

# ***Engineering Standards***

***Issue 0.4 – Revised 2022***

## Document Control

Version	Comments	Author	Date Finalised	Approved by	Date Approved	Date Effective
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0.2	Completed drawing sheets attached	R Mannion	08 May 2018			
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## Document Revision

The Whangārei District Councils Engineering Standards shall be reviewed and updated annually. If you identify any issues with this document, or any areas where improvements can be made, please contact Councils *Manager – Infrastructure Development* at [ESProject@wdc.govt.nz](mailto:ESProject@wdc.govt.nz).

The ES 2022 has been significantly updated since the 2010 version. This 2022 version has been developed from that earlier document and the Hamilton City Council Infrastructure Technical Specifications together with other changes incorporating input from Council staff and practitioners.

WDC acknowledges input into the ES from the following:

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

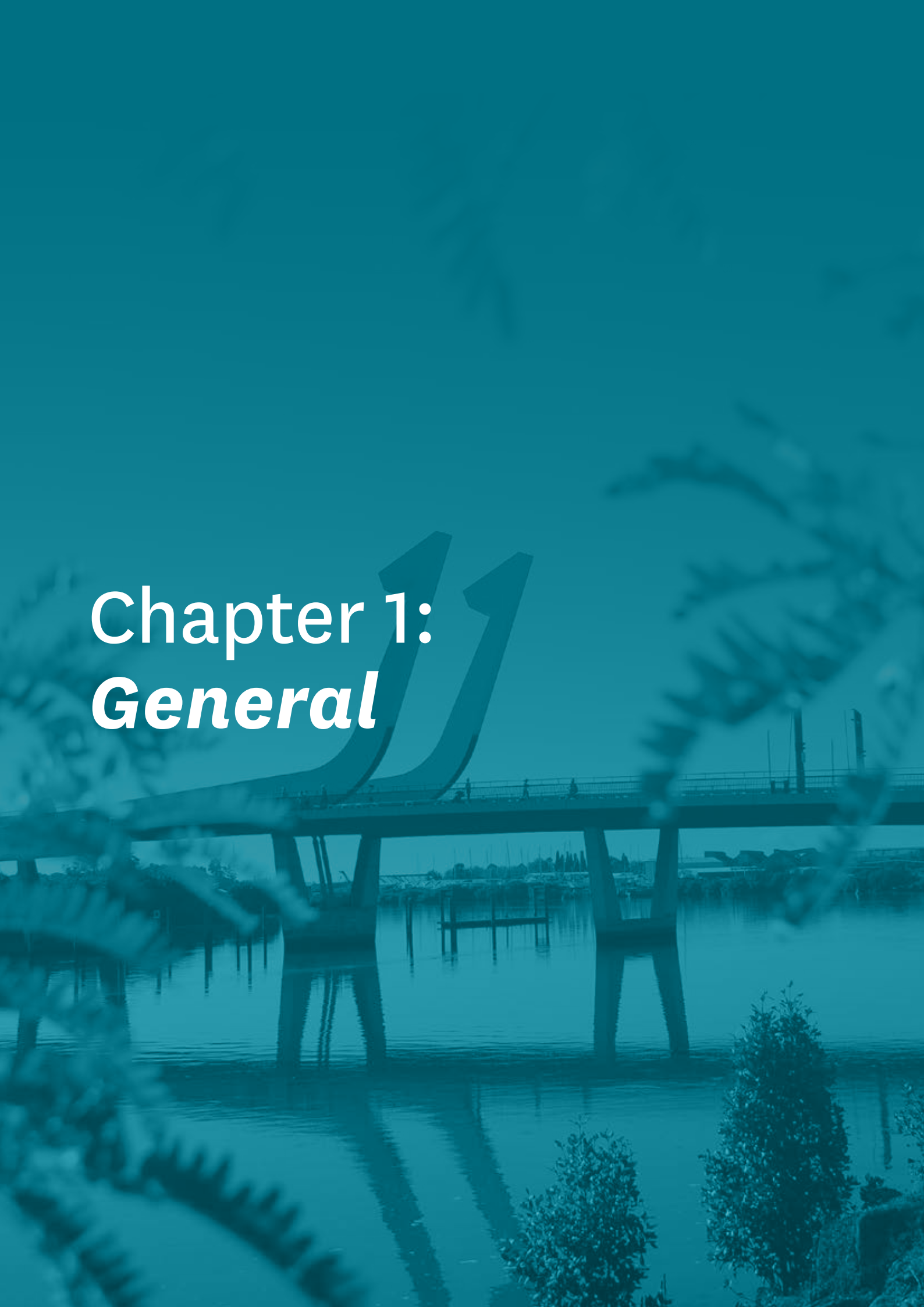
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- c. Photographs supplied by Ricardo Zucchetto

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## 1.1. Introduction

### 1.1.1. The Engineering Standards

The Whangārei District Council (WDC) Engineering Standards (ES) sets out the processes and standards that are expected to be followed and met whenever any development project is undertaken within the District. The ES recognises that WDC 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 WDC 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 WDC's minimum acceptable technical specification.

Any queries shall be directed to [ESProject@wdc.govt.nz](mailto:ESProject@wdc.govt.nz), unless otherwise specified in the ES.

### 1.1.2. Scope

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

- a. The WDC's capital and/or operational works contracts or professional services agreements,
- b. Development works regardless of whether the infrastructure will be vested in WDC or remain in private ownership, or
- c. Any other form of infrastructure development that will connect to the WDC'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 WDC acknowledges that the development of some infrastructure is not covered by the specific requirements in the ES.

Examples of such infrastructure are:

- a. Water reservoirs,
- b. Bulk watermains,
- c. Trunk sewers,
- d. Structures, (such as buildings, bridges, and retaining/palisade walls) and
- e. Traffic signals.

These works shall be undertaken on a [Specific Design](#) basis involving the WDC's engineers and 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 Roding 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](#)

[WDC Stormwater Management Bylaw 2014](#)

### 1.1.4.2 New Zealand Standards

[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 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 WDC Documents

Appendix A- Health and Safety Requirements for Procurement Documents, November 2021 *(To be provided by WDC on request)*

Contractor Health and Safety Handbook *(To be provided by WDC on request)*

Health and Safety Considerations When Going Through Procurement Processes, November 2021 *(To be provided by WDC on request)*

Policy #0074 - Uncompleted Works Bond (2011) *(To be provided by WDC on request)*

[Policy #0129 - Land Development Stabilisation 2018 and Land Development Stabilisation – Technical Design Requirements 2018](#)

[Public Utility Connection/Disconnection application form](#)

[Quality Assurance / Quality Control Manual for Vested Assets - Inspection and Handover Procedures \(2010\)](#)

[Road Assessment and Maintenance \(RAMM\) Data Collection Form](#)

[WDC Specification for Registered and Licensed Contractors for Waste & Drainage](#)

WDC Specification for Registered and Licensed Contractors for Water Supply *(To be provided by WDC on request)*

[WDC Urban Design Guidelines](#)

### 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:

- a. Building Act 2004
- b. Electricity Act 1992
- c. Health and Safety in Employment Act 1992
- d. Fencing Act 1978
- e. Land Drainage Act 1908
- f. Land Transfer Act 2017
- g. Land Transport Management Act 2003
- h. Local Government Act 1974
- i. Local Government Act 2002
- j. New Zealand Building Code
- k. Plumbers, Gasfitters and Drainlayers Act 2006

- l. Public Works Act 1981
- m. Reserves Act 1997
- n. Resource Management Act 1991
- o. Telecommunications Act 2001
- p. Government Rounding Powers Act 1989
- q. Transport Management Act 2003
- r. Water Services Act 2021
- s. Regional Plan for Northland
- t. Regional Coastal Plan for Northland
- u. NZ Coastal Policy Statement
- v. WDC Operative District Plan
- w. WDC Stormwater Management Bylaw 2014
- x. WDC Wastewater Bylaw 2014
- y. WDC Water Supply Bylaw 2012
- z. WDC Trade Waste Bylaw 2012

### **1.2.2. Relationship with the District Plan**

Where a resource consent is required under the [District Plan](#) compliance with the ES may 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	<a href="#">Annual Exceedance Probability</a> (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	Chartered Member of Engineering NZ
CMP	Stormwater Catchment Management Plan or historical Catchment Drainage Plans
CN	Curve Number
CPEng	Chartered Professional Engineer
DN	Nominal Diameter
EDA	Engineering Design Approval
ES	Engineering Standards (this document)
ETVP	Existing Tree and Vegetation Plan
EDV	Extended Detention Volume
HIRDS	High Intensity Rainfall Design System in the form of software produced by NIWA
Hu	Household Unit
HUE	Household Unit Equivalent
ID	Internal Diameter
ISO	International Standards Organisation
ITP	Inspection and Testing Plan
LDEng	Survey + Spatial 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
RAMM	Road Assessment and Maintenance Management
REA	Registered Engineering Associate
RMA	Resource Management Act
ROW	Right of Way (refer to definitions below)
RPSurv	Registered Professional Surveyor
RTS	Road and Traffic Standards (Published by the LTSA)
SCADA	Supervisory, Control and Data Acquisition
SISD	Safe Intersection Sight Distance
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
WDC	Whangārei District Council

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

Access (Low Volume)	Refer to Access (Road) below and <a href="#">Table 3-2</a> .
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 <a href="#">Table 3-2</a> . 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	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	WDC 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 <a href="#">District Plan Maps</a> .
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	The average, or expected, value of the periods between exceedances of a given rainfall total accumulated over a given duration. Refer to <a href="#">Annual Exceedance Probability</a> above.
Brownfield Development	Land area that has existing or legacy infrastructure, or land that has been contaminated.

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 <b>Sheet 2</b>
Collector Road	Roads that collect traffic from specific areas or link important roads or major traffic generators. Existing collector roads are shown on <a href="#">District Plan Maps</a> .
Commercial and Industrial Area	As defined in the <a href="#">District Plan</a> (WDC 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 WDC.
Consent Holder	See <a href="#">Developer</a>
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 WDC, 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. WDC will normally require a bond to cover any necessary works. See Section <a href="#">1.7.3.1 Defects Liability Period</a> .

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 <a href="#">ENZ Practice Note 02: Peer Review -Version 2, April 2018</a> . The review can be done internally with WDC or externally. External reviews must be accompanied by a <a href="#">PS2- Design Review</a> and associated documentation. Also see <a href="#">Peer Review</a> .
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 <a href="#">1.4.1 Developer's Representative</a>
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 WDC owned assets and/or proposed assets to be vested to WDC will require an EDA.
EDA Certificate of Completion	Any completion of works requires the developer to apply for an EDA Certificate of Completion from WDC.
Flooding	Refers to both ponding and overland flows.
Footpath	The part of a road that is laid out or constructed primarily for pedestrians. It may 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	<p>Is defined in <a href="#">B1 Acceptable Solutions and Verification Methods</a>, and in <a href="#">NZS 4229:2013</a>: 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:</p> <p>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</p> <p>Expansive soils being those that have a liquid limit of more than 50% when tested in accordance with <a href="#">NZS 4402</a> Test 2.2 and a linear shrinkage of more than 15% when tested from the liquid limit in accordance with <a href="#">NZS 4402</a> Test 2.6, and</p> <p>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’</p>
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	Development 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	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	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.
Infill Development	Development within a previously developed area.
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 <a href="#">Public Works Act 1981</a> .
	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 <a href="#">WDC Specification for Registered and Licensed Contractors for Water Supply</a> See <a href="#">Public Utility Connection/ Disconnection application form</a> for a list of Licenced contractors. (see also <a href="#">Registered Contractor</a> )
Licensed Contractor (Wastewater & Stormwater)	As defined in <a href="#">WDC Specification for Registered and Licensed Contractors for Waste &amp; Drainage Department</a> See <a href="#">Public Utility Connection/ Disconnection application form</a> for a list of Licenced contractors. (see also <a href="#">Registered Contractor</a> ).
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 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 (for the critical duration), $A$ = 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 <a href="#">Resource Management Act 1991</a> .
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 <b>Sheet 2</b> and <b>Sheet 3</b> .
Peak Flow (Q)	The maximum rate of surface flow at a point in a catchment for a given period of runoff and rainfall. It could be determined using various hydrological modelling software or by <a href="#">Modified Rational Method</a> .



Peer Review	An overall review of a design or report by a suitably qualified and experienced professional. Refer to <a href="#">ENZ Practice Note 02: Peer Review - Version 2, April 2018</a> . Also see <a href="#">Design/Technical Review</a> .
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 WDC or controlled by easements, <a href="#">Local Government Act</a> and the <a href="#">WDC Stormwater Management Bylaw</a> .
Principal Watermains	All water reticulation 100 mm inside diameter or greater, including associated valves.
Private Road	Any roadway, place or arcade laid out within WDC 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 <a href="#">District Plan</a> 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	<p>Public stormwater network includes: Any stormwater pipe, channel, watercourse, land drainage or treatment facility, vested in or under the control of WDC.</p> <p>Any stormwater drain, drain, land drainage work or treatment facility declared by WDC to be a public drain under Section 462 of the <a href="#">Local Government Act 1974</a>.</p> <p>The stormwater assets of other public entities such as Transport, KiwiRail, 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.</p>
Receiving Environment	A water body, river, stream, lake or sea where a catchment runoff discharges.
Registered Contractor (Water Supply)	As defined in <a href="#">WDC Specification for Registered and Licensed Contractors for Water Supply</a> . See the <a href="#">Public Utility Connection/ Disconnection application form</a> for a list of Registered Contractors (see also <a href="#">Licensed Contractor</a> ).
Registered Contractor (Wastewater & Stormwater)	As defined in <a href="#">WDC Specification for Registered and Licensed Contractors for Waste &amp; Drainage</a> See the <a href="#">Public Utility Connection/ Disconnection application form</a> for a list of Registered Contractors (see also <a href="#">Licensed Contractor</a> ).
Regulatory Review	As defined in <a href="#">ENZ Practice Note 02: Peer Review -Version 2, April 2018</a> .
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	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 <a href="#">Government Roading Powers Act 1989</a> , any road as defined in Section 315(1) of the <a href="#">Local Government Act 1974</a> , 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 <a href="#">Table 4-3</a> .
Rural Area	As defined in the <a href="#">District Plan</a> .
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 ( <a href="#">WorkSafe NZ Health and Safety by Design: An Introduction, August 2018</a> ).
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 <a href="#">Local Government Act 1974</a> .
Specific Design	<p>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.</p> <p>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 <a href="#">District Plan</a>. The design shall comply with New Zealand Standard specifications and/or other nationally recognised procedures and systems.</p> <p>All specific designs must be accompanied by a <a href="#">PS1 Design</a> and a <a href="#">PS4 Construction Review</a>. WDC may require a <a href="#">PS2 Design Review</a> to be provided.</p>

Standard Design Vehicle	See <b>Sheet 26</b> for details
Stable Ground	Land that in the opinion of a suitably qualified and experienced <a href="#">Geo-Professional</a> 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 <a href="#">Attenuation</a> ).
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	WDC requires that the engineering, including other technical aspects of infrastructure, environmental land development projects that need an engineering design approval and a consent from WDC shall be undertaken, supervised and certified by a SQEP who is working within their level of competency. Generally the required level of competency and qualifications corresponds with the scale and type of the project and the overall risk (Refer to <a href="#">Section 1.5.1.3 Risk Based Assessment Framework</a> ).
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 <a href="#">Resource Management Act 1991</a> .
Swale	A planted or grassed channel that conveys stormwater, generally at low, non-eroding velocities and provides water quality treatment and amenity.

Transport Corridor	For the purpose of the ES, includes all <a href="#">Road or Street</a> as defined in this table, 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 <a href="#">District Plan</a> .
Vehicle Crossing	A trafficable pavement created over a public road corridor in order to connect WDC'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

WDC 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 WDC and the information submission requirements for Engineering Design Approval (EDA).

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

### 1.4.1. Developer's Representative

The Developer shall nominate SQEP, in accordance with Section [1.5.1.3 Risk Based Assessment Framework](#), to be the Developer's Representative. This shall be submitted in writing to WDC.

Should the appointed SQEP change during the various phases of the work, WDC 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 WDC correspondence relating to the conditions of consent shall be with the nominated SQEP.

### **1.4.2. Cost of the Work and WDC Contributions**

The Developer shall pay all development contributions and other fees and charges set by WDC.

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

In certain circumstances WDC 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 WDC 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 WDC.

### **1.4.3. Insurance**

Where work is carried out on a public road or reserve, on a WDC 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 WDC asset is low, WDC 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.
  - i. 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](#).
- c. 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.

#### **1.4.4. Quality Assurance and Quality Control**

The [WDC QA/QC Manual 2010](#) sets out the minimum Quality Assurance/Quality Control requirements for developments incorporating assets that will be vested to WDC 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 WDC's approved Inspection and Testing Plan (ITP) 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 WDC shall be accompanied by a Design Statement (see Section [1.5.3.3.5 Design Statements and Engineering Drawings](#)).

##### **1.5.1.2 Alternative Designs**

WDC 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 WDC.

Where a designer identifies a product that is not currently approved (refer to WDC's Approved Materials Lists), an application shall be made to WDC 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 WDC's relevant management team in accordance with their delegations, policies and performance 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 in order 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 WDC 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 WDC requires that the engineering, including other technical aspects of infrastructure, environmental land development projects that need an engineering design and a consent from WDC, 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 WDC 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, LDEng, 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, LDEng, RPSurv, CMEngNZ, CMEngNZ (PEngGeol), CMEngNZ (Engineering Technologist).

- d. **Tier 4:** Work can be certified by a Chartered Professional Engineer (CPEng) accredited with the Chartered Professional Engineer 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 WDC for clarification.

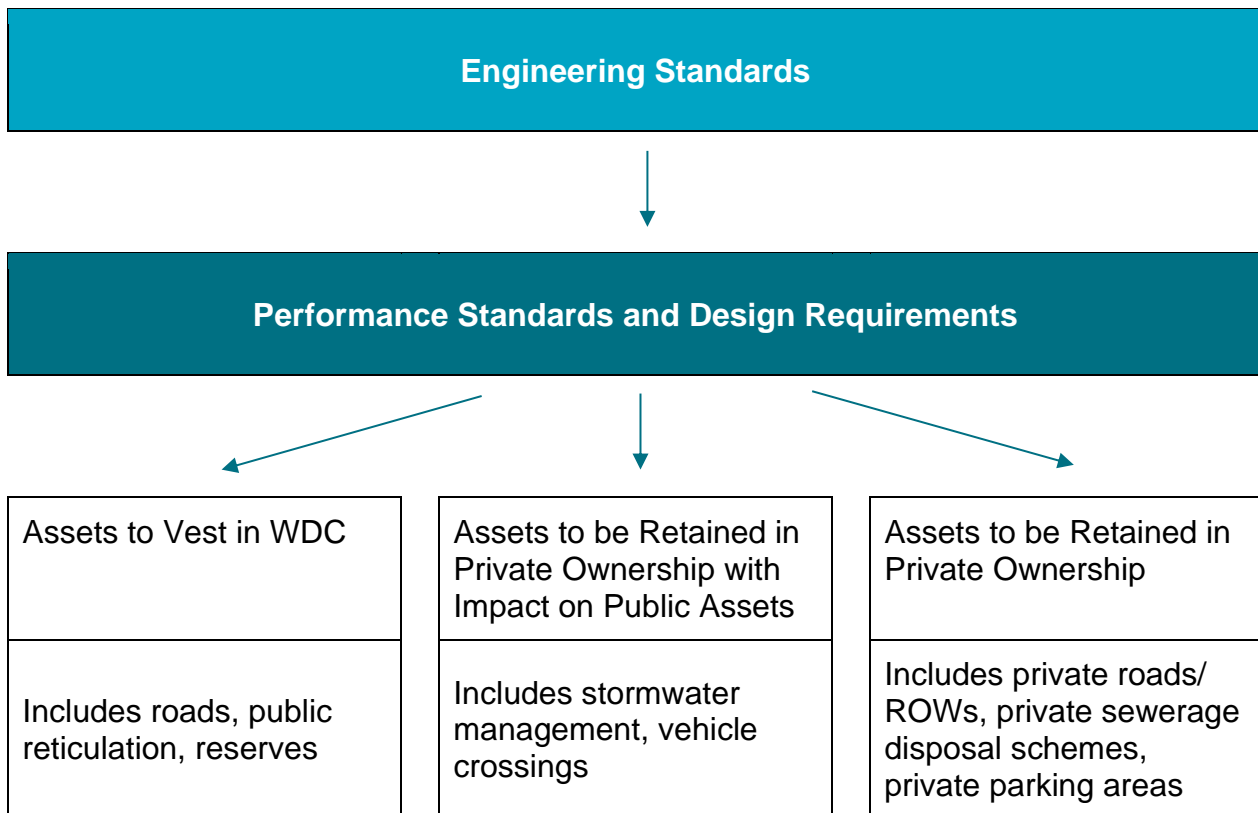
Regardless of what Tier the SQEP may be, all work and supporting documentation must be in accordance with the ES or follow the [Specific Design](#) requirements for alternative methods. Work requiring [Specific Design](#) shall be accompanied by detailed calculations, analysis, and reports and submitted to WDC 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 WDCs and SQEP involvement in various aspects of development.

**Figure 1-1 Performance Standards and Design Requirements**



- 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 [WDC QA/QC Manual 2010](#).
- Relevant Producer Statement ([PS4 Construction Review](#)), documentation and as-built information provided.
- Maintenance bond secured (where necessary).
- Asset vests to WDC

- 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 WDC included in plan approval.
- Inspections undertaken in accordance with Schedule.
- Final inspection undertaken by WDC 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](#)).
- WDC 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 WDC for clarification.*

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

	Complexity of Site Suitability	
	<i>Low risk or not identified in a hazard zone</i>	<i>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)</i>
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 <i>(This includes all elements listed in Section <a href="#">2.4.1 Geotechnical Design Report</a> except for the Erosion and Sediment Control Plan, see SQEP requirements below)</i>	Tier 3* (CMEngNZ, CMEngNZ (PEngGeol), CMEngNZ (Engineering Technologist) or REA)	Tier 4 Geo-Professional (including PEngGeol)

	Complexity of Site Suitability	
	<i>Low risk or not identified in a hazard zone</i>	<i>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)</i>
Erosion and Sediment Control Plan	Tier 1	Tier 4*
Geotechnical Completion Report	Tier 4 Geo-Professional (including PEngGeol)	Tier 4 Geo-Professional (including PEngGeol)
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 <a href="#">Users' Guide National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health 2012</a> 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			
	<i>Low complexity AND small subdivisions (Typically 0-2 Dwellings)</i>	<i>Low complexity AND small to medium developments (Typically 3-8 Dwellings)</i>	<i>Low complexity AND medium to large developments (Typically 9-29 Dwellings)</i>	<i>Medium to high complexity AND/OR large developments (Typically 30+ Dwellings)</i>
All Design & Access Statements as per Section <a href="#">3.2.2.2 Design and Access Statements</a> for vested roads.	Tier 1	Tier 1	Tier 2	Tier 4
Integrated Transportation Assessment As required under the District Plan Rules - Section TRA-15	Tier 1			
Roadway Design for Private Accessways: <ul style="list-style-type: none"> <li>• Geometric Design</li> <li>• Horizontal &amp; Vertical Alignment</li> <li>• Cut/Fill Batters</li> <li>• Footpaths</li> <li>• Accessible Crossings</li> <li>• Cycle Facilities</li> <li>• Crossfall &amp; Superelevation</li> </ul>	Tier 1	Tier 1	Tier 2	Tier 4
Roadway Design for Roads to Vest based on District Plan Table TRA 13 - Transport Network Hierarchy:	Tier 2 (Only if low volume and access roads)	Tier 3 (Only if Secondary Collector)	Tier 4 (For Primary Collector, Arterial,	Tier 4 (For Primary Collector, Arterial,

	Complexity of the Development			
	<i>Low complexity AND small subdivisions (Typically 0-2 Dwellings)</i>	<i>Low complexity AND small to medium developments (Typically 3-8 Dwellings)</i>	<i>Low complexity AND medium to large developments (Typically 9-29 Dwellings)</i>	<i>Medium to high complexity AND/OR large developments (Typically 30+ Dwellings)</i>
<ul style="list-style-type: none"> <li>• Geometric Design</li> <li>• Horizontal &amp; Vertical Alignment</li> <li>• Cut/Fill Batters</li> <li>• Footpaths</li> <li>• Accessible Crossings</li> <li>• Cycle Facilities</li> <li>• Crossfall &amp; Superelevation</li> </ul>			regional & National Roads)	regional & National Roads)
<p>Intersection Design - Based on District Plan Table TRA 13 - Transport Network Hierarchy</p> <p>For the intersection of two different classifications of roadway, qualification requirements will be based on the higher of the two roadway classifications.</p>	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			

	Complexity of the Development			
	<i>Low complexity AND small subdivisions (Typically 0-2 Dwellings)</i>	<i>Low complexity AND small to medium developments (Typically 3-8 Dwellings)</i>	<i>Low complexity AND medium to large developments (Typically 9-29 Dwellings)</i>	<i>Medium to high complexity AND/OR large developments (Typically 30+ Dwellings)</i>
Traffic Signal Design	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		
	<i>Low complexity AND small subdivisions (Typically 0-2 Dwellings)</i>	<i>Low complexity AND medium to large developments (Typically 3-10 Dwellings)</i>	<i>Medium to high complexity AND/OR large developments (Typically &gt;10 Dwellings)</i>
Stormwater Management Plan	Tier 2*	Tier 3*	Tier 4
Stormwater Mitigation Analysis	Tier 2*	Tier 3*	Tier 4

	Complexity of the Development		
	<i>Low complexity AND small subdivisions (Typically 0-2 Dwellings)</i>	<i>Low complexity AND medium to large developments (Typically 3-10 Dwellings)</i>	<i>Medium to high complexity AND/OR large developments (Typically &gt;10 Dwellings)</i>
<p>Stormwater Management Device Design:</p> <ul style="list-style-type: none"> <li>• Rainwater Re-use and/or Attenuation Tanks</li> <li>• Vegetated Swales</li> <li>• Bioretention Devices (including raingardens)</li> <li>• Pervious Paving (including porous or permeable paving)</li> <li>• Infiltration devices</li> </ul>	Tier 3*		
Design details of ponds and constructed wetlands, including detention ponds, box culverts and major circular culverts sized ≥600 mm.	Tier 4		
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 <a href="#">Table 1-1</a>		



	Complexity of the Development		
	<i>Low complexity AND small subdivisions (Typically 0-2 Dwellings)</i>	<i>Low complexity AND medium to large developments (Typically 3-10 Dwellings)</i>	<i>Medium to high complexity AND/OR large developments (Typically &gt;10 Dwellings)</i>
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			
	<i>0-6 Dwellings AND if extension is of the existing water or wastewater network.</i>	<i>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.</i>	<i>&gt;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.</i>	<i>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)).</i>
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)	Tier 2 (If no specialist input is required, such as structural design that cannot be taken directly from WDC ES standard)	Tier 3 (There may be simple structural designs required for network components such as narrow stream)	Tier 4

	Complexity of the Development			
	<i>0-6 Dwellings AND if extension is of the existing water or wastewater network.</i>	<i>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.</i>	<i>&gt;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.</i>	<i>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)).</i>
	without any deviation or amendment to the standard ES design drawing solutions. The EDA application must show the intended extension in detail)	design details i.e. requires <u>Specific Design.</u> )	crossings or slightly deeper services that can be deduced from design catalogues.)	
Gravity reticulation requiring pipework larger than 150mm ID	Tier 4			
Sewer pump stations and rising mains	Tier 4			
Suitability report for on-site disposal (using	Tier 2	Tier 3*	Tier 3*	Tier 4

	Complexity of the Development			
	<i>0-6 Dwellings AND if extension is of the existing water or wastewater network.</i>	<i>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.</i>	<i>&gt;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.</i>	<i>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)).</i>
<a href="#">Appendix B ES-SEW1</a> or similar)				
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			
	<i>0-6 Dwellings AND if extension is of the existing water or wastewater network.</i>	<i>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.</i>	<i>&gt;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.</i>	<i>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)).</i>
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 WDC undertakes review of information submitted to the WDC. 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.

WDC at its own discretion may arrange for external regulatory reviews as part of the approval process where WDC 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 WDC, 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 WDC 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 WDC 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 WDC 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.
- g. Traffic assessment. This may only be an assessment of entrance sight lines but may involve a full report from a SQEP, depending on the proposal and the type of road accessing.
- h. In WDC reticulated areas, an assessment that shows that the existing infrastructure has sufficient capacity to support the development (wastewater, 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 Plans](#).
- 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 firefighting 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](#) 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 manoeuvring, 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 Design](#) are proposed.

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

### **1.5.3. Engineering Design Approval**

The Developer shall provide sufficient information in support of their proposal and engage SQEP who will liaise with WDC 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 WDC management teams on all infrastructure design and landscaping proposals at an early stage of the development is encouraged.*

### 1.5.3.2 Information requirements

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 F Drawing Standards](#).
- b. Completion of the supporting information [Appendix I Checklist for Supporting Information](#).
- c. Drawings submitted for approval shall include the WDC'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 WDC 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 WDC.

#### 1.5.3.3.5. Design Statements and Engineering Drawings

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 WDC 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 kept on site at all times during construction of the works.

The WDC 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 WDC 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, WDC 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 EDA*

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

The approved drawings may only be amended after consultation with the WDC.

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

Where changes to the approved EDA documentation are proposed, the Developer shall not proceed until WDC approves the variation.

