diameter

The minimum diameter of the pump chamber shall meet both the minimum separation distances of the pump supplier, and provide sufficient operational capacity to meet the maximum number of starts per hour (refer Section 5.2.10.2 Design Criteria) but be no less than 1.8 m deep.

5.2.10.5.2. Depth

Sufficient depth shall be provided in the pump chamber such that:

a. For a gravity inlet pipe, the inlet shall have a minimum of 100 mm free board to surcharge during operation of the duty pump,

b. For a rising main inlet, the inlet shall be below the pump stop level,

c. The minimum distance between duty pump start and stops levels is 400 mm, and

d. The design stop level is 50 mm above the pump manufacturer's minimum continuous operating levels.

5.2.10.5.3. Structural Stability

The pump station wet well shall be designed to have negative or zero buoyancy. Accordingly, the chamber may require mass concrete in the bottom to counter buoyancy forces. The depth and extent of mass concrete shall be as specified on the Engineering Drawings.

The ground water level shall be assumed to be at ground level unless an actual level is established by geotechnical investigation and approved as suitable for this purpose by the FNDC.

The mass of the wet well structure included in the stability analysis shall not include the associated mechanical and electrical components of the pump station nor can the soil friction forces of backfill around the wet well chamber be taken into account. The proposed pump station drawings shall provide dimensions of the extent of mass concrete needed to counter buoyancy of the chamber.

Foundation design of wet wells requires Specific Design by a SQEP in accordance with the design considerations in Section 5.2.7.7 Manholes Requiring Specific Design.

5.2.10.5.4. Valve Chamber

The valve chamber shall be attached to the pumping chamber. Where the delivery point is within close proximity to the pumping station the valve chamber may be dispensed with and a separate rising main from each pump laid to the delivery point. Where this occurs land shall be allocated for a valve chamber to cater for any future operational changes.

The layout of the pumping chamber, valve chamber and pipe work shall be similar to that shown on **Sheet 42** and **Sheet 41**.

5.2.10.5.5. Lids

Lids shall be of a standard design as per the FNDC Approved Materials List - Wastewater and Stormwater.

For any well or chamber where the depth is greater than 2.0 m, secondary lids are required to satisfy health and safety requirements.

5.2.10.6 Emergency Storage

See also 5.2.10.7 Compliance with the NRC Regional Plan for Northland.

Pump stations shall provide for wastewater storage in the event of pump failure through electricity outage.

5.2.10.6.1. Sizing

A minimum of 4 hours emergency storage based on average dry weather flow, or minimum specified in the NRC Regional Plans (whichever is greater) shall be provided prior to emergency overflow occurring. The storage volume should be measured between the high-level alarm and the point of overflow.

The required storage volume shall be provided by:

a. The volume of the wet well, plus

b. Any additional ancillary storage chambers.

The wet well volume below the high-level alarm level shall be excluded from the calculation of available storage volume.

5.2.10.6.2. Layout

A site-specific layout design is required.

Preferably the storage volume shall be provided in the pumping wet well structure and upstream pipelines.

Any pipe or chamber (whose sole purpose is for the provision of storage capacity) can be connected directly into the pump chamber. It shall be benched such as to direct all flow to the outlet point.

For all other sole purpose storage facilities, the benching shall be at a minimum gradient of 1 in 3 to allow self-draining. A central channel within the storage well shall be at a minimum of 1% gradient.

If the storage chamber is provided with an automated wash down facility following storage use the minimum grade can be reduced to 0.15%.

Where storage is developed within the upstream pipework and carries wastewater flow, these structures shall have the haunching constructed to cater for the normal operation, with a seamless progression to the haunching required for the free drainage post emergency.

5.2.10.6.3. Structural Stability

The foundation and buoyancy of the storage chambers shall be determined and designed for as per the methods used in Section 5.2.10.5 Wet Well.

5.2.10.7 Compliance with the NRC Regional Plan for Northland

Pump stations shall comply with the requirements for a controlled activity in the Rules for Sewage Discharges in the NRC Regional Plans, and any necessary resource consents for its installation and use shall first be obtained by the Developer.

Note: Where particular constraints exist – e.g. a sensitive receiving environment such as a bathing area or marine farm, the consent conditions may require a greater storage capacity.

5.2.10.8 Electrical and Control

The Developer shall determine adequacy of any existing supply and arrange for the power supply to a pump station. The power supply for public pump stations shall be transferred to FNDC following successful testing and commissioning of the pump station.

The electrical switch box shall be located in a safe position as close as practicable to the pump chamber. It shall be fabricated Aluminium or Stainless Steel, or Aluminium Montrose type. Vents etc. should be incorporated in telemetry masts.

5.2.10.9 Telemetry

All pump stations and treatment facilities shall be connected to FNDC's telemetry system. FNDC shall confirm whether satisfactory radio network communications are available at the site. If not, an alternative communication system (e.g. telephone land-line with autodialer, or cell phone) shall be provided.

5.2.10.10 Water Supply

Where a FNDC reticulated water supply is available, fresh water shall be supplied from a standard 25 mm. ID connection at a minimum static pressure of 250 kPa. A standard hose connection shall be fitted.

If the water supply is taken from FnDC's drinking water network, backflow prevention shall be provided in accordance with the NZ Building Code Approved Documents for a high-hazard installation (RPZD) and **Sheet 44**.

The backflow preventer shall be positioned next to the electrical control cabinet and the water connection outlet shall terminate in the pump chamber.

The Developer shall apply to FNDC for the connection (including the meter and backflow preventer), pay all costs and provide as-built details including all requirements of Section 6.1.7 Connection to Existing Water Supply System.

5.2.10.11Pump Design

5.2.10.11.1. Pump Selection

Pumps shall be three phase submersible type design selected, from FNDC Approved Materials List - Wastewater and Stormwater.

Pump jackets shall be stainless steel.

The pumps shall be connected by way of a 'duck foot' discharge pedestal to enable the removal and manipulation of the pump from the top of the wet well.

In selecting the appropriate pumps, the operating conditions shall correspond as closely as practicable to the point of maximum pump efficiency. Final pump selection shall be approved by FnDC in order to facilitate standardisation of pump model and impellor sizes.

In calculating the system head losses, allowances shall be made for all bends and fittings beyond the pump discharge bend together with the rising main friction losses.

The system static head shall be based on the difference in level between the centreline of the inlet face for the pump discharge bend and the highest point on the rising main system.

The rising main system curve shall be modelled using the Colebrook White formula. Calculations of friction loss should be carried out based on roughness 'k' values of 1.5 m and 0.5 mm to ensure that the selected pump is capable of operating over this range of duty points.

5.2.10.11.2. Risers and Valve Sizing

The pumpset riser is defined as all pipework between the discharge bend to the inlet of the rising main isolation valve.

Internal pipework for each pumpset shall be at a minimum of that determined by the pump discharge bend. Where there is a difference in the size between the discharge bend and subsequent steelwork the reducer shall be immediately post discharge bend and/or prior to isolation valve if needed.

The valve installed along the pump set riser shall be of a similar dimension to the pipework.

Isolation valves for each pump set shall be of a quarter turn eccentric plug type with ability to lock in either open or close position using a standard padlock.

5.2.10.11.3. Non-Return Valves

The installation of a non-return valve on each pump set is required to ensure the pumps are protected from reverse flow and that flow from a pump is not returned to the well through the standby pump reducing operational capacity.

Where the dynamic head for a pump is less than 15 m, as measured at the location of the non-return valve, a ball type valve can be used. For those stations that experience levels greater than 15 m a resilient seated rubber flap check valve shall be used. Flap check valves shall be installed with an external indicator arm.

For those stations where the total head is above 30 m a detailed engineering design solution shall be provided showing the limitations on the system for water hammer following the controlled shutdown of pumps (excluding power failure).

5.2.10.12 Private Pump Stations

Private pump stations are permitted where it is not practicable or economic to provide a gravity connection to a public sewer. A proprietary packaged pump station, with grinder pumps, shall be used and shall comply with the NZ Building Code. Private pump stations will not be accepted as vested assets. Connection of private pump stations to public gravity networks shall be in accordance with **Sheet 38.**

5.2.11. Rising Mains

5.2.11.1 General Requirements

Rising main design requires specific approval from the FNDC. All design works of rising mains shall be undertaken by a SQEP and shall met the following requirements:

a. Fully account for the characteristics of the system in question including pump characteristics, surge, flow regimes and fatigue.

b. Minimise the time wastewater spends in a rising main and maintain self-cleansing velocities.

c. Be designed to withstand normal operating pressures, including short duration surge pressures from normal cycling and special events (such as power failure).

d. Be designed for connection to a FNDC approved location on the existing wastewater network.

e. The SQEP shall consider the hydraulic adequacy of the network, including the specified levels of service and impact on the existing network.

f. Pipe diameters shall be limited to the following standard sizes: 50 mm, 100 mm, 150 mm, 200 mm, and 300 mm nominal bore (internal diameter). FNDC's specific approval is required for pipe sizes exceeding 150 mm.

Note: FNDC may specify the diameters and classes of pipes to be used and the alignment of the rising main.

For design purposes, and subject to availability, FNDC may:

a. Provide details of the working pressure of the existing network, or of pressures at the approved connection point, and

b. Provide details of the capacity of existing network.

Where this information is not available from FNDC records, or further information is required for the design, the Developer shall consult with FNDC regarding the completion of any investigations. Investigations shall generally be carried out at the cost of the Developer.

5.2.11.2 Maximum Operating Pressure

The components of a pressure pipeline shall be designed to withstand a maximum operating pressure that is greater the following:

a. 400 kPa (note that this is not the minimum pipeline pressure class),

b. 1.5 x (static head + friction head),

c. Pump shut off head,

d. Positive or negative surge pressures.

External loads on the pipeline shall be included in all load cases, especially when pressure testing large diameter pipes. A factor of safety of at least 2 against buckling under negative or external pressures shall be allowed for. All fittings shall have a pressure rating equal to or greater than the pressure rating of the associated pipeline, or PN12, whichever is the greater.

For plastic pipes, fatigue during service may require that a higher nominal pressure rating is specified, which shall be the greatest of the following:

a. The maximum calculated operating pressure,

b. The equivalent operating pressure based on a surge & fatigue analysis.

To calculate the equivalent operating pressure (P_{eo}) the methodology described in Appendix A Design for Surge and Fatigue shall be used.

5.2.11.3 Pressure Surges

Design for pressure surge in pump rising mains shall be undertaken by a SQEP in accordance with the principles detailed in Appendix A Design for Surge and Fatigue.

In addition to the considerations in Appendix A Design for Surge and Fatigue, the SQEP shall also consider:

a. Soft closing, non-return valves for installations in high head situations as well as variable speed controls:

b. Allowance for Operation and Maintenance requirements:

c. Failure of any mechanical surge protection measures and protection from damage during these situations.

5.2.11.4 Velocity

Pressure mains shall have a minimum velocity of 0.75 m/s, and a maximum velocity of 2.5 m/s.

The preferred velocity range is 0.8 m/s to 1.2 m/s. Velocity shall be confirmed in the design submission.

5.2.11.5 Gradients

The profile of rising mains shall be designed to minimise the number of high and low points, which require the installation of air and scour valves respectively. The final profile will be a balance between the minimum depth of main and number of valves.

Rising mains shall be graded continually upwards from the pumping station to termination and designed to keep the pipe full and prevent sudden discharges of foul air at pump start.

If a summit is unavoidable;

a. automatic air release valves shall be provided,

b. air valves shall be design specifically for wastewater operation

c. air valves shall be mounted vertically above the pipeline to which the air valve is connected.

d. an isolating gate valve shall be fitted between the air valve and the vented pipeline and the valves shall be mounted in a concrete valve chamber.

The valve chamber shall be large enough to allow easy access for maintenance staff to operate the isolating valves, or remove all valves from the chamber.

At low points, drain valves and chambers shall be provided such that the contents of the entire main can flow into the chamber and the contents be collected by a sucker truck. Alternatively, it may be practicable to drain directly to a nearby sewer (subject to the FNDC's confirmation of suitability and availability of capacity).

5.2.11.6 Cover over Pressure Pipes

The minimum cover over the top of the pressure pipe to finished ground level shall comply with the requirements of section 5.2.3.3 Minimum Cover.

5.2.11.7 Flanges

All valves and fittings shall be flanged to either AS 2129:2000 Table D/E or AS/NZS 4087:2011 Class 16, alternative flange standards will not be approved. All mating flanges shall be compatible.

Note: This also applies to items such as flow meters and check valves

5.2.11.8 Sluice Valves

All valves and fittings shall be in accordance with FNDC Approved Materials List - Wastewater and Stormwater, and meet the following requirements, as applicable:

a) Valves shall be ductile iron Metal Seated valves to AS/NZS 2638.1 and fully polymetric coated to AS/NZS 4158.

b) Valves shall have a minimum pressure rating of PN16.

c) Spindle shall be non-rising.

d) Spindle seal shall be non-asbestos gland box or O-ring that is accessible for replacement under full operating pressure.

e) Valve operating torque shall not exceed 125 Nm at the fully unbalanced allowable operating pressure, otherwise geared operation, motorised valves or a valve bypass arrangement shall be specified.

f) Valves shall be clockwise closing and supplied with triangular spindle cap, which shall be coated fusion bonded polymer complying with AS/NZS 4158. Colour shall be red

g) The valve operating direction shall be permanently marked on the valve, gearbox, spindle cap or hand-wheel.

h) Flanges shall be in accordance with Section 5.2.11.7 Flanges.

The use of butterfly valves requires the specific approval from the FNDC.

5.2.11.9 Scour Valves

Scour valves are required on the low point of all rising mains.

Valves shall be the same size as the main, but no greater than 150 mm in size.

Scour valves shall be installed at the lowest point between isolating valves, and discharge to an approved chamber.

5.2.11.10Air Valves

Air can accumulate at high points when it is drawn into the system.

It is preferred not to have any high points in wastewater rising mains. If this cannot be achieved, mains should be laid evenly to grade between peaks to ensure all practicable locations of potential air pockets are well known.

The need for air valves at all high points shall be investigated, particularly those more than 2 m higher than the lower end of the section of main, or if the main has a steep downward slope on the downstream side.

Air may also come out of solution in the wastewater due to a reduction in pressure, such as when wastewater is pumped uphill. Air valves may be required to allow continuous air removal at these locations.

Air valves shall be sized for peak flow rates and located as required for surge protection.

Air valves shall also be located on long horizontal runs at a maximum interval of 800 m.

Only air valves on FNDC Approved Materials List - Wastewater and Stormwater shall be used.

5.2.12. Pressure Sewer Systems

5.2.12.1 General Requirements

Several areas within the Far North District are serviced by pressure sewer systems. Pressure sewer systems consist of a small pumping unit installed on each property which pumps sewage into a small diameter pressure pipe network which then discharges either to the downstream gravity sewer network or into a communal pump station.

The design of a pressure sewer system shall be in accordance with WSA 07-2007. References in WSA 07-2007 to the “Water Agency” shall be taken to mean the FNDC.

In addition to those set out in WSA 07-2007 the sewer system shall meet the following objectives:

a. All domestic wastewater is catered for:

b. All stormwater is excluded from the sewer system:

c. Minimum 12 hours of emergency storage is provided within the pumping station.

All design works of pressure sewer systems shall be undertaken by a SQEP (See Section 1.5.1.3 Risk Based Assessment Framework).

Pressure sewer design shall be separated into the following two components:

a. Reticulation design (design of the actual pressure sewer system) which includes:

   i. Reticulation pressure pipes,

   ii. laterals,

   iii. boundary kits, and

iv. appurtenances (e.g. valves and flushing points).

Note: Boundary valve kits shall be installed by the Developer at the time of construction of the pressure sewer reticulation.

b. On-property design – (design of the property discharge line), which includes:

i. collection tank/pump unit,

ii. control/alarm panel, and

iii. electrical cables.

Note: The on-property design takes place after the reticulation has been designed and installed.

5.2.12.2 Design Requirements

The following requirements for pressure sewer system design shall be met in addition to, and shall take precedence over those set out in WSA 07-2007:

In addition to meeting these design standards, the Developer's design shall comply with the requirements of resource consent conditions, archaeological requirements, and district & regional plans.

Note: Septic tank effluent pump (STEP) systems are not an approved pressure sewer system.

5.2.12.2.1. Design Inputs and Outputs

During the design process, the Developer shall confirm with the FNDC, the nominated discharge point on the FNDCs existing system that the Developer needs to convey sewage to.

The FNDC may direct the SQEP to increase the diameter of pressure sewers to account for adjoining developments or based on its own operation experience.

5.2.12.2.2. Odour Control

Ventilation and odour control shall be in accordance with Section 5.2.6 Ventilation and Odour Control.

5.2.12.2.3. Design tolerances

Design Tolerances shall be in accordance with Section 3.2 of WSA 07-2007 for reticulation design and Section 6.1.2 for on-property design. Reference to MGA, GDA and AHD is removed.

5.2.12.2.4. Survey Co-ordinates and Levels

Survey co-ordinates and levels shall be provided in accordance with Section 1.7.2 As-Built Plans, Asset Information Schedules, Operation and Maintenance Manuals and Appendix G Drawing Standards

5.2.12.2.5. On-property Components

All on-property items shall be located within the property boundary of the property being served.

Easements are generally not required over the property discharge pipeline, but the owner is to provide a clear and direct alignment for the discharge pipeline to connect to the reticulation in the street.

5.2.12.2.6. Clearance from Structures

To enable future maintenance and protect the system, a minimum offset of 2 m from any building or structures is required. The sewer reticulation main shall not be constructed through private land.

5.2.12.2.7. Septicity

Calculation of sewage age shall take into account the staging of the development.

5.2.12.2.8. Sanitary Flows

Sanitary flows shall be determined in accordance with Section 5.2.2 Design Criteria.

5.2.12.2.9. Infiltration and Inflows

The pumping unit shall be designed to prevent infiltration and inflows. Existing houses will not be connected to the system until all private drains discharging into the system have been inspected and pass the building consent requirements. The pumping unit shall be separated from any stormwater drainage pipes.

5.2.12.2.10. High Water-use Appliances

High water-use appliances shall not discharge to the pressure sewer system unless appropriate flow restrictors are installed to ensure the discharge rate does not exceed the capacity of the pump station.

5.2.12.2.11. Design Flows

Design flows shall be calculated in accordance with 5.2.2 Design Criteria.

The probability design method is an acceptable method for designing grinder systems unless the limitations noted in section 4.4.4.1 of WSA 07-2007 apply. The EDA shall include calculations of the design flows adopted for each pressure sewer line.

5.2.12.2.12. Alignment of Pressure Sewers

90° bends shall be avoided, where practicable, when aligning pressure sewers. Alternatives include use of 2 x 45° bends or bending the pipe within the manufacturers allowed limit.

5.2.12.2.13. Flow meters

The FNDC shall determine whether flow meters are required and their location. Where specified, the flow meter shall be in accordance with Section 5.2.10.3.2 Flow Meter Sizing

5.2.12.2.14. Collection Tank and Pumping Units

Only pumping units (including collection tanks) in the FNDC Approved Materials List - Wastewater and Stormwater and the associated purchasing specifications shall be used.

5.2.12.2.15. Boundary Valve Kits

Individual boundary valve kits shall be provided to serve each lot. They shall be installed at the time of construction of the pressure sewer reticulation and shall be located outside the property boundary, unless it is more prudent to locate it inside the property which the unit serves. In all cases the location shall facilitate access to the valves and shall not be installed in a trafficable area. The boundary kit is to have a bright red coloured lid with the colour homogeneous in the lid material.

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

5.2.12.2.16. Isolation Valve Location

Isolation valves shall be installed at incoming reticulation pressure lines, i.e. at Tees, and one upstream and one downstream of scour valves.

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

Isolating valves shall be constructed in accordance with the detail in **Sheet 49**, located in surface boxes, circle lids painted with red colour homogeneous in the lid material. The valve shall also be identified using a grey marker post with letters “SSV” (for “Sewer Sluice Valve”)

5.2.12.2.17. Air Release and Vacuum Break Valves

Only air release valves authorised by FNDC and listed in the FNDC Approved Materials List - Wastewater and Stormwater shall be used.

Proximity to properties, venting requirements, and aesthetics shall be considered when determining the location of the air release valves

Air release valves shall be in covered concrete chambers so as to provide adequate clearance for servicing/replacement of the valves (**Sheet 51**).

The chamber shall be adequately vented for effective operation of the valve. Any odour issues associated with the venting shall be addressed in the design.

Air valve shall be identified by a grey marker post, and have a letters "SAV" (for “Sewer Air Valve”).

5.2.12.2.18. Discharge Manholes

Where the receiving manhole is substantially deeper than the normal depth of the pressure main, the pressure main shall be graded out to enter the base of the manhole in such a way that it can discharge directly towards the downstream gravity pipe, minimizing disturbance to flows and the likelihood of creating gases. If grading out the pressure main is not practicable an internal manhole drop shall be designed in such a way that the flow is discharged directly towards the downstream gravity pipe as above.

Where required, venting shall be provided to the receiving manhole.

Consideration shall be given to protecting the receiving structure by, replacing it with corrosion resistant chamber or coating internal exposed surfaces (if approved by FNDC).

The receiving structure should be located as far as practicable from residential properties.

5.2.12.2.19. Property Discharge Line

Pressure sewer laterals shall only be directly connected to pressure mains that are DN225 or less. Where a connection to mains greater than DN225 is necessary, a new pressure main will be required.

5.2.12.2.20. Pipework and Fittings for Pressure Sewer System

The pressure sewer pipes and fittings shall be constructed using PE100 SDR11 (PN16) suitable for jointing with electrofusion fittings or butt fusion welding. Refer to Section 5.3.5.1 Rising Mains.

The minimum pipe size for reticulation is DN50 (50 mm OD).

Property discharge line for a standard house connection is usually DN40 (40 mm OD).

Only black polyethylene pipes with off-white (cream) stripe shall be used.

5.3. Construction

5.3.1. Pipeline Installation

The installation of pipelines shall be carried out in accordance with AS/NZS 2566.2:2002 (where applicable) and **Sheet 31** and **Sheet 32**.

5.3.2. Materials

Materials shall be in accordance with the requirements of Section 5.2.5 Approved Materials.

5.3.3. Pipe Installation by Trench

5.3.3.1 Pipe Embedment and Marking

5.3.3.1.1. Embedment

Where a pipeline is to be constructed through areas with unsuitable foundations, such material shall be removed and replaced with approved material. Alternatively, other methods of construction may be carried out with approval from FNDC to ensure adequate foundation and side support is provided.

Pipe bedding and protection must be specified on the design drawings and shall be in accordance with **Sheet 31** and **Sheet 32,** AS/NZS 3725:2007, and the manufacturer's specifications.

The trench design shall be of sufficient width, and in accordance with **Sheet 31**, to allow pipes to be safely laid and all embedment material properly compacted.

Embedment and fill shall be installed so that not more than 15 m of pipes shall be left exposed in the open trench at any time.

The trench's subbase shall be able to support all expected design loads over the pipe. Geotechnical investigations and report by a SQEP are required for all pipes laid in known weak grounds and/or any pipe with a diameter greater than 600 mm.

A SQEP shall inspect and record the trench ground condition before embedment material is placed or pipes are laid.

Where pipelines have protruding projections such as sockets, flanges or couplings, a suitable recess shall be provided, in the supporting material, to ensure the pipeline is fully supported along the pipe barrels.

Pipes made of plastic materials shall be laid with product labelling uppermost in the trench.

All trenches over 1.5 m depth shall be secured from collapsing.

5.3.3.1.2. Pipeline Marking

Detection tape shall be laid directly above all rising mains and above new sewers. The tape shall have 'sewerage' written on it in white and be located at a depth of between 200 and 250 mm above the pipe crest.

Where the pipe is not laid in a straight line between manholes the tape shall contain sufficient metal to be detectable from the surface by a standard metal detector.

Tracer cable shall also be attached to all pump riser mains and pressure sewer mains. This wire shall take the form of a continuous 2.5 mm multi strand (polythene sleeved) cable, strapped to the pipe wall by means of a minimum of two complete wraps of heavy-duty adhesive tape, at a maximum of 3.0 m intervals.

The tracer cable shall be connected to all surface boxes, and electrically tested for continuity by a registered electrician following installation and backfilling. Records of the electrical continuity test shall be provided by the contractor.

5.3.3.2 Tolerances

Pipes shall be accurately laid to the lines, levels and gradients shown on the approved drawings using pipe-laying laser equipment. The allowable tolerances are shown in Table 5-9.

Table 5-9 Tolerances

Alignment	Tolerance
Vertical Alignment	There shall be no steps at the junctions between successive pipe segments and no point in the pipeline shall be lower than any downstream point.
Horizontal Alignment	± 100mm
Invert levels (IL)	± 50 mm, subject to the downstream IL being lower than upstream IL.
Gradient	± 20 mm from a straight line between the inverts of successive manholes.

Where the installed pipes exceed the tolerances in Table 5-9, FNDC may order the removal and relaying of any affected pipes

5.3.3.3 Backfilling and Reinstatement

5.3.3.3.1. General

The trench or embankment fill material and trench reinstatement shall be as specified on the approved drawings and in accordance with **Sheet 31**.

Trench bedding and backfill material shall be compacted in layers to the designed ground level.

In public areas, backfilling shall be installed so that no more than 15 m of trench is open at any time.

Mechanical compaction of the backfill material directly above the pipe shall not be applied until sufficient cover is reached above the pipe to prevent damage to the pipe.

Displacement of the laid pipes during backfilling and compaction shall be prevented. Compaction or vibration equipment which can produce horizontal or vertical forces, which can cause damage or excessive distortion of the pipeline, shall not be used.

The Contractor shall reinstate trenches within seven days of backfill completion unless agreed otherwise by a SQEP. The surface level of the reinstated trench shall match the surrounding surface level.

Compaction test results shall be submitted to FNDC for approval, as applicable.

5.3.3.3.2. Backfill Materials

Except as specified below, selected material excavated from the trench may be used for backfilling trenches. Where reuse of previously excavated material is specified, its selection and use shall be approved by the SQEP.

a. In roads and paved areas where material excavated from the trench cannot meet the compaction standards in Section 5.3.3.3.3 Compaction, imported granular material shall be used.

b. Surplus and unsuitable material from the excavation shall be disposed of at a consented landfill.

5.3.3.3.3. Compaction

Within the Transport Corridor

Trenches in the Transport Corridor, or under private access or paved (vehicular) areas, shall be backfilled and compacted in layers of thickness commensurate with the compaction equipment to a density of at least 95% of the maximum dry density. Field compaction shall be tested as follows:

a. For cohesive soils - New Zealand standard compaction test, nuclear densometer and shear vane.

b. For non-cohesive soils - New Zealand standard compaction test, nuclear densometer or dynamic cone penetrometer (Scala Penetrometer).

Testing by other means shall be subject to the approved Inspection and Testing Plan or conditions of the EDA.

Compaction testing of sub-base and base course shall be in accordance with requirements 3.3.4 Pavement Testing.

The SQEP shall specify a testing regime to verify the compaction effort meets the density specified to support the designed traffic loading.

The Contractor shall undertake tests in accordance with the approved Inspection and Testing Plan or conditions of the EDA, to demonstrate that the specified compaction standards have been achieved throughout.

Outside of the Transport Corridor

Trenches not in roads or paved (vehicular) areas shall be backfilled and well compacted with mechanical equipment in layers not exceeding 300 mm thick to the specified finished level.

Under no circumstance shall the bearing capacity of the backfill material be less than that of the material prior to excavation, for the full depth of the trench. Scala Penetrometer tests may be used to establish the criteria for compliance, with a minimum of one test per 50 m of trench or 50 m^3 of trench backfill, whichever is greater.

Compaction testing of fill material shall be in accordance with NZS 4402:1988/1986.The Contractor shall undertake tests to demonstrate that the specified compaction standards have been achieved throughout.

5.3.4. Trenchless Construction

5.3.4.1 General

Trenchless technology may be preferable or required 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.

Trenchless construction shall only be used for applications in which the specified tolerance can be achieved.

Pipes used for trenchless installation shall have suitable mechanically restrained joints, specifically designed for trenchless application, which may include integral restraint, seal systems, or heat fusion welded joints.

Any trenchless technology and installation methodology shall be chosen to be compatible with achieving the required gravity pipe gradient.

5.3.4.2 Installation Methods

Trenchless installation methods for new pipes include

a. Horizontal directional drilling (HDD) (PVC with restraint joint/fusion welded PE):

b. Uncased auger boring/pilot bore microtunnelling/guided boring (PVC with restraint joint/fusion welded PE):

c. Pipe jacking (GRP/ reinforced concrete).

5.3.5. Joints

5.3.5.1 Rising Mains

Joints between fittings and pipes on rising mains shall be made using the most suitable of the following methods:

a. Socket & spigot (except for PE pipes) only where the socket is designed specifically for the spigot outside dimension:

b. Bolted unrestrained mechanical couplings (except for PE pipes/tension systems) where the coupling is either of the multi-fit type or specifically designed for the outside diameters of the items to be joined. Bolted unrestrained mechanical couplings shall not be used where the step difference exceeds 10 mm:

c. Flange-sockets to AS/NZS 2280:2020 or flange coupling adaptors to AS/NZS 4998:2009 (except for PE pipes):

d. Butt-welded jointing (PE pipes DN160 and larger only) by a specialist contractor only (see below):

e. Electrofusion (see below):

f. Mechanical couplers (full restraint type – PE pipes only):

g. Welding (concrete lined steel only):

h. Threaded connections to BSP (only for pressure tappings or similar):

i. Solvent-cement joints are not permitted without FNDC's specific approval.

5.3.5.2 Gravity Mains

5.3.5.2.1. General

Specification of joints on gravity mains shall be as follows.

a. All pipes shall have flexible joints of an approved type, such as Rubber ringed joints:

b. Steel pipes shall be flexibly jointed (bolted unrestrained mechanical coupling 'denso' wrapped and sealed with approved outer wrapping or approved rubber ring):

c. Joints shall be provided adjacent to manholes to the requirements of AS/NZS 2566.2:2002 except for PVC where proprietary connections may be used.

5.3.5.2.2. Rubber Ring Joints

Rubber ring joints shall be installed in accordance with the manufacturer's instruction. Care should be taken to ensure that the rubber rings are located evenly around the joint with no twists in them. The pipe shall be pushed up firm and tight to the joints.

5.3.5.3 Welding PE Pipes

Butt or electrofusion jointing of PE pipes shall be undertaken by a FNDC approved contractor using calibrated and data logging butt fusion or electrofusion machines. Only employees of an approved contractor who have successfully completed a Water New Zealand approved butt fusion or electrofusion jointing course for polyethylene pipe, or re-fresher in the past two years, shall be permitted to physically undertake welding.

Prior to commencing work, the following shall be provided:

a. Copy of current calibration certificate(s) of the butt fusion or electrofusion machine (not more than 12 months old)

b. Registration number of the fusion technician, and current certification (not more than 24 months old).

All jointing of PE pipe shall be data logged.

Fusion jointing shall take place in a covered environment to avoid contamination of weld faces and prepared pipe.

For all electrofusion joints, including tapping saddles, a mechanical scraper with winding mechanism shall be used to ensure even finishing. Hand scraping of pipe ends, with the appropriate tools, will only be permitted if mechanical scraping is not practicable and with prior permission from the Distribution Engineer. Electrofusion joints shall be undertaken using clamps and the equipment correctly calibrated.

5.3.5.3.1.

The certifying organisation shall satisfy the requirements of Section 5.3.5.1 Rising Mains.

In addition, welders may be required to carry out satisfactory test welds for each joint type and to stamp the welder's number on each joint. Butt welds shall be at least 90% of the tensile strength of the parent pipe material, when tested in accordance with ISO 13953:2001.

All internal weld beads shall be removed in an approved manner, to be smooth and flush with the pipe inner surface, without compromising the strength of the pipe joint.

5.3.6. Manholes

5.3.6.1 Channels and Benching

A semi-circular channel shall be formed in the concrete floor of the manhole. Benching shall then rise vertically from the spring line of the pipe to the height of the soffit and then be sloped back at a gradient of 1:3 (refer **Sheet 39**). A U3 standard of finish as specified in NZS 3114:1987 shall be achieved.

The flow channel shall be formed so that it presents an evenly curved flow path through the manhole. The cross section of the flow channel shall be uniform. In wastewater pipelines the main channel shall be lined with ceramic half pipes. Ceramic half pipes shall be saw cut to form mitred joints around bends.

Benching shall be floated to a dense, smooth hard surface using 3:1 sand cement mortar and a steel float. Side branches shall be similarly formed with a smooth bend into the main channel.

Use of pre-formed benched manhole bases from FNDC Approved Materials List - Wastewater and Stormwater is an acceptable alternative to formed in-situ benching.

5.3.6.2 Manhole Throats

The maximum depth of throat on all manholes shall be 450 mm.

5.3.6.3 Flexible Joints

All pipes, other than PE pipes, shall have a flexible joint adjacent to the manhole on all incoming and outgoing pipes not more than 600 mm away from the manhole wall. The upper part of the pipe inside the manhole shall be cut back to the wall, the reinforcement cut out and the ends plastered with a cement mortar to a neat finish. Where the pipe is cut using a power saw the ends of the steel reinforcement shall be protected from corrosion by the application of epoxy before rust has a chance to develop. Refer to **Sheet 39**.

5.3.6.4 PE Pipe Connections

PE pipe shall be connected to the manholes with sliding joints, as per **Sheet 33**.

5.3.6.5 Sealing of Manholes

Where precast manhole units are used, the joints of abutting units shall be sealed against ingress of water with an approved sealant and with epoxy mortar on the inside and outside of the joints.

Plastic manholes shall be sealed, where required, in accordance with the FNDC Approved Materials List - Wastewater and Stormwater.

5.3.6.6 Manhole Steps

The steps shall be bolted through the walls using properly formed and recessed bolt holes.

The step shall have a washer welded to it on the appropriate angle to seat flush against the inside of the manhole chamber.

Prior to tightening, BM100 shall be placed around the stainless-steel shank both inside and outside the manhole riser. After the steps have been tightened in place the outside recess which houses the nut shall be sealed with Expocrete 'UA' or acceptable equivalent in accordance with the manufacturer's directions. Plastering of the recess will not be approved. The sealant shall be applied at least 48 hours before the manhole risers are required for construction.

5.3.6.7 Concrete

All concrete used for manufacturing manholes shall have a minimum crushing strength of 20.0 MPa at 28 days, unless otherwise specified or detailed by FNDC.

5.3.7. Connections

Connections will preferably be made into manholes.

Direct connection of a minor pipeline into a major pipeline shall be in accordance with the following:

a. The minor pipe diameter shall not be greater than half of the major pipe diameter:

b. Connection is made via a suitable prefabricated junction or saddle:

c. The distance between the pipeline connection and the closest inspection point shall not exceed 25 m:

d. Saddling of catch-pit leads into primary lines is permitted provided that the connection is made at 45º or less to the direction of primary flow:

e. Saddling of double catch-pits is not permitted:

f. Connections shall be sealed with removable caps until required.

g. Connection locations and depths to invert shall be accurately measured and shown on As-Built Plans in accordance with the requirements of Section 1.7.2 As-Built Plans, Asset Information Schedules, Operation and Maintenance Manuals:

h. The connection position shall be marked with a wooden stake (100 x 50 mm) with 'WW' painted/fixed onto the stake and extending from the invert of the connection to a minimum of 600 mm above ground level.

Connections shall be constructed as per **Sheet 37**.

All connections to FNDC piped network or work on FNDC piped network shall be undertaken by a Licensed Contractor.

5.3.8. Pump Stations

5.3.8.1 Wet Well and Valve Chamber

Care shall be exercised to ensure that the wet well chamber is vertical and set to the correct levels before the station floor is poured.

Bases in accordance with FNDC Approved Materials List - Wastewater and Stormwatershall be used.

Flotation of the chamber shall be prevented.

Pipe joints shall be sealed and made watertight.

5.3.8.2 Foundations

The wet well pump station foundation shall be constructed as specified on the approved drawings (**Sheet 42** and **Sheet 43**).

Where not specified on the approved drawings, the SQEP shall investigate the foundation soils and determine a suitable foundation in accordance with Section 5.2.10.5 Wet Well and Section 5.2.7.7 Manholes Requiring Specific Design). The FNDC shall not be responsible for delays to the construction resulting from approval of designs.

5.3.8.3 Painting and Lining

Any block work mortar joints shall be pointed inside and outside, and all cores filled with grout.

The outside of the block work shall be painted with a waterproofing membrane and the internal walls of the well and valve chamber shall be painted with a sealant. The products shall be approved by FNDC before use.

5.3.8.4 Top Slab

The placement of reinforcement shall be carefully controlled to ensure adequate cover. The lids and frames shall be carefully set into the concrete upstands so that they fit flush with the finished upstand level. All concrete shall be ordinary grade 20 MPa crushing strength.

The lid and frame shall be as per FNDC Approved Materials List - Wastewater and Stormwater. All reinforcing steel bars shall be grade 300 deformed bars complying with AS/NZS 41671:2019 . All nuts, bolts and washers shall be grade 316 stainless steel with an appropriate releasing agent applied prior to setting any nut. Where concrete shall be poured around high-density polyethylene pipe, the pipe shall be first wrapped with 1.5 mm thick butynol sheeting.

5.3.8.5 Well and Chamber Lids

The primary covering lids shall be as per FNDC Approved Materials List - Wastewater and Stormwater as appropriate for the pump size selected at full development.

a. All stainless welds shall be AS/NZS 2980:2018, pickled to prevent corrosion. All metal to metal fasteners shall be coated with an appropriate releasing agent before installation:

b. All fasteners shall be 316 stainless steel:

c. All edges shall be made clean of burs or sharp edges:

d. Secondary Safety Lids are required where depth is greater than 2.0 m.

5.3.8.6 Cable Bracket

The float and motor cables shall be secured by a grade 316 stainless steel bracket with ceramic insulators. The bracket shall be mounted in such a position as to be easily accessible from the lid opening as shown in **Sheet 42** and **Sheet 43**.

5.3.8.7 Pump Discharge Bends

The pump discharge holding down bolts shall be grouted in place and accurately positioned so that the 50mm dia. pipe guide rails stand vertically between the guide rail brackets and the discharge connection. Care shall be exercised in grouting in the bolts to ensure that they will not vibrate loose with use.

5.3.8.8 Guide Rails

Guide rails shall be fixed to the edge of the well, using stainless fittings with the guide rails installed vertically using the Flygt guide rail bracket. The guide rails shall be 316 schedule 10 stainless steel tube and each guide rail shall be of a single continuous pipe run with no joins.

5.3.8.9 Riser

Each pump installed shall be fitted with an individual riser manufactured from 316 schedule 10 stainless steel tube. All welds shall be to AS/NZS 2980:2018, pickled to prevent corrosion. All flanges shall be of Table E.

Where a flange is installed on a horizontal pipework, the two bolts shall be placed so they are level at the top. On vertical sections the two bolts shall be perpendicular to the discharge bend inlet coupling base.

The riser for each pump consists of three major components:

a. The pump lift,

b. Valve wall penetration, and

c. Non-return valve connector.

5.3.8.10 Pump Lift

The pump lift component consists of a vertical section of pipe from the bellows located on the discharge bend to the valve set elevation. The section is to contain a single 90-degree bend.

If the design requires that the pump lift component shall be connected to a discharge bend of a smaller diameter, this is to occur by way of a reducer fabricated into the base of the vertical riser and the bellows sized to meet the discharge bend.

Where the pump lift component riser is greater than 3.0 m, additional support brackets shall be installed at 2.0 m intervals, measured down from the centre line of the valve wall penetration.

5.3.8.11 Valve wall penetration

A flange shall be installed prior to entering into the valve chamber wall, no closer than 200 mm to the wet well wall facing. The penetration through the valve wall shall be horizontal and centred vertically over the pipe discharge bend. No partial bends for realignment shall be used without specific authorisation from FNDC.

Where the pipe penetrates the valve wall, a square stainless-steel flange shall be welded to the pipe and bolted to the wall with dimensions at least 2.5 times the external pipe diameters and fixed with M16 stainless steel Chemset studs. The penetration hole for the riser to pass through shall be approximately 20 mm larger than the external diameter of the pipe and extend a sufficient length to the cut off to fully allow the bolted unrestrained mechanical coupling connection to slide fully onto this length of pipe work to release all downstream pipework.

A non-return valve connector shall be fitted with a length no less than 100 mm plus 60% the overall length of the bolted unrestrained mechanical couplings. It shall be fitted with a Table E flange and welded as per the required specifications and a 15 mm BSP threaded socket welded to the centre line of the pipe with a stainless steel plug no closer than 50 mm to valve flange.

5.3.8.12 Non-Return Valve and Riser Isolation Valves

The non-return and isolation valves shall be installed as per the manufacture’s requirements, post isolation valve.

5.3.8.13 Inlet

The inlet to the overflow pipe shall be baffled to restrict the entry of floatable solids and constructed in 316 stainless steel bolted to the wall. The baffle shall extend from 200 mm below the invert of the overflow pipe to 150 mm above the obvert of the overflow pipe. The cross-sectional area enclosed by the baffle shall be (at a minimum) 1.5 times the overflow pipes cross sectional area. The baffle shall be design such as to not impede the movement or operation of the pumps, level floats or ultrasonic level control.

5.3.8.14 Collection Manifold

The individual riser shall be joined together by a collection manifold which continues through the exterior valve wall including puddle flange over each pipe. On leaving the valve chamber, the individual risers shall be joined together using 45-degree connections. On collection of all individual risers the manifold is to proceed with a minimum straight length, free of fittings, for a distance of no less than five times the diameter of the pipe, prior to termination in a flange, for connection to the flow meter. The downstream section of the flow meter is to continue in stainless steel without fittings for at least 2 diameters, until either a rising main bypass tee fitted or the isolation valve.

All fastening bolts are to have a releasing compound applied prior to installation.

5.3.8.15 Emergency Storage

The Emergency Storage chamber shall be constructed in accordance with the approved drawings.

The entire storage tank shall be painted as per the requirements of the wet well.

Any washing fixtures are to be constructed using 304 Schedule 10 Stainless Steel pipe and fixtures.

5.3.8.16 Odour Control

Odour control shall be provided as specified on the approved drawings.

Where not specified on the drawings, provision of space free of services shall be provided in case of future installation, as shown in **Sheet 41**.