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

**Table 1-5: Engineering Drawing Requirements**

Type	Plan View	Long Sections	Other
Site Locality	<ul style="list-style-type: none"> <li>• Major street names</li> <li>• Legal descriptions of the site and adjacent properties</li> <li>• Overall extent of the works</li> <li>• Relationship with works or services adjacent to the site</li> <li>• Clear identification of existing works that will be modified, removed or abandoned</li> <li>• Proposed house sites and access routes</li> </ul>		<ul style="list-style-type: none"> <li>• Other major features that assist locating the site</li> <li>• Effluent disposal sites (if applicable).</li> <li>• Location of services in berms and accessways in relation to other services and site boundaries</li> </ul>
Geotechnical	<ul style="list-style-type: none"> <li>• Positions of tests</li> <li>• Areas of noted instability (slip scarps, unstable ground etc) on or adjacent to the site</li> <li>• Proposed works required to mitigate the effects of geotechnical issues</li> </ul>		

Type	Plan View	Long Sections	Other
Earthworks Scheme Plan	<ul style="list-style-type: none"><li>• Original contours</li><li>• Final contours</li><li>• Overland drainage pattern</li><li>• Cuts and fills</li><li>• Batter slopes</li><li>• Erosion and Sediment Control proposals</li></ul>		

Type	Plan View	Long Sections	Other
Transportation	<ul style="list-style-type: none"> <li>• Horizontal alignment of kerb and channel including traffic facilities</li> <li>• Horizontal alignment of footpaths</li> <li>• Horizontal alignment of cycleways</li> <li>• Location of vehicle crossings where known</li> <li>• Parking arrangements</li> <li>• Locations of ducts and other below ground features</li> <li>• Location, type and colour of streetlight columns (may be separate plan)</li> <li>• Traffic signal details</li> <li>• Location of landscaping areas and street trees; landscape plans to include underground services and street lighting</li> <li>• Location of all street furniture</li> <li>• Location of any reserves</li> <li>• Location and type of any stormwater treatment and detention device</li> </ul>	<ul style="list-style-type: none"> <li>• Existing ground levels at minimum of 15 m intervals</li> <li>• Proposed final centre line levels</li> <li>• Cuts and fills</li> <li>• Grades</li> <li>• Vertical curve information</li> <li>• Location of catch pits</li> <li>• Location of intersecting roads</li> </ul>	<p>Cross Sections</p> <ul style="list-style-type: none"> <li>• Proposed road</li> <li>• Existing ground contour extending at least 3.0 m into adjacent land</li> </ul> <p>Road Marking and Signage</p> <ul style="list-style-type: none"> <li>• Location and types of signage</li> <li>• Location and alignment of all road markings</li> </ul> <p>Construction Details, including</p> <ul style="list-style-type: none"> <li>• Road pavements</li> <li>• Kerb &amp; Channel, side drainage</li> <li>• Footpaths, cycleways</li> <li>• Vehicle access crossings</li> <li>• Proposed planting</li> </ul> <p>Details of information signs shall include the full layout, including sign text and colours (all road markings and signs to comply with <a href="#">Waka Kotahi TCD Manual</a> and/or <a href="#">MOTSAM</a> as applicable)</p>

<p>Stormwater</p>	<ul style="list-style-type: none"> <li>• Horizontal alignment of all pipelines relative to property boundaries or kerb lines as appropriate and tie-in to existing services</li> <li>• Location of all pipes and nodes (manholes, inlets, outlets, catchpits, etc.)</li> <li>• Location of all stormwater treatment devices</li> <li>• Location of any watercourse</li> <li>• Position of all property connections relative to property boundaries and the depth at the property boundary</li> <li>• Secondary network to 1% AEP (+ CC 20%) with easements where required</li> <li>• 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.)</li> <li>• 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</li> </ul>	<ul style="list-style-type: none"> <li>• Existing ground levels</li> <li>• Proposed ground levels</li> <li>• Pipe material, size, class, length, depth, inverts and grade</li> <li>• Location and depth of existing and proposed pipelines, cables and ducts crossing the alignment</li> <li>• Invert levels of all pipelines connecting to a manhole</li> <li>• Inlet, outlet and hydraulic information for all treatment and detention devices</li> </ul>	<p>Construction Details, including</p> <ul style="list-style-type: none"> <li>• Open drains and watercourses</li> <li>• Inlet/outlet structures, including scour protection, protective screens, etc</li> <li>• Stormwater treatment and/or attenuation devices</li> </ul>
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Type	Plan View	Long Sections	Other
Wastewater	<ul style="list-style-type: none"> <li>• Horizontal alignment of all pipelines relative to property boundaries or kerb lines and tie-in to existing services</li> <li>• Location of all manholes and other access structures</li> <li>• Location of all structures (including pump stations, rising mains, air valves, odour control facilities etc)</li> <li>• Position of all property connections relative to property boundaries</li> <li>• Show finished land level contours (not greater than 1.0 m intervals – include RL labels on contours)</li> </ul>	<ul style="list-style-type: none"> <li>• Existing ground levels</li> <li>• Proposed ground levels</li> <li>• Pipe material, size, class, length, depth, inverts and grade</li> <li>• Location and depth of existing and proposed pipelines, cables and ducts crossing the alignment</li> <li>• Invert levels of all pipelines connecting to a manhole</li> </ul>	<ul style="list-style-type: none"> <li>• Pump Station (including Rising Main and Overflow)</li> <li>• Show all relevant details to enable the design to be audited and the structure constructed</li> <li>• Construction drawing of pump station structure</li> <li>• Rising main plan and long section</li> <li>• Water and electrical services to the pump station</li> <li>• Show the provision for pump station overflow in both plan and elevation views</li> <li>• Make and model of all pumps, valves and associated pump station equipment</li> <li>• Pipeline details including thrust blocks, special connections, pipeline bridges etc.</li> </ul>

Type	Plan View	Long Sections	Other
Water	<ul style="list-style-type: none"> <li>• Horizontal alignment of all pipelines relative to face of kerb (or boundary as appropriate) and tie-in to existing services</li> <li>• Location of all valves, bends and tees</li> <li>• Location of all hydrants and building sites to be provided with fire protection</li> <li>• Pipe material, size, length and class</li> <li>• Position of all property connections relative to property boundaries and the depth at the property boundary</li> <li>• Position of meters and boxes, backflow devices, etc</li> <li>• Location of all flushing valves</li> </ul>	<ul style="list-style-type: none"> <li>• Existing and proposed pipelines, cables and ducts crossing the alignment</li> <li>• 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.</li> </ul>	<p>Construction Details</p> <ul style="list-style-type: none"> <li>• Details of connection into existing reticulation and other special connections</li> <li>• Special details, including pump stations, reservoirs</li> <li>• Pipeline details including thrust blocks, pipeline bridges etc</li> <li>• The make and model of all pumps, valves and other equipment</li> <li>• Nominal static pressure at the connection point and at the lowest point in the works, design pressure and maximum design pressure.</li> </ul>
Landscaping	Landscaping plan with plant locations for reserve areas, including stormwater and recreational reserves.		



Type	Plan View	Long Sections	Other
Staging	<p>Where the development is likely to be constructed in stages:</p> <ul style="list-style-type: none"> <li>a plan showing the pattern and chronology of the land development</li> </ul> <p>The staging shall have been included as part of the resource consent application process and in the consent conditions.</p>		
Utility Services	<p>The depth and location of existing and proposed electricity and telecommunications, (including gas services where applicable).</p>		

**Table 1-6: Supporting Documentation for Approval**

Type	Prior to Construction Commencing	During Construction	After Construction
Geotechnical Information	<ul style="list-style-type: none"> <li>Geotechnical Design Report</li> </ul>	<ul style="list-style-type: none"> <li>Site Supervision</li> </ul>	<ul style="list-style-type: none"> <li>Geotechnical Completion Report</li> <li>Site Contamination Validation Report</li> <li>Statement of Professional Opinion</li> <li>Final contour plan identifying areas of fill</li> </ul>

Type	Prior to Construction Commencing	During Construction	After Construction
Transportation	<ul style="list-style-type: none"> <li>• Road pavement design calculations including results of preliminary soil testing.</li> <li>• Approval for sub-soil drainage discharge (if appropriate)</li> <li>• Signal Plans including design, traffic modelling and peer review</li> <li>• Pre-Construction Road Safety Audit (RSA) or RSA Exemption</li> </ul>	<ul style="list-style-type: none"> <li>• Site Supervision</li> </ul>	<ul style="list-style-type: none"> <li>• Producer Statement</li> <li>• As-built information</li> <li>• Post Construction RSA</li> </ul>
Stormwater	<ul style="list-style-type: none"> <li>• Detailed catchment runoff calculations including each sub-catchment input factors used in the calculations</li> <li>• Detailed pipeline flow capacity analysis.</li> <li>• For stormwater treatment and detention devices, detailed analysis demonstrating the design performance in respect of stormwater quantity and quality as appropriate</li> <li>• Proposed operations and maintenance manuals for stormwater treatment and detention devices</li> <li>• Proposed landscaping plan for stormwater treatment and detention devices, landscape plans to include any services and access requirements for future maintenance</li> </ul>	<ul style="list-style-type: none"> <li>• Site Supervision</li> </ul>	<ul style="list-style-type: none"> <li>• CCTV Inspection and Report</li> <li>• Final operations and maintenance manuals for stormwater treatment and detention devices</li> <li>• As-Built Plans</li> </ul>

Type	Prior to Construction Commencing	During Construction	After Construction
Wastewater	<ul style="list-style-type: none"> <li>Wastewater flow estimates supported by the estimates of population equivalents for each catchment together with catchment boundaries and catchment areas</li> <li>Pipe flow calculations showing pipe capacity and flow velocity for average dry weather flow, peak daily flow and peak wet weather flow</li> <li>Pump station calculations justifying the selection of wet well size, pump selection and rising main hydraulics.</li> </ul>	<ul style="list-style-type: none"> <li>Site Supervision</li> </ul>	<ul style="list-style-type: none"> <li>CCTV Inspection and Report</li> <li>As-Built Plans</li> </ul>
Water	<ul style="list-style-type: none"> <li>Fire flow calculation</li> </ul>	<ul style="list-style-type: none"> <li>Site Supervision</li> </ul>	<ul style="list-style-type: none"> <li>As-Built Plans</li> </ul>
Landscaping	<ul style="list-style-type: none"> <li>Statement of design intent and design objectives</li> <li>Planting schedule</li> <li>Existing tree and vegetation plan</li> <li>Maintenance schedule for weeding and replacement planting during Defects Liability Period</li> </ul>	<ul style="list-style-type: none"> <li>Site Supervision</li> </ul>	<ul style="list-style-type: none"> <li>As-Built Plans</li> </ul>

## 1.6. Construction

### 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 WDC 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 WDC contribution toward the cost of work, or other specific approval has been approved in writing.
- e. A Construction Management Plan has been approved by WDC in accordance with Section [1.6.2 Construction Management Plan](#).
- f. An Inspection & Testing Plan has been approved by WDC in accordance with Section [1.6.3 Inspection and Testing Plan \(ITP\)](#).

The Developer's Representative shall give WDC 24 hours' notice of the intention to commence construction work, and advise WDC 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 approval of EDA will be at the Developer's risk. The WDC 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-start meeting may be required (see Section [1.6.4 Pre – Start Meeting](#)).

### 1.6.2. Construction Management Plan

The Developer's Representative shall submit a Construction Management Plan, where required by the resource consent or EDA conditions, and receive written WDC approval prior to commencing work on site. The plan shall include the following information, (as 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, and
- j. Confirmation of all insurance.

### **1.6.3. Inspection and Testing Plan (ITP)**

The Developer's Representative and SQEP are to prepare an 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 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 WDC prior to the commencement of work on site.

### **1.6.4. Pre – Start Meeting**

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

Where construction proceeds in stages, a separate pre-start 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 WDC's construction requirements.
- b. The process for monitoring compliance and auditing (ITP).
- 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.

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

If the pre-start 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 WDC may require a design amendment. Design amendments shall be in accordance with Section [1.5.3.3.8 Changes to Approved EDA](#).

## 1.6.5. Site Works, Site Inspections and Approvals

### 1.6.5.1 Health and Safety

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

Where WDC is not the Principal (e.g. work is carried out by a Developer), all contractors working on public land and/or on WDC assets are required to meet the following requirements:

- a. Comply with WDC's [Appendix A- Health and Safety Requirements for Procurement Documents](#),
- b. Ensure they can meet the minimum requirements outlined in the current [WDC Contractor Health and Safety Handbook](#),
- c. Comply with Appendix 1, where applicable, of WDC's [Health and Safety Considerations When Going Through Procurement Processes](#),
- 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 WDC assets or on any public land shall proceed before the above has been complied with and approved by WDC. WDC may refuse to allow a contractor to carry out work on WDC assets or on public land where in the opinion of WDC, 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 WDC Road Reserves (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 WDC land to undertake works. Separate approval is required from WDC 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 WDC.

### 1.6.5.3 Registered Contractors and Licensed Contractors

For some infrastructure services, WDC maintains a list of contractors that are permitted to construct or work on WDC assets, or assets that will be vested to the WDC. 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 WDC 24 hours prior to requiring site inspections. WDC 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 (stripped ground and completed earthworks to be inspected),
- 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: WDC may inspect any incomplete WDC 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 WDC assets, may be inspected/tested by a SQEP. WDC is still to be informed 24 hours in advance of when such inspections/tests taking place so that a WDC officer may observe if so desired.

All works that impact on WDC assets, may require WDC representative to be present when inspections/testing take place. WDC 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 WDC, 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 WDC upon completion of the work shall be undertaken in accordance the [WDC QA/QC Manual 2010](#) 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 watermains,
- l. Hydrant flow testing,
- m. Benkelman Beam tests, and
- n. Other testing as directed by WDC.

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

If the work does not meet the standard when inspected by WDC, 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. In order 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 WDC 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 in writing from WDC and shall be clearly marked with a detection tape that identifies the service.

**Table 1-7: Pipe Colours**

Pipe Use	Colour
Wastewater - Gravity	White
Wastewater - Pressure	Black with white stripe
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 WDC owned services, the Developer shall arrange for the connection to be made. The connection shall only be made by a [Licensed Contractor \(Water\)](#) or [Licensed Contractor \(Wastewater and Stormwater\)](#).

A WDC 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 WDC.

### 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 dripline areas,
- b. Flat steel tracked machines shall only be permitted to run on sealed road carriageways with prior WDC 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 WDC that they have made the proper reinstatement. The WDC 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, WDC 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 WDC 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, WDC 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 WDC 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 WDC.

*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 WDC on application for 224(c) or works acceptance.

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

Auditing requirements for types of works are covered in the various sections. WDC 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 WDC 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, WDC 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 to 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, WDC will accept Developers/Contractors/Agents own Quality Assurance forms that convey similar information.

### **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](#) 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 Whangārei 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 WDC 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 WDC 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 WDC 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. The WDC 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 an EDA Certificate of Completion upon completing the works, and the 224(c) Certificate if related to a subdivision consent, only when satisfied that 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 WDC 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 C 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 WDC 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 WDC. 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 WDC 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 [WDC QA/QC Manual 2010](#)) shall be provided on completion of construction work.

### **1.7.2.1 Resource Consents**

Asset Information Schedules, As-Built Plans and Operation and Maintenance Manuals shall be provided and accepted by WDC 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 three months prior to a request to issue the Section 224 certificate, WDC 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 F 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-Built.
- 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 H Asset Attributes](#) and the example in [Appendix G 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:

- a. Be adequately labelled and dated,
- b. Reference the WDC's approved consents (EDA sub-division or contract number),
- c. Include the name and contact details of the principal contractor that completed the work,
- d. Show what has actually been constructed, including all approved changes and items removed or decommissioned,
- e. Label roads with WDC approved road names, and parcels with legal descriptions and house numbers (where available), and
- f. Have accurate position and depth of all existing services exposed during construction works.

Refer to [Appendix G 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 F Drawing Standards](#), to the following accuracy:

- a. Levels (z ordinate) accurate to  $\pm 10\text{mm}$ .
- b. Locations (x,y co-ordinates) accurate to  $\pm 100\text{mm}$ .

### 1.7.2.3 RAMM Data Requirements

RAMM 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 WDC. RAMM data requirements are as set out in WDC RAMM data forms (Refer to [WDC Road Assessment and Maintenance \(RAMM\) Data Collection Form](#)).

#### 1.7.2.3.1. Resource Consents

The WDC assess RAMM data capture for WDC 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., and

*Note that culverts with a watercourse area greater than 3.4 m<sup>2</sup> 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 WDC, 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 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 Metadata Standards, August 2017](#) 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 20 m centres and the perimeter, sufficient that the area can be drawn in GIS,
- f. Public (WDC owned) or private, and
- g. Asset specific information as per [Appendix H Asset Attributes](#).

See example schedules in [Appendix G Example As-Built Drawings](#).

## 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 WDC 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 an EDA Certificate of Completion is issued, whichever is the latter, and shall be for a minimum period of 12 months for all assets to be vested in the WDC.

*Note: Resource consents and/or EDA's related to landscape planting may require a Defect Liability Period and associated bond for a period of up to 24 months, where WDC 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 WDC 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 WDC notice or within such other reasonable time agreed by the WDC.

If the Developer fails to carry out any work in the specified time frame, WDC 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 WDC from the Developer. As soon as practicable after the completion of the work WDC shall notify the Developer of the work undertaken and the cost.

The taking of any action by WDC 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 relevant WDC policies shall be consulted to establish the full conditions for the bond. The following WDC Bond requirements shall also be met, where applicable:

- a. The bond shall be an agreed cash deposit, or at the WDCs discretion where sound reasons for not providing a cash bond are demonstrated, a bank bond from a New Zealand based Trading Bank,
- b. WDC will pay no interest on bond monies,
- c. The bond amount shall be a minimum of 150% of the estimated value of the bonded works, including GST, if any, or as otherwise approved by WDC,
- d. Defects/maintenance bonds shall be a minimum of 5% of the estimated value of the bonded work, including GST, if any; or as otherwise approved by WDC. 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 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. WDC 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 WDC following completion of the works, and payment of all associated fees,
- h. Bond payments and refunds shall include GST, where applicable, in the bond value approved by WDC.

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

### **1.7.3.3 Uncompleted Works Bond**

All requests for Uncompleted Works Bonds will be considered against the [WDC Policy #0074 - Uncompleted Works Bond](#).

### **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 WDC.

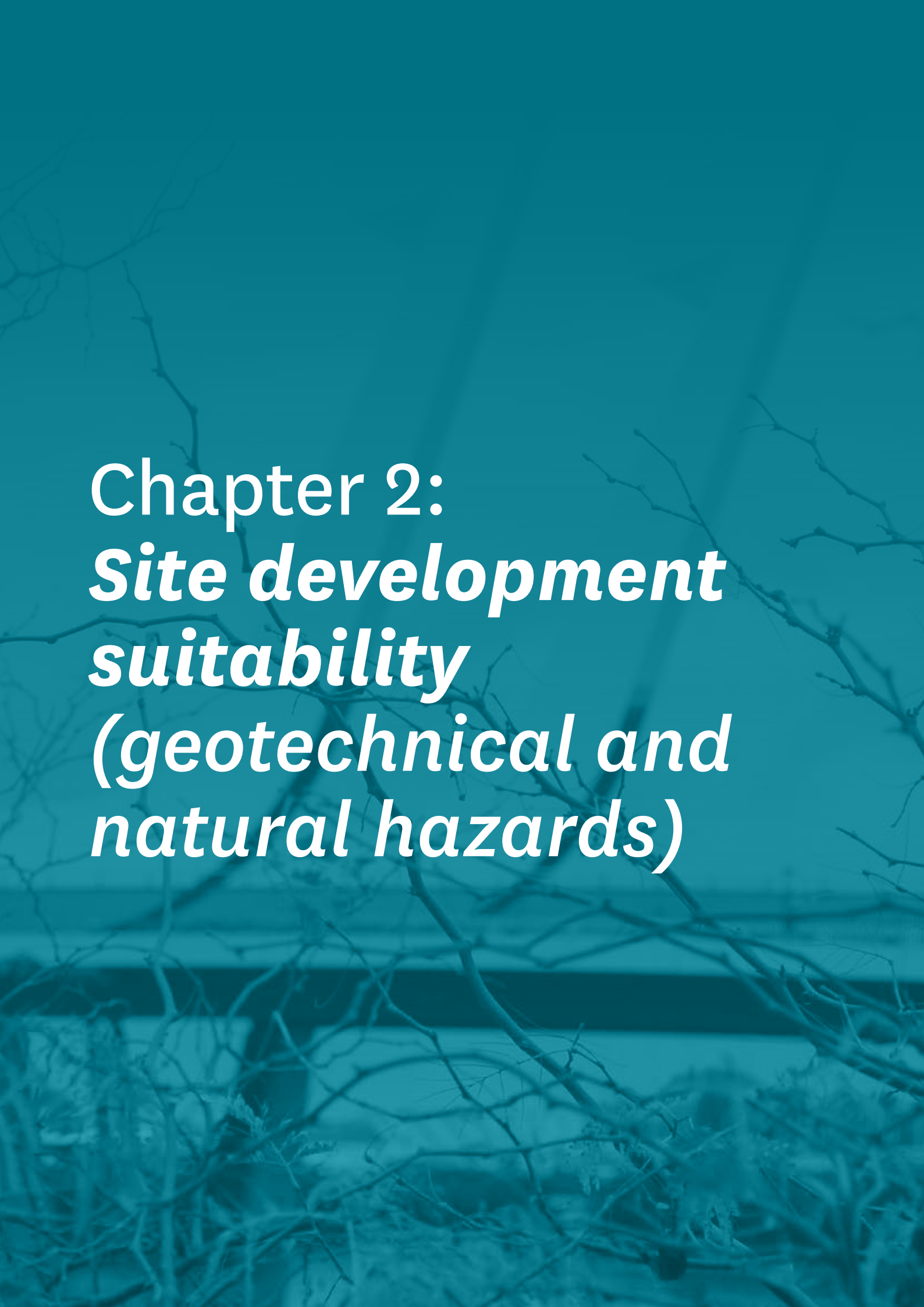
### **1.7.3.5 Vesting and Easements**

The Developer's Representative shall ensure that all WDC requirements are satisfied prior to requesting the transfer of constructed assets to WDC ownership. (As required in accordance with [WDC QA/QC Manual 2010](#)). See Section [1.4.4 Quality Assurance and Quality Control](#).

Roads, stormwater, water, wastewater and parks infrastructure and land shall be vested or protected by easements in favour of WDC as specified in the conditions of resource consent, or as otherwise approved, at the Developer's expense.

Easements in favour of WDC 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 WDC at the date of issuing of the Section 224 certification.



Chapter 2:  
***Site development  
suitability  
(geotechnical and  
natural hazards)***

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## 2.1. Introduction

The WDC 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 Whangārei District are referenced in this chapter.

### 2.1.1. Scope

This section sets out the WDC's requirements for the assessment and reporting of site suitability and 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. Assessment of other hazards that may affect the development. This may include hazards identified in the District Plan or held by WDC or other engineering reports or hazards identified as part of the site investigation.

### 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 other 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 WDC'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, 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 Developer to ensure the most up to date referenced document is sourced.*

### **2.1.3.1 Statutory**

[Building Act 2004](#)

[NRC Regional Plans](#)

[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 infrastructure](#)

[NZS 4431:1989 - Code of practice for earth fill for residential purposes](#)

### **2.1.3.3 WDC Documents**

[Acid Sulphate Soil Planning Policy Basic Guide 2015](#)

[Coastal Structure Plan - Slope Instability Hazard Potential and Effluent Disposal Potential: Oakura to Langs Beach 2005](#)

[Land Hazard Maps](#)

[Land Instability Maps](#)

[Policy #0129 - Land Development Stabilisation 2018 and Land Development Stabilisation – Technical Design Requirements 2018](#)

Stormwater Catchment Management Plans *(To be provided by WDC on request)*

Liquefaction Vulnerability Study – Whangārei District 2020 *(To be provided by WDC on request)*

### **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](#)

### **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 the [NRC Regional Plans](#). The Developer shall satisfy any NRC requirements applicable to their development activity in addition to the requirements in this Section.

Permitted Activities under the [NRC Regional Plans](#) may still require consent under the [District Plan](#). The Developer shall refer to the [NRC Regional Plans](#) 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 [NRC Regional Plans](#) pertaining to earthworks activities, and shall identify, in their development application to WDC any NRC consents that may be required under those rules.

If a NRC consent is required for earthworks, the Developer shall consult with WDC to understand requirements required for earthworks prior to submitting the NRC consent application.

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

### **2.2.2. WDC 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, records and requirements prior to commencing a geotechnical assessment,
- b. Site inspection and investigations of subsurface conditions to satisfy the requirements of this chapter,



- c. Review drawings and specifications defining earthworks or other construction for the proposed development,
- d. Report to WDC 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 of the development earthworks during construction, and
- i. Provide a Geotechnical Completion Report, in accordance with [NZS 4431:1989](#) or other applicable specifications, on the compliance of earthworks and the suitability of the development for its proposed use.

Upon carrying out these functions, reporting shall be provided to WDC at the following stages of the development:

#### *2.2.2.1.1. 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 all relevant information, guidance and recommendations that:

- a. Relate to the geotechnical suitability of the land for the proposed development,
- 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,
- c. Inform the design of future development earthworks, services, structures, etc.,
- d. Identify information gaps or specific requirements for further geotechnical investigation needed prior to design or construction,
- 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.

#### 2.2.2.1.2. WDC Consents

The Developer shall assess their proposed development against the [District Plan](#), and shall identify whether a WDC resource consent is required for the proposed development earthworks activities.

Any WDC resource consents that are required shall be obtained prior to application for Engineering Design Approval (EDA) under the ES.

#### 2.2.2.1.3. Engineering Design Approval

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

- a. Arise from a [Geo-Professional](#) review of the Geotechnical Assessment Report, design or construction drawings and/or specifications for the proposed development,
- b. Identify information gaps or specific requirements for further geotechnical investigation prior to or during construction,
- c. Relate to management of geotechnical risk during construction,
- d. Specify the construction or compliance criteria of proposed earthworks,
- 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.

#### 2.2.2.1.4. Completion of Works

After construction, any relevant information that:

- a. Identifies information gaps or specific requirements for further geotechnical investigation,
- b. Documents construction inspections, test results and reliability/significance of geotechnical investigation undertaken,
- 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 WDC 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 WDC documents:

- a. [Coastal Structure Plan - Slope Instability Hazard Potential and Effluent Disposal Potential](#),
- b. [WDC Stormwater Catchment Management Plans](#),
- c. [NRC Regional Policy Statement for Northland](#),
- d. [NRC Coastal Flood Hazard Assessment for Northland Region 2019-2020](#),
- e. [NRC Coastal Erosion Hazard Assessment for Selected Sites 2019-2020](#),
- f. [WDC Acid Sulphate Soil Planning Policy Basic Guide](#),
- g. [WDC Policy #0129 - Land Development Stabilisation 2018](#),
- h. [WDC Land Development Stabilisation – Technical Design Requirements 2018](#),
- i. [Liquefaction Vulnerability Study – Whangarei District 2020](#),
- j. [Rockfall: Design considerations for passive protection structures 2016](#), and
- k. Other relevant WDC documents available on the [Land Hazards](#) page of the WDC website.

### 2.2.2.3 Historic Investigations

WDC 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 and review information from the WDC's GIS, NRC's GIS, NZGD and other available sources, regarding hazards and development limitations that may affect the proposed development, as part of the desktop study for the Geotechnical Assessment Report (see Section [2.3.3 Geotechnical Assessment Report](#)), 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, and
- g. Acid sulphate soils.

Where the proposed development site is outside of an area covered by the [WDC Land 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: Levels of stability hazard are also identified in the WDCs commissioned reports on slope stability.*

*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 NRC and WDC permitted rules or consent requirements regarding erosion, sediment or dust control which may be applicable to the proposed development.

### **2.2.1. 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.

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

- a. (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
- b. (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
- c. (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 [WDC Land Instability Maps](#), or covered by a WDC 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 [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](#),
- 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 SQEP 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](#).

Levels of stability hazards are identified in the WDCs commissioned reports on slope stability and are included as a Hazard Mapping layer in WDC's GIS which is accessible through the WDC website.

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

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 [WDC 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:

- a. Walk-over inspection of the site and the surrounding land,
- b. Inspection of historical aerial photographs taken at various times to provide insight into the local geomorphology and evidence of any previous instability,
- c. Review of geological data (maps, bulletins),
- d. Any local information about stability of the ground,
- e. Any existing data about the soil and rock profile (look for nearby exposures) or perform some simple subsurface investigation,
- f. Examination of the soil profile to confirm that if the soil is in-situ and not colluvium (slide debris),
- g. Examination of the existing survey records for evidence of movement (slippage or erosion),
- h. A [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), and
- i. 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 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 WDC.

The Geotechnical Assessment Report of moderate risk land shall include the following requirements, in addition to the requirements of Section [2.3.3.2 Low Stability Hazard](#):

- 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 augering (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 piezometric 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 waste water into or over the area) on the whole slope, and
- 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 where 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 occur unless a Geotechnical Assessment Report, including an appropriate and adequately detailed stability analysis, is produced to the satisfaction of WDC.

The Geotechnical Assessment Report shall demonstrate that the proposed development area will not be subject to erosion, 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.

The Geotechnical Assessment Report of high-risk land shall include the following requirements, in addition to the requirements of Section [2.3.3.3 Moderate Stability Hazard](#):

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

Site development works in particular 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 the 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 in accordance with [WDC Policy #0129 – Land](#)



## [Development Stabilisation 2018 and Land Development Stabilisation – Technical Design Requirements 2018](#) .

### **2.3.3.6 Special Soil Types**

Special soil types are known to exist in the Whangārei 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, and
- g. Previous fill material.

### **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 (refer to Section [4.3.5.2 Coastal Flood Hazard Assessment](#)).

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

This 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 waterlogged 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. Refer to [WDC Acid Sulphate Soil Planning Policy Basic Guide](#) for the classification of low, moderate and high risk activities.*

#### **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 a site-specific assessment of the flood hazard and risk associated with the proposed development as per Section [4.3.5.1 Flood Hazard Assessment](#).

#### **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 a 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 1991](#).

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

#### **2.3.4.5 Rockfall Hazard**

For all sites subject to, or potentially subject to rockfall, the Developer shall engage a SQEP to undertake a 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, and
- 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:
  - i. Positions of borehole/test pit/penetrometer etc., and
  - ii. Areas of concern (including but not limited to slip scarps, unstable ground, rockfall etc.),
- b. Location of any adjoining land/river/ocean details which might affect the stability etc. of the subject land, and
- 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 EDA when earthworks are included in the design. The report shall be submitted to WDC 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. NRC and WDC 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 WDC and NRC 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 and applicability to the given material type:

- 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 vane. 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 should confirm the method of compaction they wish to adopt to achieve the targets specified by the engineer.

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.

## 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 EDA.

### 2.4.2.2 Erosion, Sediment and Dust Control

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

The Erosion and Sediment Control Plan 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 NRC), and the sections are more than 400 m from an existing tsunami siren, the Developer shall install tsunami sirens so that the entirety of each section is no more than 400 m 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

### 2.6.1.1 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 WDC.



As a minimum, this shall contain the data and all test results listed in the [Contaminated Land Management Guidelines 2021](#).

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.





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## **3.1. Introduction**

### **3.1.1. Scope**

This Chapter sets out the requirements for the design and construction of 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 WDC or retained in private ownership and whether initiated and undertaken by a Developer or by WDC.

### **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 manoeuvring 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 design outcomes.
- e. Ensure future growth can be supported by the provision of appropriate transportation infrastructure.

### **3.1.3. Performance Standards**

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 manoeuvres 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. Manoeuvring 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,
- b. An increased number of alternative routes for all types of users,
- c. Increased opportunity for interaction, and
- d. Improved access to public transport, cycling and walking networks, and to destinations such as schools and public amenities.

Transport Corridors serve the following functions:

- a. Movement (linking places with transportation infrastructure that provides for a range of transport modes and user groups to move people and goods),
- b. Place Context (creating public spaces for people to interact, exercise and enjoy where appropriate), and
- c. 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, Method 32: Weak particles \(including clay lumps, soft and friable particles\) in coarse aggregates](#)

[AS/NZS 1906.1:2017 - Retroreflective materials and devices for road traffic control purposes - Part 1: Retroreflective 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 - Standard 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 Waka Kotahi 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 Waka Kotahi 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 Austroad 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 \(2017\)](#)

[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 (*To be provided by WDC on request*)

[NZ Building Code](#)

[NZ Utilities Advisory Group: National Code of Practice for Utility Operators' Access to Transport Corridors - Updated Version 2, July 2019](#)  
[Operative District Plan](#)

Road Safety Audit Standard for the Whangārei District (*To be provided by WDC on request*)

[WDC District Plan Maps](#)

[WDC Policy #0064 - Road Naming](#)

[WDC Policy #0129 - Land Development Stabilisation 2018 and Land Development Stabilisation – Technical Design Requirements 2018](#)

[WDC Urban Design Guidelines](#)

[Wellington Water – Water Sensitive Design for Stormwater: Treatment Device Guideline, December 2019](#)

*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 Chapter.*

## **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), [Table 3-3](#) (Rural) and [Table 3-4](#) (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. Engineering Design Approval**

#### **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 WDC, 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 [3.2.3 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, and
- 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 Content of Design Submission

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 Engineering 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. Road marking 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 statements.

In addition, design drawings complying with the requirements of [Appendix F 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. 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 Whangarei 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 WDC prior to final WDC approval.

### **3.2.4. 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 [4.3.7 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.

### 3.2.5. Road Classifications and Design Criteria

#### 3.2.5.1 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

Classification	Average Daily Traffic (ADT)		Brief Descriptive
	Urban	Rural	
			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.

### 3.2.5.2 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. Living 1 – 3 Environments
- b. Business 1 – 4 Environments
- c. Town Basin Environment
- d. Marsden Point Port Environment
- e. Airport Environment
- f. Port Nikau Environment
- g. Marsden Primary Centre
- h. Urban Transition Environment
- i. Kamo Walkability Environment
- j. Ruakaka Equine Environment
- k. Open Space Environment adjacent to another Urban zone
- l. Rural Village Environment
- m. Rural (Urban Expansion) Environment allotments under 2000 m<sup>2</sup>
- n. Strategic Rural Industry Environment
- o. City Core Environment\*
- p. City Fringe Environment \*

- q. General Business Environment\*
- r. Trade Retail Environment\*
- s. Heavy Industry Environment\*
- t. Local Centre Environment\*
- u. Shopping Centre Environment\*
- v. Waterfront Environment\*
- w. Urban Residential Environment\*
- x. Large Lot Residential Environment\*
- y. Passive Recreation Environment adjacent to another Urban zone\*
- z. Active Recreation Environment adjacent to another Urban zone\*
- aa. Natural Environment adjacent to another Urban zone\*

“Rural” shall include the following environments:

- a. Countryside Environment
- b. Coastal Countryside Environment
- c. Open Space Environment not adjacent to any Urban zone
- d. Rural Countryside Environment
- e. Rural Living Environment
- f. Rural (Urban Expansion) Environment allotments over 2000 m<sup>2</sup>. Special considerations for lots between 2000 m<sup>2</sup> and 4000 m<sup>2</sup> can be found in Section [3.2.5.3 Rural \(Urban Expansion\) Zone Lots 2000-4000 m<sup>2</sup>](#).
- g. Passive Recreation Environment not adjacent to any Urban zone \*
- h. Active Recreation Environment not adjacent to any Urban zone \*
- i. Natural Environment not adjacent to any Urban zone \*

*Note: \* denotes a proposed environment/zone*

Likewise, where “urban” and “rural” references are made throughout this Chapter, the above definitions shall apply.