5.3.8.17 Direct Buried Cable

Where specified cables are laid directly in the ground, they shall be located not less than 0.6 m below ground on a 50 mm thick bed of clean sand. The trench shall be backfilled with a 75 mm thick layer, measured from the top of the cable, of clean sand. Lengths of 'Mag- Slab' cable cover shall then be laid end to end to provide cable protection. The trench shall then be further backfilled with clean sand or soil, free from rock, stones or other debris, to a level 200 mm below the surface. Orange PVC signal tape shall then be laid and backfilling completed, the surface being restored to Council's satisfaction.

5.3.8.18 Cable Ducting

The following cable ducts are required

a. One pump cable duct and one control cable duct of 100 mm dia. shall be installed from the base of the electrical control cabinet concrete plinth to the pump station chamber:

b. One 100 mm duct shall be installed in the plinth for the mains cable:

c. A 50 mm duct shall be installed from the electrical control cabinet concrete plinth to the flow meter:

d. A further 50 mm duct shall be installed for each of the emergency storage spray wash control solenoid and/or a distal float overflow if fitted:

Each cable duct shall be fitted with a pull cord for future cable repair works and shall be sealed, to restrict corrosive fumes entering the electrical cubicle, by way of expanding foam encased in a plastic liner to allow ease of future removal.

5.4. Completion of Works

5.4.1. Testing and Inspections for Pipelines

All wastewater mains and branch pipelines, including extended connections, shall be inspected during construction. On completion of all other engineering work within the development, there shall be a final test conducted.

Where the reticulation shall be vested in FNDC, this final test shall be carried out in the presence of a FNDC representative. If the reticulation is to remain private, this test shall be carried out in the presence of a SQEP who shall certify the test and forward the results to a FNDC representative

New sewer reticulation shall be completely and permanently isolated from the FNDC's 'live' sewer reticulation until such time as all tests are passed, and written authority from FNDC to connect to the live sewer is obtained. Connection shall only be carried out by a Registered contractor, and the connection shall be inspected by a FNDC representative before the connection is backfilled.

A minimum of 24 hours' notice is required to be given to FNDC before any tests are carried out, so that arrangements for a representative can be made. The Developer/Contractor shall provide all fittings and materials to carry out any tests.

5.4.1.1 Inspections

The Developer/Contractor shall ensure that inspection and subsequent approval is granted before continuing with the installation. Failure to follow this process may result in the Developer/Contractor removing items or excavating a competed work to allow inspection. The progress inspections include:

a. Set out:

b. Excavation and bedding:

c. Backfill:

d. Pre-pour Form and Reinforcing:

e. Pre-Cover Installation:

f. Water Tightness:

g. Rising Main Pressure Test:

h. Electrical Inspection.

5.4.1.2 Low Pressure Air Test

The materials and workmanship used shall pass a low-pressure air test.

a. Introduce air to the pipeline till a pressure of 300 mm of water is reached. (This shall be measured by a manometer such as a 'U' tube, connected to the system):

b. Wait until the air temperature is uniform (indicated by the pressure remaining steady):

c. Disconnect the air supply:

d. Measure pressure drop after five minutes:

e. The pipeline/manhole is acceptable if the pressure drop does not exceed 50 mm.

Note: The pipeline shall be sealed with suitably restrained plugs at both ends and at branch connections. The pipes should have the voids filled by soaking for 24 hours prior to testing.

5.4.1.3 Manhole Leakage Tests

The materials and workmanship used shall pass a low-pressure hydraulic test.

Manholes shall be watertight and tested by plugging and filling the manhole with water (allowing sufficient time for absorption).

During the test, the level of water in the manhole shall not drop more than 5 mm in 10 minutes.

5.4.1.4 Rising Main Test

Rising main pipeline and welds shall be tested in accordance with Section 6.3.3.1 Testing of Welds and Section 6.3.3.2 Pipeline Pressure Testing.

5.4.2. CCTV Inspections

5.4.2.1 General Requirements

CCTV inspection shall be carried out on every new system to vest in FNDC. The timing of CCTV inspection shall be determined by WC.

CCTV inspections and deliverables shall be in accordance with The New Zealand Gravity Pipe Inspection Manual, Fourth Edition.

All defects shall be remedied to the satisfaction of FNDC. Where defects are found and repaired the section of pipe shall be re-filmed to ensure that there are no further problems.

CCTV inspection shall be carried out for all existing wastewater pipes before and after the construction works, which may affect the pipes by either directly interfering with the network or indirectly by using machinery and/ or plant at the site which may impose heavy loads and vibrations onto the wastewater network.

CCTV inspection shall be carried out in dry weather and where there is no flow which may affect the quality of video and still images.

If there are pipe blockages and debris found the contractor shall apply to FNDC to flush the pipe with water prior to the CCTV being completed.

The CCTV camera shall travel upstream.

CCTV maps with log sheets (showing the pipe GIS identification references, still images of critical locations with distances form the stat node, and indication of defects types and severity) shall be submitted to the FNDC.

The following deliverables are required:

5.4.2.2 Deliverables

The following deliverables are required.

a. As-built plans and/or FNDC GIS maps for existing assets, showing pipes and nodes being inspected.

b. Computer generated log sheets showing the pipe identification references for new and existing assets; still images of critical distances from the starting node; and indication of defect types and severity.

c. CCTV inspection record in digital video format.

d. CCTV footage shall also be referenced to the node unique numbers and shown on As-Built Plans and/or FNDC GIS maps.

e. Still images shall be in a source file and a PDF format.

f. CCTV inspection summary sheets in a PDF digital format.

5.4.2.3 Header Information Required

Refer to FNDC QA/QC Manual 2022 for CCTV header information requirements.

5.4.3. Pump Station Commissioning

Refer to FNDC QA/QC Manual 2022 for pump station commissioning requirements.

Chapter 6: Water Supply and Reticulation

6.1. Introduction

6.1.1. Water Supply System Description and Expectations

This section covers the requirements for design and construction of all extensions and connections to the FNDC's water reticulation system. A connection to FNDC system shall be provided to all lots within Living and Business Zones unless FNDC confirms in writing that a connection is unwarranted, unavailable, or unsuitable.

Connections in other Zones will be subject to the availability of a water supply. The FNDC may however require that a water supply be provided to a development, regardless of the Zone, if FNDC considers that the connection would be a logical extension of an existing supply.

6.1.2. Objectives

The objectives of the water reticulation system are:

a. To supply the required quality and quantity of water to all properties as required by legislation and to meet or exceed the FNDC's performance standards.

b. To control the design and construction of water networks in order to ensure an acceptable water supply is available for each property, including fire flows, by providing:

   i. A watermain allowing an appropriate supply to each property, and

   ii. Service connections from the main to the point of supply to each residential property

c. To ensure that water networks meet the minimum design life requirement, taking into account structural strength, design loadings, soil conditions and water conditions (internal and external corrosion).

d. To ensure that water networks are cost efficient over their design life while accounting for environmental and community impacts through integrated three waters management and water conservation.

e. To ensure that where properties or household units are not within a water supply area or an extension of such an area, water is collected, treated and supplied in a way that is consistent with relevant building code and other national standards,

6.1.3. Performance Standards

New water supply works connected to a Water Supply Area shall be designed and constructed to achieve the following minimum standards:

a. Minimum pressure of 250 kPa at the point of supply for existing residential lots and for new connections at the building platform.

b. Minimum flow rate of 15 litres per minute at the point of supply for existing residential lots and 20 litres per minute for new connections.

c. Be designed and installed to ensure that the works will meet the Drinking Water Standards for New Zealand 2005 (Revised 2018) and the relevant water safety plan.

d. Provide firefighting pressure and flow in conformance with the SNZ PAS 4509:2008.

e. Achieve the specified minimum design life for systems/assets to vest with the FNDC.

f. All pipelines and fittings fixed by accurate positioning and the coordinates of those positions specified in terms of the FNDC's coordinate specifications in Section 1.7.2 As-Built Plans, Asset Information Schedules, Operation and Maintenance Manuals and Appendix G Drawing Standards:

g. Comply with all relevant structure plan requirements and pipe sizes set by FNDC in order to provide an integrated approach to development.

h. The supply shall be capable of serving the entire development and any undeveloped land beyond, when that land is developed to the ultimate development intensity.

6.1.4. Reference Documents

The following documents are referenced in this Chapter:

Note it is the responsibility of the ES user to ensure the most up to date referenced document is sourced.

6.1.4.1 Statutory

NRC Regional Plans

Resource Management Act 1991

Water Services Act 2021

Water Supply Bylaw 2012

6.1.4.2 New Zealand Standards

AS 1831:2007 - Ductile cast iron

AS 3996:2019 - Access covers and grates

AS/NZS 2033:2008 - Installation of polyethylene pipe systems

AS/NZS 2280:2020 - Ductile iron pipes and fittings

AS/NZS 2638.2:2011 - Gate valves for waterworks purposes - Part 2: Resilient seated

AS/NZS 4087:2011 - Metallic flanges for waterworks purposes

AS/NZS 4129:2020 - Fittings for polyethylene (PE) pipes for pressure applications

AS/NZS 4130:2018 - Polyethylene (PE) pipes for pressure applications

AS/NZS 4158:2003 - Thermal-bonded polymeric coatings on valves and fittings for water industry purposes

AS/NZS 4673:2001 - Cold-formed stainless steel structures

NZS 4404:2010 - Land development and subdivision infrastructure

NZS 4442:1988 - Welded steel pipes and fittings for water, sewage and medium pressure gas

NZS 4522:2010 - Underground fire hydrants

NZS 7643:1979 - Code of practice for the installation of unplasticized PVC pipe systems

SNZ PAS 4509:2008 - New Zealand Fire Service firefighting water supplies code of practice

6.1.4.3 District Council Documents

Approved Materials List - Water Services (*To be provided by FNDC on request*)

FNDC Connect-to-our-water-network Commercial and Residential Water and Wastewater Connection Application Forms

Quality Assurance / Quality Control Manual for Vested Assets - Inspection and Handover Procedures (2022)

FNDC Treated Water Supply Bylaw 2021

6.1.4.4 Other Referenced Documents

Drinking Water Standards for New Zealand 2005 (Revised 2018)

ENZ Producer Statement – PS1 Design

Waka Kotahi – M/7 Roadmarking Paints (2009)

PIPA - POP010A – Polyethylene Pressure Pipes Design for Dynamic Stresses

PIPA- POP101 – PVC Pressure Pipes Design for Dynamic Stresses

UK Water Industry Specification: 4-24-01 - Specification for Mechanical Fittings and Joints for Polyethylene Pipes of Nominal Sizes 90 to 1000

6.1.5. Private Water Supply Systems

The Water Services Act 2021 provides that all water suppliers have a duty to ensure their water is safe to drink.

All drinking water suppliers and supplies must be registered with Taumata Arowai.

Small isolated developments outside existing water supply areas may be served by private water supply systems. These systems may serve either single or multiple lots.

Private water supply systems shall only be approved as potable water supplies if they comply with the Drinking Water Standards for New Zealand 2005 (Revised 2018), and operation and monitoring systems are implemented to ensure ongoing compliance of the system with the Drinking Water Standards for New Zealand 2005 (Revised 2018), where applicable.

The Developer is advised to consult with and shall obtain any necessary approvals from the FNDC, Fire and Emergency New Zealand, Northland Health and the Northland Regional Council.

6.1.6. Upgrading of Existing Water Supply System

Where the existing reticulation or a proposed extension cannot comply with the minimum flow or operating pressure requirements, the Developer may be required to provide and install elevated storage and/or booster pumping systems to the approval of the FNDC.

6.1.7. Connection to Existing Water Supply System

6.1.7.1 Work on Existing Watermains

Where work is required on or over existing watermains, the Developer may be required to lower, move or protect the main to ensure cover and separation distances are met.

Only a Licensed Contractor will be permitted to work on existing live watermains (see 6.3.1 Licensed and Registered Contractors).

The Developer shall pay the full cost of this work.

6.1.8. Disconnections

Where an existing water supply connection to a development is no longer required or is not adequate the existing connection shall be permanently disconnected.

FNDC approval is required for disconnections from the water supply network to ensure continued network integrity and quality of supply.

Disconnections shall only be undertaken by a FNDC/ FNDC Agent.

A FNDC Connect-to-our-water-network Commercial and Residential Water and Wastewater Connection Application shall be submitted to FNDC and approved before any work may be undertaken.

A FNDC representative shall inspect all disconnections before back-filling takes place. All FNDC owned fittings including meter and backflow preventer shall be returned to the FNDC.

6.2. Design

6.2.1. Engineering Design Approval

6.2.1.1 Content of Design Submission

In addition to the general requirements in Section 1.5.3 Detailed Design/Approval, the information submitted for an EDA of water supply design shall provide, as applicable, the following:

a. Include analysis of the water demand for consumption and firefighting. Firefighting flows for industrial land shall be obtained from SNZ PAS 4509:2008, based on type and size of industry,

b. Include analysis of potential water hammer, surge and fatigue effects and demonstrate appropriate mitigation measures are incorporated into the design,

c. Demonstrate that the existing and proposed water supply reticulation is adequate and identify existing and proposed connection points to serve the proposed development,

d. Where the proposal would use more than 10% of the capacity of the existing water source and/or treatment facilities, demonstrate that the existing water source and/or treatment facilities are adequate to serve the proposed development,

e. Demonstrate that required firefighting pressures and flows can be met from all hydrants and service connections,

f. Submit details of any system components that do not meet the performance standards (Section 6.1.3 Performance Standards), i.e. components with design lives less than 100 years, and

g. Contain Producer Statements forms (refer to PS1 Design) identifying the design standards used, and certifying that the design complies with the ES.

All analysis shall include appropriate supporting information, calculations, reports, etc. to enable an external review to be undertaken without reference back to the design originator.

For industrial uses, the type and size of industry used to establish water use and the Water Supply Classification for firefighting supply shall be identified. This information will be put on the relevant property files by the FNDC.

Any departures from the ES shall be noted and fully justified. Such assessment shall be carried out by a SQEP who is working within their competencies in accordance with the requirements of Section 1.5.3 Detailed Design/Approval and Table 1-4. The SQEP shall identify the design standards used and certify that the design complies with the referenced standards.

The SQEP shall certify that the works through all stages until completion are in accordance with the requirements of Section 1.5.3 Detailed Design/Approval and Table 1-4.

Note: Refer to Appendix A Design for Surge and Fatigue for details of designing for surge and fatigue.

6.2.2. Design Criteria and Scope

6.2.2.1 General Requirements

Proposed water supply works shall be designed for connection to a FNDC approved location on the existing water supply network.

The FNDC may specify the diameters and classes of pipes to be used for all reticulation within the development and specify reticulation alignment.

SQEP shall consider the hydraulic adequacy of the network including the specified levels of service, water quality and impact on the existing network.

For design purposes, and subject to availability, FNDC may:

a. provide details of the working pressure of the existing water supply network, or of pressures at the approved connection point to the existing reticulation, and

b. provide details of the capacity of existing water supply facilities.

Where this information is not available from FNDC records, or further information is required for the design, the Developer shall consult with FNDC regarding the completion of any investigations.

The Developer shall cover the cost of investigations required to complete their design to the ES.

6.2.2.2 Scope of Design

The scope of design shall include:

a. Pipe sizes, material, and layout of the reticulation,

b. Hydraulic design,

c. Service connection locations, including multi-connection box locations,

d. Types and locations of valves, hydrants and other similar control devices

e. Thrust blocks and anchors (where applicable),

f. Pipe cover and protection appropriate to expected loading,

g. Bedding and backfill, and any specific installation requirements (e.g. pipe anchors/bulkheads), and

h. Preparation of construction specifications.

Design drawings shall comply with the requirements of Section 1.5.3.3.5 Design Statements and Engineering Plans and Appendix G Drawing Standards and the following requirements:

i. Infill developments (not exceeding four lots): may be shown on combined services design drawings, and

j. All other developments: water reticulation shall be on separate drawings from other services.

6.2.2.3 Domestic Demand

The design shall provide for annual, seasonal and peak domestic demand, and allow for a minimum domestic demand of 300 litres/person/day.

6.2.2.4 Commercial and Industrial Demand

The water demands for commercial and industrial areas, and for irrigation shall be analysed and specifically allowed for in the design.

6.2.2.5 Peak Flows

Peak Flows (PF) shall be calculated as follows:

Peak Day Demand (over a 12 month period) = Average Day Demand x PF, where;

a. For populations below 2,000 PF = 2,

b. For populations above 2,000 the FNDC shall specify PF.

Peak Hourly Demand = Average Hourly Demand (on peak day) x PF (over a 24-hour period) and where:

c. For populations below 2,000 PF = 5,

d. For populations above 2,000, the FNDC shall specify PF.

The minimum flow for an individual 20 mm ID residential connection shall be 20 litres per minute at the meter location.

6.2.2.6 Pressure Fluctuations

The design shall ensure that large pressure fluctuations caused by variations in usage are avoided.

Head losses in existing and new mains at peak flow shall be limited to:

a. DN less than or equal to 150 mm: 5 m per 1000 m of pipeline

b. DN greater than or equal to 200 mm: 3 m per 1000 m of pipeline.

6.2.2.7 Flow Velocities

Pipelines shall be designed for flow velocities within the range of 0.5 – 2.0 m/s.

6.2.2.8 Operating Pressures

The minimum service water pressure, in other than firefighting conditions, shall be 250 kPa at the ground level of each lot.

Where minimum service water pressure cannot be met, a booster pumping system may be required. Provided that the water supply reticulation satisfies firefighting performance standards, private pumps serving up to five lots may be provided. The lot owners shall be jointly responsible for ongoing maintenance of the booster system and this responsibility shall be registered on the affected property titles.

The preferred operating pressure in the reticulation system shall be 400 kPa or the working pressure, whichever is the lesser. The FNDC may require that a pressure reducing valve be installed to reduce the pressure in any development to 400 kPa or below.

For the purpose of pipeline design, the maximum static water pressure at ground level for any lot shall be 600 kPa, unless otherwise approved by the FNDC. In cases where the static pressure exceeds 600 kPa, a pressure reducing valve may be required.

6.2.2.9 Capacity and Future Expansion

SQEPs shall allow for the effect on existing and potential future development in an area when determining whether there is capacity to serve a subdivision.

The FNDC has the discretion to make a final decision on water availability.

Where future development beyond the current development boundaries is practicable, reticulation (sufficient to serve the future development) shall be extended to the boundaries of the current development. Costs of the extensions shall be at the Developer’s expense.

Where applicable, the Developer shall provide a blanked off line to serve future development. FNDC may require installation of additional pipelines or fittings in order to prevent stagnant areas occurring in the extended reticulation prior to any future development proceeding.

6.2.3. Piped System Layout

6.2.3.1 Mains and Rider Mains

Mains and rider mains shall in general be located within public road reserves.

A principal main shall be laid on at least one side of all carriageways. The FNDC may also require principal mains on both sides of arterial and dual carriageway roads, and also in industrial subdivisions.

A rider main shall be laid along the road frontage of all lots not fronted by a principal main including the circular head of cul-de-sacs. Rider mains shall be designed as ring mains, with a connection to a principal main at both ends as shown in **Sheet 45**. Fire mains may be required in a private way or private road to meet proximity requirements for buildings. See Section 6.2.9.2 Hydrant Locations for hydrant locations.

The order and layout of watermains and other underground services shall be in accordance with **Sheet 29** and **Sheet 30.**

Water mains shall have a minimum clearance, between the outside edges of the water service and any other service, of:

a. 500mm, or

b. three times the water service diameter,

whichever is the greater, or

c. the greater of the required clearances between the relevant services as shown on **Sheet 30**.

Watermains shall always be laid at a higher level than wastewater pipelines to avoid cross contamination.

6.2.3.2 Reticulation on Private Property

Location of FNDC owned reticulation within private property, or down right-of-way or private roads, requires specific approval from the FNDC.

Approval of public reticulation located in private property or right-of-way will depend upon:

a. the number and length of connections required, and/or

b. the requirement to provide fire cover that complies with SNZ PAS 4509:2008.

If approved, the following shall be provided:

a. An easement in favour of FNDC over the private property, right-of-way or private access,

b. The main shall be laid in a duct,

c. The required minimum clearances from other services (refer to **Sheet 30**) shall apply, and

d. Valves and surface boxes shall be located in berms, clear of carriageways where practicable.

The FNDC may require the legal width of the access to be greater than the minimum specified in Section 3.2.28 Private Accessways in order to ensure minimum clearances from other services.

Details on points of supply are as stated in FNDC Treated Water Supply Bylaw 2021.

6.2.3.3 Minimum Cover

The minimum cover between the top of the pipe and finished ground level for all reticulation shall be:

a. 600 mm in areas not subjected to traffic loading, or

b. 900 mm under carriageways and trafficked areas.

The FNDC may require greater depth of cover in certain circumstances.

Any pipelines that cannot achieve the minimum pipe cover requirements shall:

a. Be specifically designed by a SQEP to support the likely loading in relation to the actual cover to be provided, or,

b. Be provided with pipe protection in accordance with **Sheet 32**.

All pipes with less than 500 mm cover under carriageways shall be laid in a larger protective duct.

Where excavations for entrances to developments encounter existing water supply reticulation, then those pipelines shall be relocated to comply with the cover requirements of this section. The Developer shall cover the cost of relocation of the existing reticulation to provide compliant cover.

The sections of pipe adjacent to a carriageway crossing shall be gradually deepened either side of the carriageway, to allow the required cover to be achieved under the carriageway without provision of vertical bends. Air valves may be required on the resulting crests in the pipe.

Service connections shall not have less than 600 mm cover under footpaths and berms terminating at the meter box as per **Sheet 46**. Reduced cover is accepted where the service line connects to the main and as the service line approaches point of supply.

6.2.3.4 Clearance from Structures

Pipes adjacent to existing buildings and structures shall be located clear of the 'zone of influence' of the building foundations. If this is not practicable, a Specific Design shall be undertaken to cover the following:

a. Protection of the pipeline,

b. Long term maintenance access for the pipeline, and

c. Protection of the existing building or structure.

Any such proposals shall be considered an Alternative Design (Section 1.5.1.2 Alternative Designs). Approval shall be at the discretion of the Water Manager.

Sufficient clearance for laying and access for maintenance is also required. Table 6-1 may be used as a guide for minimum clearances for mains laid in public streets.

Table 6-1: Clearances from Structures

Pipe Diameter (DN)	Minimum Clearance to wall or building (mm)
<100	600
100 to 150	1000
200 to 300	1500
375	2000

Note: These clearances shall be increased for mains in private property (even with easements) as access is often more difficult and the risk of damage is greater.

6.2.3.5 Watermains Near Trees

Pipes shall not be installed within the tree drip line.

6.2.3.6 Clearance from Existing Reticulation

Where any pipe or cable is laid alongside existing water reticulation then a separation of at least 1m is to be maintained where practicable so as not to disturb the existing trench.

6.2.3.7 Aerial Pipes and Pipe Bridges

Any such proposals shall be designed by a SQEP and considered an Alternative Design (See Section 1.5.1.2 Alternative Designs) and approval shall be at the discretion of the Wastewater Manager.

If a pipe bridge is approved by FNDC for construction, the following Specific Design requirements shall be satisfied:

a. The underside of the pipe bridge structure shall be a minimum of 300 mm above the 1% AEP (+ CC 20%) flood levels.

b. Where pipelines are fixed to road bridges, they shall be installed on the downstream face of the bridge and shall be located above 1% AEP flood levels.

c. Piles shall be concrete unless specifically approved by the FNDC

d. Pipe materials shall be ductile iron or coated steel and shall be provided with an appropriate Petrolatum wrapping.

e. The Developer shall be responsible for obtaining all necessary building and/or resource consents.

6.2.3.8 Thrust and Anchor Blocks

On all mains exceeding 50 mm diameter where no end restraint is available, concrete anchor blocks shall be provided at all valves, bends, tees, reducers and dead ends. Refer to drawings WS-003, 004 & 005 in NZS 4404:2010 for further detail.

Generally, anchor/thrust blocks are not required on PE mains, except where a connection is made to an unrestrained pipe or fitting.

The size of anchor block bearing surfaces shall be specifically designed. **Sheet 50** gives guidelines for shape and size for a soil with a bearing pressure of 100 kPa and a design pressure of 1500 kPa. These shall be confirmed by a SQEP at the time of design.

Anchor block concrete shall be ordinary grade concrete supplied from a graded plant and have a minimum compressive strength of 17.5 MPa at 28 days. All anchor blocks shall be poured using adequate formwork, with the bearing surface poured against an undisturbed soil surface. A protective wrapping shall be provided between the pipe and concrete.

If reticulation is being extended from the end of an existing pipe with a blank cap and thrust block, the thrust block shall be removed, and the new pipe continued in the same alignment as the original pipe.

6.2.4. Fire Service Requirements

6.2.4.1 Fire Risk Classification

A “normal single family home” will have a classification FW2. Other buildings with a sprinkler system fitted to an approved standard may have a classification of FW2.

All other buildings are classified according to Table 1, SNZ PAS 4509:2008.

6.2.4.2 Fire Fighting Water Requirements

The minimum standard of water supply for firefighting shall be as set out in Table 6-2.

The required flow shall be obtained from the maximum number of fire hydrants as scheduled within an accessible distance of 270 m of any fire risk. The accessible distance is via a route from the fire hydrant to the property, following roads, driveways or rights of way.

For maximum hydrant spacing refer to Section 6.2.9.2 Hydrant Locations.

The water supply requirements for fire protection systems shall be considered in addition to firefighting water supplies. All firefighting water requirements are additional to the expected daily demand.

The minimum firefighting residual running water pressure shall be 100 kPa at any fire hydrant. For industrial subdivisions, the water supply classification to which the system has been designed shall be stated. Following approval, this classification shall be registered against all property titles as a consent notice, noting that the design does not necessarily account for future consumption from other large users.

For large industrial sites, the requirements of SNZ PAS 4509:2008 may not be able to be met from existing Water Services infrastructure. In such cases, the Developer shall provide a supplementary supply. The Developer shall establish requirements and obtain approval for such a supply from the Fire Service and provide evidence of this approval with the consent application.

Where any development is of such a nature that the required flows cannot be achieved without serious negative effects on the system, the Developer shall install sprinklers or provide an alternative means of firefighting to the satisfaction of the NZ Fire Service.

For non-reticulated firefighting water requirements refer to SNZ PAS 4509:2008.

Table 6-2: Simplified Method for Determining Fire Fighting Supplies

Water Supply Classification	Water flow within an accessible distance of 135m (l/s)	Additional water flow required within an accessible distance of 270m (l/s)	Water storage time (min)	Water storage volume (m^3)	Maximum number of fire hydrants to provide flow
FW1	7.5		15	7	1
FW2	12.5	12.5	30	45	2
FW3	25	25	60	180	3
FW4	50	50	90	540	4
FW5	75	75	120	1080	6
FW6	100	100	180	2160	8
FW7	As calculated (see note 7 below)				

Refer to Table 1 SNZ PAS 4509:2008 for Water Supply Classification.

Notes – (from SNZ PAS 4509:2008)

(1) Table 1 lists the minimum requirements for firefighting water supplies. In developing towns' main reticulation systems, a water supply authority needs to cater for domestic/industrial water usage in addition to the above. This procedure is outlined in Appendix K. of the Standard

(2) Special or isolated fire hazards which have higher requirements in an area of lower water supply classification shall determine measures to mitigate the hazard or increase the water supply (see 4.4).

(3) Where houses have a sprinkler system installed to an approved Standard, the distance to a fire hydrant or alternative water supply may be negotiated by agreement with the Fire Region Manager.

(4) The water requirements for fire protection systems shall be considered in addition to the firefighting water supplies, as detailed in table 1 (FW2), the fire protection system demand plus 1500 L/min (25 L/s) at 1 bar residual pressure.

(5) The minimum flow from a single hydrant shall exceed 750 L/min (12.5 L/s), except for those cases where a home sprinkler is installed, in which case the minimum is 450 L/min (7.5 L/s) while the maximum design flow, for safety reasons, is limited to 2100 L/min (35 L/s).

(6) If the minimum water storage requirement as listed in the above table is not available from the reticulated system (reservoir), water can be sourced from an 'alternative supply' as approved by the Fire Region Manager. This water supply shall always be within 90 m of the fire risk.

(7) FW7 is for either special or isolated hazards or where the fire hazard due to the size of the largest firecell and its fire hazard category make specific fire engineering assessment necessary. Appendix H and J [SNZ PAS 4509:2008] shall be used as the basis for calculating this required firefighting water supply.

(8) See Appendix B [of SNZ PAS 4509:2008].

6.2.4.3 Dedicated Sprinkler and Fire Fighting Watermains

Dedicated sprinkler and firefighting watermains require specific approval from the FNDC.

Design of sprinkler systems shall demonstrate that the minimum operating pressure of 250 kPa is available.

All dedicated watermains for sprinkler systems shall have a FNDC approved testable double check (or RPZ) detector backflow prevention device together with isolation valves for testing, located within, but as close as practicable to the property boundary. The owner shall be responsible for the ongoing maintenance of the sprinkler system.

All dedicated private firefighting watermains with hydrants connected to them shall have an RPZ backflow prevention device together with isolation valves for testing located within, but as close as practicable to the property boundary together with an electromagnetic water meter, or NZ Insurance FNDC approved meter. The backflow prevention device shall be mounted above ground level and be protected by a cage to avoid damage. The hydrants shall not be used for any purpose other than firefighting.

6.2.4.4 Domestic Sprinkler Systems

Domestic sprinkler systems shall be designed to run at a pressure of no more than 250 kPa, which is the target minimum operating pressure at customer meters.

If the sprinkler system is a dead-end system and not linked to the internal plumbing, then a backflow preventer shall be installed.

All sprinkler systems shall be metered.

6.2.5. Design Life

All elements of water supply networks shall be designed and constructed for a design life expectancy of at least 100 years.

Where components of the water supply network, such as pumps, metering, control valves, and control equipment require earlier renovation or replacement, it shall be considered an Alternative Design (see Section 1.5.1.2 Alternative Designs) and assessed as a departure from the ES, requiring specific approval by the Water Manager. The proposed water works shall document the asset renewal requirements for each component in the Operations and Maintenance Requirements, which shall be provided with EDA.

6.2.6. Approved Materials

Materials and products used for public water supply networks must be in accordance with the FNDC Approved Materials List - Water Services. This can be updated from time to time at the discretion of the FNDC.

The use of material not described in the FNDC Approved Materials List - Water Services shall be considered an Alternative design (see Section 1.5.1.2 Alternative Designs) and shall require specific approval from the Water Manager.

The FNDC Approved Materials List - Water Services will be updated from time to time at the discretion of the FNDC.

Materials and pressure ratings for pipelines greater than DN 150 shall be determined by Specific Design and in consultation with the FNDC.

6.2.7. Pipe Selection

6.2.7.1 General Requirements

The size, class and material of water supply mains shall be selected to achieve the objectives and meet the performance standards set out in Section 6.1.2 Objectives and Section 6.1.3 Performance Standards.

Pipeline sizes shall allow for future growth, both infill and extension.

6.2.7.2 Standard Pipe Sizes

Pipelines shall be standardised as DN 50, 100, 150, 200, 250, 300, 375, 450, 525 and 600 mm nominal internal diameter only. The FNDC shall specify the diameter of larger pipes.

Design documentation and drawings shall clearly indicate whether diameters of pipes are specified as inside (ID) or outside (OD) diameters.

Principal Main sizing shall be in accordance with Table 6-3. Rider Main sizing shall be in accordance with Table 6-4.

Table 6-3: Empirical Guide for Principal Main Sizing

Nominal diameter of main DN	Capacity of main (single direction feed only)			
	Residential (lots)	Rural residential (lots	General/light industrial (ha)	High usage industrial (ha)
100	40	10	-	-
150	160	125	23	-
200	400	290	52	10
225	550	370	66	18
250	650	470	84	24
300	1000	670	120	35
375	1600	1070	195	55

Table 6-4: Empirical Guide for Rider Main Sizing DN 50 Rider mains

Pressure	Maximum number of household units	
	One end supply	Two end supply
High> 600kPa	20	40
Medium 400 to 600kPa	1530	30
Low <400 kPa	715	15

6.2.7.3 Minimum Pipe Sizes

Minimum pipe sizes shall be as set out in Table 6-5.

Table 6-5: Minimum Water Supply Pipe Sizes

Reticulation Hierarchy	Minimum ID (mm)
Industrial Area Main (Business 4)	150
Industrial Rider mains	100
Principal Main (other Zones)	100
Residential Rider main	50
Residential Service Connection	20

6.2.7.4 Pipe Class

Standard approved pipe classes are given in Table 6-6. Other classes shall not be used, except with FNDC's specific approval.

Table 6-6: Pipe Classes

Class of Pipe and Fittings	Maximum Working Pressure	
	Head (m)	kPa
Class 12 (PN12.5)	120	1200
Class 16 (PN16)	160	1600

6.2.7.5 Pipe Materials

The following pipe materials are approved for use:

a. PE80/PE100 to AS/NZS 4130:2018,

b. Ductile Iron to AS/NZS 2280:2020, and

c. Steel to NZS 4442:1988.

Watermains shall be constructed using PE80 or PE100 unless otherwise approved or required by the FNDC.

PE pipes shall conform to the following requirements:

a. Rider mains and service connections of 50 mm ID and under shall use solid blue PE 80 pipe or black internally with a blue outer skin,

b. PE 80 and PE 100 watermains with a nominal ID of 100 mm or greater shall be black internally with a blue outer skin, and

c. The blue outer skin shall be co-extruded with the internal material and have a thickness equivalent to 10% of the pipe wall thickness unless otherwise approved by the FNDC. The Developer shall provide evidence of the blue outer skin thickness.

Note: Blue, or black with blue stripe pipes or ducts shall not be used for any application other than potable water supply within the Far North District.

Note: PVC is not an acceptable pipe material for new installations, it shall only be used for repair work carried out by the FNDC.

Note: Steel or ductile iron will only be approved where the use of PE is not appropriate, e.g. in above ground applications.

Note: Use of steel or ductile iron is subject to specific FNDC approval, which will require evidence of tight quality control of fabrication and construction.

Note: Steel and ductile iron pipes shall have a spun concrete lining not less than 6 mm thick, and an external coating of extruded blue HDPE as detailed in the FNDC Approved Materials List - Water Services. Care shall be taken not to damage the coating during handling and installation. No welding is permitted after the protective coatings have been installed on the pipes.

6.2.8. Valves, Fittings and Marking

6.2.8.1 General

All valves and fittings shall be in accordance with FNDC Approved Materials List - Water Services (See also Section 6.2.6 Approved Materials).

6.2.8.2 Sluice Valves and Peet Valves

6.2.8.2.1. Types

Sluice valves used on principal mains shall be ductile iron Resilient Seated valves to AS/NZS 2638.2:2011 and fully nylon coated to AS/NZS 4158:2003. They shall be bi-directional, anti-clockwise closing, have raised flange faces to AS/NZS 4087:2011 and shall be provided with cast iron spindle caps.

The depth to the top of the spindle from the finished ground surface shall be, where practicable, between 75 mm and 250 mm and the spindle shall be truly vertical. Where depth to the spindle exceeds 500 mm a spindle extension shall be used to bring the top of the spindle between 75 mm and 250 mm of the surface.

Peet Valves used on rider mains shall be ductile iron Resilient Seated valves to AS/NZS 2638.2:2011 and fully nylon coated to AS/NZS 4158:2003. They shall be clockwise closing with a ductile iron handwheel. They shall have threaded end connections to which a 63 mm PE compression coupling can be screwed.

Use of butterfly valves requires the specific approval of the FNDC. If approved they shall meet the following Specific Design requirements:

a. Be anti-clockwise closing, and

b. Be fitted with travels tops and a special type of spindle or cap dolly, which differs from those for sluice valves.

6.2.8.2.2. Location of Valves and Fittings

Valves shall be so arranged that a shutdown of any section of watermain will affect as small an area as practicable, in accordance with .

Valves located at intersections shall be fixed on all legs of a tee or cross installation and shall, where practicable, be located in berm areas free of the carriageway.

A peet valve is required on rider mains at the connection to the principal main. Where there are more than 15 connections on the rider main, an isolating peet valve shall be provided in the middle of the rider main.

Valve layout on the principal and rider mains shall enable the rider main to be flushed through the nearest hydrant. Where this is not practicable a scour valve may be required.

Where the rider main is a continuation from the end of the principal main in the same direction, the end of the principal main shall be provided with a peet valve immediately after the reducer.

The maximum spacing of valves shall be in accordance with Table 6-7.

Table 6-7: Valve Spacing

Water Main Size DN	No of Property Service Connections (nominal)	Maximum Spacing of Valves (m)
≤ 150	40	300*
200 - 300	100	750
≥ 375	150	1000
* In rural areas, the maximum spacing may be increased to 500 m		

6.2.8.3 Air Release and Scour Valves

Air Release and Scour Valves shall be located within the network, as required, to provide effective release of entrained air and effective flushing of the system. The FNDC may specify the type, number and/or location of air release and scour valves.

Air release valves shall be ductile iron and be a combination type as per the FNDC Approved Materials List - Water Services. They shall be installed in a fully draining box as per **Sheet 51**.

A connection to a suitable drainage system shall be provided for all scour points where practicable.

6.2.8.4 Pressure Reducing Valves

Pressure reducing valves may be required by FNDC where water pressure is greater than 600 kPa and a significant number of properties are affected or potentially affected (typically over a distance of 500 m and affecting more than 40 lots).

Pressure reducing valves shall be installed as per **Sheet 52**. Pressure gauges are required upstream and downstream of the valve. Only valves as specified by the FNDC Approved Materials List - Water Services shall be used.

The valve shall be installed in an approved chamber with isolating valves to allow removal.

6.2.8.5 Valve Marking

The position of all valves on watermains shall be indicated by a FNDC approved reinforced concrete indicator post bearing the inscribed letters ‘SV’, ‘AV’, ‘BV’ or ‘PV’ in black to indicate either sluice valves, air valves, butterfly valves or peet valves, respectively and shall be in accordance with **Sheet 48**.

A concrete mowing strip 150 mm wide shall surround the post when it is set in the grassed berm.

The correct main size in millimetres and the distance between marker and valve in metres shall be attached to the post using black adhesive lettering near the top of the post.

There shall also be a rectangle painted on the kerb in a direct line between the valve and the marker post. This rectangle shall be white unless the valve shall be normally closed, in which case it shall be red. In all cases the colour of the valve box lid shall match the rectangle. This rectangle shall be painted using Waka Kotahi M/7 Class B paint or at the discretion of the FNDC Water Manager.

6.2.9. Hydrants

6.2.9.1 Hydrant General Requirements

All mains of 100 mm diameter or greater shall be provided with hydrants. Hydrants shall comply with the following requirements:

a. Hydrants shall be ductile iron, clockwise closing, screw down type in accordance with NZS 4522:2010, and shall be tall pattern.

b. Hydrants and risers shall be fully coated inside and out with blue nylon to AS/NZS 4158:2003.

c. Hydrant stoppers shall be resilient seated and encapsulated in nitrile or EPDM rubber.

d. Hydrant spindles shall be non-rising stainless steel or DR brass, stem seals shall be nitrile rubber 'O' rings (gland packing is not acceptable).

e. Hydrant tees shall be ductile iron and coated in Rilsan 11 or approved alternative complying with AS/NZS 4158:2003**.**

f. Sealing cup washer shall be of nitrite rubber and the gland seal shall be either braided PTFE yarn or a minimum of two captive 'O' sealing rings.

g. Hydrants shall not be self-draining.

6.2.9.2 Hydrant Locations

Hydrants shall be located opposite the common boundaries of lots and spaced at intervals not exceeding 135 m on principal mains.

For developments requiring pipelines greater than or equal to 100 mm ID on both sides of the road, hydrants shall be fitted on the larger pipe as above, and on the smaller pipe at intervals not exceeding 270 m.

Terminal hydrants shall be within 135 m of the furthermost portion of any building site along a route that is fully accessible[1]. In cul-de sacs or other terminal streets the last hydrant shall be as per **Sheet 45** and not be more than 65 m from the end of the street.

Where a private way is more than 65 m long, a hydrant shall be provided at the street end of the private way or on the other side of the street immediately opposite the entrance.

The FNDC may require a 100 mm diameter principal main with hydrant to be constructed within a private way or private road to ensure fire coverage. In this instance, adequate turning must be provided within 50 m of the end of the private way. Adequate turning shall mean a turning area of no less than 11.3 m radius, or as per Fire and Emergency NZ requirements. The access shall be designed to take heavy vehicles.

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[1] The definition of accessible is a route from the fire hydrant to the building or building site following roads, driveways or right of ways.

Where an isolated risk is identified such as a school or large industrial complex, a private fire main shall be constructed onto that lot. No other reticulation shall be taken off this line. Meter and backflow requirements shall apply as per the ES.

Hydrants shall be readily accessible for fire appliances and should be positioned near street and private way intersections and at least 6 m from any building.

Hydrant risers shall be used where necessary to ensure that the top of the spindle is not less than 75 mm nor greater than 250 mm below finished surface level.

Hydrants are also required at all dead-end lines, high points for the purpose of air release, and low points to enable mains flushing if a normal washout cannot be fitted.

6.2.9.3 Hydrant Marking

Location marking of fire hydrants shall be to SNZ PAS 4509:2008 and as per **Sheet 48**.

Markings in carriageways and berm areas shall by in accordance with **Sheet 48**. Final triangular hydrant markings shall be placed at completion of the works. Marking around hydrant boxes in parking bays shall be yellow retroflective paint.

Yellow painted, FNDC approved reinforced concrete marker posts shall be fixed 225mm from the street boundary at the closest point to and facing the hydrant, with the top of the post 600mm above finished ground level.

A concrete mowing strip 150 mm wide shall surround the hydrant marker post when it is set in the grassed berm.

The correct main size in millimetres and the distance between marker and hydrant in metres shall be attached to the post using black adhesive lettering near the top of the post.

6.2.10. Surface Boxes

All valves and hydrants shall be accessible via surface boxes as shown on **Sheet 45** and **Sheet 49**.

Surface boxes shall be heavy duty cast iron or ductile iron, and be directly above the valve or hydrant. Hydrant boxes in “Arterial” roads and State Highways shall be Motorway Grade. All other hydrant boxes in road carriageways shall be manufactured to AS 3996:2019. All hydrant boxes to be installed to NZS 4522:2010.

The long side of the surface box shall run parallel to the watermain. The box shall be supported on concrete risers sized to provide unobstructed access to the valve or hydrant. For hydrants, this shall include easy access for standpipes and installation of data logging equipment.