### **3.2.5.3 Rural (Urban Expansion) Zone Lots 2000-4000 m<sup>2</sup>**

The Rural (Urban Expansion) Zone provides for a density of rural residential development that lies between the densities of the Rural Living and Residential Zones. The zoning provides capacity for the future urban expansion of the City and accordingly must be managed for this purpose. Section [3.2.5.2 Design Criteria](#) provides that lots over 2000 m<sup>2</sup> shall be classified as rural. For the purposes of the road corridor, special design consideration may be given to lot sizes between 2000 m<sup>2</sup> and 4000 m<sup>2</sup> 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) <sup>1</sup>	Minimum Legal Road Width <sup>2</sup>	Carriageway Requirements				Berm <sup>5</sup> Requirements	
			Overall Width <sup>3</sup>	Movement Lane Width <sup>4</sup>	On Street parking	Cyclists	Pedestrians	Utility Service Corridor
Low Volume Access	< 200	18.0	8.0	2 x 3.0	1 x 2.25	cycling shared in movement lane on road	2 x 1.8 m wide footpath, both sides.	1.5 m both sides
Access	200 - 1,000	20.0	10.5	2 x 3.0	2 x 2.25	cycling shared in movement lane on road	2 x 1.8 m wide footpath, both sides	1.5 m both sides
Secondary Collector	1,001 - 3,000	24.0	15.0	2 x 3.5 marked	2 x 2.0	2 x 1.5 m wide marked cycle lane, both sides on road	2 x 1.8 m wide footpath, both sides	1.5 m both sides
Primary Collector	3,001 - 5,000	25.0	16.0	2 x 3.5 marked	2 x 2.0	2 x 1.8 m wide marked cycle lane, both sides on road	2 x 1.8 m wide footpath, both sides	2.0 m both sides
Industrial	N/A	22.0	13.0	2 x 3.5 marked	2 x 3.0	See Note 6 below	2 x 1.8 m wide footpath, both sides	2.0 m both sides
Arterial	5,001 – 15,000	<a href="#">Specific Design</a>						
Regional	15,001 – 25,000	<a href="#">Specific Design</a>						
National	> 25,000	<a href="#">Specific Design</a>						

1. ADT as defined in [Research Report 453 Trips & Parking Related to Land Use November 2011](#)
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
6. Cycling shared in movement lane unless ADT > 3,000 in which case cycling provisions to be agreed with WDC

**Table 3-3: Rural Road Design Criteria – Sealed Roads**

Classifications	Average Daily Traffic (ADT) <sup>7</sup>	Minimum Legal Road Width <sup>8</sup>	Carriageway Requirements					Berm Requirements
			Overall Width <sup>9</sup>	Movement Lane Width <sup>10</sup>	Unsealed Shoulder	Sealed Shoulder	Cyclists	Pedestrians <sup>11</sup>
Low Volume Access	<50	20.0	7.0	2 x 2.5	2 x 0.5	2 x 0.5	shared in movement lane	shared on shoulder & berm
Access	50 - 200	20.0	7.0	2 x 2.5	2 x 0.5	2 x 0.5	shared in movement lane	shared on shoulder & berm
Secondary Collector	201 – 1,000	20.0	8.0	2 x 3.0	2 x 0.5	2 x 0.5	shared in movement lane	shared on shoulder & berm
Primary Collector	1,001 - 3,000	20.0	11.0	2 x 3.5	2 x 0.5	2 x 1.5	on sealed shoulder where it is a defined cycle route	shared on shoulder & berm

Classifications	Average Daily Traffic (ADT) <sup>7</sup>	Minimum Legal Road Width <sup>8</sup>	Carriageway Requirements					Berm Requirements
			Overall Width <sup>9</sup>	Movement Lane Width <sup>10</sup>	Unsealed Shoulder	Sealed Shoulder	Cyclists	Pedestrians <sup>11</sup>
Arterial	3,001 – 10,000	20.0	12.0	2 x 3.5	2 x 0.5	2 x 1.8	on sealed shoulder where it is a defined cycle route	shared on shoulder & berm
Regional	10,001 - 15,000	<a href="#">Specific Design</a>						
National	> 15,000	<a href="#">Specific Design</a>						

7. ADT as defined in [Research Report 453 Trips & Parking Related to Land Use November 2011](#)

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 <sup>12</sup>	Minimum Legal Road Width <sup>8</sup>	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

Classification	Characteristics <sup>12</sup>	Minimum Legal Road Width <sup>8</sup>	Carriageway Requirements			
			Minimum Width	Maximum Width	Pavement Depth (mm)	Wearing Course (mm) nominal
Access	Band 1	20.0	3.0	4.0	100.0	No Wearing Course
Low Volume	Band 1	20.0	3.0	4.0	100.0	No Wearing Course
Arterial		<a href="#">Specific Design</a>				
Regional		<a href="#">Specific Design</a>				
National		<a href="#">Specific Design</a>				

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

**Table 3-5 Low Volume Access and Access Roads for Rural Zone Lots 2000-4000 m<sup>2</sup>**

Classifications	Average Daily Traffic (ADT) <sup>1</sup>	Minimum Legal Road Width <sup>2</sup>	Carriageway Requirements				Berm <sup>5</sup> Requirements	
			Overall Width <sup>3</sup>	Movement Lane Width <sup>4</sup>	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

Classifications	Average Daily Traffic (ADT) <sup>1</sup>	Minimum Legal Road Width <sup>2</sup>	Carriageway Requirements				Berm <sup>5</sup> Requirements	
			Overall Width <sup>3</sup>	Movement Lane Width <sup>4</sup>	On Street parking	Cyclists	Pedestrians	Utility Service Corridor
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

### 3.2.6. Geometric Design

#### 3.2.6.1 General

Roads shall be designed to satisfy the requirements of [Table 3-6](#) and the sub-sections following.

**Table 3-6: Road Classification Designs**

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

13. Where the gradient of a public road is steeper than 12.5% a resolution of WDC is required (refer to Section 329 of the [Local Government Act 1974/2002](#))

14. Refer to Sections [3.2.27.2 Urban Private Accessways](#) and Section [3.2.27.3 Rural Private Accessways](#) for specific gradient details.
15. Specific Design shall be to [Austroads Guide to Road Design – Part 3: Geometric Design](#).

### 3.2.6.2 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.

### 3.2.6.3 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](#).

### 3.2.6.4 Curve Radius

The minimum centreline radius for roads shall be in accordance with [Table 3-6](#).

### 3.2.6.5 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%.

### 3.2.6.6 Widening on Curves

In some instances, (e.g. 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	-	-

### 3.2.6.7 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 WDC has the legal right to trim or remove vegetation within that area. Easements or covenants are acceptable land protection instruments in this regard.

## 3.2.7. Cut / Fill Batters

### 3.2.7.1 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 WDC considers that the stability of any planned embankment is in doubt, a stability analysis of the slope under saturated conditions may be required.

### 3.2.7.2 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 750 mm high shall be cut at 1V:4H and shall be top soiled and grassed,
- b. Batters greater than 750 mm high shall be cut at 1V:2H and shall be protected from face erosion by hydro-seeding or similar, and
- c. Batters 4.5 m 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.

## 3.2.8. Intersections

### 3.2.8.1 General

Subject to the following provisions and the provisions of Section [3.2.8.2 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.

### 3.2.8.2 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	30 m	50 m	100 m	100 m
Rural	75 m	100 m	150 m	150 m

The minimum kerb radius at urban intersections shall be:

- a. 8 m with corner splays of 4 m to 6 m 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 WDC.
- b. 13.5 m with corner splays of 6 m 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 18 m semi-trailer units, and all urban intersections (access roads and above) designed for a minimum 11.5 m large rigid truck, as defined by the 'RTS18' tracking curves referenced in Section [3.2.6.3 Horizontal and Vertical Alignment](#).

Gradients within 30 m 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.

### 3.2.8.3 Arterial Road Intersections

For intersections with arterial roads, the engineering drawings 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 0.6 m.

Reference can also be made to [Austroads Guides to Road Design Parts 4, 4A, and 4C](#).

### **3.2.9. 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 WDC 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.

### **3.2.10. Traffic Signals**

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

### **3.2.11. Pavement Structural Design**

#### **3.2.11.1 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, the proposal shall be considered an Alternative Design (See Section [1.5.1.2 Alternative Designs](#)) and will require specific approval from WDC.

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.

### 3.2.11.2 Design

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

#### 3.2.11.2.1. 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<sup>7</sup> shall have a pavement design completed by a Chartered Professional Engineer (CPEng).

Factors to be included in the design are:

- a. Design Life,
- b. Trips generated per household per day – 10,
- c. Annual Heavy Commercial Vehicle (HCV) growth factor - 3 % minimum unless otherwise specified by the WDC,
- d. Load factor - the **Presumptive ESA/HCV of 1.44** shall be used for design purposes unless otherwise specified by the WDC, 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 WDC may require site-specific increased values where peer reviews indicate the need or where WDC believe that circumstances exist where they can be justified.*

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

- a. Results of soils investigations,
- b. Design assumptions and figures,
- c. Material specifications,
- d. Engineering drawings, and

- e. QA measures for construction.

### 3.2.11.2.2. 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 [Table 3-9](#).

**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 in-situ subgrade having a soaked CBR of 5 for a minimum depth of 0.6 m. If the in-situ subgrade does not achieve this strength, then subgrade improvements may be undertaken in order to achieve the required design subgrade CBR value. Refer to Section [3.2.11.2.1 Subgrade Testing](#) for method of determining the design CBR.

If a subgrade of 0.6 m depth and a CBR of 5 is not practicable, a [Specific Design](#) will be required as per Section [3.2.11.2.1 Sealed Pavement – Specific Design](#).

### 3.2.11.2.3. Unsealed Pavement

SQEP shall engage with WDC’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 [Austroads Guide to Pavement Technology Part 5](#), (DCP investigation through test pit methodology).

Where a subgrade CBR is less than 7:

- a. 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

- b. 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. 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, and
- b. 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 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 40 material with a minimum soaked CBR of 20. Wearing Course, where required from [Table 3-4](#), shall be page green compliant, and of AP30 material, 100 mm thick and shall 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.

### 3.2.11.3 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 + 50 m / 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 WDC 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 1.0 m 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 10<sup>th</sup> 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 1.0 m below the design subgrade level and/or when subgrade improvements are required, the design CBR shall be determined using the nomograph on **Sheet 5a**.

#### 3.2.11.4 Peer Review

All specific pavement designs shall be peer reviewed (see [Peer Review](#)) 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.

### 3.2.12. Road Surfacing

#### 3.2.12.1 General

All new urban carriageways shall be surfaced with either a chip seal or asphaltic concrete. The use of concrete will require specific approval from WDC.

All new rural carriageways shall be surfaced with a chip seal unless specifically approved otherwise by WDC 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 WDC) 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 WDC. On cul-de-sac heads, asphalt shall be applied until the carriageway becomes a constant width.

#### 3.2.12.2 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 WDC. 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](#).

#### 3.2.12.3 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 WDC. For further details and requirements see Section [3.3.5.2 Asphaltic Concrete \(AC\)](#).



### 3.2.12.4 Permeable Paving

Generally permeable pavement (other than on unsealed road) will not be approved for public roads. This type of pavement may only be used for low traffic roads, pedestrian areas, carparks, private roads or similar; and require specific approval under Section [1.5.1.2 Alternative Designs](#).

## 3.2.13. Road Drainage

### 3.2.13.1 General

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

- a. 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,
- b. Enabling groundwater recharge through soakage systems,
- c. 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.
- d. Complying with requirements of the NRC,
- e. 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,
- f. Water discharged from adjoining land,
- g. Public safety,
- h. Minimising of future maintenance requirements,
- i. Capacity of any existing piped network,
- j. Cyclists,
- k. Reduction of peak discharge rate, and
- l. Compliance with [Chapter 4: Stormwater and Drainage](#), 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 [3.2.13.6 Catch-Pits](#) for catch-pit design requirements. Where proprietary treatment devices are proposed, the type of device shall be pre-approved by WDC.

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

### 3.2.13.2 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 WDC that it is not necessary - e.g. low water table and natural ground with high permeability – refer to [WDC Policy #0129 - Land Development Stabilisation 2018 and Land Development Stabilisation – Technical Design Requirements 2018](#). 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.

### 3.2.13.3 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 [4.3.12.3 Open Channel Flow Calculations](#). 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.

### 3.2.13.4 Swales

The use of swales for stormwater treatment will require the pre-approval from WDC 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 WDC. Swales shall be designed with the following principles:

- a. Have 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 [4.3.21 Soakage Devices](#) and Section [4.3.22 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 [3.2.26 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](#), [Wellington Water - Water Sensitive Design for Stormwater: Treatment Device Guideline](#) and [WDC Urban Design Guidelines](#) for further guidance.

### 3.2.13.5 Kerb and Channel

Subject to the provisions of Section [3.2.13.4 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 WDC.

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.

### 3.2.13.6 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 [4.3.19 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 WDC, 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.

### 3.2.13.7 Secondary Stormwater Network 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 [4.3.9.3 Secondary Stormwater Network Design Requirements](#).

## 3.2.14. Parking and Manoeuvring

### 3.2.14.1 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 WDC. Crossfall requirements are the same as for the carriageway.

### 3.2.14.2 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 2890.2:2018](#). Refer also to [District Plan](#) for layout dimensions.
- b. Adequate provision shall be made for access between the road and parking area and for manoeuvring within the site so that vehicles do not reverse out onto the road.
- c. On-site manoeuvring for cars and heavy goods vehicles shall comply with the vehicle tracking curves shown on **Sheet 26**, **Sheet 27** and **Sheet 28** as applicable. Manoeuvring in and out of a parking/loading bay shall not require more than one reverse manoeuvre.
- d. The gradient for off-street parking spaces, loading bays and associated manoeuvring 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 [3.2.11 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](#).

### **3.2.15. No Exit Roads and Cul-de-sac Heads**

#### **3.2.15.1 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.

#### **3.2.15.2 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 15 m 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 (11.5 m rigid truck) using tracking curves. The minimum trafficable width shall be 5.5 m.

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.

### **3.2.16. Road Lighting**

#### **3.2.16.1 General**

WDC 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](#).

### 3.2.17. 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	✓
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.

### **3.2.18. 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:

- a. Vertical features,
- b. Horizontal features,
- c. Traffic management and control,
- d. Traffic signs and road markings, and/or



e. 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.

### 3.2.18.2 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	30 km/h operating speed (safe and appropriate)
	School Zones (within 500 m of a school active frontage)	30 km/h
	Primary & Secondary Collector	40 km/h
	Arterial, Regional	50 km/h
UTE & Future Urban (Semi-rural)	Low Volume Access, Access Primary & Secondary Collector	40 km/h
	School Zones (within 500 m of a school active frontage)	30 km/h
	Arterial, Regional	60 km/h
Rural	Low Volume Access, Access	40 km/h
	School Zones (within 500 m of a school active frontage)	60 km/h or lower
	Primary & Secondary Collector	60 km/h
	Arterial, Regional	80 km/h



### 3.2.18.3 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 WDC at an early stage in the design. Safety audits (refer to Section [3.2.3 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 WDC.

### 3.2.18.4 Electronic Variable Speed Limits

WDC 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 WDC at an early stage.

Developers need to be aware of the following:

- a. The Developer is responsible for upgrading any existing variable speed limit sign impacted by their works.
- b. 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).
- c. [Specific Design](#) is required to demonstrate compliance.
- d. Safety audits (refer to Section [3.2.3 Safety Audit](#)) may be required to ensure no hazards are introduced as a result of the works.

### 3.2.19. 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 WDC 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<sup>2</sup> are regarded as 'major culverts' under the Waka Kotahi Bridge Manual. Some culverts may be considered dams, for Further details refer to Section [4.3.14.1 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 WDC.

### 3.2.19.1 Bridge and Culvert Design

Particular features that shall be considered/covered in the design 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](#) and [Table 3-3](#).
- 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 in order to undertake inspection and maintenance activities.

### 3.2.19.2 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:

- a. On roads carrying > 3000 vpd, no interruption to traffic during a 1% (adjusted for climate change) AEP flood event, or

- b. For roads carrying between 250 and 3000 vpd, no interruption to traffic during a 2% (adjusted for climate change) AEP flood event, or
- c. For roads carrying < 250 vpd, no interruption to traffic during a 10% (adjusted for climate change) AEP flood event.

### 3.2.19.3 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.

### 3.2.20. Footpaths and Pedestrian Accessways

Pedestrians shall be provided for in accordance with [Table 3-2](#) and [Table 3-3](#).

#### 3.2.20.1 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 WDC.
- 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 WDC.

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.

### 3.2.20.2 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 water table. 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.

### 3.2.20.3 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 WDC 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.

### **3.2.21. 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](#).

### **3.2.22. 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.

### 3.2.23. Berms

#### 3.2.23.1 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.

#### 3.2.23.2 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 be grassed. See Section [3.3.8 Berms](#) for construction details.

#### 3.2.23.3 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 [3.2.11.2 Design Footpaths](#).



### 3.2.24. *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. Street trees shall be suitably located and meet the requirements of Section [7.2.8 Street Tree Planting Design Considerations](#).

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 Works](#). The approval of WDC will be required for all such plantings and structures. The Developer is encouraged to discuss landscape concepts with WDC prior to applying for resource consents, to ensure the suitability of the proposal and consistency with the ES.

Street trees and other planting are considered to be assets for the purposes of as-built information.

### 3.2.25. *Road Names and Signs*

Names for new roads (including private roads and accessways serving more than five lots), will be determined by WDC in accordance with the [WDC Policy #0064 - Road Naming](#). The Developer shall submit three names to WDC 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 3-13](#) and comply with the details in **Sheet 24** and **Sheet 25**. The following requirements for road name signs shall also be met, where applicable:

- a. 'No exit' supplementary blades shall be erected on all cul-de-sac and dead-end road signage.
- b. 'Private access' supplementary blades shall be erected on all private road and accessway signage.
- c. The WDC logo shall only be placed on public road signage.
- d. All signage shall be erected at intersections.

**Table 3-13: Road Name Signage**

Parameter	Urban and Rural Arterial Roads	All Other Public Roads	Private Roads and Accessways
Blade Size	200 mm	150 mm	150 mm

Parameter	Urban and Rural Arterial Roads	All Other Public Roads	Private Roads and Accessways
Background Colour	Blue	Blue	White
Letter Colour	White	White	Blue
Letter Height	150 m	100 mm	100 mm
Letter Type	Transport	Transport	Transport

### 3.2.26. Vehicle Entrances

#### 3.2.26.1 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	<a href="#">Specific Design</a>				
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	<a href="#">Specific Design</a>				
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°, although a minimum angle of 70° can be used when justified by other constraints (as approved by WDC). 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 specifically approved by WDC.

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.*

### 3.2.26.2 Urban 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**.

### 3.2.26.3 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**.

### 3.2.26.4 Rural 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%.

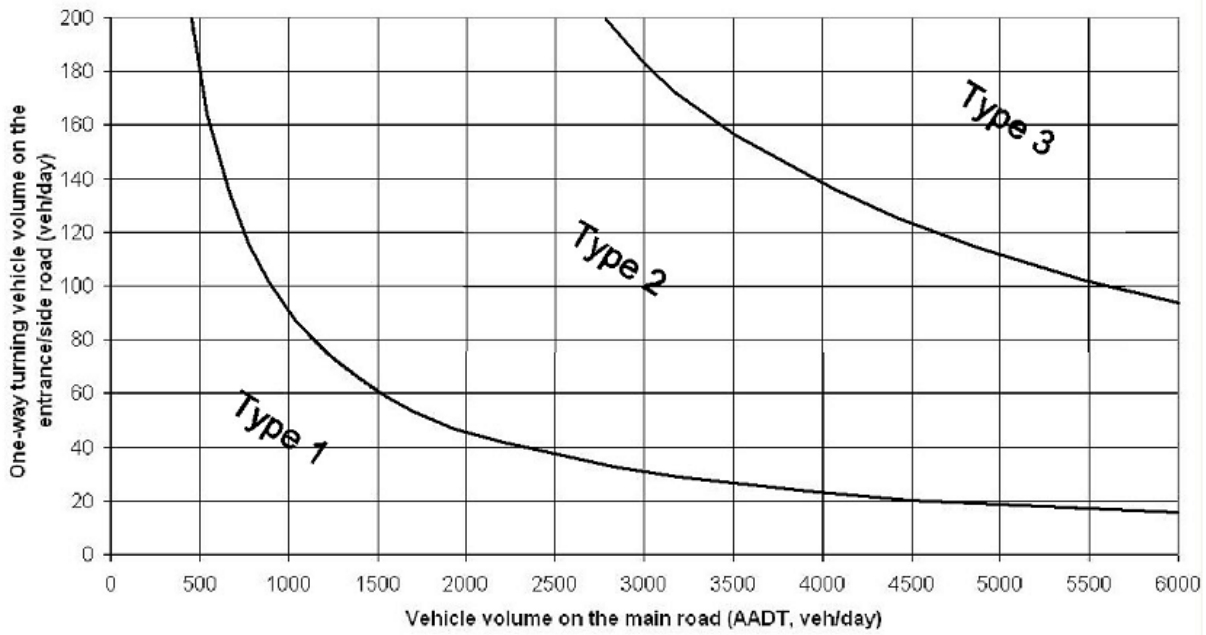
The crossing shall not obstruct any drainage facilities within the berm. Where the drain is shallow and only carries low rain flow, the crossing may pass through the drain. Where the drain is of an unsuitable shape or carries significant rain flow the drain shall be piped under the crossing. Pipes and 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.

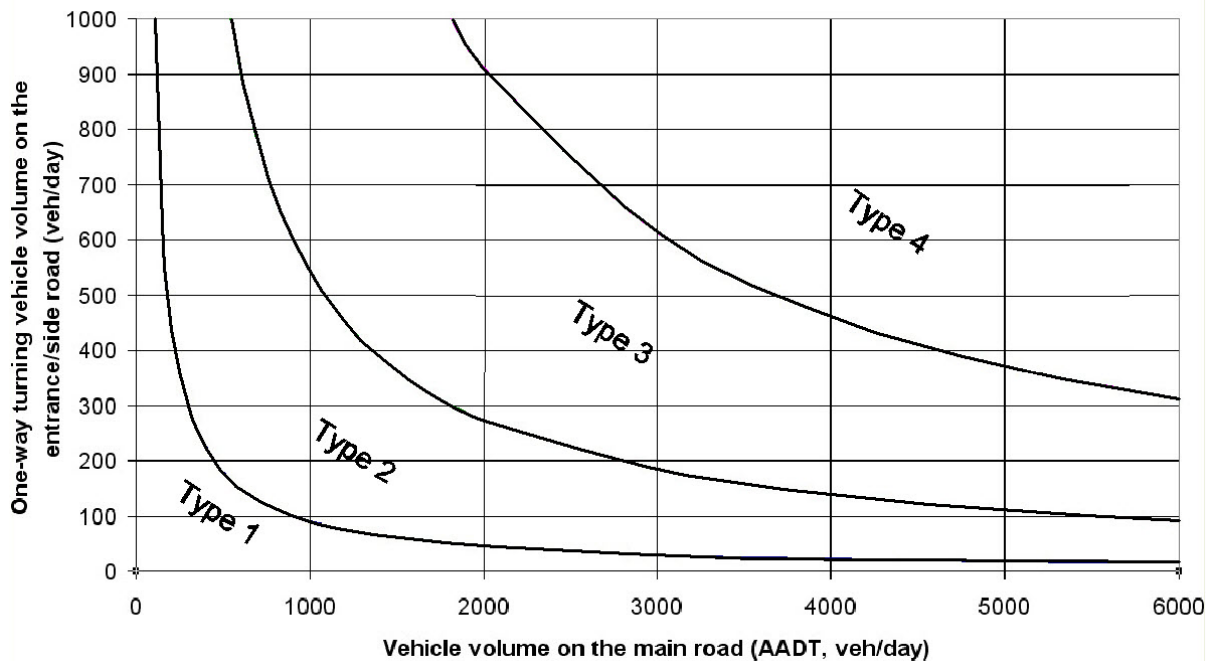
Vehicle crossings for individual lots and private accessways shall comply with the following:

- |            |  |
|------------|--|
| Type<br>1A | A basic entrance with flares but no local widening as shown on <b>Sheet 21</b> .   |
| Type<br>1B | Shall be used for dairy tanker entrances and the like as shown on <b>Sheet 21</b> .  |
| Type 2     | A basic entrance with some local widening as shown on <b>Sheet 21</b> .  |
| Type 3     | The same as the Waka Kotahi 's 'Diagram D' standard (as described and shown in Appendix 5B of the <a href="#">Waka Kotahi Planning Policy Manual</a> ) 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 <a href="#">Waka Kotahi Manual of Traffic Signs and Markings</a> 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.

### 3.2.27. Private Accessways

#### 3.2.27.1 General

Vehicular accesses that serve eight or less lots or Household Units shall be private accessways, except where WDC 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 <sup>17</sup>	Total		
<b>Urban</b>							
A	2 - 4	4.0	-	1 x 3.0	3.0	-	Seal or Concrete
A(Alt) <sup>16</sup>	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
<b>Rural</b>							
C	2	4.0	2 x 0.25	1 x 3.0	3.5	-	Aggregate <sup>18</sup>
C(Alt) <sup>16</sup>	2	5.0	2 x 0.25	1 x 4.0	4.5	-	Aggregate <sup>18</sup>
D	3 - 5	6.0	2 x 0.25	1 x 4.0	4.5	-	Aggregate <sup>18</sup>
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 WDC 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 [3.2.26 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 4.0 m. See [NZ Building Code](#) C/AS1 Part 6.

Where a private accessway contains public water and/or sewer reticulation, the legal width shall be increased to accommodate the minimum clearances required by **Sheet 30**.

Easements in gross in favour of WDC 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.

### 3.2.27.2 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 [3.2.26 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**.

### 3.2.27.3 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 Living, Rural (Urban Expansion) and Rural Village environments 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 in excess of 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 [3.2.26 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 WDC 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 75 mm maximum size with no more than 65% passing a 19.0 mm sieve and 3% - 18% passing a 1.18 mm sieve, and
- c. A sand equivalent equal to or greater than a value of 20.

Evidence of these properties will be required for approval by WDC.

### 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, the grading limits defined in [Table 3-18](#) and the shape control of [Table 3-19](#). The grading limits defined in [Table 3-18](#) shall be 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.



**Table 3-17: Materials Standards for GAP Aggregates**

	Test	Standard
Crushing Resistance (kN)	<a href="#">NZS 4407:2015</a> Test 3.10	>110kN
Weathering Quality Index	<a href="#">NZS 4407:2015</a> Test 3.11	AA, AB, AC, BA, BB,CA or CB
Clay Index	<a href="#">NZS 4407:2015</a> Test 3.5	>3.5, <8.0
California Bearing Ratio	Compacted to <a href="#">NZS 4402:1988/1986</a> Test 4.1.3, Tested to <a href="#">NZS 4407:2015</a> Test 3.15	Not less than 40 %
Sand Equivalent	<a href="#">NZS 4407:2015</a> 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 <a href="#">NZS 4407:2015</a> 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			
	Waka Kotahi 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
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

Test Sieve Aperture	Percentage Passing			
	Waka Kotahi M/4 (AP 40)	GAP 65	GAP 40	GAP 20
75 micron	7 max	6 max	7 max	8 max

**Table 3-19: Aggregate Grading Shape Control**

Fractions	Percentage of Material in Fraction			
	Waka Kotahi 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	6-22	6-19	6-22	6-27
1.18 mm – 300	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 120 kN instead of 130 kN.
- 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](#), and
- 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 WDC 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:

- a. 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.
- b. 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 WDC.

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 WDC,
- 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 WDC,

- 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 WDC, 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 8.5 m	At the kerbside wheel tracks	Alternating sides, 10 m between tests. (20 m repetition of testing rows)
Greater than 8.5 m	At centreline and kerbside wheel tracks	Staggered across the road, 10 m between tests. (30 m repetition of testing rows)

The kerbside wheel tracks are assumed to be 0.5 m 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 [3.2.11.3 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 9.5 mm 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 WDC 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 WDC. The pavement shall be sealed as soon as practicable after acceptance by WDC, 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 WDC 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 9.5 mm.

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

Accessway Type	Basecourse Clegg Values
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.	no value < 45
For all commercial accessways to be sealed ( <i>Shared ROW</i> ).	no value < 45
For all private accessways to be sealed ( <i>ROW &amp; Joint Access Lot</i> ).	no value < 45
For all private accessways to remain unsealed.	no value < 25
For all commercial vehicle crossings to be concreted & built.	no value < 30
For all residential vehicle crossings to be concreted & built.	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 90<sup>th</sup> 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 [3.2.12 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 [3.3.5.3 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 20 m 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<sup>2</sup>. 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<sup>2</sup> 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 WDC.

#### 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°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<sup>2</sup> residual (measured at 15°C).

The first layer chip shall comprise the spreading and rolling of a grade 3 chip at a spread rate of 75 m<sup>2</sup>/m<sup>3</sup>. 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<sup>2</sup> residual (measured at 15°C).



The second layer chip shall comprise the spreading and rolling of a grade 5 chip at a spread rate of 150 m<sup>2</sup>/m<sup>3</sup>.

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<sup>2</sup> residual (measured at 15<sup>0</sup>C). 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<sup>2</sup>/m<sup>3</sup>.

#### **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 WDC.

#### **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 WDC. The design of the road shall be carried out by a SQEP. 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, or
- 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 [3.2.12.4 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 requires prior approval from WDC.

### 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 not be 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 WDC.

#### 3.3.7.4 Asphaltic Concrete Surfacing

AC footpaths and cycle paths shall be subject to the specific approval of WDC.

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/m<sup>2</sup>. 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 WDC.

They shall be laid to 5 mm 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 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 WDC.

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 [3.2.27 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 shall be 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 [3.2.26 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**

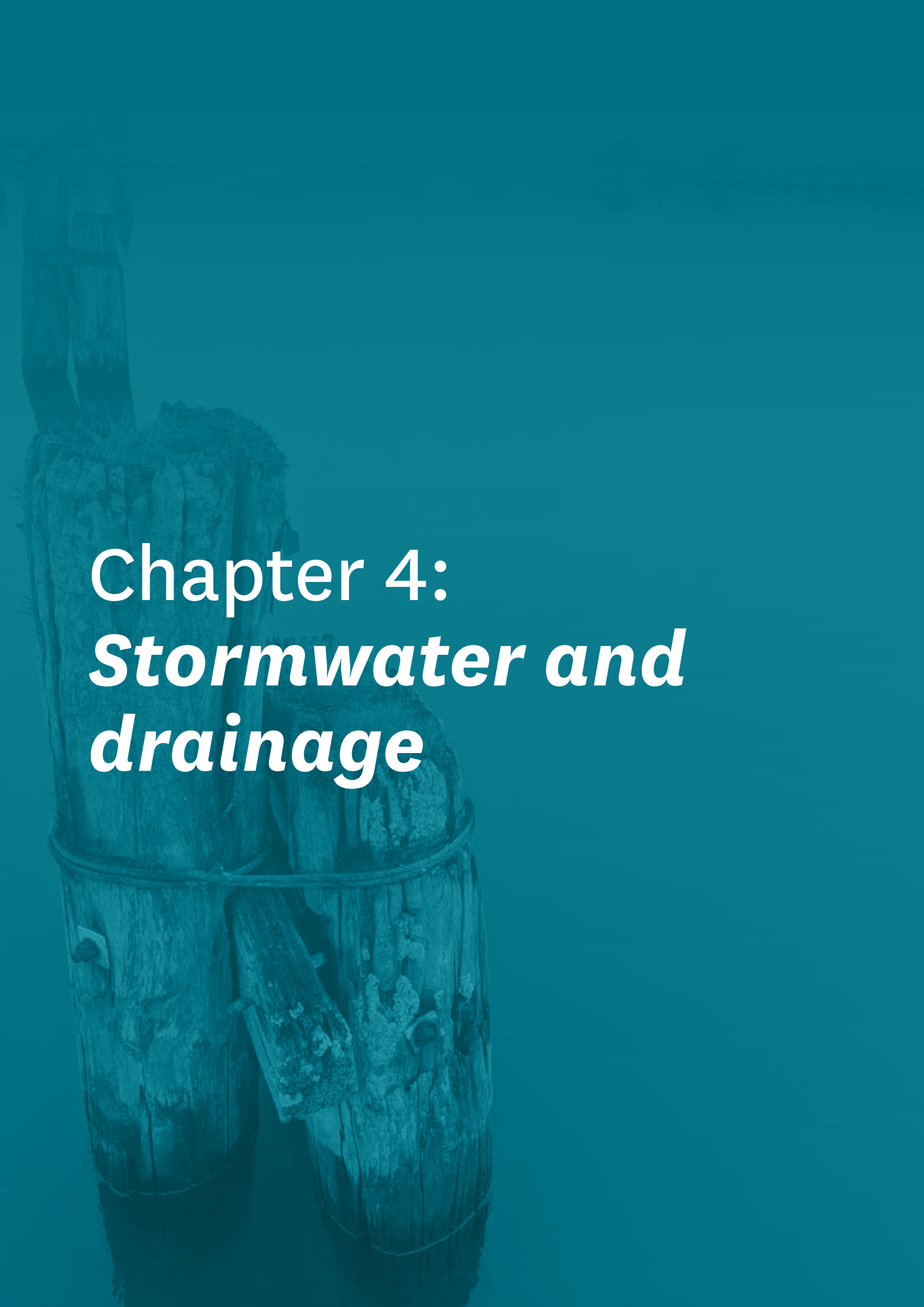
Following completion of the work, a producer statement (construction) [PS4 Construction Review](#) (or similar and approved), along with all testing, measuring etc. shall be supplied to WDC for approval.