The design shall ensure that surface loading (traffic, etc.) is not transmitted via the box and supports to the pipe or fittings.

Where a valve is particularly deep, a length of 200 mm diameter PN9 PVC pipe shall be used to direct the valve key to the spindle (in addition to the requirement for concrete surrounds).

All surface boxes shall be marked in accordance with the ES, including **Sheet 45** and **Sheet 48.**

6.2.11. Bulk Water Meters

FNDC may require a bulk water meter to be provided at the connection point of the reticulation.

Bulk water meters will normally only be required where there are more than 20 industrial connections, 40 commercial or 150 residential connections.

Bulk water meters shall be a full bore magnetic flow meter in accordance with the FNDC Approved Materials List - Water Services and include an approved data logger.

6.2.12. Service Connections

6.2.12.1 Layout and Location

A service connection shall be provided for each single lot or residential unit with individual street or right of way access. The connection shall:

a. Be perpendicular to the main or rider main,

b. Be centralised on the road frontage for front lots,

c. Be located as to avoid existing or proposed vehicle crossings,

d. Terminate 400 mm from the boundary,

e. Include a Water Services approved gate valve, meter, check valve/higher hazard backflow preventer blue meter box with base (see Sheet 46), and

f. Be located with respect to the main by a 12 mm wide cut in the kerb and a 250 mm wide blue strip painted on the kerb

Manifolds shall be in accordance with **Sheet 46**, and be blanked off with a brass plug and cross cut into cap of the manifold.

Where there are three or more service connections provided along a private access road or right of way, the following shall apply:

g. A single connection feed sized as a rider main (as per **Sheet 47**), shall be provided within the legal road,

h. The single connection feed shall extend from the public watermain to a point no closer than 500 mm to the road boundary,

i. A peet valve shall be installed at the junction with the main,

j. At the road boundary end, a multiple meter box shall be provided in accordance with **Sheet 47**,

k. Separate individual connections shall then extend from the meter box to each lot, and

l. The lot number of each connection shall be clearly marked within the box.

Where lots are situated on either side of a private access road or right of way, service pipes shall be split either side to avoid passing under the carriageway. The multiple meter box requirements above shall apply to each side. Where this is not practicable, service connections crossing under carriageways shall be laid in a larger protective duct.

Subject to restrictions in Section 6.2.9.2 Hydrant Locations, where a FNDC maintained watermain is provided along a private access or road, connections may be provided from this main to each property.

Connections to single residential units at the point of supply pipe shall be 20 mm ID. For multiple units, the points of supply pipe shall be sized to match the expected demand.

Where private water lines are required to cross other private property then suitable easements shall be created protecting the water line.

Service connections are not required to be installed for commercial/industrial business lots.

6.2.12.2 Meters

Meters shall not be installed during development.

For water supplies to public assets that will be maintained by FNDC in the future (e.g. a sewer pumping station or irrigation system for a reserve), the following shall apply:

a. The Developer shall submit an application to FNDC for the connection, including written agreement for payment from the relevant FNDC Department,

b. The Developer shall pay all costs including any Development Contributions for the connections,

c. A utility as-built form shall be submitted to FNDC as per the specification for service connections, and

d. Meters and backflow preventers shall be installed at the time of the physical works for the development.

In all other cases:

e. A FNDC Connect-to-our-water-network Commercial and Residential Water and Wastewater Connection Application to install a meter shall be submitted and approved before any work may be undertaken.

Connection sizes up to and including 25 mm diameter, meters shall be in accordance with the FNDC Approved Materials List - Water Services.

For connections larger than 25 mm diameter, FNDC shall specify the type of meter and backflow preventer.

6.2.12.3 Materials and Sizes

Service connections and fittings shall be in accordance with FNDC Approved Materials List - Water Services (See Section 6.2.6 Approved Materials)

Mechanical fittings may be used for connections up to 50mm and shall comply with WIS 4-24-01.

Electrofusion fittings shall be used for service connections greater than 50mm and shall comply with Section 3 of AS/NZS 4129:2020.

6.2.12.4 Backflow Prevention

All connections shall be provided with a dual check valve Backflow Preventer unless:

a. The potential risk requires a greater level of protection, in which case the Developer shall provide protection appropriate to the level of contamination risk, or,

b. The FNDC specifies an alternative backflow prevention.

For sewer pumping stations a reduced pressure zone backflow preventer, in accordance with **Sheet 44**, shall be provided above ground in a protective cage.

All backflow preventers shall be installed between isolating valves and be fully testable.

6.2.12.5 Recording Existing Connections

Where a connection (metered or otherwise) exists to a property that is being subdivided or re-developed, the As-Built Plans shall clearly provide the details of the connection as it relates to the subdivided property including the meter details.

6.2.13. Pump Stations and Reservoirs

The design of pump stations and components require specific approval from FNDC and shall be design by a SQEP.

The following Specific Design requirements for pump stations shall be met:

a. The pump station shall be a 'package' type pump-station which incorporates the pumps, valves, pipework, and electrical control panel all mounted on a plinth or frame.

b. Where a pump station is required to provide compliant pressure and/or flow then it shall, where practicable, be linked to an appropriate sized reservoir. Where no reservoir site is available, or provision of a reservoir is not practicable, then a pressure sustaining system may be used.

c. Pump Stations shall be designed in accordance with **Sheet 53**.

d. Pumps shall be capable of maintaining the pressures and flows required, including firefighting flows, with reserve capacity. A standby pump shall be provided.

Reservoirs, where provided, shall be of concrete or timber (with liner) construction and sized to provide:

e. A firefighting supply as specified in the SNZ PAS 4509:2008, with a minimum of one hour's supply, and

f. Sufficient storage for two day's supply at peak daily demand, plus additional future demand as assessed by the FNDC.

A FNDC approved SCADA and telemetry link shall be provided for control of pumps and reservoir levels. Details of the equipment requirement will be provided by FNDC upon enquiry

The reservoir and pump station site shall be vested in the FNDC.

Access and water supply easements shall be provided in favour of FNDC where the supply pipeline is within private property.

6.3. Construction

6.3.1. Licensed and Registered Contractors

Only contractors who are a Licensed Contractor or Registered Contractor and hold the National Certificate in Water Reticulation (or relevant sections) and are always in possession of their Blue Card during the works may install water assets that will be vested in FNDC and only a Licensed Contractor may undertake work on existing water assets.

Contractors who produce workmanship of a substandard quality or fail to comply with the ES will have their approved status revoked.

Connections to live water pipelines shall only be undertaken by FNDC or its agent.

6.3.2. Pipeline Installation

6.3.2.1 Watermains

Watermains shall be installed in accordance with this section and with the bedding and backfill details on **Sheet 31**.

Pipes shall be laid so that the identification code is uppermost where practicable and shall be evenly supported along their length.

Mains and rider mains installed by trenching shall be thoroughly bedded and protected by a well hand-compacted granular material. The bedding material shall be placed as per requirements of AS/NZS 2033:2008 for PE pipe or in layers of less than 100 mm and shall surround the pipe by at least 100 mm in all directions.

The particle size range of bedding material shall be in accordance with **Sheet 31**, and shall be compacted in accordance with Appendix B of NZS 7643:1979 regardless of pipe material.

When reinstating trenches in existing carriageways the Contractor shall:

a. Lodge a Corridor Access Request to the Road Control Authority,

b. Meet any further specific requirements regards reinstatement of the Road Control Activity

6.3.2.2 Service Connections

Service connections onto a principal main or rider main shall be made with an electro-fusion tapping saddle.

Tapping saddles on PE80/PE100 pipes shall be with ball valves or self-tapping ferrules at the point of connection, installed in accordance with the manufacturer's instructions. Connection between the tapping saddle and the service connection shall be made using an approved compression fitting or electro-fusion coupling.

Use of alternative LG2 gun metal tapping bands requires specific FNDC approval prior to installation.

All materials and fittings shall comply with the FNDC Approved Materials List - Water Services, and be installed in accordance with the manufacturer's recommendations.

The tapping saddle for each service connection shall be sited at the central point of the front boundary or house site, and clear of any driveways or accessways. The position shall be marked on the kerb with a 125 mm square of blue paint: in addition, a notch 12 mm wide and 12 mm deep shall be cut in the top of the kerb before painting.

Service connections shall be a minimum of 1 m apart at the point of connection to the main.

All connections shall be provided with backflow prevention in accordance with Section 6.2.12.4 Backflow Prevention.

6.3.2.3 Jointing

Pipe laying and jointing shall be as recommended by the manufacturer and as required by the applicable standard for the type and class of pipe.

Joints in PE pipes of greater than 50 mm ID shall be welded joints unless mechanical fittings have been specifically approved by the FNDC.

100 mm ID pipes (125 mm OD) may be supplied in coils and joined using electrofusion couplers. Where pipe is supplied in 6 m or 12 m lengths and the pipeline length is greater than 50 m, joints shall be butt welded.

Pipes from different suppliers or different batches shall not be butt welded.

Welding (butt or electrofusion) of PE pipes shall be undertaken by an approved Contractor using calibrated data logged welding machines. Only employees of an Approved Contractor who have successfully completed a Water New Zealand approved welding course for polyethylene pipe, or re-fresher in the past two years, shall be permitted to physically undertake welding.

An initial (Practice) test weld shall be done on site using the equipment, personal and materials (pipe) that will be used for the welding works. The weld shall be tested and approved **before** work starts. If there is any change to the above factors, (i.e. materials, personnel) another test weld shall be done, tested and approved before continuing.

Prior to commencing work, the following shall be provided to the FNDC:

a. A copy of the current calibration certificate(s) of the welding machine (not more than 12 months old),

b. Registration number of welder, and current certification (not more than 24 months old).

All welding of PE pipe shall be data logged.

Welding shall take place in a covered environment to avoid contamination of weld faces and prepared pipe.

For all electrofusion welds, including tapping saddles, a mechanical scraper with a winding mechanism shall be used to ensure even finishing. Hand scraping of pipe ends, with the appropriate tools, will only be permitted if mechanical scraping is not practicable and with prior permission from the Distribution Engineer. Electrofusion welds shall be undertaken using clamps and the equipment correctly calibrated.

The jointing of flanged fittings to PE pipe shall be with stub flanges and backing rings. Backing rings shall be mild steel and plastic coated with Rilsan 11 or approved alternative to AS/NZS 4158:2003**.** Where Ductile Iron flanges backing rings are used they shall be to B5 of AS/NZS 4087:2011

The thickness of the backing rings shall be as shown in Table 6-8.

Table 6-8: Thickness of Mild Steel Backing Rings on PE Water Pipe Joints

Pipe Outside Diameter (mm)	Backing Ring Thickness (mm)
125	16
180	16
250	16
315	20

For pipes greater than 180 mm OD, slim flanges with reinforced faces shall be used. Gaskets shall be used for all flanged connections. All bolted flanges shall be tightened in accordance with the manufacturer's specification using a torque wrench.

During transportation and on-site storage temporary capping of all pipes is required. The pipes shall be inspected externally immediately prior to laying to check for damage in accordance with the manufacturer's specifications. An internal inspection shall also be carried out and adequate protection against the ingress of debris shall be made as laying proceeds. Temporary caps shall be placed over all open ends during construction.

6.3.2.4 Detection Tape and Tracer Cable

A metallic detection tape and tracer cable shall be laid directly above all new non-metallic watermains including rider mains.

Detection tape shall have 'water' written on it in blue, be located at a depth of between 200 and 250 mm below the finished surface level and contain sufficient metal to be detectable from the surface by a standard metal detector.

Tracer cable shall also be attached to all principal mains and rider mains. This wire shall take the form of a continuous 2.5 mm^2 multi strand (polythene sleeved) cable, strapped to the pipe wall by means of a minimum of two complete wraps of heavy-duty adhesive tape, at a maximum of 3.0 m intervals.

The tracer cable shall be connected to all surface boxes, and electrically tested for continuity by a Registered Electrician following installation and backfilling. Records of the electrical continuity test shall be provided by the contractor.

6.3.2.5 Aggressive Ground Conditions

Where aggressive soil conditions are likely to be encountered, only materials specifically approved by FNDC shall be used.

For metal components, the approved materials are Grade 316 stainless steel complying with AS/NZS 4673:2001, Ductile Iron coated to AS/NZS 4158:2003**,** or aluminium-bronze. Metal components shall have a molybond coating corrosion protected with an approved Petrolatum system primer paste covered with Petrolatum mastic (for moulding around irregular profiles such as flanges, valves etc. to provide a suitable profile for wrapping), followed by Petrolatum tape and 'Greensleeve' over wrap.

Alternative corrosion protection requires specific approval from the FNDC.

The FNDC may direct the use of materials for aggressive ground conditions regardless of the outcome of any investigation of aggressive ground conditions.

6.3.3. Testing and Inspections for Pipelines

6.3.3.1 Testing of Welds

For welded pipelines, one or more welded joints shall be removed for tensile or peel de-cohesion testing. The test sample(s) shall be sent to an approved laboratory for testing at the contractor's expense.

Should a weld fail to pass the test, two further welds shall be tested. If one or more of these welds fail in a brittle manner the pipeline may be condemned and the Contractor/ Developer asked to remove all welds up to this point and re-lay the pipe at their expense. Should the machine, the welder, the pipe supplier or the raw material batch change then new tests shall be undertaken.

All costs associated with the removal of the welds and the re-joining of the pipe shall be met by the Contractor/ Developer. The Contractor shall arrange for the testing of the welds as specified at a FNDC approved laboratory (usually Opus laboratory, Napier). FNDC staff shall be present when the welded section is being removed. The cost of removing and testing welds which fail and the cost of further tests to prove pipeline integrity shall be met by the Contractor at no cost to the FNDC. Test results shall be forwarded to the FNDC.

6.3.3.2 Pipeline Pressure Testing

On completion of the pipe laying and jointing, sufficient backfill materials shall be placed over the pipes to prevent movement during pressure testing, leaving joints, fittings and anchor blocks visible. No connections of a permanent nature between existing mains and the new work will be allowed at this stage. PE 80 rider mains shall not to be connected to the mains before testing, but shall be tested separately. Service connections shall be included within the test.

To complete the preliminary test, the new reticulation system shall be swabbed and any air eliminated using a temporary supply. All valves on the new main shall be fully opened and all hydrants, stop taps and valves on the consumer end of the service pipes shall be shut. Water for tests may be obtained from the existing system provided prior FNDC approval is obtained and a metered standpipe with a check valve is used. Standpipes are available from the FNDC.

A visual inspection of the line including joints and fittings shall be made and any apparent flaws and leaks shall be remedied. The pipe shall be left full overnight before pressure testing.

Pressure tests shall be carried out using an approved pressure pump at a steady rate without shock loading. Pressure gauges used shall be accurate and read to a minimum of 10kPa intervals.

Note: Gauges shall be calibrated on an annual basis, with test certificates available for all equipment on request

The contractor shall give FNDC at least 24 hours' notice before carrying out testing. The test shall be carried out in the presence of a FNDC representative and a data logger shall be used to verify the results.

The test pressure shall be 1.25 x the rated pressure of the pipe (1500 kPa for PN 12 and 2000 kPa for PN 16). Test sections shall not exceed 500 m in length. The specified test pressure is the pressure to be applied at the lowest point in the section.

If the pressure gauge is not located at the lowest point a correction shall be made for the difference in levels. Pressure testing against valves will not be permitted.

For PE 80 or PE 100 pipe the type of test will depend on the length and diameter of pipe to be tested. The 'small diameter' pipeline test shall be limited to 50 mm ID pipes and to 100 mm ID pipes where the length to be tested does not exceed 135 m.

The contractor shall supply a graph or data logger printout of the pressure test and show calculations n_1 and n_2 where applicable.

The Developer, SQEPs and contractors are reminded of their obligations under the Resource Management Act 1991 in terms of the discharge of testing water into natural water courses. It will only be acceptable to discharge the water into a FNDC-managed stormwater system if it is of a quality that would comply with the requirements of the relevant catchment drainage plan or the rules in the NRC Regional Plans. Otherwise, testing water shall be discharged into a FNDC-managed sewerage system.

6.3.3.3 Hydrant Flow Test

Following completion of the pipe test and connection to the main, the Developer shall provide certification from the fire service or other FNDC approved independent certifier, of the static pressure, the maximum flow and the residual pressure at maximum flow for each hydrant.

6.3.4. Disinfection

After backfilling, pressure testing and flushing and no more than 10 days before being put into service, all pipes, valves service pipes and connected fittings shall be disinfected. All disinfection testing will be at the contractor's cost.

Disinfection testing shall be carried out by persons who have successfully completed NZQA Unit Standard 19209 - Water Reticulation - Demonstrate knowledge of water reticulation system cleaning and disinfection.

The main shall firstly be swabbed with a suitable swab if not already done prior to pressure testing. The main shall then be drained and slowly filled with potable water to which sufficient free chlorine is added to produce a concentration of 50 parts per million (ppm) in the main. It is recommended this be done via a water tanker of known volume.

Chlorine may be added to the pipe in one of the following ways:

a. Chloride of lime solution,

b. Calcium hypochlorite solution,

c. Sodium hypochlorite solution, or

d. HTH dry chlorine granules dissolved in water before put into the main.

The chlorinated water solution shall be introduced at the lowest point of the section of main to be disinfected to ensure no air is trapped. The main shall be left full of the chlorinated water for 24 hours, during which time all valves, hydrants and other fittings on the section shall be operated to ensure all part of the main are disinfected.

The residual chloride concentration shall not be less than 20 ppm after 24 hours.

After 24 hours contact time, the pH of the water shall be recorded. The effectiveness of hypochlorite as a disinfectant is greatly reduced above pH 8.0. A pH level greater than 9.0 will not be accepted as compliance with the disinfectant requirements and shall be repeated using a solution with a pH less than 8.0.

The main shall then be flushed out until the chlorine concentration of the issuing water is between 2.0 and 0.2 ppm.

The chlorine solution shall not be discharged into the stormwater system. Instead it shall be discharged to the sewer system. The rate of discharge to the sewer shall be limited to a maximum of 10 litres per second. If this is not practicable, then the solution shall be dechlorinated to acceptable levels before being disposed to ground or a stormwater system.

If the chlorination is found to be unsatisfactory, the contractor shall repeat the procedure until the water is of acceptable quality.

The testing for chlorine, pH and bacteria (total coliforms and E.coli). shall be carried out by the FNDC's Water Testing Laboratory or another approved laboratory. It is the contractor's responsibility to engage the laboratory and to pay for all the necessary testing. At least 24 hours' notice is required for the initial chlorine application. The laboratory representative shall return 24 hours later for the second residual chlorine test and will stay on site while the line is flushed until the chlorine concentration is between 2 & 0.2 ppm.

The laboratory will then issue FNDC with a written report confirming the tests.

6.3.5. Connection

Following a successful chlorination procedure and flushing, the following steps shall be undertaken

a. The main shall be charged with fresh mains water with a chlorine concentration of less than 1.0 mg/litre.

b. The water shall then be tested for the presence of E.coli at a minimum of two locations. One bacteriological test shall be carried out for a minimum of every 300 m of pipe disinfected, including the extremity of any branches.

c. The contractor shall provide FNDC with a site plan showing the location of the new main as well as the sampling points.

The tests will take approximately 24 hours. A satisfactory result is E.coli <1/100 ml or an “E.coli Absent” result.

If this requirement is not achieved, the disinfection procedure shall be repeated and a further bacteriological test done until a satisfactory result is achieved. A satisfactory pH result is pH<9.

If the newly chlorinated main has not been connected to the existing reticulation within 10 days, the main shall be retested for E.coli as per the initial testing.

If any of the new samples fail the E.coli test the disinfection procedure shall be repeated. All sample results shall be received before approval for the main to be connected can be given.

The Developer shall keep the new reticulation continuously charged with water under pressure and obtain FNDC approval to connect to the existing reticulation. This approval is requested by notifying FNDC in writing, lodging a connections application, and providing the test results and a sketch of the connection detail.

The connection shall only be made by the FNDC or its agent. Upon connection, the new reticulation shall be flushed to the satisfaction of FNDC and left operational.

Only the FNDC’s Reticulation Maintenance Contractor may undertake the connection.

All costs associated with connection to the existing system shall be met by the Developer.

6.3.6. Pump Station Commissioning

Commissioning shall be undertaken in accordance the FNDC QA/QC Manual 2022. Particular reference should be made to the requirement to produce and complete:

a. Inspection and Test Plan – Pump Stations

b. Pre-Commissioning Checklist for New Pump Stations

c. Procedure for Performance Testing of Pumps

d. Commissioning of Civil Works

6.1. Completion of Works

6.1.1. Completion

Following completion of all works the water supply network serving the development shall be isolated until the 224c certificate has been issued for the development and the first lot connection has been authorised.

6.1.2. As-Built Drawings and Schedule of Asset Information

As-built drawings, a schedule of asset information and Operation and Maintenance Manuals shall be submitted in accordance with Section 1.7.2 As-Built Plans, Asset Information Schedules, Operation and Maintenance Manuals.

In addition to the requirements in Section 1.7.2 As-Built Plans, Asset Information Schedules, Operation and Maintenance Manuals and Appendix G Drawing Standards, as-built drawings shall clearly and accurately show:

a. The constructed locations and details of all water infrastructure provided as part of the work, including any modifications made to the existing system.

b. Any existing connections (metered or otherwise) to a property that is being subdivided or re-developed, meter details must be included.

c. Weld data logging information for all welds, including welders name and company, shall be submitted with as-built drawings.

d. Directional drilling log if that method of installation was used.

Additional information to be included in the asset information schedule, is required for all hydrants, valves and meter box locations as follows:

e. Location diagram, including offset distance from the lot boundary and distances from corners of the lot,

f. Location coordinates (X,Y,Z) in accordance with datum requirements in Appendix G Drawing Standards,

g. Item type (hydrant, sluice valve, peet valve, pressure reducing valve),

h. Make, model and manufacturer,

i. Depth to spindle/handle,

j. Date installed, contract or PU number (if relevant) and installing contractor's name,

k. For Hydrants, test results as per Section 6.3.3.3 Hydrant Flow Test showing:

   i. static pressure,

   ii. residual pressure, and

   iii. maximum flow rate

l. For valves, number of turns to fully open from off position.

The FNDC may audit as-built information on site upon completion of the works, development.

A certificate of completion for the works will not be issued until as-built information fully complies with the requirements of the ES to the satisfaction of the FNDC.

Chapter 7: Public Spaces and Landscape Development Works

7.1. Introduction

7.1.1. Public Spaces and Landscape Development Requirements

The Public Spaces and Landscape Development chapter sets out minimum requirements (and some best-practice examples) for the design and construction of landscaping development works for land development and subdivision on reserves and streetscapes.

7.1.2. Objectives

Landscape design has application throughout the subdivision and development process. As such, it should be considered in the early stages of a development. At the initial concept stage, it is important to establish objectives for overall landscape design involving the appropriate professionals.

The objective of any landscape design on public spaces shall:

a. Maximise long term benefits including environmental, community cohesion and recreational benefit.

b. Minimise on-going maintenance works and costs.

~~c.~~ Respond to the surrounding landscape character and context including landform, ecological and geological elements, cultural and heritage importance.

d. Enhance and strengthen existing natural and built character and intended future character.

e. Ensure public safety through consideration to National Guidelines for Crime Prevention through Environmental Design in New Zealand (CPTED)

f. Create public places that are consistent with the Urban Design Protocol and all relevant urban design requirements including any National, and Regional Policy Statements, the District Plan and any Council adopted local urban design guides.

g. Protect, maintain and restore existing natural ecosystems, vegetation, and landscape features, and contribute to ecological and habitat biodiversity as well as adapt to or mitigate the effects of a changing climate.

h. Provide amenity open space, “buffer areas”, open space connections and access to watercourses.

i. Provide a coherent, efficient and legible design that promotes ease of pedestrian and cycle access to and through areas of public space and to other public amenities and social infrastructure.

7.1.3. Landscape Development on Public Spaces; Reserves and Streetscapes

Public spaces referred to in this chapter refer to landscape development works (hard and soft) on both public and reserves and streetscapes - whether they are currently vested in Council or will be following development/subdivision.

Landscape design and development works for reserves include but are not limited to selection of appropriate lands in terms of size/scale, contour and topography and proximity to communities and services, but also the purpose of the reserve provision. Landscape development on reserves includes but is not limited to installation of utilities, pedestrian and vehicle networks, and pathways, landscape structures to provide play and sport opportunities, seating, shade, lighting, picnicking, amenity and ecological plantings and many other components to meet reserve function and add utility for its future public users.

Landscaping works in streetscapes refer to all works other than road surfacing, kerbing, general pedestrian and non-vehicular transport network provision, traffic signage, piped or channeled infrastructure such as mains, sewer and storm-water and other infrastructure such as fiber/telecommunications, electricity (overhead and trenched) and street lighting within the legal public road corridor.

Landscape works on streetscapes may include but are not limited to paving and concreting detailing, tree pits and raised planting areas, fencing/barriers/handrails, street furniture – including seating, refuge bins, shade structures, bike and scooter racks, drinking fountains, art installations etc.

Street trees are an integral part of street design as they contribute to the sense of enclosure, act as a buffer to traffic noise/pollution and enhance place. A traffic calming effect can also be achieved, where trees are planted in continuous rows and their canopies overhang, at least in part, the vehicular carriageway. Street trees can also be used to enhance legibility by highlighting the importance of connecting routes and distinguishing one area from another through variations in size and species selection.

Early liaison to accommodate these competing interests between Council departments, utility providers and developers allows for best possible outcomes for both public streetscapes and reserves.

7.1.4. Reference Documents

The design for all proposed reserves shall (where applicable and where not in conflict with the ES) be consistent with the following documents:

Note it is the responsibility of the ES user to ensure the most up to date referenced document is sourced.

7.1.4.1 Statutory Documents

Reserves Act 1977

Resource Management Act 1991 and National Policy Statements

District Plan and Operative District Plan

Operative Northland Regional Plan

Health and Safety at Work Act 2015

NRC Regional Plans

7.1.4.2 New Zealand Standards

NZS 4404:2010	Land Development and Subdivision Engineering
SNZ HB 8630:2004	New Zealand Handbook Tracks and Outdoor Visitor Structures
NZS 5828:2015	Playground Equipment and Surfacing
NZS 8409:2021	Management of agrichemicals
SNZ HB 44:2001	Subdivision for people and the environment

7.1.4.3 Other Relevant Documents

The following district council documents

- Approved Materials/Product Lists
- Any relevant Reserve Management Plan
- Policies not limited to (and any subsequent amendments):
- Reserves Policy 2017
- Art and Memorials in Public Places 2017
- Development Contributions Policy
- Equity and Access for People with Disabilities Policy 2013
- Footpaths Policy 2012
- Fencing Contributions Policy

The following other relevant documents

Waka Kotahi	Pedestrian Planning and Design Guide (2009)
	Growsafe Standard Certificate
MfE	New Zealand Urban Design Protocol (2005)
	National Guidelines for Crime Prevention Through Environmental Design in New Zealand
Auckland University	Low Impact Urban Design and Development (LIUDD) research programme publications 2003-2009
Waka Kotahi	RTS 14 Guidelines for Facilities for Blind and Vision Impaired Pedestrians
Cancer Society	Cancer Society Guidelines for Shade Planning and Design:
NRC	Clean Streams – A Guide to Riparian Management In Northland
NRC	Pest Management Strategy 2007
NRC	Northland Regional Pest and Marine Pathway Management Plan 2017-2027
Auckland Council	TP010 Stormwater management devices manual
MPI	National Pest Plant Accord
Auckland Council GD01	Stormwater Management Devices in the Auckland Region (2017)

7.1.5. Reserve Provision through Development

Reserves and roads are vested with the District Council (primarily) as a result of the subdivision process. In some instances, Developers voluntarily elect to include public spaces within their developments recognising the benefits that such spaces will provide to their development. In other circumstances, reserves such as esplanade reserves may be a requirement of the resource consent process. In either circumstance, the Developer is encouraged to discuss reserve design concepts with the District Council at an early stage, to ensure all proposals are consistent with the ES and wider Reserve Strategy. It is preferable for this process to begin at a pre-application meeting prior to applying for resource consent.

In most instances, reserves vested in Council will be given a classification in accordance with the Reserves Act 1977. Typical common classifications include Esplanade, Recreation, and Local Purpose Reserves. Local Purposes include but are not limited to Local Purpose – Utility or Drainage/Stormwater, Local Purpose – Neighbourhood, Local Purpose – Cemetery, and many others.

Where the function of the reserve will have different ongoing maintenance requirements and levels of service, each part of the land to be vested shall be identified and classified separately according to that function.

7.2. Design

7.2.1. General Landscape Design Principles and Requirements

Landscape development should be designed to respond to the overall environmental context of an area such as vegetation and water bodies, cultural and heritage elements, local road geometry, stormwater, and reserve purpose/function, and utilities placement.

General landscape design principles for public spaces and landscape development works include but are not limited to:

- The intended purpose of the reserve and the benefit to the community.
- The impact of Climate Change and Natural Hazards on the resilience of the reserve.
- How any cultural and/or historic associations with the land are recognised.
- How the reserve will be accessed (intended to be walked/cycled or driven to).
- Located in prominent locations with sufficient street frontage to provide passive surveillance for safety and greater amenity.
- Relatively equal reserve dimensions are likely to create useable and flexible spaces.
- The design of reserves shall seek to maximise linkages and access opportunities to the surrounding street and reserve network, including esplanade reserves.
- In urban areas, these may be provided to facilitate safe all-abilities pedestrian and cycle movement through suburbs, and to create a more permeable, legible, open space environment.
- How the overall development will link to the surrounding landscape including existing areas of open space, and to other public areas, such as schools, town centres, community facilities or public transport routes. Neighbourhood reserves should be accessible to all surrounding neighbourhoods and communities.
- Provision for network utilities and lighting based on the mature size of any planned or existing vegetation.
- The ability to get a mower over all grassed areas (road berm and slopes on reserves i.e.: Maximum finished gradients for mowable areas are 1 vertical to 5 horizontal, with profiles that drain sufficiently to allow year-round mowing by tractor-mounted equipment).
- Trees and planting are designed for long-term retention and easy and cost-effective maintenance as well as reflecting local values and biodiversity.

- Structures fulfill a necessary function and are safe and appropriate to the setting.
- Planting in streets allows for safe transport functions including movement of vehicles and pedestrians.

7.2.2. Crime Prevention through Environmental Design (CPTED)

All landscape design will involve the application of National Guidelines for Crime Prevention through Environmental Design in New Zealand (CPTED) principles.

The basic principles are:

1. Natural Surveillance: All areas throughout the site that are publicly accessible can be seen from other parts of the site so that people can see and be seen. Likewise, ensuring there are no visually closed entrapment areas.
2. Access Control and Management: The site has well-defined routes, spaces and entrances that provide for convenient movement without compromising security.
3. Territorial reinforcement: The physical design is used to promote a sense of ownership, respect, responsibility, and community well-being.
4. Quality Environment and Space Management: The site has an appropriate use of space, is well-cared for, attractive and has vandal resistant facilities and buildings.

7.2.3. Landscape Concept Design Development

Council will likely request to see and discuss at the pre-development stage the landscape concept-design including:

1. A ***Statement of Design Intent*** and ***Design Objectives***. This should also include the proposed classification of any reserves and how it benefits the wider community.

2. A scaled and labelled ***Base Plan*** showing existing natural features (topographical, geological, hydrological and ecological), including all existing trees and areas of vegetation within the site, existing structures, any archeological or cultural features identified in the **Cultural Impact Assessment** and proposed mitigation, and any proposed modifications or changes to these areas.

3. A scaled and labelled ***Landscape Concept Plan*** showing proposed structures including: paths/paving, fencing, signs, seating, tables, play equipment and lighting, access structures, (such as gates, boardwalks, platforms), retaining walls, stop banks, drainage structures, rock revetment etc. and services reticulation including water, waste water, electricity and other utilities to boundary.

7.2.4. Final Design Approval

Additional finalised plans with accompanying information to be included for approval at the consenting stage by Council includes:

1. Detailed scaled and labelled ***Master Landscape and Construction Plans*** with details of all elements and features of the design (as above) – including specifications of each of the components and technical specifications for their installation. This should include any archeological or cultural features identified in the Cultural Impact Assessment and proposed mitigation.

Note: The price of each component (including plant materials) and installation will be requested by Council to be recorded for future asset management and depreciation.

2. A scaled and labelled ***Planting Plan*** and associated ***Plant Schedule***, showing planting locations for all plant species (with botanical and common names), spacings, plant grades and quantities, soil and mulch quantities, areas of ecological enhancement, areas of grass to be mown, as well irrigation or other services.

3. A ***Landscape Maintenance Schedule*** (including full costs) that will be applied during the defects and liability period(s).

Only drawings stamped and signed by the District Council are approved drawings. Unless specifically stated otherwise, the approval of drawings does not supersede the requirements or obligations of the ES.

7.2.5. Reserve Design and Components

7.2.5.1 Green Infrastructure and Reserves

Reserves offer a unique opportunity to contribute positively to the built neighbourhood. The size and quality of green spaces and plantings contribute significantly to the local character and amenity of the place and to the ecological function of the site by sequestering carbon, stabilising soils, attenuating stormwater, providing habitat and building on biodiversity and numerous other positives.

Planted vegetation that performs such function (and associated systems) is referred to as 'green infrastructure'. All new reserves should at minimum contain permeable open space grassed areas, various canopy trees and some lower level planting. This would apply also to new turfed sports parks.

The ideal 'green' threshold for most reserves vested to Council is one of the following:

- Tree-Park: Over 50% continuous canopy when mature, with remaining areas of grassed open space and assorted low-level planting.
- Wetland/Water Park: with a natural or constructed wetland with bio-diverse planting.
- Forest Park: Multi-layered self-regenerating forest. (100% green).

There are a number of devices or ways to incorporate green infrastructure together with hard infrastructure systems. These include for example raingardens, carbon filters, permeable paving, tree pits and bioretention systems.

Prior to acceptance of any new reserves and associated green infrastructure, Council will require detailed engineered design that ensures that the systems are well-designed, well-constructed, effective, and easy to maintain into the future.

7.2.5.2 Reserve Access

Connecting existing reserves, accessways and open spaces provides routes and return loops for recreational use. They also encourage sustainable transport choices by allowing for continuous off-road journeys. These can provide more direct routes to destinations than vehicular routes and encourage a healthier access alternative. Connections can also create larger open space areas and add recreational amenity value (walkers and runners prefer a loop to a dead end).

Consideration should be given to how the development will link to the surrounding landscape including existing areas of open space, and to other public areas, such as schools, town centres, community facilities or public transport routes. Neighbourhood reserves should be accessible to all surrounding neighbourhoods and communities.

7.2.5.3 Pedestrian, Cycle Access and Other Non-Vehicular Access on Reserves

Minimum standards for pedestrian paths within urban recreation reserves (and other parks serving the same purpose) is 1.8 metres in width - but ideally 2.2 metres to allow an increasing variety of users (including those on mobility scooters, in wheelchairs or those pushing prams etc.) to pass one another safety.

Shared paths are paths separated from a road carriageway that may be used by some or all of the following persons at the same time: pedestrians (including pushchairs), cyclists, riders of mobility devices, and riders of other wheeled recreational devices. These should be a minimum of 2.6 metres but ideally 3 metres in width.

A clear space buffer on either side of paths of at least 0.5m is required and shared paths should ensure that there is a minimum overhead clearance of 2.2 metres. Street or park seating or other structures should be set back at least 0.5m from paths.

Local pathways should generally have an easy gradient (maximum 1:20 or 5%) and avoid steps where possible to allow for cycle and mobility vehicle use. Paths with gradients greater than 1:20 are recognized as ramps. Ramps should be no more than 1:12 for wheel-chair accessibility and allow for a wheelchair maneuvering space of 1500mm x 1500mm at either end of the ramp for turning. Safety handrails (non-climbable with no toe holds) are generally required where there is an effective fall height from any formed path over 1 metre. Please see SNZ HB 8630:2004 for further details.

See Drawing Sheet 59. Specification/Details – Reserve Paths – Widths, Gradients, and Fall Heights.

Pathways through reserves should be contiguous, connecting to community facilities and to typical public reserve assets such as toilets, bins, picnic and barbeque facilities, shade structures, seating, playgrounds etc. Site-specific CPTED principles need to be considered in locating paths within any reserve area as well as the placement, growth and maintenance of nearby vegetation.

Surfacing materials need to be appropriate to site conditions and topography as well as expected usage for long-term durability. Concrete paths should be a minimum 75mm (ideally 100mm) thick with adequate base course and reinforced where vehicles are likely to access. Oxides and surface treatments such as exposing the aggregate are to be used to reduce pathway glare. Concrete must be cut at a maximum 3m2 to reduce the incidence of cracking. Other surfacing materials (such as timber, asphalt, metal, crushed lime, timber/recycled plastic composites, and pavers) will be considered for pathway construction on a case-by-case basis.

For more remote or wilderness trail networks, track and trail construction standards as outlined SNZ HB 8630:2004 - New Zealand Handbook Tracks and Outdoor Visitor Structures will be applicable.

See Sheet 60. Specification/Details – Reserve Paths – Material Specifications and Concrete Cutting

7.2.5.4 Vehicle Access to and on Reserves

When designing parking areas for reserve use, special consideration must be given to safe pedestrian accessibility from where people park their vehicles to the nearby amenities. Accessible parking provision for users of disability devices must be considered and located appropriately. The design and construction of roadways, parking areas, parking spaces and vehicle crossings must comply with the Transportation section.

Access roadways and off-street parking may be required for reserves such as sports parks, amenity parks, and the starting point of walking tracks and neighbourhood parks receiving high-use or serving a regional function. Consult with Council to see if parking areas and access roadways are required.

See Sheet 61. Specification/Details – Reserve Paths – Connections to Accessible Carparking and Amenities.

Vehicle accesses will be installed by the applicant prior to the vesting of the reserve. Vehicle access points are required for vehicles to undertake mowing, refuse collection, maintenance and for emergency vehicles. Vehicle access points must be wide enough to allow for heavy machinery (minimum 6m). Concreted vehicle crossings must be reinforced to accommodate typical maintenance traffic loading, comply with the Transportation section and any applicable bylaw.

See Sheet 62. Specification/Details – Reserve Paths – Paths and Vehicle Accesses in to Reserves

7.2.5.5 Vehicle Barriers (to prevent vehicular access)

Where required, measures to prevent unauthorised vehicle entry will be installed by the applicant prior to vesting of the reserve. Where possible planting and landscaping should be incorporated. Other options may be standard non-mountable kerbs, a physical vehicle barrier such as oversized rocks, or bollards – removable or fixed.

When designing vehicle barriers, the following objectives should be applied:

- Prevention of unauthorised vehicles from accessing (1.4 metres is considered the maximum gap to restricts vehicles).
- Unimpeded cycle and pedestrian access. (NB. consider sufficient lighting and/or reflective markers on any central barrier for safety.)
- Design and materials consistent with other reserve structures and furniture.
- Longevity and low maintenance requirements - e.g. No requirement for repainting and the use of minimum 300mm wide mowing strips for ease of vegetation maintenance.
- Vandal resistance.

See Sheet 63. Specification/Details – Reserve Paths – Threshold Design and Vehicle Barriers

7.2.5.6 Reserve Fencing

All fencing shall be constructed to the detail contained in *Drawing Sheet 6. Specification/Details – Reserve Fencing - Standard Reserve Fencing Designs* unless otherwise approved by the Council**.**

Boundary treatments that allow visibility into reserves from adjoining houses and properties (i.e. provides natural surveillance) are desirable. Identification of the boundary also makes the adjoining property safer. Boundary definition consisting of planting or fencing up to 1.2m in height is ideal and desirable in most circumstances.

Fencing within reserves or on walkways shall be consistent with the fence types outlined in the specifications unless otherwise agreed by the District Council and relate to the surrounding use and landscape type. The materials chosen should be consistent with the community character.

Table 1. Standard Fencing Types

Type	Description	Use
Standard Timber/ Timber Composite Paling	Fence at least 1.0m high, posts 100 x 75mm and placed not more than 2.75m apart. There should be two rails (three if the fence is higher than 1.0m), with sawn or PG timber/timber composite palings placed upright and well-fixed to both rails, with a gap of no more than 40mm between palings. Any timber rails and palings should be tanalised to minimum H3.1 or H3.2 and the posts to H4. Must have a contiguous concrete mowing strip underneath of minimum 300mm wide.	Urban accessways and reserves that border private property
Five wire	Fence properly strained, the wire to be 12.5 H.T. galvanised or similar. The posts are to be concrete or H4 treated timber minimum 1100 out of ground with min 1/3 (550mm) in ground. Posts are to be placed no more than 4m apart, and the battens or droppers of treated timber, metal or plastic, evenly spaced, and at least three	Rural living (non-live stocked) option only

Type	Description	Use
	between posts. The top wire is to be at least 1000mm from ground level, and no barbed wire is to be used	
Single, double or triple rail	A timber fence with minimum 125mm square posts H4 RS or PG posts (can also be 150mm square or 200x100mm2), 500mm-1200 out of ground (min 1/3 concreted into ground). Rails 150x 50mm H3.2 RS or PG, maximum 1800mm spacing for single rail and maximum 2400mm for triple-rail. Fence must have a contiguous concrete mowing strip underneath of minimum 300mm wide. Option for top rail (50x150mm) on single rail fence where seating is required	Reserve road frontage, carparking areas instead of bollards, and near playgrounds – (added option for top rail seating.)
Visually Permeable	Mix solid and permeable fence that is over 1.4m in height (maximum 2m) with a minimum of 25% visually permeable structure, such as pool style fencing. Non-permeable components can be part solid timber, concrete block, colorsteel or other similar material. See examples	Fencing fronting a street or other public place
Safety Guard/Handrails	Solid non-climbable rails with no toeholds to reduce the chances of climb and fall from heights. Minimum height 1.5m. Specifications for rail determined by criteria set in SNZ HB 8630 – Tracks and Outdoor Visitor Structures.	Directly adjacent to formed public pathways where direct fall is over 1m within 500mm of edge.
Pool Fence	The Building Code clause F9 sets out the standard of fencing/barriers required. There may be alternate solutions to your pool fencing requirements under New Zealand Standard (NZS8500:2006).	Where private pools border all reserves
Seven wire stock proof	At road frontages, no hot wires shall be used unless they are attached at 300mm inside a physical barrier. Shall be a durable fence which achieves the required purpose of preventing access of all livestock to the site under development.	Where stock proofing is required. At road frontages the fence shall meet the standards in Table 2 below:

Table 2. Stock-proof Fencing Standards

Component	Type	Size and Placing
Stays	No.2	2.4m long. In poor soil conditions or variable topography, longer posts, longer strainers and more substantial footings and stays shall be used where necessary to achieve a stable fence.
Posts	No.2	Min 1.8m long at maximum 2.7m spacing
Battens	50 x 40	Equidistant placing, 0.85m maximum spacing – behind wires.
Wire	High Tensile Wire	7/9 for pig-proof wires – front facing.