### **3.4.2. As-Built Information and RAMM Data**

As-built drawings, a schedule of asset information and Operation and Maintenance Manuals, and RAMM Data shall be submitted in accordance with Section [1.7.2 As-Built Plans, Asset Information Schedules, Operation and Maintenance Manuals](#).

### **3.4.3. Second Coat Seal Bond**

The second coat chip seal required as a consequence of Section [1.6.5.8 Second Coat Chip Seal and Resealing](#) shall require a bond in terms of Section [1.6.5.8 Bonds](#). The bond shall be released upon satisfactory completion of the works as determined by the WDC.

A bundle of logs, tied together with a rope, is the central visual element. The logs are weathered and stacked vertically. The background is a solid teal color. The text is overlaid on the left side of the image.

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## **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 take into account 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 WDC 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, and
- 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 WDC 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 WDC 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 WDC 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:

- a. The stormwater system shall operate by gravity. Pumped public systems are not generally acceptable unless specific approval is obtained from the WDC Stormwater Manager before proceeding with design details (see Section [4.3.9.2 Primary Network Design Requirements](#)).
- b. The primary stormwater system shall be capable of conveying 50% and 20% AEP design storm events without surcharge (see Section [4.3.10 Hydrological Design Criteria](#)).
- c. 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.
- d. The stormwater system shall not connect or be able to overflow to the wastewater network.
- e. Development shall not increase peak discharge rates to receiving environment. An increase may be acceptable for large events, up to 1% AEP (+ CC 20%), 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.
- f. The stormwater system shall provide the required amount of treatment through the use of low impact design and sustainable solutions (See [WDC Urban Design Guidelines](#) and Sections [4.3.21 Soakage Devices](#) and [4.3.22 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:

- a. The [District Plan](#),
- b. Relevant [WDC Stormwater Catchment Management Plans](#),
- c. These standards, then
- d. [Auckland Council GD01](#) (the adopted design guideline for stormwater treatment and low impact design), and
- e. [Wellington Water- Water Sensitive Design 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 WDC 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 WDC.

#### **4.1.5. 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.*

##### **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](#)

[WDC Stormwater Management Bylaw 2014](#)

##### **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 WDC Documents

Approved Materials List - Wastewater and Stormwater (*To be provided by WDC on request*)

[Land Hazard Maps](#)

[Quality Assurance / Quality Control Manual for Vested Assets - Inspection and Handover Procedures \(2010\)](#)

Stormwater Catchment Management Plans (*To be provided by WDC on request*)

[WDC Policy #0022 - Building Over or Near Public Sewer and Stormwater Pipelines, 2015](#)

[WDC Policy #0129 - Land Development Stabilisation 2018 and Land Development Stabilisation – Technical Design Requirements 2018](#)

[WDC Urban Design Guidelines](#)

### 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 V4 \(HIRDS\)](#)

[NRCS- USDA TR-55: Urban Hydrology for Small Watersheds](#)

[Waka Kotahi F2:2013 - Pipe subsoil drain construction](#)

[The Regional Infrastructure Technical Specification \(RITS\) 2018 \(Waikato\)](#)

[Water New Zealand; New Zealand Gravity Pipe Inspection Manual Fourth Edition, 2019](#)

## Wellington Water – Water Sensitive Design for Stormwater: Treatment Device Guideline, December 2019

### **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.

- a. Upstream flood levels shall not be increased by any downstream development.
- b. 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.

- c. Where such impacts are considered detrimental by WDC, 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. WDC 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](#).

The building over or near public pipes is not generally acceptable and requires a specific approval from the Stormwater Manager (refer to [WDC Policy #0022 - Building Over or Near Public Sewer and Stormwater Pipelines](#)).

#### **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, overland flow, 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 Land Stability](#) and Section [4.3.21 Soakage Devices](#)),
- c. 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 the Stormwater Network

Stormwater treatment and detention will be required prior to discharge to the primary and secondary network.

OLFP shall be assessed, maintained and provided, as necessary, in accordance with Section [4.3.9.3 Secondary Stormwater Network Design Requirements](#) 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.

### 4.2.2. Discharge into a Stream or Watercourse

All new and existing discharges to an existing WDC 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, WDC 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 [WDC Stormwater Catchment Management Plan](#) (CMP). 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 WDC.
- b. In the absence of an approved CMP the Developer shall contact WDC 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 (see 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 [4.3.9.3 Secondary Stormwater Network Design Requirements](#) to cater for events exceeding the capacity of the primary system and where there is a risk the primary drainage system could fail.

### **4.2.3. Discharge to a WDC Owned Reserve**

This section applies to public stormwater infrastructure within recreation reserves or open spaces (Reserves).

For private stormwater infrastructure within WDC owned Reserves refer to [Chapter 7: Public Spaces and Landscape Works](#).

The Developer shall consult with WDC as to the applicability of this section to other WDC owned Reserves that may be affected by their proposed development.

In situations where a property borders onto a WDC 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 WDC.

Stormwater discharge to a WDC public network within a WDC owned Reserve 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 WDC.

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 WDC to discuss a site-specific SMP and what measures are required.
- b. A site-specific SMP shall be submitted for approval by WDC.
- 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 WDC.

- f. The receiving Reserve area shall be well vegetated or grassed, not susceptible to erosion and have no geotechnical constraints. Where requested by WDC, 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 WDC.
- 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 any 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 WDC.
- 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, and

- c. 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 NRC.

The following requirements shall be satisfied when discharge of stormwater is proposed onto a beach or a WDC owned coastal reserve:

- a. NRC 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 by the WDC Stormwater Manager, 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 0.35 m as tail water level.

### **4.3. Design**

#### **4.3.1. Capacity and Future Network 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 [4.3.10 Hydrological Design Criteria](#). In

addition, WDC may require the Developer to take account of unmitigated MPD flows from the potential development of the upstream catchment.

WDC 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, WDC 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 WDC 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. WDC 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 WDC 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 Land Stability**

Soakage device design must be supported by a suitable geotechnical investigation and report confirming the soils are suitable for soakage and that the 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 WDC's [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 WDC on the approach and obtain all necessary resource consents from NRC for the proposed site-specific SMP.
- b. The Developer shall consult with WDC to understand requirements regarding stormwater management (e.g. flood hazard, treatment and disposal), prior to submitting the NRC consent application.
- c. WDC's Stormwater Manager shall review and accept NRC Resource Consent conditions before the consent being granted.

WDC will advise whether the area of a development is covered by a CMP/CDP, and conditions associated with it. WDC 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 WDC controlled downstream networks.

### **4.3.5. Hazard Assessments**

#### **4.3.5.1 Flood Hazard Assessment**

For all sites subject to, or potentially subject to flood hazard(s), the Developer shall engage a SQEP to undertake a 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):
  - i. upstream and downstream flooding,



- ii. loss of floodplain storage,
  - iii. peak flow,
  - iv. flood extents and elevations,
  - v. accessibility/escape during inundation,
- c. Recommendations for mitigation of the identified risk, e.g. minimum floor levels (see Section [4.3.11.7 Freeboard Requirements](#)), and
  - d. Assessment against section 106 of the [Resource Management Act 1991](#).

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

#### **4.3.5.2 Coastal Flood Hazard Assessment**

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 (see Section [2.3.4.1 Coastal Hazards](#)) and coastal flooding.

Minimum floor levels in coastal areas shall take into account storm surge, wave run-up, tsunami hazards, erosion potential and climate change effects (see Section [4.3.11.7 Freeboard Requirements](#)).

### **4.3.6. Engineering Design Approval**

#### **4.3.6.1 Content of Design Submission**

In addition to the general requirements of Section [1.5.3 Engineering 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-surge 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, and
- 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 adequately mitigated, including:

- a. Flow peaks (where approved) and frequency patterns,
- b. Flood water levels, flood plain storage volumes,
- c. Water quality,
- d. Scouring and erosion of both primary and secondary stormwater system, and
- e. 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](#).

#### **4.3.7. Design Life**

All stormwater infrastructure assets to be vested to WDC 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 [1.5.1.2 Alternative Designs](#)) 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.



### **4.3.8. Approved Products Materials**

Materials and products used for public stormwater infrastructure must comply with the relevant NZ standards and be from the [WDC Approved Materials List - Wastewater and Stormwater](#).

The use of material not listed in the [WDC Approved Materials List - Wastewater and Stormwater](#) shall be considered an Alternative Design, refer to Section [1.5.1.2 Alternative Designs](#).

The [WDC Approved Materials List - Wastewater and Stormwater](#) will be updated from time to time at the discretion of WDC.

### **4.3.9. Stormwater Network Design**

#### **4.3.9.1 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 <a href="#">TR-55</a> for catchment areas up to 8 ha (Rainfall intensity can be determined as a function of time concentration Tc). For catchments greater than 8 ha refer to Section <a href="#">4.3.10.2.1 Catchments Larger Than 8 ha</a> .	Always.
Runoff coefficients	Pre-development runoff coefficients shall be based on existing imperviousness. Post-development runoff coefficients shall be based on allowable imperviousness based on the MPD by the <a href="#">District Plan</a> . Refer to <a href="#">Table 4-3</a> .	Always.
Design Rainfall	Refer to Design Rainfall (Section <a href="#">4.3.10.4 Design</a> and Section <a href="#">4.3.10.5 Design Storm</a> ).	Current rainfall (i.e. not climate change adjusted) shall be used for the following: <ul style="list-style-type: none"> <li>Sizing temporary works where climate change is not relevant.</li> </ul> Climate change adjusted rainfall shall be used for the following: <ul style="list-style-type: none"> <li>Determining pre- and post-development stormwater runoff flows and volumes for stormwater infrastructure design.</li> </ul>
Time of concentration	Determined in accordance with Section <a href="#">4.3.10.4 Design</a> .	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 Refer to Flood Hazard Areas in the <a href="#">District Plan</a> and any known downstream restrictions causing flooding.
Flow attenuation (Attenuation of the 50% and 20% AEP events)	Pre- and post-development flows shall be calculated with climate change allowance. 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 required in the upper catchment. This may not be required where a 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	<p>Stormwater management hierarchy (Section <a href="#">4.1.8 Stormwater Management Hierarchy</a>)</p> <ul style="list-style-type: none"> <li>• Provide treatment of the water quality flow or volume.</li> <li>• Managing at source where possible.</li> <li>• Designing for correct storm size.</li> <li>• Use a suite of water sensitive design devices, including pre-treatment where practical.</li> <li>• Design parameters shall be based on a selected device's effectiveness to remove pollutants and in accordance with GD01.</li> </ul>	Always.
Water Quality Rainfall (WQR)	90 <sup>th</sup> percentile of a 24-hour storm event (approx. 25 mm).	Always. Refer to <a href="#">Auckland Council GD01</a> for details.
Water Quality Volume	Based on 90 <sup>th</sup> percentile of a 24-hour storm event (approx. 25 mm).	When discharging directly into a natural stream or manmade channel.

Criteria	Design Parameter	When Required
Primary and Secondary Network Level of Service Requirements	As per <a href="#">Table 4-2</a> . Secondary overflow as per Section <a href="#">4.1.3 Stormwater Management Hierarchy</a> ).	<p>Always.</p> <p>The primary system shall be designed to ensure gravity flow with capacity to accommodate the peak flows, without surcharge.</p> <p>The secondary system shall be designed for safe conveyance of 1% AEP.</p>
Minimum Floor Levels	Freeboard requirements (Section <a href="#">4.3.11.7 Freeboard Requirements</a> ).	Always.
Whole-of-life	Shall demonstrate that the proposed system provides the most cost-effective whole-of-life outcome for WDC. (e.g. providing an operation and maintenance manual)	Always.

In addition to key design criteria, 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 [4.3.11 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:

- a. The [NZ Building Code](#) compliance document Clause E1 – Surface water (NZBC Clause E1)
- b. [Auckland Council GD01](#) Stormwater Water Management Devices Design Guidelines Manual
- c. [Wellington Water– Water Sensitive Design for Stormwater: Treatment Device Guideline](#)
- d. [The Regional Infrastructure Technical Specification \(RITS\) 2018 \(Waikato\)](#)
- e. [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.*

#### **4.3.9.2 Primary Network 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 Network 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 Network 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 [4.3.10 Hydrological Design Criteria](#).

Proposed stormwater ponds or wetlands are generally an acceptable treatment approach, provided that:

- a. The ponds or wetlands comply with the requirements of the [NRC Regional Plans](#),
- b. The ponds or wetlands, including associated lands shall be contained within its own land title(s) and it can be vested to WDC for drainage purposes at no costs to WDC, or can be retained in private ownership, subject to a specific approval by the Stormwater Manager.
- c. The ponds or wetlands shall not be included in Local Purpose Reserves without specific prior approval from the Parks and Recreation Manager, and
- d. The ponds or wetlands shall be designed in accordance with [Auckland Council GD01](#), or an alternative design can be submitted to WDC for consideration.

(Refer to Section [4.3.22.8 Constructed Ponds and Wetlands](#) for additional requirements for constructed ponds and wetlands).

Note: Stormwater shall not be directly connected to ANY wastewater system.

#### 4.3.9.2.2. Stormwater Pumping

WDC 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. WDC 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.

#### 4.3.9.2.3. *Availability/Capacity of The WDC 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. WDC 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 [4.3.9.4 WDC Design Input](#)).

#### 4.3.9.3 Secondary Stormwater Network Design Requirements

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 WDC or provide an easement or otherwise record any limitations or public interests on the title shall be at the WDC'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.

#### 4.3.9.4 WDC Design Input

Notwithstanding the outcome of [Specific Design](#), WDC may require additional stormwater requirements including:

- a. The diameters and classes of pipes to be used for all reticulation within the development,



- b. Connection points and reticulation alignment.
- c. 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.

### 4.3.10. Hydrological Design Criteria

#### 4.3.10.1 Design Rainfall Event

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 WDC Stormwater Manager.

**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 0.3 m of the lid level	20	1:5
2	For secondary systems (all environments)		
	c. Overland flowpaths, watercourses	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 rainfall 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.

#### 4.3.10.2 Stormwater Flow Estimate

Rainfall runoff curves are used to describe rainfall losses. The curves used in [TP108](#) and methods were 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 [TR-55](#) and [TP108](#) have been adopted for typical Northland soils encountered in the Whangārei District. [Table 4-3](#) below sets out the typical values to be applied. For more detailed information refer to the original tables in [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 WDC 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 Whangārei 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 Whangārei District Conditions (CN - C)**

Land Use	% impervious	Type B soils	Type C soils	Type D soils
<b>Open space (lawns, parks etc)</b>				
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
<b>Impervious areas</b>				
Paved parking lots, roofs, driveways, curbs, channels etc (excluding right-of-way)		98 - 0.96	98 - 0.96	98 - 0.96
<b>Roads and streets</b>				
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

Land Use	% impervious	Type B soils	Type C soils	Type D soils
<b>Urban development</b>				
Commercial and business	85	92 - 0.85	94 - 0.89	95 - 0.90
Industrial	72	88 - 0.79	91 - 0.83	93 - 0.87
Landscaped	0	70	75	80
<b>Residential by average lot size</b>				
500 m <sup>2</sup> or less	65	85 - 0.74	90 - 0.82	92 - 0.85
1000 m <sup>2</sup>	40	75 - 0.60	83 - 0.71	87 - 0.77
2000 m <sup>2</sup>	25	70 - 0.54	80 - 0.67	85 - 0.74
4000 m <sup>2</sup>	20	68 - 0.52	79 - 0.65	84 - 0.72
10,000 m <sup>2</sup> (1 ha)	10	65 - 0.48	77 - 0.63	82 - 0.69
<b>Rural development</b>				
Pasture, grassland (m <sup>2</sup> )		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

#### 4.3.10.2.1. Catchments Larger Than 8 ha

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 [WDC Approved Materials List - Wastewater and Stormwater](#). Alternative modelling methods require specific approval by the Stormwater Manager.

A complete electronic copy of the hydrological/ hydraulic model shall be provided to WDC 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.

#### 4.3.10.3 Time of Concentration

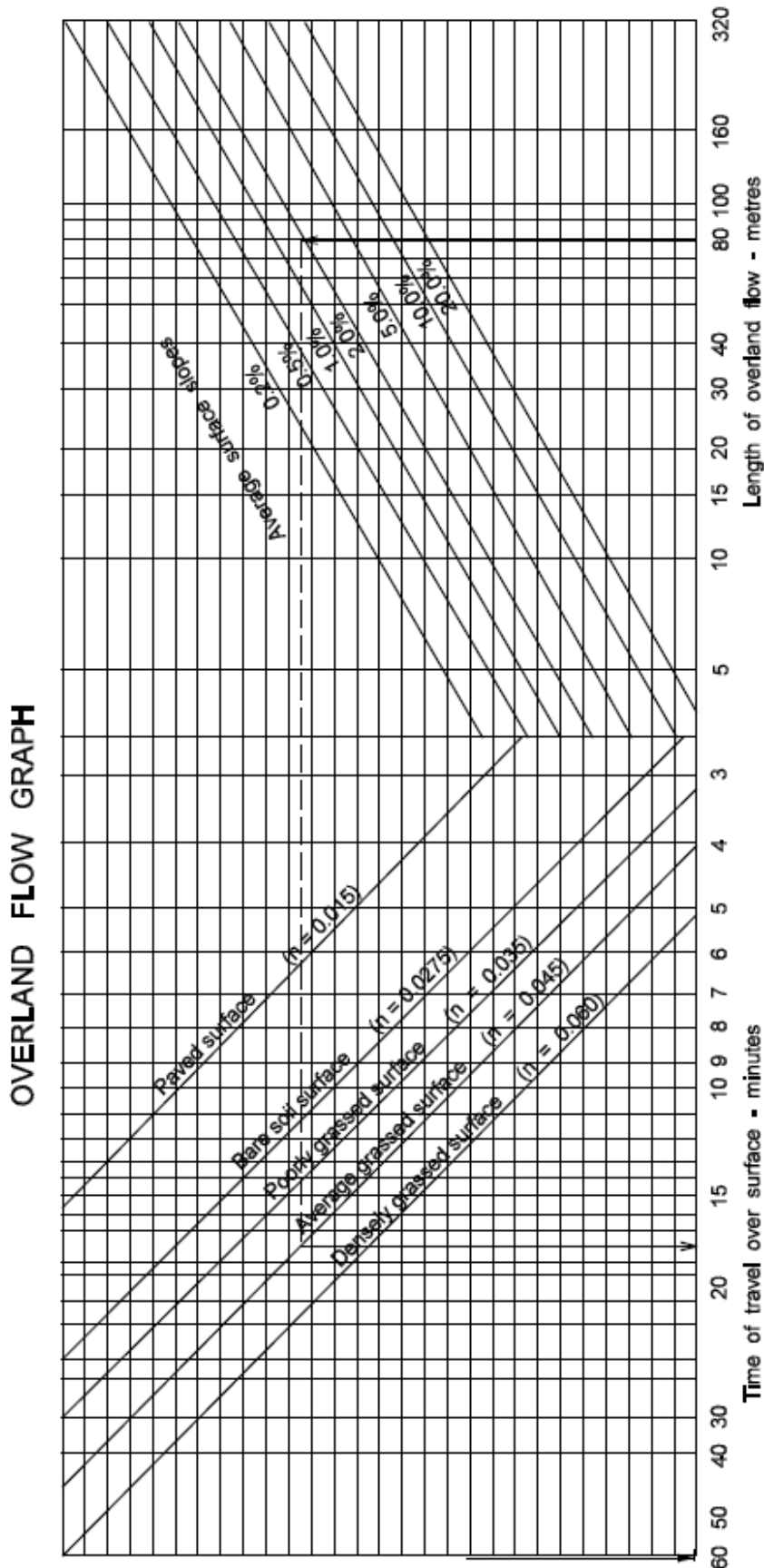
The time of concentration shall be determined as the 'time of entry' plus the 'time of flow' from the furthest point of the whole catchment to the point of discharge.

Time of entry to the system shall be calculated from [Figure 4-1](#) 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



**FORMULA**  $t = \frac{107n \sqrt{l}}{5s}$

Where:-  
 t = time of travel over surface in minutes  
 n = Horton's values for the surface  
 l = length of flow in metres  
 s = slope of surface in %

**EXAMPLE**  
 Length of over land flow 80m  
 Average slope of surface 2%  
 Average grassed surface  
 Time of travel 18 minutes

Data attributed to U.S. Dept. of Agriculture 1942  
 Nomograph published in "Municipal Utilities" Sept. 1951

#### 4.3.10.4 Design Rainfall

Acceptable sources for rainfall data for design within the Whangārei District are:

- a. Rainfall depth data from the [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.

#### 4.3.10.5 Design Storm

For analysis of rainfall events either the Modified Rational Method (variable duration, uniform profile), or a [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.

*Notes: This critical duration is unlikely to be the same as that used for the pre-development assessment.*

*The use of the [TP108](#) profile for estimation of pre-development peak runoff in the Whangārei District is not acceptable.*

### 4.3.11. Hydraulic Design

#### 4.3.11.1 Energy Loss through Structure

Energy loss is expressed as velocity head:  $H_e = kV^2/2g$  (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

#### 4.3.11.2 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

#### 4.3.11.3 Minimum Pipe Diameters

The following minimum pipe diameters shall apply:

- a. Public stormwater branch line: 150 mm.
- b. Main line: 225 mm
- c. Private / Lateral connection: 100 mm.

In no circumstances shall the pipe size be reduced on any downstream section.

#### 4.3.11.4 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.

#### 4.3.11.5 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.

#### 4.3.11.6 Pipe Surcharge

New pipelines shall be designed without surcharge during the 20% AEP.

Surcharge in the proposed stormwater network may be approved under specific circumstances, subject to impacts on the existing network performance and risks, and at the discretion of the Stormwater Manager.



### 4.3.11.7 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:

- a. Rivers,
- b. Tides,
- c. Elevated groundwater, and
- d. Surface water ponding.

Minimum floor levels in tidal areas shall take into account 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](#).

## 4.3.12. Watercourses

### 4.3.12.1 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

WDC as a Drainage Reserve (Section [4.3.12.4 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 [4.3.15 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 Northland 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 WDC as a Drainage Reserve (Section [4.3.12.4 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 WDC 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.

#### 4.3.12.2 Natural Open Stream Systems

The development proposal shall demonstrate, in addition to requirements outlined in Section [4.3.12.1 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 WDC,
- d. Has had the consequences of any blockage assessed and adequate mitigation has been provided,
- e. 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 [4.3.14 Culverts in Water](#) 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 WDC or protected by an easement, of sufficient width to contain the catchment design flow.

#### 4.3.12.3 Open Channel Flow Calculations

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 WDC 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

Description	Manning's value 'n'
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)	1.0
Rock spall lined channels	2.0
Fine sand, colloidal	0.4
Sandy loam, noncolloidal	0.5
Silt loam, non colloidal	0.6
Alluvial silts, noncolloidal	0.6
Ordinary firm loam	0.8
Volcanic ash	0.8
Stiff clay, very colloidal	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

Description	Max velocity (m/s)
Coarse gravel, noncolloidal	1.2
Cobbles and shingles	1.5

#### 4.3.12.4 Drainage Reserves

Drainage Reserves include a land planned to be vested to WDC 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,
- e. Enable public cycle/foot paths and links with other reserves and traffic networks, where practicable, and
- f. Be of sufficient width to contain the catchment design flow.

#### 4.3.13. Outlets and Inlets

##### 4.3.13.1 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.

- d. 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 WDC.
- e. [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.

#### 4.3.13.2 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.

#### 4.3.13.3 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.

#### **4.3.14. Culverts in Watercourses**

##### **4.3.14.1 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<sup>3</sup>, 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 WDC.
- 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 WDC 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 WDC 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 WDC.
- r. All culverts transferring flow across the road reserve, roadside drains and water table are owned and maintained by WDC 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 [3.2.19 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 [3.2.19 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](#).

#### **4.3.14.2 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.

#### **4.3.14.3 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%

### 4.3.15. 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.

### 4.3.16. Piped System Layout

#### 4.3.16.1 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 the WDC Stormwater Manger.
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 the WDC Stormwater Manger. 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 WDC 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 dripline.

- 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.

#### 4.3.16.2 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**.

#### 4.3.16.3 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

#### 4.3.16.4 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	$S = 100 / \text{Grade } (\%)$
> 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) WDC 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 [4.3.17.7 Manholes Requiring Specific Design](#).

*Note: Pipes laid to minimum grades will NOT be accepted in ground liable to settlement.*

### 4.3.17. Manholes

#### 4.3.17.1 General Requirements

Manholes shall be located:

- a. On WDC 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. 2 m clear of new structures in private property as per [WDC Policy #0022 - Building Over or Near Public Sewer and Stormwater Pipelines](#).

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.

#### **4.3.17.2 Spacing**

For reticulation pipes, the maximum distance between any two manholes shall be 120 m.

#### **4.3.17.3 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.

#### **4.3.17.4 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.

#### **4.3.17.5 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.

#### **4.3.17.6 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 [WDC Approved Materials List - Wastewater and Stormwater](#) and installation details.

#### **4.3.17.7 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.

#### **4.3.17.8 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 [4.3.17.4 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).

#### 4.3.17.9 Covers

Watertight manhole covers with a minimum clear opening of 600 mm in diameter, complying with [AS 3996:2019](#), and included on the [WDC 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.*

#### 4.3.17.10 Manhole 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 [WDC 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.

### 4.3.18. Connections

#### 4.3.18.1 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](#).

#### 4.3.18.2 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 WDC.
- e. Existing connections, if found on site, which may not be documented on WDC 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, WDC 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.

#### **4.3.18.3 Services in Accessways, Access Lots, Rights of Way or Multi-Unit Properties**

Refer to the [WDC Stormwater Management Bylaw 2014](#) for requirements.

#### **4.3.19. 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**.

#### **4.3.20. 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.

All subsoil drains shall be designed in accordance with WDC's [Policy #0129 Land Development Stabilisation 2018 and Land Development Stabilisation – Technical Design Requirements 2018](#).

Refer to **Sheet 14**.

#### **4.3.21. 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 E 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 Land 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.

### 4.3.22. Stormwater Treatment and Detention Devices

#### 4.3.22.1 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 WDC.

The WDC will assess a preferred approach based on the following considerations:

- a. The lifecycle maintenance cost to the WDC,
- 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 WDC.

Where proposed stormwater treatment and detention solutions may impact on the operation or maintenance of other WDC 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 WDC 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:

- a. [Wellington Water- Water Sensitive Design for Stormwater: Treatment Device Guideline](#)
- b. [The Regional Infrastructure Technical Specification \(RITS\) 2018 \(Waikato\)](#)

If WDC shall be ultimately responsible for maintenance the treatment or detention device shall be located on land owned by, or to be vested in WDC.

The WDC encourages early consultation between the Developer and WDC to achieve mutually beneficial design outcomes. Of particular note WDC seeks design outcomes that meet operational, environmental and amenity requirements.

#### 4.3.22.2 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 <sup>2</sup> )	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<sup>2</sup>, 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.

#### 4.3.22.3 Proprietary Treatment Systems

The treatment of stormwater using proprietary systems is approved when:

- The proprietary system meets or exceeds the minimum treatment requirements of [Auckland Council GD01](#), and,
- The proprietary system is on [WDC Approved Materials List - Wastewater and Stormwater](#), and
- The proprietary system is installed in accordance with the supplier's specifications and/or recommendations.

Use of a proprietary system that is not a WDC 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.

#### 4.3.22.4 Swales

The design of swales shall be undertaken by a SQEP in accordance with design guidelines contained in [Auckland Council GD01 / Wellington Water- Water Sensitive Design 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 [3.2.13.4 Swales](#) for use of swales within the Transport Corridor as road pavement drainage controls.

#### 4.3.22.5 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 Water- Water Sensitive Design 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 [3.2.13.4 Swales](#) for use of bio-retention within the Transport Corridor as road pavement drainage controls.

#### 4.3.22.6 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 <a href="#">4.1.3 Performance Standards</a> and <a href="#">Table 4-1</a> as required. Consult manufacturer's guidance for detailed sizing information. The minimum cover depths will apply.

#### 4.3.22.7 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
Catchment area	Less than 1 ha
Performance	Gross pollutant removal. Some coarse 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.

#### 4.3.22.8 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 Water- Water Sensitive Design 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 [4.3.22.9 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 WDC 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 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 WDC 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.

#### **4.3.22.9 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 Water- Water Sensitive Design 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<sup>3</sup>, 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 [7.2.1.1 Crime Prevention Through Environmental Design](#).
- c. Embankments shall be permanently planted if the slope is steeper than 1v:4h or as it may be otherwise advised by the WDC.
- 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 from 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 WDC.*

#### **4.3.22.10 Planting 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 WDC 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:

- a. Woody vegetation and trees are not to be planted within 3.0 m of the slope of the toe of wetlands and ponds.
- b. 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:

- c. Integrating planting into the wider environment such as streetscape and/or park setting so that the planting is seamless (where this is desired),
- d. Extending the footpath into wetland area as a boardwalk, and
- e. Making the wetland shape and edges aesthetically appealing

Landscaping shall:

- f. Comply with engineering requirements and [Safety in Design](#) Principles,
- g. Take into account landscaping design guidance contained in [Auckland Council GD04](#) and [WDC Urban Design Guidelines](#).
- h. Minimise ongoing maintenance,
- i. Improve stormwater water quality discharge,
- j. Retain existing bush areas and tree stands where practicable, and
- k. Provide, where practicable, forage and habitats for native flora and fauna.

#### 4.3.22.10.2. *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 WDC.

**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

#### 4.3.22.10.3. *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.

#### 4.3.22.10.4. *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 7.2.7.3 Species Selection](#) and:

- a. Compliance with [Section 3.2.6.7 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 [3.2.24 Trees and Landscaping](#).

#### 4.3.22.10.5. 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 ( <i>Carex</i> 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 Landscape Works](#).

#### 4.3.22.10.6. Bio-Filter Planting

Bio-filters (e.g. raingardens and tree pits) can be planted with a mix of WDC approved groundcovers, shrubs and trees, as site conditions and engineering requirements permit.

#### 4.3.22.11 Maintenance 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.

## 4.4. 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 [4.3.8 Approved Products](#) 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 WDC 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](#), WDC 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 WDC 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 ITP 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 ITP or conditions of the EDA, 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<sup>3</sup> 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 WDC 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 [WDC 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 [WDC 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 WDC.

#### 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 45° 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/fixated 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 WDC piped network or work on WDC 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 WDC.

#### **4.4.10. Stormwater Treatment and Detention Devices**

Planting, protection, site preparation, spacing, and mulching shall be in accordance with the WDC Approved Landscape and Parks Specification.

## **4.5. Completion of Works**

### **4.5.1. Testing and Inspections for Pipelines**

A pipelines pressure test shall not normally be required however WDC 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 completed 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 WDC.

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 WDC. 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 WDC 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 from the stat node, and indication of defects types and severity) shall be submitted to the WDC.

#### 4.5.3.2 Deliverables

The following deliverables are required:

- a. As-built plans and/or WDC 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 WDC 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 [WDC QA/QC Manual 2010](#) for CCTV header information requirements.





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## 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 WDC.
- b. Private reticulation systems that discharge into a WDC reticulation system.
- c. Private wastewater networks and on-site treatment and disposal systems.

WDC require a proposed development to connect to a public wastewater system if:

- a. There is a public wastewater system with sufficient spare capacity available for connection: and
- b. WDC considers that it is reasonable or practicable to require connection: or
- c. WDC 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 be considered an Alternative Design (See Section [1.5.1.2 Alternative Designs](#)). Approval of the applicable design and construction requirements shall be at the discretion of the Wastewater Manager.

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 WDC.

### 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 WDC'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 WDC for the purpose of balancing flows in the existing network. Storage, if approved by WDC, 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. SQEP 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 Developer 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](#)

[WDC Trade Waste Bylaw 2012](#)

[WDC Wastewater Bylaw 2014](#)

### 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 ([BS EN 1124-1:1999](#) ; [BS EN 1124-2:2014](#) ; [BS EN 1124-3:2008](#) ; [BS EN 1124-4:2013](#))

[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 WDC Documents

Approved Materials List - Wastewater and Stormwater (*To be provided by WDC on request*)

Briefing Document – EES 1: Wastewater Pump Stations Electrical Engineering Standards (*To be provided by WDC on request*)

[Coastal Structure Plan - Slope Instability Hazard Potential and Effluent Disposal Potential: Oakura to Langs Beach 2005](#)

[WDC Policy #0022 - Building Over or Near Public Sewer and Stormwater Pipelines \(2015\)](#)

[Policy #0056 - Pressure Sewer Policy \(2012\)](#)

[Public Utility Connection/Disconnection application form](#)

[Quality Assurance / Quality Control Manual for Vested Assets - Inspection and Handover Procedures \(2010\)](#)

[WDC Urban Design Guidelines](#)

### 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 WDC 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 WDC 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:

- a. The site is suitable for the disposal system proposed.
- b. 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 WDC.

The SSA shall reference the following:

- a. The WDC Hazard Plans, e.g. [WDC Coastal Structure Plan - Slope Instability Hazard Potential and Effluent Disposal Potential](#) and,
- b. WDC'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 WDC 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 WDC.

Existing private systems will not be accepted to vest in WDC 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 m<sup>2</sup>,
- 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 WDC 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:

- a. 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.
- b. A contract with an approved company is entered into on an ongoing basis to attend to the specified maintenance and any equipment failure,
- c. A comprehensive management plan is supplied and approved by the WDC.

If it is proposed to have the system become a public asset, the Developer shall engage with WDC at an early stage in order for WDC to consider the proposal. WDC'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 WDC.

Should the relocation of a WDC main be approved as part of Resource Consent or Building Consent application, a management plan shall be submitted to WDC 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 WDC system unless WDC confirms in writing that a connection is unwarranted, unavailable or unsuitable.

Where properties are adjacent to an area of benefit, WDC 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 WDC approval.

Early consultation with WDC 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 Engineering 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](#). 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](#).

### **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 Drawings](#) and [Appendix F Drawing Standards](#) shall be provided for approval.

## **5.2.2. Design Criteria**

### **5.2.2.1 General Requirements**

The WDC 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 WDC will provide (on request) for design purposes, details held by WDC of the existing wastewater reticulation. Where necessary, and at the Developer's expense, WDC 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 WDC.

*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

Source	Wastewater Flow Allowances (litres / person / day)	
	Tank Supply	Reticulated / Bore Supply
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 WDC 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 from the WDC Wastewater Manager 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 WDC Wastewater Manager.

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 WDC and shall be subject to the provisions of the [WDC Trade Waste Bylaw 2012](#).

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	
		(%)	(Ratio)
<b>Connections and Permanent Ends of Reticulation</b>			
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
<b>Wastewater Pipes – Reticulation with more than 10 Residential Lots (except PE pipelines and pipes installed by trenchless methods)</b>			
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
<b>PE Pipes and Pipes Installed by Trenchless Methods</b>			
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 WDC'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 WDC 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 WDC'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 WDC'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 WDC 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 WDC 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 WDC may require the legal width of an access to be greater than the minimum specified in Section [3.2.27 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 WDC, 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 WDC.
- 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 WDC 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 comply with the relevant NZ standards and be from the [WDC Approved Materials List – Wastewater and Stormwater](#).

The use of material not described in the [WDC Approved Materials List – Wastewater and Stormwater](#) shall be considered Alternative Designs, refer to Section [1.5.1.2 Alternative Designs](#)

The [WDC Approved Materials List – Wastewater and Stormwater](#) will be updated from time to time at the discretion of WDC.

#### **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 WDC 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 WDC 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. 2 m clear of new structures in private property as per [WDC Policy #0022 - Building Over or Near Public Sewer and Stormwater Pipelines](#).
- 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 Changes of pipe invert level	Yes	No	No
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 1.2 m 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 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 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 [WDC 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 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.

#### 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 [WDC 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 [WDC 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 WDC's Public Utility connection process as per [Public Utility Connection/Disconnection application form](#) shall be completed by the Developer and the WDC'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 [WDC Trade Waste Bylaw 2012](#). 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 WDC 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 WDC 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 [WDC Wastewater Bylaw 2012](#) 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 WDC. 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 WDC's specific approval (refer to [WDC Policy #0022 - Building Over or Near Public Sewer and Stormwater Pipelines](#)):

- 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 WDC'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 WDC's specific approval. 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.

The following requirements shall apply for public pump stations:

- 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 WDC 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 WDC, 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 [WDC Approved Materials List - Wastewater and Stormwater](#).
- g. Electrical and control systems shall comply with the [WDC Briefing Document – EES 1](#).
- h. Fencing around the pump station may be required.

*Note: Pump stations serving less than six household equivalents shall not be taken over by the WDC.*

### 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 [WDC 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 impellers 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 warranties
- aa. Pump stations shall be tested and commissioned in the presence of a WDC representative strictly in accordance with the [WDC Briefing Document – EES 1](#) and the [WDC QA/QC Manual 2010](#).

### 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 WDC's telemetry system. The system shall record instantaneous flow and totalised flows.

The flow meter shall be from [WDC 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 WDC'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 Pump Station Inlet**

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.

### **5.2.10.6 Wet Well**

#### *5.2.10.6.1. 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.

#### *5.2.10.6.2. 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.

#### *5.2.10.6.3. 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 WDC.



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](#).

#### 5.2.10.6.4. *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**.

#### 5.2.10.6.5. *Lids*

Lids shall be of a standard design as per the [WDC 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.

### 5.2.10.7 **Emergency Storage**

See also [5.2.10.8 Compliance with the NRC Regional Plan for Northland](#).

Pump stations shall provide for wastewater storage in the event of pump failure through electricity outage.

#### 5.2.10.7.1. *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.

#### 5.2.10.7.2. *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.

#### 5.2.10.7.3. *Structural Stability*

The foundation and buoyancy of the storage chambers shall be determined and designed for as per the methods used in Section [5.2.10.6 Wet Well](#).

### 5.2.10.8 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.*

### 5.2.10.9 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 WDC 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.

The electrical and control system shall strictly comply with the [WDC Briefing Document – EES 1](#).

### 5.2.10.10 Telemetry

All pump stations and treatment facilities shall be connected to WDC's telemetry system. WDC shall confirm whether satisfactory radio network communications are available at the site. If not, an alternative communication system (e.g. telephone landline with autodialer, or cell phone) shall be provided.

### 5.2.10.11 Water Supply

Where a WDC 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 WDC'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 WDC 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](#).

### 5.2.10.12 Pump Design

#### 5.2.10.12.1. Pump Selection

Pumps shall be three phase submersible type design selected, from [WDC 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 WDC 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.

#### 5.2.10.12.2. 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.

#### 5.2.10.12.3. *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).

### 5.2.10.13 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 WDC. All design works of rising mains shall be undertaken by a SQEP and shall meet 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 WDC 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). WDC's specific approval is required for pipe sizes exceeding 150 mm.

*Note: WDC 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, WDC 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 WDC records, or further information is required for the design, the Developer shall consult with WDC 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 WDC'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 [WDC 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 2638.1:2011](#) and fully polymeric coated to [AS/NZS 4158:2003](#).
- 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 4158:2003](#). 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](#).

Use of butterfly valves is subject to [Specific Design](#) and approval shall be at the discretion of the Wastewater Manager.

### 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.

### 5.2.11.10 Air 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 [WDC 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 Whangārei 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 manner in which the pressure sewer system shall be used or applied in the district is described in the [WDC Policy #0056 – Pressure Sewer Policy](#).

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 WDC.

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](#)).

*Note: Septic tank effluent pump (STEP) systems are not an approved pressure sewer system. Refer to Section [5.1.5.4 Private Treatment and Disposal](#) for considerations regarding STEP systems.*

### **5.2.12.2 Design Requirements**

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.*

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](#):

#### 5.2.12.2.2. *Environmental Considerations*

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.

#### 5.2.12.2.3. *Design Inputs and Outputs*

During the design process, the Developer shall confirm with the WDC, the nominated discharge point on the WDCs existing system that the Developer needs to convey sewage to.

The WDC may direct the SQEP to increase the diameter of pressure sewers to account for adjoining developments or based on its own operation experience.

#### 5.2.12.2.4. *Odour Control*

Ventilation and odour control shall be in accordance with Section [5.2.6 Ventilation and Odour Control](#).

#### 5.2.12.2.5. *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.

#### 5.2.12.2.6. *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 F Drawing Standards](#)

#### 5.2.12.2.7. *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.

#### 5.2.12.2.8. *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.

#### 5.2.12.2.9. *Septicity*

Calculation of sewage age shall take into account the staging of the development.

#### 5.2.12.2.10. *Sanitary Flows*

Sanitary flows shall be determined in accordance with Section [5.2.2 Design Criteria](#).

#### 5.2.12.2.11. *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.

#### 5.2.12.2.12. *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.

#### 5.2.12.2.13. *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.

#### 5.2.12.2.14. *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.

#### 5.2.12.2.15. *Flow meters*

The WDC 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](#)

#### 5.2.12.2.16. *Collection Tank and Pumping Units*

Only pumping units (including collection tanks) in the [WDC Approved Materials List - Wastewater and Stormwater](#) and the associated purchasing specifications shall be used.

#### 5.2.12.2.17. *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.

#### 5.2.12.2.18. *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")

#### 5.2.12.2.19. *Air Release and Vacuum Break Valves and Chambers*

Only air release valves authorised by WDC and listed in the [WDC 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").

#### 5.2.12.2.20. *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 WDC).

The receiving structure should be located as far as practicable from residential properties.

#### *5.2.12.2.21. 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.

#### *5.2.12.2.22. 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 WDC 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](#), WDC 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 WDC for approval, as applicable.

#### 5.3.3.3.2. 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 [5.3.3.3.3 Compaction](#), imported granular material shall be used.

Surplus and unsuitable material from the excavation shall be appropriately disposed of.

#### 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 ITP 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 ITP 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<sup>3</sup> 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 WDC'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](#) with the exception of 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 WDC 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 refresher 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.

#### 5.3.5.3.2. *Butt Welded Jointing*

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 [WDC 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 [WDC 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 WDC.

## 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 45° 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 WDC piped network or work on WDC 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 [WDC Approved Materials List - Wastewater and Stormwaters](#) shall 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 [5.2.10.6 Wet Well](#) and Section [5.2.7.7 Manholes Requiring Specific Design](#)). The WDC 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 WDC 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 [WDC 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 [WDC 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 WDC.

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 Electrical Cabinet Plinths

The electrical cabinet plinth shall be constructed as per [WDC Briefing Document – EES 1](#).

#### 5.3.8.18 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.

#### 5.3.8.19 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 WDC, this final test shall be carried out in the presence of a WDC 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 WDC representative

New sewer reticulation shall be completely and permanently isolated from the WDC's 'live' sewer reticulation until such time as all tests are passed, and written authority from WDC 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 WDC representative before the connection is backfilled.

A minimum of 24 hours' notice is required to be given to WDC 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 completed 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 WDC. 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 WDC. 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 WDC 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 from the stat node, and indication of defects types and severity) shall be submitted to the WDC.

The following deliverables are required:

#### **5.4.2.2 Deliverables**

The following deliverables are required.

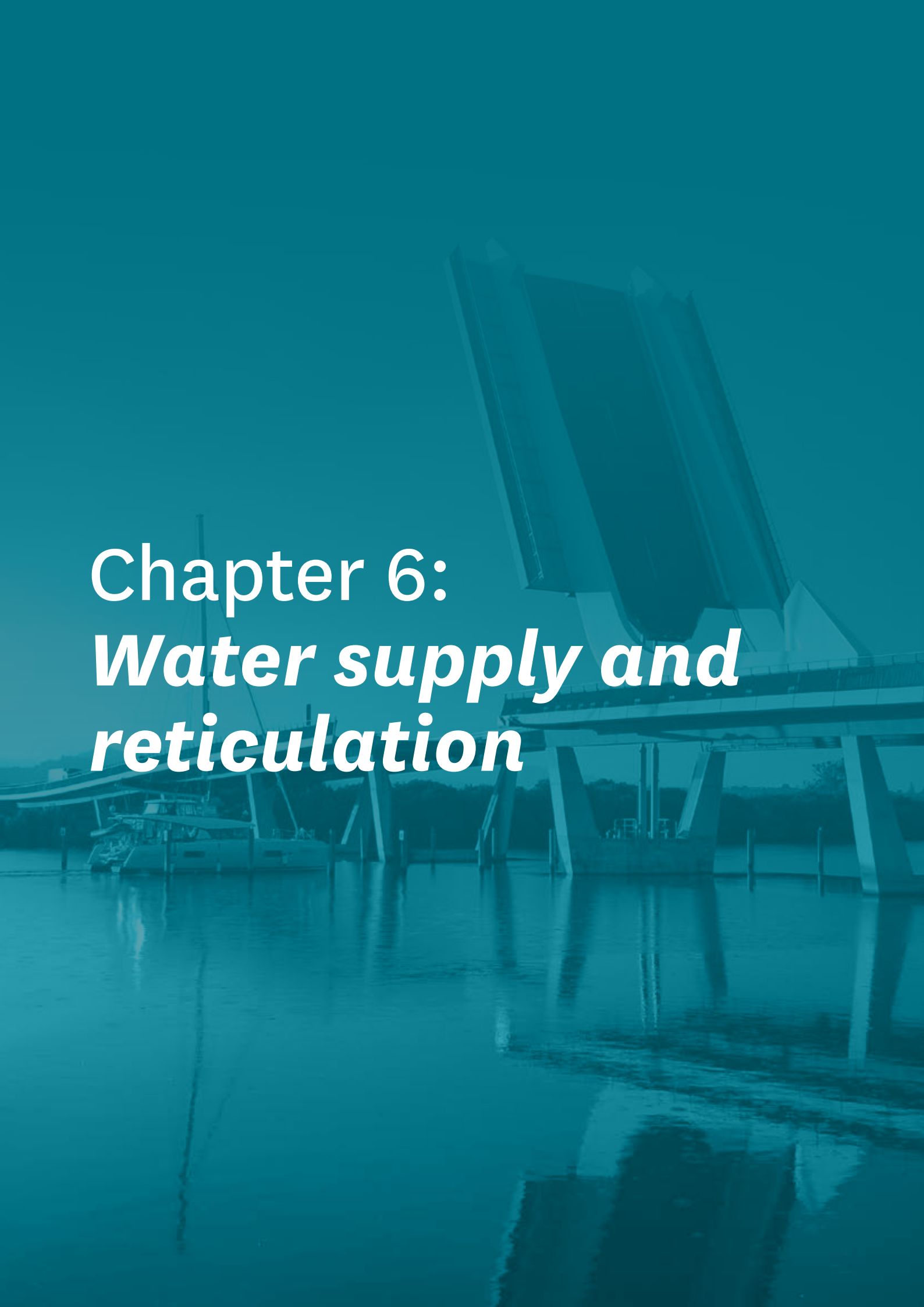
- a. As-built plans and/or WDC GIS maps for existing assets, showing pipes and nodes being inspected.
- b. Computer generated log sheets showing the pipe identification references for new and existing assets; still images of critical distances from the starting node; and indication of defect types and 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 WDC 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 [WDC QA/QC Manual 2010](#) for CCTV header information requirements.

#### **5.4.3. Pump Station Commissioning**

Refer to [WDC QA/QC Manual 2010](#) for pump station commissioning requirements.

A teal-tinted photograph of a modern cable-stayed bridge over water. A boat is docked at a pier in the foreground. The bridge's structure, including its tall pylons and stay cables, is reflected in the calm water. The overall scene is serene and modern.

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## **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 WDC's water reticulation system. A connection to WDC system shall be provided to all lots within Living and Business Zones unless WDC 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 WDC may however require that a water supply be provided to a development, regardless of the Zone, if WDC 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 WDC'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.
- f. To ensure that where properties connect to a water supply network, that network shall meet the WDC's performance 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 WDC.
- f. All pipelines and fittings fixed by accurate positioning and the coordinates of those positions specified in terms of the WDC's coordinate specifications in Section [1.7.2 As-Built Plans, Asset Information Schedules, Operation and Maintenance](#) Manuals and [Appendix F Drawing Standards](#):
- g. Comply with all relevant structure plan requirements and pipe sizes set by WDC 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 Developer 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 WDC Documents**

Approved Materials List - Water Services (*To be provided by WDC on request*)

Briefing Document – EES 1: Waste Water Pump Stations Electrical Engineering Standards (*To be provided by WDC on request*)

General Specification for Installation of Watermains (*To be provided by WDC on request*)

Hygiene Code of Practice for All Personnel working on the Water Production and Distribution System (*To be provided by WDC on request*)

[Public Utility Connection/Disconnection application form](#)

[Quality Assurance / Quality Control Manual for Vested Assets - Inspection and Handover Procedures \(2010\)](#)

Specification for Registered and Licensed Contractors for Water Supply (*To be provided by WDC on request*)

Specification for the Installation of Service Connections (*To be provided by WDC on request*)

[WDC Policy 0020 - Backflow Prevention Policy and Code of Practice 2012](#)

[WDC Urban Design Guidelines](#)

#### **6.1.4.4 Other Referenced Documents**

[Drinking Water Standards for New Zealand 2005 \(Revised 2018\)](#)



[ENZ Producer Statement – PS1 Design](#)

[PIPA - POP010A – Polyethylene Pressure Pipes Design for Dynamic Stresses](#)

[PIPA- POP101 – PVC Pressure Pipes Design for Dynamic Stresses](#)

[WIS: 4-24-01 - Specification for Mechanical Fittings and Joints for Polyethylene Pipes of Nominal Sizes 90 to 1000](#)

[Waka Kotahi – M/7 Roadmarking Paints \(2009\)](#)

### **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 WDC, 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 WDC.

### **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.

WDC 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 WDC [Licensed Contractor](#).

A [WDC Public Utility Connection / Disconnection Application](#) shall be submitted to WDC and approved before any work may be undertaken.

A WDC representative shall inspect all disconnections before back-filling takes place. All WDC owned fittings including meter and backflow preventer shall be returned to the WDC.

## **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 Engineering 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 WDC.

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](#).

*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 WDC approved location on the existing water supply network.

The WDC 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, WDC 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 WDC records, or further information is required for the design, the Developer shall consult with WDC 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 Drawings](#) and [Appendix F Drawing Standards](#) and the following requirements:

- a. Infill developments (not exceeding four lots): may be shown on combined services design drawings, and
- b. 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 WDC 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 WDC 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.

Unless otherwise approved by WDC, 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 WDC 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 WDC. 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 WDC 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. WDC 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 WDC 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 WDC owned reticulation within private property, or down right-of-way or private roads, requires specific approval from the WDC.

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 WDC 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 WDC may require the legal width of the access to be greater than the minimum specified in Section [3.2.27 Private Accessways](#) in order to ensure minimum clearances from other services.

Details on points of supply are as stated in the [WDC Water Supply Bylaw 2012](#).

### 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 WDC 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 a meter manifold 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 dripline.

### 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 Water Manager.

If a pipe bridge is approved by WDC 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 WDC
- d. Pipe materials shall ductile iron or coated steel and shall be provided with an appropriate Petrolatum wrapping as per clause 3.6 of the [WDC General Specification for Installation of Watermains](#).
- 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 <sup>3</sup> )	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 2 100 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 WDC.

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 WDC 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 WDC 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 on water networks shall comply with the relevant NZ standards and be from the [WDC Approved Materials List - Water Services](#).

The use of material not described in the [WDC 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 [WDC Approved Materials List - Water Services](#) will be updated from time to time at the discretion of the WDC.

Materials and pressure ratings for pipelines greater than DN 150 shall be determined by [Specific Design](#) and in consultation with the WDC.

## 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 WDC 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

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)
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 WDC'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 WDC.

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 WDC. 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 Whangārei District.*

*Note: PVC is not an acceptable pipe material for new installations, it shall only be used for repair work carried out by the WDC.*

*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 WDC 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 [WDC 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 [WDC 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 is subject to [Specific Design](#) and approval shall be at the discretion of the Water Manager. If approved they shall meet the following 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 arranged so that a shutdown of any section of watermain will affect as small an area as practicable.

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



Water Main Size DN	No of Property Service Connections (nominal)	Maximum Spacing of Valves (m)
* 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 WDC 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 [WDC 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 WDC where water pressure is greater than 600 kPa and a significant number of properties are affected or potentially may be 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 [WDC 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 WDC approved reinforced concrete indicator post bearing with 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 WDC 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 an approved alternative complying with [AS/NZS 4158:2003](#).
- f. Sealing cup washer shall be of nitrile 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 furthest portion of any building site along a route that is fully accessible<sup>1</sup>. 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 WDC 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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<sup>1</sup> 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 Appendix L of [SNZ PAS 4509:2008](#).

Markings in carriageways and berm areas shall be in accordance with **Sheet 48**. Final triangular hydrant markings should not be placed until near the end of the Defects Liability Period. Marking around hydrant boxes in parking bays shall be yellow retroreflective paint.

Yellow painted, WDC 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 **Sheet 45** and **Sheet 48**.

### **6.2.11. Bulk Water Meters**

WDC 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 [WDC 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 100 mm from the boundary,
- e. Include a Water Services approved manifold with diaphragm isolation valve and dual check valve and 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:

- a. A single connection feed sized as a rider main (as per **Sheet 47**), shall be provided within the legal road,
- b. The single connection feed shall extend from the public watermain to a point no closer than 500 mm to the road boundary,
- c. A peet valve shall be installed at the junction with the main,
- d. At the road boundary end, a multiple meter box shall be provided in accordance with **Sheet 47**,
- e. Separate individual connections shall then extend from the meter box to each lot, and

- f. 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 WDC 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 WDC 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 WDC for the connection,
- b. The Developer shall pay for all costs and fees, including any Development Contributions for the connections,
- c. A utility as-built form shall be submitted to WDC as per [WDC Specification for the Installation of 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:

- a. A [WDC Public Utility Connection / Disconnection 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 [WDC Approved Materials List - Water Services](#).

For connections larger than 25 mm diameter, WDC shall specify the type of meter and backflow preventer.

#### **6.2.12.3 Materials and Fittings**

Service connections and fittings shall be in accordance with [WDC 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 WDC 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.

*Note: Guidance on where backflow preventers are required can be found in the [WDC Policy 0020 – backflow Prevention Policy and Code of Practice 2012](#) and the [WDC Water Supply Bylaw 2012](#).*

#### 6.2.13. Pump Stations and Reservoirs

The design of pump stations and components require specific approval from the WDC Water Manager and shall be designed by a SQEP.

The following 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** and [WDC Briefing Document – EES 1](#).
- 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:

- a. A firefighting supply as specified in the [SNZ PAS 4509:2008](#), with a minimum of one hour’s supply, and

- b. Sufficient storage for two day's supply at peak daily demand, plus additional future demand as assessed by the WDC.

A WDC approved SCADA and telemetry link shall be provided for control of pumps and reservoir levels. Details of the equipment requirement will be provided by WDC upon enquiry

The reservoir and pump station site shall be vested in the WDC.

Access and water supply easements shall be provided in favour of WDC 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](#) may install water assets that will be vested in WDC. Only a [Licensed Contractor](#) may undertake work on existing water assets or on live watermains.

[Licensed Contractor](#)'s and [Registered Contractor](#)'s shall satisfy the requirements of and only undertake work that is specifically listed as being within the scope of their approval, as specified in the [WDC Specification for Registered and Licensed contractors for Water Supply](#).

Contractors who produce workmanship of a substandard quality or fail to comply with the ES will have their approved status revoked.

### 6.3.2. Pipeline Installation

#### 6.3.2.1 Watermains

Watermains shall be installed in accordance with this section, the [WDC General Specification for Installation of Watermains](#) 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. Comply with clause 4.15 of the [WDC General Specification for Installation of Watermains](#),
- b. Lodge a Corridor Access Request to the Road Control Authority,
- c. 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 approval from the WDC Water Manager prior to installation.

All materials and fittings shall comply with the [WDC Approved Materials List - Water Services](#), and be installed in accordance with the [WDC Specification for the Installation of Service Connections](#) and 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 WDC.

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 a WDC Approved Contractor (See [WDC Specification for Registered and Licensed contractors for Water Supply](#)), 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 WDC:

- 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 as per [WDC Hygiene Code of Practice](#) 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<sup>2</sup> 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 WDC 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 WDC.

### **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. For further details on testing refer to [WDC General Specification for Installation of Watermains](#). 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 may be asked to remove all welds up to this point and re-lay the pipe at their expense. Should the machine, welder, pipe supplier or the raw material batch change, then new tests shall be undertaken at the expense of the Contractor/ Developer.

WDC staff shall be present when the welded section is being removed.

Test results shall be forwarded to the WDC.

### 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 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 WDC approval is obtained and a metered standpipe with a check valve is used. Standpipes are available from the WDC.

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 WDC at least 24 hours' notice before carrying out testing. The test shall be carried out in the presence of a WDC 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 WDC-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 WDC-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 WDC 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 WDC'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 WDC 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 WDC 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.

Following approval by WDC, an [ES-W1](#) (in [Appendix D](#)) shall be completed by a WDC representative.

Upon completion of [ES-W1](#) the Developer shall keep the new reticulation continuously charged with water under pressure and obtain WDC approval to connect to the existing reticulation. This approval is requested by notifying WDC in writing and providing a copy of [ES-W1](#), the test results and a drawing of the connection detail.

The connection shall only be made by the [Licensed Contractor](#) shown in the application.

Upon connection, the new reticulation shall be flushed to the satisfaction of WDC and left operational.

If WDC considers that the main being connected is critical, then only the WDC'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 [WDC QA/QC Manual 2010](#). 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

## **6.4. Completion of Works**

### **6.4.1. 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.

### **6.4.2. 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](#) and [Appendix F Drawing Standards](#).

In addition to the requirements in Section [1.7.2 As-Built Plans, Asset Information Schedules, Operation and Maintenance Manuals](#) and [Appendix F 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.

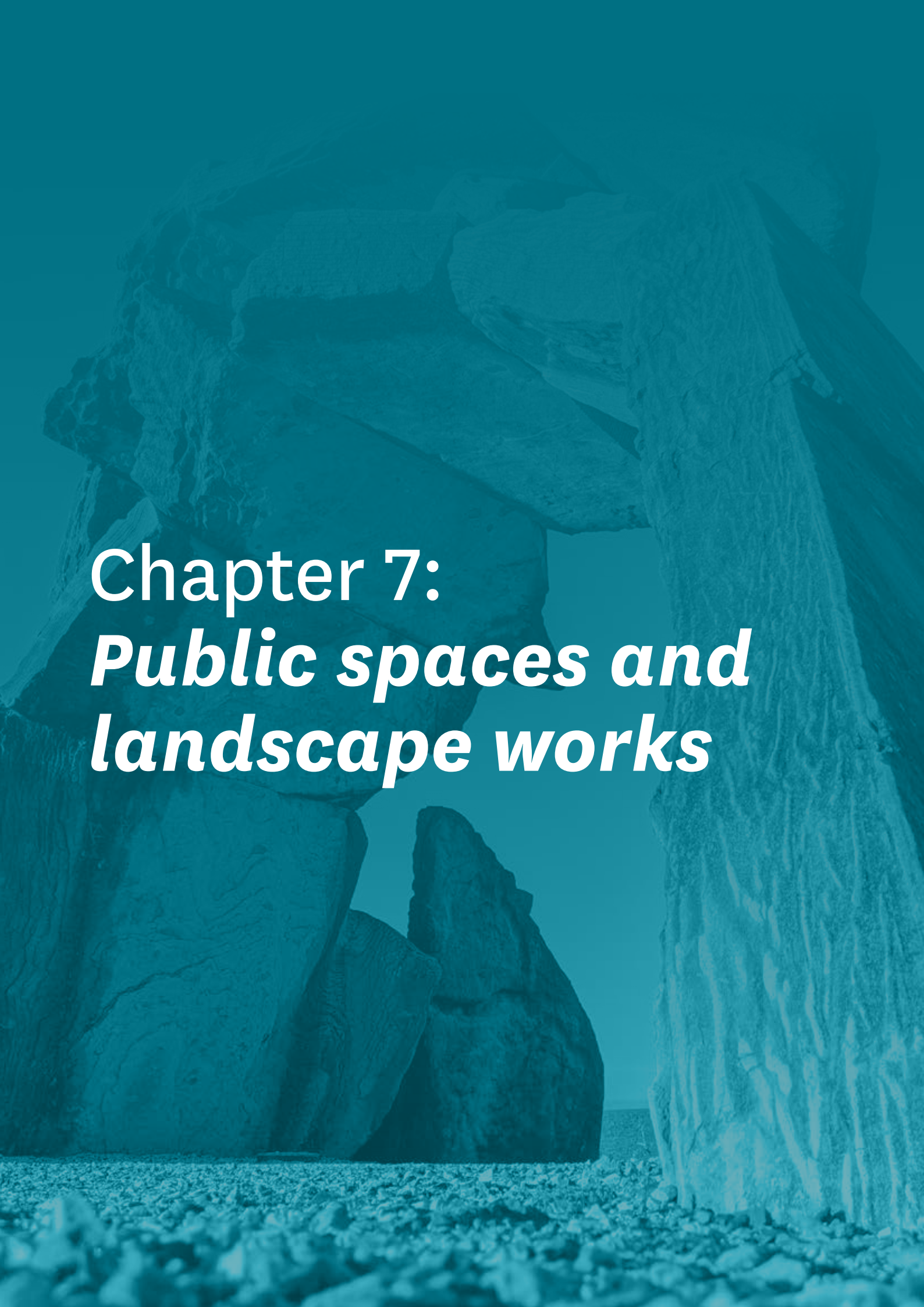
Additional information to be included in the asset information schedule, is required for all hydrants, valves and meter box locations as follows:

- 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 F 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 WDC may audit as-built information on site upon completion of the works, development.

An EDA Certificate of Completion for the works will not be issued until as-built information fully complies with the requirements of the ES and is to the satisfaction of the WDC.





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***Public spaces and  
landscape works***

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## 7.1 Introduction

### 7.1.1. Scope

This section covers the spatial design of reserves, and the landscape design and construction of public spaces including reserves and streets. The design, layout and landscape enhancement of public spaces shall comply with this Chapter.

### 7.1.2. Objectives

The creation of areas of public space and landscape development shall:

- a. Maximise long term benefits including environmental, community, recreation and systems 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 that any landscape engineering design and works are compatible with these objectives and any consent conditions, and
- f. Ensure public safety through consideration to [National Guidelines for Crime Prevention through Environmental Design in New Zealand](#).

Where practicable, the development shall:

- g. Protect, maintain and restore existing natural ecosystems, vegetation, and landscape features, and contribute to ecological and habitat biodiversity,
- h. Protect and enhance existing vegetation,
- i. Provide amenity open space, “buffer areas”, open space connections and access to watercourses, and
- j. Provide a coherent and legible design that promotes ease of pedestrian access to and through areas of public space and to other public amenities.

### 7.1.3. Performance Standards

The design and development of reserves and other public spaces shall achieve the following:

- a. Reserves and other public spaces have an appropriate size and shape for expected use.