See Sheet 54. Specification/Details – Reserve Fencing - Standard Reserve Fencing Designs

All reserves should contain adequate covenants or fencing agreements, to ensure Council is not responsible for any fencing costs on reserve boundaries.

Note: If fences are to be painted, the colour shall be as specified by Council.

Refer to the Fencing Act 1978 or the Operative District Plan for any clarification.

7.2.5.7 Reserve and Streetscape Structures

Common structures in public areas include retaining walls, decks, jetties, boardwalks, bridges, steps and staircases, shade structures and many others.

Structures shall be designed to safely withstand appropriate loadings. Structures that are not exempt under the Building Act shall only be constructed on receipt of a Building Consent (and Resource Consent where required). Code compliance certificates will be required for all structures that require a building consent.

All retaining walls, including those not requiring a building consent, should be constructed to resist lateral earth pressures, including those from any surcharge loading that may be present. Retaining walls should be located wholly within private land where they meet the needs of private property.

All structures constructed on public land require permissions from Council as landowner.

Companies such as Urban Effects, Streetscape, Shade Systems etc. provide a range of shelter and shade structure designs for public spaces. Specific selection of appropriate shelter structures should be discussed and approved by Council.

Many structures require site specific engineering, and will generally also require Building (and in some cases Resource) Consent/s.

Please also see SNZ HB 8630:2004 - New Zealand Handbook for Tracks and Outdoor Visitor Structures where applicable.

7.2.5.8 Reserve Play Equipment and Play Surfacing

The Council’s objective is to provide engaging and challenging yet accessible playgrounds that provide a range of play opportunities and meet a wide range of community needs. Playgrounds should be designed to cater for a range of ages from babies and toddlers to adolescents and adults, as siblings and caregivers will often directly engage in play with young children in their care. Council will likely wish to work with the developer in the early stages to develop a specific brief for the design of the playground and playground components to meet the aspirations of the surrounding community and compliment other nearby facilities.

Play equipment and safety surfacing may be required to be installed by the developer, or Council may decide to install the equipment following the vesting of the reserve. All play equipment and surfacing shall be installed by certified and experienced installers. Any equipment and surfacing installed shall comply with NZS 5828:2004 Playground Safety Standards and the requirements of required building or resource consents.

All new playgrounds must be designed to enable elements of inclusive play for children and caregivers with accessibility issues. Considerations should be given to playground edging that is safely mountable by wheeled mobility devices from nearby pathways (e.g. flush concrete kerb), spacing of play equipment and surfacing that can be easily navigated such as solid rubber tiles or wet-pour rubber rather than standard ‘cushion fall’ chip. Incorporation of inclusive play options such as ‘basket’ swings, wheel-chair accessible carousels, in-ground trampolines, and ramp accessed multi-play ‘towers’ is best practice.

Specialty and complex play areas such as splash pads and waterparks, basketball courts, pump-parks and skateparks etc. must be designed by suitably qualified and experienced professionals. Care must be taken to ensure considered design that allows for maximum play opportunities for a variety of children and young people while considering durability and future maintenance costs. Further information should be sought from Council teams prior to creating a scope for/or commencing any design for such projects.

Consideration should also be given to secure yet visually permeable fencing (or a low-lying natural barrier such as rocks or planting) of areas where toddler and younger children play if the play area is within 10 meters of roadways or carparks with high volume traffic. Other elements such as fully connective pathways, the inclusion of artificial shade structures or locating play areas close to mature shade trees, incorporation of natural material and play options and planting, drinking fountains, and seating for caregivers is also desirable and should be incorporated in the playground layout.

Newer trends in playground design is the inclusion of 'nature' play – which children have access to the natural world - such as using natural slopes, vegetation and other resources for unstructured play, and the incorporation for 'play' equipment to cater for adults to meet the health and recreation needs of older people. Any installed natural play elements or adult play or exercise equipment incorporated into public reserves should also meet the standards as set out in NZS 5828:2004.

All play space design and installation methodology shall be approved by Council prior to installation.

See Sheet 64. Specification/Details – Reserve Playgrounds - Safety Surfacing and Edging Details for Accessible Playgrounds

To ensure quality, safety and for ease of maintenance Council has developed a list of approved playground suppliers and installers.

See Appendix K List 1. Approved Playground Equipment and Surfacing Suppliers and Installers.

Note: Any requests from developers to utilise alternative play equipment providers and installers will be considered on a case-by-case basis.

7.2.5.9 Reserve and Streetscape Furniture

Reserve and Streetscape furniture includes (but is not limited to) benches and picnic sets, shade sails, bollards and other barriers, waste bins and recycling receptacles, bikes and scooter racks, drinking fountains, fixed barbeques, fences and gates, wheel stops, tree surrounds and grates, planters and many others.

To ensure quality, safety, aesthetics and for ease of maintenance, Council has developed a list of approved common approved landscape furniture products and suppliers for use on reserves and streetscapes.

See Appendix L List 2. Approved Common Landscape Furniture Products and Suppliers.

The materials chosen for all landscape structures and furniture should be robust to suit their purpose, location and reflect the local character. Durability and maintenance requirements will be considered.

Note: Any requests from developers to utilise alternative landscape furniture products and suppliers will be considered on a case-by-case and need to be approved by Council.

7.2.5.10 Public Conveniences – Toilets and Change Facilities

The design and location of public conveniences – toilets, change facilities are important in contributing to accessibility, comfort and enjoyment of reserves and other civic spaces. Public conveniences should be complimentary in terms of form and function, sustainability, maintenance and management.

Form and function considerations include:

a) Connections to the history of place, surrounding community and natural landscape.

b) Cladding that integrates into the surrounding environment.

c) Are accessible to people of all ages and physical abilities.

d) Positioning to take in desirable vistas/view shafts.

e) Provision of minimum basic facilities – such as handwashing and drying features to contribute to positive public health.

Sustainability considerations include:

a) Incorporation of efficient energy design principles – such as energy efficient lighting, low flush toilets/shower heads, and in some instances dry-vault facilities, on-demand washbasins and other low energy use materials and features.

b) Use of solar capture – in the form of solar panels on roofs etc. to power systems.

c) Use of bore water or collection of rainwater for toilet flushing or irrigation.

d) Providing outdoor areas of shade and shelter.

Maintenance and management considerations include:

a) Ease of hard surface access for regular servicing vehicles.

b) Use of durable, hygienic - easy to clean, graffiti resistant materials.

c) Use of basic, solid, yet ergonomic and comfortable features that function without electricity (i.e. non-automated)

d) Use of materials and components that can be renewed and maintained by locally based contractors (i.e. Auckland and Northland).

Other specific considerations Council has for design of toilet facilities include ensuring:

a) Toilet stalls are all accessible (i.e. – suitable for those using a wheelchair or other mobility device).

b) Unisex where possible.

c) Open to the public area for good passive surveillance for those entering and exiting.

d) Well-lit and well ventilated when in operation.

e) Located and rationalized to where they are most required – remote locations with high public use, near some popular playgrounds or other recreational and civic areas with high public use.

Council currently utilises a 'gold' and 'silver' standard for new public convenience facilities. These standards detail some standard features for the two grades of facilities including specifications for internal flooring and walls, toilet systems, hand basins, doors, fixtures such as grab rails, toilet roll holders, hand washing and drying features and others.

See Appendix O Spreadsheet 1. Public Toilets – Gold and Silver Standards for New Public Conveniences

A number of companies can offer some bespoke external roofing and internal configuration design options while keeping componentry reasonably standard for ongoing servicing. Permaloo for example, is a current lead in quality public toilet and change room design at time of writing and can customise with local artwork and design features. Other companies including local contractors should be invited to tender for new installations.

NSZ:3604 2011 Timber-framed Buildings Standards and Handbook Set provides some further technical guidance for timber framed buildings.

7.2.5.11 Reserve and Reserve Carpark Lighting

Public lighting in parks and reserves will be considered only when appropriate i.e. – when facilities are abs0lutely necessary for use after sunset. Examples would be 24-hour toilet/change facilities, associated carparks, or a priority cycle route when deliberately diverted from the road network through a park.

Reserve lighting design should:

a) Be in accordance with existing landscaping and any proposed new planting plans to avoid lights being obscured when plants mature.

b) Light only the main movement corridors (footpaths, shared paths, cycleways) and key amenities on that route.

c) Either delineate the route or adequately illuminate any entrapment spots along the route.

d) Cycle and pedestrian paths through reserves shall be designed to comply with the requirements of the latest revision of AS/NZS 1158:3:1.

Outdoor Carpark Lighting shall be designed to comply with the requirements of the latest revision of AS/NZS 1158:3:1.

7.2.5.12 Reserve Signs

Signs will be designed (or co-designed) and installed by Council or Council contractors following vesting of the reserve. Council does not generally accept any other permanent private or commercial signage on reserves outside of exclusive use events. The exceptions being when working with agencies such as Northland Regional Council, Civil Defence, Ministry of Primary Industries, The Department of Conservation, Iwi and Hapu, Pouhere Taonga/Heritage New Zealand etc. where signage contains necessary specific public information, or environmental or cultural health warnings.

Council signage on reserves will generally either be one of four types;

a) Reserve or Park Name sign.

b) Site specific regulatory, guidance or directional signage (at entries, junctions and on facilities).

c) Interpretation - historic or environmental enrichment.

d) Temporary signage – for construction works or other temporary reason.

Council takes the approach that all signage should;

a) Be well sited and succinct - appropriate in scale, minimise clutter (rationalise messages in to one), be located near other built elements, and use natural vegetative backdrops where possible.

b) Located near the entry and exits of tracks, be accessible along routes, and clearly identify key assets for people with physical disabilities at the entrance to the park or reserve.

c) Reinforce sense of place – materials and colours that complement the natural environment, not block or detract from significant natural or cultural landscapes.

d) Clear and durable – endure with prolonged environmental exposure, are non-reflective. easy to clean and maintain by local contractors, are legible and text contrasts with the background, are well mounted to reduce vandalism and have a concrete mowing strip underneath to reduce vegetation maintenance wear and tear.

Temporary signage will likely be required to meet Health and Safety requirements throughout development of a new or existing reserve.

7.2.5.13 Reserve Plant and Tree Species Selection

In selecting species for planting, the overall composition, level of maintenance, and longevity are to be taken into account. The Council maintains registers of suitable species – shrubs and trees for local conditions. Note – these lists are not exhaustive or conclusive (particularly for shrubs) but a good guide for design to be approved on a case-by-case basis by Council.

See Appendix M List 3. Suitable Shrub Species for Reserve and Streetscape Planting.

See Appendix N List 4. Suitable Tree Species for Reserve and Streetscape Planting.

Consideration should be a given to provide a balance of native and exotic plants (where appropriate) to give year-round interest and seasonal variances.

The following matters shall be considered:

a) Suitability of eco-sourced native plants for re-vegetation planting of the ecological region to protect the local biodiversity.

b) Suitability to environmental conditions, for example climate, ground moisture, wind, and shade.

c) Tolerance to high foot traffic use where appropriate.

d) Pest and disease resistance.

e) Potential to become invasive – refer Regional Pest Management Plan.

f) Non-suckering habit.

g) Final height, form, longevity, and potential impact upon neighbouring properties, structures and infrastructure.

h) Maintenance requirements.

i) Safety such as toxicity of leaves, flowers, seeds, and bark in areas likely to be used by young children, along with impairments to pedestrians

j) Plants considered to be short lived, frost tender or high maintenance should be avoided in areas other than re-vegetation ecological areas.

Note: The development of a scaled and labelled ***Planting Plan*** and associated ***Plant Schedule***, helps determine numbers of species required for the development.

7.2.6. Streetscape Design and Components

7.2.6.1 Introduction

Landscaping within a road corridor is otherwise known as streetscaping. This applies to all proposed road reserve landscape design or works in any part of the road corridor.

Streets, like reserves, also offer an opportunity to incorporate green infrastructure. Planting in streetscapes in built-up neighbourhoods is often more appreciated in its contribution to local character, amenity and ecology than in reserves and parks which are often of larger scale and isolated from parts of the community and each other.

If designed well, green infrastructure in streets where many surrounding surfaces are impervious, are invaluable in regulating stormwater run-off, reducing sediment and pollutants, providing shade, and reducing the 'heat island' effect (fluctuations or hot, cold and wind) caused by large area of hard surfacing and surrounding buildings. Plantings can provide an important corridor for birds and other pollinating insects. Green infrastructure can also reduce the need for hard infrastructure and often reduce costs in initial installation and ongoing maintenance.

Streets however can vary considerably in relation to incorporation of general landscaping and other green infrastructure.

For new urban streets the minimum green threshold wherever possible is a grass berm and street trees at maximum of 25 metre centres, impervious (non-permeable) surface 70-80%, and tree canopy coverage 10-30%.

Preferred green thresholds to incorporate green infrastructure would be integrated water sensitive urban design and/or street trees at 10-15 metre centres with continuous canopy cover (greater than 40% overall) and impervious surfacing at less than 70%.

See Sheet 65. Specifications/Details – Streetscapes - Planting for Water Sensitive Design in the Streetscape.

7.2.6.2 Streetscaping and Frangibility

For transportation corridors where speeds are greater than 50km/hr., landscape design is to take into account potential for errant vehicles to strike objects and landscape which increases the likelihood of crash severity. Frangibility of proposed trees and features is to be considered.

7.2.6.3 Visibility Splay Requirements

Driver sight distances need to relate to traffic function and vehicle speeds, and as such tree and streetscape planting should not be placed in the visibility splay. The achievement of relevant Austroads Criterion is desirable.

In front of low intersection sign boards, planting shall be designed to be not more than 300mm high at maturity or these areas are to be paved to ensure compliance with visibility splay requirements.

7.2.6.4 Traffic-Calming and Shared Space Environments

All traffic calming and shared space initiatives must be approved by Council.

Traffic Calming

From a traffic-calming perspective, landscaping helps to reduce vehicular speed by reducing the perceived openness of streets, signals where an area is not intended to be traversed or moved through and indicate where traffic-calming initiatives have been implemented.

When landscape planting is used in this context, vegetation is intended to visually block, reduce or impair motorist's line of sight, either along the carriageway berms or within the carriageway. The mature height of the vegetation will therefore be according to the traffic engineering specifications instead of normal carriageway landscape specifications.

Other considerations include.

a) Ensuring there will be sufficient drainage (and water reticulation) for new landscaped traffic calming devices to be installed in existing carriageways.

b) Ensuring that existing infrastructure (such as underground piping, cabling etc.) will not be compromised by the plant roots.

c) Maintenance requirements (including the establishment of traffic management plans).

d) Landscape replacement costs should a traffic calming device be traversed by a motorist.

e) Proximity to other services such as lighting columns and utilities.

f) Signage, bus stop and pedestrian crossing (formal and informal) visibility.

g) CPTED principles, especially passive surveillance.

h) Using the appropriate plant species for the traffic engineering, ecological, sense of place and amenity requirements.

See Sheet 55. Specifications/Details – Streetscapes - Tree Pits and Tree Planting within the Road Corridor.

Shared Space Environments

Landscaping in shared space environments is intended to reduce speed, through measures such as reducing forward visibility and introducing a horizontal deflection to create a meandering route through the space. This is especially useful in long straight streets; however, pedestrian and motorist visibility should not be reduced to impair safety for either.

7.2.6.5 Minimum Streetscaping Design Requirements

Where at all possible, a service-free corridor for landscaping purposes, of a minimum 1200mm wide shall be located within the berm on both sides of the road. This service free berm shall be between the kerb and any hard surface pathway rather than between the pathway and private property boundaries.

See Sheet 66. Specification/Details – Streetscapes – Service Free Berm for Landscaping Purposes, and Utility Placement.

Street trees should be considered for inclusion for all residential and mixed used developments in urban zoned areas. Public street trees may be less desirable in rural living and lifestyle zoned areas where private residents are likely to have the space for trees and other landscaping within their own properties, and where there are less ratepayers to fund ongoing maintenance. When development intensifies, street trees should be incorporated into roading upgrades in conjunction with other infrastructure.

In urban development areas trees are to be planted at regular spacings of between 10-25 metres, although groups of trees may be approved where the kerb line and location of services allow for local features. Alternative tree planting areas shall be provided where streets are narrow, or such a corridor cannot be provided. Alternative areas are equivalent to 1.0m^2 per metre of street length with any one area having a minimum site area of 12.0m^2. Areas protecting existing trees may be accepted as contributing to dedicated tree planting areas.

Typically, street tree planting locations should conform to those shown on:

See Sheet 56. Specification/Details – Streetscapes – Street Tree Planting Clearances.

Design of streets may include kerb extensions for intersections and speed controls which allow non-standard tree planting where utilities are not a problem and visibility requirements are designed to incorporate planting as a means of slowing traffic.

Traffic Islands and Berms

Design of planting in traffic islands, splitters and median strips shall be in accordance with the following table.

Table 3- Design Criteria for Infill Areas

PER INFILL AREA	SURFACE APPLICATION
Infill Area less than 6m^2	Hard Surface – concrete or decorative hardstand
PER INFILL AREA	SURFACE APPLICATION
Infill Area more than 6m^2	Approved Landscaping
Internal Kerb to Kerb Width less than 1500mm	Hard Surface – concrete or decorative hardstand
Internal Kerb to Kerb Width more than 1500mm	Approved Landscaping

Roundabouts

Design of planting on roundabouts shall be in accordance with the following table:

Table 4 - Design Criteria for Roundabouts

ROUNDABOUT DIMENSIONS	DESIGN CRITERIA
Visibility Splay Austroads Criterion 2 Areas	Groundcovers and bedding should not exceed 300mm in height although these may vary depending on road grades and levels
Visibility Splay Austroads Criterion 3 Areas	Groundcovers and bedding plants should not exceed 400mm in height although these may vary depending on road grades and levels

Roundabouts: More than 12m Diameter	These roundabouts are to have at least 65 % of the internal area planted with approved intersection plant species while ensuring that visibility splays, frangibility requirements and utility services remain uncompromised. Centralised trees can be included, subject to approval to aid in slowing traffic and act as a visual nodal reference.
Roundabouts: Between 6-12m Diameter	These roundabouts may be planted with up to 50% of the internal area in-filled with low groundcovers or shrubs, otherwise they are to have a Council-approved hardscape application such as paving or concrete. Centralised trees can be installed subject to approval.
Roundabouts: Less than 6m Diameter	These roundabouts are to have a Council-approved hardscape application such as paving or concrete.

7.2.6.6 Street Tree (and other Plant) Species Selection

Understanding the space constraints trees and other plants will experience at maturity is critical to selecting the appropriate species for the location. Street tree and plant selection must take account of pedestrian needs and expected traffic activity as well as above and below ground conditions.

The number of tree species suitable for street tree planting is much smaller than in open larger reserves due to limited space and more challenging growing conditions – such as roadside pollution, limited irrigation, service interference, need to provide clear sightlines for safe traffic movement etc. Care in choosing the right tree for the right place must be given.

Consideration should be a given to provide a balance of native and exotic trees and plants (where appropriate) to give year-round interest, seasonal variances, disease resistance, and for biodiversity.

The Council maintains a register of suitable tree species for street planting. Note – these lists are not exhaustive or conclusive but a good guide for design to be approved on a case-by-case basis by Council.

See Appendix N List 4. Suitable Tree Species for Reserve and Streetscape Planting.

7.2.6.7 Street Tree Layout and Planting

Trees should be planted where they will not create a future hazard for the public, especially visually impaired people, mobility or wheelchair users when utilsing formed pedestrian networks – footpaths and shared use paths. No trees (regardless of species) should be planted directly over existing buried services.

Unless otherwise stated all street, trees are to be centrally located within road berms. All trees are to be planted a minimum of:

a) 1.5m from underground services (ideally).

b) 10.0m from any driveway.

c) 10.0m from any bus stop, school speed sign or catch/cesspit.

d) 10.0m from any light standard or power pole.

e) 10.0m from pedestrian crossing facilities.

f) 15.0m from any intersection.

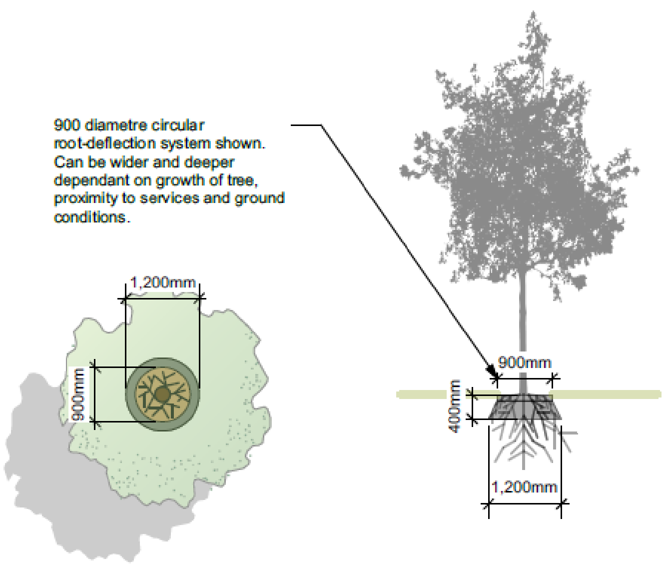
See Sheet 56. Specification/Details – Streetscapes – Street Tree Planting Clearances.

All service locations shown on the planting plans are to be used as an indicative guide only. All services shall be located on site and any damage repaired or mitigated.

7.2.6.8 Tree Pits and Tree Root Deflectors

Approved tree root deflectors or root barriers should be installed in all new street (and reserve) tree plantings where hard surfaced pedestrian footpaths or other shared pathways will be within the mature dripline of that tree species. These systems are designed to direct roots down and away from any hard surfacing to reduce the chance of lifting.

Diagram 1: Root Deflection Systems



Plan and Elevation - Showing Example of Root-Deflector System - Directing Roots Down and Away fom Utilities

To note that services are typically buried at or below 600mm below the surface and suitable street tree species are unlikely to have roots that would interfere with these unless these systems are otherwise compromised (i.e. broken clay pipes)

See Sheet 66. Specification/Details – Streetscapes – Service Free Berm for Landscaping Purposes, and Utility Placement.

Carriageway tree pits require additional design consideration such as frangibility, tree root intrusion into base material, the possibility of the tree drowning in a confined root space – or obtaining insufficient water. Optimum species would be those with a ball root system or those which have a deep rooting habit with minimum surface roots. Species will be site specific according to conditions and soil type.

See Sheet 55. Specifications/Details – Streetscapes - Tree Pits and Tree Planting within the Road Corridor.

7.3. Construction

7.3.1. Introduction

Following construction standards and recommended procedures will ensure that all landscaping is to an acceptable standard prior to final inspection and release of the bond (if a bond is required).

It is the Developer/Contractor responsibility to ensure that the landscaping meets these required standards at the termination of the maintenance period. The developer/contractor is responsible for the routine maintenance and replacement of the planting, including dead wooding, weed control, mulching, replacing dead trees, shrubs, and plants, and watering for the period from planting to the issue of a section 224 completion certificate under the Resource Management Act or contract maintenance period.

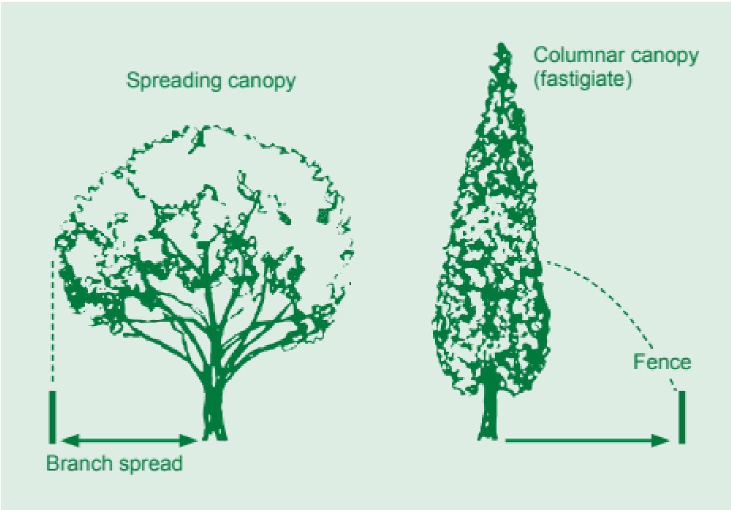
7.3.2. Protecting Existing Vegetation and Trees

7.3.2.1 Root Protection Distances

A tree root protection zone must be established by an arborist or otherwise qualified person before any work is carried out around tree to be retained. A sufficient amount of the root system to ensure the survival of the tree during the construction phase must be taken into account. This will also be dependent on the following factors:

- Tolerance of the tree to root disturbance base on species, age and condition.
- Compressibility of the soil.,
- Site topography and drainage.
- The use of the site once work is complete.

Diagram 2: Root Protection Distances



Note: For fastigiate species (erect, almost parallel braches) the tree-protection zone equals half the height of the tree. The actual tree root zone can spread well beyond the canopy drip-line.

7.3.2.2 Below Ground Works

If installation is required under existing trees and vegetation, then trenchless technology should be considered. If this is not practicable, advice from a qualified Arborist is required to minimise damage to the vegetation.

No works are to commence within 20m of historic/protected or notable trees without written approval from Council's parks staff. Council may require that an Arborist monitor works in or around these trees.

7.3.2.3 Assessment Prior to Works

Prior to undertaking any work within the dripline of retained vegetation an on-site assessment of the work proposed shall be undertaken by the Arborist.

Where heavy machinery would be operated, driven or sited within the dripline of any retained tree temporary protective fences shall be erected between the tree and the work area so as to protect the tree from damage. The position and composition of the protective fences shall be established prior to works commencing, and once erected, approved by the Arborist prior to the commencement of any site construction works. The temporary protective fences shall be strong and appropriate to the degree of construction works taking place on the site. The protective fences shall be a solid barrier, which cannot easily be picked up and moved. The protective fence shall be at least 1.5m high.

No works, storage of materials, cement/concrete washings and leaching of chemicals, trenching or alteration of soil grade shall occur within those areas demarcated by a temporary protective fence. The temporary protective fences shall remain in place throughout the duration of the construction works. The position of the protective fence shall not be altered without the prior consent of the Arborist.

7.3.2.4 During Works

Within the root zone of retained trees:

a) The removal of any existing footpath, kerb and channels, when within the root zone of retained trees, shall be carefully undertaken so as to cause no more than minor damage to the retained trees.

b) All roots of greater than 35mm in diameter shall be carefully worked around and protected. No such roots shall be removed, except:

- where no practicable alternative to removing the root exists and;
- where this would have a no more than minor detrimental effect on the tree and this is the supported professional opinion of the Arborist. Any such removal shall be undertaken by the Arborist.

c) Exposed roots of greater than 50mm shall be covered with 50mm of sand and rootzone areas shall be immediately covered with a suitable permeable Geotextile fabric immediately after removal of existing concrete.

d) Prior to laying of basecourse the underlying roots shall be protected by laying a suitable permeable Geotextile fabric over the soil surface.

e) There shall be no positioning (sitting or driving through) of heavy machinery unless this is on an existing hard surface (concrete or paved) or temporary hard surface.

f) The temporary hard surface methodology must be approved in writing by a qualified Arborist or the Council's engineer. It shall be constructed by laying geo-tech matting on the surface, 100mm weed free mulch or similar soft material on a hard surface placed on the soft material, i.e. sheets of plyboard.

All roots that are severed shall be pruned cleanly back to the surface of the excavation using sharp handsaw or secateurs. All exposed or severed roots shall be kept damp (using hessian cloth or similar) until the excavated area is backfilled.

No damage shall be done to the trunk and above ground parts of any tree that is to be retained.

Any pruning required to facilitate the works to retained trees shall be undertaken by the Arborist.

7.3.3. Reserves Specimen Tree Location

All reserve plantings shall be marked out on site, and approved by Council, prior to planting works commencing.

7.3.4. Site Preparation

All irrigation and drainage work, utilities installation, signs or landscape structures shall be completely installed prior to planting.

7.3.4.1 Excavation and Bedding of Planting Areas

Excavation shall be carried out where necessary to achieve either of the required soil profiles where depths indicated are post consolidation.

7.3.4.2 Landscape Planting

All waste material shall be removed from site.

The exposed subgrade shall be trimmed and levelled so that no part of the subgrade shall be above the required depth of cut.

7.3.5. Soil

Topsoil, both imported and existing on site, shall be:

- a loam soil of good quality
- free draining
- free of weeds and contaminates
- free of building materials and debris
- screened
- healthy; and
- contain no pans

All new planting areas on existing topsoil shall be deep ripped to a minimum of 300mm prior to planting.

7.3.6. Tree Pits

Saw-cutting of existing seal where required shall be undertaken between 250mm to 300mm from the back of the kerb. The design and measurements must be approved by Council prior to works commencing. The cut line shall be parallel the kerb lines wherever possible. All cut-outs are to be square and to be a minimum 1.0m x 1.0m dimension.

Planting holes shall be excavated, according to the following minimum specification:

Table 5: Tree Pits Design Criteria

TREE TYPE	TREE GRADE	PIT SIZE	PIT DEPTH
Street Trees	45 litre (PB95)	1.0m diameter	1.0m
Reserve Tree	45 litre (PB95)	2.0m diameter	750mm
Reserve Tree	90 litre	2.5m diameter	1.0m

See Sheet 55. Specifications/Details – Streetscapes - Tree Pits and Tree Planting within the Road Corridor.

The sides of the planting hole shall also be loosened by forking to 150mm minimum, and the surrounding ground to two times the root ball diameter shall be ‘forked’ over to reduce compaction.

Where topsoil is unsuitable for backfilling, imported or modified topsoil for backfilling shall be used. The imported topsoil shall be a free draining loam of a quality and subject to inspection by Council prior to placement.

Modified backfill soil shall consist of a homogenous mixture of the following to min 500mm deep.

- Parts by volume of good quality, friable topsoil from the site or imported.
- Three parts by volume of Council approved compost.
- Two parts by volume of coarse river sand.

The base of the planting hole shall be forked to a minimum depth of 200mm and any stones over 50mm diameter or poor-quality subsoil shall be removed from the hole.

See Sheet 57. Specifications/Details – Reserves and Streetscapes - Tree Planting Methods.

7.3.7. Grassing, Sowing and Turfing

This section covers the preparation and sowing of any new grassed areas or those requiring reinstatement or turfing of such areas. It includes berms, lawns and embankments.

7.3.7.1 Preparation for Sowing or Turfing

The following conditions apply:

- Grassing and fertilizing shall be carried out over all existing grassed areas disturbed by contract activity and other specified areas which may require reinstatement.
- Excessive compaction of subsoil in existing grassed areas shall be relieved to achieve satisfactory long-term growing conditions.
- All topsoil removed to permit contract works to be carried out shall be stockpiled for reuse.
- All new grass areas shall be built on soil prepared to industry best practice standards.
- Sloped areas shall be neatly contoured into adjoining grassed areas.
- Perennial weeds shall be controlled with industry best practice methods.

7.3.7.2 Grass Sowing

The following requirements apply:

- The seed mixture shall be an industry standard quality.
- Suitable grass mixtures include Kikuyu, Rye and Couch which provide differing levels of drought tolerance, visual appeal, proven wear and lower maintenance.
- On large areas the seed shall be “check” sown in at least two directions and surface rolled with suitable flat roller.
- On small areas the grass seed shall be evenly applied and raked into the soil.

7.3.7.3 Establishment of Sown Areas

The following requirements apply:

- Newly established grass shall be protected from damage by pedestrian and vehicular traffic until grass has reached a self-sustaining state.
- Grassed areas shall be watered as required to achieve an efficient germination of the seed.

- Newly grassed areas shall be maintained with regular mowing (90mm-30mm) ensuring that all clippings are removed from adjacent hard surfaces.

All grassed areas adjacent hardscape - such as paths, kerbs, hardstand areas – to ensure base of grass is flush with adjacent path. If base of grass level is 30mm lower or more than adjacent hardstand, grass will need to be removed min 1m back from path, soil put back in, levelled and re-consolidated to spec and grass res-own to correct level. If less than 30mm top dressing at 10mm each time, over time will be acceptable until the correct level is achieved.

7.3.7.4 Turf/Instant Turf

The following requirements apply:

- The turf shall be of good quality in line with industry standards.
- Suitable grass mixtures include Kikuyu, Rye and Couch which provide differing levels of drought tolerance, visual appeal, proven wear and lower maintenance.
- Turf shall be installed and maintained in accordance with supplier’s requirements.
- Areas of turf where there has been a poor establishment shall be re-laid.

7.3.7.5 Sloped Areas

In all sites, except natural gully systems, where the slope gradient is steeper than 1:3 (one metre high by three metres long), it is preferable that the embankment is either scarified or grooved on an angle to a depth of 200mm, from the top of the bank to the base. This assists topsoil adhesion and prevents separation of the top 150mm topsoil from the base material due to gravity and/or glazed/planning of base material.

7.3.8. Street Tree Planting

7.3.8.1 Timing

All tree planting shall be undertaken between May and August.

All trees shall be planted on the day of delivery to the site.

Council shall be provided with not less than five days’ notice of dates upon which planting will commence.

7.3.8.2 Layout

Trees shall be planted in the locations shown on the planting plans and in accordance with these specifications. Unless otherwise indicated on the planting plans all plants shall be planted centrally within the road berm.

See Sheet 56. Specification/Details – Streetscapes – Street Tree Planting Clearances

7.3.8.3 Tree Root Barriers

Root barriers shall be installed prior to tree planting in almost all circumstances with exception berms that contain no utilities. The location of root barriers shall be as specified and centred around the plant stem.

Refer Diagram 1: Root Deflection Systems

7.3.8.4 Street Tree Mulching

All street trees must have a minimum 1.0m diameter mulching circle from the tree trunk.

Mulch shall be well rotted organic tree mulch. Mulch shall be free of foreign debris such as rocks and plastic.

Mulch shall be applied to a depth of no more than 150mm after planting. The final settled depth shall be no more than 120mm and no less than 100mm. Ensure that mulch is welled up to ground level around the tree trunk.

7.3.9. Irrigation and Fertilising

7.3.9.1 Irrigation

During installation and establishment, the soil in all planting areas moisture shall be retained to ensure active plant growth throughout the growing season (September – May). To achieve a high level of site presentation or in areas of annual bedding display planting, irrigation systems may be required to achieve this.

Where an irrigation system is required to be installed, 'Toro' brand or a similar approved brand shall be used. The system shall be capable of providing a minimum soil moisture level of 50% to 200mm depth, throughout the planted areas or within the dripline of trees specified. It shall be capable of fully re-wetting the root zone to 200mm depth when the irrigation is applied; and shall be fully automated to operate between 1:00am and 6:00am when moisture levels drop below 50%.

7.3.9.2 Passive Street Tree Irrigation

When surrounded by hard surfaces or as specified, a street tree shall have a 1900mm long section of perforated Novaflow, or similar, perforated pipe inserted into the tree pit. The Novaflow is to run down one side of the tree pit, under the intended root ball and up the opposite side of the tree pit to be level with the ground surface. The other end is to extend above the intended mulch layer by 20mm. Both ends of the pipe should be capped. Underground irrigation systems can be used instead of manually watering.

7.3.9.3 Fertilising General

Generally, some form of fertiliser shall be applied to planting depending on the soil type. For shrubs and trees, all fertiliser shall be well mixed with the backfilled soil. For bedding or groundcover all fertiliser shall be well mixed with the site topsoil prior to planting. Fertilisers shall be either an approved pelletised natural or organic fertiliser or an approved synthetic fertiliser.

An exception to these approved pelletised natural and organic fertilisers or approved synthetic fertilisers is for the Proteaceous species and ferns which should on no account be fertilised with Phosphate (P) containing fertilisers.

7.3.9.4 Street Trees Fertilising

All specimen tree plantings shall have two-year slow release fertiliser tablets installed at the time of planting.

7.3.9.5 Grass Sowing and Turf

All fertilisers shall be delivered to the site immediately before they are required for spreading and shall be thoroughly mixed on the site. Council may prohibit the use of any fertilisers which have deteriorated because of interaction, wetting, etc. Fertilisers shall be lightly harrowed into the topsoil, 2-3 days prior to seed sowing, at the following rates at 200kg/ha.

Table 6. Equation: Grass Sowing Rates

Fertiliser	Application rate
30% Potassic Superphosphate	150 kg/ha (15g/m^2)
Sulphate of Ammonia	50 kg/ha (5g/m^2
This shall be followed one month after sowing, with an application of	
Di-ammonium Phosphate (DAP)	100 kg/ha.

7.3.10. Quality Control

7.3.10.1 Plant Grades, Species and Quality

General Plant Grades

All plants shall be supplied true to the species and grades specified on the approved landscape plans and fill the specified planter bag. All street trees, unless specified otherwise, shall be of a minimum grade of 45 litres (Pb95) with a minimum 60mm caliper at 1m from ground level.

All other stock shall be of minimum 2 litre grade for groundcover and 3 litre grade for shrubs.

General Plant Species and Quality

a) Trees shall be selected from Council's approved tree species list. No substitution of species or grade shall be made without the written approval of Council.

b) All plant material supplied shall be clearly labeled.

c) Council shall be provided with not less than ten working days' notice of dates upon which plants are to be delivered on site, so that arrangements can be made for quality inspection and confirmation of identification of plant material.

d) Trees shall be well branched, symmetrical and of typical habit for the species.

e) All plants shall be nursery stock of good form, healthy and vigorous with strong fibrous root systems and free of all pests and diseases.

f) All trees shall be supplied with the central leader intact - no pruning of the central leader shall have taken place. All torn or damaged roots shall be pruned before dispatch. All stock shall be well rooted but not root bound. Open ground stock shall be well-wrenched.

g) All root balls and containers shall be free of all weeds. Plants shall be well 'hardened -off' prior to supply.

h) All plants and their roots shall be maintained in a moist environment, protected from adverse conditions such as drying winds, frost or water logging. All roots must be covered during transit and storage to prevent desiccation or damage.

7.3.10.2 Street Tree Grades, Species and Form

All street trees, unless specified otherwise, shall be of a minimum grade of PB 95/or 45litres and be first grade nursery specimens. No substitution of species or grade shall be made without the written approval of Council.

Trees shall be well branched, symmetrical and of typical habit for the species. All plants shall be nursery stock of good form, healthy and vigorous with strong fibrous root systems and free of all pests and diseases.

All trees shall be supplied with the central leader intact, whereby no pruning of the central leader shall have taken place. All torn or damaged roots shall be pruned before dispatch.

All stock shall be well rooted but not root bound. All root balls and containers shall be free of all weeds.

7.3.11. Weed and Litter Control

7.3.11.1 Litter Control

The planting area shall be kept clear of all rubbish, including domestic and building materials.

7.3.11.2 Chemical Applications for Weed and Pest Control

All chemical application on planted areas shall be carried out by qualified, trained personnel and according to NZS 8409:2004 – Management of Agrichemicals, any relevant local Herbicide Policy and manufacturers' requirements.

All spraying operations shall be carried out in windless, dry conditions, when rain is not imminent for at least 12 hours and at times which minimise possible hazards or disruption to the public, animals or other beneficial fauna. Care shall be taken to prevent spray drifting onto non-target areas or plants and comply with notification requirements as required by the proposed Northland Regional Plan.

Herbicides may be used to control weeds or excess grass growth over structures, surfaces or into planting areas.

All trees in grassed areas shall have a weed release spot spray applied between four and six months after planting. General weed control shall be carried out whenever necessary to maintain the planting weed-free.

Chemical weed control in planting areas shall be kept within the edge of the planting beds, within a maximum of 500mm of tree trunks, within 50mm of the edge of any undefined mulch surface, and within 50mm of any posts or the base of any landscape structures.

7.3.12. Mulching

Unless otherwise approved by Council, all new planting areas shall be mulched. All care shall be taken in placing the mulch so as to protect the plants and any irrigation system, ensuring that no plant canopy is covered by mulch post-installation. All damage to the plants or irrigation system shall be rectified.

7.3.12.1 Site Specific Mulch Applications

Flat Site Mulch

On sites flatter than a 1:3 grade (1.0m high by 3.0m metres long), quality 5B/shredded cambian bark mulch or 'Forest Floor' shall be spread evenly to a depth of 100mm over the planted area, creating an inverted cone hollow around each plant stem. The mulch shall be supplied as scheduled, clean and free of soil, sawdust and wood preservatives. A sample may be required to the District Council for approval prior to spread.

Steep Site Mulch

On slopes steeper than 1:3, mulching for weed control shall consist of Council approved matting. The matting shall be a single layer of fully biodegradable mulching fabric or material without synthetic geonet or synthetic geotextile content with at least 1000gsm density. The mulching fabric shall have a minimum 24-month life expectancy and be fully biodegraded into soil within six years. It shall be installed according to manufacturer's instructions prior to planting, ensuring that the mulch will not uplift due to inundation, winds or from animals such as Pukeko.

At Council's discretion, mat rounds may be used instead of matting. These shall be a minimum 500mm diameter and have the same characteristics as the mulch fabric. Each round shall have 8 pins: 4 pins equidistant near the outer edge and 4 pins around the plant stem.

On steep slopes with erosion issues that are receiving planting, biodegradable netting with no geotextile or geonet content shall be used at the District Council's discretion. The netting will have an expected lifespan of at least 36 months. This shall be placed on top of the mulch matting and shall be installed according to manufacturer's instructions. The netting is not intended to suppress weeds and shall be used in conjunction with mulch matting or rounds.

7.3.13. Staking, Fencing and Protection

Specimen and Street Trees

Newly planted specimen trees shall be staked with two 50 x 50 x 1.8m hardwood or rough sawn pine H4 stake with at least one third of their length (600mm) in the ground and at least 1.0m exposed minimum, or as specified on the approved plan. One flexible hessian tie per stake shall be attached to secure the tree. Ties shall be tensioned to avoid chafing of the tree against the stakes but with enough play for the tree to move in the wind. All ties shall be fixed to the stakes. Any other stakes including those against the main stem shall be removed.

Ties shall be fixed to the outer stake face with a minimum of four staples in a square pattern.

All stakes shall be inserted to avoid hitting the root ball. Stakes shall be at least 350mm away from the tree trunk and no more than 500mm away.