- b. Reserves provide a pedestrian access function and where useful and compatible with other values of the reserve, access linkages to and through the reserve shall support access for ongoing maintenance requirements.
- c. Earthworks are planned and executed to achieve appropriate gradients for intended use and optimise drainage for ongoing use and maintenance.
- d. Trees and planting are designed for long term retention and easy and cost-effective maintenance.
- e. Any structures fulfil a necessary function and are safe and appropriate to the setting.
- f. Planting in streets allows for safe transport functions including movement of vehicles and pedestrians.
- g. Planting design and layout is compatible with both underground and overhead network utility services and ongoing maintenance requirements.

#### **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 Developer to ensure the most up to date referenced document is sourced.*

##### **7.1.4.1 Statutory**

[NRC Regional Plans](#)

[Reserves Act 1977](#)

[Resource Management Act 1991](#)

[Operative District Plan](#)

##### **7.1.4.2 New Zealand Standards**

[NZS 4404:2010 - Land development and subdivision infrastructure](#)

[NZS 5828:2015 – Playground equipment and surfacing](#)

[NZS 8409:2021 – Management of agrichemicals](#)

[SNZ HB 44:2001 – Subdivision for people and the environment](#)

[SNZ HB 8630:2004 - Tracks and Outdoor Visitor Structures](#)

##### **7.1.4.3 WDC Documents**

[WDC Urban Design Guidelines](#)

#### 7.1.4.4 Other Referenced Documents

[Auckland Council GD01 – Stormwater Management Devices in the Auckland Region \(2017\)](#)

[Cancer Society Guidelines for Shade Planning and Design: Under Cover](#)

[Growsafe Standard Certificate](#)

Low Impact Urban Design and Development (LIUDD) research programme publications 2003-2009 (Landcare Research: Auckland University)

[MfE New Zealand Urban Design Protocol \(2005\)](#)

[Ministry for the Environment's National Guidelines for Crime Prevention Through Environmental Design in New Zealand \(2005\)](#)

[Ministry of Primary Industry's National Pest Plant Accord](#)

Northland Transportation Alliance Design Manual - Street Lighting Version 1 (*To be provided by WDC on request*)

[NRC - Clean Streams – A Guide to Riparian Management](#)

[NRC Northland Regional Pest and Marine Pathway Management Plan 2017-2027](#)

[Waka Kotahi - Pedestrian Planning and Design Guide \(2009\)](#)

[Waka Kotahi - RTS 14 Guidelines for Facilities for Blind and Vision Impaired Pedestrians \(2015\)](#)

#### 7.1.5. Reserve Provision

Some Developers may 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.

Where a reserve or future reserve contains or is likely to contain large and/or protected trees, the size and layout of the reserve shall take into account separation distances from existing and future adjacent residential activity and an ETVP shall be submitted, refer to Section [7.2.2.2 Existing Trees and Vegetation Plan](#).

Each reserve shall be identified and vested in accordance with the most appropriate reserve classification under the [Reserves Act 1977](#).

All land transferred to WDC (whether as road or reserve) shall vest in WDC free from all existing interests. Any such interests shall be removed by the Developer (and all relevant consents obtained), at the Developers cost, and prior to the vesting of the land. Only in special circumstances will WDC accept land to vest subject to existing interests.

Where the function of the reserve will have different ongoing maintenance requirements and levels of service, each part of the reserve shall be identified and vested separately

according to its primary function. Locating reserves with different functions together may be beneficial, for example a drainage reserve adjacent to a recreation reserve.

### **7.1.5.1 Gifting of Land**

WDC may accept the gift of land in certain circumstances and subject to the written agreement of the WDC. The vesting or gifting of land will not result in any financial offset or payment from WDC, unless specific agreement is reached with WDC. The conditions of any application shall confirm the basis of the WDCs acceptance of any vested land.

Where land is proposed to vest as a result of [Resource Management Act 1991](#) requirements, such as esplanade reserves or drainage reserves, there shall be no expectation of any recompense or reduction in development contributions.

## **7.2. Design**

### **7.2.1. Design Principles and Requirements**

It is important that consideration to landscape design occurs throughout the development process through to construction, to ensure that landscaping can be successfully integrated into the reserve or road corridor, with sufficient provision for network utility services and lighting.

Infrastructure services should be planned at the same time as the landscape design so that planting locations do not compromise the integrity and efficient operation of services. If particular landscape conditions or objectives are required for a development, then these shall be considered prior to undertaking detailed engineering design.

The designer and any contractors shall have both experience and qualifications that are relevant to the scope of the development. The landscape designer shall be familiar with the landscape works requirements in this Chapter.

#### **7.2.1.1 Crime Prevention Through Environmental Design**

All landscape design will involve the application of [National Guidelines for Crime Prevention through Environmental Design in New Zealand](#) principles, regardless of the location.

In some locations, where WDC staff consider greater surveillance is required, the design may need to take into account the location of CCTV cameras.

### **7.2.2. Content of Design Submission**

The application for resource consent shall include drawings locating the following (where applicable):

- a. Existing natural features (topographical, geological, hydrological and ecological), including all existing trees and areas of vegetation within the site, and any proposed modifications or changes to these areas,

- b. Existing and proposed structures including: paths/paving, fencing, signs, seating, tables, play equipment and lighting, access structures, (such as stiles, gates, boardwalks, platforms), retaining walls, stop banks, scour mats, drainage structures, rock revetment etc.,
- c. Proposed planting including plant locations and spacing, plant species and grade, mulch, areas of ecological enhancement, areas of grass to be mown,
- d. Services reticulation including water, wastewater, electricity and other utilities to boundary,
- e. Landscape features such as mounding,
- f. Irrigation or other services, and
- g. A design statement accompanying the design drawings detailing how the proposal is consistent with the referenced documents (Section [7.1.4 Reference Documents](#)) and the ES.

Design drawings shall comply with the requirements of Section [1.5.3 Engineering Design Approval](#) and [Appendix F Drawing Standards](#). Sufficient information shall be provided to demonstrate that the proposed work meets WDC requirements.

#### **7.2.2.2 Existing Trees and Vegetation Plan**

Where a reserve or road to vest includes existing trees and vegetation, an Existing Tree and Vegetation Plan (ETVP) shall be prepared by a qualified and experienced arborist, or as approved by the WDC, and submitted in the EDA.

The purpose of the ETVP is to:

- a. Identify existing trees and vegetation which are proposed to be removed or retained on land to be vested to WDC.
- b. Provide ongoing maintenance requirements.
- c. Provide whether a methodology is required to protect trees and vegetation from construction activities.

The ETVP shall be submitted to the WDC and shall be approved prior to any removal of trees or vegetation or earthworks commencing.

The ETVP shall include the following:

- a. Identification of the size, species and location of all trees, including those trees currently protected by the [District Plan](#) and trees that will be afforded protection under the [District Plan](#) when the land is vested, due to their scale and situation on public land.
- b. Identification of any existing trees that are proposed to be retained and removed.
- c. Identification of the tree protection zone around each tree to be retained, which is determined by either the tree dripline, or a 2.0 m radius from the

trunk (whichever is greatest), and / or any other provisions that may apply to trees protected by the [District Plan](#),

- d. Construction methodology and protection measures to avoid damage or other adverse effects on the health and value of trees. Construction methodology is to include:
  - i. Restrictions on construction activities in the tree protection zone, including the exclusion of machinery and heavy equipment and storage of materials.
  - ii. The position and design of any temporary protective fencing or other methods of protection required.
- e. Identification of any arboricultural maintenance on trees to be retained, to ensure that the trees are in a healthy and stable state for long-term viability.

### **7.2.3. Design of Reserve and Reserve Linkages**

The Developer is encouraged to discuss reserve design with WDC at an early stage. This process shall begin at a pre-application meeting, prior to applying for resource consent.

Reserves, including neighbourhood recreation reserves, shall:

- a. Have a minimum size of 3000 m<sup>2</sup>, to provide for expected recreation activities.
- b. Have flat or gently sloping contours.
- c. Not be dominated by services such as overhead wires that compromise the amenity.
- d. Give consideration 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.
- e. Seek to maximise linkages and access opportunities to the surrounding street and reserve network, including esplanade reserves.
  - i. In urban areas, esplanade reserves may be provided to facilitate safe pedestrian and cycle movement through neighbourhoods, and to create a more permeable, legible, open space environment.
- f. Provide public access points from walkways to roads at 300 m intervals where walkways are located within esplanade and similar reserves to allow access options and ease.

Neighbourhood recreation reserves shall:

- a. Be located in prominent locations with sufficient street frontage to provide passive surveillance for safety and greater amenity.



- b. Generally, have relatively equal reserve dimensions, to create useable and flexible spaces.
- c. Be accessible to all surrounding neighbourhoods and communities.

Reserves that provide for stormwater management purposes shall be created as local purpose (drainage) reserves, with separate titles and shall:

- a. Comply with Section [4.3.12.4 Drainage Reserves](#).
- b. Not include ponds or wetlands without prior specific approval from the Parks and Recreation Manager.

Reserves other than local purpose (drainage) reserves used for stormwater treatment or detention ponds for stormwater runoff from the reserve areas, require specific prior approval from the Parks and Recreation Manager, and shall only be allowed where they are designed for >2% AEP flood events. In such circumstances, the design of any drainage structure shall be compatible with the function and amenity of the reserve. The impacts and ongoing maintenance requirements of any stormwater infrastructure in reserves shall be detailed and provided to WDC prior to vesting as per Section [1.7.2 As-Built Plans, Asset Information Schedules, Operation and Maintenance Manuals](#).

Multi-use reserves, including recreational or access use of drainage reserves, where consistent with other values, is encouraged.

The alignment of public utility or private services through future reserves shall only be permitted for the benefit of a facility within the reserve.

### 7.2.3.2 Pedestrian Accessways

Pedestrian linkages in urban areas, and other accessways and leg-ins to reserves including esplanade reserves shall:

- a. Have a minimum legal width of 6 m (also to allow for maintenance vehicle access) with a central permanently surfaced pedestrian path 2.20 m in width, or shared path 3 m in width, constructed in accordance with **Sheet 2**.
- b. Be aligned in such a way as to provide clear views of entry and exit points. The length of the area of the reserve that functions as a pedestrian accessway shall be no more than five times the narrowest width.

### 7.2.4. Streetscape Design

The design of streets shall reinforce the legibility of the city by building on the urban context including:

- a. Landscape,
- b. Built form,
- c. Existing use, and
- d. Social, economic, cultural, aesthetic and historical associations.

In an urban environment, underground space is limited, and infrastructure placement and provision of space dedicated to planting may be critical for a successful design.

Approval of paving, lighting and other structures that do not align with the ES will require specific approval and shall only be approved where the feature improves the wider urban legibility and character. The WDC will not approve any structures in public land that do not provide public benefit e.g. walls or signs at entrances to subdivisions.

### **7.2.5. Earthworks Design**

Earthworks shall be designed so that maximum finished gradients for mowable areas are 1v: 5h, with profiles that drain sufficiently to allow year-round mowing by tractor-mounted equipment.

Refer to Section [7.3.1 Earthworks](#) when planning earthworks.

### **7.2.6. Landscaping Structures and Furniture**

#### **7.2.6.1 Play Equipment**

Approval from WDC is required for all play equipment (including hard courts and skateboarding facilities) in reserves and shall only be approved where WDC considers the equipment and location meets the recreational needs of the local community and complies with current WDC play strategies and policies.

Approved play equipment may be installed by the Developer or by WDC following vesting of the reserve.

Play equipment and surfacing shall comply with [NZS 5828:2015](#), shall meet the conditions of required building or resource consents, and any other engineering or quality control requirements that WDC may require.

#### **7.2.6.2 Landscape Structures**

Approval from WDC is required for all landscaping structures in reserves, and in road reserves.

The Developer is responsible for gaining any necessary building or resource consents for proposed structures, including retaining walls.

The following structures shall be provided, prior to the vesting of a reserve:

- a. Bollards on the street frontage of reserves, with a removable barrier for maintenance access (refer **Sheet 58**), and
- b. Vehicle crossings for maintenance vehicles constructed in accordance with Section [3.2.26 Vehicle Entrances](#) and Section [3.3.7 Footpaths, Cycleways and Vehicle Crossings](#),

The following structures shall be provided, prior to the vesting of a walkway:

- a. Bollards on the street frontage of reserves, with a removable barrier for maintenance access (refer **Sheet 58**),
- b. Fencing to a maximum height of 1.2 m on side boundaries constructed in accordance with **Sheet 54**, and
- c. Pedestrian path 2.20 m in width, or shared path 3 m in width, constructed in accordance with Section [7.2.3.2 Pedestrian Accessways](#).

Durability and maintenance requirements shall be considered in the design of all landscape structures.

Structures shall be located so that they do not obstruct the sight lines for intersections, pedestrian crossings and signs. The location shall take into account any separation required from trees and other landscaping features.

Entranceway wall structures shall be located fully on private land. Any other immovable landscape structure (e.g. boulders) shall not be located where they prevent access to underground services.

Structures shall be designed to safely withstand appropriate loadings and shall not be a hazard to traffic, pedestrians, people with disabilities and cyclists.

Landscape track structures shall comply with the requirements of [SNZ HB 8630:2004](#).

All retaining walls shall be constructed to resist lateral earth pressures and those from any surcharge loading that may be present.

If paths are provided, the maximum gradient of paving and ramps shall be no greater than 1 in 8. Paths shall be no closer than 2 m to residential boundaries.

Where vehicle barriers are required by WDC to control unauthorised vehicles, these shall be constructed as detailed in **Sheet 58** or otherwise as agreed with WDC.

*Note: The WDC may not approve jetties, landings, fishing pontoons and similar structures that will be located on public land.*

### 7.2.6.3 Fencing styles

Refer to the [WDC Urban Design Guidelines](#) for further guidance on boundary treatments.

Fencing within reserves or on walkways shall be consistent with the fence types outlined in **Sheet 54** unless otherwise agreed by the WDC.

The standard fences in [Table 7-1](#) shall be used.

Refer to the [WDC Urban Design Guidelines](#) for further guidance on boundary treatments.

**Table 7-1: Standard Fence Uses**

Fence Type	Use
Type 1 (post and mesh)	Urban walkways and reserves

Fence Type	Use
Type 2 (tube and mesh)	Urban walkways and reserves
Type 3 (stock proof)	Where stock proofing is required

*Note: A building consent shall be obtained for fencing over 2.5 m in height, and [District Plan](#) requirements and consent notices shall be checked.*

#### 7.2.6.4 Fencing Covenant on Reserve Boundaries

All fencing within and on the boundaries of reserves shall be subject to a fencing covenant. The covenant shall exempt WDC from liabilities relating to fences and shall require fencing to be agreed by WDC in line with the fencing guidelines.

### 7.2.7. Planting Design General Requirements

#### 7.2.7.1 Grassing, Sowing and Turfing

Requirements for establishing lawn are covered in Section [7.3.8 Establishment of Sown Areas](#).

#### 7.2.7.2 Planting and Garden Areas

Planting, including native revegetation and garden areas, will only be approved by WDC where the planting adds to visual amenity, urban legibility, improved ecological outcomes and/or reduce maintenance requirements. Refer to the [WDC Urban Design Guidelines](#) for further guidance.

Trees, and reserve plantings shall be located so as not to compromise the integrity and efficient operation of network utility services. As such, if particular landscape conditions or objectives are required for a development then these shall be taken into account prior to undertaking detailed engineering design.

Designs shall consider the effect of tree roots on the operation and maintenance of piped services and vice versa. Trees shall not be planted where piped services will be within the tree dripline, unless specific consideration by an arborist confirms that the root system is unlikely to affect the services, and that excavation to maintain the service will not affect the tree. Areas free of services shall be designed so that trees can be successfully incorporated into the street environment. To achieve this, the design shall demonstrate how sufficient room is provided for the proposed planting, with reference to likely root growth of a particular species.

#### 7.2.7.3 Species Selection

The species choice shall ensure a unified result to complement street planting, environment, and scale of surroundings. The following shall be considered for appropriate species selection:

- a. Overall composition, low maintenance and longevity,

- b. Suitability to environmental conditions such as modified groundwater table, exposure to wind and frost, vehicular and cycle traffic, and
- c. Suitability to locality e.g. scale in relationship to the surrounding environment, shading consistent with location: impact on neighbouring properties, structures and infrastructures, fruiting,
- d. Minimum maintenance requirements including longevity, non-suckering habit, pest and disease resistance,
- e. Safety such as toxicity of leaves, flowers, seeds, and bark in areas likely to be used by young children, along with impairments to pedestrians,
- f. Avoidance of Invasive or pest species recognized by the NRC and the [National Pest Plant Accord](#), and
- g. Native species are preferred.

All plants shall be high quality specimens for their grade and species, and be well rooted relative to container size. Stock shall be a minimum RT or PB 3 grade for groundcover, and PB 5 grade for shrubs.

The minimum planting size of a specimen tree is 1.5 m tall with a minimum caliper of 30mm at the time of planting, unless the local conditions of a site require consideration of alternatives, e.g. an exposed site may require small, well-hardened trees.

No substitution of species or grade shall be made without the written approval from WDC. If species or grades specified are unobtainable, WDC may approve alternatives. Smaller grades of plants may require an increased planting density and numbers.

#### 7.2.7.4 Location of Trees to be Planted in Reserves

The following offsets from boundaries shall apply for tree planting:

**Table 7-2: Tree Planting Offsets from Boundaries**

Mature tree height	Minimum boundary offset from north of adjoining property (m)	Minimum boundary offset from other boundaries adjoining property (m)
Small (up to 6m)	5	3
Medium (6-12 m)	12	8
Large (12+ m)	17	11

Any variations from these offsets shall be approved by the WDC.

Consideration shall be given to placement of trees to avoid conflict with future views, for example placing trees in line with boundaries between residential lots.

Trees shall be located a minimum of 3 m from paths.

### 7.2.7.5 Irrigation Provision

The WDC may require provision for permanent irrigation of street and reserve gardens or turf. Provision for irrigation during the establishment of plants may be acceptable for gardens that are not otherwise irrigated.

All irrigation connections shall be provided with a water meter. The Developer shall apply for, and pay all costs associated with the water connection, including development contributions.

### 7.2.8. Street Tree Planting Design Considerations

Street trees shall be planned to ensure they don't compromise sight lines, underground services, or the safety of road users, cyclists and pedestrians, and shall meet the following requirements:

- a. Be located to meet recommended clearances shown in **Sheet 55** and **Sheet 56** unless otherwise approved by the WDC. See the [Northland Transportation Alliance Design Manual - Street Lighting Version 1](#) for lighting columns clearance requirements.
- b. Tree species within the road reserve shall be selected for appropriate root structure and growth patterns for urban areas.
- c. Street trees shall have access to a root area of at least 10 m<sup>2</sup> clear of paving and utilities. Tree root barriers may be required where trees will be located near paving or other infrastructure.
- d. All street trees, unless specified otherwise, shall be first grade nursery specimens of a minimum grade of pb95, with a minimum height of 2.0 m, have a 30 mm trunk calliper and have appropriate formative pruning ensure optimal visibility from when they are first planted through to maturity.
- e. Tree species in the road corridor shall be selected to provide minimal leaf fall.
- f. The WDC will require a street tree maintenance period to ensure trees are well-established. This will vary depending on the tree type and location.
- g. Trees located in the sight triangle of intersections, or other traffic or vehicle/pedestrian conflict areas should not exceed 400 mm in height when mature, unless the trees are grown to create clear trunks and a high canopy that does not interfere with sight lines.

The WDC may refuse the planting of street trees where space does not allow for a tree to mature.

No substitution of species or grade shall be made without the written approval of the WDC.

Drawings of proposed street trees provided for in the EDA shall show all WDC services, overhead power lines and other relevant services, and visibility splays at road intersections and corners.

## 7.3. Landscape Works

### 7.3.1. Earthworks

Approval from WDC is required before any earthworks can take place in areas that are or will be vested as reserves. All earthworks shall comply with the [District Plan](#), and Environmental Standards for Land Disturbance Activities contained within the [NRC Regional Plans](#) or have appropriate resource consent approval.

Unless otherwise agreed, earthworks shall remove all tree stumps, buildings and foundations, and redundant tracks and other features. All topsoil removed to permit earthworks to be carried out shall be stockpiled for reuse within the area of the reserve.

Refer to Section [7.2.5 Earthworks Design](#) for finished gradients and profiles to be achieved by earthworks.

### 7.3.2. Existing Vegetation and Trees

Land development can damage or threaten the long-term viability of existing trees and vegetation, and works shall be planned to minimise risk of this. All existing vegetation and trees to be retained during works shall be protected before construction starts, and remain protected until completion of construction as outlined in the ETVP (See Section [7.2.2.2 Existing Trees and Vegetation Plan](#)) for each site.

Existing trees within road reserves and WDC reserves, and other listed trees in the [District Plan](#) may have additional planning requirements. New construction and planted areas shall also be protected from any practicable damage from site works (refer Section [7.3.18 Protecting Newly Planted Areas in Work Sites](#) and Section [7.3.6 Landscaping Structures and Furniture](#)).

#### 7.3.2.1 Construction Activities Near Trees

Site works including earthworks shall not take place within 10 m of the tree dripline of existing trees, unless allowed for in a site-specific ETVP approved by WDC.

Any exceptions to the requirements for trees outlined in this section shall be identified and require specific approval from WDC.

The Tree Protection Zone identified in the approved ETVP shall be fenced or otherwise restricted to the satisfaction of WDC to avoid activities in this area that may adversely affect the health and value of the tree. Machinery and equipment shall be kept outside the Tree Protection Zone, and nothing shall be deposited within the Tree Protection Zones at any time.

Pruning or removal of branches or roots 50 mm in diameter or more may only be carried out by an Arborist or other expert as approved by the WDC and shall be in accordance with approved ETVP. All tree roots severed that are between 10 mm and 50 mm shall be neatly cut with a saw or other suitable pruning equipment. Roots larger than 25 mm in diameter shall be retained in an undamaged state and protected. Any exposed roots and cut roots shall be protected from drying winds and frost with damp sacking or similar material if not backfilled immediately. When there is a need for an open cut trench near



trees, works will be done under the supervision of an arborist, and hand excavation shall be used. Under no circumstances may a digger be used to sever tree roots within the Tree Protection Zone.

Services shall be routed around the outside of the tree dripline. If installation of services is required under existing trees and vegetation then trenchless technology shall be used, and the depth of thrusting approved by the WDC. If this is not practicable, an assessment of the effects on the tree(s) from a qualified arborist shall be provided to the WDC.

*Note: Works within the tree dripline of trees protected by the [District Plan](#) may require resource consent. The WDC may require that a suitably qualified WDC staff member monitor all works in or around these trees.*

### **7.3.2.2 Existing Trees to Remain on Land to be Vested**

Prior to vesting, any arboriculture maintenance on trees that will be retained as identified in the ETVP shall be undertaken by an arborist approved by the WDC.

### **7.3.3. Natural Areas**

Natural areas, including native forest and wetlands contained within reserves to be vested shall be free of rubbish and debris, and weed free (for list of weeds refer to [Northland Regional Pest and Marine Pathway Management Plan 2017-2027](#)) when vested. All persistent perennial weeds including gorse, wild ginger, pampas and tobacco weed shall have been killed by spraying and, where practicable, removed from site.

### **7.3.4. Soil and Fertility**

Imported topsoil shall be a good quality loam soil that is free draining, free of perennial weeds and debris and capable of sustaining the required plant growth. All topsoil shall be inspected at its source and shall not be placed without the prior consent of the WDC.

Stockpiles of imported or site topsoil to be used in planting areas shall be left to grow vegetation and sprayed to eliminate perennial weeds prior to their seeding and prior to the soil's use, (refer to Section [7.3.14 Weed Control](#)). Topsoil stockpiles shall be a maximum of 2 m in height and stored for the minimum practicable period and less than 12 months. The WDC may require that topsoil is supplemented with compost when soil is deficient in organic matter or stored for a longer time.

#### **7.3.4.1 Soil Laboratory Testing**

At the WDC's discretion, topsoil on site or topsoil to be brought onto site shall require nutrient or chemical laboratory testing (e.g. contamination testing). If WDC requires soil testing, planting shall not proceed without WDC approval of the soil test and agreement on any necessary improvements.

The WDC may:

- a. View the topsoil at its source: and/or
- b. Request further topsoil sample testing: and/or

- c. Undertake further topsoil sample testing.

The laboratory results and a plan indicating sample site location shall be provided to WDC prior to planting. Where sample results are beyond acceptable parameters for intended use, the topsoil shall be modified to ensure that it aligns within these parameters or another conforming topsoil source shall be identified to be used for planting.

### 7.3.5. Preparation of Planting Areas

Excavation and soil placement shall be carried out where necessary to achieve the soil depths in [Table 7-3](#):

**Table 7-3: Excavation and Soil Placement Depths**

Situation	Topsoil depth (minimum) (mm)	Mulch depth (minimum) (mm)	Depth below adjacent paving or kerbs (mm)
Street gardens including traffic islands	400	100	50
Planting areas - mulched	400	100	50
Annual bedding areas	400	-	70

All levels shall be after cultivation and reasonable consolidation. In areas of very good soil conditions and where approved by the WDC, topsoil from site may be used to achieve depths listed above.

In locations such as street gardens and roundabouts where the topsoil is not in contact with underlying soil strata, a detail of ground preparation including drainage shall be approved by the WDC. Concrete haunching of edges shall not extend into planting areas more than the minimum required to hold. Haunching of edges shall not surpass a maximum of 100 mm into gardens.

Prior to planting, all planting areas shall be cleaned of rubbish, stones, unwanted vegetation and other debris.

### 7.3.6. Landscaping Structures and Furniture

No structures other than those on the approved plans shall be constructed without approval from the WDC. Any structures that form part of the landscape works requirements shall be protected from other landscape activities by fencing or other means.

#### 7.3.6.1 Play Equipment

All play space construction works shall be approved by WDC prior to installation.

#### 7.3.6.2 Vehicle Access Barriers

Bollards shall be constructed in timber to the detail in **Sheet 58** or as otherwise approved by the WDC.

### 7.3.6.3 Fencing

All fencing shall be constructed to the detail drawings in **Sheet 54** unless otherwise approved by the WDC.

Livestock fencing shall be provided where required. At road frontages, no hot wires shall be used unless they are attached at 300 mm inside the fence. 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.

### 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

Grass seeding and fertilising shall be carried out over all existing grassed areas disturbed by machinery and other areas which may require reinstatement. In existing grassed areas, excessive compaction of the subsoil shall be relieved by a method approved by WDC such as verti-draining, vibra-moling, coring or ripping to achieve satisfactory long-term growing conditions.

All new grass areas shall be built on subgrades prepared to a CBR of not less than five and no greater than seven throughout the area. A minimum 100 mm layer of clean, friable loam topsoil, free of all perennial weeds, stones and rubbish shall be placed on the subgrade. If the subgrade has been backfilled with sand or if the existing subgrade material is of a sandy nature, then the 100 mm topsoil shall be of a heavier silt loam.

The topsoil shall be lightly compacted or consolidated, and may be laid proud of adjoining features (such as kerb and channel, path, crossings etc.) by not more than 25 mm to allow for settlement, provided that it does not cause water to pond on any footpath or vehicle crossing area. All finish levels shall be those specified on the plans or to a 2-2.5% cross slope. New areas shall be neatly contoured into adjoining grassed areas. The top 25 mm of topsoil shall have a loose tilth. No soil shall be cultivated or handled when the moisture content is at a level where soil structure damage will result.

For weed removal, a suitable broad spectrum weed control chemical spray shall be used. Any other spraying shall be approved prior to application by the WDC, and used according to manufacturer's instructions, (refer Section [7.3.14 Weed Control](#)).

#### 7.3.7.2 Grass Sowing

All seed shall be certified and less than 12 months old at the time of sowing. The WDC may prohibit the use of seed which has deteriorated because of wetting, fertiliser-burning, and other reasons at their discretion. The seed mixture shall be a high endophyte amenity turf rye certified as having greater than 89% live endophyte content and used at a rate of 200 kg per hectare.

For lawn areas greater than 100 m<sup>2</sup>, the seed shall be broadcast sown in at least two directions or planted with a mechanical seeder to ensure an even spread. The seed shall

then be incorporated into the soil by use of a drag mat, harrow, or brush harrow, then rolled with a suitable light turf roller.

For areas 100 m<sup>2</sup> or less, grass seed shall be evenly applied to the prepared surface by hand and raked thoroughly into the soil so that little seed remains exposed, then rolled with a light turf roller.

### **7.3.8. Establishment of Sown Areas**

Newly established grass shall be protected from damage by pedestrian and vehicular traffic until the grass growth has reached a self-sustaining state.

The grassed areas shall be watered as required, to achieve an efficient germination of the seed and maintain satisfactory growth throughout the maintenance period.

During the establishment, the newly grassed areas shall be maintained as follows:

- a. Upon the grass reaching 100 mm in height, it shall be cut to 50 mm high,
- b. For subsequent mowing, the mowing frequency shall be governed by growth rate. Minimum grass height to be 40 mm - maximum grass height to be 70 mm,
- c. The turf shall be maintained free of all broadleaf weeds,
- d. Areas where there has been a poor strike of grass shall be either re-cultivated and re-sown or under sown, and
- e. Upon completion of mowing, either all grass clippings shall be collected and removed from all sown grass areas except non kerb and channelled berms, or grass shall be mowed in dry conditions that ensure efficient mulching of clippings. All clippings shall be removed from adjacent hard surfaces.

Lawn fertiliser with an NPK ratio of approximately 6:1:5 shall be applied at a minimum rate of 200 kg/ha or according to manufacturer's instructions followed by watering in Spring, or at least 6 weeks after sowing.

#### **7.3.8.2 Turf**

The turf shall be of good quality, free of weeds and pests and with an even thickness of approximately 20 mm depth, 450 mm wide and of a consistent length. The constituent grasses of the turf shall be suitable for the area where they will be grown. The turf shall be sufficiently fibrous to hold together when handled, but excess fibre or thatch is undesirable.

Turf shall be packed to avoid drying out in transit and sprayed with water and covered with hessian in hot weather. Turf shall be delivered to the site within 24 hours of lifting and shall be off-loaded by hand unless arranged on pallets for mechanical handling. Any turf permitted to dry out shall be rejected when, in the opinion of the WDC, its survival after placement is doubtful. All turf shall be laid immediately after delivery to site. Where this is not practicable, the turves shall be unloaded and stacked on clear ground to a maximum height of one metre and suitably protected.

No turf shall be laid in exceptionally hot dry weather, or in exceptionally wet or frosty soil or weather conditions. Turf shall not be laid until the soil works have been satisfactorily completed by being brought to an even tilth and firmness.

Turf shall be handled carefully to ensure minimum breakage and prevent soil dropping from the roots. The turf shall be laid from planks working over turves previously laid.

The turves shall be thoroughly watered until the turf mat and top 50mm of soil is wet. After allowing a 'soaking in' period the turves shall be lightly and evenly firmed with a wooden tamper to ensure the underside of the turf mat and the wet soil surface are thoroughly bonded.

The finished level of the turf shall conform to the levels indicated. Where the turf meets paths the finished mowing strip level shall be 12 mm above the path. Any inequalities in finished levels owing to variation in turf thickness or uneven consolidation of soil shall be adjusted by raking and/or packing fine soil under the turf, not by topdressing the lawn surface.

During establishment, the turf shall be maintained as follows:

- a. Prevent any pedestrian traffic until grass is well established,
- b. Remove weeds and replace soil if necessary,
- c. Water regularly: The turf shall not be allowed to dry out for at least three weeks after laying, then it shall be watered normally. In Summer this will require watering at least daily. Watering shall normally be carried out prior to 7am and shall not be done in hot sunny conditions,
- d. Initial mowing shall be carried out when first growth is apparent, with blades set no lower than two-thirds of the height of the grass. Use roll-type mower for first cuts. Grass shall be in a reasonably dry condition. All clippings shall be collected and removed from site. All clippings shall also be removed from adjacent hard surfaces,
- e. Edges of all turf areas adjoining cultivated gardens, borders, hand paving, sealed surfaces or landscape structures shall be trimmed to the edge or controlled by herbicide to within 25 mm of flat surfaces or 50 mm of vertical structures. Grass shall not be allowed to encroach over flat paved or sealed surfaces by more than 25 mm,
- f. Lawn fertiliser with a NPK ratio of approximately 6:1:5 shall be applied at the minimum rate of 200 kg/ha or according to the manufacturer's instructions, in Spring or at least one month after turf is installed, and
- g. Areas of turf where there has been a poor establishment shall be re-laid.

## **7.3.9. Landscape Planting**

### **7.3.9.1 Staging and Notice of Planting Works**

Consideration shall be given to staging of landscape works. All irrigation and drainage work, utilities installation, signs or landscape structures shall be completely installed prior to planting.

All specimen tree planting shall be undertaken between June and August. Evergreen stock may be planted outside this period at the WDC's discretion but will be subject to additional maintenance requirements.

The WDC shall be provided with not less than five days' notice of dates upon which planting will commence. All plantings on existing or proposed reserves shall be marked out on site prior to planting works commencing. All trees shall be planted on the day of delivery to the site.

### **7.3.10. Plant Stock**

#### **7.3.10.1 Eco-Sourced Plants**

Conditions of resource consent may require that plants be eco-sourced, and in some locations WDC may, at its discretion, require that any species of plants to be planted on reserves or street trees be eco-sourced. Where this is the case, nursery documentation shall be provided to WDC to certify where propagation material was sourced from.

#### **7.3.10.2 General Plant Species and Quality**

- a. Plants 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.
- b. 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 have dense root formation.
- c. All root balls and containers shall be free of all weeds. Plants shall be well 'hardened -off' prior to supply.
- d. 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 shall be covered during transit and storage and other planting operations to prevent desiccation or damage.
- e. All plants shall be sound, healthy, vigorous and free of any defects which may be detrimental to plant growth and development. Defects may include but are not limited to the following:
  - i. Pests,
  - ii. Diseases,

- iii. Sun scalds,
- iv. Abrasions,
- v. Cankers,
- vi. Cracks,
- vii. Denuded bark,
- viii. Multi leaders,
- ix. Dead wood,
- x. Girdling roots,
- xi. Breakages,
- xii. Spent flowerheads,
- xiii. Weed and parasites,
- xiv. Excess dead leaf material,
- xv. Frost damage,
- xvi. Form not consistent with species, or
- xvii. Tree proportion (i.e. trunk caliper/tree size)

### 7.3.10.3 Transit of Plants from Nursery

Street trees shall be well 'hardened-off' prior to supply.

All trees and plants shall be thoroughly watered prior to dispatch from the nursery and shall be thoroughly watered-in after planting.

All trees are shall be transported in covered trailers or vehicles from the nursery to the planting site.

All roots shall be covered during transit and adequately stored to prevent desiccation or damage.

### 7.3.11. Tree Planting Works in Reserves

Trees shall be planted and staked to the detail shown on **Sheet 56**. In areas of volcanic and other suitable soils, WDC may approve reduced excavation areas. WDC may, at its discretion, require that drainage and / or a drainage pipe for watering be installed from the planting pit where a suitable outlet is available.

Where WDC determines that soil 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 WDC prior to placement. Additions to modify soil for back filling shall be as directed by WDC.



## **7.3.12. Street Tree Planting**

### **7.3.12.1 Layout**

Confirmation shall be obtained that the planting has been approved by WDC prior to planting. The WDC services including powerlines shall be shown on planting plan. Service plans shall be obtained from 'beforeudig' before planting so that all other services are located to avoid damage.

Plants shall be planted in the locations shown on the approved planting drawings.

### **7.3.12.2 Installation**

Planting holes will be dug to excavate an area 1 metre square and 1 metre deep.

Planting shall not be undertaken in waterlogged soil or holes that are full or part full of water. If the water table is high and water cannot be dispersed from the hole, WDC shall be consulted to determine if works can continue.

Roots of all plants shall be pre-watered if required so that they are moist. All plant containers or wrapping and if necessary, any root bound roots shall be removed prior to planting.

The hole shall first be backfilled with consolidated soil or soil mix, mounding the soil in the centre to aid even spread of the roots in 150 mm layers.

The plants shall be placed in the hole ensuring that the final soil level is equal to or not exceeding 10mm above the nursery soil level and at an appropriate depth to ensure sustained growth.

The street tree shall have tree root barriers installed where required, irrigated (when applicable), fertilised, mulched and staked as specified in this Section.

All specimen tree plantings shall have two-year slow release fertiliser tablets installed at the time of planting. This shall be implemented using eight minimum 10g tablets inserted in the base of the planting pit, prior to planting, 100 mm below the root ball to stimulate root growth. All fertiliser tablets shall have a balanced NPK.

### **7.3.12.3 Passive Street Tree Irrigation**

When surrounded by hard surfaces or as required by the WDC, a street tree shall have a 1900 mm long section of 65 mm perforated drainage pipe inserted into the tree pit. The drainage pipe 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 mulched or ground surface. The other end is to extend above the intended mulch layer by 20 mm. Underground irrigation systems can be installed instead of manually watering.

### **7.3.12.4 Tree Root Barriers**

At the WDC's discretion, root barriers may be required to be installed prior to tree planting. This will be assessed on a case by case basis.

Each fabric/HDPE-based root barrier shall be a minimum 2000 m length and be impermeable to penetration by roots according to the following minimum specifications:

**Table 7-4: Tree Root Barriers**

Weight	Thickness	Tensile Strength	Puncture Resistance	Width (Depth)
750g/m <sup>2</sup>	1.0 mm	15 kN/m	300N	300 mm

### **7.3.13. Irrigation and Fertilising**

#### **7.3.13.1 Irrigation**

During planting and establishment, the soil moisture in all planting areas including tree pits 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 a permanent irrigation system is required to be installed, the brand shall be approved by the WDC. The system shall provide a minimum soil moisture level of 50% to 200 mm depth, throughout the planted areas or within the dripline of trees specified. It shall be capable of fully re-wetting the root zone to 200 mm depth when the irrigation is applied: and shall be able to be fully automated to operate between 1:00am and 6:00am when moisture levels drop below 50%.

#### **7.3.13.2 Fertilising**

Fertiliser shall be applied to planting. 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 shall on no account be fertilised with Phosphate (P) containing fertilisers.

### **7.3.14. Weed Control**

#### **7.3.14.1 Chemical Applications for Weed and Pest Control**

All chemical application on planted areas shall be carried out by qualified, trained personnel and according to the [Growsafe Standard Certificate, NZS 8409:2021](#), and any manufacturers' directions. Glyphosate spray shall be used as the first option. Use of any other herbicides shall be first approved by the WDC.

All spraying operations shall be carried out in up to 10 km/hr winds, dry conditions, when rain is not imminent for at least 12 hours and at times which minimise practicable 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 [NRC Regional Plans](#).

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 (for list of weeds refer to [Northland Regional Pest and Marine Pathway Management Plan 2017-2027](#)).

Chemical weed control in planting areas shall be kept within the edge of the planting beds, within a maximum of 500 mm of tree trunks, within 50 mm of the edge of any undefined mulch surface, and within 50 mm of any posts or the base of any landscape structures.

### **7.3.15. Pruning**

Pruning shall be carried out in accordance with acceptable modern arboricultural and horticultural practices.

On-going pruning during the defects and liability period shall concentrate on producing good plant form, ground coverage, removal of spent flowers, healthy growth, preventing plants smothering other planting, keeping accessways clear of growth and maintaining visibility.

Trees shall be pruned up to provide good visibility for vehicles and pedestrians throughout all growth stages. In the long term, trees shall comply with [District Plan](#) sightline requirements.

Where shrubs are located within the intersection or other road visibility splays, they shall be pruned down to 400 mm height maximum for good visibility.

Pruning of shrubs and groundcovers shall be consistent with landscape plans and use techniques which maintain the natural form and habit of the plants. Pruning shall avoid 'hedging' techniques which create strong visual lines and detract from the natural texture and form of the plants. Groundcover plants shall be pruned by undercutting at the edges.

Planting designed as hedges shall be clipped only after Spring or Autumn growth flushes. Hedges grown for flowers shall be clipped only after completion of flowering. Hedge trimming shall be carried out in a way that will promote even growth to the specified height and width.

All material pruned from plants shall be removed from the planted areas and the site so that the site is left in a clean and tidy condition.

### **7.3.16. Mulching**

Unless otherwise approved by the WDC, all new planting areas shall be mulched. All care shall be taken in placing the mulch to protect the plants and any irrigation system, ensuring that no plant canopy is covered by mulch post-installation. Any damage to the plants or irrigation system shall be rectified.

### 7.3.16.1 Site Specific Mulch Applications

#### 7.3.16.1.1 Flat Site Mulch

On sites flatter than a 1:3 grade (1.0 m high by 2.0 m long), bark mulch shall be spread evenly to a depth of 100 mm over the planted area, creating an inverted cone hollow around each plant stem with a maximum 25 mm depth around plant stems. The mulch shall be supplied as scheduled, clean and free of soil, sawdust and wood preservatives, and a sample shall be provided to WDC for approval prior to spread.

- a. Coarse untreated shredded pine bark shall have an average diameter of 50 mm and with no pieces longer than 100 mm. Coarse bark is appropriate to most locations.
- b. Fine untreated shredded pine bark shall have no pieces longer than 40 mm and be evenly graded. Fine bark may be specified by WDC in commercial areas, or for other specified locations.
- c. Aged woodchip or arbour mulch may be used at the WDC's discretion.

#### 7.3.16.1.2 Steep Site Mulch

On slopes steeper than 1:3, mulching for weed control shall consist of a WDC approved matting. The matting shall be a single layer of biodegradable mulching fabric or material without synthetic geonet or synthetic geotextile content with at least 1000 gsm density. The mulching fabric shall have a minimum 24-month life expectancy and be fully biodegraded into soil within six years. It should be walkable on by maintenance crew, without damage to the fabric, within the first 6-12 months of installation.

It shall be installed according to manufacturer's instructions prior to planting, ensuring that the mulch will not uplift due to inundation or wildlife exposure from animals such as Pukeko.

*Note: A simple test to ascertain whether the mulching fabric is viable, is to hold a sample to the sky. It shall be mostly opaque. This density inhibits weed seeds trapped under the mulching fabric from sprouting, provides good moisture retention and assists with batter erosion control.*

At the WDC's discretion, mat rounds may be used instead of matting. These shall be a minimum 500 mm 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 WDC'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.

### **7.3.17. Staking, Fencing and Protection of Trees**

#### **7.3.17.1 Staking of Specimen and Street Trees**

Newly planted specimen trees shall be staked with three 40 x 40 x 1.8 m hardwood stakes with at least one third of their length (600 mm) in the ground and at least 1.0 m exposed minimum, or as specified on the approved plan. One synthetic tie per stake shall be attached. 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 of a type approved by WDC prior to tying. 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 400 mm away from the tree trunk and no more than 500 mm away.

Street trees shall have two hardwood stakes located outside of the root ball to firmly anchor the tree. Stakes shall be rough sawn 40 x 40 mm with tapered end and long enough to firmly support the tree. Reinforced hessian ties at a height of no more than 1/3 tree height shall be fixed to the stakes to provide stable support, and any stakes including those against the main stem shall be removed.

Refer to **Sheet 57**.

#### **7.3.17.2 Staking of Mass-Planted Trees**

Unless otherwise approved by the WDC, all mass-planted trees including revegetation plantings shall be staked with a single 1.2 m minimum long 22-25 mm diameter dead bamboo stake, positioned outside the root ball, driven into the ground to at least a 400 mm depth. Where nursery-supplied plants are provided with a stake attached, usually directly against the main stem, this stake shall be removed and replaced according to this specification.

The stake shall be fastened 2/3rd up the plant stem/trunk with a tree tie as approved by WDC.

If the tree tie is not biodegradable:

- a. The tie shall be adjusted periodically so that the stem/trunk does not become damaged or the stem/trunk grow over the tie.
- b. The tie shall be removed at a time designated during the design phase of the landscape planting.

### **7.3.18. Protecting Newly Planted Areas in Work Sites**

Newly planted areas shall be protected from any practicable damage from site works and onsite storage of plant and material, and any other damage.

If necessary, to ensure protection for the duration of the site works, 1 m (minimum) high fences are to be erected around new, single or grouped, trees and shrubs.

During planting, existing structures, turf, other planting, or irrigation system shall be protected by appropriate means from practicable damage. All damage to existing utilities, structures, planting and irrigation systems shall be repaired.

## **7.4. Completion of Works**

It is the Developer's responsibility to ensure that the landscaping meets these required standards at the termination of the maintenance period. The Developer is responsible (and may be bonded) for the routine maintenance and replacement of the planting including dead wooding, weed control, mulching, replacing dead trees, shrubs, and plants, and watering for a defined period from the time of acceptance of as-built landscape plans by WDC or issue of a section 224 completion certificate under the [Resource Management Act 1991](#).

### **7.4.1. As-Built Drawings and Schedule of Asset Information**

A set of as-built drawings and a schedule of asset information shall be submitted as per Section [1.7.2 As-Built Plans, Asset Information Schedules, Operation and Maintenance Manuals](#) to the WDC. These shall clearly and accurately show the as-built locations and details of all reserves infrastructure provided as part of the work, including details of planting and any modifications made to existing systems. A copy of the as-built plan recording any variation from the approved landscape planting plans shall be provided to the WDC.

As-built information for specimen trees shall include the following:

- a. Species and Common names,
- b. Planting date,
- c. Height,
- d. Address / Location description, and
- e. GPS X/Y co-ordinates.

As-built information for planting areas shall include the shape and dimensions of the planting, and either the GPS location of the centre of the planting for circular shapes e.g. roundabouts, or two or more other points sufficient to locate the shape of the planting.

As-built drawings may be checked by WDC on site for accuracy on completion of the development.

An EDA Certificate of Completion for the works will not be issued until acceptable as-built drawings have been provided.

The drawings shall identify assets that have been removed or decommissioned.

### **7.4.2. Operation and Maintenance Manuals**

Full details of any equipment shall be submitted to WDC along with the Operations and Maintenance Manual as per Section [1.7.2 As-Built Plans, Asset Information Schedules, Operation and Maintenance Manuals](#).

The Operation and Maintenance Manuals shall include:

- a. Equipment List, with make, model and serial numbers,
- b. Equipment supplier details,
- c. Maintenance schedules,
- d. Warranty information, and
- e. Conservation plans.

### **7.4.3. Defects liability**

The Planting Defects Liability Period shall be until 24 months from works clearance and acceptance of the landscape planting works by the WDC, or otherwise upon release of any implementation bond held for uncompleted landscaping.

Works to be carried out under the defects and liability period include routine maintenance of the landscape planting works i.e. weeding, mulching, watering and replacement of plants.

The WDC 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 by the Developer within one month.

If planting is completed outside the stated planting timeframes additional watering will be required at the WDC's discretion.

#### **7.4.3.1 Works Clearance Inspection**

After completing all proposed works, WDC 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.

#### **7.4.3.2 Defects Liability Period Final Inspection**

At the end of the Defects Liability Period, WDC shall be provided notice at least seven working days prior to the proposed commencement of WDC acceptance of the asset and its on-going maintenance.

#### **7.4.3.3 General Planting Defects Liability Period**

During and at the end of the Defects Liability Period, the following minimum standards are required.

- a. All planted areas shall be free of weeds and litter,



- b. All planted areas including street trees shall be mulched with fibre or 100 mm loose fill mulch,
- c. All trees and other planting shall be vigorous and healthy, free of disease and free of dead growth or dead flowers,
- d. Planting is becoming well established. Any plants failing during this period shall be replaced to the specification, to ensure adequate establishment of the planting,
- e. Plant growth shall be trimmed to the extent and height required for any visibility splays or [National Guidelines for Crime Prevention through Environmental Design in New Zealand](#) requirements,
- f. All tree stakes and ties shall be intact and correctly installed, or should the stakes no longer be providing adequate support for a plant, on approval from WDC, the stakes shall be removed and disposed without damaging the plant, and
- g. Fertiliser shall have been applied at start of second growing season.

#### 7.4.3.4 Replacement Planting

All replacement plants that have been installed due to plant failure shall have successfully established for at least three months prior to the final defects check otherwise the defects period will be extended by at least three months. The WDC may request replacement records that include dated digital photographic evidence to verify installation dates.

Should more than 25% of the originally installed planting fail during the defects period, the plants shall be replaced and the defects period for the whole planting area shall extend by a minimum six months.

#### 7.4.3.5 Fencing and Landscape Structure Defects Liability Maintenance

During and at the end of the Defects Liability Period the following minimum standards shall be maintained:

- a. All permanent or temporary landscape structures shall be structurally sound, safe, functional or operational and in a presentable finished form
- b. Paint work 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
- c. All structures shall be free of litter, graffiti, grime, weeds and plant growth or any other foreign matter
- d. Borders, footing edges or paving shall be maintained so that no more than 25 mm 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 25 mm and no more than 75 mm.

### 7.4.3.6 Grassing and Turf Defects Liability Period

After initial establishment, during and at the end of the Defects Liability Period, the following minimum standards shall be maintained:

- a. All kerb and channelled berms shall have grass growth no more than 50 mm high. Non-kerb-and-channelled berms shall have grass growth no more than 200 mm high and banks shall have grass growth not more than 250 mm high.
- b. The sward shall be maintained in a healthy, weed-and-disease free state without bare patches
- c. 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
- d. Maintenance and mowing operations shall be carried out at times which minimise disruption to the public
- e. Maintenance and mowing operations shall be carried out only in conditions and with equipment that ensures maintenance of good soil structure, minimum deformation of ground surfaces and on-going establishment of the grass sward
- f. Litter shall be removed prior to commencing maintenance or mowing operations. Highly visible shredded litter shall be removed following maintenance and mowing
- g. Grass clippings, when not required to be collected during mowing, shall be spread evenly over the sward.

A teal-tinted photograph of a bridge over water. The bridge has several large concrete pillars supporting it. In the background, there are buildings and a dock with many masts of boats. A large, stylized, light blue 'U' shape is overlaid on the right side of the image. The text 'Chapter 8: Electricity, telecommunications and gas' is written in white on the left side of the image.

Chapter 8:  
*Electricity,  
telecommunications  
and gas*

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## **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 WDC: 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 legalisation 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 WDC.

### **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 (see [WDC Urban Design Guidelines](#)), 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 Developer to ensure the most up to date referenced document is sourced.*

#### **8.1.3.1 Statutory**

[Operative District Plan](#)

#### **8.1.3.2 New Zealand Standards**

[NZS 5258:2003 - Gas distribution networks](#)

#### **8.1.3.3 WDC Documents**

[WDC Urban Design Guidelines](#)

#### **8.1.3.4 Other Referenced Documents**

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

[NZECP 34:2001 - New Zealand Electrical Code of Practice for Electrical Safe distances](#)

[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 10 m 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, WDC 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 WDC.

### 8.2.4. Drawings

Drawings of utilities shall be consistent with the drawing standards outlined in [Appendix F 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 Drawings the Developer shall meet the requirements of the Network Utility Operator and the Corridor Access 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 Roding Corridor Access,
- 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 \(Updated Version 2, July 2019\)](#), 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 [WorkSafe NZ publication - 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  $\pm 300$  mm and vertical  $\pm 100$  mm.
- b. Ducts shall be installed with draw-wires and endcaps 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.

A teal-tinted photograph of a sailboat docked at a pier under a bridge. The sailboat is the central focus, with its mast and rigging visible. The bridge spans across the background, and the water in the foreground is calm, reflecting the scene. The overall mood is serene and nautical.

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## 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 WDC 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:

- a. Identified causative scenarios (e.g. power failure, pump trip, component failure, air valve operation, rapid closure of valves),
- b. The highest pressure along the pipeline,
- c. The lowest pressure along the pipeline, and
- d. 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:

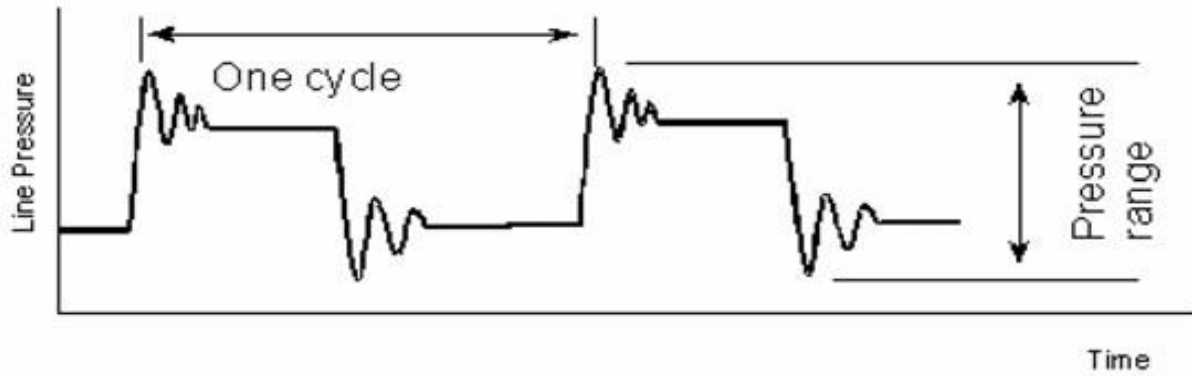
- a. Confirm the design lifetime of pipeline. (The pipeline design life must be taken as 100 years unless specified otherwise by Council),



- b. Estimate the likely number of pressure cycles during design life,
- c. Calculate the range of pressure surges,
- d. Calculate the fatigue load factor,
- e. Determine the equivalent operating pressure, and
- f. 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

Total Cycles	Cycles per day for 100 year life	PE80B	PE100
100,000	3	1.00	1.00
300,000	8	1.00	1.00
500,000	14	0.95	0.95
1,000,000	27	0.88	0.88
5,000,000	137	0.74	0.74
10,000,000	274	0.68	0.68
50,000,000	1370	0.57	0.57
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:

$$P_{eo} = \frac{\Delta P}{FLF}$$

$$P_{eo} = \underline{\Delta P}$$

$P_{eo}$  = Equivalent operating pressure (bar)

$\Delta P$  = 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: \_\_\_\_\_

Details of SQEP who will carry out on-site effluent investigations/designs are to be supplied below.

Name of SQEP: \_\_\_\_\_

Qualification(s): \_\_\_\_\_

Company Name: \_\_\_\_\_

Postal Address: \_\_\_\_\_

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)*

<input type="checkbox"/>	WDC REQUIREMENT	APPLIES TO LOT(S)	COMMENTS
<b>1</b>	<b>Hazard maps/GIS hazard layer - stability</b>		
<input type="checkbox"/>	Low stability risk		
<input type="checkbox"/>	Moderate stability risk		
<input type="checkbox"/>	High stability risk		
<b>2</b>	<b>GIS hazard layer – effluent on slope stability</b>		
<input type="checkbox"/>	Low disposal potential		
<input type="checkbox"/>	Moderate disposal potential		
<input type="checkbox"/>	High disposal potential		
<b>3</b>	<b>GIS hazard layer – effluent suitability</b>		
<input type="checkbox"/>	Medium unsuitability		
<input type="checkbox"/>	High unsuitability		
<b>4</b>	<b>GIS hazard layer – flood susceptibility</b>		
<input type="checkbox"/>	Is flood susceptible		
<input type="checkbox"/>	Is partially flood susceptible		
<input type="checkbox"/>	Is not flood susceptible		
<b>5</b>	<b>GIS land resources layer - streams</b>		

Are there streams on or adjacent to land under investigation?	<input type="checkbox"/>	Yes		
	<input type="checkbox"/>	No		
<b>6</b>	<b>GIS land resources layer – aquifers at risk</b>			
Is land situated over or adjacent to aquifer?	<input type="checkbox"/>	Yes		
	<input type="checkbox"/>	No		
<b>7</b>	<b>Annual Rainfall (HIRDS)</b>			

*Note: It is to be noted that all information obtained off WDC 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	<input type="checkbox"/> Structureless (massive)		
2 Sandy loams	<input type="checkbox"/> Weakly Structured		
	<input type="checkbox"/> Massive		
3 Loams	<input type="checkbox"/> High/Moderate structured		
	<input type="checkbox"/> Weakly structured or Massive		
4 Clay loams	<input type="checkbox"/> High/moderate structured		
	<input type="checkbox"/> Weakly structured		
	<input type="checkbox"/> Massive		
5 Light clays	<input type="checkbox"/> Strongly structured		
	<input type="checkbox"/> Moderately structured		
	<input type="checkbox"/> Weakly structured or massive		
6 Medium to heavy clays	<input type="checkbox"/> Strongly structured		
	<input type="checkbox"/> Moderately structured		
	<input type="checkbox"/> 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)

<input type="checkbox"/>	DETAILS	APPLIES TO SITE(S)
<b>1</b>	<b>Flooding potential to proposed field and reserve field (refer note 1 below)</b>	
<input type="checkbox"/>	Fields will not flood, or	
<input type="checkbox"/>	<b>Fields will flood in</b>	
<input type="checkbox"/>	20% AEP event	
<input type="checkbox"/>	5% AEP event	
<input type="checkbox"/>	1% AEP event	
<b>2</b>	<b>Surface water separation to proposed field and reserve field (refer note 2 below)</b>	
<input type="checkbox"/>	Main/reserve disposal field comply with NRC rules	
<input type="checkbox"/>	Main/reserve disposal field do not comply with NRC rules	
<b>3</b>	<b>Surface water separation to proposed field and reserve field (refer note 2 below)</b>	
<input type="checkbox"/>	Main/reserve disposal field comply with NRC rules	
<input type="checkbox"/>	Main/reserve disposal field do not comply with NRC rules	
<b>4</b>	<b>Winter ground water separation to proposed field and reserve field (refer note 3 below)</b>	
<input type="checkbox"/>	Main and reserve disposal field comply with NRC rules	
<input type="checkbox"/>	Main and reserve disposal field do NOT comply with NRC rules	
<b>5</b>	<b>Slope of ground of proposed field and reserve field (refer note 4)</b>	
	Description	
<b>6</b>	<b>Shape of ground of proposed field and reserve field (Refer note 5 below)</b>	

<input type="checkbox"/>	Waxing divergent	<input type="checkbox"/>	Linear divergent	<input type="checkbox"/>	Waning divergent		
<input type="checkbox"/>	Waxing planar	<input type="checkbox"/>	Linear planar	<input type="checkbox"/>	Waning planar		
<input type="checkbox"/>	Waxing convergent	<input type="checkbox"/>	Linear convergent	<input type="checkbox"/>	Waning convergent		
Comments							
<input type="checkbox"/>	<b>DETAILS</b>		<b>APPLIES TO SITE(S)</b>				
<b>7</b>	<b>Intended water supply source</b>						
<input type="checkbox"/>	Public supply						
<input type="checkbox"/>	Rainwater						
<input type="checkbox"/>	Bore						
<b>8</b>	<b>Proposed method of disposal and recommended Daily Loading rate (DLR) (refer note 6 below)</b>						
Description							
<b>Peak loading factored in (refer note 6 below)</b>				<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
Comments							
<b>9</b>	<b>Site exposure (refer note 7 below)</b>	<b>Description</b>	<b>Applies to Site(s)</b>				
Site(s) aspect							
Pre-dominant wind direction							
Presence of shelter belts							
Presence of topographical features or structures							
<b>10</b>	<b>Proximity of water bores (include adjacent to properties) (refer note 9 below)</b>						

<b>11</b>	<b>Visible evidence of slips / instability (refer not 8 below)</b>
<b>12</b>	<b>Total suitable area available for type of effluent disposal proposed (including reserve area)</b>
<b>13</b>	<b>Setback areas proposed (if any) (refer note 10 below)</b>

**Notes**

1. *If the WDC 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 OLFP 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-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 Whangārei 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 B1 Acceptable Solutions and Verification Methods 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.

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iv.

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- 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 D ES-W1

## Application to Connect Water Reticulation to WDC Mains

Subdivision / Development Name \_\_\_\_\_

Subdivision / Development Number \_\_\_\_\_

Application No \_\_\_\_\_

Building Consent \_\_\_\_\_

PID \_\_\_\_\_

Surveyor \_\_\_\_\_

Approved Contractor \_\_\_\_\_

Developer \_\_\_\_\_

**Document Information** \_\_\_\_\_

Drawing Numbers \_\_\_\_\_

Other Documents \_\_\_\_\_

1 Approval of Works Yes No

The works have been built in full accordance with the approved drawings and have been inspected against the SEEO checklist and passed all inspections

2 Pressure Testing Pass Fail

Pressure taken to \_\_\_\_\_ Kpa For \_\_\_\_\_ hours N1 \_\_\_\_\_

Pressure drop \_\_\_\_\_ % N2 \_\_\_\_\_

3 Disinfection Pass Fail

Initial Chlorine Residual \_\_\_\_\_ 24hr Chlorine Residual \_\_\_\_\_ ppm

Final Chlorine Residual \_\_\_\_\_ ppm

4 the above inspection / testing is for the:

completed works or  part of the works.

If for part of the works, please give specific details

\_\_\_\_\_

\_\_\_\_\_

Approved by

---

*(SEEO of Delegated Representative)*      *Date*

Office Use Only

Yes    No

Approved to connect into Public Water Supply

---

---

*Name of Approving Officer*

---

*Signature*

---

*Date*

## Appendix E 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 1.5 m 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	$d_{50} = (W_{\max} - W_{\min}) / 2 + W_{\min} =$		m
	d	$A_{s50} = (22 \times D \times d_{50}) / 7 =$		m <sup>2</sup>

	e	$Vol = (22 \times D^2) / 28 =$		$m^3$
	f	$T$ (time between $W_{max}$ and $W_{min}$ )(Test #3) =		min
	g	Soil permeability = $P = Vol / A_{s50} \times T \times 60 =$		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)**

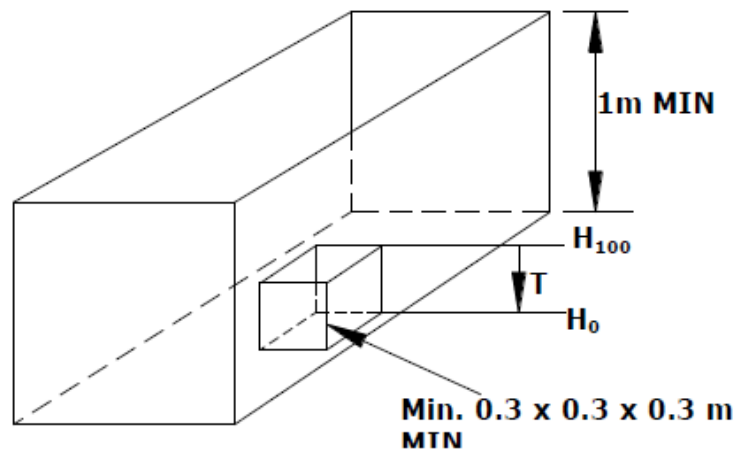
- Excavate 0.3 x 0.3 x 0.3 m test pit at base of main excavation (minimum 1 m deep)
- Refill test pit 3 times
- Use results from 3<sup>rd</sup> test

**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 =  $V = W \times L \times D =$  \_\_\_\_\_  $m^3$
- b.  $A = (H \times L \times 2) + (W \times H \times 2) =$  \_\_\_\_\_  $m^2$  (base ignored)
- c. Time for pit to drain full to empty  $H_{100}$  to  $H_0 = T =$  \_\_\_\_\_ minutes (Test 3 result)
- d. Permeability (test)  $P_t = V / (T \times 60 \times A) =$  \_\_\_\_\_ m/sec
- e. Permeability (final)  $P_f = P_t \times 0.5 =$  \_\_\_\_\_ m/sec

Use  $P_f$  for soak pit designs



## Appendix F 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, WDC 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:

- g. sewer (red),
- h. water (blue), and
- i. 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 WDC in writing) by way of a USB Drive or as agree with the WDC).

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 WDC shall be reduced levels on NZ Vertical Datum 2016 (NZVD2016).

*Note: Submission of local circuit or site-specific coordinates and levels for any assets to vest in WDC will not be accepted, unless previously discussed with WDC and approval obtained in writing.*

### Drawing Layout

- a. 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.

- b. All plans shall have a North point.
- c. Plans shall have a scale bar to confirm printed scale.
- d. Long sections shall commence with the lowest distance/lowest invert on the left-hand side of the sheet.
- e. 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:

- a. A project title, including street address,
- b. A unique number or identifier, preferably the consent or project number,
- c. Designer's name, signature and contact details,
- d. Draughtsperson's name,
- e. Drawing checker's name,
- f. Design reviewer's name and signature,
- g. Stage of work e.g. for acceptance, accepted engineering drawings, construction, as-built,
- h. Date of preparation and of acceptance,
- i. Scale or scales used,
- j. Graphic scale bar(s),
- k. Datum and origin,
- l. Original sheet size,
- m. Drawing title e.g. Long section,
- n. Sheet numbers, including the number in the set, and
- o. 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
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 2.5 mm in height.