7.3.14. Pruning

Pruning should be carried out in accordance with acceptable arboricultural and horticultural practices (ideally by a New Zealand Arboricultural Association registered member) with oversight from Council's parks team.

See Sheet 57. Specifications/Details – Reserves and Streetscapes - Tree Planting Methods

7.4. Completion of Works

7.4.1. Completion

Works to be carried out under the defect's liability period include routine maintenance of the landscape planting works i.e. weeding, litter removal, mulching, watering and replacement of dead or diseased plants.

Council may periodically check the site to ensure that maintenance requirements are being met. Should any defects be identified, the defects shall be remedied or mitigated within one month.

7.4.2. As-built Information

Upon completion of construction work, copies of As-built plans and data attributes of the completed works shall be provided.

Separate plans are required for wastewater, stormwater, and water supply.

Responsibility for providing the plans and associated data shall lie with:

a) The Developer, in the case of land development (urban and industrial subdivision).

b) The Contractor, in the case of works constructed for Council under contract to Council.

7.4.3. Works Clearance Inspection

After completing all proposed works Council shall be provided notice at least seven working days prior to the proposed commencement of the defects liability period and shall be available for a joint pre-defects' liability period inspection.

7.4.4. Defects Liability Period Final Inspection

The Developer/Contractor shall request acceptance from Council of the asset and its ongoing maintenance at least 7 working days prior to the end of the defect's liability period.

The General Planting Defects Requirements apply to all planting, except where Street Trees and Grass Turf have been planted.

7.4.5. Street Trees Defects Liability Period

The planting defects liability period shall be 2 years from works clearance or practical completion (or as defined in the resource consent) and acceptance of the landscape planting works by Council or upon release of any implementation bond held for uncompleted landscaping.

A copy of the as-built plan recording any variation from the approved landscape planting plans shall be provided to Council.

7.4.6. General Planting Defects Liability Period

The planting defects liability period shall be 2 years from works clearance or practical completion (or as defined in the resource consent) upon release of any implementation bond held for uncompleted landscaping.

During and at the end of the defect's liability period, the following minimum standards are required:

- All top-soiled areas prior to planting and mulching shall be weed-free.
- All planted areas shall be kept weed-free.
- All planted areas including street trees shall be replenished with the approved mulch.
- All trees and other planting shall be vigorous and healthy, free of disease and free of dead growth or dead flowers.
- If planting is to take place during drier, summer months, provision of temporary on-site irrigation should be discussed with Council.

- The planting has become established. Any plants failing during this period shall be replaced to the specification, to ensure adequate establishment of the planting.
- The plant growth shall have been trimmed to the extent and height required for any visibility splays.
- All tree stakes and ties shall be intact and correctly installed.

Replacement Planting

All replacement plants shall have been successfully established for at least three months prior to the final defects check. Council reserves the right to request replacement records that preferably include dated digital photographic evidence to verify installation dates.

7.4.7. Fencing and Landscape Structure Defects Liability Maintenance

During and at the end of the defect's liability period the following minimum standards shall be maintained

- All permanent or temporary landscape structures shall be structurally sound, safe, functional or operational and in a presentable finished form
- Paintwork and other finishes shall be maintained in a clean and presentable finished form. Bolts and other fixtures shall be maintained sound and without loose parts or rough edges
- All structures shall be free of litter, graffiti, grime, weeds and plant growth or any other foreign matter
- Borders, footing edges or paving shall be maintained so that no more than 25mm of grass or other vegetation is allowed to encroach. Vertical elements without mowing edges shall have vegetation maintained clear of the structure by no less than 25mm and no more than 75mm

7.4.8. Grassing and Turf Defects Liability Period

After initial establishment, during and at the end of the defect's liability period, the following minimum standards shall be maintained:

- All kerb and channeled verges shall have grass growth no more than 50mm high, non-kerb-and-channeled verges shall have grass growth no more than 200mm high and banks shall have grass growth not more than 250mm high.
- The sward shall be maintained in a healthy, weed-and-disease free state without bare patches.
- Trees and other plantings shall be protected from damage by maintenance or mowing operations and if damaged shall be reinstated within one week of the damage occurring.
- Maintenance and mowing operations shall be carried out at times which minimise disruption to the public.
- Maintenance and mowing operations shall be carried out only in conditions with equipment that ensures maintenance of good soil structure, minimum deformation of ground surfaces and on-going establishment of the grass sward.
- Litter shall be removed prior to commencing maintenance or mowing operations. Highly visible shredded litter shall be removed following maintenance and mowing.

- Grass clippings, when not required to be collected during mowing, shall be spread evenly over the sward.

Table 7: Minimum General Landscape Maintenance Schedule during Defects Liability Period

Component	Action	Frequency	Period	Notes
Compliance Inspections - Council.	Assess that the site(s) is being maintained as per specifications required.	Three monthly.	Defects duration.	
Compliance Inspections - Developer/Contractor.	Check for problem weeds, failed plants, pest damage, pruning and replacement needs. Ensure mulch application correct depth and coverage.	Monthly.	Defects duration.	
Fertiliser (in planting areas).	Pellets: NPK at 100g/m2 on shrub planted areas or 100g/tree.	Pellets - Once only at start of second growing season or after replacement planting.	As applicable.	Spring preferrably.
	Foiliar feed: On Council approval, apply approved liquid foliar feed.	Folliar feed - Once two weeks prior to the end of the defects liability period.	As applicable.	
Mulching.	5B/Forest Floor Mulch: Maintained at 9=80-100mm depth with 25mm depth around stem with inverted hollow cone. Mulch travel not evident outside planting area.	Mulch - Replace/top up mulch after planting as required checking every 2 months.	Defects duration.	April - October preferrably.
	Biodegradable Matting: Check and ensure pins and matting is installed correctly and fabric is intact.	Repair or replace fabric as required.	Periodically througout defects period.	
Plant Replacement.	Replace according to the allocated planting scheme. Maintain as per Plant Schedule species and centres.	As determined by Compliance Inspections	Planting early Winter to early Spring ideally throughout full defects liability period.	Note: expect up to 20% lost for coastal plantings.
Rubbish.	Remove to waste all domestic and construction rubbish from planted areas.	Monthly.	Defects duration.	
Staking.	Damaged ties and stakes (including those leaning over) are to be replaced. Replant plant if on lean ensuring roots are not exposed.	Two montly inspection regieme.	Defects duration.	
Weed Control.	Manual removal of weeds or specific herbicide. (No spraying near waterways).	Two monthly.	Defects duration.	

Chapter 8: Electricity, Telecommunications and Gas

8.1. Introduction

8.1.1. Description and Expectations

This section sets out the requirements for network utilities that are not owned or managed by the District Council: electricity, telecommunications/data and gas (compressed natural gas).

The District Plan has varying requirements for the provision of network utilities depending on the Environment. There is no requirement for gas to be reticulated in future subdivisions, whereas there is an expectation that electricity and telecommunication are reticulated in urban areas.

The Developer shall liaise with the relevant Network Utility Operator(s) as necessary for the development and as required by the District Plan. The cost of this work, necessary legalization and transferring of land, installation work, and amendments to existing utilities shall be the responsibility of the Developer unless otherwise agreed in writing with the respective Network Utility Operator and/or the District Council.

8.1.2. Objectives

a. To ensure that each network is located so as to be capable of servicing the intended users.

b. To ensure that networks are designed to acceptable urban design, landscaping and engineering standards

c. To ensure all networks are laid underground unless not required by the District Plan

d. To ensure that any network that is to be located above ground within the road reserve shall be located clear of footpaths, cycleways, accessways and vehicular sightlines.

8.1.3. Reference Documents

The following documents are referenced in this Chapter;

Note it is the responsibility of the ES user to ensure the most up to date referenced document is sourced.

8.1.3.1 Statutory

Operative District Plan and Proposed District Plan

8.1.3.2 New Zealand Standards

NZS 5258:2003 - Gas distribution networks

8.1.3.3 Other Referenced Documents

NZ Utilities Advisory Group: National Code of Practice for Utility Operators' Access to Transport Corridors 2015

Any Relevant Regional Plan

NZECP 34:2001 - New Zealand Electrical Code of Practice for Electrical Safe distances

Telecommunication Facilities Regulations 2008

Resource Management National Policy Statement (NPS)

NES for Electricity Transmission Activities Regulations 2009.

Electricity (Hazards from Trees) Regulations 2003.

WorkSafe NZ Publication; Guide for Safety with Underground Services

8.2. Design

8.2.1. General Requirement

a. Where network utilities shall be installed as part of the subdivision development, a point of supply shall be provided to the boundary of each lot, or at the discretion of the Network Utility Operator it shall be provided at a selected location within 10m of each lot. Ducting for any network utility may be laid at the discretion of the Network Utility Operator at the time of subdivision. All cables and pipes shall be underground, (preferably installed during road construction) as specified in the District Plan.

b. Where an electricity or telecommunications network is not to be installed as part of the subdivision, the District Council will require the use of a ‘no electricity supply encumbrance’ or ‘no telecommunications supply encumbrance’ registered on the affected land title(s).

c. The design of network utility reticulation and service connections shall be undertaken by a suitably qualified designer for each utility type.

d. The Developer shall be responsible for:

   i. All arrangements with the Network Utility Operator for the supply and installation of the relevant utilities,

   ii. Ensuring that the network utility is installed as part of the subdivision works and in accordance with the ES, and

   iii. Obtaining certification from the relevant Network Utility Operator that the network utility has been installed in accordance with their requirement and the ES

e. The point of supply, such as distribution pillars and similar, shall be located in the road reserve boundary of each lot and shall not be located where they are likely to cause interference with access construction at the common boundary of access ways onto roads.

f. It is the incoming owner’s responsibility (not withstanding prior arrangements) to meet the costs of any internal (within the lot) network utility reticulation and/or any network utility upgrade that may be necessary to supply loads above that designed for.

g. Where applicable on private land, easements shall be registered over new and existing network utility cables, lines, and plant in favour of the Network Utility Operator to ensure the security of supply.

h. Sites for transformers, gas regulators and other equipment and facilities shall be provided where required and positioned and secured to minimise any hazard. They be located in a utility reserve outside the road reserve unless Specific Approval is obtained.

8.2.2. Reticulation Layout

The position of utilities in the road shall conform with the standard layout shown in the **Sheet 29** and **Sheet 30**.

Network Utility Operators may require their utilities to be spaced at greater distances from the minimum specifications, in which case the most restrictive requirements will govern the clearances applied.

The Developer is responsible for ensuring that all Network Utility Operator's requirements are achieved.

The following shall also apply:

a. All utilities shall run parallel to the surveyed road boundary line, and

b. Wherever the utility crosses a carriageway, the utility shall be installed in a duct. The duct shall conform to the requirements of the Network Utility Operator. Where the duct can be installed before the road base is constructed the duct can be installed by open trenching otherwise the duct shall be installed using trenchless methods.

8.2.3. Utilities on Bridges

The installation of utilities on bridges and the approach route shall be subject to Specific Approval.

All utilities shall be enclosed in ducts mounted in positions approved by the District Council.

8.2.4. Plans

Plans of utilities shall be consistent with the drawing standards outlined in Appendix G Drawing Standards.

Note: Copies of the plans of the development shall be forwarded by the Developer to all of the affected Network Utility Operators at an early date to facilitate the design of the reticulation.

In preparing the Engineering Plans the Developer shall consider the requirements of the Network Utility Operator and the TA corridor manager for:

a. Minimum cover to cables and pipes,

b. The Network Utility Operator's desired position for the cables and pipes within the road berm as agreed with the TA corridor manager,

c. The minimum separation distances between power or telecommunication cables, and gas and water assets,

d. The width of berm which shall be clear of other utilities and obstructions to enable efficient cable laying operations,

e. The requirements of NZS 5258:2003,

f. The requirements of the National Code of Practice for Utility Operators' Access to Transport Corridors 2015, and

g. The minimum separation distances between overhead power lines and buildings, structures and earthworks outlined in the NZECP 34:2001.

8.3. Construction

8.3.1. Underground Cabling

Underground cabling shall be achieved by the most appropriate method considering the following:

a. nature of the subsoils,

b. the potential damage to other infrastructure, and

c. the state of completion of other infrastructure

with the method used subject to the approval of the Corridor Access Manager.

Where open trenching is used, all backfilling and compaction of trenches shall be undertaken in accordance with the ES and to the satisfaction of the Corridor Access Manager.

8.3.2. Materials

Materials and sizes of ducts and pipes shall comply with the requirements of the Network Utility Operators and the colours shall be in accordance with the Work Safe NZ publication Underground services - Guide for safety with underground services.

8.3.3. Ducting

The following shall apply:

a. Ducts shall be laid in straight lines, parallel to or at right-angles to the kerb and/or property boundaries with horizontal tolerances of horizontal ±300mm and vertical ±100mm.

b. Ducts shall be installed with draw-wires and end-caps where the network utility reticulation or connection is likely to be installed after roads, footpaths, entranceways and the like are constructed. This minimises the need for trenching through the new surfaces. If cables shall be installed after completion of paved areas and where ducts have not been provided then trenchless installation methodologies shall be required.

c. The duct size, colour and installation shall comply with the network utility provider specifications and the WorkSafe NZ publication; Guide for Safety with Underground Services.

8.4. Completion of Works

8.4.1. As-Built Plans

Upon completion, the Developer shall accurately record 'as-built data' for network utility reticulation installed for the development, which shall be kept as a permanent record by the Network Utility Operator in a format suitable for use by others.

Appendices

Appendix A Design for Surge and Fatigue

A1 Introduction

All pipelines are subjected to pressure variations during their lifetimes. Some of these pipelines, e.g. rising mains, will experience significant and regular pressure surges, while others may be subjected only to minor diurnal pressure variations.

Rapid pressure fluctuations and surges generally result from events such as pump start -up and shutdown, or rapid closing or opening of valves, including 'slamming' of air valves as can happen during venting of bulk air from pipelines.

For the purposes of the FNDC ES, a pressure surge is defined as a rapid, short-term pressure variation. Surges are characterised by rapid, high-pressure rise rates, with minimal time spent at the peak pressure. Surge events usually consist of a number of diminishing pressure waves that cease within a few minutes.

The frequency and magnitude of the pressure transients affects the choice of pipe pressure class. Ensure that the following aspects are considered when designing for surges and fatigue;

a. That the maximum and minimum pressures are within acceptable limits for the pipe and fittings for all surge events (including infrequent events such as power failure, emergency shut-down, rapid closure of fire hydrants),

b. Consider the potential for fatigue and select the pipe pressure class accordingly, to allow for frequent repetitive pressure variations, and

c. The pipe and the quality of installation and their influence on the fatigue resistance of the pipe.

The following sections provide a methodology for dealing with surge and fatigue, so that pipes are adequately designed to provide the 100 year design life that is required.

The PIPA Guidelines may also be used, specifically the following;

d. POP010A – Polyethylene Pressure Pipes Design for Dynamic Stresses

e. POP101 – PVC Pressure Pipes Design for Dynamic Stresses

These may be found at https:/www.pipa.com.au/technical/pop-guidelines.

A2 Pressure Surge Events

A surge analysis is required to check whether damaging pressure surges (or surges that could cause customer complaint) could occur in a system. The level of detail of the surge analysis should be appropriate to the pipeline. For example, a reticulation pipeline may require only consideration of rapid closure of fire hydrants and conservative selection of pipe pressure rating.

Pipelines that may be subjected to more severe surge effects e.g. rising mains, areas close to control valves (reservoir inlet valves and pressure reducing valves) and where specified by Council, require a more detailed level of analysis, or the selection of pipe materials that are highly resistant to surge and fatigue issues.

The source(s) of significant pressure surges in a water system should be identified and included in any surge analysis. Mitigating measures may be needed to minimise any surges generated, and any surge control devices must be designed accordingly. As a minimum, such a surge analysis should consider;

f. Identified causative scenarios (e.g. power failure, pump trip, component failure, air valve operation, rapid closure of valves),

g. The highest pressure along the pipeline,

h. The lowest pressure along the pipeline, and

i. Vacuum and air relief requirements along the pipeline under all conditions.

Note that non-slam air valves may be required on plastic pipelines, to minimise the risk of severe surges being generated by the movement of trapped air, and to minimise the potential for instantaneous 'slamming' shut of a conventional air valve.

If, during the design phase, it is found that the minimum pressure in the mains could fall below atmospheric pressure during pressure surge events or drain down, mitigating measures must be designed to eliminate or minimise these effects. If negative pressures are a possibility, buckling of the pipe must be considered and a safety factor of at least 2.0 applied.

A3 Fatigue

Consideration of the effect of fatigue is particularly relevant to plastic pipes that are subjected to a large number of pressure cycles. Fatigue considerations can generally be ignored for ferrous pipe materials, e.g. ductile iron and concrete-lined steel. The important factors are the magnitude and frequency of the pressure fluctuations.

For fatigue loading situations, the maximum pressure reached in the pressure cycle must not exceed the nominal pressure rating of the pipe.

Fatigue does not need to be considered if the number of pressure cycles during the pipe's designed lifetime does not exceed the values in Table 0-1 below.

Table 0-1: Critical number of surges in pipe lifetime

Pipe Material	Critical Number of Cycles in Lifetime
PVC-U, PVC-O	100,000
PE 80B, PE100	300,000

The procedure for fatigue design is:

j. Confirm the design lifetime of pipeline. (The pipeline design life must be taken as 100 years unless specified otherwise by Council),

k. Estimate the likely number of pressure cycles during design life,

l. Calculate the range of pressure surges,

m. Calculate the fatigue load factor,

n. Determine the equivalent operating pressure, and

o. Select the pipe PN rating.

A4 Number of Pressure Cycles

Calculate the expected number of cycles during the pipe's lifetime, based on realistic estimates of the number of pressure cycles per day or per hour. If the primary pressure variation is followed by a smaller number of pressure fluctuations on each cycle, as shown in Figure 0-1, the calculated number of cycles should be doubled.

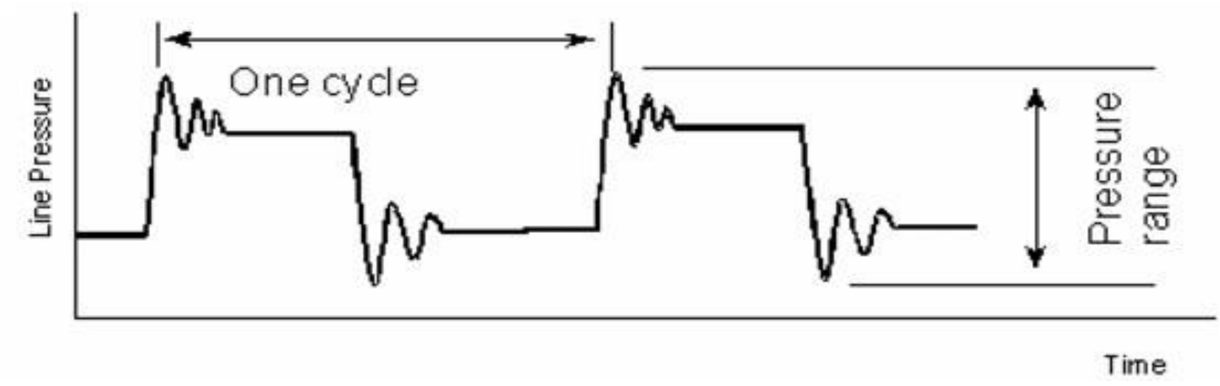


Figure 0-1: Pressure Cycle and Pressure Range (From POP101 Figure1)

Table 0-2 below shows the number of pressure cycles over 100 years for various numbers of cycles per day and hour

Table 0-2: Pressure Cycles in 100 Years for Various Numbers per Hour and per Day

Cycles per Hour	Cycles per Day	Total Number of Cycles in 100 Years
0.04	1	36,000
0.5	12	440,000
1	24	880,000
10	240	8,800,000
60	1440	52,500,000
120	2880	105,000,000

A5 Range of Pressure Surges

Calculate the pressure range of the regular pressure variations by surge analysis. Figure 0-1 shows a typical cyclic pressure pattern. Where pumps are controlled by variable speed drives, select a pressure cycle that is most representative of the expected pipeline operation over its design life.

Note that the pressure range will vary along the pipeline. Economies may be possible on some pipelines by dividing the pipeline into sections and evaluating the fatigue design for each, subject to the approval of Council.

A6 Fatigue Load Factor

The fatigue load factors for plastic pipes are as shown below in Table 0-3 and Table 0-4.

Table 0-3: Fatigue Load Factors for PE80B and PE100 (from POP010A Table 1)

Total Cycles	Cycles per day for 100 year life	PE80B	PE100
36,500	1	1.00	1.00
100,000	3	1.00	1.00

Total Cycles	Cycles per day for 100 year life	PE80B	PE100
300,000	8	1.00	1.00
500,000	14	0.95	0.95
1,000,000	27	0.88	0.88
5,000,000	137	0.74	0.74
10,000,000	274	0.68	0.68
50,000,000	1370	0.57	0.57
36,500	1	1.00	1.00
100,000	3	1.00	1.00
300,000	8	1.00	1.00
500,000	14	0.95	0.95

Table 0-4: Fatigue Load Factors for PVC (from POP101 Table 1)

Total Cycles	Cycles per day for 100 year life	PVC-U	PVC-M	PVC-O
26,400	1	1.00	1.00	1.00
100,000	3	1.00	0.67	0.75
200,000	5.5	0.81	0.54	0.66
500,000	14	0.62	0.41	0.56
1,000,000	27	0.50	0.33	0.49
2,500,000	82	0.38	0.25	0.41
5,000,000	137	0.38	0.25	0.41
10,000,000	274	0.38	0.25	0.41

A7 Equivalent Operating Pressure

Calculate this using the following equation;

Equation 0-1: Equivalent Operating Pressure

Where;

$$Peo = \frac{\Delta P}{FLF}$$

Peo = $\underline{\Delta P}$

Peo = Equivalent operating pressure (bar)

ΔP = Cyclic pressure range (bar).

FLF = Fatigue Load Factor

Appendix B ES-SEW1

Onsite Wastewater Disposal Investigation

This form is to be read in conjunction with AS/NZS 1547:2012 (or any amendments as applicable), and, in particular with Part 4: Means of Compliance

Part A – Contact Details

1 - Applicant

Name: ______________________________

____

Property Address: ______________________________

____

Lot/DP Number: ______________________________

2 - Consultant / Site Evaluator

Site Evaluator Name: ______________________________

____

Company Name: ______________________________

____

Postal Address: ______________________________

____

Business Phone: ______________ Mobile: ______________

Email: ______________________________

SQEP Registered[2]: ❑ Yes ❑ No If no, details of suitably registered SQEP who will countersign the report are to be supplied below.

Name of SQEP: ______________________________

____

Company Name: ______________________________

____

Postal Address: ______________________________

____

[2] It is a requirement that the Evaluator be SQEP registered to carry out on-site effluent investigations/designs. If not, then evaluation/design will need to be counter-signed by a suitably registered SQEP

Business Phone:______________________ Mobile:______________________

Email:____

Part B - Site and Soil Evaluation

1: Desk Study

Requirements (✓ appropriate box) Please complete **all** options. (*If more than one option applies to land under consideration, please clarify with supporting information)*

☐	FNDC REQUIREMENT	APPLIES TO LOT(S)	COMMENTS
1	**Hazard maps/GIS hazard layer - stability**		
☐	Low instability risk		
☐	Medium instability risk		
☐	High instability risk		
2	**GIS hazard layer – effluent on slope stability**		
☐	Low disposal potential		
☐	Moderate disposal potential		
☐	High disposal potential		
3	**GIS hazard layer – effluent suitability**		
☐	Medium unsuitability		
☐	High unsuitability		
4	**GIS hazard layer – flood susceptibility**		
☐	Is flood susceptible		
☐	Is partially flood susceptible		
☐	Is not flood susceptible		
5	**GIS land resources layer - streams**		
Are there streams on or adjacent to land under investigation?	☐ Yes		
	☐ No		
6	**GIS land resources layer – aquifers at risk**		
Is land situated over or adjacent to aquifer?	☐ Yes		
	☐ No		
7	**Annual Rainfall (HIRDS)**		

Note: It is to be noted that all information obtained off FNDC GIS/Hazard Maps is to be taken as a guide only.

Note: All information obtained from the above sites is to be confirmed by a specific site investigation as localised conditions could vary substantially. However, should the above data checks indicate the potential for a hazard/non-complying activity etc., this must be further investigated to confirm/deny the indicated situation.

2: On-Site Evaluation

a. Determination of Soil Category *(refer table 4.1.1 AS/NZS 1547:2012)* (✓ appropriate box)

Soil Category		Structure	Applies to lot(s)	Comments
1 Gravels & Sands	☐	Structureless (massive)		
2 Sandy loams	☐	Weakly Structured		
	☐	Massive		
3 Loams	☐	High/Moderate structured		
	☐	Weakly structured or Massive		
4 Clay loams	☐	High/moderate structured		
	☐	Weakly structured		
	☐	Massive		
5 Light clays	☐	Strongly structured		
	☐	Moderately structured		
	☐	Weakly structured or massive		
6 Medium to heavy clays	☐	Strongly structured		
	☐	Moderately structured		
	☐	Weakly structured or massive		

Note: Refer 4.1 A4 – Soil Assessment AS/NZS 1547:2012 for assessment criteria.

Note: Details of the method used to determine soil type etc. are to be clearly stated, along with positions of boreholes/test pits etc. clearly marked on a site plan. Bore logs are to be provided. Photos should be included.

Note: The site plan should also clearly show the intended area for effluent disposal, along with any site features such as drains, water bores, overland flows etc., along with separation distance achieved.

On-Site Evaluation Continued

b. Site Characteristics for Proposed Disposal Area: (if there is a marked difference between sites, please fill in a separate form for each site and clearly note which site the assessment applies to) (✓ appropriate box)

?	DETAILS	APPLIES TO SITE(S)
1	**Flooding potential to proposed field and reserve field (refer note 1 below)**	
☐	Fields will not flood, or	
	Fields will flood in	
☐	20% AEP event	
☐	5% AEP event	
☐	1% AEP event	
2	**Surface water separation to proposed field and reserve field (refer note 2 below)**	
☐	Main/reserve disposal field comply with NRC rules	
☐	Main/reserve disposal field do not comply with NRC rules	
3	**Surface water separation to proposed field and reserve field (refer note 2 below)**	
☐	Main/reserve disposal field comply with NRC rules	
☐	Main/reserve disposal field do not comply with NRC rules	
4	**Winter ground water separation to proposed field and reserve field (refer note 3 below)**	
☐	Main and reserve disposal field comply with NRC rules	
☐	Main and reserve disposal field do NOT comply with NRC rules	
5	**Slope of ground of proposed field and reserve field (refer note 4)**	
Description		

6	**Shape of ground of proposed field and reserve field (Refer note 5 below)**				
☐	Waxing divergent	☐	Linear divergent	☐	Waning divergent
☐	Waxing planar	☐	Liner planar	☐	Waning planar
☐	Waxing convergent	☐	Linear convergent	☐	Waning convergent
Comments					

⍰	**DETAILS**	**APPLIES TO SITE(S)**
7	**Intended water supply source**	
☐	Public supply	
☐	Rainwater	
☐	Bore	
8	**Proposed method of disposal and recommended Daily Loading rate (DLR) (refer note 6 below)**	
Description		
Peak loading factored in (refer not 6 below)	☐ Yes	☐ No
Comments		

9	**Site exposure (refer note 7 below)**	**Description**	**Applies to Site(s)**
Site(s) aspect			
Pre-dominant wind direction			
Presence of shelter belts			
Presence of topographical features or structures			

10	**Proximity of water bores (include adjacent to properties) (refer note 9 below)**
11	**Visible evidence of slips / instability (refer not 8 below)**
12	**Total suitable area available for type of effluent disposal proposed (including reserve area)**
13	**Setback areas proposed (if any) (refer note 10 below)**

Notes

1. *If the FNDC hazard maps/GIS indicate a flooding susceptibility on the site being evaluated, an on -site evaluation is to be carried out to determine the effects from 20%, 5% and 1% AEP storm events. This evaluation is to include all calculations to substantiate conclusions drawn. If necessary, include a detailed contour plan and photos.*
2. *NRC Water & Soil plan defines surface water as 'All water, flowing or not, above the ground. It includes water in continually or intermittently flowing rivers, artificial watercourses, lakes and wetlands, and water impounded by structures such as dams or weirs but does not include water while in pipes, tanks, cisterns, nor water within the Coastal Marine Area'. By this definition, separation (complying with NRC rules) is to be maintained by both the proposed disposal and reserve areas from any overland flowpaths and/or swale drains etc. or R/C will be required from NRC. Surface water is to be clearly marked on each site plan, showing the extent of a 1% AEP storm event, and detailing separation distances to main/reserve disposal areas.*
3. *Positions of test borehole/s to be shown and bore logs to be provided. Separation (complying with NRC rules) is to be maintained by both the proposed disposal and reserve areas from winter ground water level or R/C will be required from NRC. If the investigation is done outside of the winter period, allowance is to be made in determining the likely winter level.*
4. *Slopes of ground are to be compared with those recommended maximums for type of system proposed (refer Appendix 4.2B AS/NZS 1547:2012). Designs exceeding those maximums will require specific design to justify the proposal and may also need Resource Consent from NRC.*
5. *Shape of ground is important as it will determine whether there is potential for concentrated overland flows from the upper slopes and also if effluent might be concentrated at base of slope if leeching occurs. Refer Figure 4.1B2 AS/NZS 1547:2012.*
6. *The proposed system (for residential developments) should be sized to accommodate an average 3 bedroom house with 5 people. Sites in holiday areas need to take peak loading into effect in determining daily volumes. The design must state what DLR was used to determine area necessary (including reserve area). If ground conditions are marginal for type of disposal proposed, then a soil permeability test utilising the constant head method is to be carried out across the proposed disposal area. Refer Appendix 4.1F AS/NZS 1547:2012.*
7. *The site aspect is important as a north-facing site that is not sheltered from wind and sun by shelterbelts or other topographical features or structures will perform far better than a south-facing site on the lee of a hill that is shaded from wind and sun etc.*
8. *If any effluent disposal area (including any reserve area) proposed has or is adjacent to areas that show signs of instability, then a full report from a CPEng (Geotech) will be required to justify the viability of the area for effluent disposal.*
9. *If there are any water bores on the subject property or adjacent properties then a site plan will be required showing bore positions in relation to any proposed effluent field(s).*
10. *If setback areas are proposed to mitigate effects, the extent and position/s need to be shown on a site plan.*

Appendix C ES – PS1

Refer to ENZ Producer Statement – PS1 Design

Appendix D ES – PS4

Refer to ENZ Producer Statement – PS4 Construction Review

Appendix E ES-PO1

Statement of Professional Opinion on Suitability of Land for Building Construction

Development ______________________________

Developer ______________________________

Location ______________________________

I *(full name)* ______________________________

Of *(Name and address of firm)* ______________________________

1 I am a Geo-Professional as defined in Section 1.3 Abbreviations and Definitions and was retained by the Developer as the geo-professional on the above development

2 The extent of my preliminary investigations are described in my Report(s) number ______________ dated ______________ and the conclusions and recommendations of that/those document(s) have been re-evaluated in the preparation of this report. The extent of my inspections during construction, and the results of all tests and/or re-evaluations carried out are as described in my geotechnical completion report dated ______________.

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

a. The earth fills shown on the attached Plan No ______________have been placed in compliance with the requirements of the Far North District Council and my specification. (However, lots ____ did not pass final fill specification testing and as a result, specific site investigations and foundation designs will be required here at the time of building consent application)

b. The completed works take into account land slope and foundation stability considerations, subject to the appended foundation recommendations and earthworks restrictions, *(which should be read in conjunction with the appended final site contour plan)*

c. Subject to 3(a) and 3(b) above, the original ground not affected by filling satisfies the description of 'good ground' as described in NZS 3604:2011 and NZS 4229:2013 ☐ Yes ☐ No

(If no, a specific foundation investigation/design will be required at the time of Building Consent)

d. Subject to 3(a) and 3(b) above, the filled ground satisfies the description of 'good ground' as described in NZS 3604:2011 and NZS 4229:2013 ☐ Yes ☐ No

(If no, a specific foundation investigation/design will be required at the time of Building Consent)

e. The original ground not affected by filling and the filled ground are not subject to erosion, subsidence, or slippage in accordance with the provisions of section 106 of the Resource Management Act 1991 provided that:

i. ____

ii. ____

iii. ____

iv. ____

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

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

Signature	*Professional Qualifications*	*Date*

Appendix F Permeability Test Sheets

Falling-Head Permeability Test (Borehole)

Site Address ______________________________

Completed By ______________________________

Date of Test ________________ Signature ________________

Ensure the following procedures are followed (□ when complete)

- ❒ Bore hole of minimum 150mm diameter and minimum 1.5m depth (or to groundwater level)
- ❒ Bore is filled to minimum 75% of total depth
- ❒ Drop in water level is recorded at intervals of 15 minutes or less
- ❒ Test is continued for 4 hours or until hole is to 25% of depth
- ❒ Three tests completed in bore

1 – Details

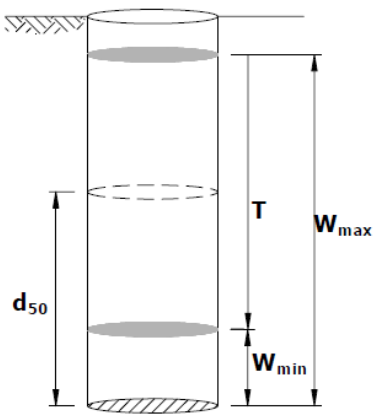
a. diameter of bore = D = ___________m b. total bore depth = _______________m

Test 1	
c. depth to water (m)	Time (min)

Test 2	
c. depth to water (m)	Time (min)

Test 3	
c. depth to water (m)	Time (min)

2 – Calculate Permeability Rate: Note Base area disregarded



a	Maximum water depth = W_{max} =		m
b	Minimum water depth = W_{min} =		m
c	d50 = (W_{max} – W_{min}) /2 + W_{min} =		m
d	As50 = (22 x D x d50) / 7 =		m^2
e	Vol = (22 x D^2) / 28 =		m^3
f	T (time between W_{max} and W_{min})(Test #3) =		min
g	Soil permeability = P = Vol / A_{s50} x T x 60) =		m/sec

	h	Safe soil permeability = P_{safe} = P / 2 =		m/sec

Falling-Head Permeability Test (Soak Pit)

Site Address ____________________

Completed By ____________________

Date of Test ____________________ Signature ____________________

Ensure the following procedures are followed (☐ when complete)

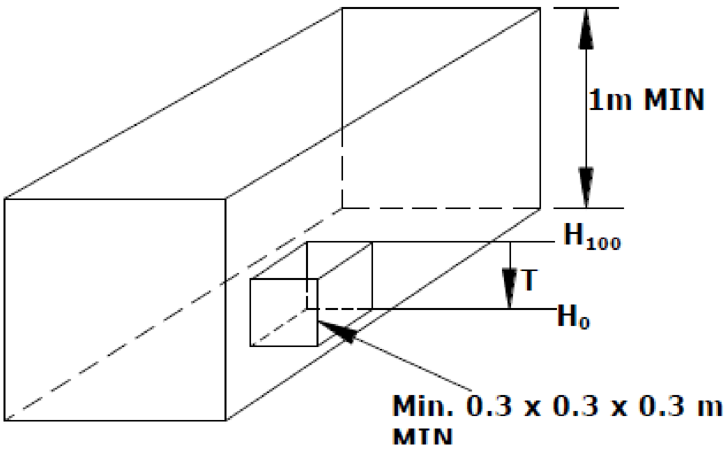
- ❒ Excavate 0.3 x 0.3 x 0.3m test pit at base of main excavation (minimum 1m deep)
- ❒ Refill test pit 3 times
- ❒ Use results from 3rd test

1 – Test Pit Details

a. depth of pit = H = __________m

b. Length of pit = L = __________m

c. width of pit = W = __________m



Test 1 – Time (min)

Test 2 – Time (min)

Test 3 – Time (min)

2 – Calculate Permeability Rate

a. Test pit volume = V = W x L x D = ______________ m^3

b. A = (H x L x 2) + (W x H x 2) = ______________ m^2 (base ignored)

c. Time for pit to drain full to empty H_{100} to H_0 = T = ______________ minutes (Test 3 result)

d. Permeability (test) P_t = V / (T x 60 x A) = ______________ m/sec

e. Permeability (final) P_f = P_t x 0.5 = ______________ m/sec

Use P_f for soak pit designs

Appendix G Drawing Standards

General

Drawings shall comply with the following standards, which are based on NZS 1100:1985/1986/2002. Where the drawings do not comply or are not clear in their presentation, the District Council may require revised plans to be presented.

Coloured lines may be used for services in drawings, but standard line type and thickness shall be used alongside the colour. If colour is used for services, it shall be as follows:

p. sewer (red),

q. water (blue), and

r. stormwater (green)

Standard symbols and line styles as detailed in **Sheet 1** shall be used to ensure uniformity.

Existing services shall be shown in faint lines and proposed services in heavy bold lines, in the specified line type for the particular service.

Existing infrastructure that is proposed to be modified or removed shall be clearly identified.

Drawings shall clearly identify infrastructure that is/will be public as distinct to infrastructure that is/will be in private ownership.

Existing and proposed property boundaries shall be shown and clearly marked on all plans.

Design plans shall be provided in hard copy format. For larger developments plans shall also be provided in DWG format (or other format agreed to by the District Council in writing) by way of a USB Drive or as agree with the District Council).

As-Built Plans shall be provided in .pdf and .dwg/dxf format.

Survey Co-ordinates and Levels

As built coordinates shall be in terms of NZTM coordinate projection NZGD2000.

As-built levels for assets to vest in the District Council shall be reduced levels on One Tree Point 1964 Datum (OTP Datum).

Note: Submission of local circuit or site-specific coordinates and levels for any assets to vest in the District Council will not be accepted, unless previously discussed with FNDC and approval obtained in writing

Drawing Layout

s. Plan views should generally be oriented with north to the top of the sheet; however, plan views may be oriented otherwise if this improves clarity by allowing use of a larger scale on the sheet.

t. All plans shall have a North point.

u. Plans shall have a scale bar to confirm printed scale.

v. Long sections shall commence with the lowest distance/lowest invert on the left hand side of the sheet.

w. Cross sections shall commence at the bottom left hand corner of the sheet and proceed upwards and to the right.

Title Blocks

Title block shall include:

x. A project title, including street address,

y. A unique number or identifier, preferably the consent or project number,

z. Designer’s name, signature and contact details,

aa. Draughtsperson’s name,

bb. Drawing checker’s name,

cc. Design reviewer’s name and signature,

dd. Stage of work e.g. for acceptance, accepted engineering drawings, construction, as-built,

ee. Date of preparation and of acceptance,

ff. Scale or scales used,

gg. Graphic scale bar(s),

hh. Datum and origin,

ii. Original sheet size,

jj. Drawing title e.g. Long section,

kk. Sheet numbers, including the number in the set, and

ll. An amendment box, including brief description of amendment and sign off by designer.

Scales

Table 0-5: Preferred Scales gives preferred scales for plans. Plans using other scales will generally not be accepted. Items listed within the table refer to the minimum scales that will be accepted on A3 sheets. If plans are produced on A1 sheets, a reduced plan on A3 must meet these minimum scales. All text and symbols must be clearly legible at A3 size.

Table 0-5: Preferred Scales (to ensure clarity)

Preferred drawing scales	Items listed show minimum preferred scale at A3 sheet size
1:50	
1:100	
1:200	Road cross-section horizontal

Preferred drawing scales	Items listed show minimum preferred scale at A3 sheet size
1:250	
1:500	Long section horizontal. Site plan view showing details of services etc.
1:750	
1:1000	
1:1250	
1:1500	

All scales are to be clearly depicted, along with the plan size they relate to.

Long section details shall have a scale ratio of 1 horizontal to 5 vertical.

Plans are to have both a horizontal and vertical graphical scale bar for confirmation of print size/scale.

Hard Copy Format

Drawings shall be prepared on standard ISO A3 plan sheets, with a clean background.

Plans must be suitable for photo reduction and scanning

Printing should be spaced sufficiently to retain clarity when reduced.

Capital letters shall be not less than 2.5mm in height.

Electronic Formats

The following electronic file formats are acceptable;

mm. AutoCAD .dwg/dxf files, provided these include all referenced files so that a full replication of the hardcopy drawings can be reproduced.

nn. .pdf copies of plans, endorsed/certified as As-Built Plans. These .pdf copies are to be high resolution, suitable for producing quality prints

Particular requirements for AutoCad plans include;

oo. Layouts shall be set up so they may be printed as they are required to be printed, i.e. with all necessary layers turned on and irrelevant information frozen. Layers that are required for the design but are not required to be printed shall have the ‘Do not Print’ symbol selected in the layer control area,

pp. All x-refs, pen assignments, images and special fonts used shall be included with the plan file,

qq. Layouts shall be named to represent the content of each sheet (normally the sheet title), rr. Different elements of the plan shall be drawn on its own appropriately named layer, e.g. sewer manholes on a 'SWMH' layer,

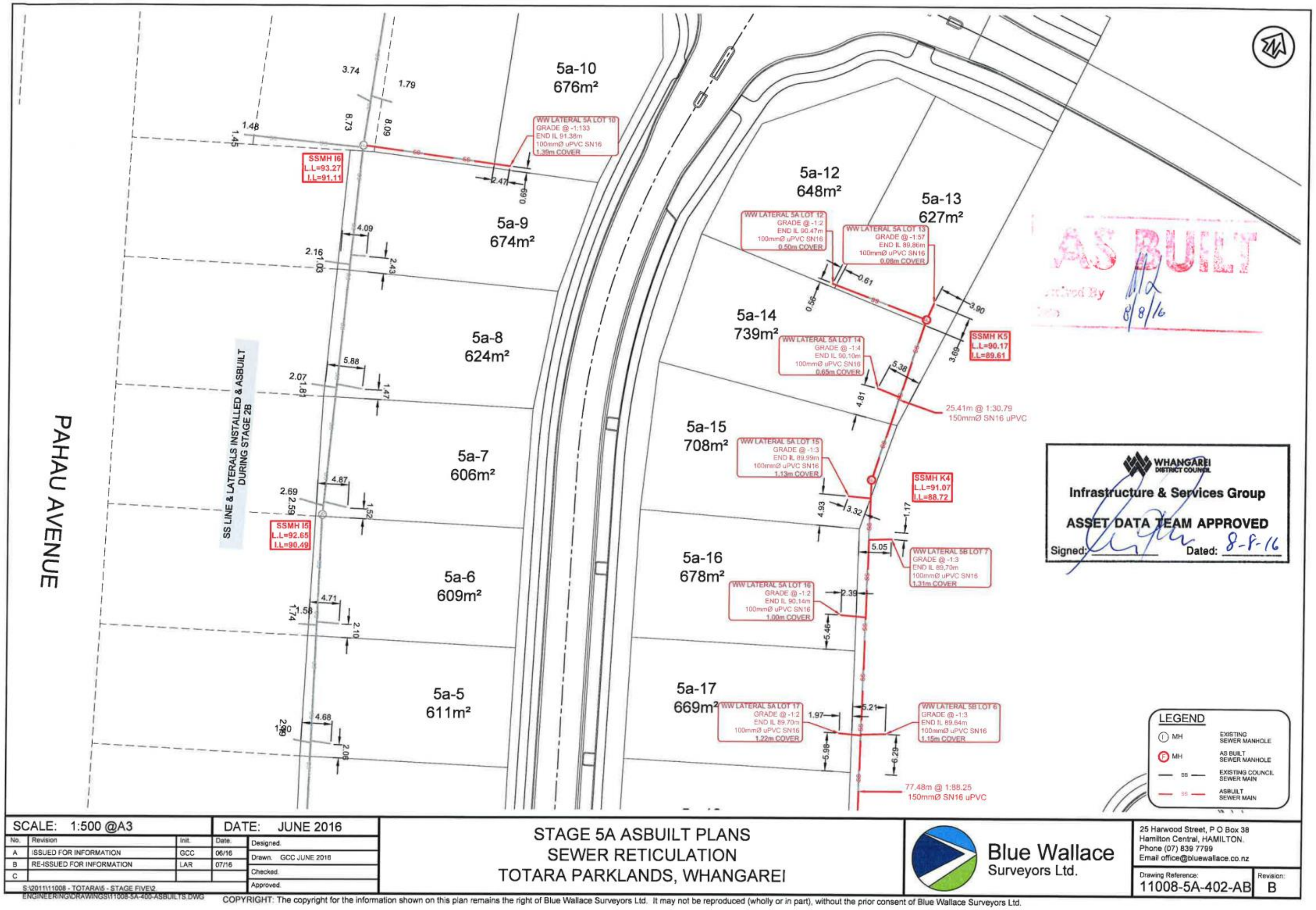
ss. As-built layouts shall have 'As-built' incorporated in the title, and

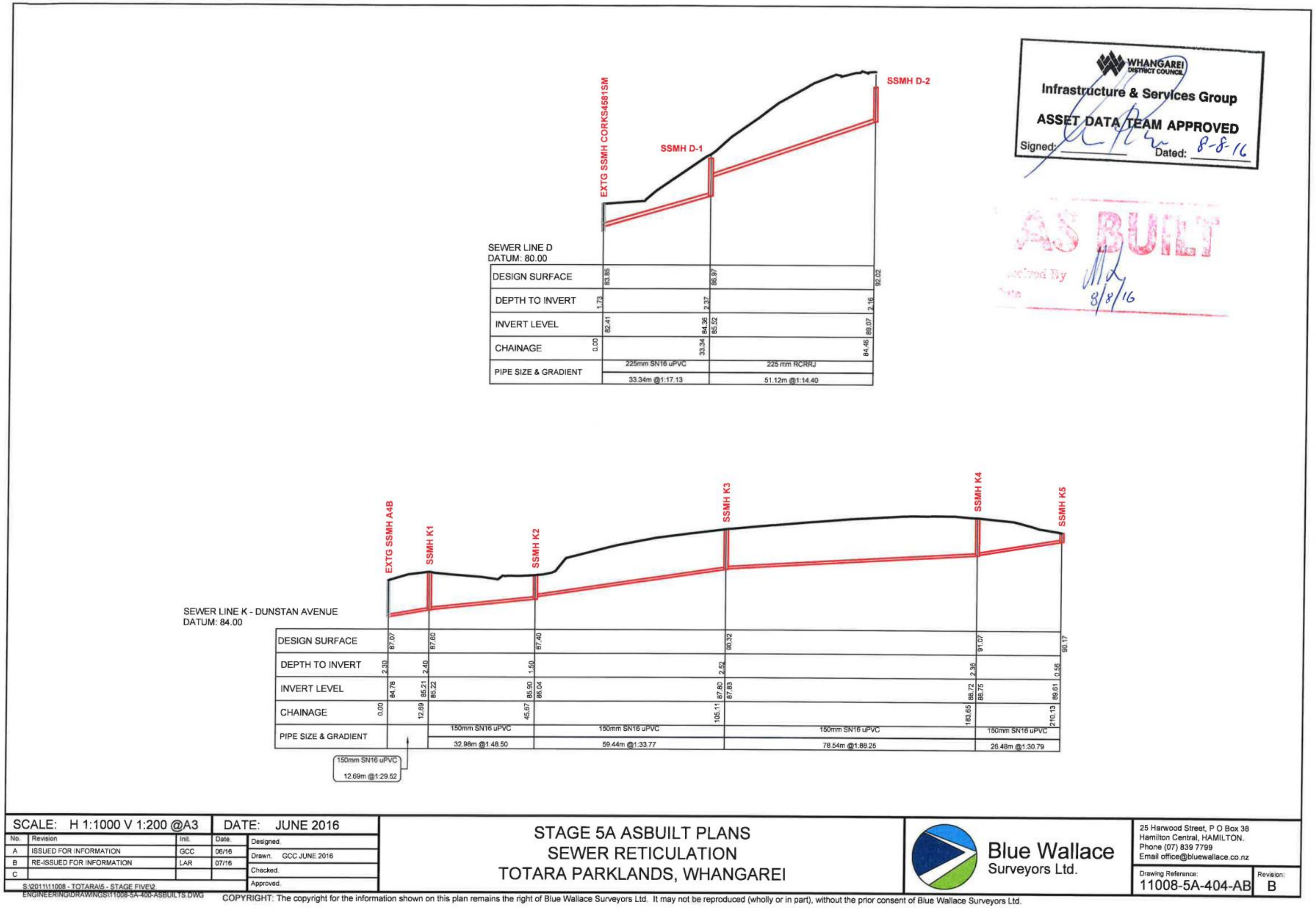
tt. Layouts should have line-type scale setting inset into them to ensure correct printing.

uu.

Appendix H Example As-Built Drawings

Wastewater As-Built Plan examples





EXTG SSMH CORKS4581SM
SSMH D-1
SSMH D-2
SEWER LINE D
DATUM: 80.00
DESIGN SURFACE 83.65 86.97 92.02
DEPTH TO INVERT 1.73 2.37 2.16
INVERT LEVEL 82.41 84.36 85.52 89.07
CHAINAGE 0.00 33.34 84.46
PIPE SIZE & GRADIENT
225mm SN16 uPVC
33.34m @1:17.13
225 mm RCRRJ
51.12m @1:14.40
WHANGAREI DISTRICT COUNCIL
Infrastructure & Services Group
ASSET DATA TEAM APPROVED
Signed:
Dated: 8-8-16
AS BUILT
Checked By
Date
8/8/16
EXTG SSMH A4B
SSMH K1
SSMH K2
SSMH K3
SSMH K4
SSMH K5
SEWER LINE K - DUNSTAN AVENUE
DATUM: 84.00
DESIGN SURFACE 87.07 87.60 87.40 90.32 91.07 90.17
DEPTH TO INVERT 2.30 2.40 1.50 2.52 2.36 0.56
INVERT LEVEL 84.78 85.21 85.22 85.90 86.04 87.80 87.83 88.72 88.75 89.61
CHAINAGE 0.00 12.69 45.67 105.11 183.65 210.13
PIPE SIZE & GRADIENT
150mm SN16 uPVC
32.98m @1:48.50
150mm SN16 uPVC
59.44m @1:33.77
150mm SN16 uPVC
78.54m @1:88.25
150mm SN16 uPVC
26.48m @1:30.79
150mm SN16 uPVC
12.69m @1:29.52
SCALE: H 1:1000 V 1:200 @A3
DATE: JUNE 2016
No. Revision Init. Date.
A ISSUED FOR INFORMATION GCC 06/16
B RE-ISSUED FOR INFORMATION LAR 07/16
C
Designed.
Drawn. GCC JUNE 2016
Checked.
Approved.
S:\2011\11008 - TOTARA\5 - STAGE FIVE\2 ENGINEERING\DRAWINGS\11008-5A-400-ASBUILTS.DWG
STAGE 5A ASBUILT PLANS
SEWER RETICULATION
TOTARA PARKLANDS, WHANGAREI
Blue Wallace
Surveyors Ltd.
25 Harwood Street, P O Box 38
Hamilton Central, HAMILTON.
Phone (07) 839 7799
Email office@bluewallace.co.nz
Drawing Reference:
11008-5A-404-AB
Revision:
B
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Infrastructure & Services Group
ASSET DATA TEAM APPROVED
Signed:
Dated: 8-8-16

AS BUILT

						Mt Eden Circuit 2000		NZTM Proj									
CODE	XREF	UNIT TYPE	DESCRIPTION	INSTALL DATE	EXP LIFE	X Co-Ord (Easting)	Y Co-Ord (Northing)	X Co-Ord (Easting)	Y Co-Ord (Northing)	Z Co-Ord (Elevation)	US Invert	DS Invert	Material	Size	Quantity	Public/ Private	Surface
Stage 5A Sewer Reticulation																	
SSMH	EXTG SSMH A4B	SSMH		Jun-16	50	359860.84	933517.62	1719525.33	6051234.91	87.06			CC	1050	1	PUBLIC	GRASS
SSMH	SSMH K1	SSMH		Jun-16	50	359849.88	933524.02	1719514.49	6051241.51	87.80			CC	1050	1	PUBLIC	GRASS
SSMH	SSMH K2	SSMH		Jun-16	50	359824.66	933502.77	1719488.90	6051220.72	87.46			CC	1050	1	PUBLIC	GRASS
SSMH	SSMH K3	SSMH		Jun-16	50	359787.74	933549.34	1719452.82	6051267.94	90.47			CC	1050	1	PUBLIC	GRASS
SSMH	SSMH K4	SSMH		Jun-16	50	359749.86	933618.15	1719416.19	6051337.40	91.38			CC	1050	1	PUBLIC	GRASS
SSMH	SSMH K5	SSMH		Jun-16	50	359744.20	933644.02	1719411.00	6051363.36	90.94			CC	1050	1	PUBLIC	GRASS
SSMH	SSMH D1	SSMH		Jun-16	50	359688.81	933761.81	1719357.73	6051482.12	86.73			CC	1200	1	PUBLIC	GRASS
SSMH	SSMH D2	SSMH		Jun-16	50	359663.35	933717.48	1719331.49	6051438.26	91.23			CC	1050	1	PUBLIC	GRASS
SMN		SEWER	SSMH K1 - EXTG SSMH A4B	Jun-16	50						85.21	84.78	uPVC	150		PUBLIC	GRASS
SMN		SEWER	SSMH K2 - SSMH K1	Jun-16	50						85.90	85.22	uPVC	150		PUBLIC	GRASS
SMN		SEWER	SSMH K3 - SSMH K2	Jun-16	50						87.80	86.04	uPVC	150		PUBLIC	GRASS
SMN		SEWER	SSMH K4 - SSMH K3	Jun-16	50						88.72	87.83	uPVC	150		PUBLIC	GRASS
SMN		SEWER	SSMH K5 - SSMH K5	Jun-16	50						89.61	88.75	uPVC	150		PUBLIC	GRASS
SMN		SEWER	SSMH D1 - CORKS4581SM	Jun-16	50						84.36	82.41	uPVC	225		PUBLIC	GRASS
SMN		SEWER	SSMH D2 - SSMH D1	Jun-16	50						89.07	85.52	RCRRJ	225		PUBLIC	GRASS
SND	5A-1-A	JUNCT-Y	LOT 5A-1 CONN. TO MAIN	Jun-16	50	359757.51	933458.17	1719420.97	6051177.34	84.76			uPVC	100/150	1	PUBLIC	GRASS
SND	5A-1-B	SEWER	LOT 5A-1 LINE	Jun-16	50						84.80	84.76	uPVC	100	3.39	PUBLIC	GRASS
SND	5A-1-C	END PT	LOT 5A-1 CONN. END	Jun-16	50	359759.27	933461.07	1719422.78	6051180.20	84.80			uPVC		1	PUBLIC	GRASS
SND	5B-2-A	JUNCT-Y	LOT 5B-2 CONN. TO MAIN	Jun-16	50	359844.06	933519.12	1719508.58	6051236.71	85.38			uPVC	100/150	1	PUBLIC	GRASS
SND	5B-2-B	SEWER	LOT 5B-2 LINE	Jun-16	50						87.07	85.38	uPVC	100	7.18	PRIVATE	GRASS
SND	5B-2-C	END PT	LOT 5B-2 CONN. END	Jun-16	50	359839.42	933524.32	1719504.03	6051241.99	87.07			uPVC		1	PRIVATE	GRASS
SND	5A-21-A	JUNCT-Y	LOT 5A-21 CONN. TO MAIN	Jun-16	50	359821.14	933507.22	1719485.45	6051225.23	86.20			uPVC	100/150	1	PUBLIC	GRASS
SND	5A-21-B	SEWER	LOT 5A-21 LINE	Jun-16	50						86.80	86.20	uPVC	100	19.88	PRIVATE	GRASS
SND	5A-21-C	END PT	LOT 5A-21 CONN. END	Jun-16	50	359805.44	933495.03	1719469.54	6051213.32	86.80			uPVC	100	1	PRIVATE	GRASS
SND	5B-1-A	JUNCT-Y	LOT 5B-1 CONN. TO MAIN	Jun-16	50	359820.44	933508.10	1719484.77	6051226.12	86.23			uPVC	100/150	1	PUBLIC	GRASS
SND	5B-1-B	SEWER	LOT 5B-1 LINE	Jun-16	50						86.85	86.23	uPVC	100	2.9	PRIVATE	GRASS
SND	5B-1-C	END PT	LOT 5B-1 CONN. END	Jun-16	50	359822.53	933510.01	1719486.90	6051227.99	86.85			uPVC	100	1	PRIVATE	GRASS
SND	5A-22-A	JUNCT-Y	LOT 5A-22 CONN. TO MAIN	Jun-16	50	359819.98	933508.67	1719484.33	6051226.70	86.25			uPVC	100/150	1	PUBLIC	GRASS
SND	5A-22-B	SEWER	LOT 5A - 22 LINE	Jun-16	50						86.84	86.25	uPVC	100	4.21	PRIVATE	GRASS
SND	5A-22-C	END PT	LOT 5A-22 CONN. END	Jun-16	50	359816.60	933506.24	1719480.90	6051224.33	86.84			uPVC	100	1	PRIVATE	GRASS
SND	5A-20-A	JUNCT-Y	LOT 5A-20 CONN. TO MAIN	Jun-16	50	359797.76	933536.70	1719462.62	6051255.12	87.33			uPVC	100/150	1	PUBLIC	GRASS
SND	5A-20-B	SEWER	LOT 5A-20 LINE	Jun-16	50						88.90	87.33	uPVC	100	4	PRIVATE	GRASS
SND	5A-20-C	END PT	LOT 5A-20 CONN. END	Jun-16	50	359794.76	933534.57	1719459.57	6051253.04	88.90			uPVC	100	1	PRIVATE	GRASS
SND	5B-3-A	JUNCT-Y	LOT 5B-3 CONN. TO MAIN	Jun-16	50	359797.57	933536.94	1719462.43	6051255.37	87.34			uPVC	100/150	1	PUBLIC	GRASS
SND	5B-3-B	SEWER	LOT 5B-3 LINE	Jun-16	50						88.68	87.34	uPVC	100	3.72	PRIVATE	GRASS
SND	5B-3-C	END PT	LOT 5B-3 CONN. END	Jun-16	50	359800.17	933539.26	1719465.07	6051257.63	88.68			uPVC	100	1	PRIVATE	GRASS
SND	5A-19-A	JUNCT-Y	LOT 5A-19 CONN. TO MAIN	Jun-16	50	359784.22	933555.73	1719449.42	6051274.39	87.90			uPVC	100/150	1	PUBLIC	GRASS
SND	5A-19-B	SEWER	LOT 5A- LINE	Jun-16	50						89.50	87.90	uPVC	100	3.62	PRIVATE	GRASS
SND	5A-19-C	END PT	LOT 5A-19 CONN. END	Jun-16	50	359781.28	933554.34	1719446.46	6051273.05	89.50			uPVC	100	1	PRIVATE	GRASS
SND	5B-4-A	JUNCT-Y	LOT 5B-4 CONN. TO MAIN	Jun-16	50	359784.16	933555.84	1719449.37	6051274.49	87.91			uPVC	100/150	1	PUBLIC	GRASS
SND	5B-4-B	SEWER	LOT 5B-4 LINE	Jun-16	50						89.23	87.91	uPVC	100	3.46	PRIVATE	GRASS
SND	5B-4-C	END PT	LOT 5B-4 CONN. END	Jun-16	50	359786.86	933557.55	1719452.09	6051276.16	89.23			uPVC	100	1	PRIVATE	GRASS
SND	5A-18-A	JUNCT-Y	LOT 5A-18 CONN. TO MAIN	Jun-16	50	359778.08	933566.89	1719443.48	6051285.66	88.05			uPVC	100/150	1	PUBLIC	GRASS
SND	5A-18-B	SEWER	LOT 5A-18 LINE	Jun-16	50						89.44	88.05	uPVC	100	3.24	PRIVATE	GRASS
SND	5A-18-C	END PT	LOT 5A-18 CONN. END	Jun-16	50	359775.42	933565.66	1719440.80	6051284.47	89.44			uPVC	100	1	PRIVATE	GRASS
SND	5B-5-A	JUNCT-Y	LOT 5B-5 CONN. TO MAIN	Jun-16	50	359778.07	933566.91	1719443.47	6051285.67	88.05			uPVC	100/150	1	PUBLIC	GRASS
SND	5B-5-B	SEWER	LOT 5B-5 LINE	Jun-16	50						88.99	88.05	uPVC	100	3.16	PRIVATE	GRASS
SND	5B-5-C	END PT	LOT 5B-5 CONN. END	Jun-16	50	359780.61	933568.53	1719446.04	6051287.25	88.99			uPVC	100	1	PRIVATE	GRASS
SND	5A-17-A	JUNCT-Y	LOT 5A-17 CONN. TO MAIN	Jun-16	50	359769.16	933583.10	1719434.85	6051302.02	88.26			uPVC	100/150	1	PUBLIC	GRASS
SND	5A-17-B	SEWER	LOT 5A-17 LINE	Jun-16	50						89.70	88.26	uPVC	100	3.68	PRIVATE	GRASS

SCALE:

DATE: JUNE 2016

No.	Revision	Init.	Date
A	ISSUED FOR INFORMATION	GCC	06/16
B	RE-ISSUED FOR INFORMATION	LAR	07/16
C			

Designed.
Drawn. GCC JUNE 2016
Checked.
Approved.

S:\2011\11008 - TOTARA\5 - STAGE FIVE\2 ENGINEERING\DRAWINGS\11008-5A-400-ASBUILTS.DWG

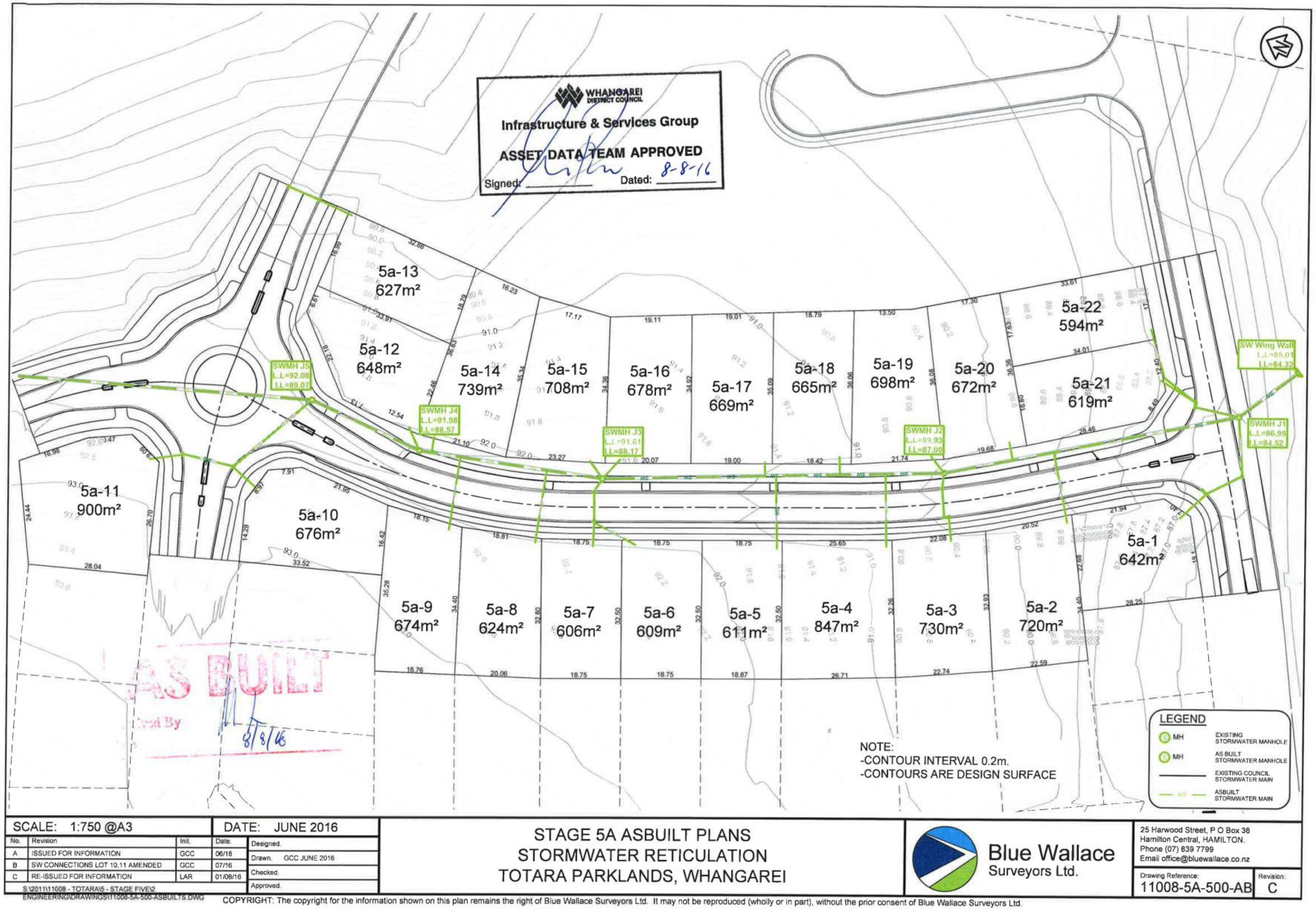
STAGE 5A ASBUILT PLANS
SEWER RETICULATION
TOTARA PARKLANDS, WHANGAREI

Blue Wallace Surveyors Ltd.

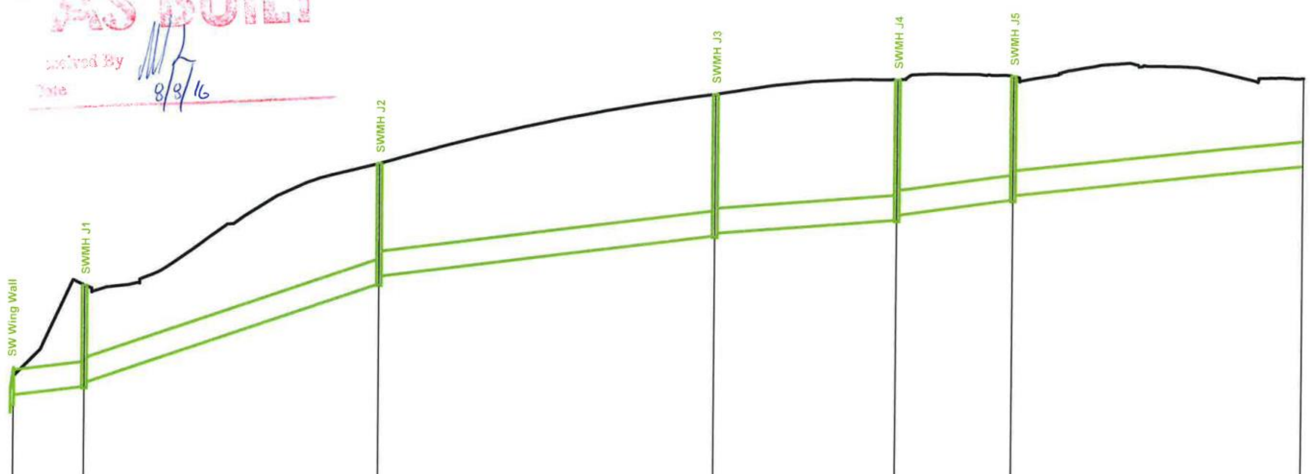
25 Harwood Street, P O Box 38
Hamilton Central, HAMILTON.
Phone (07) 839 7799
Email office@bluewallace.co.nz

Drawing Reference: 11008-5A-405-AB
Revision: B

Stormwater As-Built examples



AS BUILT
Received By
Date 8/8/16



WAIRAU-STORMWATER MAIN
DATUM: 82.00

	SW Wing Wall	SWMH J1	SWMH J2	SWMH J3	SWMH J4	SWMH J5	End
DESIGN SURFACE	84.81	86.99	89.93	91.61	91.98	92.08	92.06
DEPTH TO INVERT	0.69	2.48	2.94	3.45	3.42	3.02	2.15
INVERT LEVEL	84.36	84.56 84.65	87.04 87.22	88.21 88.27	88.61 88.72	89.11 89.21	89.95
CHAINAGE	0.00	16.88	87.08	166.99	210.29	238.10	307.23

PIPE SIZE & GRADIENT	Wing Wall – J1	J1 – J2	J2 – J3	J3 – J4	J4 – J5	J5 – End
Pipe size	600 mm RCRRJ	600 mm RCRRJ	600 mm RCRRJ	600 mm RCRRJ	600 mm RCRRJ	600 mm RCRRJ
Gradient	16.88m @-1:84.38	70.20m @-1:29.37	79.91m @-1:80.72	43.31m @-1:127.38	27.80m @-1:71.29	69.14m @-1:93.43

WHANGAREI DISTRICT COUNCIL
Infrastructure & Services Group
ASSET DATA TEAM APPROVED
Signed: Dated: 8-8-16

SCALE: H 1:1000 V 1:100 @A3

DATE: JUNE 2016

No.	Revision	Init.	Date.
A	ISSUED FOR INFORMATION	GCC	06/16
B	SW CONNECTIONS LOT 10,11 AMENDED	GCC	07/16
C	RE-ISSUED FOR INFORMATION	LAR	01/08/16

Designed.
Drawn. GCC JUNE 2016
Checked.
Approved.

S:\2011\11008 - TOTARA\5 - STAGE FIVE\2. ENGINEERING\DRAWINGS\11008-5A-500-ASBUILTS.DWG

STAGE 5A ASBUILT PLANS
STORMWATER RETICULATION
TOTARA PARKLANDS, WHANGAREI

Blue Wallace Surveyors Ltd.

25 Harwood Street, P O Box 38
Hamilton Central, HAMILTON.
Phone (07) 839 7799
Email office@bluewallace.co.nz

Drawing Reference: 11008-5A-504-AB
Revision: C

WHANGAREI DISTRICT COUNCIL
Infrastructure & Services Group
ASSET DATA TEAM APPROVED
Signed: Dated: 8-8-16

CODE	XREF	UNIT TYPE	DESCRIPTION	INSTALL DATE	EXP LIFE	Mt Eden Circuit 2000 X Co-Ord (Easting)	Mt Eden Circuit 2000 Y Co-Ord (Northing)	NZTM Proj X Co-Ord (Easting)	NZTM Proj Y Co-Ord (Northing)	Z Co-Ord (Elevation)	US Invert	DS Invert	Material	Size	Quantity	Public/ Private	Surface
Stage 5A Stormwater Reticulation																	
SWMN		STORM	SW WING WALL - SWMH J1	Jun-16	50						84.56	84.36	RCRRJ	600	15.67	Public	Grass
SWMN		STORM	SWMH J1 - SWMH J2	Jun-16	50						87.04	84.65	RCRRJ	600	69.13	Public	Road
SWMN		STORM	SWMH J2 - SWMH J3	Jun-16	50						88.21	87.22	RCRRJ	600	78.84	Public	Grass
SWMN		STORM	SWMH J3 - SWMH J4	Jun-16	50						88.61	88.27	RCRRJ	600	42.24	Public	Grass
SWMN		STORM	SWMH J4 - SWMH J5	Jun-16	50						89.11	88.72	RCRRJ	600	26.74	Public	Grass
SWMN		STORM	SWMH J5 - ENDPOINT	Jun-16	50	359676.06	933727.11	1719344.37	6051447.66	89.95	89.95	89.21	RCRRJ	600	68.07	Public	Road
SWMN		STORM	SWMH J1 - CP 1	Jun-16	50						85.10	84.96	RCRRJ	375	13.84	Public	Grass
SWMN		STORM	CP1 - CP2	Jun-16	50						85.33	85.16	RCRRJ	375	9.28	Public	Road
SWC	5A-1-A	JUNCT-Y	LOT 5A-1 CONNECTION TO CP2	Jun-16	50	359780.10	933467.82	1719443.72	6051186.58	85.66					1	Public	Road
SWC	5A-1-B	STORM	LOT 5A-1 CONNECTION LINE	Jun-16	50						86.12	85.66	uPVC	100	8.62	Private	Grass
SWC	5A-1-C	ENDPT	LOT 5A-1 CONNECTION END	Jun-16	50	359772.29	933470.60	1719435.97	6051189.50	86.12					1	Private	Grass
SWMN		STORM	CP2 - CP15	Jun-16	50						85.43	85.43	RCRRJ	375	1.2	Public	Road
SWCP	CP2	CP	CP2 - DOUBLE CATCH PIT WITH CP15	Jun-16	50	359780.30	933467.78	1719443.92	6051186.53	86.33			RC	675 x 450	1	Public	Road
SWCP	CP15	CP	CP15 - DOUBLE CATCH PIT WITH CP2	Jun-16	50	359780.57	933468.94	1719444.21	6051187.69	86.44			RC	675 x 450	1	Public	Road
SWCP	CP1	CP	CP1	Jun-16	50	359787.80	933462.30	1719451.32	6051180.93	86.28			RC	675 x 450	1	Public	Road
SWMN		STORM	SWMH-J1 - CP3	Jun-16	50	359799.62	933469.98	1719463.27	6051188.39		85.74	85.59	RCRRJ	375	9.87	Public	Road
SWMN		STORM	CP3 - CP14	Jun-16	50	359797.32	933479.74	1719461.15	6051198.18		86.12	86.12	RCRRJ	375	1.2	Public	Road
SWC		JUNCT-Y	LOT 5A-21 - CONNECTION TO CP14	Jun-16	50	359798.07	933480.20	1719461.91	6051198.63	86.16					1	Public	Road
SWC		STORM	LOT 5A-21 - CONNECTION LINE	Jun-16	50						86.99	86.16	uPVC	100	9.36	Private	Grass
SWC		ENDPT	LOT 5A-21- CONNECTION END	Jun-16	50	359798.84	933489.53	1719462.84	6051207.94	86.99					1	Private	Grass
SWC		JUNCT-Y	LOT 5A-22 - CONNECTION TO CP14	Jun-16	50	359798.13	933480.22	1719461.97	6051198.65	86.16					1	Public	Road
SWC		STORM	LOT 5A-22 - CONNECTION LINE	Jun-16	50						87.03	86.16	uPVC	100	20.83	Private	Grass
SWND		BEND	BEND IN LOT 5A-22 CONNECTION	Jul-16	50	359799.76	933489.11	1719463.76	6051207.51	86.54					1	Private	Grass
SWC		ENDPT	LOT 5A-22 - CONNECTION END	Jun-16	50	359808.39	933497.15	1719472.53	6051215.39	87.03					1	Private	Grass
SWCP	CP14	CP	CP14 - DOUBLE CATCH PIT WITH CP3	Jun-16	50	359798.12	933480.00	1719461.96	6051198.43	86.99			RC	675 x 450	1	Public	Road
SWCP	CP3	CP	CP3 - DOUBLE CATCH PIT WITH CP14	Jun-16	50	359797.01	933479.65	1719460.84	6051198.10	86.99			RC	675 x 450	1	Public	Road
SWC		JUNCT-Y	LOT 5A-2 - CONNECTION TO LINE	Jun-16	50	359772.33	933503.91	1719436.60	6051222.80	86.15					1	Public	Road
SWC		STORM	LOT 5A-2 - CONNECTION LINE	Jun-16	50						87.97	86.15	uPVC	100	16.78	Private	Grass
SWC		ENDPT	LOT 5A-2 - CONNECTION END	Jun-16	50	359759.19	933493.47	1719423.28	6051212.60	87.97					1	Private	Grass
SWC		JUNCT-Y	LOT 5A-20 - CONNECTION TO LINE	Jun-16	50	359766.20	933511.63	1719430.61	6051230.62	86.49					1	Public	Road
SWC		STORM	LOT 5A-20 - CONNECTION LINE	Jun-16	50						88.35	86.49	uPVC	100	4.18	Private	Grass
SWC		ENDPT	LOT 5A-20 - CONNECTION END	Jun-16	50	359769.47	933514.23	1719433.93	6051233.16	88.35					1	Private	Grass
SWC		JUNCT-Y	LOT 5A-19 - CONNECTION TO SWMH J2	Jun-16	50	359756.24	933524.90	1719420.90	6051244.07	89.14					1	Public	Road
SWC		STORM	LOT 5A-19 - CONNECTION LINE	Jun-16	50						89.56	89.14			4.46	Private	Grass
SWC		ENDPT	LOT 5A-19 - CONNECTION END	Jun-16	50	359758.06	933528.97	1719422.78	6051248.11	89.56					1	Private	Grass
SWC		JUNCT-Y	LOT 5A-3 - CONNECTION TO CP16	Jun-16	50	359747.27	933518.49	1719411.81	6051237.82	89.06					1	Public	Road
SWC		STORM	LOT 5A-3 - CONNECTION LINE	Jun-16	50						89.60	89.06	uPVC	100	5.37	Private	Grass
SWC		ENDPT	LOT 5A-3 - CONNECTION END	Jun-16	50	359742.78	933515.56	1719407.27	6051234.97	89.60					1	Private	Grass
SWCP	CP16	CP	CP16 - DOUBLE CATCH PIT WITH CP4	Jun-16	50	359747.52	933518.65	1719412.07	6051237.98	89.79			RC	675 x 450	1	Public	Road
SWMN		STORM	CP16 - CP4	Jun-16	50						88.95	88.95	RCRRJ	375	0.5	Public	Road
SWCP	CP4	CP	CP4 - DOUBLE CATCH PIT WITH CP16	Jun-16	50	359746.90	933519.58	1719411.47	6051238.91	89.82			RC	675 x 450	1	Public	Road
SWMN			CP4 - CP5	Jun-16	50						88.69	88.66	RCRRJ	375	6.39	Public	Road
SWCP	CP5	CP	CP5	Jun-16	50	359752.64	933523.11	1719417.26	6051242.35	89.82			RC	675 x 450	1	Public	Road
SWMN		STORM	CP5 - SWMH J2	Jun-16	50	359752.80	933523.22	1719417.43	6051242.45		88.59	88.50	RCRRJ	375	2.92	Public	Road
SWC		JUNCT-Y	LOT 5A-4 - CONNECTION TO LINE	Jun-16	50	359749.46	933536.47	1719414.32	6051255.76	87.39					1	Public	Road
SWC		STORM	LOT 5A-4 - CONNECTION LINE	Jun-16	50						89.39	87.37	uPVC	100	17.03	Private	Road
SWC		ENDPT	LOT 5A-4 - CONNECTION END	Jun-16	50	359734.51	933528.32	1719399.23	6051247.88	89.37					1	Private	Grass
SWC		JUNCT-Y	LOT 5A-18 - CONNECTION TO LINE	Jun-16	50	359744.33	933545.88	1719409.37	6051265.26	87.52					1	Public	Road
SWC		STORM	LOT 5A-18 - CONNECTION LINE	Jun-16	50						89.76	87.52	uPVC	100	4.19	Private	Grass
SWC		ENDPT	LOT 5A-18 - CONNECTION END	Jun-16	50	359748.01	933547.89	1719413.08	6051267.20	89.76					1	Private	Grass
SWC		JUNCT-Y	LOT 5A-5 - CONNECTION TO LINE	Jun-16	50	359737.21	933558.96	1719402.48	6051278.46	87.71					1	Public	Road
SWC		STORM	LOT 5A-5 - CONNECTION LINE	Jun-16	50						89.67	87.71	uPVC	100	17.06	Private	Road

SCALE:

DATE: JUNE 2016

No.	Revision	Init.	Date.
A	ISSUED FOR INFORMATION	GCC	06/16
B	SW CONNECTIONS LOT 10,11 AMENDED	GCC	07/16
C	RE-ISSUED FOR INFORMATION	LAR	01/08/16

Designed.
Drawn. GCC JUNE 2016
Checked.
Approved.

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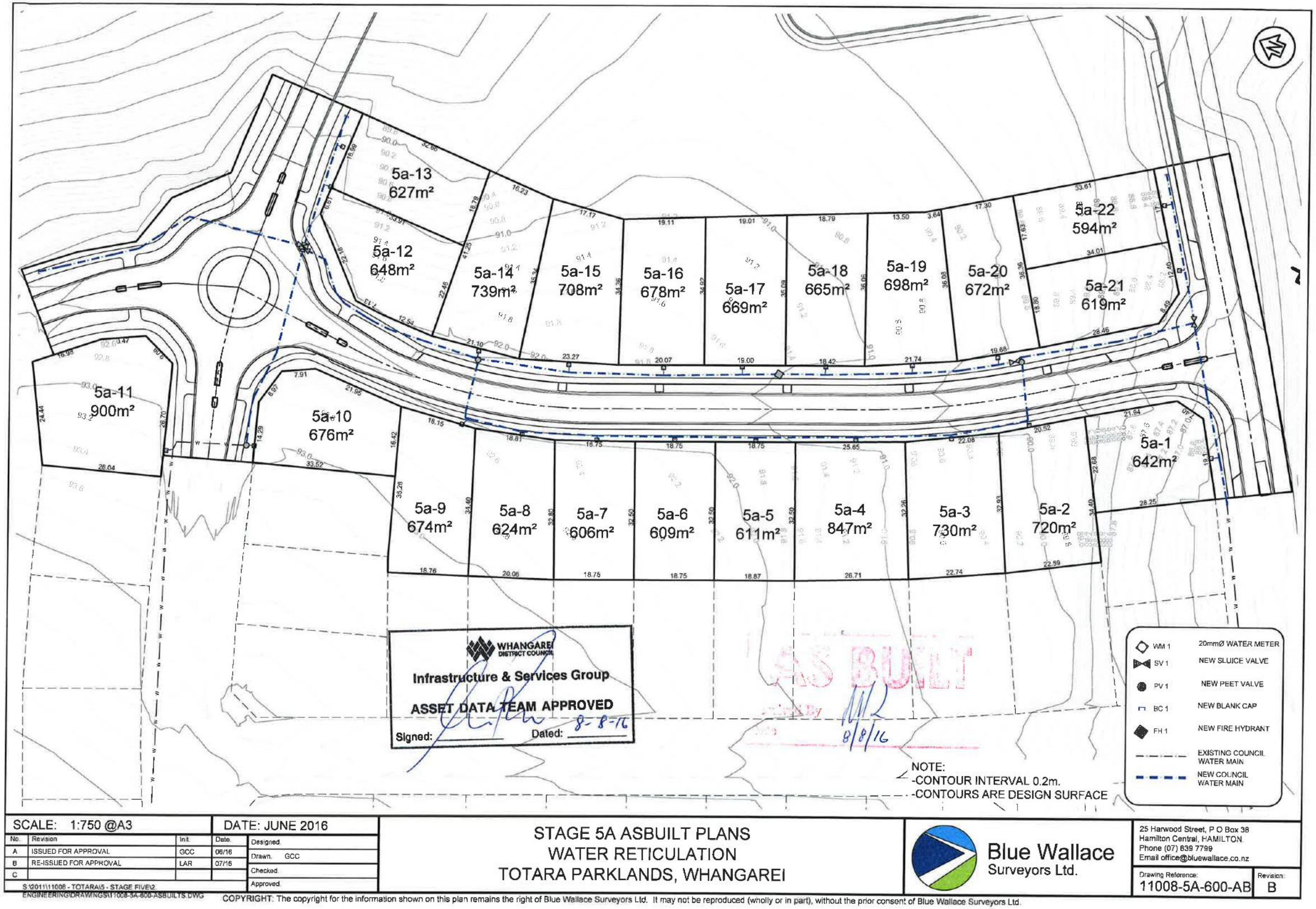
STAGE 5A ASBUILT PLANS
STORMWATER RETICULATION
TOTARA PARKLANDS, WHANGAREI

Blue Wallace Surveyors Ltd.