### Electronic Formats

The following electronic file formats are acceptable:

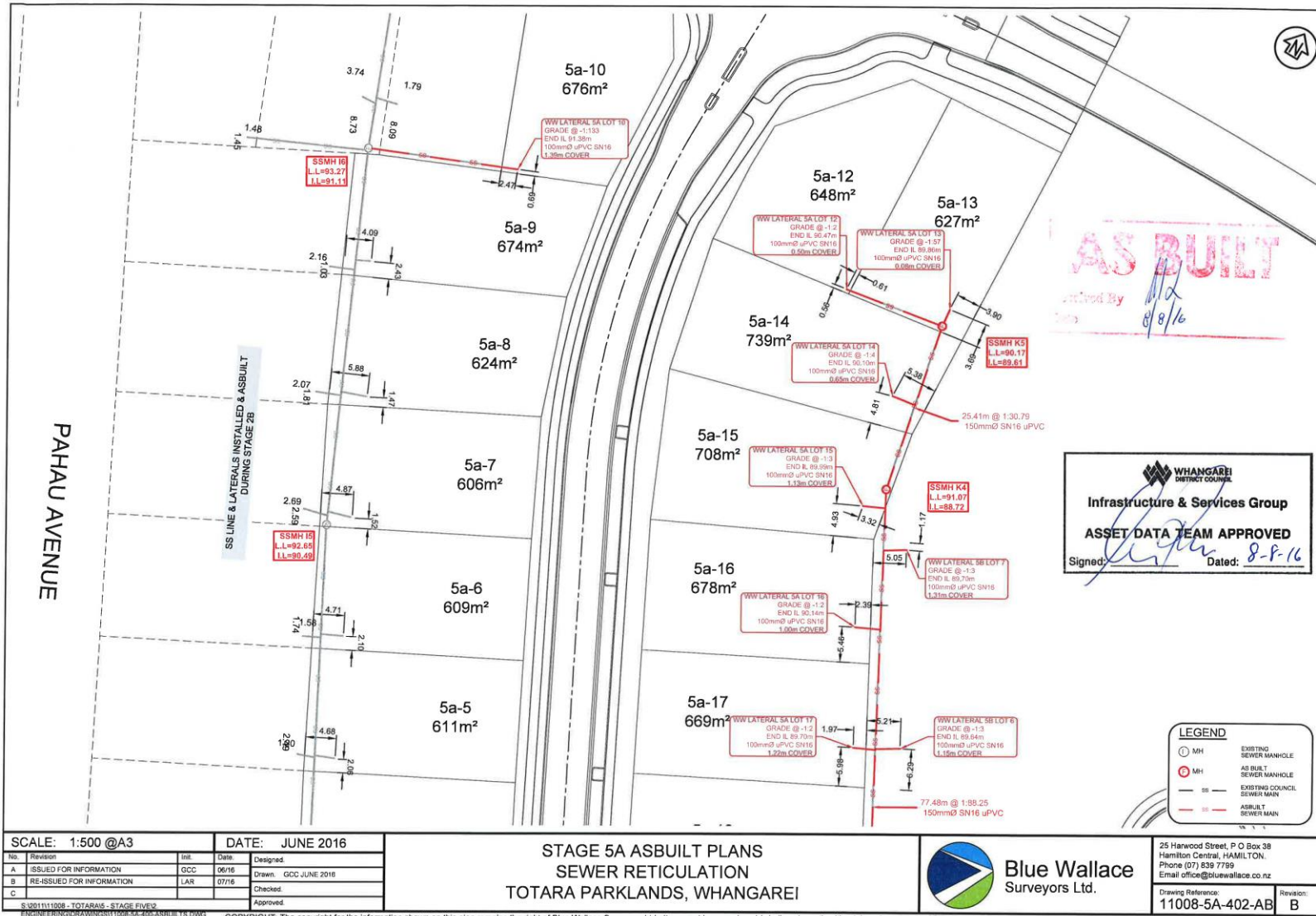
- a. AutoCAD .dwg/dxf files, provided these include all referenced files so that a full replication of the hardcopy drawings can be reproduced.
- b. .pdf copies of plans, endorsed/certified as As-Built Plans. These .pdf copies are to be high resolution, suitable for producing quality prints

Particular requirements for AutoCad plans include:

- a. 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,
- b. All x-refs, pen assignments, images and special fonts used shall be included with the plan file,
- c. Layouts shall be named to represent the content of each sheet (normally the sheet title),
- d. Different elements of the plan shall be drawn on its own appropriately named layer, e.g. sewer manholes on a 'SWMH' layer,
- e. As-built layouts shall have 'As-built' incorporated in the title, and
- f. Layouts should have line-type scale setting inset into them to ensure correct printing.

## Appendix G Example As-Built Drawings

*Wastewater As-Built Plan examples*



SCALE: 1:500 @A3		DATE: JUNE 2016	
No.	Revision	Init.	Date
A	ISSUED FOR INFORMATION	GCC	06/16
B	RE-ISSUED FOR INFORMATION	LAR	07/16
C			
		Checked	
		Approved	

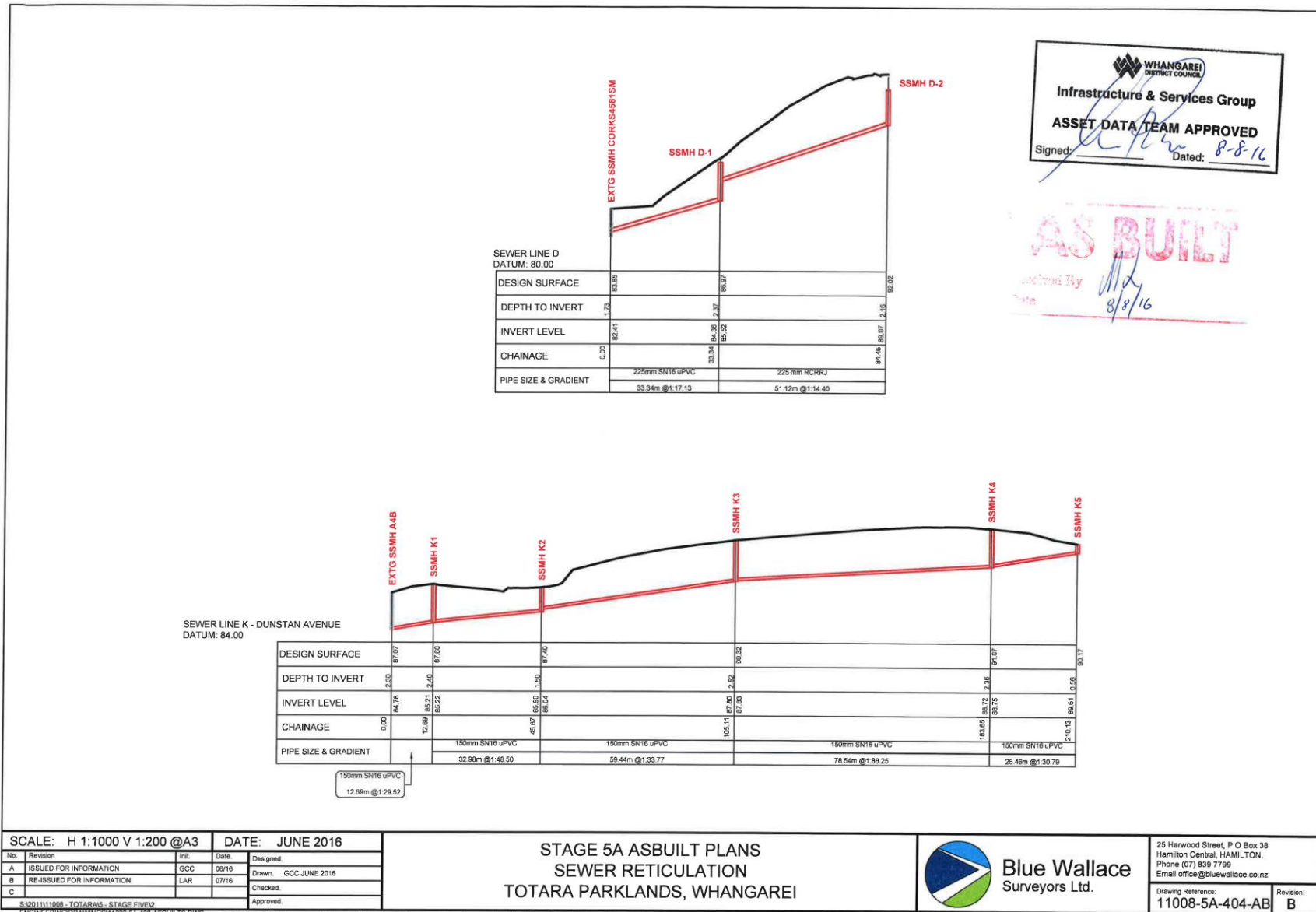
**STAGE 5A ASBUILT PLANS  
SEWER RETICULATION  
TOTARA PARKLANDS, WHANGAREI**



25 Hanwood Street, P O Box 38  
Hamilton Central, HAMILTON.  
Phone (07) 839 7789  
Email office@bluewallace.co.nz

Drawing Reference: 11008-5A-402-AB  
Revision: B

S:\2011\11008 - TOTARA5 - STAGE FIVE\ENGINEERING\DRAWINGS\11008-5A-402-ASBUILT.DWG COPYRIGHT: The copyright for the information shown on this plan remains the right of Blue Wallace Surveyors Ltd. It may not be reproduced (wholly or in part), without the prior consent of Blue Wallace Surveyors Ltd.





**WHANGAREI DISTRICT COUNCIL**

**Infrastructure & Services Group**

**ASSET DATA TEAM APPROVED**

Signed: *[Signature]* Dated: 8-5-16

CODE	XREF	UNIT TYPE	DESCRIPTION	INSTALL DATE	EXP LIFE	Mt Eden Circuit 2000		NZTM Proj		Z Co-Ord (Elevation)	US Invert	DS Invert	Material	Size	Quantity	Public/Private	Surface
						X Co-Ord (Easting)	Y Co-Ord (Northing)	X Co-Ord (Easting)	Y Co-Ord (Northing)								
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-19 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	Int	Date
A	ISSUED FOR INFORMATION	GCC	06/16
B	RE-ISSUED FOR INFORMATION	LAR	07/16
C			

**STAGE 5A ASBUILT PLANS**

**SEWER RETICULATION**

**TOTARA PARKLANDS, WHANGAREI**

S:\0111\1008 - TOTARAIS - STAGE FIVE\ENGINEERING\DRAWINGS\11008-5A-400-ASBUILT.DWG

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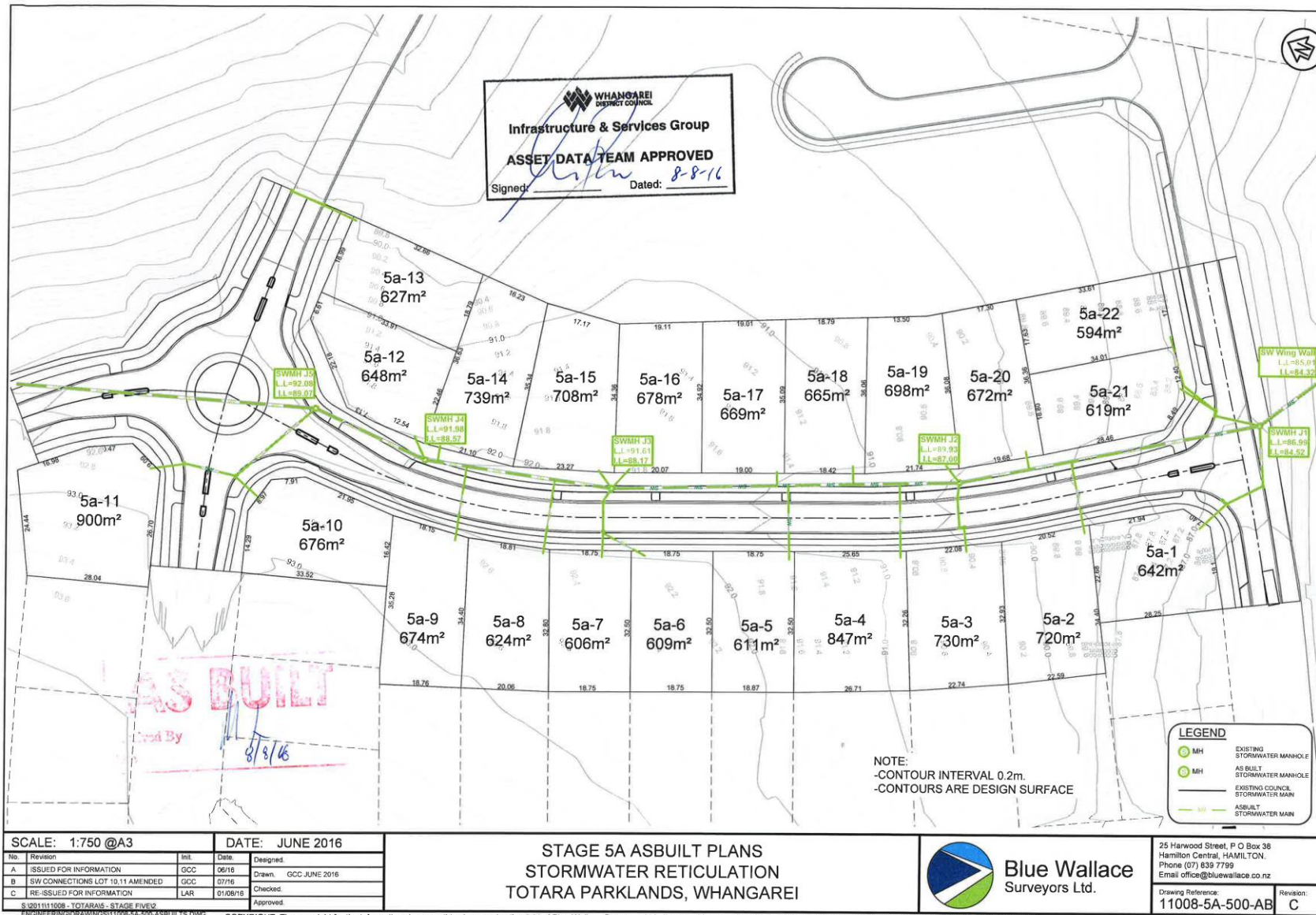
**Blue Wallace**  
Surveyors Ltd.

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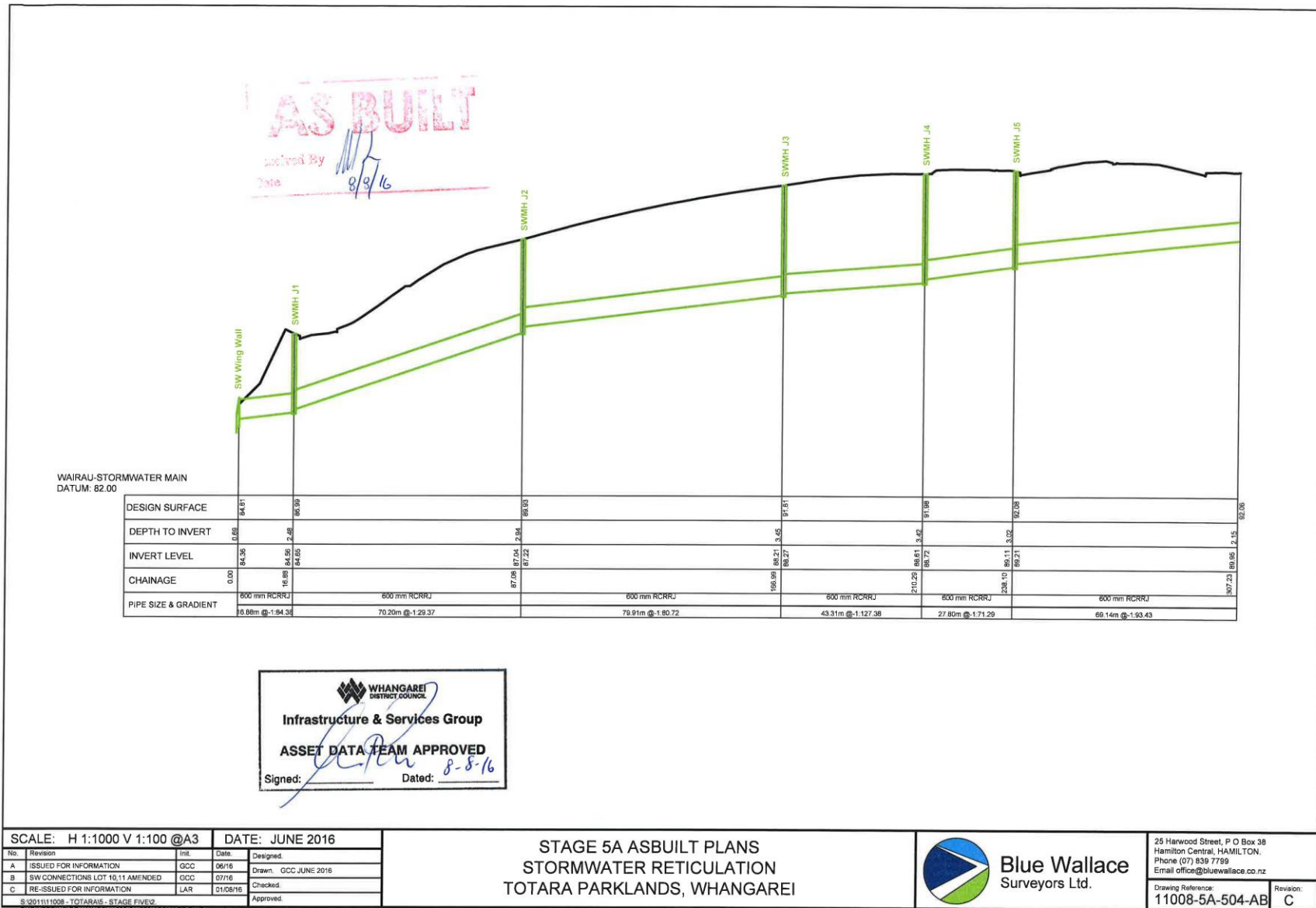
Drawing Reference: 11008-5A-405-AB

Revision: B

*Stormwater As-Built examples*







Infrastructure & Services Group				Mt Eden Circuit 2000		NZTM Proj										
CODE	XREF	UNIT TYPE	ASSET DATA TEAM APPROVED	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 Stormwater Reticulation																
			Signed: <i>[Signature]</i> Date: 8-8-16													
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	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	RCRRJ	375	9.87	Public	Road
SWMN		STORM	CP3 - CP14	Jun-16	50	359797.32	933479.74	1719461.15	6051198.18		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		STORM	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	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	Int.	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
S:\2011\11008 - TOTARAIS - STAGE FIVE\2 ENGINEERING\DRAWINGS\11008-5A-500-ASBUILTS.DWG		Approved:	

STAGE 5A ASBUILT PLANS  
STORMWATER RETICULATION  
TOTARA PARKLANDS, WHANGAREI

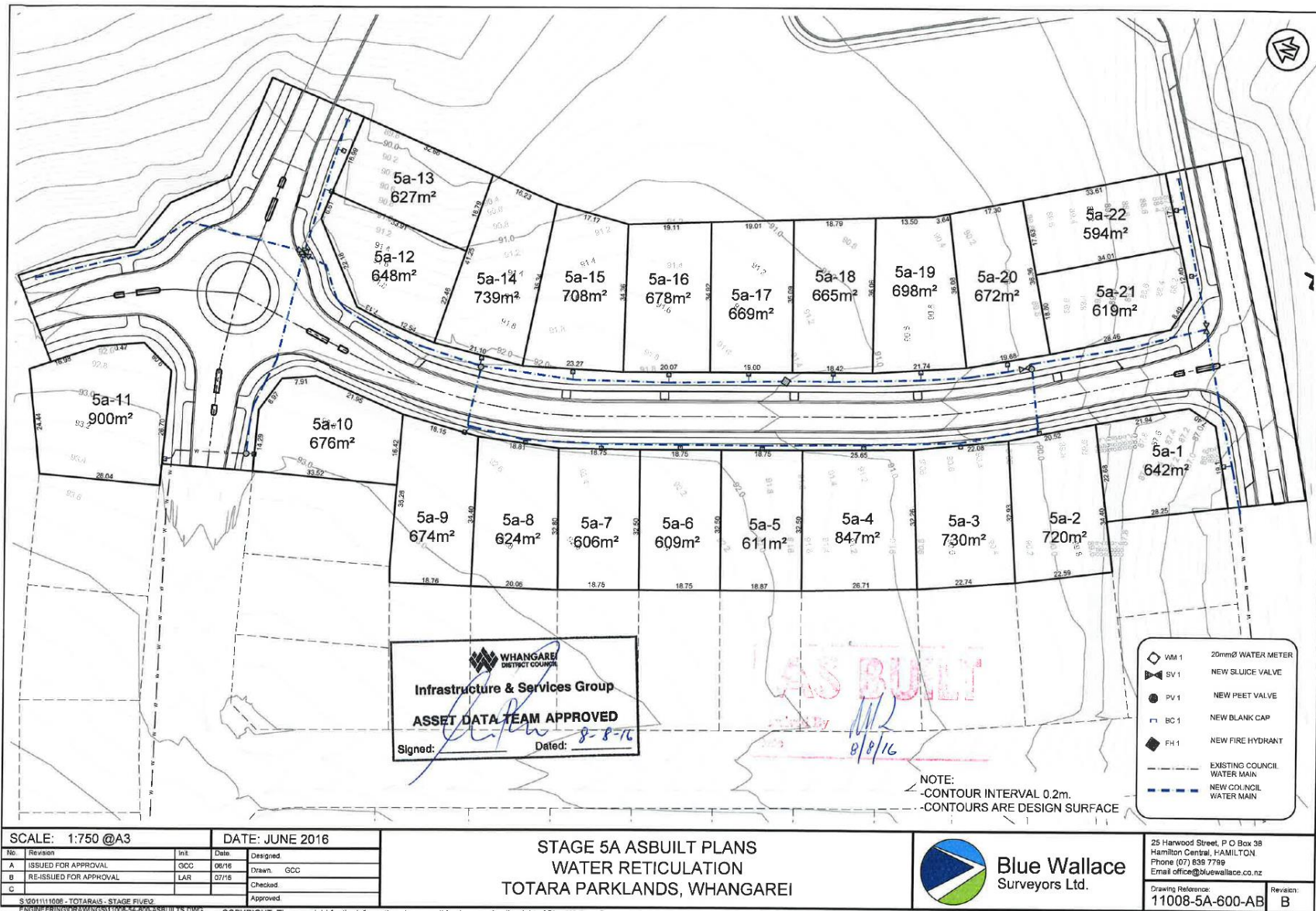


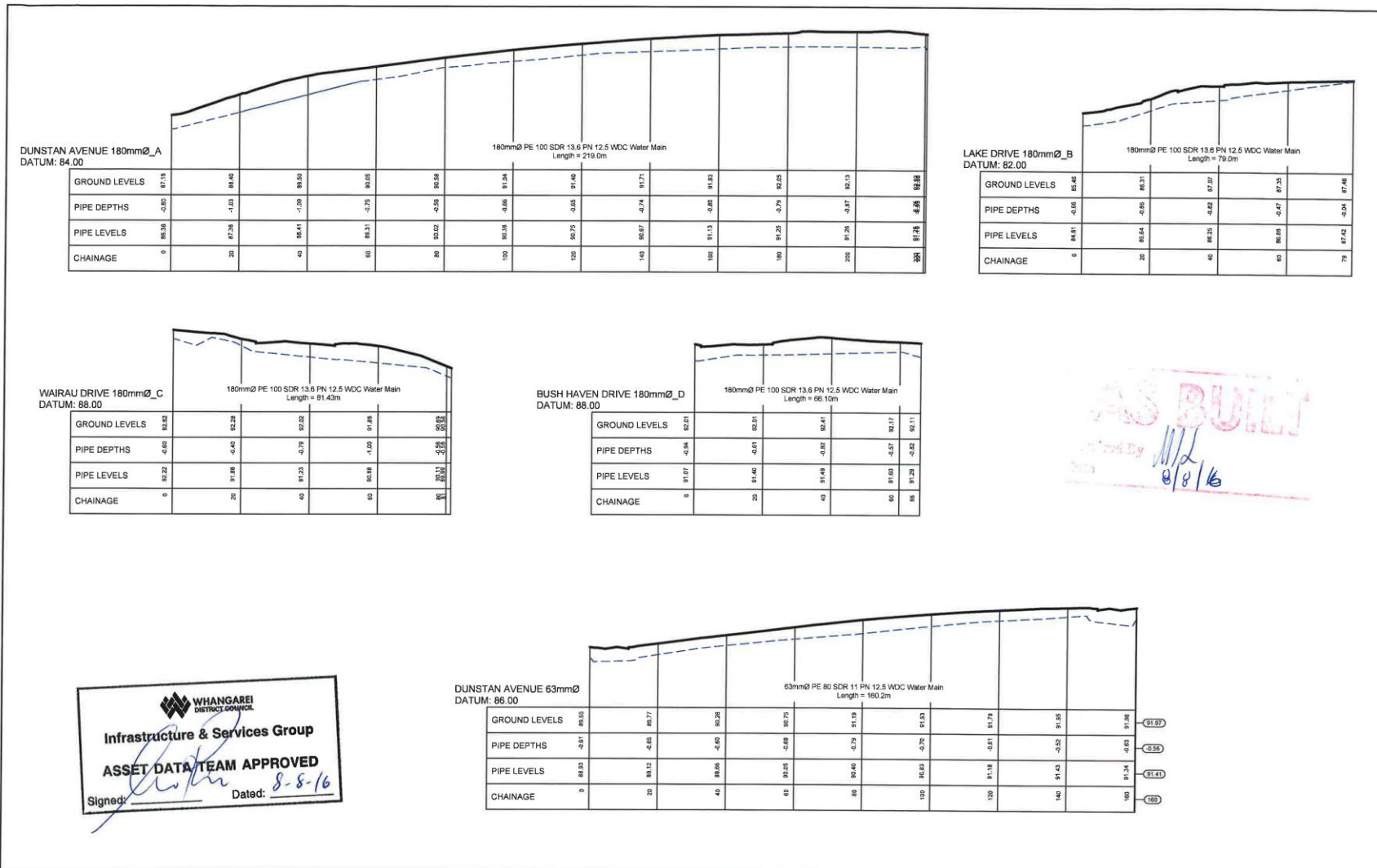
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Drawing Reference:  
11008-5A-506-AB  
Revision: C

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*Water Reticulation As-Built examples*







AS BUILT  
1/2/16  
8/8/16

**WHANGAREI DISTRICT COUNCIL**  
Infrastructure & Services Group  
**ASSET DATA TEAM APPROVED**  
Signed: [Signature] Dated: 8-8-16

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			

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STAGE 5A ASBUILT PLANS  
WATER RETICULATION  
TOTARA PARKLANDS, WHANGAREI



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Drawing Reference: 11008-5A-604-AB  
Revision: B

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CODE	XREF	UNIT TYPE	DESCRIPTION	INSTALL DATE	EXP LIFE	Mt Eden Circuit 2000		NZTM Proj		Z Co-Ord (Elevation)	Material	Size	Quantity	Public/Private	Surface
						X Co-Ord (Easting)	Y Co-Ord (Northing)	X Co-Ord (Easting)	Y Co-Ord (Northing)						
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

WHANGAREI DISTRICT COUNCIL  
**Infrastructure & Services Group**  
**ASSET DATA TEAM APPROVED**  
 Date: 8-8-16  
 Signed: [Signature]

9/8/16  
 [Handwritten notes]

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
			Checked
			Approved

STAGE 5A ASBUILT PLANS  
 WATER RETICULATION  
 TOTARA PARKLANDS, WHANGAREI



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Drawing Reference: 11008-5A-605-AB  
 Revision: B

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## Appendix H Asset Attributes

### Roading RAMM

Refer to Whangārei District Councils WDC Road Assessment and Maintenance (RAMM) Data Collection Form

## 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	
	Grate/Lid Level		Level of Grate or Lid of pit
	Invert Level		Level of bottom of cesspit
	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

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
	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
	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

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
	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
	Eastern Coordinates – Downstream End		If downstream end is not on a manhole or other point asset
	Northern Coordinates – Downstream End		If downstream end is not on a manhole or other point asset
	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	
	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

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
	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		
Invert Level			



Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
	Eastern Coordinate – End 1		
	Northern Coordinate - End 1		
	Eastern Coordinate – End 2		
	Northern Coordinate - End 2		
	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 environment, e.g. Waikato River
	Ground Level		
	Eastern Coordinate		Location at point of stormwater discharge

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
	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
	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		
	Catchpit Dimensions		Length and width of catchpit in mm
	Invert Level		Level of bottom of cesspit
	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



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	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
	Invert Level		Level of bottom of cesspit
	Eastern Coordinates – Downstream End		If downstream end is not on a manhole or other point asset
	Northern Coordinates – Downstream End		If downstream end is not on a manhole or other point asset
	Install Date		Installation date
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Stormwater Open Channel	Plan ID	Yes	Plan number used to identify as-built plan
	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

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
	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

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	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

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
	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
	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

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
	Surface Width	Yes	Surface width at top water level. On the plan, show extent of secondary flow path at top water 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	

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
	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	
	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
	Eastern Coordinates – Downstream End		If downstream end is not on a manhole or other point asset
	Northern Coordinates – Downstream End		If downstream end is not on a manhole or other point asset
	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

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
	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

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
	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
	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
	Eastern Coordinates		Coordinates of chamber centre point
	Northern Coordinates		Coordinates of chamber centre point
	Install Date		Installation date

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
	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
	Eastern Coordinates		
	Northern Coordinates		
	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 or watermain plan if not a pump station project
	Manufacturer	Yes	ABB/Edress and Hauser etc
	Model Number	Yes	As per manufacturer
	Magflow Serial number		Unique serial number for the meter
	Eastern Coordinates		
	Northern Coordinates		
	Install Date		Installation date
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

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
	Eastern Coordinates		
	Northern Coordinates		
	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		
	Eastern Coordinates		
	Northern Coordinates		
	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
	Eastern Coordinates		
	Northern Coordinates		
	Install Date		Installation date
	Comments		Any pertinent comments
Telemetry	RT Brand		
	RT Model		
	Aerial Type		

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
	Micrologix 110 Allen Bradley Module Model		
	Eastern Coordinates		
	Northern Coordinates		
	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
	Eastern Coordinates-End 1		

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
	Northern Coordinates-End 1		
	Eastern Coordinates-End 2		
	Northern Coordinates-End 2		
	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. at the service valve or toby
	Northern Coordinate		Coordinate of customer end of service pipeline i.e. at the service valve or toby
	Eastern Coordinates – tapping band		Coordinates of point where service line meets the watermain

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
	Northern Coordinates – tapping band		Coordinates of point where service line meets the watermain
	Toby Lid Level		From middle of toby lid
	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
	Meter Installed	Yes	Yes / no response (if yes complete a HCC ' Water Meter" form for each installtion
	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.

Asset Component Type	Asset Attribute Required	Show on plans	Description of Asset Attribute
	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
	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 I Checklist for Supporting Information

The following checklist is a summary of the requirements of the ES 2022 and should be used as a prompt to the matters which require certification by a 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 Wastewater 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 fire fighting 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/ES/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 moderate/high stability 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 stormwater 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 Manoeuvring*

- 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 moderate/high stability 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 watercourses
- 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 EDA

All EDA containing proposed works certified by a 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
<b>Site Suitability</b>			
Earthworks/Compaction design			
Land Instability areas			
Coastal Hazards, Mine zones, Flood zones			
Road and Access			
<b>Roads and Access</b>			
Pavement structural design			
Geometric design			
Surfacing design			
Lighting design			
Bridges and major culverts			
Retaining walls			
<b>Stormwater</b>			
Catchment Analysis			
Overland flow paths (1%AEP)			
Stormwater treatment devices			
Stormwater attenuation structures			
<b>Wastewater</b>			
Gravity reticulation			
Sewer pump stations			
Rising mains			
On-site disposal details			
Community wastewater treatment systems			
Pipe bridges & other structure			
<b>Water</b>			

<b>Summary of SQEP Certification</b>			
<b>Engineering Aspect</b>	<b>Detail of works</b>	<b>Plan ref</b>	<b>SQEP initials</b>
Water booster stations			
Reservoirs			
Pipe bridges & other structures			
Hydraulic design			
Other design matters			





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