25 Harwood Street, P O Box 38
Hamilton Central, HAMILTON.
Phone (07) 839 7799
Email office@bluewallace.co.nz

Drawing Reference: 11008-5A-506-AB
Revision: C

Water Reticulation As-Built examples


5a-1 642m²
5a-2 720m²
5a-3 730m²
5a-4 847m²
5a-5 611m²
5a-6 609m²
5a-7 606m²
5a-8 624m²
5a-9 674m²
5a-10 676m²
5a-11 900m²
5a-12 648m²
5a-13 627m²
5a-14 739m²
5a-15 708m²
5a-16 678m²
5a-17 669m²
5a-18 665m²
5a-19 698m²
5a-20 672m²
5a-21 619m²
5a-22 594m²
WHANGAREI DISTRICT COUNCIL
Infrastructure & Services Group
ASSET DATA TEAM APPROVED
Signed:
Dated: 8-8-16
AS BUILT
8/8/16
WM 1 20mmØ WATER METER
SV 1 NEW SLUICE VALVE
PV 1 NEW PEET VALVE
BC 1 NEW BLANK CAP
FH 1 NEW FIRE HYDRANT
EXISTING COUNCIL WATER MAIN
NEW COUNCIL WATER MAIN
NOTE:
-CONTOUR INTERVAL 0.2m.
-CONTOURS ARE DESIGN SURFACE
SCALE: 1:750 @A3
DATE: JUNE 2016
No. Revision Init. Date
A ISSUED FOR APPROVAL GCC 06/16
B RE-ISSUED FOR APPROVAL LAR 07/16
C
Designed.
Drawn. GCC
Checked.
Approved.
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STAGE 5A ASBUILT PLANS
WATER RETICULATION
TOTARA PARKLANDS, WHANGAREI
Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38
Hamilton Central, HAMILTON.
Phone (07) 839 7799
Email office@bluewallace.co.nz
Drawing Reference: 11008-5A-600-AB
Revision: B
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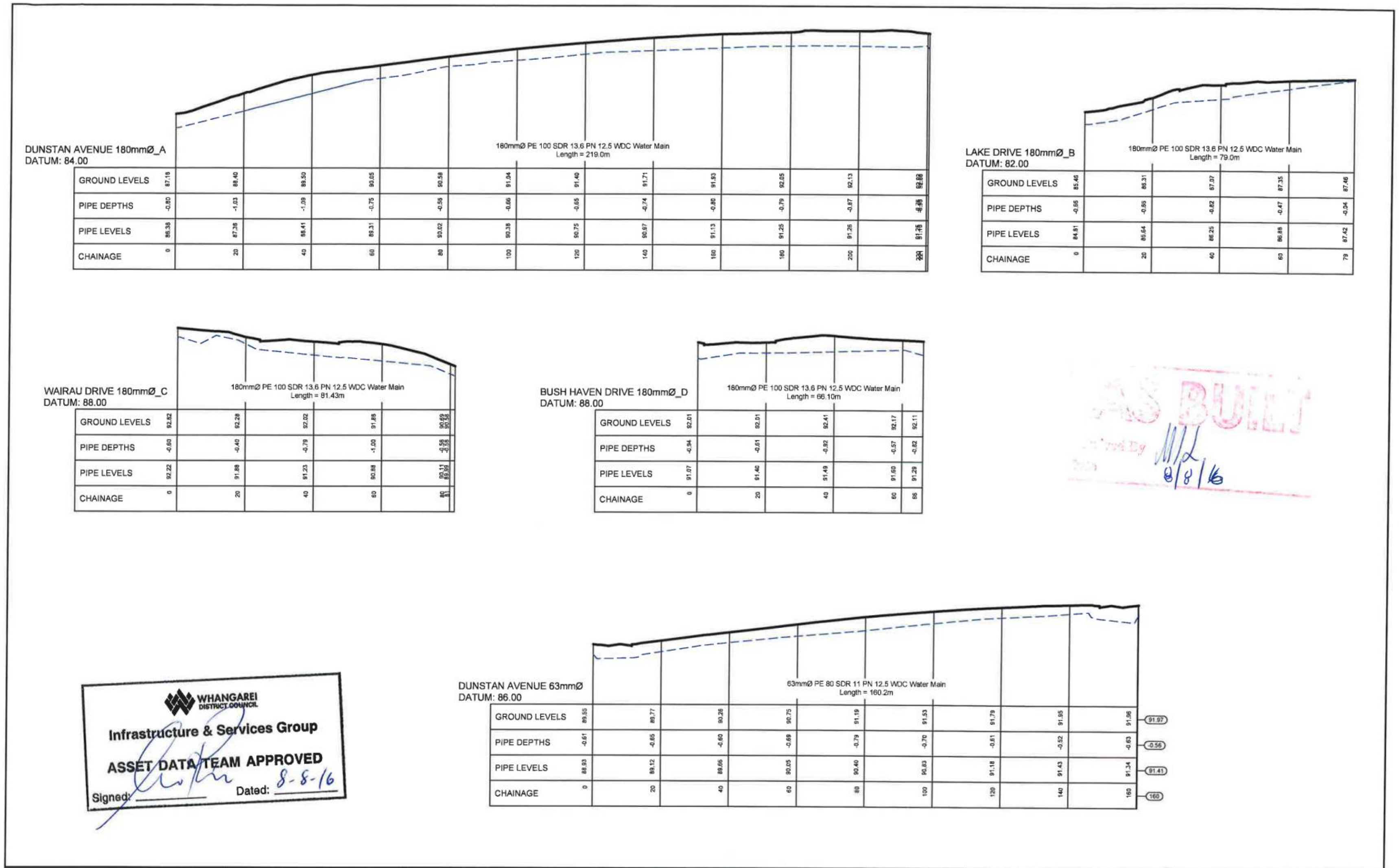

DUNSTAN AVENUE 180mmØ_A — DATUM: 84.00

GROUND LEVELS	87.18	88.40	89.50	90.05	90.58	91.04	91.40	91.71	91.93	92.05	92.13	[illegible]
PIPE DEPTHS	-0.80	-1.03	-1.09	-0.75	-0.56	-0.66	-0.65	-0.74	-0.80	-0.79	-0.87	[illegible]
PIPE LEVELS	86.38	87.38	88.41	89.31	90.02	90.38	90.75	90.97	91.13	91.25	91.26	[illegible]
CHAINAGE	0	20	40	60	80	100	120	140	160	180	200	220 219

LAKE DRIVE 180mmØ_B — DATUM: 82.00

GROUND LEVELS	85.46	86.31	87.07	87.35	87.46
PIPE DEPTHS	-0.66	-0.66	-0.82	-0.47	-0.04
PIPE LEVELS	84.81	85.64	86.25	86.88	87.42
CHAINAGE	0	20	40	60	79

WAIRAU DRIVE 180mmØ_C — DATUM: 88.00

GROUND LEVELS	92.82	92.28	92.02	91.88	90.69 90.58
PIPE DEPTHS	-0.60	-0.40	-0.79	-1.00	-0.58 -0.58
PIPE LEVELS	92.22	91.88	91.23	90.88	90.11 89.99
CHAINAGE	0	20	40	60	80 81

BUSH HAVEN DRIVE 180mmØ_D — DATUM: 88.00

GROUND LEVELS	92.01	92.01	92.41	92.17	92.11
PIPE DEPTHS	-0.94	-0.61	-0.92	-0.57	-0.82
PIPE LEVELS	91.07	91.40	91.49	91.60	91.29
CHAINAGE	0	20	40	60	66

DUNSTAN AVENUE 63mmØ — DATUM: 86.00

GROUND LEVELS	89.55	89.77	90.26	90.75	91.19	91.53	91.79	91.95	91.96	91.97
PIPE DEPTHS	-0.61	-0.65	-0.60	-0.69	-0.79	-0.70	-0.61	-0.52	-0.63	-0.56
PIPE LEVELS	88.93	89.12	89.66	90.05	90.40	90.83	91.18	91.43	91.34	91.41
CHAINAGE	0	20	40	60	80	100	120	140	160	160

SCALE: H_1:1000 V_1:200 @A3 — DATE: JUNE 2016

No.	Revision	Init.	Date.
A	ISSUED FOR APPROVAL	GCC	06/16
B	RE-ISSUED FOR APPROVAL	LAR	07/16
C			

Designed.
Drawn. GCC
Checked.
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STAGE 5A ASBUILT PLANS
WATER RETICULATION
TOTARA PARKLANDS, WHANGAREI

Blue Wallace Surveyors Ltd.

25 Harwood Street, P O Box 38
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Email office@bluewallace.co.nz

Drawing Reference: 11008-5A-604-AB — Revision: B

WHANGAREI DISTRICT COUNCIL
Infrastructure & Services Group
ASSET DATA TEAM APPROVED
Signed: Dated: 8-8-16

AS BUILT
8/8/16

CODE	XREF	UNIT TYPE	DESCRIPTION	INSTALL DATE	EXP LIFE	Mt Eden Circuit 2000 X Co-Ord (Easting)	Mt Eden Circuit 2000 Y Co-Ord (Northing)	NZTM Proj X Co-Ord (Easting)	NZTM Proj Y Co-Ord (Northing)	Z Co-Ord (Elevation)	Material	Size	Quantity	Public/ Private	Surface
Stage 5A Water Reticulation															
WW	W1	WATER	WELD 1	Jun-16	50	359759.49	933454.86	1719422.89	6051173.99	84.75	PE 100	180	1	PUBLIC	GRASS
WND		JUNCT - T	LOT 1 TAPPING BAND	Jun-16	15	359767.54	933461.07	1719431.04	6051180.06	85.07	PE 100	180	1	PUBLIC	GRASS
SCTP	SCTP1	DOMESTIC	LOT 1 SERVICE CONNECTION TERMINATION POINT	Jun-16	15	359766.53	933462.59	1719430.06	6051181.59	85.80		20	1	PUBLIC	GRASS
WW	W2	WATER	WELD 2	Jun-16	50	359792.45	933480.85	1719456.30	6051199.38	86.29	PE 100	180	1	PUBLIC	GRASS
SV	SV1	SLUICE	SLUICE VALVE 1	Jun-16	50	359793.02	933481.19	1719456.88	6051199.71	86.76	PE 100	180	1	PUBLIC	GRASS
WND	T1	JUNCT - T	TEE1 180/180	Jun-16	50	359792.79	933481.05	1719456.65	6051199.58	86.35	PE 100	180	1	PUBLIC	GRASS
WND		JUNCT - T	LOT 21 TAPPING BAND	Jun-16	15	359802.77	933488.89	1719466.76	6051207.24	86.77	PE 100	180	1	PUBLIC	GRASS
SCTP	SCTP21	DOMESTIC	LOT 21 SERVICE CONNECTION TERMINATION POINT	Jun-16	15	359802.05	933489.86	1719466.06	6051208.22	87.34		20	1	PUBLIC	GRASS
WND		JUNCT - T	LOT 22 TAPPING BAND	Jun-16	15	359815.13	933498.71	1719479.30	6051216.83	87.22	PE 100	180	1	PUBLIC	GRASS
SCTP	SCTP22	DOMESTIC	LOT 22 SERVICE CONNECTION TERMINATION POINT	Jun-16	15	359813.97	933500.11	1719478.16	6051218.25	87.54		20	1	PUBLIC	GRASS
WND	BC1	END - PT	BLANK CAP 180	Jun-16	50	359820.76	933503.19	1719485.00	6051221.21	87.20	PE 100	180	1	PUBLIC	GRASS
SV	SV2	SLUICE	SLUICE VALVE 2	Jun-16	50	359792.56	933481.30	1719456.42	6051199.83	86.64	PE 100	180	1	PUBLIC	GRASS
WND	T2	JUNCT - T	TEE2 180/63	Jun-16	50	359766.77	933513.16	1719431.21	6051232.14	88.78	PE 100	180	1	PUBLIC	GRASS
WW	W4	WATER	WELD4	Jun-16	50	359792.35	933481.56	1719456.21	6051200.09	86.38	PE 100	180	1	PUBLIC	GRASS
PV	PV1	PEET	PEET VALVE 1	Jun-16	50	359765.80	933512.46	1719430.23	6051231.46	88.93	PE 80	63	1	PUBLIC	GRASS
SV	SV3	SLUICE	SLUICE VALVE 3	Jun-16	50	359765.13	933513.96	1719429.58	6051232.97	89.11	PE 100	180	1	PUBLIC	GRASS
WW	W4	WATER	WELD 4	Jun-16	50	359764.95	933514.17	1719429.41	6051233.19	88.83	PE 100	180	1	PUBLIC	GRASS
WW	W5	WATER	WELD 5	Jun-16	50	359764.97	933511.85	1719429.39	6051230.87	88.69	PE 100	180	1	PUBLIC	GRASS
SCTP	SCTP2	DOMESTIC	LOT 2 SERVICE CONNECTION TERMINATION POINT	Jun-16	15	359753.52	933503.94	1719417.80	6051223.16	89.22		20	1	PUBLIC	GRASS
WND		JUNCT - T	LOT 2 TAPPING BAND	Jun-16	15	359753.95	933505.16	1719418.25	6051224.38	88.94	PE 100	180	1	PUBLIC	GRASS
WND		JUNCT - T	LOT 3 TAPPING BAND	Jun-16	15	359742.92	933519.07	1719407.47	6051238.48	89.49	PE 100	180	1	PUBLIC	GRASS
SCTP	SCTP3	DOMESTIC	LOT 3 SERVICE CONNECTION TERMINATION POINT	Jun-16	15	359742.19	933518.60	1719406.74	6051238.02	89.79		20	1	PUBLIC	GRASS
WND		JUNCT - T	LOT 4 TAPPING BAND	Jun-16	15	359732.06	933538.58	1719396.97	6051258.18	89.96	PE 100	180	1	PUBLIC	GRASS
SCTP	SCTP4	DOMESTIC	LOT 4 SERVICE CONNECTION TERMINATION POINT	Jun-16	15	359731.45	933538.28	1719396.35	6051257.89	90.23		20	1	PUBLIC	GRASS
WND		JUNCT - T	LOT 5 TAPPING BAND	Jun-16	15	359721.09	933559.23	1719386.37	6051279.02	90.35	PE 100	180	1	PUBLIC	GRASS
SCTP	SCTP5	DOMESTIC	LOT 5 SERVICE CONNECTION TERMINATION POINT	Jun-16	15	359720.47	933558.94	1719385.75	6051278.74	90.75		20	1	PUBLIC	GRASS
WND		JUNCT - T	LOT 6 TAPPING BAND	Jun-16	15	359712.53	933576.15	1719378.12	6051296.09	90.77	PE 100	180	1	PUBLIC	GRASS
SCTP	SCTP6	DOMESTIC	LOT 6 SERVICE CONNECTION TERMINATION POINT	Jun-16	15	359711.85	933575.83	1719377.43	6051295.78	91.05		20	1	PUBLIC	GRASS
WND		JUNCT - T	LOT 7 TAPPING BAND	Jun-16	15	359704.27	933592.36	1719370.15	6051312.44	91.13	PE 100	180	1	PUBLIC	GRASS
SCTP	SCTP7	DOMESTIC	LOT 7 SERVICE CONNECTION TERMINATION POINT	Jun-16	15	359703.41	933591.93	1719369.28	6051312.03	91.40		20	1	PUBLIC	GRASS
WND		JUNCT - T	LOT 8 TAPPING BAND	Jun-16	15	359696.99	933608.34	1719363.16	6051328.55	91.31	PE 100	180	1	PUBLIC	GRASS
SCTP	SCTP8	DOMESTIC	LOT 8 SERVICE CONNECTION TERMINATION POINT	Jun-16	15	359696.46	933608.03	1719362.62	6051328.25	91.55		20	1	PUBLIC	GRASS
WND		JUNCT - T	LOT 9 TAPPING BAND	Jun-16	15	359693.95	933620.90	1719360.35	6051341.16	91.51	PE 100	180	1	PUBLIC	GRASS
SCTP	SCTP9	DOMESTIC	LOT 9 SERVICE CONNECTION TERMINATION POINT	Jun-16	15	359692.06	933621.64	1719358.47	6051341.93	91.74		20	1	PUBLIC	GRASS
WND		JUNCT - T	LOT 20 TAPPING BAND	Jun-16	15	359762.72	933517.03	1719427.23	6051236.09	89.10	PE 100	180	1	PUBLIC	GRASS
SCTP	SCTP20	DOMESTIC	LOT 20 SERVICE CONNECTION TERMINATION POINT	Jun-16	15	359764.06	933517.89	1719428.59	6051236.92	89.55		20	1	PUBLIC	GRASS
WW	W6	WATER	WELD 6	Jun-16	50	359757.75	933523.77	1719422.38	6051242.91	89.20	PE 100	180	1	PUBLIC	GRASS
WW	W7	WATER	WELD 7	Jun-16	50	359751.57	933533.85	1719416.39	6051253.10	89.50	PE 100	180	1	PUBLIC	GRASS
WND		JUNCT - T	LOT 19 TAPPING BAND	Jun-16	15	359751.42	933534.02	1719416.24	6051253.27	89.65	PE 100	180	1	PUBLIC	GRASS
SCTP	SCTP19	DOMESTIC	LOT 19 SERVICE CONNECTION TERMINATION POINT	Jun-16	15	359753.06	933534.80	1719417.89	6051254.02	90.26		20	1	PUBLIC	GRASS
WW	W8	WATER	WELD 8	Jun-16	50	359745.78	933544.32	1719410.79	6051263.67	90.00	PE 100	180	1	PUBLIC	GRASS
WND		JUNCT - T	LOT 18 TAPPING BAND	Jun-16	15	359741.65	933551.86	1719406.79	6051271.28	90.26	PE 100	180	1	PUBLIC	GRASS
SCTP	SCTP18	DOMESTIC	LOT 18 SERVICE CONNECTION TERMINATION POINT	Jun-16	15	359743.39	933552.55	1719408.54	6051271.94	90.84		20	1	PUBLIC	GRASS
WW	W9	WATER	WELD 9	Jun-16	50	359740.08	933555.06	1719405.28	6051274.51	90.25	PE 100	180	1	PUBLIC	GRASS
FH	FH1	TALL	FIRE HYDRANT 1	Jun-16	50	359736.73	933561.40	1719402.05	6051280.91	90.92	PE 100	180	1	PUBLIC	GRASS
WND		JUNCT - T	LOT 17 TAPPING BAND	Jun-16	15	359732.67	933569.08	1719398.12	6051288.66	90.62	PE 100	180	1	PUBLIC	GRASS
SCTP	SCTP17	DOMESTIC	LOT 17 SERVICE CONNECTION TERMINATION POINT	Jun-16	15	359734.27	933569.83	1719399.74	6051289.38	90.99		20	1	PUBLIC	GRASS
WND		JUNCT - T	LOT 16 TAPPING BAND	Jun-16	15	359723.99	933585.32	1719389.74	6051305.05	90.87	PE 100	180	1	PUBLIC	GRASS
SCTP	SCTP16	DOMESTIC	LOT 16 SERVICE CONNECTION TERMINATION POINT	Jun-16	15	359725.60	933586.06	1719391.36	6051305.76	91.39		20	1	PUBLIC	GRASS

SCALE: | DATE: JUNE 2016

No.	Revision	Init.	Date.
A	ISSUED FOR APPROVAL	GCC	06/16
B	RE-ISSUED FOR APPROVAL	LAR	07/16
C			

Designed.
Drawn. GCC
Checked.
Approved.

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STAGE 5A ASBUILT PLANS
WATER RETICULATION
TOTARA PARKLANDS, WHANGAREI

Blue Wallace Surveyors Ltd.

25 Harwood Street, P O Box 38
Hamilton Central, HAMILTON.
Phone (07) 839 7799
Email office@bluewallace.co.nz

Drawing Reference: 11008-5A-605-AB Revision: B

Appendix I Asset Attributes

Roading RAMM

Refer to the FNDC Roading Asset Manager for the Road Assessment and Maintenance (RAMM) Data Collection Sheet.

Stormwater

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
Stormwater Inlet	Plan ID	Yes	Plan number used to identify as-built plan
	Downstream MH ID	Yes	
	Property ID	Yes	Either property number or legal description adjacent to manhole
	Street Name	Yes	If street name is not applicable use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Location		Private property, roadway, berm, reserve
	Reduced Level	Yes	
	Structure Type	Yes	Plain end pipe, headwall, in-ground chamber, etc. Show structure location on plan
	Structure Material		PVC, concrete, timber, etc.
	Eastern Coordinate		
	Northern Coordinate		
	Install Date		Installation date
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Stormwater Pipeline (including culverts)	Plan ID	Yes	Plan number used to identify as-built plan
	Upstream MH ID	Yes	Use pipe-end ID if pipeline is simply blanked-off
	Downstream MH ID	Yes	Or ID of stormwater outlet structure
	Street Name	Yes	If street name is not applicable use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Physical Location		Private property, roadway, berm, reserve, adjoining street
	Pipe Diameter	Yes	Nominal bore
	Pipe Length		Length upstream MH to downstream MH
	Pipe Material	Yes	Material and strength classification
	Joint Type		RRJ
	Invert Level Upstream	Yes	Pipe invert level

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
	Invert Level Downstream	Yes	Pipe invert level
	Secondary Flow Path	Yes	Show on As-Built Plans (easement required on private land). Not required on data sheet.
	Service Status	Yes	Abandoned or removed pipelines are required to be identified on as-built records. Show “A” for abandoned pipes, “R” for removed pipes, otherwise leave blank
	Install Date		Installation date
	Comments		Any pertinent comments (particularly water table depth and soil conditions) Identify culverts
Stormwater Connection	Plan ID	Yes	Plan number used to identify as-built plan
	Upstream MH ID	Yes	Use ‘Pipe-End ID’ if pipeline is simply blanked-off
	Downstream MH ID	Yes	Or ID of downstream asset
	Property ID	Yes	Either property number or legal description
	Street Name	Yes	If street name is not applicable use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Service Type		Pipe drain, K & C connection
	Service Pipe Diameter	Yes	Nominal bore in millimetres
	Service Pipe Length	Yes	
	Service Pipe Material	Yes	Material and strength classification
	Invert Level at Private End	Yes	Pipe invert level
	Depth at Private End		Depth from ground level to invert level
	Eastern Coordinate Connection		Coordinate of customer end of service connection
	Northern Coordinate Connection		Coordinate of customer end of service connection
	Distance from left (LB) or right (RB) boundary	Yes	Distance to customer connection point relative to left-hand or right-hand boundary facing the property from the street
	Distance from front (FB) or back (BB) boundary	Yes	

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
	Install Date		Installation date
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Stormwater Manhole	Plan ID	Yes	Plan number used to identify as-built plan
	MH ID	Yes	
	Property ID	Yes	Either property number or legal description adjacent to manhole
	Street Name	Yes	If street name is not applicable use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Lid Level	Yes	Top edge and northern part of rim casting
	Invert Level	Yes	
	MH Diameter		Nominal Bore of MH risers
	Eastern Coordinate		Location as per lid level
	Northern Coordinate		Location as per lid level
	Service Status	Yes	Abandoned or removed pipelines are required to be identified on as-built records. Show “A” for abandoned pipes, “R” for removed pipes, otherwise leave blank
	Install Date		Installation date
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Stormwater Soakage Trench	Plan ID	Yes	Plan number used to identify as-built plan
	Street Name	Yes	If street name is not applicable use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Location		Roadway, private, recreation reserve, etc.
	Trench Soakage Media	Yes	
	Length	Yes	
	Width	Yes	
	Depth	Yes	
	Ground Level		

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
	Invert Level		
	Eastern Coordinate – End 1		
	Northern Coordinate - End 1		
	Eastern Coordinate – End 2		Only one set of coordinates is required if the
	Northern Coordinate - End 2		Only one set of coordinates is required if the
	Structure Type	Yes	Proprietary name, lined hole, perforated pipe, etc.
	Install Date		Installation date
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Stormwater Outlet	Plan ID	Yes	Plan number used to identify as-built plan
	Upstream MH ID	Yes	
	Property ID	Yes	Either property number or legal description adjacent to manhole
	Street Name	Yes	If street name is not applicable use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Location	Yes	Private property, roadway, berm, reserve
	Structure Type	Yes	Plain end pipe, headwall, etc. Show structure location on plan
	Structure material		PVC, concrete, timber, etc.
	Discharges To		Name of receiving water body, e.g. Waikato River
	Ground Level		
	Eastern Coordinate		Location at point of stormwater discharge
	Northern Coordinate		Location at point of stormwater discharge
	Install Date		Installation date
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Stormwater Catchpit	Plan ID	Yes	Plan number used to identify as-built plan
	Catchpit ID	Yes	Provide a catchpit ID to ensure correct association of tabulated information and plan

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
	Property ID	Yes	Either property number or legal description adjacent to manhole
	Street Name	Yes	If street name is not applicable use a property deposited plan (DP) number
	Street Type		Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Catchpit Type	Yes	Footpath berm, single or double sump, vertical entry
	Catchpit Grate Level		
	Eastern Coordinate		Centre of catchpit grate
	Northern Coordinate		Centre of catchpit grate
	Install Date		Installation date
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Stormwater catchpit/ connection / lead	Plan ID	Yes	Plan number used to identify as-built plan
	Catchpit ID	Yes	Identifier to associate pipeline with correct catchpit
	Downstream MH ID	Yes	Or ID of downstream asset
	Property ID	Yes	Either property number or legal description adjacent to manhole
	Street Name	Yes	If street name is not applicable use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Connection Pipe		Nominal Bore of connection pipeline
	Diameter		
	Connection Pipe Length	Yes	
	Connection Pipe Material		Material of connection pipeline
	Invert level Downstream End of Connection		RL of pipeline invert when catchpit connected to a manhole
	Install Date		Installation date
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
	Plan ID	Yes	Plan number used to identify as-built plan

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
Stormwater Open Channel	Upstream Outlet ID	Yes	Define lengths of open channel as draining between structures or junctions with other water courses / drains
	Downstream Inlet ID	Yes	Define lengths of open channel as draining between structures or junctions with other water courses / drains
	Street Name	Yes	If street name is not applicable use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Location	Yes	Private property, roadway, berm, reserve, adjoining street
	Channel Lining Material	Yes	
	Channel Length	Yes	Length upstream outlet to downstream inlet
	Channel Width	Yes	
	Average Depth		Formation depth, ground level to invert level
	Invert Level Upstream	Yes	
	Invert Level Downstream	Yes	
	Eastern Coordinate – Upstream Inlet.		
	Northern Coordinate – Upstream Inlet		
	Eastern Coordinate – Downstream Outlet		
	Northern Coordinate – Downstream Outlet		
	Install Date		Installation date
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Stormwater subsoil Drain	Plan ID	Yes	Plan number used to identify as-built plan
	Downstream MH ID	Yes	Or ID of discharge point for drain
	Street Name	Yes	If street name is not applicable use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
	Location	Yes	Private property, roadway, berm, reserve, adjoining street
	Ownership	Yes	Public or private responsibility for the subsoil drain
	Pipe Diameter	Yes	Nominal bore in millimetres
	Pipe Length	Yes	Length upstream MH to downstream MH
	Pipe Material	Yes	PE, Earthenware, etc.
	Invert Level Upstream	Yes	
	Invert Level Downstream	Yes	
	Eastern Coordinate – Upstream End		
	Northern Coordinate – Upstream End		
	Eastern Coordinate – Downstream Outlet		
	Northern Coordinate – Downstream Outlet		
	Install Date		Installation date
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Stormwater and detention treatment device	Plan ID	Yes	Plan number used to identify as-built plan
	Street Name	Yes	If street name is not applicable use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Location		Private property, roadway, berm, reserve
	Site Plan	Yes	Site plan showing detention area location and contours relative to adjoining properties and receiving watercourse. To show control structure(s) in both plan and elevation and access provision
	Type		e.g. Detention area, wet detention pond, wetland, chamber, etc.
	Surface Area	Yes	Surface area at top water level. On the plan, show extent of pond at top water level
	Total Capacity		Total volume of detention area below top water level

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
	Live Storage Capacity		Volume of detention area between normal water level and top water level
	Top water level	Yes	Level at which spillway becomes operative
	Outlet invert	Yes	Invert level of discharge control pipeline (lower operating level)
	Install Date		Installation date
	Comments		Any pertinent comments
Secondary Flow Path	Plan ID	Yes	Plan number used to identify as-built plan
	Street Name	Yes	If street name is not applicable use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane etc.
	Location		Private property, roadway, berm, reserve
	Site Plan	Yes	Site plan showing secondary flow path location and contours relative to adjoining properties and receiving watercourse
	Type		e.g. grassed swale, concrete footpath
	Surface Width	Yes	Surface width at top water level. On the plan, show extent of secondary flow path at top eater level
	Overflow Level	Yes	RL of point at which overflow into the secondary flow path begins
	Comments		Any pertinent comments such as covered by easement over xxx property title

Wastewater

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
Wastewater Pipeline	Plan ID	Yes	Plan number used to identify as-built plan
	Upstream MH ID	Yes	Use ‘pipe-end ID’ if pipeline is simply blanked-off
	Downstream MH ID	Yes	
	Street Name	Yes	If street name is not applicable use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Physical Location		Private property, roadway, berm, reserve, adjoining street
	Pipe Diameter	Yes	Nominal bore
	Pipe Length	Yes	Length from upstream MH to downstream MH
	Pipe Material	Yes	Material and strength classification e.g. uPVC SN16
	Joint Type		e.g. RRJ
	Invert Level Upstream	Yes	Pipe invert level
	Invert Level Downstream	Yes	Pipe invert level
	Service Status	Yes	Abandoned or removed pipelines are required to be identified on as-built records. Show “A” for abandoned pipes, “R” for removed pipes, otherwise leave blank
	Install Date		Installation date
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Wastewater service connection	Plan ID	Yes	Plan number used to identify as-built plan
	Upstream MH ID	Yes	Use pipe-end ID if pipeline is simply blanked-off
	Downstream MH ID	Yes	
	Property ID		Either property number or legal description
	Street Name	Yes	If street name is not applicable use a property deposited plan (DP) number
	Street Type		Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Service Pipe Diameter		Nominal bore
	Service Pipe Length	Yes	

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
	Service Pipe Material		Material and strength classification
	Invert Level at Private End	Yes	Pipe invert level
	Depth at Private End		Depth from ground level to Invert Level
	Eastern Coordinate End 1		Coordinate of upstream end of service connection
	Northern Coordinate End 1		Coordinate of upstream end of service connection
	Distance from left (LB) or right (RB) boundary	Yes	Left-hand or right-hand boundary facing the property from the street
	Distance from front (FB) or back (BB) boundary	Yes	
	Install Date		Installation date
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Wastewater Manhole	Plan ID	Yes	Plan number used to identify as-built plan
	MH ID	Yes	
	Property ID	Yes	Either property number or legal description adjacent to manhole
	Street Name	Yes	If street name is not applicable use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Lid Level	Yes	Top edge and northern part of rim casting
	Invert Level	Yes	Invert level of wetwell
	MH Diameter		Nominal Bore of MH risers
	Eastern Coordinate		Location as per lid level
	Northern Coordinate		Location as per lid level
	Service Status	Yes	Abandoned or removed pipelines are required to be identified on as-built records. Show “A” for abandoned pipes, “R” for removed pipes, otherwise leave blank
	Install Date		Installation date
	Comments		Any pertinent comments (particularly water table depth and soil conditions)

Wastewater Pump Station

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
Pump Station General	Plan ID	Yes	Plan number used to identify as-built plan
	Street name	Yes	If street name is not applicable, use a property deposited plan (DP) number
	Street type	Yes	Qualifier to street name, e.g. Crescent, Road, Lane, etc.
	Pump Station Lot Location	Yes	Show the pump station Lot boundary and surround lots and roads, including the accessway up to the Pump Station
	Install Date		Installation date
	Maximum Design Flow Rates		
	Design ADWF		ADWF – average dry weather flow
	Design PWWF		PWWF – peak wet weather flow
Pump Station Wet Well	Location	Yes	Show on a separate pump station site layout plan & cross-section plan at suitable scale
	Rising Main Discharge Point	Yes	Manhole ID
	Rising Main Diameter	Yes	The rising main should appear as an item on the schedule of wastewater pipelines
	Overflow Discharges To	Yes	Refer to the ID of the overflow pipe which should appear as an item on the schedule of wastewater pipelines
	Overflow level	Yes	RL at which overflow begins
	Length	Yes	Internal length dimension of wet well
	Width	Yes	Internal width dimension of wet well
	Diameter	Yes	Internal diameter of wet well (circular wet wells)
	Floor Elevation	Yes	Invert level of chamber
	Ground Elevation	Yes	RL of wet well access covers
	Inlet Diameter	Yes	Repeat for each inlet
	Inlet Elevation	Yes	Repeat for each inlet
	Install Date		Installation date
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Storage Chamber	Location	Yes	Show on a separate pump station site layout plan & cross section plan at suitable scale

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
	Length	Yes	Internal length dimension of chamber
	Width	Yes	Internal width dimension of chamber
	Diameter	Yes	Internal diameter of chamber (circular chambers)
	Floor Elevation	Yes	Invert level of chamber
	Ground Elevation	Yes	RL of storage chamber access covers
	Inlet Diameter	Yes	Repeat for each inlet
	Inlet Elevation	Yes	Repeat for each inlet
	Install Date		Installation date
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Valve Chamber	Location	Yes	Show on a separate pump station site layout plan & cross section plan at suitable scale
	Water Supply Backflow Prevention Device		Make & Model
	Rising Main Check Valve		Nominal Bore - Repeat for each valve
	Rising Main Isolation Valve		Nominal Bore - Repeat for each valve
	Install Date		Installation date
	Comments		Any pertinent comments
Odour Control	Location	Yes	Show on a pump station site layout plan
	Length	Yes	Internal length dimension of chamber
	Width	Yes	Internal width dimension of chamber
	Inlet Diameter	Yes	Repeat for each inlet
	Inlet Elevation	Yes	Repeat for each inlet
	Install Date		Installation date
	Comments		Any pertinent comments relating to the type of bio filter media used
Magflow Meter	Location	Yes	Show on a pump station site layout plan
	Manufacturer		
	Model Number		
	Magflow Serial number		
	Install Date		Installation date

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
Pumps each (repeat for each pump)	Manufacturer		
	Model Number		
	Performance Curve ID		
	Motor Serial Number		
	Motor Current Rating		Nameplate current in amps
	Motor Power Rating		Nameplate power rating in kW
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Level Controls	Manufacturer		
	Model ID		
	Backup Battery Type		
	Start Level		Repeat for each pump
	Stop Level		Repeat for each pump
	High Alarm Level		
	Low Alarm Level		
	Overflow Alarm Level		
	Comments		Any pertinent comments
Electrical Cabinet	Location	Yes	Show on a pump station site layout plan
	Pump Overload Setting		Repeat for each pump
	Pump Contactor Type		Repeat for each pump
	Pump Starter Type		Repeat for each pump
	Install Date		Installation date
	Comments		Any pertinent comments
Telemetry	RT Brand		
	RT Model		
	Aerial Type		
	Micrologix 110 Allen Bradley Module Model		
	Comments		Any pertinent comments (particularly water table depth and soil conditions)

Water

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
Water pipeline	Plan ID	Yes	Plan number used to identify as-built plan
	Pipe ID	Yes	Use a pipe numbering system to link individual pipes and related information such as length, diameter, material, coordinates, etc. Pipe ends occur at pipe intersections and when pipe diameter changes
	Pipe Diameter	Yes	Nominal bore
	Pipe Length	Yes	Show pipeline location on the plan and show dimensions to adjacent boundaries
	Laying Depth	Yes	Average depth below ground level to top of pipe
	Pipe Material	Yes	Material and strength classification
	Joint Type		RRJ, gibault, welded etc.
	Service Status	Yes	Abandoned or removed pipelines are required to be identified on as-built records. Show "A" for abandoned pipes, "R" for removed pipes, otherwise leave blank
	Install Date		Installation Date
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Water Connection Service	Plan ID	Yes	Plan number used to identify as-built plan
	Pipe ID	Yes	Use a pipe numbering system to identify individual pipes if Property ID or Street numbering is not adequate.
	Property ID	Yes	Either property number or legal description
	Street Name	Yes	If street name is not applicable use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Service Pipe Diameter		Nominal bore
	Service Pipe Length	Yes	Show pipeline location on the plan
	Service Pipe Material		Material and strength classification
	Eastern Coordinate		Coordinate of customer end of service pipeline i.e.

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
			at the service valve or toby
	Northern Coordinate		Coordinate of customer end of service pipeline i.e. at the service valve or toby
	Toby Lid Level		From middle of toby lid
	Distance from left (LB) or right (RB) boundary Meter Installed	Yes Yes	Distance to customer connection point relative to left-hand or right-hand boundary facing the property from the street Yes / no response (if yes complete an HCC ' Water Meter" form for each installation
	Install Date		Installation Date
	Comments		Any pertinent comments
Water Valves	Plan ID	Yes	Plan number used to identify as-built plan
	Pipe ID	Yes	Use a pipe numbering system to identify individual pipes if Property ID or Street numbering is not adequate
	Property ID	Yes	Either property number or legal description
	Street Name	Yes	If street name is not applicable use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Valve Size		Nominal bore in millimetres
	Valve Manufacturer		
	Location	Yes	Roadway, berm
	Eastern Coordinate		Coordinate of valve
	Northern Coordinate		Coordinate of valve
	Valve Level		From middle of Valve Lid
	Service Status	Yes	Abandoned or removed pipelines are required to be identified on as-built records. Show "A" for abandoned pipes, "R" for removed pipes, otherwise leave blank.
	Install Date		Installation Date
	Comments		Any pertinent comments such as 'attached to anchor block'
Hydrants	Plan ID	Yes	Plan number used to identify as-built plan

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
	Pipe ID	Yes	Use a pipe numbering system to identify individual pipes if Property ID or Street numbering is not adequate
	Property ID	Yes	Either property number or legal description
	Street Name	Yes	If street name is not applicable use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Hydrant Size		Nominal bore in millimetres
	Hydrant Manufacturer Location	Yes	Roadway, berm
	Eastern coordinate		Coordinate of hydrant
	Northern coordinate		Coordinate of hydrant
	Hydrant Level		From middle of Hydrant Lid
	Service Status	Yes	Abandoned or removed pipelines are required to be identified on as-built records. Show “A” for abandoned pipes, “R” for removed pipes, otherwise leave blank.
	Install Date		Installation Date
	Comments		Any pertinent comments

Appendix J Checklist for Supporting Information

The following checklist is a summary of the requirements of the ES 2018 and should be used as a prompt to the matters which require certification by an SQEP:

Geotechnical - Site Suitability and Earthworks *(SQEP geotechnical)*

Note - applicable where cut and fill of the site is proposed

Hazard instability zones

- ❒ An opinion stated by a geotechnical specialist as to the stability/suitability of the land and should include the effects from excavation, filling, removal of vegetation, disposal of stormwater & effluent etc.

Hazards - flood hazard exists

- ❒ Determination of flood extent and level in 1% AEP event *(+20%)*
- ❒ What effect it will have on the development and mitigating measures taken to minimise/eliminate effect
- ❒ What effect the development will have on the flooding *(displacement/redirection of flooding etc)*

Development within coastal hazard 1 & 2 zones

- ❒ An assessment of the effect of storm surge, wave run-up etc

Reticulated Sewer

- ❒ Evidence that the proposed reticulation can service the proposed development and any undeveloped land beyond
- ❒ Hydraulic design including capacity and self-cleaning velocities
- ❒ Design of public pump stations and rising mains, including private reticulation, require producer statement design and construction
- ❒ Design of private pump stations and rising mains – require producer statement design and construction
- ❒ Design details of anchor and thrust blocks *(including calculations)*
- ❒ Design details of pipe bridges – needs pre-approval of Waste Manager
- ❒ Design of reticulation larger than 150mm, serving more than 250 lots, pump stations, rising mains, above ground works, minimum cover not achieved, siphons etc
- ❒ Specific design and assessment for commercial flows
- ❒ Specific design for curved pipelines
- ❒ Steep grades >7% to be graded out
- ❒ Cleansing velocities achieved. Maximum velocity of 3ms-1 or specific design by SQEP

Reticulated Water

- ❒ Evidence *(calculations, existing pressures/supply etc)* that the proposed reticulation can service the proposed development, and any undeveloped land beyond
- ❒ Evidence that water hammer effects have been considered and appropriate measures included
- ❒ Required pressures and flows can be met from all hydrants and service connections
- ❒ Air release/scour valves/pressure reducing valves approved by Water Services
- ❒ Design details of anchor and thrust blocks *(including calculations)*
- ❒ Details of pump stations booster pumps, control valves, proposed ownership written agreements, reservoirs, make model of pump valves and other equipment – producer statement note
- ❒ Fire risk classifications and calculations to confirm complying firefighting capacity in terms of SNZ PAS 4509:2008
- ❒ Details of any above ground reticulation, pipe bridges etc *(requires specific design and Water Services approval)*

- ❒ Private booster pumps

Stormwater - Private

- ❒ Evidence that the existing public and/or public reticulation can service the proposed development and any undeveloped land beyond
- ❒ Attenuation meets ES requirements. Calculations/model to support attenuation design. Attenuation devices are serviceable and a producer statement provided including maintenance regime
- ❒ Details of treatment proposed which complies with the District Plan/EES/NRC-WSP
- ❒ Assessment of any wetlands included/proposed
- ❒ Any proposed soakage test in accordance with E2 of the Building Code (**Note**: no soakage permitted in medium/high instability areas without Geo-specialist design)
- ❒ Any soakage proposed is serviceable and silt etc is removed before entering the soakage area
- ❒ Reticulation adequate for 20% AEP event
- ❒ Details of open drains/swales, capacities etc
- ❒ No building over stormwater line or directly alongside without written approval from I & S and specific design
- ❒ Habitable buildings floor heights set 500mm above 1% AEP flood level
- ❒ Commercial buildings floor heights set 300mm above 1% AEP flood event
- ❒ Demonstration of nil effects to surrounding properties as result of development

Stormwater - Public

- ❒ Extent of overland flowpaths from 1% AEP event
- ❒ Level of treatment complies
- ❒ Attenuation meets ES requirements. Calculations/model to support attenuation design
- ❒ Reticulation adequate for 20% AEP event
- ❒ Soakage tests in terms of E1 of the building code for any proposed soakage
- ❒ Any soakage proposed is serviceable. Silt etc is removed before entering soakage area
- ❒ Flood susceptible areas on hazard maps have been assessed and flood level determined for 1% AEP event
- ❒ Demonstration of nil effects to surrounding properties as a result of development
- ❒ Assessment of unstable ground and the effects storm water will have on it, mitigation measures supplied to enhance stability
- ❒ Water table drains – calculations to confirm capacity
- ❒ Velocity/scour control on steep grades on open drains
- ❒ Cement stabilisation on steep grades
- ❒ Pipe crossings/bridges
- ❒ Calculations to show cesspit size is adequate for design volume
- ❒ Design of treatment devices

Parking and Maneuvering

- ❒ Plan shows falls and sumps/reticulation/treatment/attenuation calculated to the 1% AEP event
- ❒ Details of complying parking and manoeuvring

Rights of Way/Accessways

- ❒ Private bridges require specific design and building consent
- ❒ Retaining structures require specific design and building consent
- ❒ Subgrade test confirm CBR >7 (Subgrade >7 requires specific design by SQEP)

- ❒ Construction of access will not affect overland flowpaths *(up to and including 1% AEP event)*

Roading - Design

- ❒ Geotechnical report on stability of ground if road is designed in medium/high instability zone
- ❒ Subgrade testing shows CBR>7, no specific design – SQEP to do testing
- ❒ Subgrade testing shows CBR<7 – requires specific design
- ❒ Collector or arterial road requiring specific TOTAL design
- ❒ Speed limit on road >50km/h requiring specific geometric design
- ❒ Intersections with collector or arterial road requiring specific design
- ❒ Roundabout design
- ❒ Street lighting design
- ❒ Bridges, culverts, major waterways
- ❒ Retaining walls
- ❒ Peer/technical reviews and safety audits
- ❒ Pavement design depending on CBR, type of road etc
- ❒ Surfacing design depending on CBR, type of road etc
- ❒ Surface drainage design

Plan View

- ❒ Proposed road intersection with existing roads with sight distances
- ❒ Street lighting details/layout
- ❒ Details of tapers/turning bays etc

Cross Sections

- ❒ Stormwater treatment
- ❒ Existing levels and finished levels shown, cut/fill etc
- ❒ Steep cuts/fills require CPEng certification

Typical Cross Sections

- ❒ Pavement design if CBR<7
- ❒ Subsoil drainage with geotextiles

Summary of SQEP Certification on Engineering Plans

All Engineering Plans containing proposed works certified by an SQEP must contain the SQEPs verification for those specific works.

The following schedule of works being certified by the SQEP must be attached to the lodgement letter. The schedule must summarise all works being certified by the SQEP and reference the relevant plan/sheet number, including multiple works presented on a plan and works where the certification is by more than one SQEP.

The SQEP must also clearly identify and certify any aspects of the design that are **not** in accordance with the standard design specified in the ES.

Summary of SQEP Certification			
Engineering Aspect	**Detail of works**	**Plan ref**	**SQEP initials**
Site Suitability			
Earthworks/Compaction design			
Land Instability areas			
Coastal Hazards, Mine zones, Flood zones			
Road and Access			
Roads and Access			
Pavement structural design			
Geometric design			
Surfacing design			
Lighting design			
Bridges and major culverts			
Retaining walls			
Stormwater			
Catchment Analysis			
Overland flow paths (1%AEP)			
Stormwater treatment devices			
Stormwater attenuation structures			
Wastewater			
Gravity reticulation			
Sewer pump stations			
Rising mains			
On-site disposal details			
Community wastewater treatment systems			
Pipe bridges & other structure			
Water			
Water booster stations			
Reservoirs			
Pipe bridges & other structures			

Summary of SQEP Certification			
Engineering Aspect	**Detail of works**	**Plan ref**	**SQEP initials**
Hydraulic design			
Other design matters			

Appendix K List 1. Reserve Playgrounds - Approved Playground Equipment and Surfacing Suppliers and Installers

Play equipment suppliers/installers:

- Playground Centre
- Playco Playgrounds
- Playground People
- Park Supplies and Playgrounds

Playground surfacing suppliers/installers:

- Playmatta
- Playbases
- Numat
- Teamturf
- Playsafe
- Playco
- Play Bark

Appendix L List 2. Reserves and Streetscapes - Approved Common Landscape Furniture Products and Suppliers.

Note: Approval for products should be sought on a case-by-case basis from Council.

In all instances specific design should be sought to complement local character, the urban design theme and relationship to other chosen products.

1. Benches:

Criteria for appropriate reserve and streetscape seating are:

- Comfortable, accessible (i.e. ideally with a back and arm rest/s), easy to maintain (not-painted), durable, either hardwood timber, recycled composite or sufficiently treated, flush surface mounted with stainless steel fixtures to concrete pad with sufficient room for maneuvering, continuous pathway hard surface access, placed in a way for meet good CPTED principles.
- Reserve seating should be focused around pedestrian networks at regular intervals, near children's playgrounds for caregiver supervision, and where people naturally congregate for views or to wait.

Below are some examples of appropriate products:

- o Streetscape - Metro or Rendezvous Seat.
- o Urban Effects - Citi-style Seat.
- o Metal Art - Civic Seat.

2. Picnic Sets:

Criteria for appropriate reserve picnic tables:

- Comfortable, accessible (i.e. with ability for those in wheelchairs and mobility scooters to also be seated at the table) easy to maintain (not-painted), durable, either hardwood timber, or sufficiently treated, recycled composite, or concrete flush surface mounted with stainless steel fixtures to concrete pad with sufficient room for maneuvering (i.e. 1.3m min surfacing around the full table), continuous pathway hard surface access, with some option for shade/protection, placed in a way for meet good CPTED principles.
- Picnic seating should be focused around where people meet to eat – in civic parks next to take-away outlets, in parks that provide barbeque facilities or other areas where people meet to picnic.

Below are some examples of appropriate products:

- o BUSK Concrete Picnic Table– plain or coloured and sealed.
- o Streetscape - Metro or Rendezvous Picnic Set.
- o Urban Effects - Citi-style Bench.
- o Metal Art - Avalon Picnic Set.

3. Shade Structures:

Criteria for appropriate shade structures:

- Attractive, robust, wind/storm and UV resistant (note structures over 50m2 require consent), vandal/climb resistant, efficient in shading and providing basic shower protection.

Below are some examples of appropriate products:

- o Shade Systems - Star Shade Structure.

- o Sunshade.

4. Bollards, Barriers and Rocks:

Criteria for appropriate bollards, barriers and rocks:

- Bollard material can range from timber, recycled plastic/timber composite, stainless steel, galvanised steel, epoxy-painted or powder coated plain steel, or sealed (corten) mild steel. Timber must be H4 treated or equivalent hardwood. Appropriate dimensions are min 100mm square (can be up to 300mm square). To be at height of minimum 600mm, 900mm (ideal)– 1200mm max out of ground. Removable bollards with steel hinge joint or steel sleeve to be used for vehicle access areas. All bollards to have concrete mowing strip of min 100mm clearance around base. Ideally a contiguous mowing strip for bollards in a row to reduce maintenance. Timber bollards are ideally plain or stained timber but not painted. Rebating for local decorative effect can be incorporated as appropriate.
- One – Three Rail fence (see Drawing Sheet ** for details)
- Rocks must be a minimum 800cm round with a flattish top (so people can sit on them), ground mounted with concrete surround for ease of grass maintenance. 300mm clearance is recommended. Local sourced rocks are considered most appropriate.

Below are some examples of appropriate products:

- o Streetscape - Cutlass Bollard.
- o Urban Effects – Word Corten Bollard.

5. Waste Bins and Recycling Receptacles:

Criteria for appropriate waste bins and recycling receptacles:

- Council currently utilises a number of different types of bins in reserves and streetscapes including St Louis bins, Ly's bins, Colonial Tilt bins, Wheelie-bin enclosures, TOM litter bins and a number of others. It is recommended new bins match or compliment the surrounding landscaping as best as possible.
- Bins should range between 60litre to –240litre capacity depending on placement, how often they are serviced, and local character
- Bins should be rationalised to encourage disposal of waste created only when using the reserve or streetscape (i.e. picnic or takeaway waste etc.) rather than household or other waste. A pack-in, pack-out philosophy is adopted for other areas.
- All bins should be mounted on hard surfacing/concrete for ease of maintenance and servicing and in close proximity to main paths, picnic seats or amenity areas.
- Bins should be easy to service and clean, discourage interference from birds and other animals.
- Recycling options should be added next to refuse bins in key waste collection areas and clearly labelled as such to avoid contamination.

Below are some examples of appropriate products:

- o Tilley Group – Recycling Bins.
- o Metal Art – Wheelie-Bin Enclosures.

6. Bikes and Scooter Racks:

Criteria for appropriate waste bins and recycling receptacles:

- Bike racks can be made with a range of robust materials (as per bollards) and mounted as such to avoid trip/obstruction hazards and vandalism.
- Racks are best located as part of stopping points along the cycle network, at various convenient points in urban centres (such as near libraries and other service centres) at bigger playgrounds and near toilet facilities. Scooter racks should be considered for inclusion near skate facilities or pump parks.

Below are some examples of appropriate products:

- Urban Effects – Bike and Scooter Rack range.
- Tilley Group – Ruru Bike Stand and Spiral Hoop.

7. Drinking Fountains and other Water Dispensers:

Criteria for appropriate drinking fountains, and other water dispensers:

- Drinking fountains and other water dispensing features must be sited on proper concrete (or clean free-draining hardstand) and have good drainage - ideally a dedicated sump/drain that takes the used water way from the area.
- Drinking fountains dispensing clean potable water are best situated near children's playgrounds, at particular rest points along trails or other key urban areas and connected to a hard-surfaced path network. Consideration should also be given to accessibility to those who use mobility devices such as wheelchairs.
- Outdoor shower towers may be installed in particular circumstances in areas where people wash (sand, salt etc.) off after swimming or changing.
- Care must be in choosing items that have automatic off valves and are low flow therefore not wasting water unnecessarily. Dedicated nearby rainwater off buildings may be utilised for capture to supplement supplies as long as supply is safe and potable.
- Stainless steel fixtures should be used for ease of cleaning and for rust prevention.

Below are some examples of appropriate products:

- Mountain Fresh – Freestanding Fountain (powder-coated)
- Filters and Fountains – Stainless Steel Drinking Fountain, Wheelchair Accessible Drinking Fountain and Shower Tower.
- Urban Effects – Hydrate Fountain.

8. Public Barbecues:

Criteria for appropriate public barbeques:

- Public barbeques require significant servicing and maintenance – so inclusion of these facilities should only be considered for premier playground parks with picnic tables where there are no takeaway facilities nearby and where there are nearby bins for food waste.
- Single plate facilities with bench space for preparation are recommended.
- Barbeques should be installed under a roof structure to prevent rain filling up fat drip trays and overflowing causing a health hazard.
- Barbeques should also be installed on a sufficient sized concrete pad, with fully connected hard surface pathways for accessibility – including for users in wheelchairs and other mobility devices.

- Automated, electric, push-button facilities are recommended – so that they can't be left on risking accidental burns, fires lit in them or otherwise easily vandalised.

Below are some examples of appropriate products:

- Urban Effects – Urban Electric Easy Access Single Barbeque.
- Greenplate – Electric and Solar Barbeques.

9. Fences and Gates.

Criteria for appropriate reserve fencing and gates:

- Although a specific company (such as Boundaryline or Hamden) is not required to be engaged – the same quality standards and general specifications are to utilised for reserve fencing and gate construction.
- Urban fencing in premier parks and reserves should in most instances have contiguous concrete mowing strips underneath for ease of regular mowing/vegetation maintenance.

Below are some examples of specifications to be followed:

- Boundaryline – Sentry Flat Top Fence (permeable, powder-coated, low steel fence)
- Boundaryline – Durapanel Delta Aluminium Gates (as above for entrances)
- Boundaryline - Sentry Panel School Panel Fence (as above but taller)
- Boundaryline – Durapanel Titan Safety Fence (as above for on top of retaining walls)
- Boundaryline – Colourpanel Flattop Fence (taller partly permeable option – may be appropriate around residential areas, requiring some privacy)
- Boundaryline – Kiwipanel Fence (around courts/sports areas where needed – galvanised)
- Boundaryline – Post and Rail Fences (plain or painted H4 timber)
- Hamden – Manual Swing Barrier Arms (parks, sports grounds, carparks restricted vehicle entry)

10. Vehicle Wheel-stops:

Criteria for appropriate vehicle wheel-stops:

- Vehicle wheel-stops should be included in all public car parking bays fronting or angling on to public reserve paths to prevent the fronts of vehicles from encroaching over the available pathway/s or damaging boundary fencing.
- Wheel-stops must be fit for purpose, durable and properly installed. Ideally these should comply with AS/NZS2890. 1-2004.
- These should ideally be striped or reflectorised in parking areas that are to be used after dusk.
- The parking configuration and installation of wheel-stops must not compromise access to pedestrian paths. I.e. – a minimum of 1.3 meters gap must be provided to all paths to allow for accessibility.
- Care should be taken in choosing products that don't cause damage the bumpers of cars.

Below is an example of an appropriate product:

- Blackwoods – Rubber Wheel-stop.

11. Tree Surrounds and Tree Grates:

Criteria for appropriate tree surround and tree grates:

- In most circumstances it is better to plant the recommended specification trees with no tree surround than to use tree surrounds – i.e. trees to be 2m minimum in height, free trunking, with trunk diameter at 1m of 60-80mm with proper staking. Vandals can sometimes use the surround to lever and snap a new tree.
- If tree surrounds are to be used, then they are best used in streetscape CBD areas where there is adequate passive surveillance.
- Tree grates should be used in areas with significant surrounding hard surfacing as part of WSD (water sensitive design) systems to reduce stormwater run-off, to protect tree roots from being trampled and to ensure the tree has access to adequate rainfall.

Below are some examples of appropriate products:

- Streetscape – Tree Surrounds
- Streetscape – Tree Grates
- Permapave or Firth – Permeable paving (alternative to tree grate)

12. Boardwalk, Sand-ladder and Jetty Planking:

Criteria for appropriate boardwalk, sand-ladder and jetty planking:

- Durability and ongoing maintenance of materials for site is a major consideration for choice of product for boardwalks, sand-ladders and jetty planking.
- Traction and general user safety are also key considerations. Shaded and perpetually damp areas may require further traction coatings/treatment.
- Timber/plastic composite or recycled plastic products should be considered as alternative to timber in coastal settings – as these can be more durable and may be a more environmentally sustainable option than hardwoods.

Below is an example of an appropriate product:

- Metal Art or Replas – Enduroplank and Enduromesh

13. Tree Planters:

Criteria for appropriate tree planters:

- Generally, it is better to plant street trees in ground where at all possible where trees can access available ground water and nutrients and roots can grow freely.
- In areas where trees cannot be planted inground then specific design is required for above ground tree planter/containers including durable construction material and sealants, and appropriate dimensions/size for the root systems of the chosen species to ensure the ongoing health of the tree.
- Other considerations are installation of artificial irrigation systems, traffic safety if used within or in close proximity to the road corridor, and the ability to uplift and shift planters and transplant trees as required.
- Top quality planting medium is required for use in all tree planters.
- Treated timber alone is not an appropriate material for the construction of planters.

Below are some examples of appropriate products:

- Metal Art – Streetscape Planters
- Urban Effects – Toi Toi, Dahlia, Timber or Onice Planter

14. Play Equipment and Play Surfacing:

Note: Most detail regarding design of reserve play equipment and play surfacing is covered off in the Chapter. Council currently has several old or community-made play facilities throughout the district that do not meet current standards. These older facilities are required to be upgraded to the current NZ Standards for Playgrounds and Playground Surfacing when these are renewed or upgraded.

Criteria for selection of play equipment and play surfacing:

• Play products and professional installation that meets the current NZ Standards for Playgrounds and Playground Surfacing is required for all new play equipment and play surfacing installation.

• Consideration should be given to using professional companies that Council has engaged previously in other playgrounds across the district for ease of maintenance and parts supply. Some suppliers also do a good range of more ‘natural’ play items and design.

• Access to play equipment for children and caregivers with disabilities must be factored. A mix of universally accessible equipment and accessible surfacing must be considered for all new playgrounds and significant upgrades. (i.e. contiguous hard-surface pathways connecting to entrances flush to ground level with concrete edging and solid rubber surfacing, as well as some inclusive play equipment - meaning people of different physical abilities, ages and stages can play on them.)

Below are some examples of appropriate designers, suppliers and installers of public playgrounds - play equipment and play surfacing products:

- Playground Centre
- Playground People
- Playco Playgrounds
- Playmatta and Playbases
- Numat

15. Dog Agility/Dog Exercise Parks:

Criteria for selection of dog agility equipment for use in dog exercise parks and areas:

• Dog on and off-leash exercise areas currently exist in a number of parks and reserves across the district but to date there are no dedicated enclosed dog exercise parks or agility areas.

• Dedicated dog exercise/agility areas should ideally be fully fenced with facilities for both dogs and humans – i.e. dog bags and bins, hard-surfacing, seating, shade, water etc.

• Predesigned and tested dog agility equipment that isn’t made of timber should be considered as these are easier to clean and often more durable.

• Any equipment chosen should be installed with consideration of the differing abilities of dog owners and ease of surrounding park maintenance.

Below is an example of an appropriate product:

- Metal Art – Dog Agility Tracks

16. Reserve Signage:

Criteria for signage:

Note: Signage within the road corridor must comply with the Transportation Chapter and any applicable bylaw.

- Council maintains a standard design portfolio for park and reserve signage (sizes/dimensions, fonts, layout, colours, spacing and symbols/maps etc.) that must be utilised for general park names, labelling key facilities, wayfinding and other standard signage – such as bylaw information etc.
- Council owns and maintains or must approve any signage by others prior to installation to be installed on Council managed land.
- Interpretation and other placemaking signage can and should be used where they add value. These signs allow for some additional design and creativity. These signs may contain cultural, historical, and/or ecological information. They should be unique to the place, and part of an identifiable family of signs.
- General principles for all signs are:
    - Signs need to be securely installed and should have concrete underneath for ease of maintenance.
    - Signs should be bright and easily read by people with diminished eyesight.
    - Wayfinding signs should be kept to a minimum – use landscaping (paths etc.) instead.
    - Signs should be easy to read, have a solid standing area underneath (where they are to be read from) be durable, colourfast, and have graffiti guard to reduce damage by vandalism.
    - Any content will need to be vetted with appropriate parties and their inclusion needs to be approved by Council.
- Consideration is currently being given to adoption of some signage rationalisation initiatives - including access to on-line links (via QR or website links) for detailed information that is not critical for standard signs.
- Bilingual signage – in Te Reo and English should also be considered for inclusion.

17. Sculptural Installations:

Note: Landscape furniture is often an aesthetic three-dimensional ‘artwork’ in its own right. It is a positive to consider both the aesthetic and functional aspects when choosing all landscape furniture.

Criteria for sculptural installations:

- Sculptural installations can be incorporated in to reserves and streetscapes as part of good placemaking. They should be unique to the place and be meaningful in some way.
- Sculptural installations within streetscapes must also consider aspects such as frangibility (if collided with), clear sightlines, wind loading, reflectivity and other such considerations.
- Sculptures in reserves offer more flexibility in size, materials and placement, however they must be durable, vandal-proof and reasonably easy to maintain.
- Sculptures should ideally be connected to a regularly used pathway network and be a prominent focal point as part of reserve design. They shouldn't obstruct movement or cause undue health and safety issues – such as trip hazards, sharp corners etc.
- Local design and manufacture should be encouraged for meaningful placemaking.
- All sculptures must be approved by Council prior to manufacture and/or installation. Dependent on the structure, professional engineering and consents may also be required.

Below are examples of off the shelf sculptural installations:

- Metal Art – Art Installations – Smiling Windmill and Urban Forest Cubes

18. Wall Murals and Ground Surface Artworks.

Criteria for wall murals and ground surface artworks:

- Like sculptural installations wall murals and ground surface artwork should ideally be designed locally and reflect local character, people and place. Artworks can add significantly to local placemaking and assist in vandalism resistance.
- Ideal placement for wall murals are on large plain walls in main civic areas that are public facing (both Council - and if approved - by the owner of private walls), on the exterior of toilets or other plain public buildings near playgrounds.
- Ground surface artworks may be on reserve paths or other hard-surfacing surfacing – and could be for example designs soda-blasted in concrete, tactile vinyl coverings or other approved painted surfacing. Care and consideration must be given to aspects such as durability, UV resilience, reflectivity and traction.
- Ground surface artworks may also be part of the road corridor – at road crossings or as part of traffic calming interventions. Special considerations are required to meet criteria contained in more detail in the Transportation chapter.
- All works should be properly crafted, applied and if applicable graffiti-guarded to prevent premature wear and vandalism.
- All murals and ground surface artworks must be approved by Council prior to manufacture and/or installation. There should be an understanding that the mural may not last forever and may get replaced or repainted over in years to come.

Below are examples of various wall murals and ground surface applications:

  - Hundertwasser artworks – Mosaic, Painted etc.
  - Polymer Group – Nelson Street Cycleway (Auckland) - Enduragrip PU High Performance Coloured High Friction Surfacing Treatment.
  - Sodablast – Concrete Etching (Rotorua) – Share with Care on Shared Paths

Appendix M List 3. Reserves and Streetscapes - Suitable Shrub and Plant Species for Reserve and Streetscape Planting

Chapter 7. Public Places and Landscape Works –

List 3. Suitable Plant and Shrub Species List fo Reserve and Steetscape Planting.

Botanical Name	Common Name	Type	Main Use
Agave attenuate	Dragon Tree Agave	Shrub/Tree	Sub-tropical/Textural
Alocasia spp.	Alocasia	Shrub/Plant	Sub-tropical/Textural
Aspidistra	Cast-Iron Plant	Shrub/Plant	Sub-tropical/Textural
Bougainvillea spp	Bougainvillia	Climber/Vine	Sub-tropical/Textural
Bromeliad spp	Bromeliad	Shrub/Plant	Sub-tropical/Textural
Canna (dwarf)	Indian Shot	Shrub/Plant	Sub-tropical/Textural
Cordyline 'Showoff', fruticosa 'Fiji' and others	Narrow-Leaf Palm Lily	Shrub/Plant	Sub-tropical/Textural
Euphorbia x martinii	Martings Spurge	Shrub/Plant	Sub-tropical/Textural
Ficus bengimena	Bengamin Fig	Shrub/Plant	Sub-tropical/Textural
Gardenia spp	Gardenia	Shrub/Plant	Sub-tropical/Textural
Hedychium	Kahili Ginger	Flower Plant	Sub-tropical/Textural
Heliconia spp.	False Bird of Paradise	Shrub/Plant	Sub-tropical/Textural
Hibiscus spp.	Hibiscus	Shrub/Plant	Sub-tropical/Textural
Hymenosporum 'Gold Nuggets'	Dwarf Frangipani	Shrub/Plant	Sub-tropical/Textural
Mandevillea spp.	Rock Trumpet	Climber/Vine	Sub-tropical/Textural
Metrosideros villosa	Pacific Island Pohutukawa	Shrub/Plant	Sub-tropical/Textural
Monstera deliciosa and adansonii	Fruit Salad Plant	Shrub/Plant	Sub-tropical/Textural
Murraya paniculata	Orange Jessamine	Shrub/Plant	Sub-tropical/Textural
Musa mainii or valutina	Ornamental Banana	Shrub/Plant	Sub-tropical/Textural
Petrea	Queens Wreath	Climber/Vine	Sub-tropical/Textural
Philodendron spp.	Lacy Tree Philodendron	Shrub/Plant	Sub-tropical/Textural
Pyrostegia venusta	Orange Trumpet Vine	Climber/Vine	Sub-tropical/Textural
Radermachera dwarf	Dwarf Tree Jasmine	Shrub/Plant	Sub-tropical/Textural
Stretlizia nicolai, reginae and parvifolia	Bird of Paradise	Shrub/Plant	Sub-tropical/Textural
Strobilanthes gossypinus	Persian Sheild	Shrub/Plant	Sub-tropical/Textural
Stromanthe sanguinea	Brazilian Stromanthe	Shrub/Plant	Sub-tropical/Textural
Tibouchina spp.	Andean Princess Flower	Shrub/Plant	Sub-tropical/Textural
Vireya Rhododendron spp.	Vireya Rhodendron	Shrub/Plant	Sub-tropical/Textural
Xanthosoma spp.	Elephant Ear	Shrub/Plant	Sub-tropical/Textural

Note: Not Exhaustive. Please speak to Council for furhter guidence on suitable species if selecting species outside of this list.

List 3. Suitable Plant and Shrub Species List fo Reserve and Steetscape Planting.

Botanical Name	Common Name	Type	Main Use
Acuba japonica	Japanese Laurel	Shrub/Plant	Temperate/Flowering
Alstroemeria spp	Peruvian Lily	Flower Plant	Temperate/Flowering
Azalea 'Charlie' etc	Azalea	Shrub/Plant	Temperate/Flowering
Camellia 'Setsugeka', transnokoensis etc.	Sasanqua Camellia etc	Shrub/Tree	Temperate/Flowering
Daphne 'The Princess'	Daphne	Shrub/Plant	Temperate/Flowering
Dianella 'Blue Twist'	Blue Flax	Clumping Plant	Temperate/Flowering
Dianella caeruelan	Blue Flax Lily	Clumping Plant	Temperate/Flowering
Dianella 'Tas Red'	Tasmanian Flax Lily	Clumping Plant	Temperate/Flowering
Eucomis 'Sparkling Burgundy'	Autumn Pineapple Lily	Clumping Plant	Temperate/Flowering
Ficus tuffi	Ficus Tree	Shrub/Plant	Temperate/Flowering
Gazania spp	Treasure Flower	Flower Plant	Temperate/Flowering
Hemerocallis spp	Tawny Day Lily	Clumping Plant	Temperate/Flowering
Hydrangea 'Bridal Bouquet'	Snowball Hydrangea	Shrub/Plant	Temperate/Flowering
Laurus nobilis	Bay Tree	Shrub/tree	Temperate/Flowering
Lavendula hidcote	English Lavendar	Clumping Plant	Temperate/Flowering
Leucadendron 'Inca Gold'	Cape Cone Bush	Shrub/Plant	Temperate/Flowering
Ligularia reinformis	Tractor Seat Plant	Clumping Plant	Temperate/Flowering
Liriope muscari	Blue Lilyturf	Clumping Plant	Temperate/Flowering
Lomandra 'Tanika', 'Lime Tuff', 'White Stripes'	Spikey Head Mat-Rush	Clumping Plant	Temperate/Flowering
Loropetalum burgundy	Chinese Fringe Flower	Shrub/Plant	Temperate/Flowering
Michelia 'Coco', 'Figo', 'Fairy' etc	Port Wine Magnolia etc.	Shrub/Tree	Temperate/Flowering
Olea 'El Greco'	Olive (edible)	Shrub/Tree	Temperate/Flowering
Raphiolepsis indica	Indian Hawthorn	Shrub/Plant	Temperate/Flowering
Rosmarinum 'Tuscan Blue'	Tuscan Rosemary	Shrub/Plant	Temperate/Flowering
Teucrium fruiticans	Tree Germander	Shrub/Plant	Temperate/Flowering

Note: Not Exhaustive. Please speak to Council for furhter guidence on suitable species if selecting species outside of this list.

See: A Planters Handbook for Northland Natives - including special plants for wetlands, coast and birdfood for more specific ecological planting information.

List 3. Suitable Plant and Shrub Species List fo Reserve and Steetscape Planting.

Botanical Name	Common Name/s	Type	Main Use
Adiantum cunninghamii	Makaka/Maidenhair Fern	Clumping Plant	Native/Ornamental
Arthropodium cirratum	Rengarenga/NZ Rock Lily	Clumping Plant	Native/Ornamental
Asplenium bulbiferum	Pikopiko/Mother Spleenwort	Clumping Plant	Native/Ornamental
Aspodasmia similis	Oioi/Jointed Rush	Clumping Plant	Native/Ornamental
Astelia banksii	Wharawhara/Coastal Astelia	Clumping Plant	Native/Ornamental
Carex comans	Maurea/Longwood Tussock	Clumping Plant	Native/Ornamental
Carex pumila	Pukio/Strand Sedge	Clumping Plant	Native/Ornamental
Carex secta	Purei/Pukio/Mukura Grass	Clumping Plant	Native/Ornamental
Chinochloa flavicans	Haumata/Miniature toe toe	Clumping Plant	Native/Ornamental
Coprosma acerosa	Tarakupenga/Sand Coprosma	Clumping Plant	Native/Ornamental
Coprosma 'Lobster'	Coprosma 'Lobster'	Clumping Plant	Native/Ornamental
Coprosma 'Middlemore'	Coprosma 'Middlemore'	Clumping Plant	Native/Ornamental
Coprosma 'Painters Pallete'	Coprosma 'Painters Pallete'	Clumping Plant	Native/Ornamental
Coprosma 'Red Rocks'	Coprosma 'Red Rocks'	Clumping Plant	Native/Ornamental
Coprosma repens 'Poor Knights'	Taupata/Mirror Plant	Shrub/Plant	Native/Ornamental
Cordyline 'Red Star'	Te Kouka/Red Cabbage Tree	Shrub/Plant	Native/Ornamental
Corokia 'Frosted Chocolate'	Corokia 'Frosted Chocolate'	Shrub/Plant	Native/Ornamental
Corokia 'Geentys Green'	Corokia 'Geentys Green'	Shrub/Plant	Native/Ornamental
Cortaderia fulvida	Toe Toe	Clumping Plant	Native/Ornamental
Cyathea dealbata	Kaponga/Silver Fern	Tree Fern	Native/Ornamental
Dianella nigra	Turutu/Blueberry Lily	Clumping Plant	Native/Ornamental
Dicksonia squarrosa	Wheki/Rough Tree Fern	Tree Fern	Native/Ornamental
Ficinia nodosa	Wiwi/Knobby Club Rush	Clumping Plant	Native/Ornamental
Griselinia 'Broadway Mint'	Akapuka	Shrub/Plant	Native/Ornamental
Hebe diosmifolia	Korohiko/Shrubby Veronica	Shrub/Plant	Native/Ornamental
Hebe hartii	Kormiko/Mauve Hebe	Ground Cover	Native/Ornamental
Hibiscus diversifolius	Puarangi/Native Hibiscus	Clumping Plant	Native/Ornamental
Libertia grandiflora	Mikoikoi/New Zealand Iris	Clumping Plant	Native/Ornamental
Libertia ixoides	Mikoikoi/New Zealand Iris	Clumping Plant	Native/Ornamental
Metrosideros carminea	Akakura/Carmine Rata	Clumping Plant	Native/Ornamental
Muehlenbekia astonii	Mingimingi/Shrubby Tororaro	Shrub/Plant	Native/Ornamental
Muehlenbekia complexa	Pohuehue/Maidenhair Vine	Shrub/Plant	Native/Ornamental
Pesudowintera 'Red Leopard'	Horopito/Pepper Tree	Shrub/Plant	Native/Ornamental
Phormium cookianum	Wharariki/Mountain Flax	Shrub/Plant	Native/Ornamental
Phormium 'Dark Delight'	Phormium 'Dark Delight'	Shrub/Plant	Native/Ornamental
Phormium 'Evening Glow'	Phormium 'Evening Glow'	Shrub/Plant	Native/Ornamental
Phormiun tenax pupureum	Harakeke/Purple Flax	Shrub/Plant	Native/Ornamental
Phormum 'Black Rage'	Phormum 'Black Rage'	Shrub/Plant	Native/Ornamental
Pittosporum 'Mountain Green'	Pittosporum 'Mountain Green'	Shrub/Plant	Native/Ornamental
Pittosporum tenfolium 'Little Kiwi'	Kohuhu/Pittosporum Kiwi	Shrub/Plant	Native/Ornamental
Podocarpus 'Matapouri Blue'	Totara/Matapouri Totara	Shrub/Plant	Native/Ornamental
Pseudopanax crassifolius	Horokea/Lancewood	Upright Tree	Native/Ornamental
Pseudopanax 'Dark Star'	Pseudopanax 'Dark Star'	Shrub/Plant	Native/Ornamental
Pseudopanax laetus	Whauwhaupaku/Five Finger	Shrub/Plant	Native/Ornamental
Pseudopanax lesonii purpurea	Houpara/Coastal Five Finger	Shrub/Plant	Native/Ornamental
Xeronema callistemon	Raupo Tauranga/Poor Knights Lily	Clumping Plant	Native/Ornamental

Appendix N List 4. Reserves and Streetscapes - Suitable Tree Species for Reserve and Streetscape Planting.

List 4. Specimen Tree List – Street and Reserve Tree Species

Botanical Name	**Common Name**	**Type**	**Main Use**
Amelanchier canadensis	Shad Bush	Deciduous	Street/Park
Carpinus betulus 'Fastigata'	Upright Hornbeam	Deciduous	Street
Fagus sylvatica 'Dawyck Green'	Upright Green Beech	Deciduous	Street
Fraxinus pennsylvanica 'Cimmzam'	Cimmaron Ash	Deciduous	Street
Fraxinus 'Purple Spire'	Purple Spire Ash	Deciduous	Street
Lagerstroemia indica 'Kimono'	Crepe Myrtle	Deciduous	Street
Lagerstroemia indica 'Saint Emilion'	Crepe Myrtle	Deciduous	Street
Magnolia 'Heaven Scent'	Gresham Hybrid Magnolia	Deciduous	Street
Magnolia 'Milky Way'	Magnolia Jury Hybrid	Deciduous	Street/Feature
Magnolia 'Star Wars'	Magnolia ‘Star Wars’	Deciduous	Street
Pyrus cal. Aristocrat	Ornamental Pear	Deciduous	Street/Feature
Pyrus cal. 'Candelabra'	Birch Leaf Pear	Deciduous	Street/Feature
Pyrus cal. 'Kea'	Ornamental Pear	Deciduous	Street/Feature
Botanical Name	**Common Name**	**Type**	**Main Use**
Alectryon excelsus	Titoki	Evergreen	Street/Native
Fraxinus griffithii	Evergreen Ash	Evergreen	Street
Hymenosporum flavum	Australian Frangipani	Evergreen	Street
Magnolia 'Main Street'	Evergreen Magnolia	Evergreen	Street
Metrosideros 'Māori Princess'	Pohutukawa single stem	Evergreen	Street/Native
Michelia doltsopla 'Silver Cloud'	White Michelia	Evergreen	Street/Feature
Michelia maudiae	South China Michelia	Evergreen	Street/Feature
Nestegis ‘Montana’	Mountain Maire	Evergreen	Street/Native
Nestegis apetala	Coastal Maire	Evergreen	Native/Street
Olea europea 'Luccino'	Ornamental Olive	Evergreen	Street/Park
Rhopalostylis sapida	Nikau	Evergreen	Street/Native
Sophora fulvida	Kowhai (northern)	Evergreen	Street/Native
Tristaniopsis laurina	Water Gum	Evergreen	Street/Park

Note: Specific selection of street tree species must be prior approved dependant on environmental situation and project .

List is also not exhaustive. Please speak to Council for further assistance if recommending species not on this list.

List 4. Specimen Tree List – Street and Reserve Tree Species

Botanical Name	Common Name	Type	Main Use
Acer freemanii	Freemans Maple	Deciduous	Park
Acer griseum	Paperbark Maple	Deciduous	Park/Feature
Acer palmatum 'Bloodgood'	Japanese Maple	Deciduous	Park/Feature
Acer platinoidies 'Nigrum'	Norway Maple	Deciduous	Park
Acer rubrum	Red Maple	Deciduous	Park/Feature
Acer saccharum	Sugar Maple	Deciduous	Park/Feature
Aesculus carnea	Pink Horse Chestnut	Deciduous	Park
Alibizzia julibrissin 'Red Silk'	Red Persian Silk Tree	Deciduous	Park
Alnus imperialis	Cut Leaf Alder	Deciduous	Park
Alnus rubra	Red Alder	Deciduous	Park
Betula utilis 'jacquemontii'	Himalayan Birch	Deciduous	Park
Cercidiphyllum japonicum	Katsura	Deciduous	Park
Cercis canadensis	Eastern Redbud	Deciduous	Park
Cornus nutalli	Pacific Dogwood	Deciduous	Park
Davidia involucrata	Dove Tree	Deciduous	Park/Feature
Eycryphia cordifolia	Spanish Elm	Deciduous	Park
Fagus sylvatica	Copper Beech	Deciduous	Park
Fraxinus augustifolia 'Raywoodii'	Claret Ash	Deciduous	Park/Feature
Fraxinus excelsior	English Ash	Deciduous	Park
Fraxinus velutina	Arizona Ash	Deciduous	Park
Gingko biloba	Gingko (male only)	Deciduous	Park/Feature
Gleditsia tricanthos	Honey locust	Deciduous	Park
Jacaranda mimosaefolia	Jacaranda	Deciduous	Park
Liriodendron tulipfera fastigiatum	Tulip Tree	Deciduous	Park/Feature
Nyssa sylvatica	Tupelo Black Gum	Deciduous	Park/Feature
Parottia persica	Persian Ironwood	Deciduous	Park/Feature
Pistacia chinensis	Chinese Pistachio	Deciduous	Park/Feature
Prunus spp.	Fruiting Plum	Deciduous	Street/Park
Pyrus cal. 'Bradford' and others	Ornamental Pear	Deciduous	Park
Pyrus salicifolia	Willow Leaf Pear	Deciduous	Park
Pyrus spp.	Fruiting Pear	Deciduous	Park/Fruiting
Quercus coccinea	Scarlet Oak	Deciduous	Park/Feature
Quercus palustris	Pin Oak	Deciduous	Park
Sorbus aria 'Lutescens'	Silver Whitebeam	Deciduous	Park
Stewartia pseudocamellia	Japanese Stewartia	Deciduous	Park
Styrax japonca	Japanese Snowbell Tree	Deciduous	Park/Feature
Ulmus glabra horozontalis	Spreading Elm	Deciduous	Park/Feature
Ulmus hollandica	Upright Elm	Deciduous	Park/Feature
Zelkova cerrata	Japanese Zelkova	Deciduous	Park/Feature

List 4. Specimen Tree List – Street and Reserve Tree Species

Botanical Name	Common Name	Type	Main Use
Agathis australis	Kauri	Evergreen	Park/Native
Albertia magna	Natal Flame Tree	Evergreen	Park/Feature
Alnus jourullensis	Evergreen Mexican Alder	Evergreen	Park
Aloe banseii	Tree Aloe	Evergreen	Park/Feature
Backhousia citriodora	Lemon Myrtle	Evergreen	Park
Beilschmiedia tarairi	Tairere	Evergreen	Park/Native
Belischmiedia tawa	Tawa	Evergreen	Park/Native
Brachychiton acerifolia	Flame Tree	Evergreen	Park/Feature
Calodendrum capense	Cape Chestnut	Evergreen	Park/Feature
Ceratopetalum gummiferum	NSW Christmas Bush	Evergreen	Park
Citrus spp.	Orange/Lemons	Evergreen	Park/Fruiting
Corynocarpus laevigatus	Karaka	Evergreen	Park/Native
Dacrycarpus dacrydioidies	Kahikatea	Evergreen	Park/Native
Dacrydium cupressinum	Rimu	Evergreen	Park/Native
Dysoxlyum spectabile	Kohekohe	Evergreen	Park/Native
Elaeocarpus dentatus	Hinau	Evergreen	Park/Native
Eucalyptus leucoxylon rosea	Red Gum	Evergreen	Park/Feature
Gordonia axillaris	Fried Egg Tree	Evergreen	Park/Feature
Hedycarya arborea	Pigeonwood	Evergreen	Park/Native
Knightia excelsa	Rewarewa	Evergreen	Park/Native
Laurelia novae-zelandiae	Pukatea	Evergreen	Park/Native
Librocedrus plumosa	Kawaka	Evergreen	Park/Native
Meryta sinclairii	Puka	Evergreen	Park/Native
Metrosideros bartlettii	Bartletts Rata	Evergreen	Park/Native
Metrosideros 'Scarlet Pimpernel'	Pohutukawa hybrid	Evergreen	Park/Native
Myrsine salicina	Toro	Evergreen	Park/Native
Nestegis cuninghamii	Black Maire	Evergreen	Park/Native
Nestegis lanceolata	White Maire	Evergreen	Park/Native
Olea 'El Greco'	Fuiting Olive	Evergreen	Park/Fruiting
Phyllocladus trichomandiodes	Tanekaha	Evergreen	Park/Native
Planchonella costata	Tawapou	Evergreen	Park/Native
Planchonella costata	Tawapou	Evergreen	Park/Native
Podocarpus henkelii	Henkel's Yellowwood	Evergreen	Park/Native
Podocarpus totara	Totara	Evergreen	Park/Native
Podocarpus totrara 'aurea'	Golden Totara	Evergreen	Park/Native
Prumnopitys ferruginea	Miro	Evergreen	Park/Native
Prumnopitys taxifolia	Matai	Evergreen	Park/Native

List 4. Specimen Tree List – Street and Reserve Tree Species

Sophora microphylla 'fulvida'	Kowhai	Evergreen	Park/Native
Stenocarpus sinuatus	Fire-wheel Tree	Evergreen	Park/Feature
Syagrus romanzoffiana	Queen Palm	Evergreen	Park/Feature
Sygyzium maire	Swamp Maire	Evergreen	Park/Native
Tilia cordata 'Spring Glow'	Linden Lime Tree	Evergreen	Park/Feature
Vitex lucens	Puriri	Evergreen	Park/Native
Weinmannia silvicola	Towai	Evergreen	Park/Native

Note: Specific selection of reserve/park/feature tree species must be prior approved dependant on environmental situation and project .

List is also not exhaustive. Please speak to Council for further assistance if recommending species not on this list.

Appendix O Spreadsheet 1. Public Toilets – Gold and Silver Standards for New Public Conveniences

FNDC - New Public Convieniences - Standards and Specifications (from 2019)		
The following specifications have been agreed to for all new toilets and refurbishment of existing toilet facilities.		
Of importance is the need to ensure the environment within which the toilets are being established are considered.		
Toilets are being graded into 3 categories to ensure appropriateness of fixtures and fittings are considered.		
Grade	**Gold**	**Silver**
Reason	High use throughout the year / high visibility, low risk of damage / vandalism	High seasonal use, low non-seasonal use / medium risk of damage / vandalism
Specs & Features	RAK compact accessible wall hung toilet pan	RAK compact accessible wall hung toilet pan
	Zurn Dual flush valve (with Braille)	Zurn Dual flush valve (with Braille)
	RAK Bella medical wall hung basin	RAK Bella medical wall hung basin
	Aluminium door frames (for ease of wash down and reduce timber rotting)	Aluminium door frames (for ease of wash down and reduce timber rotting)
	Outward opening doors	Outward opening doors
	Hooks on back of doors	Hooks on back of doors
	External bollards with door stops and latches	External bollards with door stops and latches
	Privacy locks	Privacy locks
	Toilet roll holders (provided by RSL)	Toilet roll holders (provided by RSL)
	Grab rail	Grab rail
	Nappy change station	Nappy change station or alternatively a single timber wall mounted seat.
	Tiled walls (white with grey grout)	Tiles or gib.
	Tiled floors - anti-skid.	Tiled floors - anti-skid.
	Mirror	NA
	Soap/Hand Sanitiser dispenser (provided by RSL)	Soap/Hand Sanitiser dispenser (provided by RSL)
	Dyson Air blade hand drier (white)	Paper Towels
	Bin	Bin
Surfacing & Colours	Resene's: Stonehenge (Exterior Walls) Alabaster(Soffit's & Gables) White Wall tiles and Roof (Grey Friars)	Resene's: Stonehenge (Exterior Walls) Alabaster(Soffit's & Gables) White Wall tiles (if possible) otherwise white paint. Roof (Grey Friars)

Drawing Sheets